
SESAR
DEPLOYMENT MANAGER
DEPLOYMENT
PROGRAMME 2018
LET'S DELIVER TOGETHER

SESAR Deployment Programme

Edition 2018

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1. What is the SESAR Deployment Programme?

1.1. The regulatory framework

The SESAR (Single European Sky ATM Research) project was set up as the main channel to coordinate the modernisation efforts targeting the industrial development and implementation of an innovative and interoperable European ATM infrastructure, helping the Aviation community to cope with sustained air traffic growth under the safest, most cost-and-flight-efficient and environmentally-friendly conditions. Since its establishment in 2004, the SESAR initiative has been structured and conducted through three interconnected phases:

- the Definition Phase, aimed at identifying the expected performance requirements of the next generation ATM systems, as well as the most suitable solutions to achieve them. These activities are also complemented by the definition of a high-level plan to organise the subsequent activities, which resulted in the first European ATM Master Plan in 2008;
- the Development Phase, which consequently puts in place the necessary Research and Development activities to produce the necessary technological elements, identified during the Definition Phase;
- the Deployment phase, aimed at deploying throughout Europe the results of the ATM solutions developed and validated by the SESAR Joint Undertaking. It is through this phase that SESAR results are progressively deployed, finally allowing the achievement of the performance improvements that contribute to the High-level Goals of the SES initiative.

Indeed, by combining all expertise and resources of the European ATM stakeholders, the SESAR project was set up to build a common and agreed roadmap to steer modernisation efforts, coordinating research and development activities, leading to a synchronised deployment of technologies that - in the end – contributes to achieving the SES objectives.

In line with the overall arrangement of the initiative and in accordance with the provision laid down by Regulation (EU) No 409/2013, the SESAR Deployment Phase started with the adoption of the Pilot Common Project (PCP), through Regulation (EU) No 716/2014, issued by European Commission on June 27, 2014. The PCP therefore triggered the need for a unique and widely agreed implementation plan, illustrating how to get organized to ensure a synchronised, coordinated and timely deployment.

This implementation plan is the SESAR Deployment Programme, developed by the SESAR Deployment Manager, building on the technical contribution of the SESAR Joint Undertaking, the Network Manager and the European Defence Agency, whilst also taking into consideration the outcomes of a wide- ranging consultation of the ATM Community.

More specifically, Article 11 (1) of Regulation (EU) No 409/2013 states that the Deployment Programme shall provide “a comprehensive and structured work plan of all activities necessary to implement technologies, procedures and best practices required to implement common projects”.

The Programme therefore aims at organising local, regional and European-wide implementation activities for both civil and military operational stakeholders in order to comply with the requirements stated in the Pilot Common Project in the most performance driven manner, considering the readiness of the technological elements to be deployed. The Regulation also outlines the elements that the Deployment Programme shall identify, namely “all the associated risks and mitigation actions, the geographical scope, the timeframe and the operational stakeholders responsible”.

In other words, whereas the Pilot Common Project sets out at a 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 illustrates and details how the implementation shall be carried out, supporting a coherent planning and sequencing of deployment.

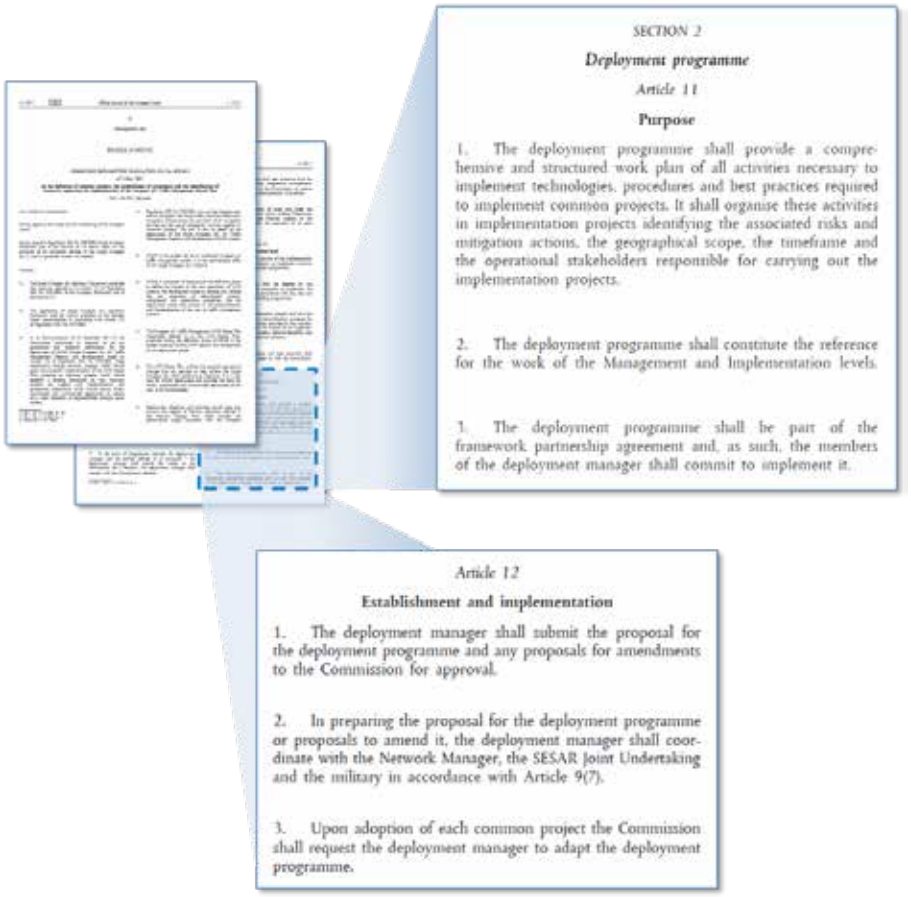


Fig. 1 - Regulation (EU) No 409/2013 and the SESAR Deployment Programme

As indicated within Article 11 (2) of the Regulation (EU) No 409/2013, the SESAR Deployment Programme shall indeed represent the reliable "reference for the work" of all stakeholders involved in the implementation of SESAR.

1.2. The blueprint for Stakeholders' ATM modernisation plans

In this perspective, the SESAR Deployment Programme fulfils the role of providing the blueprint for the investment plans of all operational stakeholders affected by the Common Projects (CPs) and therefore required to participate in the deployment of its ATM Functionalities.

Through the SESAR Deployment Programme, all ATM Stakeholders are provided with a common reference to support the optimisation and the synchronisation of their investments within the scope of the Common Projects. More specifically, the Programme flags implementation activities to be performed, identifies the optimum timing for such implementation and supports the definition of the most suitable approach in order to achieve the objectives set forth in the Common Projects.

The SESAR Deployment Programme also represents the main reference document for the Commission to identify the priorities for awarding EU financial incentives supporting implementation projects contributing to CPs deployment.

Finally, the Deployment Programme is also a planning and monitoring tool available to the EU Institutions, the States and all involved stakeholders. It presents an overall picture on the status of PCP implementation across Europe, allowing the identification of what still has to be deployed and where to ensure the achievement of the expected performance benefits.

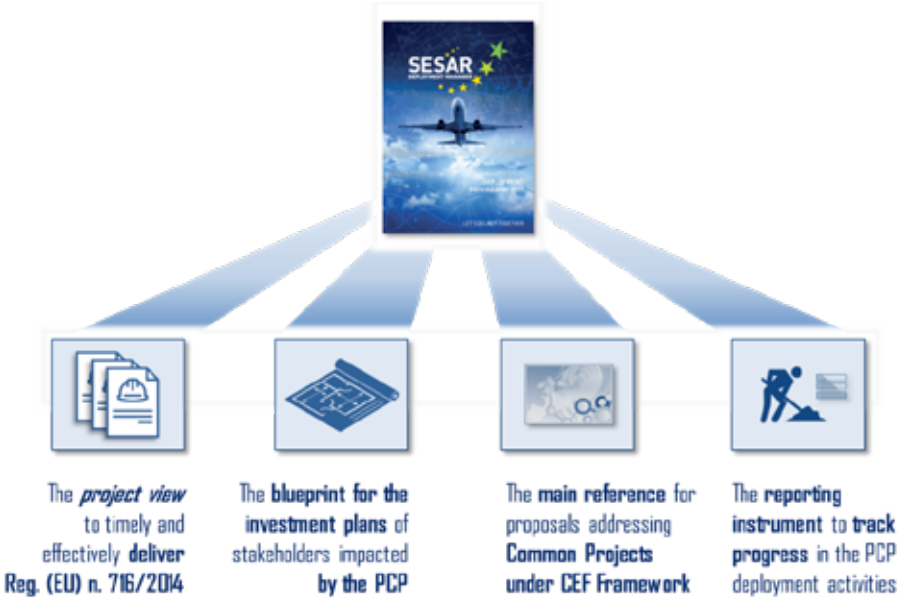


Fig. 2 – The role of the SESAR Deployment Programme

1.3. SESAR Deployment Programme and its Guidance Material

The need for a common stable reference work plan able to consistently steer the CP Implementation over the years has to be complemented with the necessary information and guidance to always ensure CPs optimum deployment scenario. This approach is necessary to make sure that all operational stakeholders can launch their implementation activities on the basis of the most updated technological developments and associated deployment guidance, identified on a yearly basis.

Therefore, the SESAR Deployment Programme, stable by nature and representing the translation into technical and operational terms of the business view identified within the CPs, is supported by specialised Guidance Material to assist stakeholders during deployment.

Fig. 3 – The lifecycle of the SESAR Deployment Programme and of the associated Guidance Material

The Guidance Material is composed of:

- The Planning View, a detailed planning tool for Operational Stakeholders clearly defining the scope of the implementation activities, as well as the suggested approach to be followed to ensure timely deployment of the ATM Functionalities listed in Reg. (EU) No 716/2014;
- The Monitoring View, a reporting instrument to illustrate the status of implementation of the Pilot Common Project across Europe, to keep track of the deployment progress on a yearly basis, and to identify those implementation activities that still need to be undertaken (i.e. implementation gaps).

The Guidance Material requires a periodical update to ensure the alignment with the deployment ATM scenario and better guide operational stakeholders in a stepwise approach towards the implementation of Common Projects.

More specifically, the update of the Planning View is essential to provide stakeholders with a common reference, which clearly identifies those activities to be urgently undertaken, whilst also encompassing the latest information on available standards and/or any other supporting document. On the other hand,

the Monitoring View has to be considered as a truly living document, as it aims at reporting the progress achieved by stakeholders from all EU Member States and to timely identify any potential delay which might hinder the achievement of the overall performance benefits.

1.4. The buy-in of ATM Community through consultation

In order to ensure the full commitment of the ATM community to implement the Common Projects in a coordinated and synchronised manner, the SESAR Deployment Programme is the result of a wide-ranging and thorough consultation process. This involved all affected categories of operational and non-operational stakeholders, in order to ensure that the document takes their standpoints and perspectives into duly consideration.

Fig. 4 – Main fields of Stakeholders' consultation

The engagement mechanisms established by the SESAR Deployment Manager fall into two different but closely inter-linked fields:

- The cooperation and coordination initiatives with other relevant SES bodies and non-operational stakeholders;
- The direct involvement of operational stakeholders in the elaboration and maintenance of the SDP and its Guidance Material.

1.4.1 Cooperation with the relevant SES bodies and non-operational stakeholders

Articles 9(7) and 12(2) of Regulation (EU) No 409/2013 establishes that the elaboration of the SESAR Deployment Programme and its maintenance shall be "coordinated with the Network Manager, the SESAR Joint Undertaking and the military", in order to exploit their specific expertise on specific topics. Bilateral coordination with the Network Manager and participation of its Experts in the development and maintenance of the SESAR Deployment Programme are critical measures to carefully address the PCP- related deployment aspects deemed to have an impact on the European network infrastructure and on its airspace organisation. Furthermore, constant cooperation is in place in order to ensure coherence of the SDP with the Network Strategy Plan, the Network Operations Plan, the European Route Network Improvement Plan and the central ATFM function.

The SESAR Deployment Manager (SDM) is also constantly cooperating with the SESAR JU to ensure the alignment of the Programme with the ATM Master Plan, as well as to guarantee adequate continuity between the different ATM innovation lifecycle phases, with specific regard to the progress made in the industrialisation phase and their impact on deployment activities. The SJU and SDM work together to support de-risking industrialisation activities, with the goal of ensuring an effective bridging between R&D and deployment and support stakeholders during the whole process.

It is also worth mentioning that the joint efforts put in place by the SDM and by the European Defence Agency, are aimed at ensuring that military contributions as well constrains and concerns are taken in due consideration. The constant alignment between the SDM and EDA, the Military Coordinator for the purposes of the SESAR Deployment, is a key enabler for fostering and encouraging the coordination between civil and military stakeholders to synchronise the CPs implementation, in order to avoid any adverse impact on national and collective defence capabilities.

Taking into account the pivotal role of the SESAR Deployment Programme in the ATM context, the SDM has activated all required cooperation streams, also expanding the coordination effort by involving other critical organisations and Agencies in the process, including:

- EASA and the main Standardisation bodies, which ensure the integration in the Programme of the most updated references, specifications, standards and supporting Regulations, to steer a harmonised and safe deployment of the PCP;

- the National Supervisory Agencies, to ensure that the progress in the PCP deployment are appropriately acknowledged in the National Performance Plans;
- the Manufacturing Industry, to ensure the alignment between the outcomes of the industrialisation phase and the optimum planning identified in the Programme, seeking their cooperation to ensure the timely development of the appropriate standards and marketing of the required hardware and software;
- the staff associations, to ensure that human factors, competency and change management issues are duly taken into account in the SESAR Deployment Programme.

1.4.2. The engagement of European operational stakeholders

In order to complement its own expertise and the inputs stemming from other SES bodies, the SDM has set up and manages a dedicated Stakeholders' Consultation Platform (SCP) opened to all European ATM operational stakeholders impacted by the Common Projects' implementation and/or benefiting from their deployment.

The SCP ensures the participation of all stakeholders' categories in the process of elaborating and updating the SESAR Deployment Programme when necessary, regardless of their participation in deployment activities within the Framework Partnership Agreement. In other words, all European operational stakeholders (Airlines, Air Navigation Service Providers, Airport Operators, the Network Manager, MET Service Providers, Military stakeholders) provide their contribution and expertise in the definition and update of the SDP, before being involved in its implementation. It is however to be noted that - in order to keep the SCP within a manageable size and to ensure smooth consultation campaigns - the participation of stakeholders is organised at groupings' level and/or at Functional Airspace Blocks (FAB) level.

The purpose of such a Platform is to seek stakeholders' points of view on the SESAR Deployment Programme and its Guidance Material, granting their buy-in when implementing.

Taking into account the broad scope of the Programme, as well as the span of its technical content, the Stakeholders' Consultation Platform is composed by Thematic Sub-Groups (TSG) – which are responsible for targeted discussion and analysis on specific technical topics – and by a Steering Group, which supports the SDP updates and develops recommendations to the SESAR Deployment Manager.

More specifically, the established and agreed process foresees multiple rounds of consultations with the operational stakeholders, called upon to provide their inputs and/or comments on preliminary versions of the SDP and its Guidance Material, as well as ad hoc technical topics.

For each comment and suggestion provided by stakeholders during the consultation cycles, the SESAR Deployment Manager replies with dedicated feedback, explaining whether the comments and observations have been agreed, partially agreed or not agreed, and the potential consequences on the document under consultation. The Thematic Sub-Groups shall be considered the most appropriate forum to hold specific discussions on technical matters: the outcomes of the TSGs shall then represent the basis for the opinions and recommendations developed by the SCP Steering Group. Such opinions shall be considered as an essential input for the SDM in the development and delivery of robust and agreed updates of the SESAR Deployment Programme.

1.5. Tracking the progress in implementing Common Projects

Considering the SESAR Deployment Manager's responsibility to "implement the Commission's Decisions and monitor their implementation by the implementation level" - as stated by Article 9 of Reg.(EU) No 409/2013, the SESAR Deployment Programme aims at providing a common reference to operational stakeholders on the status of CP implementation and at identifying all implementation activities that still need to be undertaken in order to achieve its full deployment.

A clear, reliable and constantly evolving picture of the status of CP implementation throughout Europe is built and provided to European Commission, to other SES bodies and to operational stakeholders, through the yearly updates of the Monitoring View part of the SDP Guidance Material.

In particular, this overview provides different perspectives, allowing for reporting on the status of the implementation of PCP-related technological elements within a dedicated Member State or within one of the 25 PCP-listed airports. In addition, specific information is provided at stakeholder level as well, keeping track of their involvement in deployment activities and/or of their plans to comply with the provisions set forth in the Common Projects.

This comprehensive outlook is a valuable instrument for guiding future investments and activities by the stakeholders, as well as for identifying potential delays and risks to be mitigated to avoid significant gaps in the Programme's implementation, thus supporting performance expectations.

The elaboration of a detailed monitoring outlook and the identification of the most urgent activities still to be undertaken relies on the strict cooperation amongst the SESAR Deployment Manager and the operational stakeholders, as well as on the support of the Network Manager and of the European Defence Agency.

The Monitoring Exercise is performed on a yearly basis and aims at providing up-to-date reports from all stakeholder categories involved. The exercise supports the identification of what has still to be implemented, where and by whom (i.e. the existing implementation gaps).

In particular, the monitoring directly engages ground stakeholders (Airport Operators, ANSPs, MET Service Providers, Military Authorities and the Network Manager) as well as Airspace Users. Thanks to the collected information, the SDM is able to ascertain the current status of implementation, identifying what has already been implemented, what is in progress and/or planned, as well as what is still to be planned (also specifying the expected date of completion, when available).

The update of this outlook on the status of implementation is provided within the yearly releases of the Monitoring View, as part of the Guidance Material to support the implementation of the SESAR Deployment Programme.

2. The SESAR Deployment Programme development process and the SESAR Deployment Strategy

2.1. The process to define and update an agreed plan to implement Common Projects

In accordance with the scope of responsibilities laid down by Regulation (EU) No 409/2013, the SDM is responsible for developing, proposing, maintaining, implementing and monitoring the **SESAR Deployment Programme**, which – supported by its dedicated Guidance Material – represents the operational view of Common Projects.

The Deployment Programme is the cornerstone of a wider and more comprehensive **Deployment Strategy**, which represents the main guidance to support and drive ATM stakeholders in the local implementation activities and in their effort towards the achievement of the overall economic benefits expected from Air Traffic Management modernisation at European level.

At the management level of the SESAR Deployment governance, the SDM is responsible for the definition and establishment of the mechanisms, decision-making processes and arrangements to ensure the most effective synchronisation of the local implementation activities, as well as for the management of any risks that may arise.

The **Deployment Strategy** and the **synchronisation** of the PCP are key elements of the SESAR Deployment Programme.

The **Deployment Strategy** is defined in the SESAR Deployment Programme and the Guidance Material for SESAR Deployment Programme Implementation Planning View. It is then followed by the stakeholders with the actual implementation, monitored by the SDM, and finally reviewed and adjusted if needed according to the monitoring experience.

For this purpose, the SESAR Deployment Manager has developed a comprehensive framework, composed of four interlinked phases. The combination of the actions undertaken through these four phases helps driving the modernisation joint efforts from local stakeholders and support the identification of the most appropriate shared approach to implement Common Projects:

- *Planning Phase*: the definition of a clear and widely agreed implementation programme and strategy, identifying the deployment activities to be synchronised and establishing an operational path towards the achievement of the goals listed within the formally approved Common Projects. The Deployment Strategy, as backbone of the Deployment Programme, is described in Section 2.1.1 as part of this key Phase and in Section 2.2 where the Deployment Approach (how to deploy) is detailed for each ATM Functionality.
- *Execution Phase:* The management and coordination of all deployment activities to be undertaken in a joint effort by the SDM and, at local level, by operational stakeholders working to ensure the highest level of adherence to the defined programme. This Phase is further detailed in Section 2.1.2, where the Implementing Partners deploy the Implementing Projects to achieve the PCP ATM Functionalities.
- *Monitoring Phase*: a thorough oversight of the achieved results and of the implementation gaps, as well as of the achieved performance contribution. Such activities are also considered of utmost importance to promptly detect potential synchronisation issues and delays in the delivery of Common Projects. This Phase is further detailed in Section 2.1.3;
- *Review Phase*: as an output of the three Phases above, a thorough analysis is performed of the activities carried out and of the results achieved through the rollout of the implementation. Where necessary, this review should lead to the application of corrective measures to the plan and the strategy itself, resulting in an updated strategy. This Phase is further detailed in Section 2.1.4.

In parallel with such activities, a critical pillar of the overall SDM Deployment Strategy is represented by the identification and application of the most appropriate support and assistance to operational stakeholders actively involved in the implementation of the Common Projects, fostering the synchronisation of their efforts and investments and ensuring their full engagement in the implementation process.

Fig. 5 – SESAR Deployment Programme process

2.1.1. Planning – Laying down the Deployment Strategy

The focus on sequencing and synchronising implementation initiatives is pivotal for the achievement of the Single European Sky objectives, as it allows for harmonisation of the required investments by the relevant stakeholders (civil and military Airspace Users, Air Navigation Service Providers, Airport Operators, the Network Manager, MET Service Providers and the manufacturing industry). This leads to the achievement of performance benefits, avoiding negative impacts on the provision of efficient services to Airlines and passengers.

In order to support the synchronised implementation (i.e. the alignment of investments from various stakeholders in order to achieve a timely implementation of Common Projects and the expected benefits), the first step of the SESAR Deployment Strategy, developed in cooperation with operational stakeholders and with the appropriate SES bodies, is focused on the definition of the most suitable plan for the implementation of Common Projects. This is the backbone of the SESAR Deployment Programme and its Guidance Material.

The elaboration of the SESAR Deployment Programme marks the first step toward the definition and roll out of a common Deployment Strategy, defining how to deploy Common Projects.

Specifically, it breaks down at operational level what has to be deployed and by whom, it defines the most suitable implementation timeframe and it lays down the associated optimum sequencing. Moreover, it assesses the most relevant risks that might compromise implementation and it defines the most appropriate mitigation actions.

Fig. 6 - Planning Activities: Overview

Identifying the Families composing a Common Project

The SDM has broken down and clustered technological and operational elements associated with the ATM functionalities included within the Common Projects into homogeneous Families, grouping those elements into specific sets of implementation initiatives that shall be deployed to ensure that the operational scenarios defined in the relevant Regulations become reality across Europe.

The identification, definition and establishment of these Families is necessary to guide stakeholders mandated to implement Common Projects in the definition of their investment plans.

The Families – extensively described within the guidance material to implement SDP - specifically describe scope, objectives, timeframe for deployment, stakeholders to be involved, associated SESAR Solutions, additional references as standards and means of compliance, as well as targeted recommendations for successful implementation, especially focusing on the synchronisation needs between stakeholders (see section Family descriptions, as included in the Planning View, as part of the guidance material for the implementation of the SESAR Deployment Programme).

Optimum sequencing and synchronisation – the Deployment Approach to be followed at AF level

By combining the IOC and FOC dates for each Family, it is possible to elaborate the most appropriate planning for the deployment of each ATM's functionality, and – as a whole – of the full scope of the Common Projects, which are then illustrated with an overall Gantt chart.

The Gantt (which is shown within section 2.2.2) should therefore be considered as the blueprint for investments and implementation initiatives of all stakeholders mandated to deploy the CPs.

In order to further harmonise deployment across Europe and to support stakeholders in their coordinated and synchronised effort, the overall Gantt of the SESAR Deployment Programme is complemented by the identification of the most appropriate sequencing of deployment activities to be undertaken by each stakeholder, i.e. the preferred approach to be followed for the synchronised implementation of new systems and operational changes that would lead to the achievement of the expected performance benefits.

Although specific amendments and adaptations might be applied on the basis of specific local arrangements by operational stakeholders, this Deployment Approach shall be considered the most suitable logical and chronological order to implement the Common Projects.

More specifically, as extensively explained in section 2.2, the implementation is sequenced on the basis of the interdependencies between different Families.

Thanks to both the Gantt chart and the identified Deployment Approach, stakeholders involved in the Common Projects' implementation can benefit from a common, agreed and detailed roadmap, which identifies the steps to be undertaken.

The scope of the analyses performed by the SDM, in cooperation with the appropriate bodies and organisations, is however not strictly limited to deployment activities, but could also cover the status of industrialisation, including the potential need to develop necessary standards and certifications required for the implementation of Common Projects.

To this end, constantly updated and evolving Standards and Regulation roadmaps are developed and included in the Guidance Material for the SESAR Deployment Programme implementation, more specifically in the dedicated Annex of the Planning View.

Urgent needs and evolving priorities – the short-term Deployment Approach at AF level

Whilst the recommended Deployment Approaches for each AF are considered stable in time, in parallel with the progress of the implementation of Common Projects across the European network, the SDM also cooperates with the relevant stakeholders and organisations to periodically identify those elements most urgently needed to achieve a timely deployment. The "urgency" is derived from the current status of implementation of a related functionality, and the proximity to the target deadline. The closer the deadline is, and the less the implementation has progressed, the more urgent the need to accelerate deployment will be.

Following this approach, it is possible to identify the Families whose implementation should be considered as a short-term need, and that shall be urgently addressed by operational stakeholders' investments. Those priorities, which are identified combining technical and performance considerations with the evolving status of implementation in Europe, are pinpointed in the periodic releases of the Guidance Material to support the SDP implementation (see Short Term Deployment Approach section in the Planning View for further details).

Whenever deemed necessary, the SESAR Deployment Programme can be also complemented by other specific action plans, targeted roadmaps and dedicated implementation strategies that would urgently tackle specific elements and/or items, whose timely deployment is considered as a key gateway to the full and successful implementation of the Common Projects.

How to implement each Family – the detailed Family Deployment Approach

In addition, for each of the SESAR Deployment Programme Families, the project view of the Common Projects identifies the dedicated approach to be preferably followed during their implementation; a clear list of intermediate steps to be performed and key milestones to be achieved is duly outlined and described, also considering the relevant stakeholders' categories to be involved during the different stages of the deployment initiative.

The aim is to provide local impacted stakeholders, with the most reliable and detailed list of activities to be planned and deployed to comply with the requirements laid down by the Common Project. Moreover, there is a specific focus on the potential need to involve National Supervisory Authorities in the implementation process.

Deployment risks – risk assessment and mitigation actions

Specifically listed among its tasks by Reg. (EU) No 409/2013, risk management of the implementation of Common Projects is one of the key pillars of the overall Deployment Strategy outlined by the SDM.

On the basis of an iterative approach as fully illustrated within section 5.1, the most relevant risks that might hinder or jeopardise the implementation of the Common Projects are identified and assessed in order to develop dedicated mitigation actions to reduce and/or limit their negative impact and consequences. The

full list of identified risks, along with the appropriate mitigation actions (to be implemented either directly by the SESAR Deployment Manager or by other stakeholders) are reported within section 5.2.

2.1.2. Execution – The synchronised implementation of the Deployment Programme

The relevant operational stakeholders and the SESAR Deployment Manager are called to a joint and coordinated effort in the execution activities, i.e. the execution of the projects implementing the Common Projects.

Operational stakeholders – on the basis of the responsibilities within their respective operational environments – are called to participate in the deployment of the Families identified in the SESAR Deployment Programme, thus taking part in the deployment of Sub-ATM Functionalities and ATM Functionalities identified in the Common Projects.

Moreover, operational stakeholders are encouraged to perform their respective deployment activities following the strategy provided by SDM in accordance with the optimum "Deployment approaches" laid down in the SESAR Deployment Programme for each ATM Functionality identified in the CPs.

The highest level of adherence between the agreed implementation planning and its translation into an operational reality has to be considered as a primary synchronisation objective for all involved stakeholders. Indeed, a synchronized deployment across Europe ensures that the performance benefits associated to the implementation of technological and operational elements are timely and effectively realized.

The SESAR Deployment Framework Partnership

One of the key instruments of the SESAR deployment governance that supports operational stakeholders in implementing Common Projects is the SESAR Deployment Framework Partnership. This is an unprecedented industry-wide partnership bringing together the European Commission, the SESAR Deployment Manager as coordinator, as well as civil and military stakeholders required to implement or that support the implementation of Common Projects as implementing partners.

The Framework partnership is governed by the SESAR Framework Partnership Agreement (FPA), which is the dedicated legal framework set up by the European Commission with the specific purpose of facilitating the implementation of Common Projects. The FPA "contractually" binds the three levels of the SESAR deployment governance (Policy, Management and Implementation) and, as prescribed by Article 11 (3) of Regulation (EU) No 409/2013, includes the SDP as the basis for the work of its partners.

The role assigned to the SDM in the FPA leverages its capability to coordinate, synchronise, monitor and support the deployment of technological and operational elements associated to the Common Projects in accordance with the SDP. Moreover, the FPA associates and legally binds all its partners, thus formalising their commitment to implement CPs in accordance with the SDP.

Implementing partners can rely on specific coordination and synchronisation from the SDM, which helps ensuring that best practices and success stories are shared across the industry, that significant risks to the successful implementation of Common Projects are anticipated and mitigated and that the most relevant target dates are respected.

Moreover, the FPA is the legal instrument through which Union financial support is channelled to the SDM and the implementing partners to support their efforts and investments to implement CPs.

2.1.3. Monitoring – Keeping track of the implementation progress

In parallel with the execution of the implementation projects, a pillar of the SDM Deployment Strategy is the comprehensive and continuous monitoring of deployment activities, which ensures the constant tracking of results achieved at local and network level, as well as the timely detection of potential issues and/or

delays. The Monitoring is needed to update the **Deployment Strategy** in the Review Phase based on the experience gained through the Execution Phase.

Monitoring activities carried out by the SDM follow two parallel and intertwined streams:

- A comprehensive Monitoring Exercise, aimed at identifying the progress of deployment achieved within each State included in the Common Projects geographical scope. As illustrated in detail in section 1.5, the exercise is performed on a yearly basis, integrating information and inputs coming from all involved operational stakeholders, aimed at identifying the current status of implementation of each Family, Sub-AF and AFs, as well as ensuring timely detection of any potential issues that might jeopardise the CP implementation. It also takes into account and keeps track of the stakeholders' plans to comply with the mandatory provisions set forth by the Common Projects. The availability of this information is a key element in anticipating any potential delay in the alignment with agreed target dates, as laid down in the SESAR Deployment Programme, and avoiding possible synchronisation issues (among stakeholders or among different AFs).
- The monitoring activities, which are specifically performed on Implementation Projects carried out under the Framework Partnership Agreement (FPA). For these projects, the close monitoring from the SDM leverages on data directly provided by the operational stakeholders at specific "monitoring gates" (three times per year), but also through "continuous interactions", which ensure the availability of updated information on closed projects/completed tasks/achieved milestones throughout the year. The use of such data and information allows for close monitoring of any misalignment between the implementation projects' plans and the actual situation, anticipating any potential negative impacts and supporting the development of suitable actions for an effective mitigation plan. The monitoring of implementation projects also encompasses the cross-checking of costs incurred during implementation initiatives, as consistency between planned and actual costs represents an important indicator of the capacity of Implementation Projects to fulfil the envisaged deployment scope within the defined timeframe. Finally, it is worth noting that the analyses and assessments on projects carried out under the Framework Partnership Agreement also cover performance aspects, as their actual contribution to the performance benefits expected from the implementation of the Common Projects is also identified and evaluated.

The streams of monitoring should be considered tightly interconnected, as the Implementation Projects performed under the Framework Partnership Agreement represent key drivers to steer and push forward the deployment activities. In these cases, the outcomes of monitoring activities under the FPA scope (which track down specific results of local initiatives) act as a feeder for the overall SDM Monitoring Exercise.

The main information and outcomes stemming from the FPA monitoring activities and from the SDM Monitoring Exercise are then reported in the periodic releases of the Monitoring View, dedicated to the full scope of Common Projects (updated on a yearly basis), as part of the Guidance Material to support SDP deployment. The information is also provided to the Innovation and Executive Agency (INEA) in the execution of the reporting activities required for all beneficiaries of CEF funding.

2.1.4. Review – Assessing the results and identifying potential refinements of the Deployment Strategy

On the basis of the results of the execution activities, duly checked through the dedicated Monitoring Phase, and especially of its alignment and consistency with the implementation roadmap developed within the Planning Phase, the SESAR Deployment Strategy involves a dedicated set of activities focused on the definition and identification of potential amendments and updates to the strategy. This will facilitate a faster and more effective deployment, as well as compliance with the target dates set within the Common Project.

In close cooperation both with the operational stakeholders engaged in deployment activities and with the appropriate SES bodies, the SDM will detect, analyse and evaluate any critical issues and/or setback, which might slow down or delay the Common Projects implementation. This analysis comprises also the

synchronisation needs and the evolution of the overall PCP implementation. The results of such analyses would then be shared with the different levels of the SESAR Deployment Governance framework, in order to identify the dedicated mitigation and/or recovery actions.

Should the results of the process highlight the opportunity to update and/or revise the Deployment Strategy, the SDM would then proceed to the definition of the appropriate corrective measures, potentially including the review of the SESAR Deployment Programme and/or in the definition of new short-term priorities for implementation.

Furthermore, whenever deemed necessary by the European Commission and/or following specific requests from the operational stakeholders' community, the SDM may also decide to identify specific initiatives to accelerate and/or push the deployment of targeted elements. These efforts might also encompass the coordination of activities aimed at developing new standards and/or supporting material to promote the widespread deployment of specific Families.

2.1.5. Support to Stakeholders – Bringing together all impacted organisations

With the specific goal of ensuring the highest level of coordination in modernisation initiatives and associated investments, avoiding unnecessary operational disruptions and allowing performance improvements to be made in the shortest timeframe possible, one of the main responsibilities of the SDM is to interconnect, build trust and assist all relevant civil and military organisations.

Throughout the whole implementation of the SESAR Deployment Strategy, such support provision is expected to ease and facilitate all other phases and activities, as a specific focus shall be dedicated to the provision of continuous support to operational stakeholders required to implement Common Projects. That is, to enable and ensure their full commitment to deploying the associated ATM functionalities on the basis of a commonly-agreed and synchronised approach.

To this end, the SDM is constantly working to promote the need for continued modernisation efforts in alignment with the deployment target dates listed in the Common Projects, but is especially focused on ensuring that the relevant stakeholders are aware and informed about their role in the implementation of the SESAR Deployment Programme.

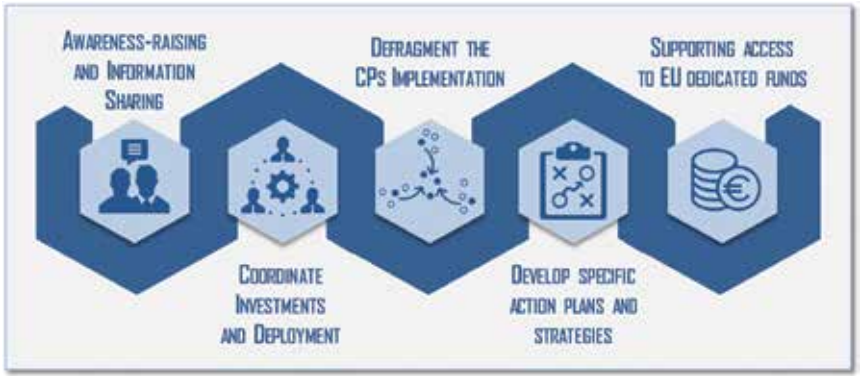


Fig. 7 - SDM Support to operational stakeholders

To this end, specific emphasis is placed on the need to close the existing implementation gaps associated to Families considered urgent for progress in the Common Projects implementation, as well as the need to coordinate investments and initiatives amongst organisations acting within the same operational environment. SDM awareness- raising and information-sharing initiatives will engage both Civil and Military stakeholders, since the civil-military coordination of investments would guarantee a timely deployment of technological and operational elements bringing performance benefits to both General Air Traffic (GAT) and Operational Air Traffic (OAT).

The coordination role undertaken by the SESAR Deployment Manager is however not limited to reinforce the awareness of operational stakeholders about their responsibilities, but it also encompasses the opportunity of

bringing them together in order to ease and synchronise deployment activities.

The SDM therefore is committed to preventing as much as possible the fragmentation of the Common Projects' implementation at local and network level, promoting and supporting cooperation and dialogue among individual stakeholders and between different stakeholder categories.

Where required, the SDM may also highlight the need for specific initiatives, especially when critical gaps in the implementation of the SDP are detected, with potential consequences for the respect of intermediate deadlines and target dates.

To achieve this, dedicated workshops and information-sharing sessions, as well as large-scale information campaigns are organised, promoting the use of good practices for deployment and guiding stakeholders in their implementation activities. The SDM could make use of its expertise and its nature as an industrial partnership among different stakeholder categories to identify specific action plans and detailed strategies to be followed by stakeholders, in order to steer the progress of deployment of the appropriate ATM functionalities.

SDM can also take advantage of its role within the SES framework to provide its contribution to the industrialisation of specific elements, which – although being considered mature when they reach the end over the R&D cycle – might still not be completely ready for a synchronized deployment at European level.

Furthermore, the SDM plays a critical role in supporting and coordinating stakeholders requesting for European Union funding support in the implementation of Common Projects. The coordination role played by the SESAR Deployment Manager is aimed at ensuring that the implementation initiatives are set up and are carried out in full compliance with the CPs Regulation, are aligned with the timeframe set out in the Programme and are consistent with the identified Deployment Approach. In particular, the SDM is responsible of directly monitoring and coordinating all implementation projects carried out under the Framework Partnership Agreement (FPA), benefitting from EU funding under the Connecting European Facility framework.

Finally, the SDM is also committed to assisting operational stakeholders in the identification of the most appropriate and innovative financial mechanisms to support SESAR Deployment, in full compliance with the rules governing EU financial incentives.

2.2. Roll-out of the Deployment Strategy: from SESAR R&D to Common Projects implementation

The SESAR R&D is connected with deployment through the European ATM Master Plan. The ATM Master Plan provides the basis for the European Commission to define Common Projects, which are then coordinated by the SESAR Deployment Manager through the Deployment Programme and then implemented by the operational stakeholders.

All elements of the SESAR concept and those part of the Common Projects, will require specific procedures, new standards and / or an underlying supporting infrastructure including Communications, Navigation and Surveillance capabilities that are adapted to support the operational changes in an efficient way.

Today, the fragmentation in Europe leads to Communications, Navigation and Surveillance being managed and operated locally. This could create a redundancy that has cost, performance and spectrum implications. Indeed, a holistic analysis of technological synergies and architecture would provide significant opportunities and benefits.

The future CNS environment shall be Performance driven, Cost-effective, Enabling advanced operations, Spectrum efficient, Safe & Secure. To achieve these goals, CNS evolution shall focus on delivering enhanced capability and rationalising the use of scarce resources.

As described in the ATM Master Plan, a gradual rationalisation of current CNS systems would lead to network optimisation, following the implementation of new functionalities and/or technologies that support higher performance and efficiency. Natural decommissioning of old systems happens when ground-based navigation aids past the end of their design life. As an example, ADS-B Out technology (automatic dependent surveillance

broadcast), which is enhancing one of the PCP ATM Functionalities (A-SMGCS Routing & Planning functions), would facilitate a European surveillance network rationalisation thanks to the potential decommissioning of old Mode A/C radars and an optimised combination of WAM, Mode S and ADS-B ground stations.

Also digitalisation and automation of the ATM is becoming paramount and progressing very fast recently. It is therefore key to bear these two topics in mind when defining the near future ATM evolution and the associated Deployment Strategy.

Linked to the digitalisation and automation is the cybersecurity, which is another cornerstone of the innovative technologies and digital systems, to ensure and protect safety and security in ATM.

For all the aforementioned reasons, a fully integrated approach taking into account the digitalisation and cybersecurity, should be established and maintained for all the lifecycle phases of the ATM infrastructure. This includes the deployment of new technologies, digital systems and the rationalisation processes, within and outside the Common Projects.

The Common Projects identify the essential ATM functionalities in the ATM Master Plan that, having completed their research, development and validation cycle through the work of the SESAR JU, have demonstrated their readiness for deployment and to produce benefits if deployed in synchronisation.

SESAR Deployment and global interoperability

As part of its effort to ensure synchronised deployment and taking into account the necessary harmonisation of the main technological developments and evolution beyond Europe as well, the SDM has elaborated its strategy to implement Common Projects taking into utmost consideration the need to ensure global interoperability, which has been a key concern for Airspace Users since the launch of the SESAR Deployment phase.

While many countries around the world are implementing ATM improvements, the United States FAA's NextGen and European Union's SESAR are the two largest ATM modernisation programs currently in progress. Cooperation between the US FAA and EU SDM was therefore identified as instrumental for the SDM's contribution to global interoperability and to support harmonisation of standards, technologies and procedures on deployment matters. The SDM is working on a complete life cycle view (definition, development, deployment) of both NextGen and SESAR, confirming the importance of promoting SESAR as one project with definition, development and deployment fully covered. With respect to cooperation with the FAA and global harmonisation, the SDM therefore works closely with the SJU, ensuring a single SESAR view for the international stakeholders' community.

Objectives

The SDM's activity on global interoperability and harmonisation, including the cooperation with FAA, feeds into the rolling updates of the Planning View of the SESAR Deployment Programme in specific technical areas. The SDP is focused also on the issues of global interoperability to avoid any extra burden to the Airspace Users on standards, procedures and equipment due to non-alignment or delayed alignments on global interoperability.

The main focus areas on global interoperability are Air/Ground Data Communication, SWIM, AMAN/TBFM (Time Based Flow Management), with a view to:

- gaining an understanding of NextGen and SDM deployment strategies and associated implementation priorities, timelines and milestones associated;
- identifying potential gaps and needs, discovered during implementation, in terms of standards;
- identifying risks to timely implementation resulting from a potential lack in global interoperability;
- identifying risks on interoperability and global harmonisation, as well as sharing mitigation strategies (see also GAO Report (GAO-15-608) July 2015, Report to Congressional requesters, Next Generation Air Transport System. Improved Risk Analysis Could Strengthen FAA's Global Interoperability Efforts);

- assessing the feasibility and the need for US/EU synchronising deployment activities and on synchronised risk mitigation actions;
- exchanging on economic impact assessments and business cases;
- sharing lessons learnt and best practices

2.2.1. Translating PCP into operational reality

Whereas the PCP – as laid down by Regulation (EU) No 716/2014 – sets forth a first set of 6 ATM functionalities and 20 sub-functionalities required to be implemented across the European Air Traffic Management infrastructure in the timeframe 2014-2026, the SESAR Deployment Programme aims at translating these groups of operational improvements and their sub-sets into coherent deployment Families.

A Family therefore represents a more specific set of homogeneous technological and operational elements, which shall be deployed within a defined geographical scope and timeframe in order to make sure that the operational scenario defined by the PCP Regulation becomes reality and the associated performance improvements are delivered to the ATM Community and – in turn – to European passengers.

The 48 Families identified in the Programme therefore regroup all local implementation initiatives that contribute to pursuing the deployment of the 20 Sub-ATM Functionalities, and – subsequently – of the 6 ATM Functionalities currently included in the PCP. In order to better organise the PCP implementation and support stakeholders in the refinement of their investment plans, the 48 families of the Programme have been clustered into three categories:

- ***36 core PCP Families***, which regroup all operational and technological improvements that are explicitly mentioned within the text of Regulation (EU) No 716/2014;
- ***7 facilitating Families***, which include the implementation activities linked to PCP Sub-AFs, which can facilitate full deployment as an intermediate step to achieving the operational concept. They are not mandatory under the PCP Regulation;
- ***5 complementary Families***, which are linked to the PCP Sub-AFs and are deemed necessary to cover an existing gap not explicitly addressed in the PCP Regulation; they are not mandatory under Reg. (EU) No 716/2014, although they can be mandatory in accordance with other EU Regulations (such as the Aeronautical Data Quality Regulation and Data Link Services Regulation[1]);

Each Family is implemented through specific implementation projects, executed by the relevant operational stakeholders in the geographical areas identified in the PCP. After the initial iterations in 2015 and 2016, the full list of the 48 Families – including their clustering into *core PCP, facilitating and complementary Families* – has been finally defined and shall be considered as stable.

Whilst the number and technical scope of the Families will no longer be modified, their readiness for implementation is still expected to evolve, thanks to the growing technological maturity of the elements to be deployed and the progresses in the industrialisation phase, with a specific focus on the availability of standards and recommended practices for deployment.

Detailed information on the readiness for deployment of each Family, on their optimum sequencing for deployment, as well as on their status of implementation throughout the PCP geographical scope, are included in the Guidance Material to support the SESAR Deployment Programme implementation, namely the Planning View and the Monitoring View.

[1] *Respectively, Regulation (EU) n. 73/2010 laying down requirements on the quality of aeronautical data and aeronautical information for the Single European Sky and Regulation n. (EU) 2015/310 amending Regulation (EC) n. 29/2009 laying down requirements on data link services for the single European Sky*

As a stable reference, the full list of the 48 Families is described below, clustered by ATM Functionality.

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

Family 1.1.1 Basic AMAN – facilitating Family

Family 1.1.2 AMAN Upgrade to include Extended Horizon function

Family 1.2.1 RNP Approaches with vertical guidance

Family 1.2.2 Geographic Database for Procedure Design – complementary Family

Family 1.2.3 RNP 1 Operations in high density TMAs – ground capabilities

Family 1.2.4 RNP 1 Operations - aircraft capabilities – facilitating Family

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

AF2 – Airport Integration and Throughput

Family 2.1.1 Initial DMAN

Family 2.1.2 Electronic Flight Strips (EFS)

Family 2.1.3 Basic A-CDM

Family 2.1.4 Initial Airport Operations Plan (AOP)

Family 2.2.1 A-SMGCS Level 1 and 2

Family 2.3.1 Time Based Separation (TBS)

Family 2.4.1 A-SMGCS Routing and Planning Functions

Family 2.5.1 Airport Safety Nets associated with A-SMGCS (Level 2)

Family 2.5.2 Aircraft and vehicle systems contributing to Airport Safety Nets – facilitating Family

AF3 – Flexible Airspace Management and Free Route

Family 3.1.1 ASM Tool to support AFUA – facilitating Family

Family 3.1.2 ASM management of real time airspace data

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

Family 3.1.4 Management of Dynamic Airspace configurations

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

Family 3.2.3 Implement Published Direct Routings (DCTs) – facilitating Family

Family 3.2.4 Implement Free Route Airspace

AF4 – Network Collaborative Management

Family 4.1.1 STAM Phase 1 – facilitating Family

Family 4.1.2 STAM Phase 2

Family 4.2.2 Interactive Rolling NOP

Family 4.2.3 Interface ATM systems to NM systems

Family 4.2.4 AOP/NOP Information Sharing

Family 4.3.1 Target times for ATFCM purposes

Family 4.3.2 Reconciled Target Times for ATFCM and arrival sequencing

Family 4.4.2 Traffic Complexity Tools

AF5 – Initial System Wide Information Management

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

Family 5.1.2 NewPENS: New Pan-European Network Service

Family 5.1.3 Common SWIM Infrastructure Components

Family 5.1.4 Common SWIM PKI and cyber security

Family 5.2.1 Stakeholders Internet Protocol Compliance – facilitating Family

Family 5.2.2 Stakeholders SWIM Infrastructure Components

Family 5.2.3 Stakeholders' SWIM PKI and cyber security

Family 5.3.1 Upgrade/Implement Aeronautical Information Exchange System / Service

Family 5.4.1 Upgrade/Implement Meteorological Information Exchange System / Service

Family 5.5.1 Upgrade/Implement Cooperative Network Information Exchange System/Service

Family 5.6.1 Upgrade/Implement Flight Information Exchange System / Service supported by Yellow Profile

Family 5.6.2 Upgrade/Implement Flight Information Exchange System / Service supported by Blue Profile

AF6 – Initial Trajectory Information Sharing

Family 6.1.1 ATN B1 based services in ATSP domain – complementary Family

Family 6.1.2 ATN B2 based services in ATSP domain

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

Family 6.1.4 ATN B1 capability in Multi Frequency environment in aircraft domain – complementary Family

Family 6.1.5 Implementation of ATN B2 in Aircraft domain

The following Work-Breakdown Structure (WBS) reflects the structure of the Pilot Common Project and its breakdown into AFs, Sub-AFs and Families. It is worth noting that the WBS includes all the PCP Families, those which are explicitly derived from the PCP Regulation text, and those which have been added at the initiative of the SESAR Deployment Manager with the full support of the operational stakeholders in order to de-risk full PCP implementation.

In addition, the following pages include dedicated factsheets to summarise the features of each of the six ATM functionalities, as included in the PCP, including the reference to the underlying SESAR Solutions[2].

It has to be noted that the link with the ATM Master Plan is provided through the associated SESAR Solutions and Key Features. However, the PCP ATM Functionalities and the SDP Families were developed before the SESAR Solutions were defined. The PCP was based on Operational Improvement Steps (OIs) and enablers from the ATM Master Plan, and the link with the OIs and enablers of the ATM Master Plan is also provided in the Guidance Material for SESAR Deployment Programme Implementation Planning View. Therefore, the connection between the ATM Functionalities and the SESAR Solutions is derived from the links with the OIs and enablers.

[2] *The second edition of the SESAR Solutions Catalogue is available at the following address: https://www.sesarju.eu/newsroom/brochures-publications/sesar-solutions-catalogue*

Fig. 8 - The full Project View of the Pilot Common Project

2.2.2. The overall GANTT of PCP implementation

The Annex to Regulation (EU) No 716/2014 – describing the technical content of the ATM Functionalities to be implemented – identifies the deployment target dates; as reported within Article 2 of the Regulation, as "*the date by which the deployment of the ATM functionality in question is to be completed and fully used operationally*". Article 1.3, 2.3, 3.3, 4.3, 5.3 and 6.3 of the Annex illustrates the deployment target dates for each ATM Functionality, or – when needed – for the deployment of specific sub-sets of their technological, procedural and/or operational elements.

A short recap of the deployment target dates – as laid down by the PCP Regulation – is given in the table below.

	ATM Functionality	Sub-ATM Functionality	Target Date
AF #1	Extended AMAN and PBN in high density TMA	Sub-AF 1.1 – Arrival Management Extended to en-route Airspace	1st January 2024
		Sub-AF 1.2 – Enhanced Terminal Airspace using RNP-based Operations	1st January 2024
AF #2	Airport Integration and Throughput	Sub-AF 2.1 - Departure Management synchronized with Pre-departure sequencing	1st January 2021
		Sub-AF 2.2 - Departure Management integrating Surface Management Constraints	1st January 2021
		Sub-AF 2.3 - Time-Based Separation for Final Approach	1st January 2024
		Sub-AF 2.4 - Automated Assistance to Controller for Surface Movement Planning and Routing	1st January 2024
		Sub-AF 2.5 - Airport Safety Nets	1st January 2021
AF #3	Flexible ASM and Free Route	Sub-AF 3.1 – ASM and Advanced FUA	no specific target date
		Sub-AF 3.2 - Free Route	1st January 2022*
		* As an intermediate step towards the deployment of Free Route, Network Manager, Air Navigation Service Providers and Airspace Users may operate Direct Routings (DCTs) as from 1st January 2018	
AF #4	Network Collaborative Management	Sub-AF 4.1 - Enhanced STAM	1st January 2022
		Sub-AF 4.2 - Collaborative NOP	1st January 2022
		Sub-AF 4.3 - Calculated Take-off Time to Target Times for ATFCM purposes	1st January 2022
		Sub-AF 4.4 - Automated Support for Traffic Complexity Assessment	1st January 2022
AF #5	Initial SWIM	Sub-AF 5.1 – Common Infrastructure Components	1st January 2025
		Sub-AF 5.2 – SWIM Infrastructure and Profiles	1st January 2025
		Sub-AF 5.3 – SWIM Aeronautical Information Exchange	1st January 2025
		Sub-AF 5.4 – SWIM Meteorological Information Exchange	1st January 2025
		Sub-AF 5.5 – SWIM Cooperative Network Information Exchange	1st January 2025
		Sub-AF 5.6 – SWIM Flights information Exchange	1st January 2025
AF #6	Initial Trajectory Information Sharing	Sub-AF 6.1 – Initial Trajectory Information Sharing	1st January 2025*
		*At least 20% of the aircraft operating within the airspace of ECAC countries from the ICAO EUR Region – corresponding to at least 45% of flights – shall be equipped with the capability to downlink aircraft trajectory using ADS-C EPP from 1st January 2026	

Fig. 9 - Deployment Target Dates, as specified within Regulation (EU) No 716/2014

Based on the mandatory target dates, the SESAR Deployment Programme defines a common and shared roadmap for the implementation of PCP-related elements.

The Programme therefore defines the expected start and end dates of deployment for each of the 36 core PCP Families and the related facilitating and complementary Families, therefore outlining the most appropriate implementation *window* within which the related implementation activities should be planned and subsequently carried out by the relevant stakeholders.

Each implementation window and the associated Initial Operational Capability and Full Operational Capability dates have been identified on the basis of:

- the readiness for implementation of the operational improvements, both in terms of technological maturity of the elements to be deployed and of the availability of:
  - o appropriate standards, that would ensure a harmonised and interoperable deployment;
  - o reliable guidance material, that would support stakeholders in their initiatives;
  - o supporting regulations, that would ensure that deployment is carried out in accordance with existing binding regulations and potentially establishing mandatory deadlines;
  - o recommended practices, that would provide a reliable example for future initiatives;
- the urgency for deployment, which indicates the need to implement in order to anticipate or at least pursue a timely achievement of the associated performance benefits.

The full picture of the implementation windows for each Family is illustrated in the chart below, the overall Gantt chart of the Pilot Common Project.

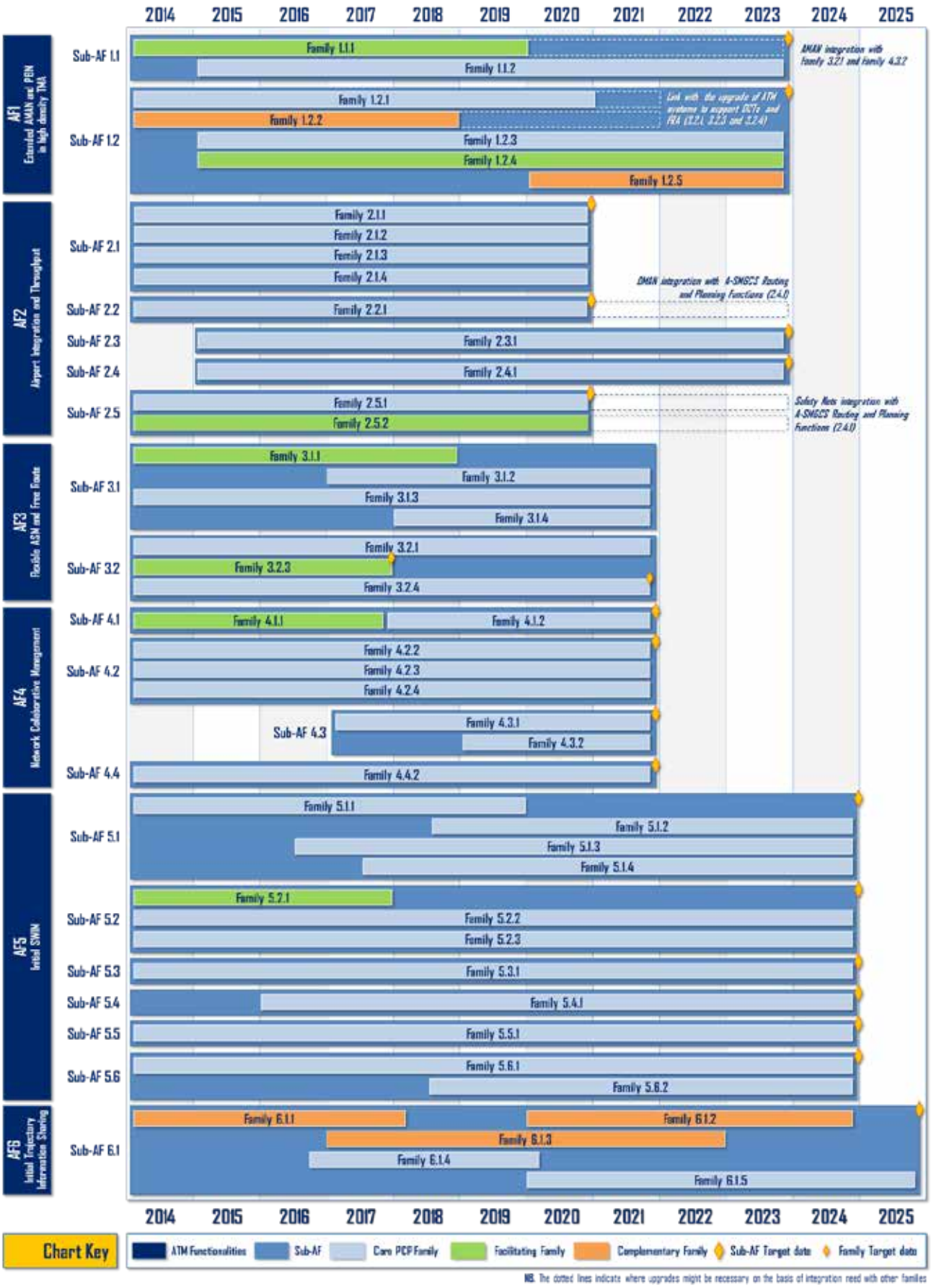


Fig. 10 - Overall Gantt of PCP Implementation

2.2.3.The Deployment Strategy and the Deployment Approach for a timely PCP implementation

CNS/ATM systems will improve the handling and transfer of information, extend surveillance and improve navigational accuracy. This will lead to, among other things, reductions in separation between aircraft, allowing for increased airspace capacity. Advanced CNS/ATM ground-based systems will exchange data directly with flight management systems aboard aircraft through data link. This will benefit the ATM provider and airspace user by enabling improved conflict detection and resolution through intelligent processing, providing for the automatic generation and transmission of conflict free clearances, as well as offering the means to adapt quickly to changing traffic requirements. As a result, the ATM system will be better able to accommodate an aircraft's preferred flight profile and help aircraft operators to achieve reduced flight operating costs and delays.

With new CNS/ATM systems, communications will increasingly take place via digital data link over existing communications channels. Satellite data and voice communications, capable of global coverage will also be introduced. Secondary surveillance radar Mode S and ADS-B, which is increasingly being used for surveillance in high-density airspace, also has the capability of transmitting digital data between air and ground. An ADS-B Out implementation plan (including ground and airborne segments), supported by operational stakeholders and the timely activation of a coordinated approach for its implementation are instrumental to ensure a harmonised and timely deployment in Europe of the Surveillance Performance and Interoperability (SPI) Commission Implementing Regulation (EU) No 1207/2011 and its amendments (EU) No 1028/2014 and (EU) No 2017/386.

Improvements in navigation will include the progressive introduction of performance based navigation (PBN) capabilities along with the global navigation satellite system (GNSS). These systems provide for worldwide navigational coverage and are being used for worldwide en-route navigation and for non-precision approaches. With appropriate augmentation systems and related procedures, it is expected that these systems will also support most precision approaches.

The role and importance of aeronautical information will continue to change significantly with the implementation of area navigation, required navigation performance (RNP) and airborne computer-based navigation systems. An integrated ATM system along with the requirement for precise navigation capability will therefore require high quality aeronautical information in order to be able to provide guidance for gate-to-gate operations between origin and destination.

In order to better streamline and harmonise PCP deployment across the large number of Stakeholders impacted by Regulation (EU) No 716/2014, the SESAR Deployment Programme complements the Family-based Gantt with the identification of the most effective way to complete the deployment of an ATM Functionality and/or of a Sub-ATM Functionality. This Deployment Strategy is settled on the Deployment Approach.

In other words, the Deployment Approach for each AF and Sub-AF represents the sequencing of deployment activities (e.g. of specific Families) associated to an ATM Functionality, and corresponds to the preferred approach to be followed by operational stakeholders affected by the PCP Regulation and therefore required to invest in the implementation of new technologies and/or operational improvements.

It is worth underlining that the proposed approach will be fine-tuned by involved stakeholders at local level, as the Family implementation time span could partially differ from one geographical area/operational environment to another, depending on several elements (such as the different operational arrangements and/or responsibilities). This approach has been determined on the basis of the combination and weighting of the following principles and criteria:

- Sequence in time;
- Interdependencies between Families;
- Potential acceleration of performance benefits.

As some Families are interdependent and some are prerequisites to others, the proposed Deployment Approaches and the associated flow diagrams must be aligned with these relationships. In particular, the optimum approaches place the Families into the most effective logical and chronological sequencing order, whilst also identifying those Families whose deployment can proceed in parallel, potentially leading to an early achievement of the associated performance benefits stemming from the deployment of the technological and operational elements included in each Family.

In addition, it should be noted that – as the technological and operational elements of the 6 ATM Functionalities are tightly intertwined between each other – the elaboration of the AF-based Deployment Approaches has enabled an overall mapping of the deployment-related interrelations between AFs and Sub- AFs, providing a unique document offering a wide-reaching overview of the full PCP implementation.

The recommended Deployment Approaches per ATM Functionalities are meant to be stable in time. They could however change following an amendment to the Pilot Common Project Regulation. The Planning View and its updates will identify for each AF the next steps in the recommended Deployment Approach. The intention is to best support stakeholders in planning their investments to deploy timely the PCP.

At the same time, the short-term Deployment Approach will be complemented in the Planning View (as part of the guidance material of the SDP) with a description of the performance contribution from each AF and Sub-AF to the main 4 KPAs that appear in the SES High-Level Goals. This performance assessment, in line with the PCP CBA, will be notwithstanding a qualitative indication to allow for identification of the most relevant SDP Families contributing to a certain KPA. The aim is neither to provide quantitative values, nor to amend or update the benefits part of the initial CBA, but to flag the performance benefits.

It must be noted that the AFs and sub-AFs cannot be seen as isolated projects. They are interconnected and there are interdependencies between them within the PCP. These interdependencies are sometimes actual prerequisites and sometimes-mere enhancements of one functionality over another. In any case, it will be worth giving an overview of the main linkages so that these are taken into account when describing the Approaches. The overall picture with the interdependencies between the different AFs will be explained at the end of this section, once each individual AF has been detailed. This will give a better understanding to the reader of how all the SDP Families are linked.

The next pages outline each ATM Functionality with its sub-AFs and SDP Families. The diagrams include the corresponding text explaining the Families sequence in time and the Deployment Approaches for each Sub-AF.

In the diagrams, a normal arrow means that one Family is a prerequisite of the successor Family, and therefore should be deployed in sequence, although sometimes deployment can start for part of a predecessor Family in parallel with part of the successor Family.

More specifically, according to the Families clustering proposed within section 2.2.1, the light blue arrows represent the core PCP Families, whilst the green and red ones respectively indicates the facilitating and complementary Families. Dummies are introduced for the unique identification of activities and/or for displaying certain precedence relationships. These activities are represented by dashed arrows in the network and do not consume time or resources. White bubbles represent intermediate steps in the deployment of the Sub-AF, whilst the dark blue bubbles indicate the achievement of the Sub-AF.

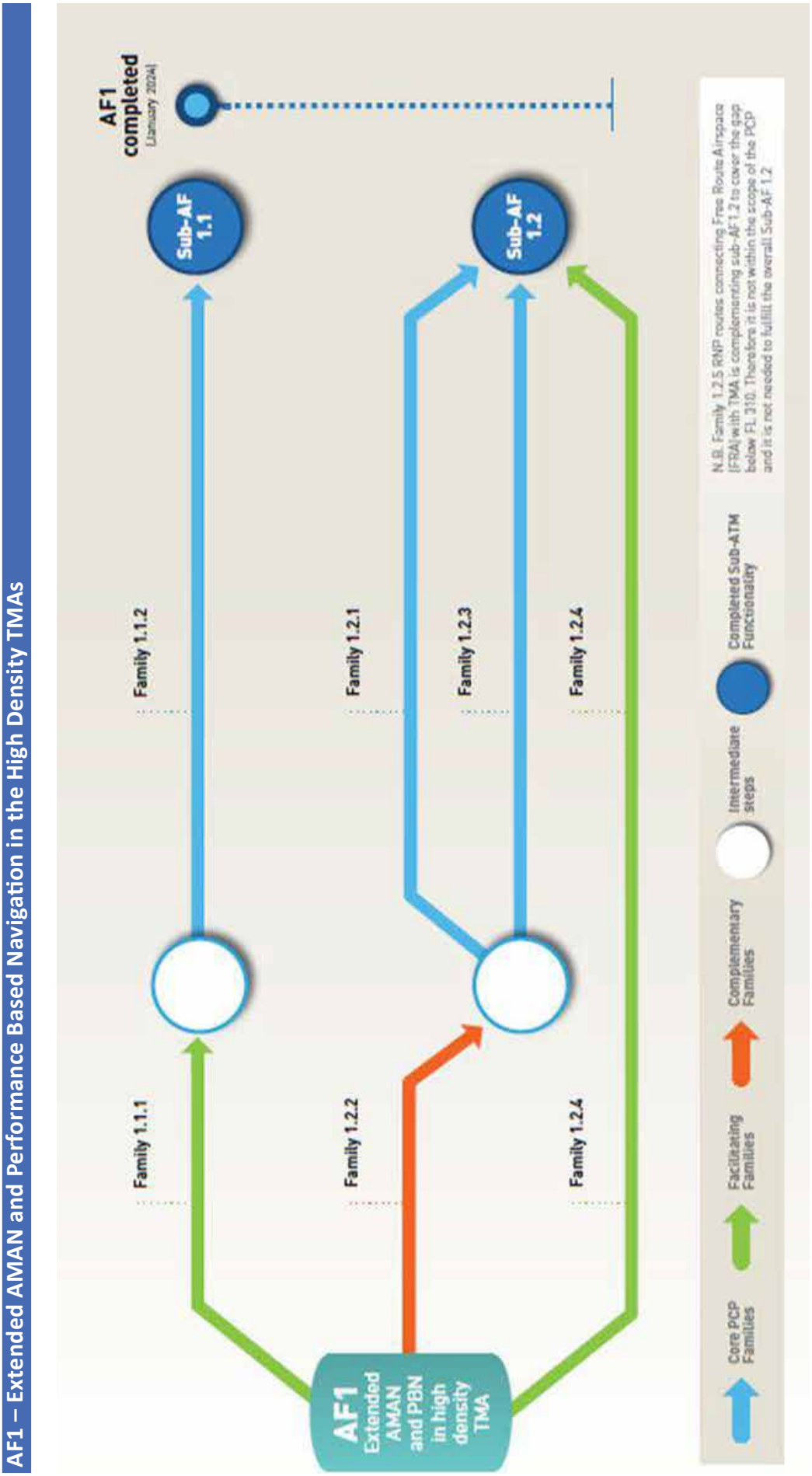


Fig. 11 - AF #1 Deployment Approach

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

To achieve the Extended AMAN implementation, the SESAR Deployment Programme includes Family 1.1.2 AMAN upgrade to include Extended Horizon function. This Family describes the core of the Extended AMAN Sub-AF, and although the Basic AMAN is also included in the SDP as an intermediate step to extend later the horizon, the full Extended AMAN functionality could be deployed directly without previously having a Basic AMAN. In those cases where Basic AMAN has not been implemented, it is recommended to move directly towards the Extended AMAN tool.

The second Sub-AF, PBN in high density TMAs, comprises RNP-based operations. RNP procedures are based on quality assured geographical data stored in databases, thus *Geographical Database (Family 1.2.2)* has been introduced. Based on accurate geographical data the *RNP Approach with vertical guidance (Family 1.2.1) and RNP1 Operations in high density TMAs (ground capabilities) (Family 1.2.3)* should be implemented.

It should be noted that RNP 1 is not mandatory in the PCP for the airspace users, *RNP1 operations (aircraft capabilities) (Family 1.2.4)*. However, full performance benefits would only be achieved once the aircraft are equipped to be able to use both RNP 1 and RNP APCH capabilities.

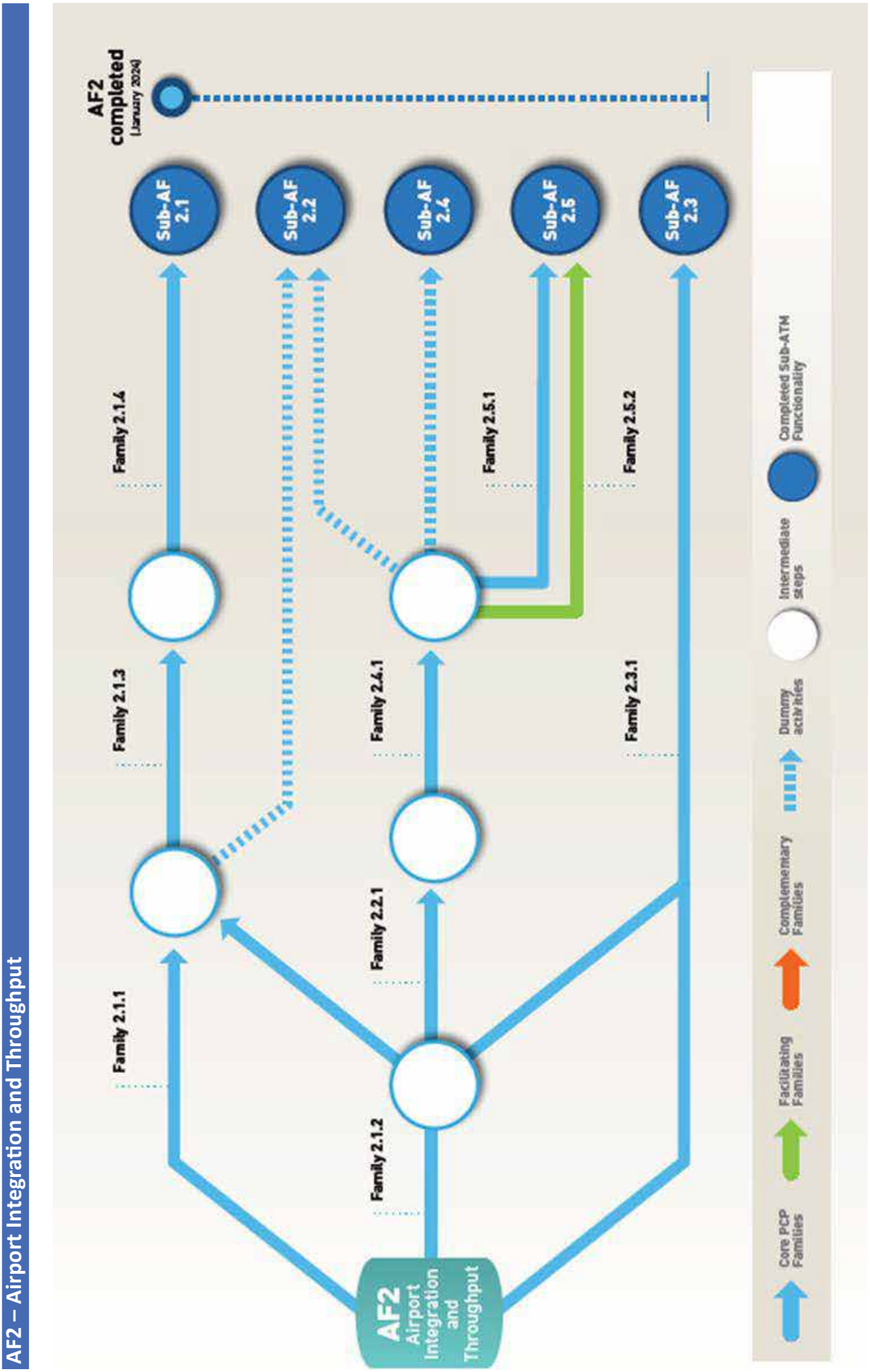


Fig. 12 - AF #2 Deployment Approach

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.

Sub-AF 2.1, Departure Management Synchronised with Pre-departure sequencing requires the integration of the Initial Departure Management and of the basic A-CDM systems, in order to support optimised pre-departure sequencing. *Family 2.1.2 Electronic Flight Strips* is also a prerequisite for the achievement of this Sub-AF. Finally, the Initial AOP, which will be fed by the Initial DMAN and A-CDM, is crucial to connecting the relevant stakeholders and to sharing the data and information related to the different status of planning phases. *Family 2.1.4 Initial AOP* is also a pre-requisite for *Family 4.2.4 AOP/NOP Information Sharing*. All these elements contribute to achieving S-AF 2.1.

Sub-AF 2.2, Departure Management integrating Surface Management Constraints will require the A-SMGCS level 1 & 2 to be fully implemented (*Family 2.2.1*). Specially A-SMGCS is required to provide the optimised taxi-time, which would be integrated into the Initial DMAN. DMAN integrating A-SMGCS constrains using a digital system, such as Electronic Flight Strips, integrating "Airport safety Nets associated with A-SMGCS Level 2" supplemented by an advanced A-SMGCS routing function will be integrated into flight data processing systems for departure sequencing and routing computation. Therefore, to successfully achieve this Sub-AF, *Families 2.1.1, 2.1.2, 2.2.1*, and part of *2.4.1* need to be implemented to achieve S-AF 2.2.

Sub-AF 2.3, Time-Based Separation for Final Approach is reflected in the SDP by the *Family 2.3.1* and with its implementation, the separation of aircraft in sequence on the approach using time intervals instead of distances will be enabled. The *Family 2.1.2 Electronic Flight Strips* will enhance the performance delivered by TBS. Both Families will contribute to achieving S-AF 2.3.

Sub-AF 2.4, Automated Assistance to Controller for Surface Movement Planning and Routing is covered by *Family 2.4.1 A-SMGCS Routing & Planning. Families 2.1.2, 2.2.1* are the prerequisites for implementing the routing and planning functionalities (automatic generation of taxi routes with the corresponding estimated taxi time and management of potential conflicts). All these Families contribute to achieving S-AF 2.4.

Sub-AF 2.5, Airport Safety Nets will be covered by *Families 2.5.1 ASN associated with A-SMGCS level 2* and *2.5.2 Vehicle and Aircraft systems contributing to airport safety nets*. It should be noted that *Family 2.4.1* FOC Date is currently 01/01/2024 while *Families 2.5.1* and *2.5.2* which both depend (partially) on *2.4.1* output have their FOCs currently set at 01/01/2021. It should be extended to 01/01/2024 to match with *2.4.1 FOC*. It should also be noted that *Family 2.2.1 A-SMGCS Level 1 and 2* is a prerequisite for *Families 2.5.1, 2.5.2* and *2.4.1*. All these Families contribute to achieving S-AF 2.5.

AF3 – Flexible Airspace Management and Free Route

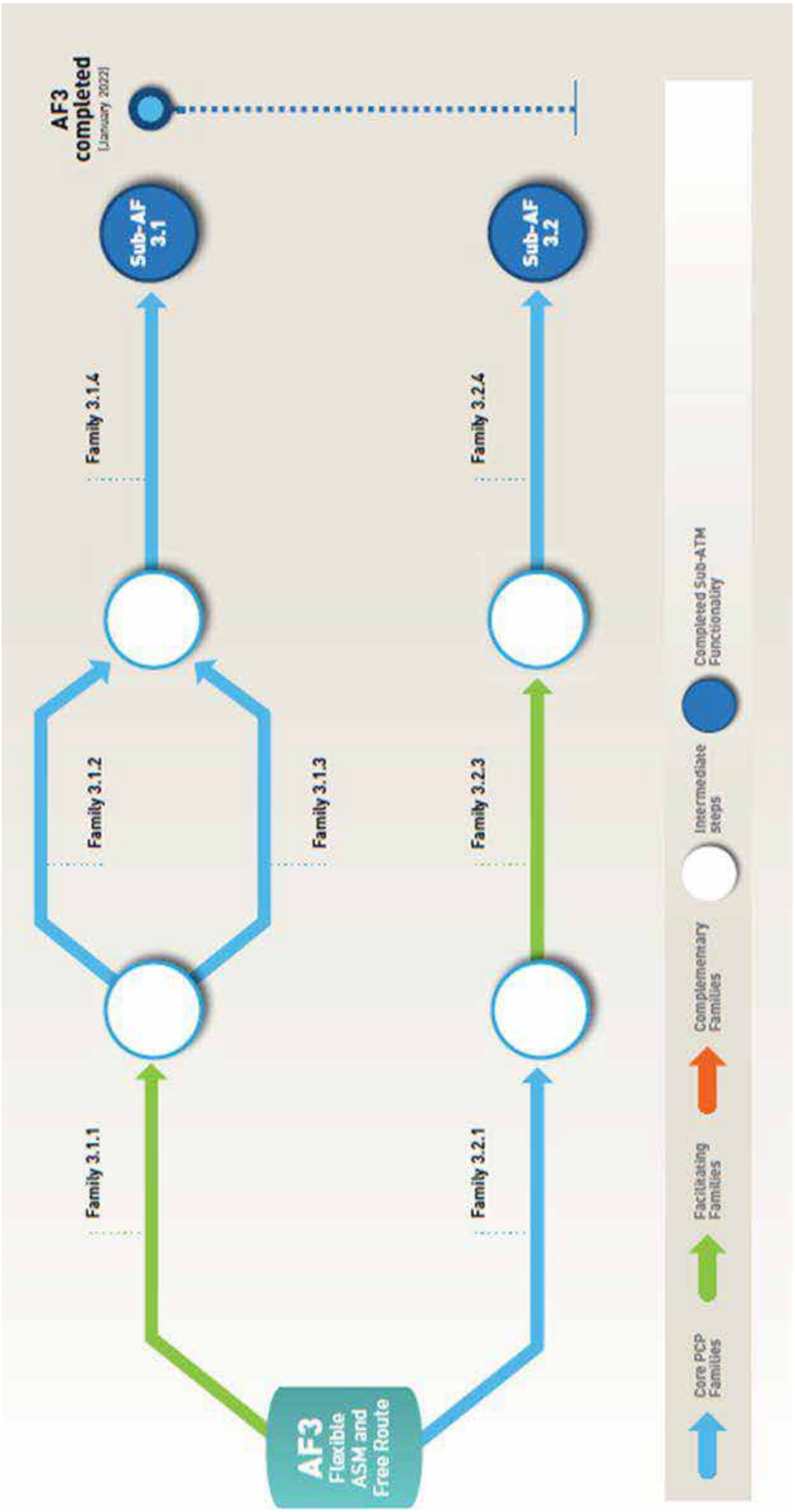


Fig. 13 - AF #3 Deployment Approach

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

Flexible Airspace Management requires airspace management tools to support AFUA and Dynamic Airspace configurations. This Sub-AF requires interaction and real-time data exchange between ASM, ATFCM and ATC systems during planning and execution phases. The Deployment Approach goes through *Families 3.1.1, 3.1.2* and *3.1.3*, partially enabling the achievement of *3.1.4 Management of Dynamic Airspace configurations*, which will support the dynamic airspace configurations for DCTs and FRA.

Concerning Free Route, the approach focuses on the ATM systems upgrade (Flight data processing systems, including HMI) to support the DCTs and Free Route (*Family 3.2.1*), which is a prerequisite for FRA (*Family 3.2.4 Implement FRA*). To facilitate early implementations before the target deployment date, FRA may be implemented through intermediate steps (*Family 3.2.3 Implement published DCTs*). The implementation of FRA is dependent on system upgrades, airspace design and airspace reservations involving civil/military coordination including OAT routes.

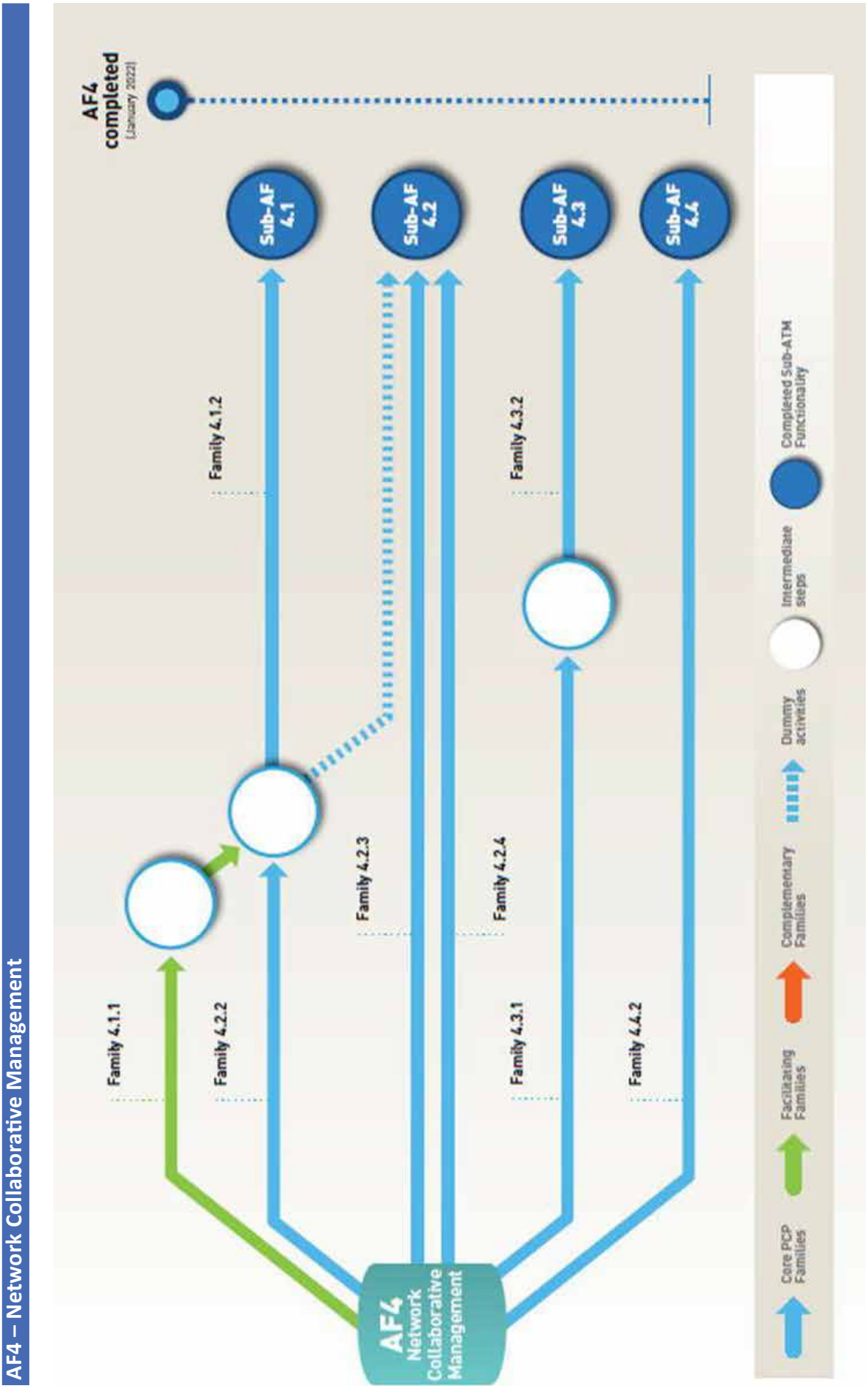


Fig. 14 - AF#4 Deployment Approach

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 first Sub-AF, STAM, comprises STAM Phase I and STAM Phase II in the SESAR Deployment Programme. STAM Phase I is a predecessor of STAM Phase II, but the deployment of STAM Phase I is not a mandatory task due to the fact that STAM Phase II focuses on network workflow procedures and STAM Phase I is more locally focused. The STAM Phase II tool and procedures, once implemented, will oversee management of ATFCM planning at network level by the Network Manager ensuring an efficient relationship between NM, FMP and airspace users. STAM Phase II requires the new information management platform described in *Family 4.2.2 Interactive Rolling NOP*. This is the reason why the Deployment Approach for this Sub-AF goes through 4.2.2 and 4.1.2.

The Collaborative NOP as described in the PCP regulation needs to integrate NOP and AOP information. Therefore, *AOP/NOP information sharing* (Family 4.2.4), which constitutes the technical data layer on the collaborative NOP, is part of the Deployment Approach together with the *Interactive Rolling NOP* (Family 4.2.2). The *Interface ATM systems to NM systems* (Family 4.2.3), which addresses the message exchange between NM systems, ANSPs ATM systems and AU/FOC/WOC flight plan filing systems in respect of collaborative flight planning, could be deployed in parallel with 4.2.2 and 4.2.4. *Family 2.1.4 Initial AOP* is a pre-requisite for *Family 4.2.4 AOP/NOP Information Sharing*.

The third Sub-AF, Calculated Take-off Time to Target Times for ATFCM purposes, is still pending full validation, and hence the Deployment Approach cannot yet be fully established. *Family 4.3.1* comprises the part of the Sub-AF that is ready to be implemented, consisting of the transmission of the calculated target times to allow an early partial optimisation from a local point of view.

Finally, the Automated Support for Traffic Complexity Assessment will be achieved directly through the implementation of *Family 4.4.2 Traffic complexity* tools. This Family enables improved capacity management, which will enhance the ATFCM and Free route. It is therefore connected to *Family 4.1.2* STAM Phase II and *Families 3.2.1 Upgrade of ATM systems to support DCTs and FRA* and *3.2.4 Implement FRA*.

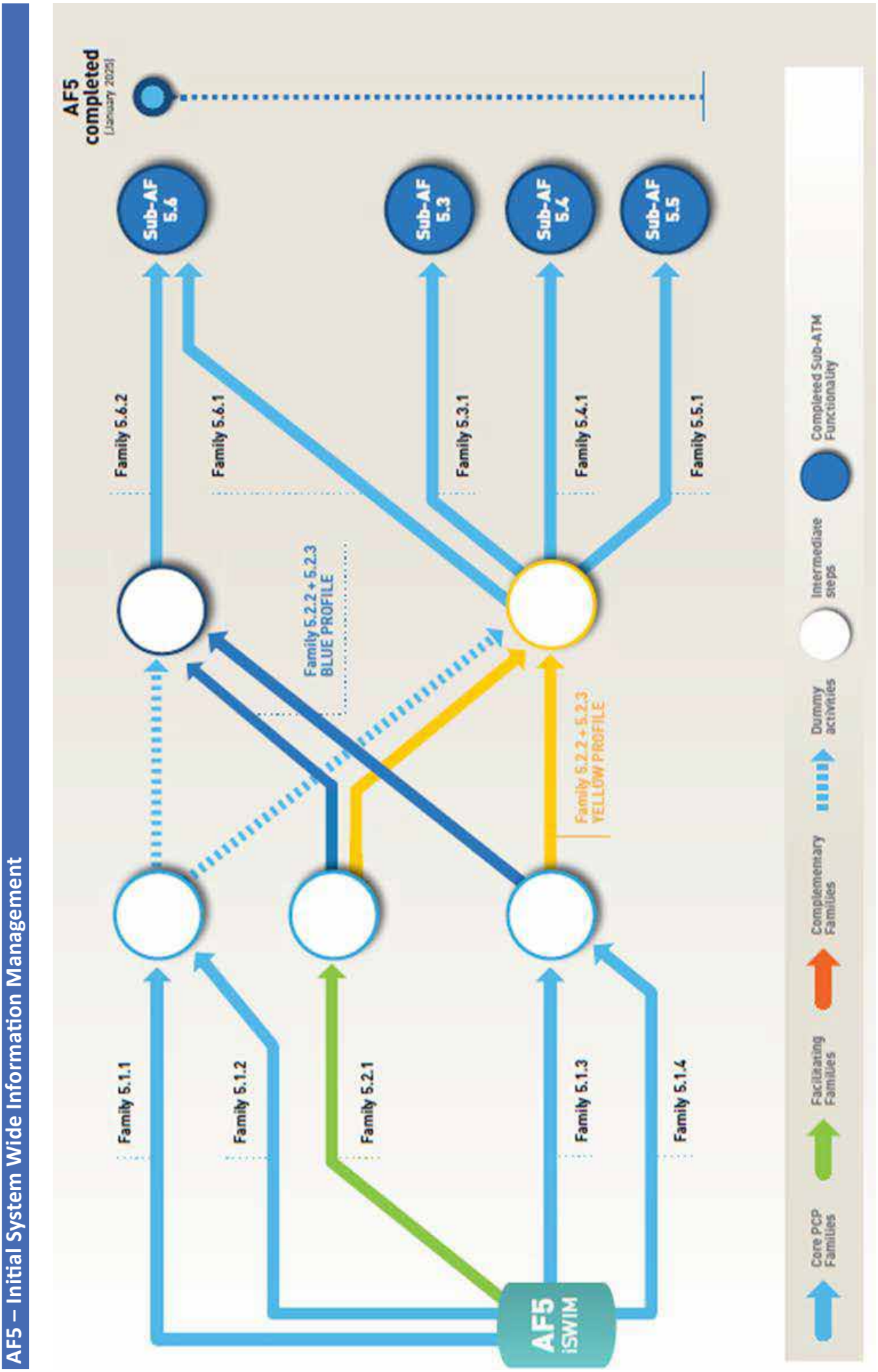


Fig. 15 - AF #5 Deployment Approach

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.

For Sub-AF 5.1, Common infrastructure components, the SDP includes a set of four Families to cover the required infrastructure components that are common to all stakeholders[3] (*Families 5.1.1, 5.1.2, 5.1.3 and 5.1.4*). For the purpose of a successful implementation of SWIM, proper SWIM governance and registry is paramount. This does not exclude the possibility of starting the local deployment of SWIM, which some Stakeholders have already initiated; fully interoperable deployment in Europe, however, needs to be commonly governed.

SWIM Technical Infrastructure and Profiles (Sub-AF 5.2) includes the Blue and Yellow SWIM profiles. In this diagram, a coloured dark blue arrow has been used to indicate the implementation sequence for the Blue Profile, while the dark yellow arrows mark the Yellow Profile.

The Blue profile is to be used for exchanging flight information between ATC centres and between ATC and the Network Manager. For this profile, the implementation of *Families 5.1.1 PENS 1* and *5.1.2 New PENS* (transition phase to migrate from PENS 1 to New PENS is expected from 2017 to 2019) will also be required, as the Blue Profile solely relies on PENS as communication network.

Aeronautical information exchange, Meteorological information exchange and Cooperative network information exchange sub-AFs rely on the Yellow Profile and their implementation can thus be concluded once the Yellow Profile is available. However, the full implementation of the Flight information exchange also requires the availability of the Blue profile (*Family 5.6.2*). *Family 5.6.2* is an essential pre-requisite to implement *Family 6.1.2* in AF6 (distribution of downlinked trajectory information via SWIM Blue profile).

The implementation of PENS (PENS 1 or NewPENS) is mandatory for *Family 5.6.2* but optional for the Yellow Profile, because this profile allows for use over public internet.

[3] *Note that PENS 1 is restricted to ANSPs and the Network Manager*

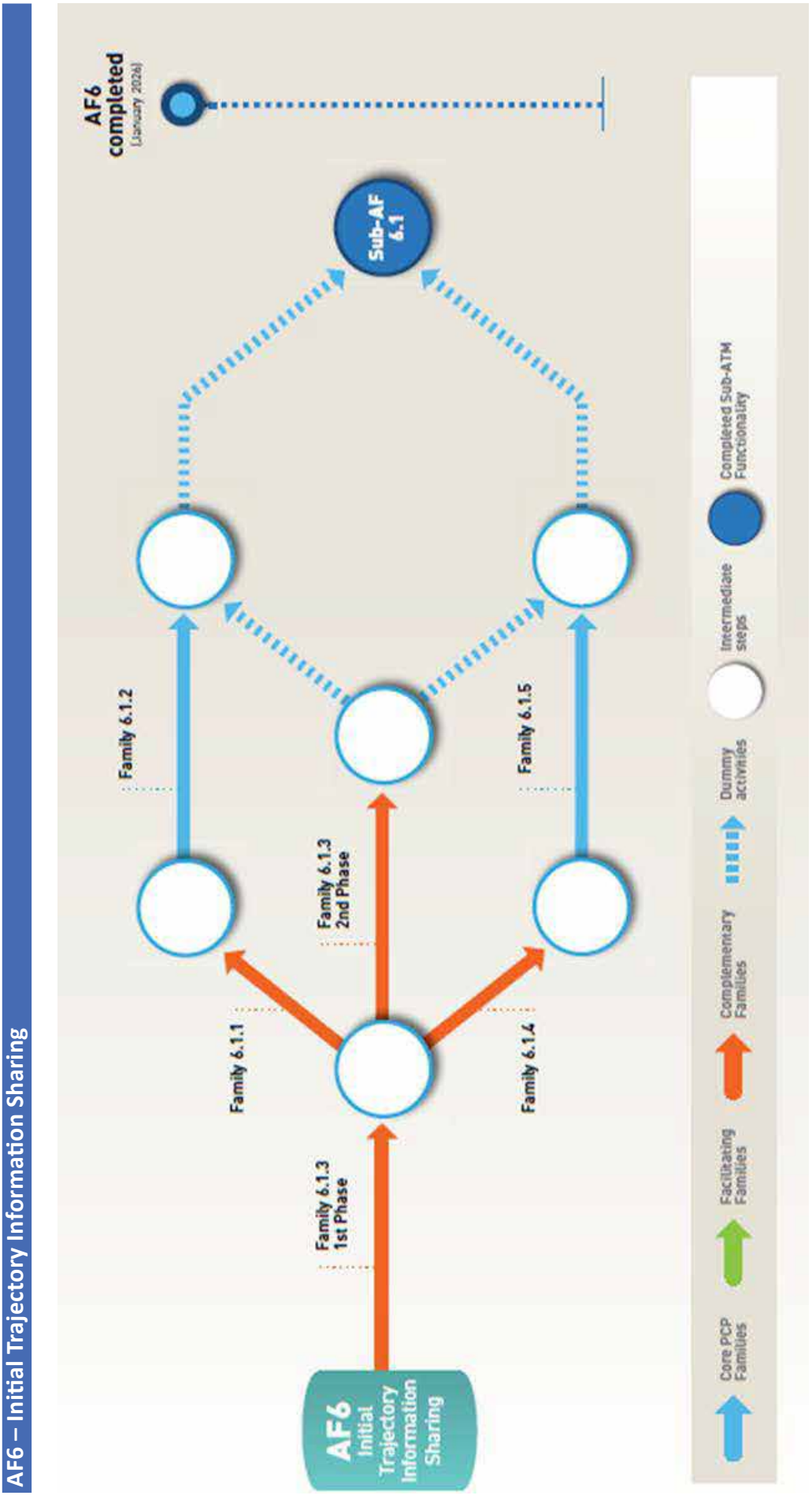


Fig. 16 - AF #6 Initial Trajectory Information Sharing

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

The Initial Trajectory Information Sharing consists of the improved use of target times and trajectory information, including where available the use of on-board 4D trajectory data by the ground ATC system and Network Manager System.

As also indicated in the dedicated DLS Recovery Plan, the Approach for successfully achieving full AF6 deployment goes through two phases based on a phased approach for the implementation of the A/G DL communication infrastructure through *Family 6.1.3* and the initial implementation of the DLS IR as prerequisite for AF6:

During the first phase, *Family 6.1.3 1st Phase* (VDL Mode 2 Multi Frequency upgrade) will provide the required VDL Mode 2 network performance to support the implementation of CPDLC as per DLS IR (EC 29/2009 and amendment). The first phase of *Family 6.1.3* is deployed in parallel with *Families 6.1.1* (ground capabilities to support CPDLC) and *6.1.4* (airborne capabilities to support CPDLC).

During the second phase, the focus of *Family 6.1.3* implementation will be the increase of the A/G DL network capacity primarily through the deployment of "Model D" Target Solution per ELSA study results. (Note: Preparatory activities for the second phase are performed in parallel with the first phase activities for Family *6.1.3*.) This network optimisation is necessary to support the increased data volume produced by the downlink of the ADS-C EPP aircraft trajectory data that is implemented parallel with *Family 6.1.3* through Families *6.1.2* (ground capabilities to support ADS-C EPP) and *6.1.5* (airborne capabilities to support ADS-C EPP). *Family 5.6.2* is an essential pre-requisite for *Family 6.1.2* (distribution of downlinked trajectory information via SWIM Blue profile).

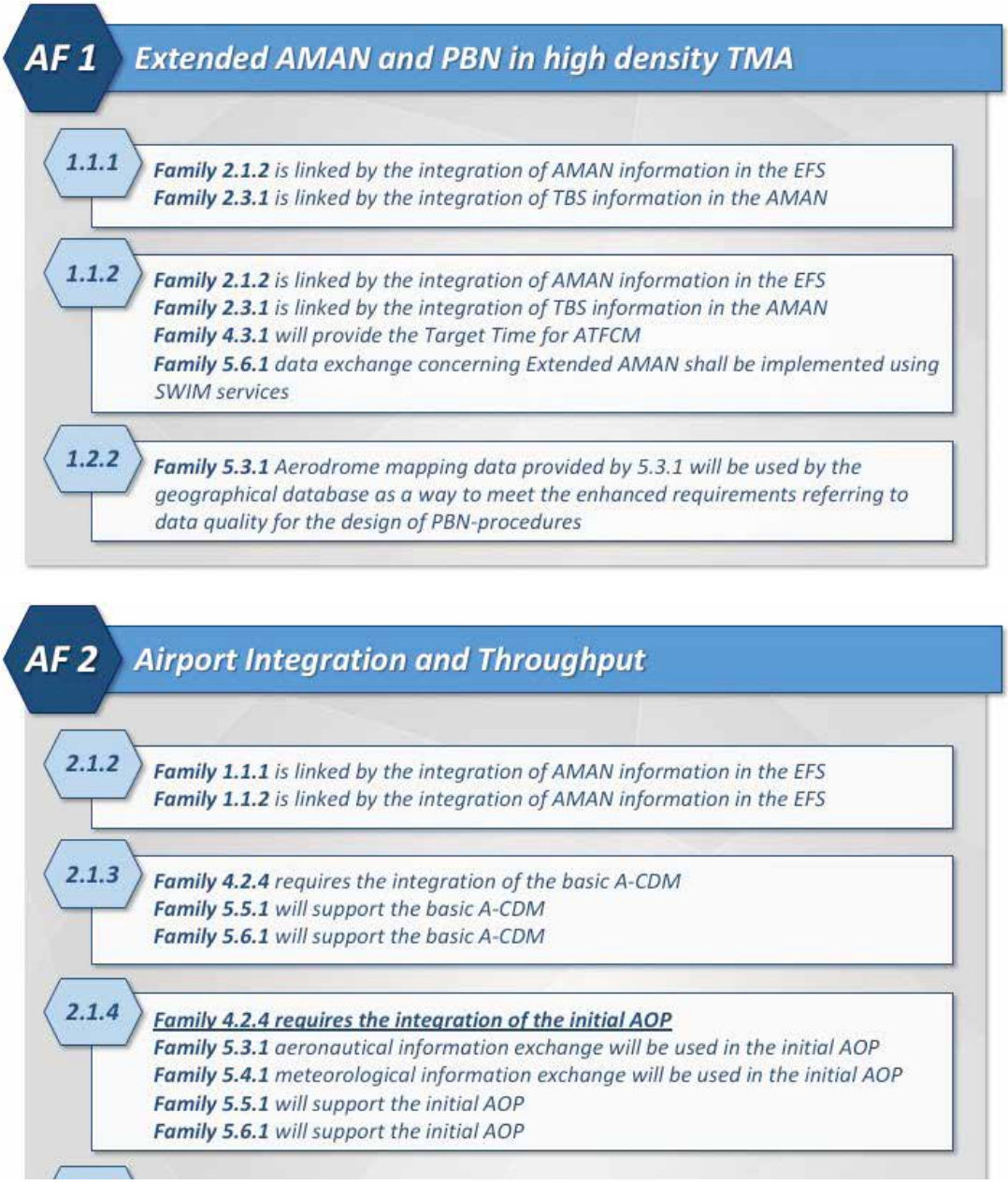
Family 6.1.3 implementation will be completed (i.e. the required network capacity will be provided with the second phase) before F*amily 6.1.2* and *6.1.5* implementations will be completed.

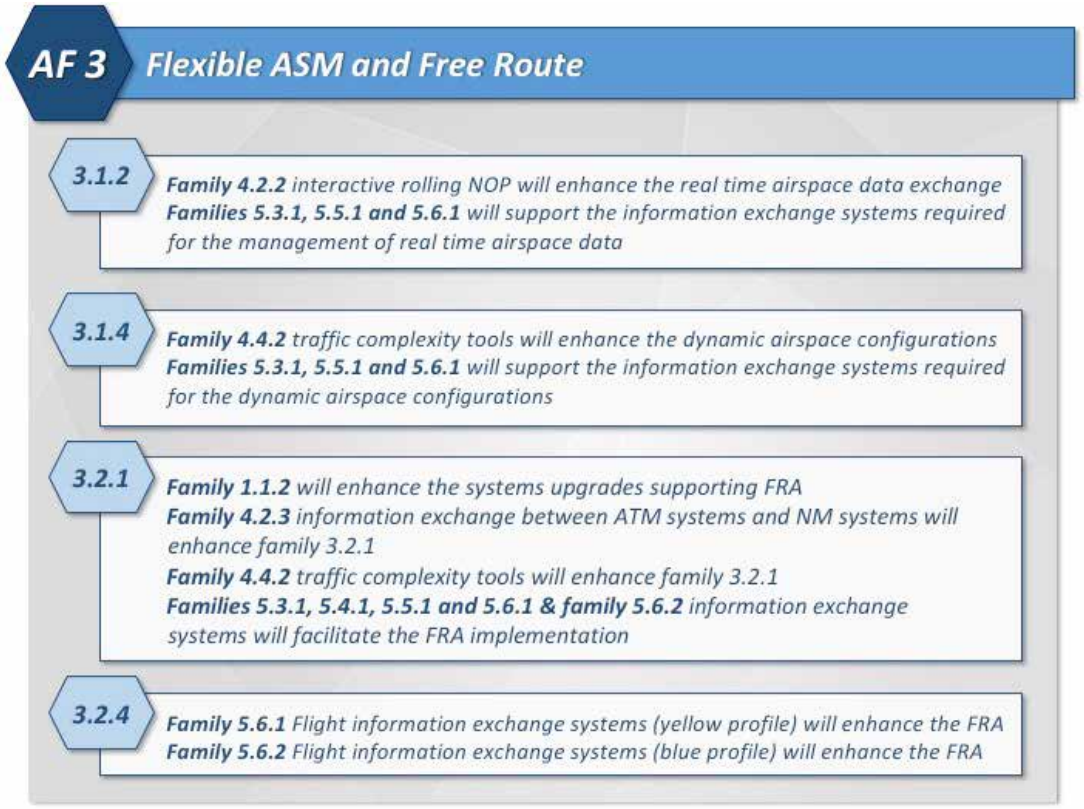
Benefits expected from Family 6.1.2 (ADS-C EPP/ground) implementation can only be achieved after the implementation of Family 6.1.5 (ADS-C EPP/airborne).

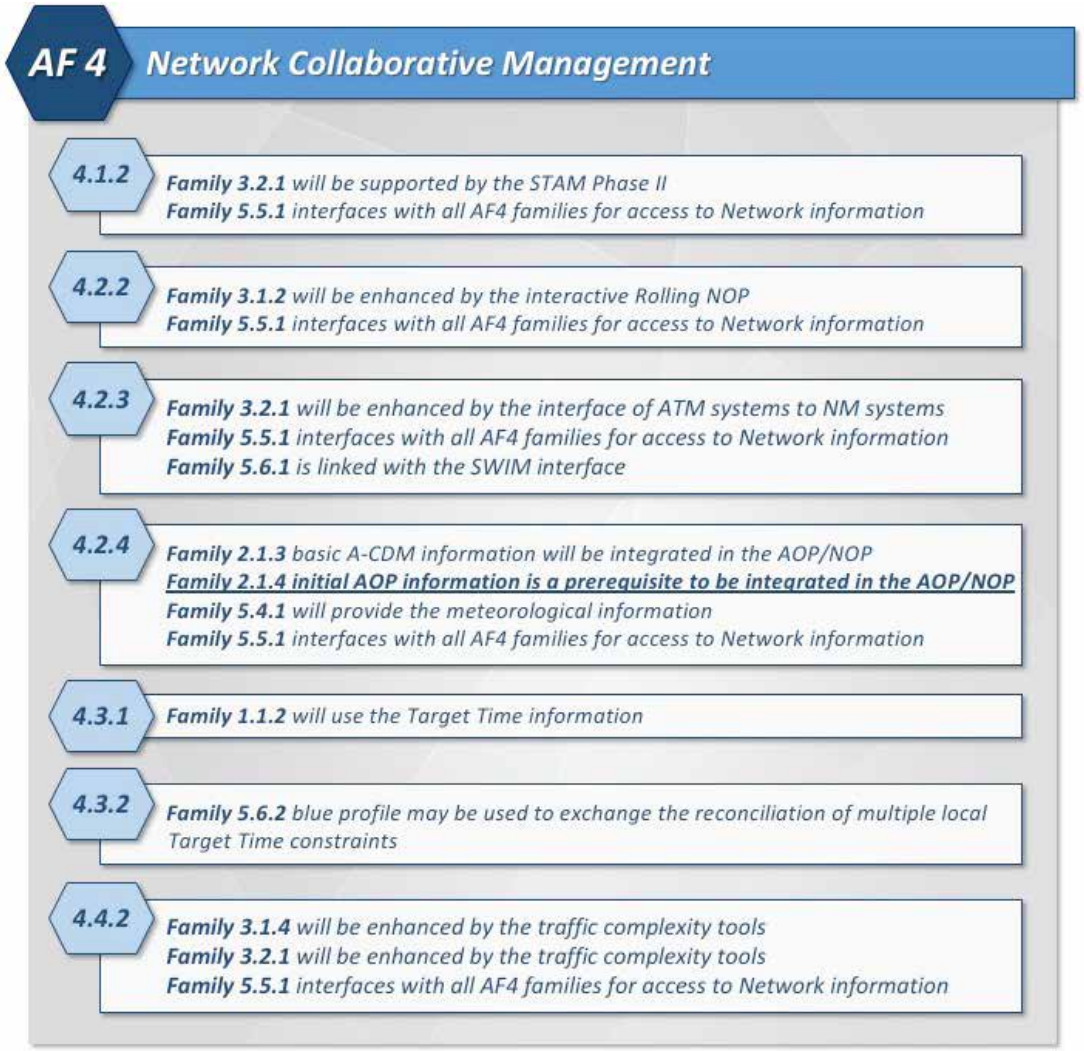
Interdependencies among the 6 ATM Functionalities and the SDP Families

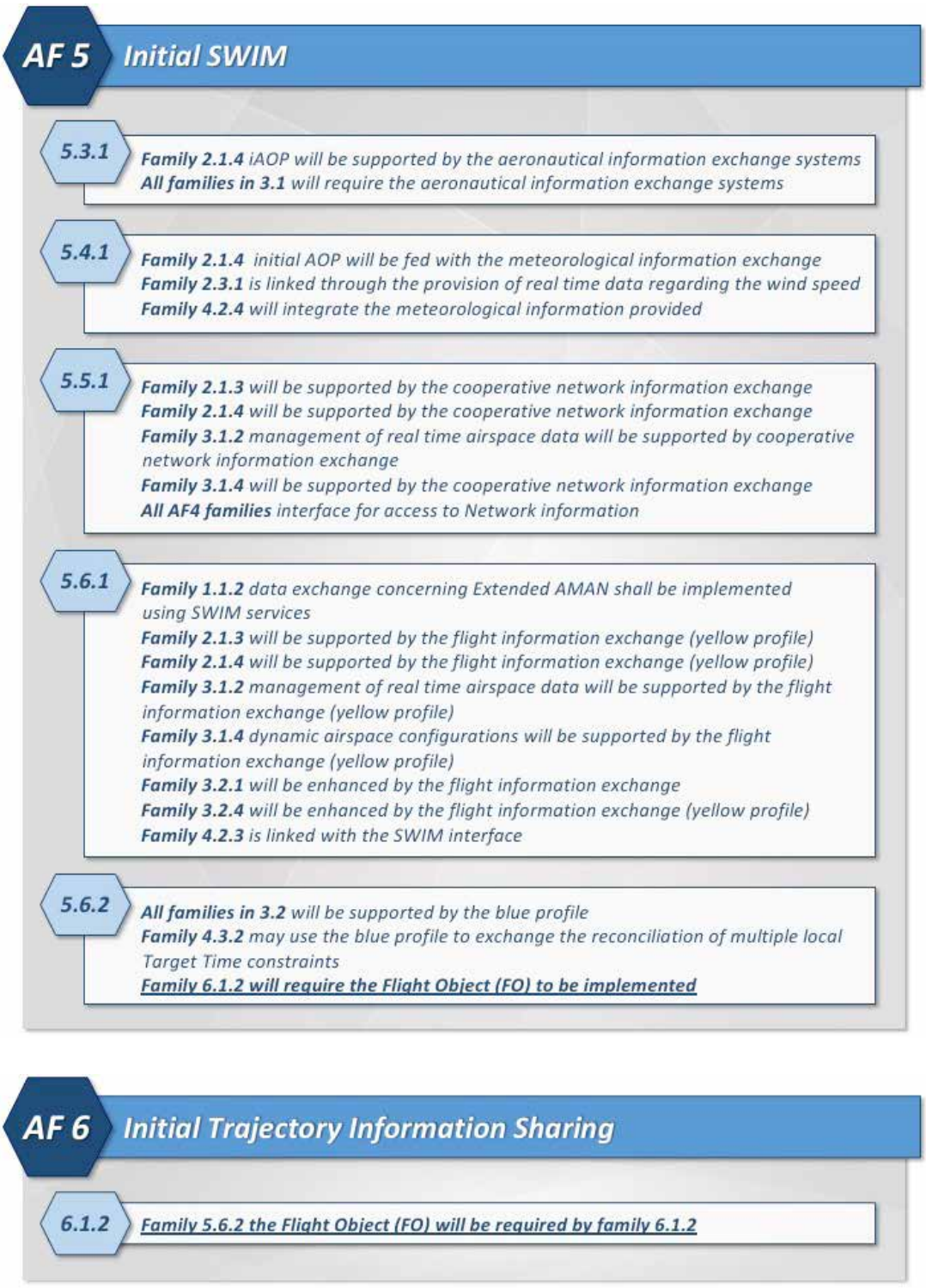
As noted at the beginning of the Deployment Approach section, the SESAR Deployment Programme Families and each AF are not isolated projects. There are many interdependencies between the different activities needed to successfully deploy the PCP. These interdependencies appear in all AFs, and sometimes they are due to the fact that certain elements of one AF are enablers for another AF, or because a given Sub-AF will be enhancing the performance and capabilities of another Sub-AF.

This section aims to show the main interdependencies within all the ATM Functionalities illustrating the linkages among the SDP Families, and the essential prerequisites that are needed to be able to proceed with the implementation of a given Family. The nature of the links varies among the Families, and the details are provided in the Guidance Material Planning View. This table only summarises the interdependencies described in the Guidance Material and differentiates between actual pre-requisites and enhancements




AF 3
Flexible ASM and Free Route
3.1.2
Family 4.2.2 interactive rolling NOP will enhance the real time airspace data exchange
Families 5.3.1, 5.5.1 and 5.6.1 will support the information exchange systems required for the management of real time airspace data
3.1.4
Family 4.4.2 traffic complexity tools will enhance the dynamic airspace configurations
Families 5.3.1, 5.5.1 and 5.6.1 will support the information exchange systems required for the dynamic airspace configurations
3.2.1
Family 1.1.2 will enhance the systems upgrades supporting FRA
Family 4.2.3 information exchange between ATM systems and NM systems will enhance family 3.2.1
Family 4.4.2 traffic complexity tools will enhance family 3.2.1
Families 5.3.1, 5.4.1, 5.5.1 and 5.6.1 & family 5.6.2 information exchange systems will facilitate the FRA implementation
3.2.4
Family 5.6.1 Flight information exchange systems (yellow profile) will enhance the FRA
Family 5.6.2 Flight information exchange systems (blue profile) will enhance the FRA


AF 4
Network Collaborative Management
4.1.2
Family 3.2.1 will be supported by the STAM Phase II
Family 5.5.1 interfaces with all AF4 families for access to Network information
4.2.2
Family 3.1.2 will be enhanced by the interactive Rolling NOP
Family 5.5.1 interfaces with all AF4 families for access to Network information
4.2.3
Family 3.2.1 will be enhanced by the interface of ATM systems to NM systems
Family 5.5.1 interfaces with all AF4 families for access to Network information
Family 5.6.1 is linked with the SWIM interface
4.2.4
Family 2.1.3 basic A-CDM information will be integrated in the AOP/NOP
Family 2.1.4 initial AOP information is a prerequisite to be integrated in the AOP/NOP
Family 5.4.1 will provide the meteorological information
Family 5.5.1 interfaces with all AF4 families for access to Network information
4.3.1
Family 1.1.2 will use the Target Time information
4.3.2
Family 5.6.2 blue profile may be used to exchange the reconciliation of multiple local Target Time constraints
4.4.2
Family 3.1.4 will be enhanced by the traffic complexity tools
Family 3.2.1 will be enhanced by the traffic complexity tools
Family 5.5.1 interfaces with all AF4 families for access to Network information


AF 5
Initial SWIM
5.3.1
Family 2.1.4 iAOP will be supported by the aeronautical information exchange systems
All families in 3.1 will require the aeronautical information exchange systems
5.4.1
Family 2.1.4 initial AOP will be fed with the meteorological information exchange
Family 2.3.1 is linked through the provision of real time data regarding the wind speed
Family 4.2.4 will integrate the meteorological information provided
5.5.1
Family 2.1.3 will be supported by the cooperative network information exchange
Family 2.1.4 will be supported by the cooperative network information exchange
Family 3.1.2 management of real time airspace data will be supported by cooperative network information exchange
Family 3.1.4 will be supported by the cooperative network information exchange
All AF4 families interface for access to Network information
5.6.1
Family 1.1.2 data exchange concerning Extended AMAN shall be implemented using SWIM services
Family 2.1.3 will be supported by the flight information exchange (yellow profile)
Family 2.1.4 will be supported by the flight information exchange (yellow profile)
Family 3.1.2 management of real time airspace data will be supported by the flight information exchange (yellow profile)
Family 3.1.4 dynamic airspace configurations will be supported by the flight information exchange (yellow profile)
Family 3.2.1 will be enhanced by the flight information exchange
Family 3.2.4 will be enhanced by the flight information exchange (yellow profile)
Family 4.2.3 is linked with the SWIM interface
5.6.2
All families in 3.2 will be supported by the blue profile
Family 4.3.2 may use the blue profile to exchange the reconciliation of multiple local Target Time constraints
Family 6.1.2 will require the Flight Object (FO) to be implemented
AF 6
Initial Trajectory Information Sharing
6.1.2
Family 5.6.2 the Flight Object (FO) will be required by family 6.1.2

3. The Project View of the Pilot Common Project (PCP)

3.1. The six PCP ATM Functionalities: factsheets

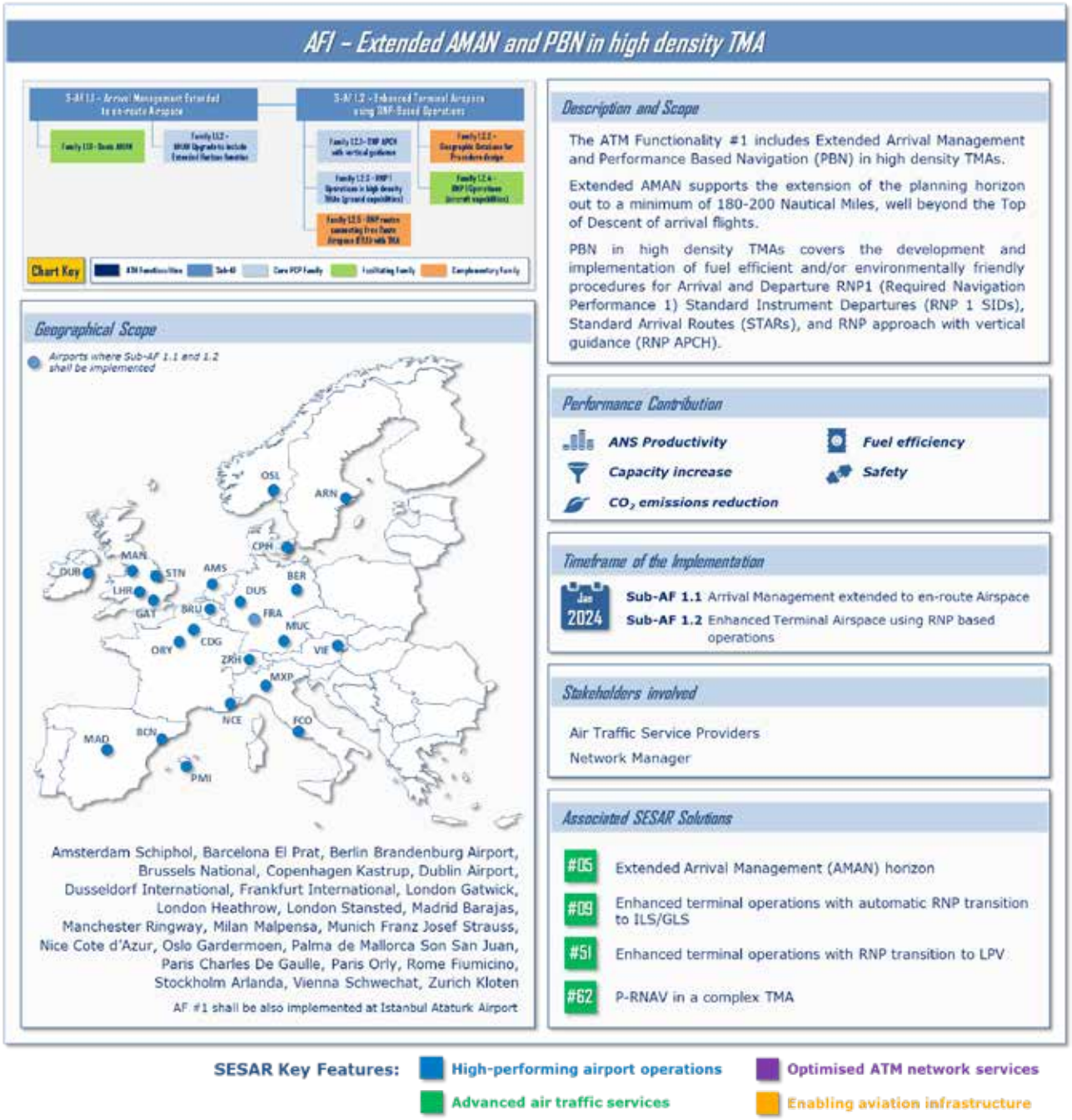


Fig. 17 - ATM Functionality #1 - Factsheet

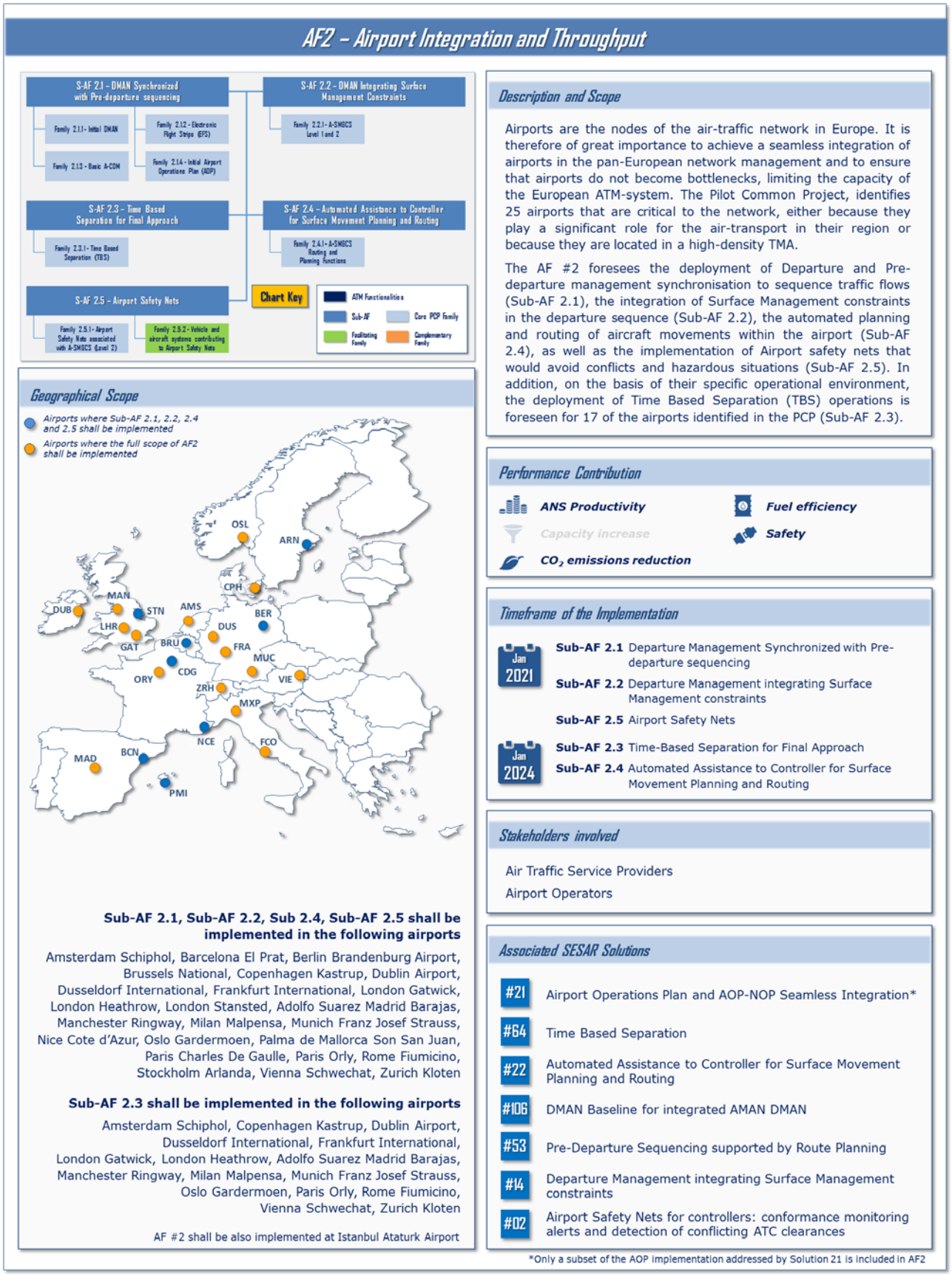


Fig. 18 - ATM Functionality #2 - Factsheet

Fig. 19 - ATM Functionality #3 - Factsheet

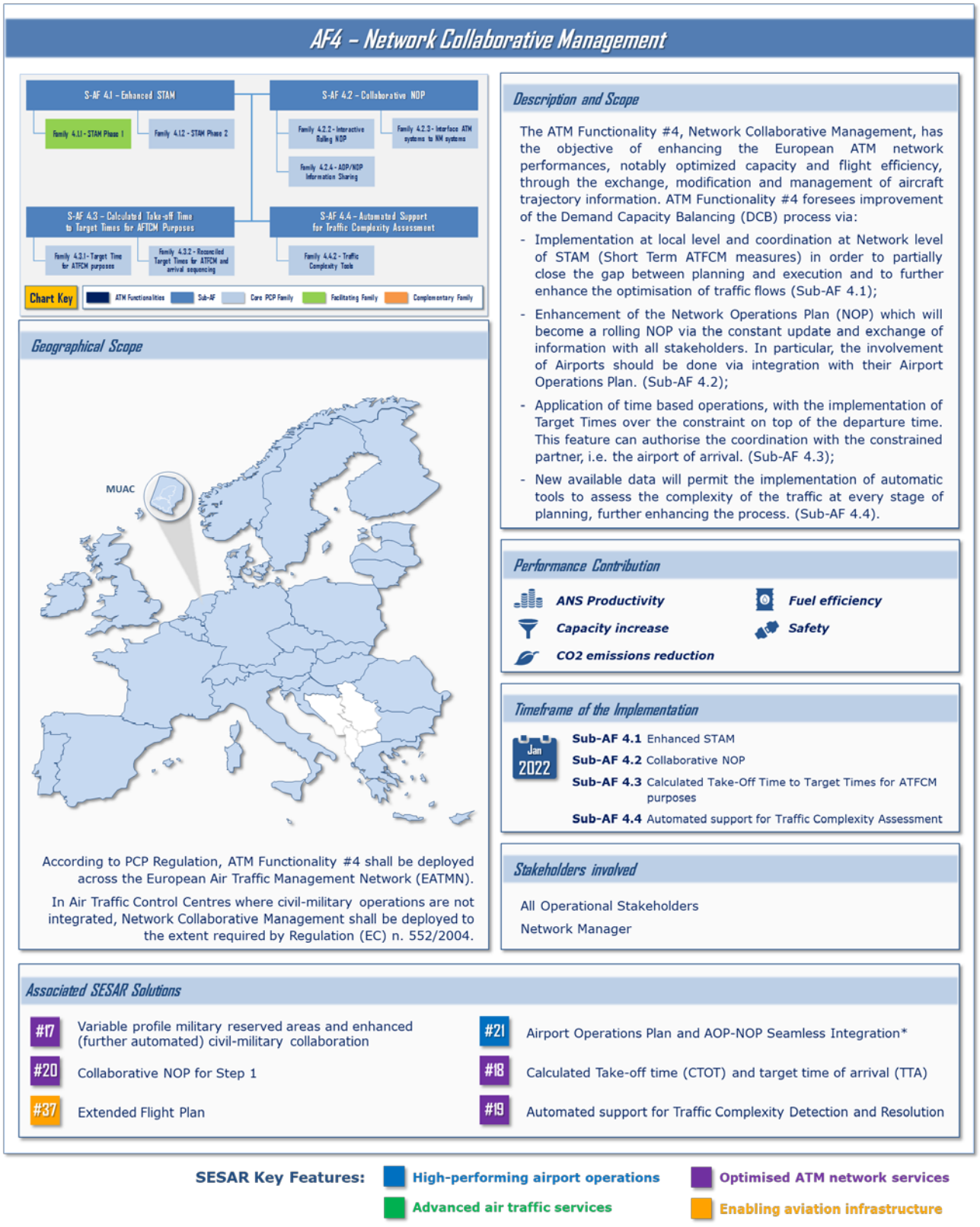


Fig. 20 - ATM Functionality # 4 - Factsheet

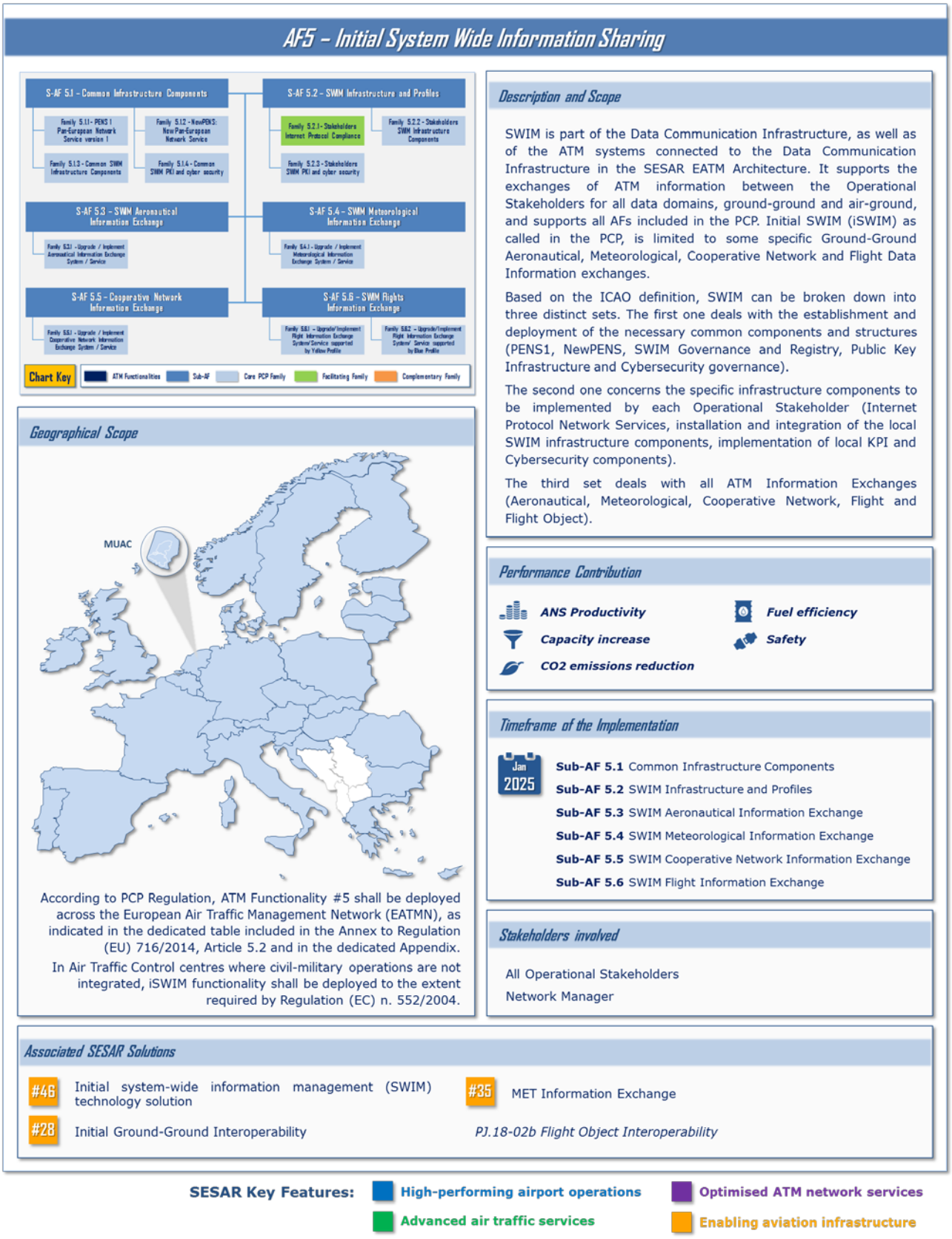


Fig. 21 - ATM Functionality #5 - Factsheet

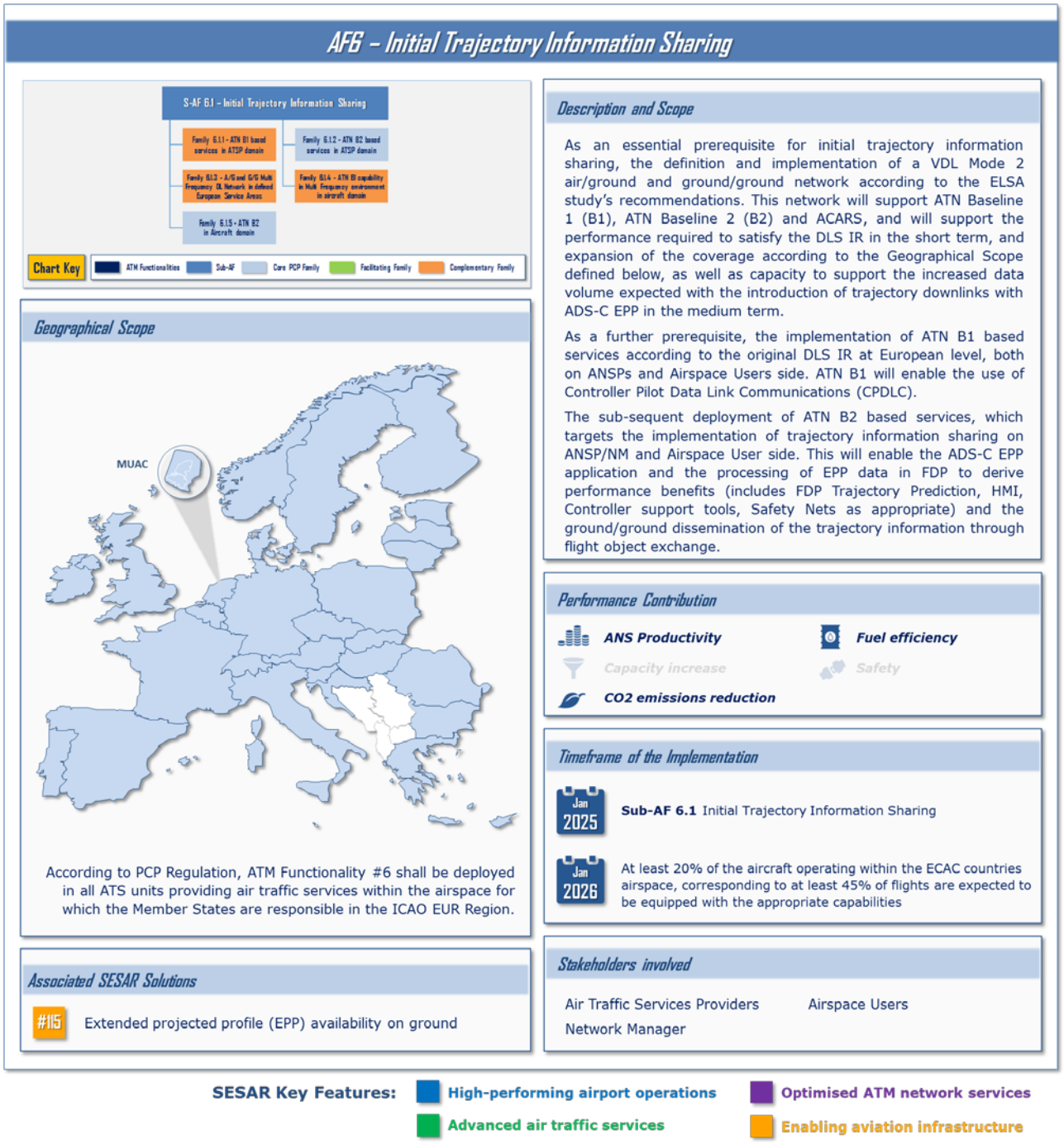


Fig. 22 - ATM Functionality #6 - Factsheet

3.2. PCP ATM Functionalities detailed description

In the following paragraphs, the content of the Project View will be expanded and the 6 ATM Functionalities composing the Pilot Common Project will be broken down, illustrating their full structure through a further detailing of the Work Breakdown Structure, as well as providing an overview on the technical content of each Family.

This overview is further detailed through a fully developed Family description within the yearly-updated Planning View, as part of the Guidance Material to support the implementation of the SESAR Deployment Programme.

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

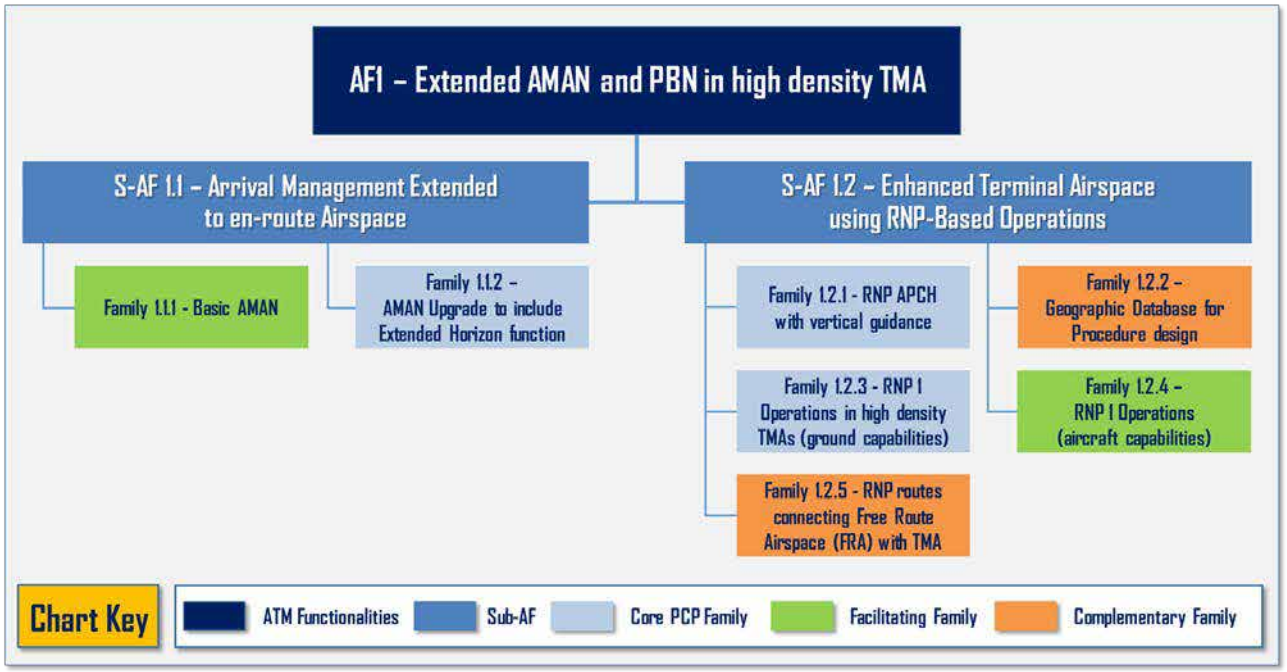


Fig. 23 - AF#1 Extended AMAN and PBN in high density - Work Breakdown Structure

Description and Scope of the ATM Functionality

In order to cope with the expected air traffic growth around the major European airports, dedicated measures to enhance the effectiveness in traffic management within the surrounding airspace and to reduce the potential of increasing congestion have been identified and grouped within ATM Functionality #1. AF #1 includes Extended Arrival Management (AMAN) and Performance Based Navigation (PBN) in high density Terminal Manoeuvring Areas (TMA).

More specifically, Extended AMAN supports the extension of the planning horizon out to 180-200 Nautical Miles, well beyond the Top of Descent of arrival flights. Through Extended AMAN, aircraft arrivals are sequenced on the basis of established operational needs, principles and rules. Air Traffic Controllers can therefore inform pilots how to most suitably adjust their aircraft speed, even before commencing descent towards the arriving airport. This sequencing in turn allows for a smoother arrival flow and reduces the need for holding, i.e. delaying aircraft from landing because of traffic congestion and/or runway unavailability.

PBN in high density TMAs covers the development and implementation of fuel efficient and/or environmentally friendly procedures for arrivals and departures using Required Navigation Performance 1 NM (RNP1) specification, Standard Instrument Departures (SIDs), Standard Arrival Routes (STARs), and RNP approach with vertical guidance (RNP APCH).

Extended AMAN and RNP1 operate in conjunction to give the controllers and pilots the necessary prerequisites to optimise the planning and execution of the arrival phase. An RNP1 STAR provides the predictable ground trajectory which is required for an accurate estimate of distance-to-go; this distance in turn is what pilots use to determine their optimum Top of Descent point. To the controller, RNP1 eliminates the lateral degree of freedom from the flight and provides a quantifiable degree of navigational accuracy and integrity. Controllers will then depend primarily on speed adjustments to implement and maintain the sequence and only revert to vectors when the speed advisories prove insufficient.

Increased traffic – as well as the need to reduce the environmental footprint of Aviation – requires the optimisation of the available airspace. The implementation of Performance Based Navigation allows aircraft to operate on more precise and efficient routes, reducing impacts on the areas surrounding the airport and easing potential bottlenecks.

Optimisation of airspace design is in most cases necessary to obtain full benefit from PBN. This includes all phases of flight from en-route down to landing and from take-off to en-route in support of operations like Continuous Descent Operations (CDO) and Continuous Climb Operations (CCO) etc. Consistent navigation based on RNP connecting Free Route Airspace (FRA) with TMAs is expected to be facilitated by Advanced RNP (A-RNP).

AF #1 - Deployment Approach

- Sub-AF 1.1 Extended AMAN: To extend to the en-Route (up to 200 Nautical Miles) the metering and sequencing of arrival aircraft in the TMAs and airports, an arrival management tool in the ATM system at an ATC centre is required. All operational/technical staff involved shall be duly trained. Synchronisation must be made with all affected sectors and Network Manager.

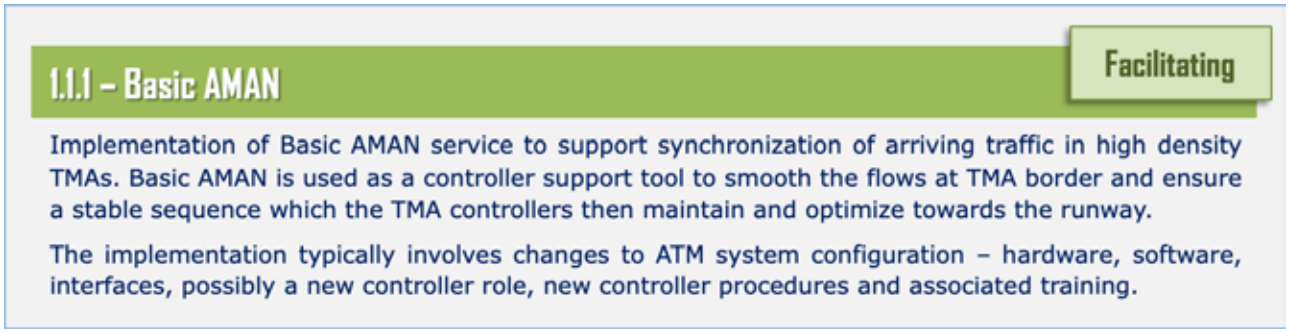
  Synchronisation is also needed to adjust/upgrade the ATM systems of the adjacent ACC/UACs to process the arrival message provided by the Extended AMAN. Airspace design and procedural changes must be coordinated with military authorities when affected.

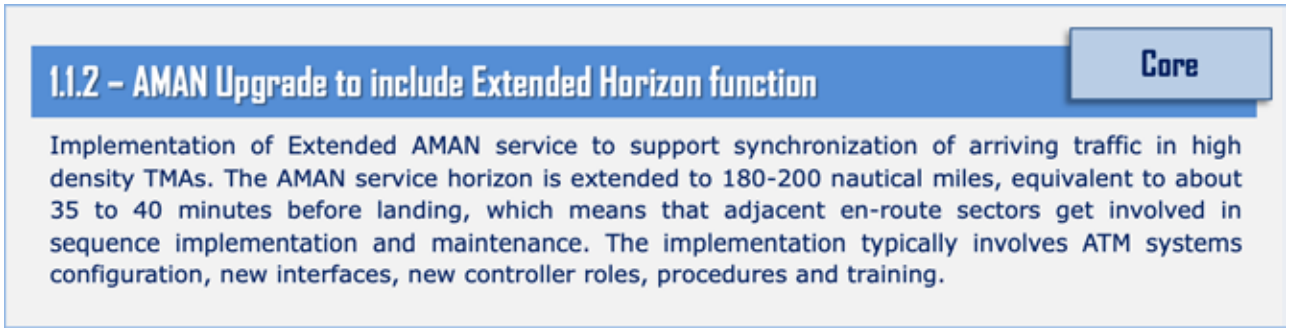
- Sub-AF 1.2 RNP-Based Operations: Regarding RNP implementation in TMAs, there are two main elements required to be deployed. The first focuses on the final approach procedures replacing non-precision approach procedures, whilst the second focuses on the departure and arrival procedures including transition to final approach procedures. To this end, staff will have to be trained when the new procedures are operational. Airspace users aiming to benefit from these new procedures will have to equip the aircraft with the corresponding avionics. Synchronisation between ANSPs and Airspace users is needed to ensure the return of investments and the start of operational benefits

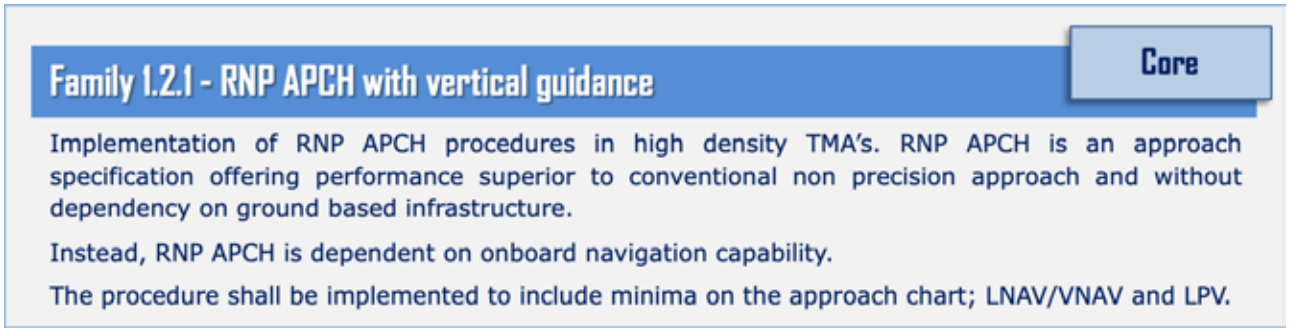
Expected Performance Improvements and Benefits

The implementation of AF 1 will deliver more optimal route structures with closer spaced routes supporting deterministic profiles, improve the precision of the approach trajectory and facilitate air traffic sequencing at an earlier stage.

Extending the sequencing of arrival traffic to and beyond 180-200 NM from the airport is expected to significantly increase operational efficiency within highly-complex TMAs and avoid unnecessary delays, as it allows de-confliction of arrival streams and reduces the need for holding. Early use of aircraft speed control and adjustment for sequencing purposes absorbs some of the queuing time, whilst enabling the reduction of fuel burn for arriving flights, which translates into both the decrease of carbon emissions in the area surrounding the airport and to significant savings for Airspace Users. The implementation of PBN and the resulting more precise, predictable and repeatable flight paths will deliver reductions in fuel burn and carbon emission by aircraft as well as controllable noise dispersion patterns. Deployment and adoption of PBN procedures within high-density complex areas will also lead to an increase in TMA capacity. Furthermore, safety benefits are also ensured thanks to optimised and stable descent paths and to improved precision in the operations.







Family 1.2.2 – Geographic Database for Procedure design

Complementary

Provision of geographic database to support procedure design including obstacle data as part of Aeronautical Information Management.

A high integrity geographic database is a facilitator for PBN procedure construction. The implementation involves system configuration – hardware, software, interfaces, database population and staff training.

Family 1.2.3 - RNP 1 Operations in high density TMAs (ground capabilities)

Core

Implementation of RNP 1 departure and arrival routes (SIDs and STARs) in TMA including the optional use of the Radius to Fix (RF) turns where benefits are enabled for noise exposure, emissions and/or flight efficiency (reducing environmental impact). A SID-STAR structure designed on the basis of a RNP 1 airspace concept allows routes spaced closer to each other, repeatable and accurate turns and deterministic routes which in turn enable greater flexibility for aircrews to plan and execute a predictable, environmentally optimized descent.

Family 1.2.4 - RNP 1 Operations (aircraft capabilities)

Facilitating

Implementation of aircraft RNP navigation capability that enables efficient and environmentally friendly operations (noise and GHG emissions) in departure (SID), arrival (STAR), approach (RNP APCH) and connecting airports to En-Route airspace.

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

Complementary

Connectivity between Free Route Airspace and TMAs through the implementation of navigation specifications covered by Advanced RNP (A-RNP).

The intention is to provide consistent PBN navigation from departure to landing. Aircraft and crew would need to be Performance Based Navigation (PBN) capable and approved for all navigation specifications applicable to the different phases of flight.

AF #2 – Airport Integration and Throughput

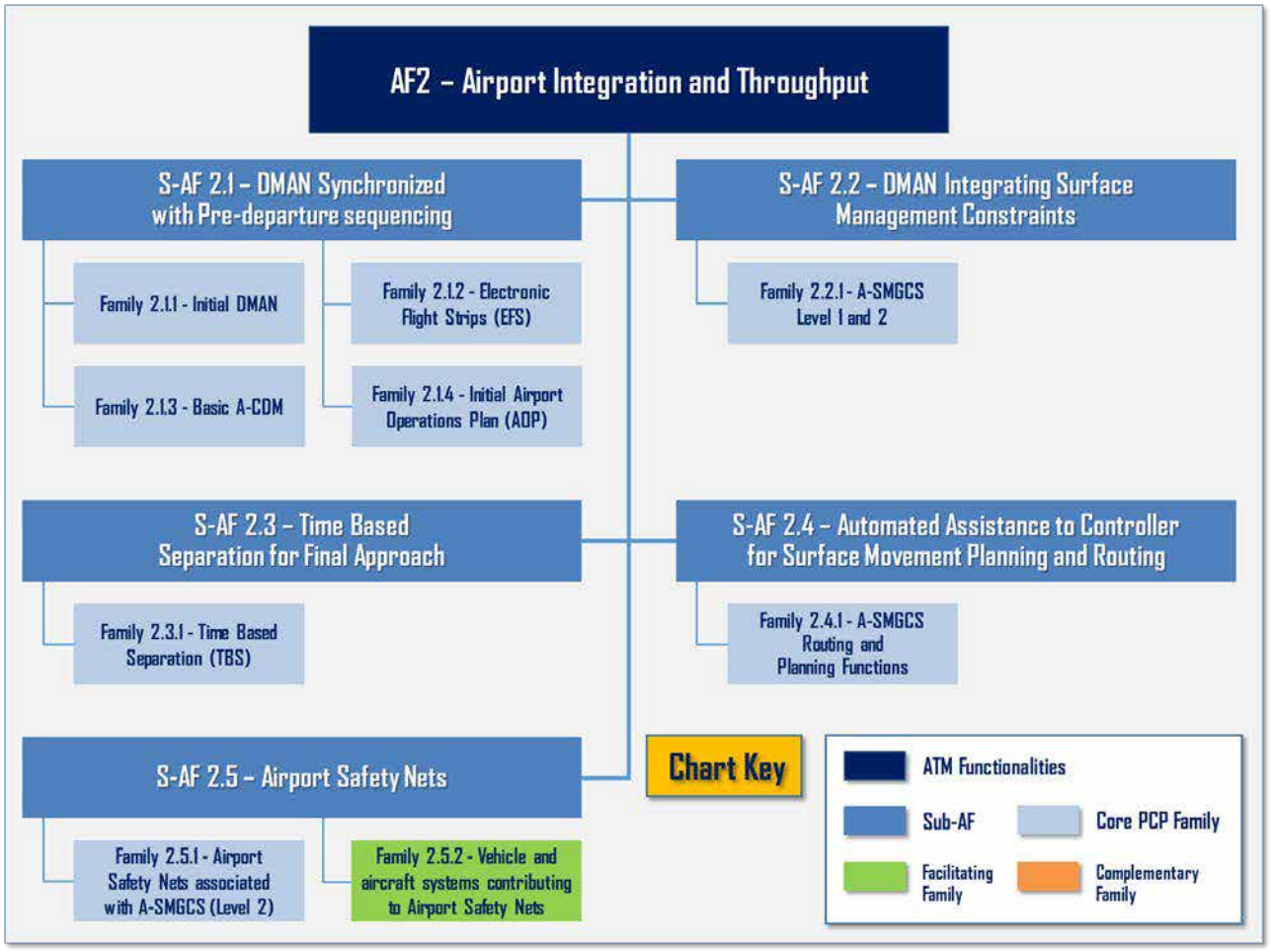


Fig. 24 - AF #2 Airport Integration and Throughput - Work Breakdown Structure

Description and Scope of the ATM Functionality

Airports are the nodes of the air-traffic network in Europe. It is therefore very important to achieve a seamless integration of airports in the pan-European network management and to ensure that airports do not become bottlenecks, limiting the capacity of the European ATM-system. The Pilot Common Project, set forth in Regulation (EU) No 716/2014, identifies 25 airports that are critical to the network, either because they play a significant role for the air-transport in their region or because they are located in a high-density Terminal Manoeuvring Area (TMA).

Within such airports, the ATM Functionality #2 foresees the deployment of Departure and Pre-departure management synchronisation to sequence traffic flows (included within Sub-AF 2.1), the integration of Surface Management constraints in the departure sequence (included within Sub-AF 2.2), the automated planning and routing of aircraft movements within the airport (included within Sub-AF 2.4), as well as the implementation of Airport safety nets that would avoid conflicts and hazardous situations (included within Sub-AF 2.5). In addition, on the basis of their specific operational environment, the deployment of Time Based Separation (TBS) operations is foreseen for 17 of the airports identified in the PCP.

The integration and synchronisation of pre-departure sequencing with the Departure Manager (DMAN) tools is a critical instrument to reduce congestion at the busiest airports. By building on the cooperation of all involved stakeholders and taking into account all variables between the moment when the aircraft is

ready to move from its parking stand up until its take-off, the resulting optimisation of traffic flows allows for a more efficient use of airport resources, the increase of predictability of operations, as well as the reduction of waiting times in queuing. The departure sequence can be also updated and fine-tuned by the integration of information and data related to potential constraints to surface movements (e.g. temporary unavailability of taxi-ways, heavy traffic in peak hours at airports with a complex lay-out, arriving flights reducing the departure rate, etc.), with significant improvements in terms of safety, due to the reduction of unexpected events.

A more effective usage of airport resources and the optimisation of surface movements is also fostered by the deployment and operational use of assisting tools to ground controllers, which allows for the definition of optimum taxi routes for both arriving and departing aircraft. On the basis of the relevant constraints (e.g. aircraft type, airport layout, weather and visibility conditions, etc.), the surface operations are expected to become even more predictable and efficient.

In parallel with increase of airport capacity and the growing complexity of ground operations, airport stakeholders shall also ensure that the highest standards of safety are in place, regardless of the complexity of the airport configuration and of the number of aircraft. In order to achieve this goal, the implementation of automation tools to detect potential conflicts between aircraft and/or vehicles moving on the runways, taxiways and aprons is a key step forward.

Finally, an efficient usage of airport resources is also supported – in the relevant airports – by the shift from distance-based separation to time-based separation for aircraft in their final approach to landing. By reducing the negative impact of weather conditions, especially in case of strong headwinds that might result in a lower flight landing rate, the overall airport capacity is positively affected and the holding times are reduced, without safety-related risks.

AF #2 - Deployment Approach:

- **Sub-AF 2.1 Departure Management Synchronised with Pre-departure sequencing**: The implementation of this Sub-AF can be described in 3 steps. The implementation of Initial DMAN is the **first step** to implement a departure management tool at the airport, which will improve the departure flows, calculate Target Take Off Times and Target Start-up Approval Times taking into account multiple constraints and preferences out of the A-CDM processes and provide a planned departure sequence. Operational procedures shall be elaborated and then published, all relevant staff shall be duly trained, and safety assessment needs to be performed.

  The Electronic Flight Strips (EFS) can help support the necessary electronic exchange of information between the Tower Air Traffic Control, the Final Approach Control and the Initial DMAN support tool. The **second step** consists of implementing Airport-Collaborative Decision Making (A-CDM), which is a local tool to share information and improving cooperation between all relevant stakeholders. After implementing A-CDM, the **third step** is to deploy Initial Airport Operations Plan (AOP), which is the common and collaboratively agreed rolling plan available to all airport stakeholders.

  It contains elements such as KPIs and alerts, which allow monitoring and assessing the performance of A-CDM operations. The Flight trajectory data, the Airport resources data and the Local weather data must be implemented in the system. All the involved staff must be duly trained.

- **Sub-AF 2.2 Departure management integrating Surface Management Constraints**: The implementation of this Sub-AF can be described in 3 steps. First Initial DMAN needs to be deployed.

  The A-SMGCS level 1 system provides ATC with the position and identity of all relevant aircraft within the movement area and all relevant vehicles within the manoeuvring area. A-SMGCS level 2 system is an upgrade of the level 1 to detect potential conflicts on runways, taxiways and intrusion into restricted areas and provide the controllers with appropriate alerts.

Finally, the optimal surface movement plans involving the calculation and sequencing of movement events and optimising resource usage need to be implemented. To this end, the DMAN systems shall take account of variable and updated taxi times and integrate the A-SMGCS constraints.

- **Sub-AF 2.3 Time-Based Separation for Final Approach (TBS)**: This Functionality consists in the separation of aircraft in sequence on the approach to a runway using time intervals instead of distances. 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. TBS operational procedure shall be elaborated and subsequently published, Air Traffic Controller and Flight Crews shall be duly trained, and a safety assessment shall be performed. EFS can help support the necessary electronic exchange of information between the Tower Runway Control, the Final Approach Control and the TBS support tool.
- **Sub-AF 2.4 Automated Assistance to Controller for Surface Movement Planning and Routing**: The implementation of this Sub-AF can be described in 3 steps. EFS needs to be implemented as a **first step**. Then as a **second step** A-SMGCS Level 1 part must be implemented. Finally, the **third step** is to implement the A-SMGCS routing and planning functions.

  This system upgrade provides aerodrome surveillance as well as routing, planning and guidance for the control of aircraft and vehicles. Operational procedures shall be elaborated and then published, all relevant staff shall be duly trained, and a safety assessment shall be performed.
- **Sub-AF 2.5 Airport Safety Nets**: The implementation of this Sub-AF needs to be synchronised with the implementation of EFS, A-SMGCS level 1 and 2 and A-SMGCS Routing and Planning Functions, which are essential pre-requisites. This Functionality consists 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 ATC support tools at the aerodrome shall be upgraded to provide the detection of Conflicting ATC Clearances as well as deviations from ATC instructions, procedures or routes. 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, all relevant staff shall be duly trained, and safety assessment shall be performed.

Expected Performance Improvements and Benefits

The ATM Functionality #2 was created to ensure that the 25 network-critical airports and TMAs would be able to manage the growing traffic demand of the future in a safe and efficient manner, whilst taking on-board environmental aspects and guaranteeing a maximum degree of interoperability for airspace users.

The implementation of the five Sub-ATM Functionalities indicated in the Pilot Common Project is expected to deliver significant operational benefits, as they appreciably contribute to increasing the predictability and resilience of airport operations, reducing the impact of unexpected events and ensuring the optimisation of ground capacity and a more effective usage of airport resources.

The provision of highly efficient air navigation services will also bring tangible economic benefits to Airspace Users, in terms of reduction of fuel consumption during ground operations, as a result of shorter waiting times before departure and improved taxi times, and by reduced holding times following TBS implementation in the appropriate airports. The reduced fuel consumption will in turn deliver positive impacts on the environment, in terms of decrease of carbon emissions

Family 2.1.1 - Initial DMAN

Core

Initial Departure Manager (DMAN) is a planning tool to improve the departure flows at airports.

This system elaborates a collaborative sequence and provides both Target Start Up Approval Time (TSAT) and Target Take Off Time (TTOT), taking into account agreed principles to be applied.

Family 2.1.2 – Electronic Flight Strips (EFS)

Core

Electronic Flight Strips (EFS) is the automated assistance to air traffic controller.

EFS shall integrate the instructions given by the air traffic controller with other data such as flight plan, surveillance, routing, published rules and procedures. The system supports coordination dialogue between controllers and transfer of flights between units or different locations within one unit.

Family 2.1.3 - Basic A-CDM

Core

Airport Collaborative Decision Making (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 Air Navigation Service Providers, airport operator, aircraft operators, Network Manager, other airport service providers).

Family 2.1.4 - Initial Airport Operations Plan (AOP)

Core

The Airport Operations Plan (AOP) is a single, common and collaboratively agreed rolling plan available to all airport stakeholders whose purpose is to provide common situational awareness.

The AOP reflects the operational status of the airport.

Family 2.2.1 - A-SMGCS Level 1 and 2

Core

A-SMGCS level 1 provides ATC with the position and identity of all relevant aircraft within the movement area and of all relevant vehicles within the manoeuvring area.

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.

Family 2.3.1 - Time Based Separation (TBS)

Core

Time Based Separation (TBS) consists in the separation of aircraft in sequence on the approach to a runway using time intervals instead of distances.

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. MET information with actual glide-slope wind conditions are provided to the TBS Support tool.

Family 2.4.1 - A-SMGCS Routing and Planning Functions

Core

A-SMGCS Routing and Planning Functions provide ATC with:

- Optimised 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.

Family 2.5.1 – Airport Safety Nets associated with A-SMGCS (Level 2)

Core

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.

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

Facilitating

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

AF #3 – Flexible ASM and Free Route

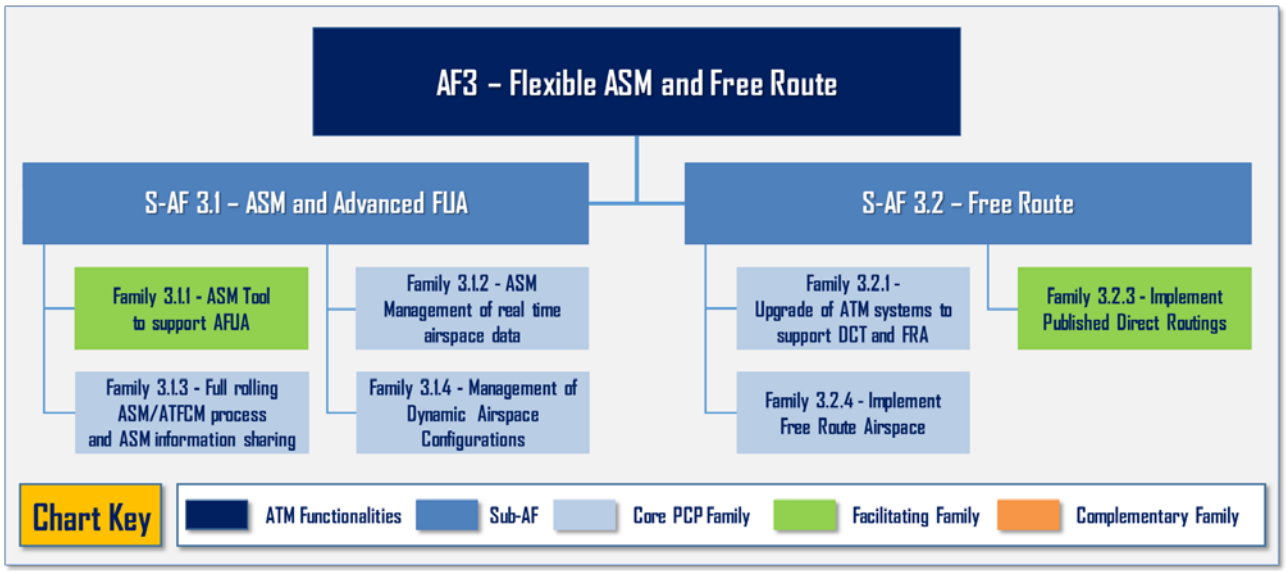


Fig. 25 - AF #3 Flexible ASM and Free Route – Work Breakdown Structure

Description and Scope of the ATM Functionality

The management of Airspace in terms of Advanced flexibility and Free Route is the future for its optimisation. The main aims of ATM Functionality #3 are to produce benefits for the environment, in terms of emissions reduction, as well as for Airspace Users, with respect to the desired trajectories and with due consideration of the impact on airspace capacity. These objectives may be achieved by combining the following operations:

- The implementation of ASM management systems, tools, airspace structure, and procedure that support an advanced Flexible Use of Airspace. The aim is to ease and facilitate segregations and reservations of portions of airspace when required for exclusive usage, avoiding, as much as possible, hampering the military mission effectiveness and providing, at the same time, minimum impact on other Airspace Users, overcoming the distinction between fixed airspace areas reserved for civil or military operations.
- The implementation of harmonised DCTs and Free Route Airspace throughout Europe, with the necessary support by system upgrades and tools. This shall enable flights to fly as far as possible their preferred route without the typical constraints of fixed route network and rigid airspace structure.

AF #3 - Deployment Approach:

- **Sub-AF 3.1 Airspace Management and Advanced Flexible Use of Airspace**: The **first step** is to implement procedural and system upgrades (ASM, ATM, NM and Civil-Military AU systems) to exchange real-time airspace status data are required. The integration and management of ASM real-time data into ANSPs ATM systems and into AUs flight planning systems are required. This would enable a full sharing of real time airspace status update in planning and/or execution phases. In parallel, it is needed to implement process/system upgrades supporting a full rolling ASM/ATFCM and dynamic ASM/ATFCM data sharing to all operational stakeholders, full management of Airspace structure, initial CDM and CDM in Free Route Airspace network impact assessment.

The **second step** is to implement management of dynamic airspace configurations, upgrading the systems for predefined airspace configurations including Direct Routes and Free Route Airspace. ASM/ATFCM and ATM systems should support the full sharing of the dynamic airspace configuration inputs and outputs via specific B2B services. Notification of Airspace Configurations will be based on automatic flows of information between the different stakeholders provided by Network Manager.

- **Sub-AF 3.2 Free Route**: The **first step** is to upgrade of ATM systems to support Direct Routings and Free Routing Airspace (FRA). The **second step** is to implement the Free Route concept where airspace users may freely plan a route between defined FRA entry points and defined FRA exit points.

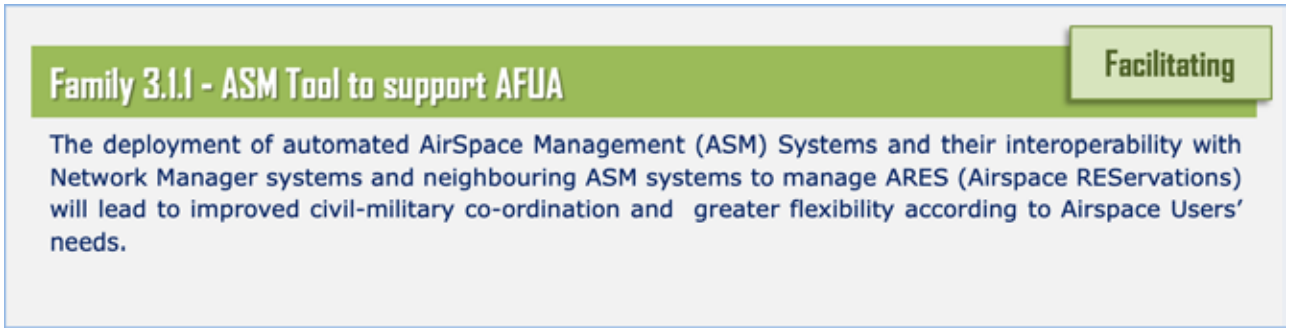
  To this end, new procedures shall be provided and Free Route Airspace shall be published into the relevant aeronautical documents after all safety assessments required are duly executed and appropriate training of ATCOs is performed.

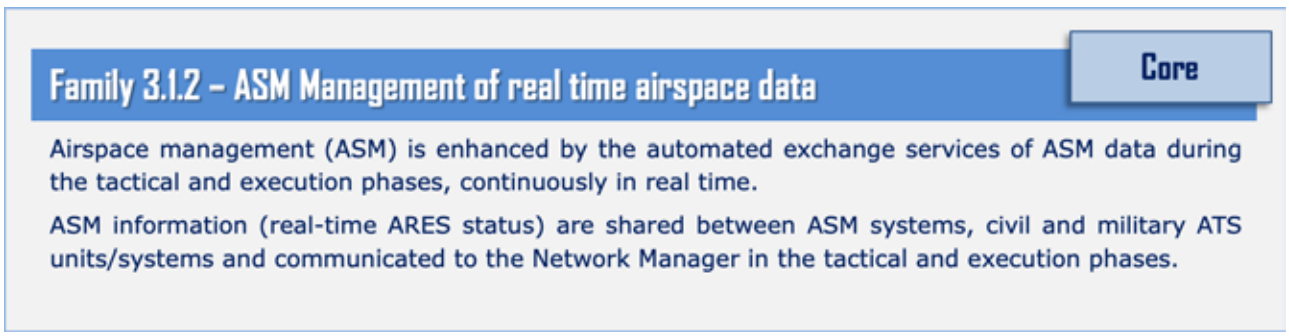
Expected Performance Improvements and Benefits

The deployment of this ATM Functionality will directly result in a more efficient operational use of airspace, increasing its overall capacity and delivering critical benefits in terms of reduction of fuel consumption.

A more efficient management of airspace resources – available through a higher level of flexibility in its allocation for civil and/or military purposes and through its dynamic configurations – would increase the overall capacity to accommodate growing traffic demand, optimise flight trajectories, reduce saturation and potentially ease existing bottlenecks.

In addition, the implementation of Free Route operations across Europe is expected to deliver tangible results to Airspace users, as it enables shorter and more efficient flight paths, thus allowing for a significant decrease in fuel burnt and flight profiles as aligned as possible with their business needs. As a result, the environmental footprint of air traffic will significantly decrease, thanks to the reduction in carbon emissions.





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

Core

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 (Collaborative Decision Making) process.

It includes requirements aiming to improve notifications to airspace users based on automation of data exchange.

Family 3.1.4 - Management of Dynamic Airspace Configurations

Core

Airspace configurations are based on pre-defined, coordinated airspace structures and ATC dynamic sector management.

Dynamic Airspace Configuration focuses on defining the concept, including roles and responsibilities in an advanced Collaborative Decision Making process.

An efficient and dynamic process involving the NM, ATFCM, ATC and military would require new procedures and well defined collaborative decision making processes at pre-tactical level. The systems and software need to be upgraded for predefined airspace configurations including Direct Routes and Free Route Airspace. ASM/ATFCM and ATM systems should be upgraded to support the full sharing of the dynamic airspace configuration inputs and outputs via specific B2B services. Also new tools for Airspace Management performance analysis are required.

Family 3.2.1 - Upgrade of ATM systems to support DCT and FRA

Core

The implementation of DCT and FRA requires the upgrades and enhancements of ATM systems belonging to the NM, AUs and ANSPs in order to efficiently manage and accommodate the demand of the desired flight route or the closest route to the desired one. These upgrades consist of several enhanced tools (including safety nets) and improvements that support the management of new Airspace structures and procedures, new Flight Plan Data exchanges, and the correct transmission of the appropriate data between all stakeholders involved and in all phases of flight.

Family 3.2.3 - Implement Published Direct Routings

Facilitating

Implementation of published Direct Routings (DCTs) may be carried out within a State or between States on a cross border basis.

The Stakeholders may choose to implement Free Route Airspace without implementing Direct Routings as an intermediate step.

Family 3.2.4 – Implement Free Route Airspace

Core

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.

AF #4 – Network Collaborative Management

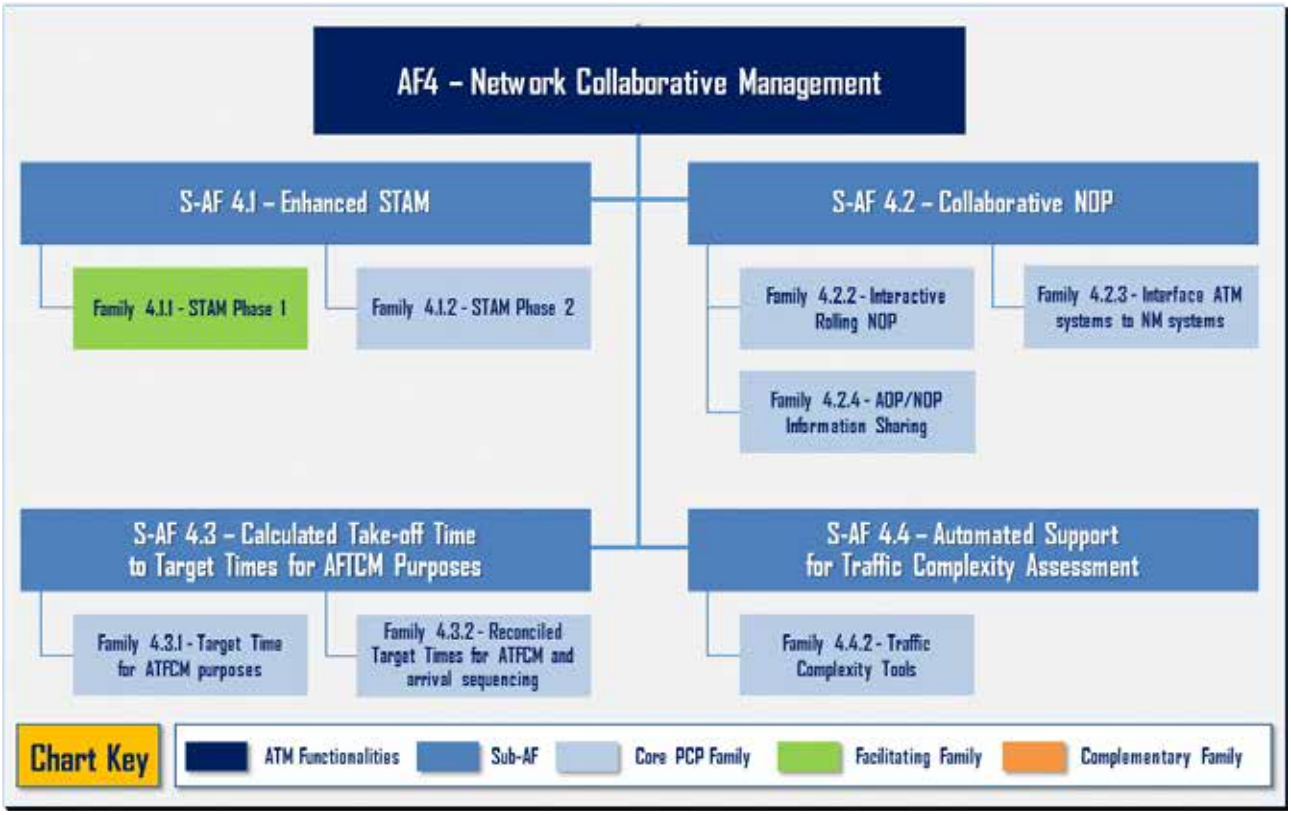


Fig. 26 - AF#4 Network Collaborative Management - Work Breakdown Structure

Description and Scope of the ATM Functionality

The ATM Functionality #4, Network Collaborative Management, has the objective of enhancing the European ATM network performances, notably optimised capacity and flight efficiency, through the exchange, modification and management of aircraft trajectory information.

Flow Management shall move to a Cooperative Traffic Management (CTM) environment, optimising the delivery of traffic into sectors and airports whilst acknowledging the requirement for Air Traffic Flow and Capacity Management (ATFCM) measures.

ATM Functionality #4 foresees improvement of the Demand Capacity Balancing (DCB) process via:

- Implementation at local level and coordination at Network level of STAM (Short Term ATFCM measures) in order to partially close the gap between planning and execution and to further enhance the optimisation of traffic flows (Sub-AF 4.1);
- Enhancement of the Network Operations Plan (NOP) which will become a rolling NOP via the constant update and exchange of information with all stakeholders. In particular, the involvement of Airports should be done via integration with their Airport Operations Plan. (Sub-AF 4.2);
- Application of time based operations, with the implementation of Target Times over the constraint on top of the departure time. This feature can authorise coordination with the constrained partner, i.e. the airport of arrival. (Sub-AF 4.3);
- New available data will permit the implementation of automatic tools to assess the complexity of the traffic at every stage of planning, further enhancing the process. (Sub-AF 4.4).

AF #4 – Deployment Approach:

- **Sub-AF 4.1 Enhanced Short Term ATFCM Measures**: The implementation of this Sub- Functionality can be described in 2 steps. After eventually implementing STAM where needed, the first step is to deploy the Interactive Rolling NOP, a platform of coordination which is necessary at Network level in order to implement the second step, STAM Phase 2, Enhanced Short Term ATFCM Measures. This consists of a 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, hotspot detection and coordination. ANSPs and AUs shall deploy an interface between local STAM support systems and the NM systems and/or the STAM Phase 2 application and services developed by NM. They shall also apply harmonised operational procedures. Synchronisation is necessary between neighbouring ACCs.

- **Sub-AF 4.2 Collaborative NOP**: 3 elements can be implemented in parallel. On top of the Network platform and the means of communication with it (the Interactive Rolling NOP) and in order to really serve as a "Network Operation Plan" NOP, information from Airport via AOP (Airport Operations Plan)/NOP integration and other stakeholders are needed. The interface between the ATM systems and the NM systems shall be addressed. ANSPs would have to upgrade their systems in order to generate messages to NM and then to receive and process messages coming from NM. NM systems would also have to be upgraded to receive and process, and distribute as required the Extended Flight Plan (EFPL) from Airspace Users.

  The involvement of militaries is necessary. Operational procedures for the use of new messages shall be defined and made available. All operational/technical staff involved shall be duly trained and safety assessment is required.

- **Sub-AF 4.3 Calculated Take-off Time to Target Times for ATFCM purposes**: The implementation of this Sub-AF can be described in 2 steps. First step, to enhance the effect of regulations, target times over the constraint (or target time of arrival coordinated with AOP) will be sent on top of the CTOT. As a second step, this implementation should open the reconciliation with arrival management. To this end, the procedures and system related to the reconciliation of multiple local Target Time constraints, coming from Airport, ANSP or Network DCB, need to be developed and upgraded. Coordination between NM and other stakeholders for local implementation is needed.

- **Sub-AF 4.4 Automated Support for Traffic Complexity Assessment**: This Sub-AF consists of the automated support for traffic complexity assessment, which continuously monitor sector demand and evaluate traffic complexity according to a predetermined qualitative scale.

  The Network Manager shall develop and provide guidance documentation as basis for required operational procedures and systems. NM shall adapt its systems in support of complexity assessments, including the exchange of associated data. Local stakeholders shall implement complexity tool in the local systems, or adapt the NM tool for the required usage. Procedures for operational stakeholders for facilitating the use of the tool shall be defined and made available. Synchronisation between NM and ANSPs is required.

Expected Performance Improvements and Benefits

A timely and synchronised deployment of ATM Functionality #4 will positively impact the overall Network performances, helping to cope with the increasing complexity stemming from the air traffic growth.

Shifting to a cooperative Air Traffic management environment – achieved through more effective and appropriate sharing of information among the relevant stakeholders - will lead to a more efficient use of the Network resources, thus increasing both the overall capacity and the effectiveness of Air Traffic Services provision, thanks to a more effective use of controller resources when facing complexity.

The increased capacity of the Network will in turn result in significant reduction of en-route delays, as well as an increased predictability of flights, due to the possibility of anticipating congestion points and to mitigating their effects on operations, even in unfavourable conditions and during peak hours.

Finally, the capability to anticipate, mitigate and resolve in advance traffic complexity will increase the overall level of safety of operations, whilst also optimising air traffic flows without extended tactical interventions. Traffic optimisation will consequently deliver tangible benefits to Airspace Users, who will be able to fly more efficient routes, reducing their fuel consumption and carbon emissions.

Family 4.1.1 – STAM Phase 1

Facilitating

The target of the Short Term ATFCM Measures (STAM) phase 1 is to replace systematic usage of En Route CASA regulations for situations when imbalances are manageable via local operational procedure. 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.

Family 4.1.2– STAM Phase 2

Core

The second phase tactical capacity management using STAM requires the deployment of additional tool and procedures in order to ensure a close and efficient working relationship between NM, FMP and airspace users.

STAM phase 2 tool should include occupancy traffic monitoring values (OTMV), hotspot detection and coordination tool.

Family 4.2.2 – Interactive Rolling NOP

Core

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

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

Family 4.2.3 – Interface ATM systems to NM systems

Core

Provision of geographic database to support procedure design including obstacle data as part of Aeronautical Information Management.

A high integrity geographic database is a facilitator for PBN procedure construction. The implementation involves system configuration – hardware, software, interfaces, database population and staff training.

Family 4.2.4 – AOP/NOP Information Sharing

Core

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 Airports and the Network Manager.

This could be done via the automatic sharing of data between AOP (Airport Operation Plan) and the NOP (Network Operation Plan). This family is limited to the PCP airport.

Family 4.3.1 – Target Time for ATFCM purposes

Core

If a flight enters into several regulated sectors, at a reference point NM system algorithm will detect the most penalising regulation (with higher delay) and the NM system should transmit calculated target time 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.

In case of single arrival regulation, it should be possible for the Airport/TMA to amend the TTA, leading to a recalculation of the CTOT by NM.

Family 4.3.2 – Reconciled Target Times for ATFCM and arrival sequencing

Core

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.

Considering the current status of development work, the concept still needs to be validated at SJU level

Family 4.4.2 – Traffic Complexity Tools

Core

Traffic Complexity tools continuously monitor and evaluate current and expected traffic loads and estimated controller's workload in order to optimise the use of available capacity.

Depending on the time horizon, the tools will use predefined metrics to enhance long-term ATFCM, and/or enhanced planned trajectory prediction for mid-term ATFCM and/or real time trajectory data for short term ATFCM. Traffic complexity tools also enhance the real time ATCO workload estimation.

AF #5 – Initial SWIM

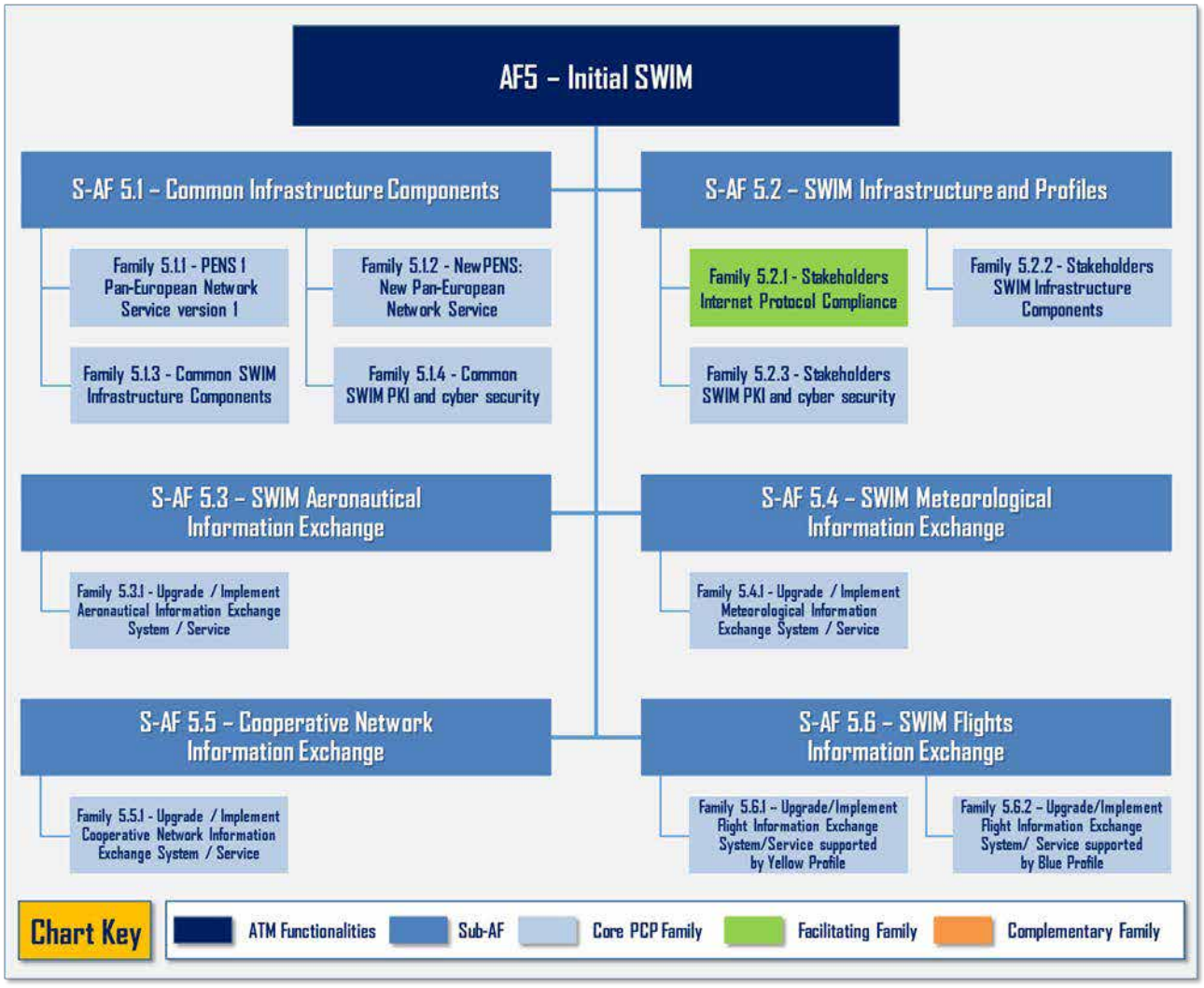
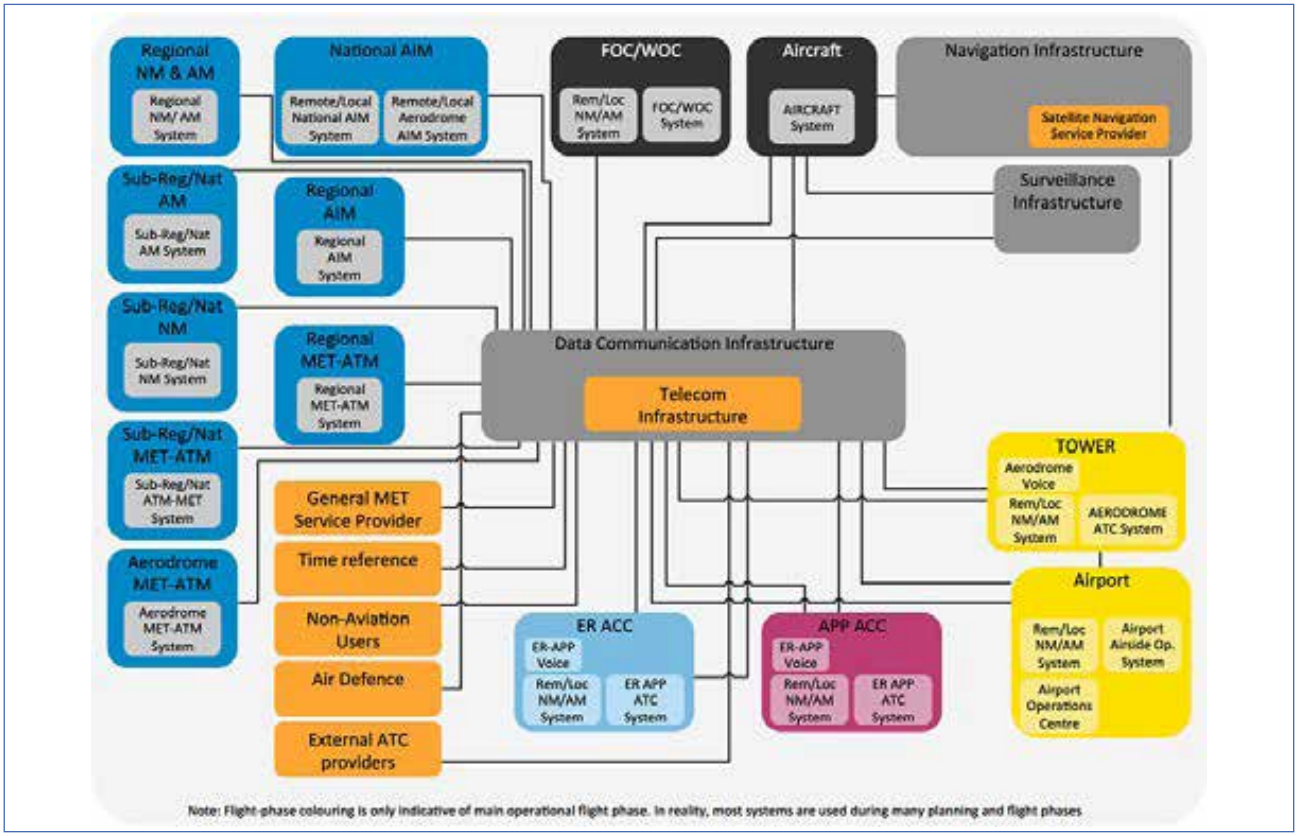


Fig. 27 - AF#5 iSWIM - Work Breakdown Structure

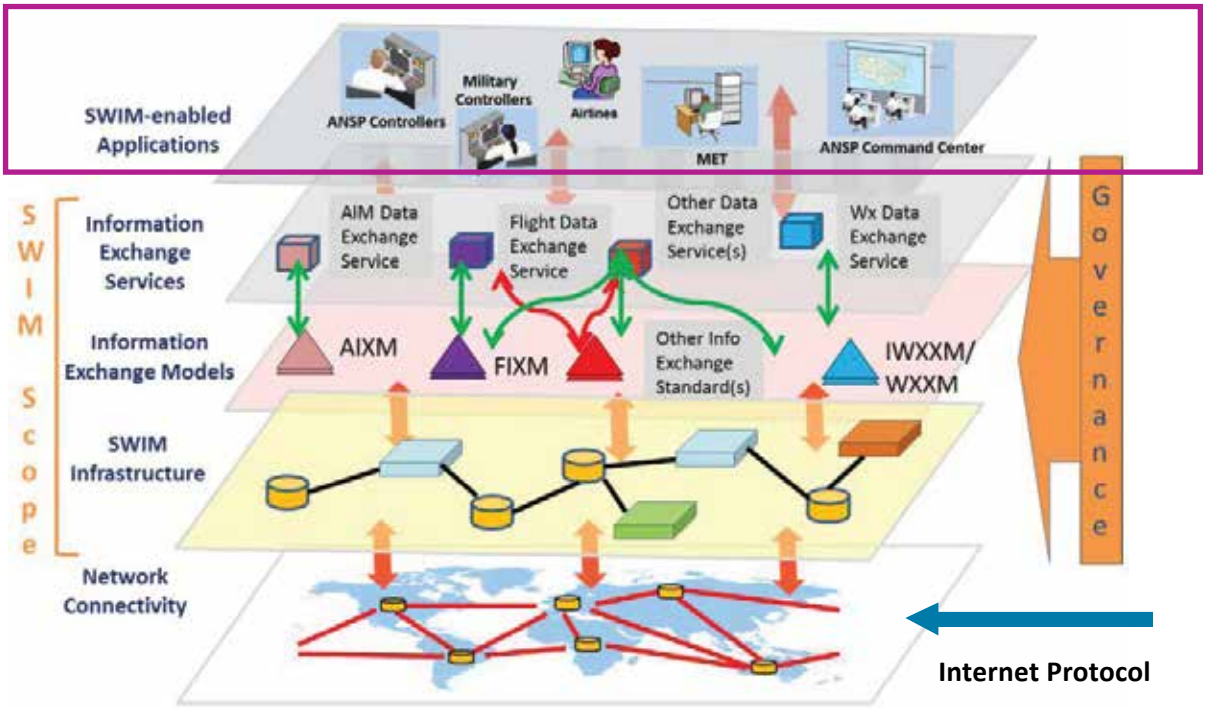
Description and Scope of the ATM Functionality

SWIM (System-Wide Information Management) is part of the Data Communication Infrastructure as well as of the ATM systems connected to the Data Communication Infrastructure in the SESAR European Air Traffic Management Architecture.



SESAR EATM Architecture

SWIM supports the effective exchanges of ATM information between the Operational Stakeholders for all data domains, ground-ground and air-ground, in a commonly understandable format. Initial SWIM (iSWIM) as it is called in the Pilot Common Project, is limited to some specific Ground-Ground Aeronautical, Meteorological, Cooperative Network and Flight Data Information exchanges.



SWIM Conceptual Overview

Based on the ICAO definition of SWIM depicted above, according to which "SWIM comprises standards, infrastructure and governance enabling the management of information and its exchange between operational stakeholders via interoperable services", ATM Functionality #5 can be broken down into three distinct sets[4].

A first set deals with the establishment and deployment of necessary common components and structures. "Common" in this respect means that only one common system or one common set of rules is to be deployed for the geographical scope mandated by the Commission Implementing Regulation (EU) No 716/2014, in order to ensure an interoperable solution.

Thus, all operational stakeholders have to collaborate and implement these components together, to facilitate the SWIM interoperability and interconnectivity at European level:

- PENS1: the first implementation of PENS (Pan-European Network Services), a common IP-based infrastructure, ending in June 2018 with a possible extension to end of 2019 due to the probable deployment delay of NewPENS;
- NewPENS: the new PENS implementation, with an adapted and stronger governance framework, launched at the very beginning of 2016 replacing PENS1 after a transition period (2017-2019), open to all ATM Stakeholders.
- The setup of the appropriate SWIM Governance and Registry, aimed at implementing the necessary common structures and processes for SWIM operations and its controlled evolution;
- The implementation of components addressing the Public Key Infrastructure (PKI) and Cybersecurity governance, developing the necessary common security requirements to guarantee a common secure SWIM implementation.

The first set is complemented by a second set, which deals with the specific infrastructure components to be implemented by each operational stakeholder within their own Area of Responsibility. These stakeholders' infrastructure components form the basis for the provision and consumption of information, dealt with in the third set. The infrastructure components are composed of:

- The setup and implementation of local dedicated Internet Protocol Network Services to support IP exchanges among all civil and military stakeholders;
- The installation and integration of the local SWIM infrastructure components (middleware), capable of supporting both the SWIM Yellow Profile and SWIM Blue Profile, the dedicated technical profiles to be used to exchange ATM information among all stakeholders:
  - Yellow Profile:
    - Based on the Web Services stack of standards.
    - Deployment options kept as open as possible.
    - Usable out-of-the-box with mainstream tools.
  - Blue Profile:
    - Primarily Real-time or near real-time uses (best effort also supported).
    - Demanding high availability with severe constraints with respect to the available resources.
    - Technical solution as much as possible supported out-of-the-box.
    - Secured interactions (different security levels).
- The implementation of local PKI and Cybersecurity components, as well as the establishment of the associated processes, to meet local security requirements, in line with the common ones;

[4] *These three sets can be linked to the DP Families:*
Set 1 comprises S-AF 5.1, i.e. Families 5.1.1, 5.1.2, 5.1.3 and 5.1.4
Set 2 is equivalent to S-AF 5-2, i.e. Families 5.2.1, 5.2.2 and 5.2.3
Set 3 comprises S-AF 5.3-5.6, i.e. Families 5.3.1, 5.4.1, 5.5.1, 5.6.1 and 5.6.2

The third and last set which makes up the ATM Functionality deals with the different kinds of ATM information exchange services, as defined by Reg. (EU) No 716/2014, including the interdependencies with the other AFs. The following information exchanges services shall be implemented by operational stakeholders:

- the exchange of Aeronautical Information;
- the exchange of Meteorological Information;
- the exchange of Cooperative Network Information;
- the exchange of Flight Information;
- the exchange of Flight Object Information.

As additional guidance to the implementation of the SESAR Programme, the Planning View encompasses a dedicated list of information exchange services, developed in the context of SESAR 1 or services deployed or planned by NM.

This list represents a starting point for the SWIM implementation and guides operational stakeholders to a partial coverage of the ATM information exchanges required by the PCP. Evolution of this starting point shall thereafter fall under the responsibility of the SWIM Governance.

AF #5 – Deployment Approach:

- **Sub-AF 5.1 Common infrastructure components**: 4 elements need to be deployed in parallel. These correspond to the common SWIM infrastructure components (PENS 1 and NewPENS, SWIM Governance and Common PKI). These four Families can be deployed in parallel. PENS 1 and NewPENS define the Internet Protocol Network connectivity necessary to support the SWIM exchanges. The signature of the Common Procurement Agreement with EUROCONTROL and the Amendment with the Network Service Provider is needed.

  Then the Network Service Provider shall install its routers in the Operational Stakeholder premises and connect with the Operational Stakeholder IP Network in a secure manner. The common SWIM infrastructure components and Public Key Infrastructure (PKI) need to be implemented in parallel to PENS 1 and NewPENS. Strong coordination is necessary between all stakeholders to implement the common components starting with an agreed SWIM Governance.

- **Sub-AF 5.2 SWIM Technical Infrastructure and Profiles**: Sub-AF 5.1 is a pre-requisite to implement this Sub-Functionality. Two new elements need to be deployed to achieve this Sub-AF, namely the specific Stakeholders SWIM Infrastructure components and the Stakeholders SWIM PKI and cybersecurity. It is essential that appropriate SWIM Governance Structure and Processes are established to develop and monitor an agreed SWIM implementation roadmap.

- **Sub-AF 5.3 Aeronautical information exchange**: Sub-AF 5.2 is a prerequisite as it contains the underlying infrastructure, therefore all the elements in that Sub-AF need to be deployed. Then the upgrade of the Aeronautical Information Exchange system can be deployed. Synchronisation is needed between stakeholders intending to exchange data with the European Aeronautical Database (EAD) and the providers of EAD.

- **Sub-AF 5.4 Meteorological information exchange**: Sub-AF 5.2 is a prerequisite as it contains the underlying infrastructure, therefore all the elements in that Sub-AF need to be deployed. Then, the upgrade of the Meteorological Information Exchange system can be deployed.

- **Sub-AF 5.5 Cooperative network information exchange**: Sub-AF 5.2 is a prerequisite as it contains the underlying infrastructure, therefore all the elements in that Sub-AF need to be deployed. Then, the upgrade of the Cooperative Network Information Exchange system can be deployed. Network Manager shall coordinate and support the stakeholders for the deployment of the information exchange with NM via the NM B2B services.

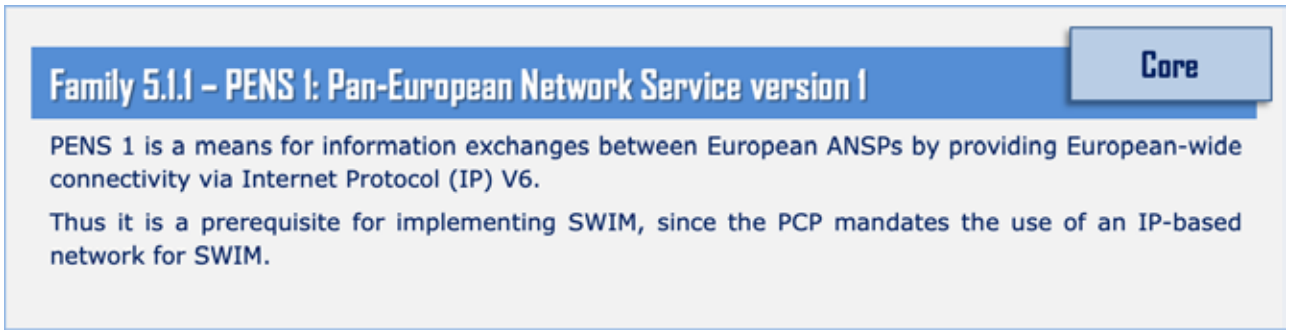
- **Sub-AF 5.6 Flight information exchange**: Sub-AF 5.2 is a pre-requisite, therefore all the elements in that Sub-AF need to be deployed. Once Sub-AF 5.2 is implemented, the upgrade of the Flights Information Exchange system supported by Yellow and Blue Profiles can be deployed in parallel. SWIM services related to Flight Object (FO) enable flight data processing systems to flight data processing systems exchange of down-linked trajectory information between ATS units. The implementation of Flight Object distribution and consumption shall be synchronised and coordinated by ANSPs. A civil-military coordination to exchange Flight Object data would be beneficial.

Expected Performance Improvements and Benefits

The definition and adoption of the SWIM approach in management and sharing of ATM information between stakeholders is considered as key stepping stone towards performance improvements affecting the whole ATM/ANS provision, as AF #5 works as an enabler to the full deployment of all other ATM Functionalities and to the achievements of the associated benefits.

Easier access to stable and reliable information, supported by higher levels of automation in its management, is also expected to lead to performance improvements in terms of safety of ATM systems. The use of an integrated data communication infrastructure and the adoption of standards profiles will reduce misalignments between different stakeholders, increase trust in the exchanged data and improve quality and reliability of information.

In parallel, SWIM implementation and operational use is also expected to increase the cost-effectiveness of ATM / ANS provision, as it fosters interoperability of data among different stakeholders and reduces duplication in managing information across different systems. Moreover, the timely availability of the appropriate information will support and enhance the decision-making process and a smooth management of operations, as all stakeholders can take advantage of an improved contextual awareness.



Family 5.1.3 - Common SWIM Infrastructure Components

Core

Common Infrastructure Components of SWIM are those elements of the SWIM infrastructure (systems or sets of rules) to be deployed only once for the entire geographical scope mandated by the PCP. The Common Infrastructure Components consist of the SWIM Governance arrangements ensuring a common baseline and controlled evolution of SWIM and the SWIM registry as one of the Governance mechanisms, which in turn is governed itself.

Family 5.1.4 – Common SWIM PKI and cybersecurity

Core

Common SWIM PKI and cyber security are those elements related to the security of SWIM to be addressed only once for the entire geographical scope mandated by the PCP.

This comprises the common specifications relating to PKI and its governance, e.g. processes related to certificates, common requirements, rules for delegating certificates etc.

Family 5.2.1 - Stakeholders Internet Protocol Compliance

Facilitating

Complementing the PENS 1 and NewPENS networks on European level, each stakeholder has to have an internal Internet Protocol (IP)-based network. This type of network is a prerequisite for supporting SWIM information exchanges using the SWIM TI Profiles.

Family 5.2.2 - Stakeholders SWIM Infrastructure Components

Core

The SWIM Infrastructure Components to be deployed at each operational stakeholder comprise technical parts – the SWIM TI Blue Profile and the SWIM TI Yellow Profile – as well as organizational means – like training and certification of technical personnel or other components necessary for stakeholder SWIM implementation (supervision, monitoring and control). These components constitute the foundation for implementing SWIM information exchanges and SWIM-enabled systems.

Family 5.2.3 - Stakeholders SWIM PKI and cyber security

Core

The scope of this Family aims at implementing basic public key infrastructure management at each operational stakeholder including certificate management, key lifecycle management, training and certification of technical personnel, monitoring and control, implementation of audit programmes ensuring continuous compliance with common and local policies and standards etc.

Family 5.3.1 – Upgrade / Implement Aeronautical Information Exchange System/Service

Core

This Family is part of the implementation of actual information exchanges and 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 exchange of Aeronautical Information via SWIM services in the role of either service provider or service consumer.

Family 5.4.1 - Upgrade / Implement Meteorological Information Exchange System / Service

Core

This Family is part of the implementation of actual information exchanges and aims at upgrading or implementing Meteorological Information Exchange systems and services in accordance with SWIM principles.

The systems shall be upgraded or implemented to support the exchange of Meteorological Information via SWIM services in the role of either service provider or service consumer.

Family 5.5.1 - Upgrade / Implement Cooperative Network Information Exchange System / Service

Core

This Family is part of the implementation of actual information exchanges and aims at upgrading or implementing Network Information Exchange systems and services in accordance with SWIM principles.

The systems shall be upgraded or implemented to support the exchange of Network Information via SWIM services in the role of either service provider or service consumer.

Family 5.6.1 – Upgrade/Implement Flight Information Exchange System/Service supported by Yellow Profile

Core

This Family is part of the implementation of actual information exchanges and aims at upgrading or implementing Flight Information Exchange systems and services using the Yellow SWIM TI Profile in accordance with SWIM principles. The systems shall be upgraded or implemented to support the exchange of Flight Information via SWIM services in the role of either service provider or service consumer. This family is also intended to provide the prerequisites for trajectory management, which requires the sharing of information regarding aircraft performance and the trajectory itself.

Family 5.6.2 – Upgrade/Implement Flight Information Exchange System/Service supported by Blue Profile

Core

This Family is part of the implementation of actual information exchanges and aims at implementing Flight Object Information Exchange systems and services using the Blue SWIM TI Profile in accordance with SWIM principles.

The systems shall be upgraded or implemented to support the exchange of Flight Object Information via SWIM services in the role of either service provider or service consumer.

AF #6 – Initial Trajectory Information Sharing

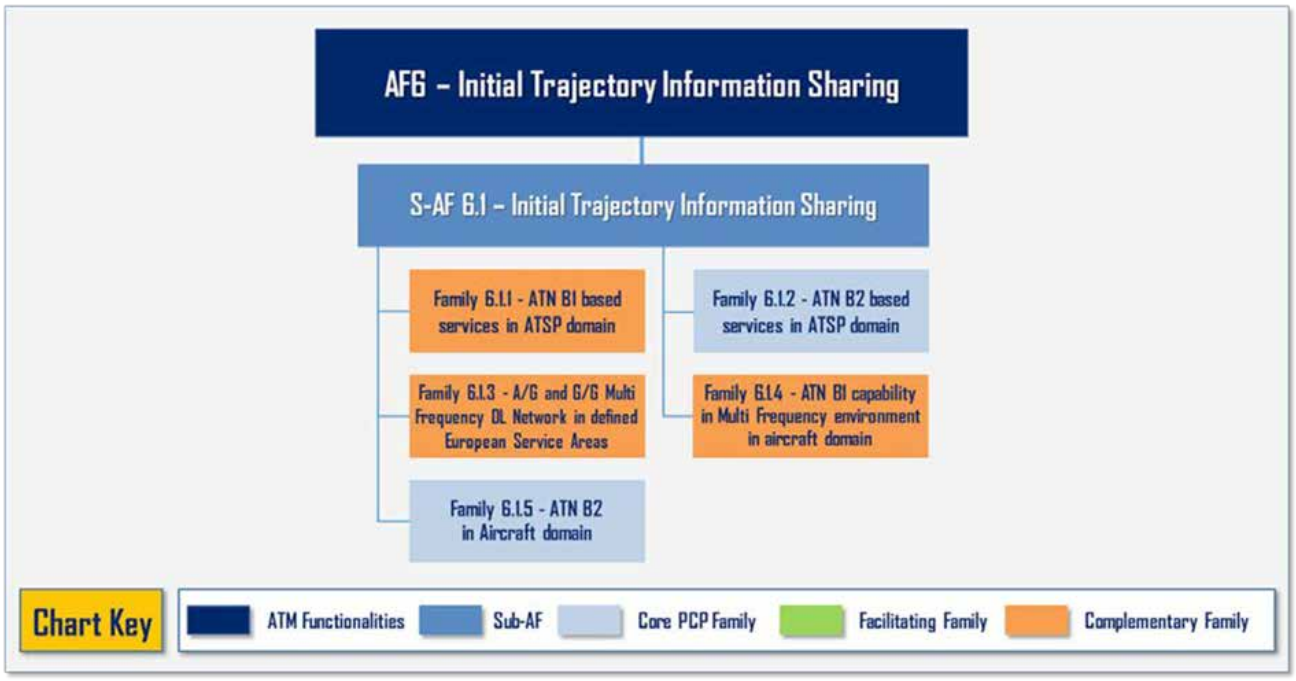


Fig. 28 - AF #6 Initial Trajectory Information Sharing

Description and Scope of the ATM Functionality

The primary objective of ATM Functionality #6, Initial Trajectory Information Sharing, is the integration of aircraft predicted flight path information and other on-board parameters into the ATM systems. To achieve this, a successful implementation of the data link capabilities described in Regulation (EC) No 29/2009, the Data Link Services Implementing Regulation, is an essential prerequisite.

In addition to these air/ground data link capabilities, an effective ground/ground dissemination of the aircraft predicted flight path information is needed, to ensure the highest level of consistency between the expected and actually flown flight route, and prevent any discrepancy and/or misalignment.

Based on the results of the ELSA study, the SDM developed the “Data Link Services (DLS) Implementation Strategy towards Initial Trajectory Information Sharing”, that was further developed 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).

The scope of ATM Functionality #6 encompasses the following elements:

- The implementation of ATN Baseline 1 (ATN B1), which targets the implementation of the original DLS IR at European level, both on the ANSPs and Airspace Users side. ATN Baseline 1, which shall be implemented according to the ELSA study’s recommendations, enable – among other applications – the use of Controller Pilot Data Link Communications (CPDLC).
- The sub-sequent deployment of ATN Baseline 2, which targets the full implementation of trajectory information sharing both on the ANSP/Network Manager and Airspace Users side. These Families would in turn enable the ADS-C EPP application, including the ground/ground dissemination of the trajectory information through Flight Object exchange via SWIM Blue Profile. The ANSPs and NM ATM systems need to be upgraded to process the air derived flight data provided by EPP, establishing and operating the appropriate ADS-C contract. The Air Traffic Service Unit systems will determine parameters for the appropriate ADS-C Contract Request and will process the EPP data in FDP to derive

performance benefits (including FDP Trajectory Prediction, HMI, Controller support tools and Safety Nets). The NM systems will process and integrate EPP data to derive network performance benefits. Air Traffic Service Unit Communication will establish the appropriate ADS-C

Contract with Aircraft System and will provide support for SWIM sharing of EPP or EPP enhanced ground trajectory data.

- The definition and implementation of an air/ground and ground/ground network supporting ATN B1, ATN B2 and ACARS, providing the performance required to satisfy the DLS IR in the short term, and coverage as well as capacity to support the increased data volume expected with the introduction of trajectory downlinks with ADS-C EPP in the medium term.

AF #6 – Deployment Approach:

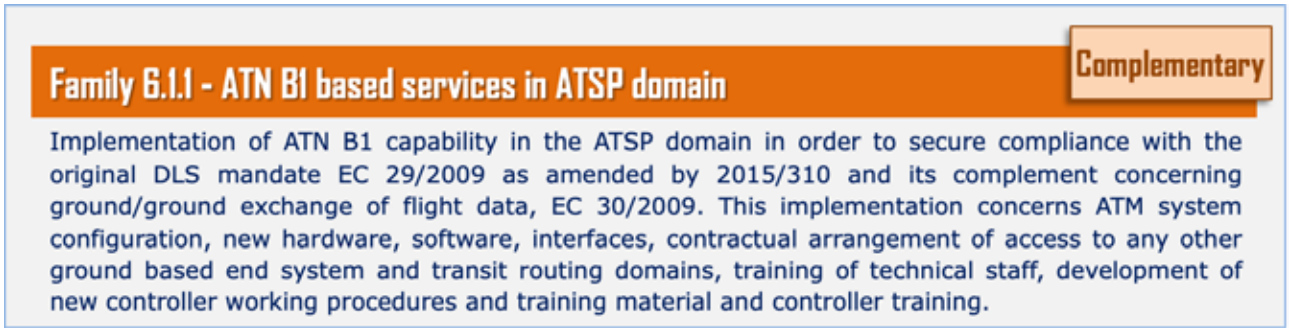
- **Sub-AF 6.1**: 2 elements need to be deployed to achieve this Sub-AF, which can be implemented in parallel. These correspond to the ATN B2 services to process the data provided by the Extended Projected Profile (EPP) in the ground systems, and to the implementation of aircraft systems to receive and process a ground ADS-C contract request for EPP data. There are however 3 additional elements which are pre-requisites to start the implementation: those which provide the corresponding ATM infrastructures for data link services.

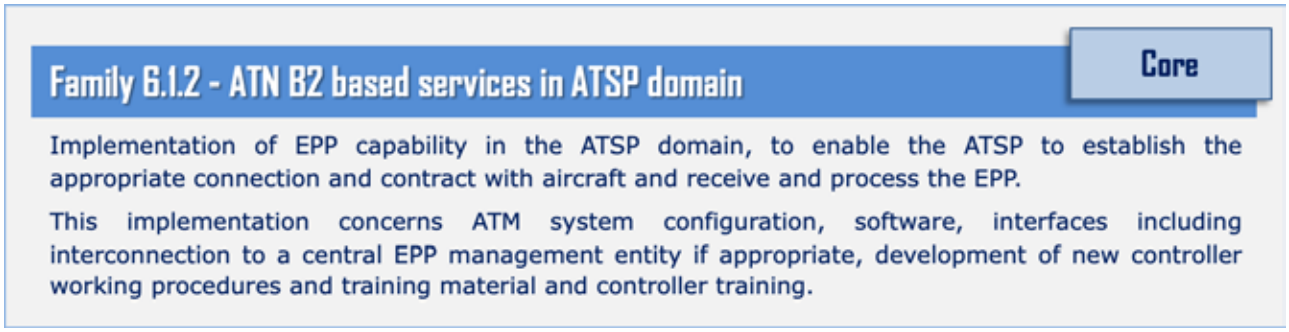
Expected Performance Improvements and Benefits

Operational benefits achieved by the deployment of ATM Functionality #6 are envisaged by the PCP in the areas of improved de-confliction and the reduction of tactical interventions, allowing the aircraft to fly as much as possible on their preferred trajectory, as a result of improved use of target times and trajectory information.

Based on the increased precision and predictability of the aircraft trajectories, the controllers' decision-making process will be assisted by enhanced supporting tools that can more accurately anticipate congestion and facilitate a smoother adaption to actual traffic situation.

In addition, the deployment of Initial Trajectory Information Sharing can also be regarded as an infrastructure provision, integrating the aircraft as a node into the European Air Traffic Management network.





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

Complementary

Implementation of multi-frequency DL network environment to attain the network capacity required for AF6. This implementation concerns primarily the G/G and A/G datalink network domains; it will concern the securing of the required radio frequencies from the appropriate authority, design, deployment and interregional integration of the G/G and A/G networks and contractual as well as physical arrangements of interconnection to any third party or transit routing domains.

Family 6.1.4 - ATN B1 capability in Multi Frequency environment in aircraft domain

Complementary

Implementation of ELSA "best-in-class" capable configuration in the airborne domain in order to enable aircraft to use datalink communication in multi-frequency environment.

This implementation concerns the procurement and installation of avionic equipment in the prescribed and approved configuration, crew training and procedures.

Family 6.1.5 - ATN B2 in Aircraft domain

Core

Implementation of ATN B2 capability in the airborne domain in order to enable aircraft to downlink EPP through ADS-C to a suitably equipped ground domain.

This implementation concerns the procurement and installation of avionic equipment in the prescribed and approved configuration.

4. Performance Approach

The Pilot Common Project has been adopted by the Commission after a positive opinion from the EU Member States and endorsement by the operational stakeholders on the basis of a high-level Cost Benefit Analysis (CBA) that demonstrated an overall benefit. The performance approach of the SESAR Deployment Programme aims at coordinating, synchronizing and monitoring the implementation of the Common Projects against the boundaries of the high-level CBA that trigger their adoption.

To meet this objective, the performance approach includes:

- An overview of the SDM's role within the SES performance framework, illustrated within the following paragraphs;
- An overview of the "Performance Assessment and CBA Methodology" that the SDM has applied in support of its performance policy and how it builds on and connect with the methodologies used by other SES and SESAR bodies involved into performance, as presented in the following paragraphs and in a dedicated Annex to the Planning View, as part of the guidance material to implement the SESAR Deployment Programme.

4.1. SDM in the SES performance framework

The SDM has been established by the European Commission as a SES instrument to ensure timely, synchronised and coordinated implementation of SESAR through a series of Common Projects. As such, the SDM's performance approach shall comply with the SES overall performance framework, use common indicators and methodologies with other SES bodies dealing with performance and build on their expertise and early results.

SESAR Deployment Manager (SDM), according to its regulatory framework set by Commission Regulation (EU) No 409/2013 and Regulation (EU) No 716/2014, considers the performance driven deployment of the Pilot Common Project and any subsequent Common Project as a priority.

SDM commitment is focused on a constant improvement of the methodology to assess the consistency with and level of contribution to European Union-wide performance targets[5] provided by technological investments. Within the scope of its responsibilities, the SDM's performance policy aims to:

1. Guarantee compliance to relevant regulations and adherence to the European ATM Master Plan as reference for operational changes that are essential enablers to achieve the Single European Sky (SES) performance objectives;
2. Guarantee full coordination with the SJU, PRB, NM and EDA on performance assessment;
3. Guarantee the consultation with the implementing partners on performance analysis before they are published and within the consultation process defined for the Deployment Program;
4. Guarantee the coordination of performance assessment with Military stakeholders through EDA;
5. Provide the assessment of implementing projects against SES performance KPA, namely safety, capacity, environment and cost efficiency as part of the synchronisation effort of the Deployment Program;
6. Provide an analysis of the costs and expected benefits of the PCP related implementation projects;
7. Provide monitoring and assessment of the impact of implementing projects on each performance target;

[5] *European Union-wide performance targets' means the targets referred to in Article 9 of Commission Implementing Regulation (EU) n. 390/2013.*

8. Promote the use of good practices in the field of cost benefit analysis methodologies and the adoption of continuous improvement models;
9. Guarantee that all involved staff are aware of their role in the achievement of performance driven deployment;
10. Develop and promote, at management and implementation levels of SESAR Deployment Governance, a performance-driven culture.

Since implementation as from 1 January 2012 of the performance scheme, the EU has been operating a formal and explicit performance-driven approach, which includes performance indicators – fit for setting binding regulatory targets on specific stakeholders accountable for delivering measurable performance outcomes. Through a succession of Reference Periods (2012-2014, 2015-2019, …) the performance scheme drives and monitors the final achievement of SES High-level Goals. As explained in the Commission Implementing Decision C (2015) 9057, "a Performance Ambition is considered as an estimation of the contribution of the SESAR project to the Single European Sky (SES) Performance objectives. This estimation shall be confirmed after the validation of the relevant Research, Development and Deployment activities".

SESAR deployment shall fit within this performance scheme: investments, benefits and performance gains drawn from SESAR deployment shall support the achievement of the specific targets of the active Reference Period. The SDM will cooperate with the Performance Review Body (PRB) to ensure this compliance, in particular through the alignment of KPIs used by the SDM and PRB allowing improvements in ATM to be tracked.

Another key player in the SES performance framework is the Network Manager (NM). Since 2011, with a specific consolidated local and network perspective, the NM has been forecasting, planning, monitoring and reporting to help deliver the performance targets of the Single European Sky. Since its establishment in December 2014, the SDM has been closely cooperating with the NM with the objective to build on the NM's wide experience, tools and findings and to ensure consistency with the Network Strategy Plan (NSP), Network Operations Plan (NOP) and European Route Network Improvement Plan (ERNIP).

Finally, the Global Cost-Benefit Analysis that the SJU delivered back to 2013 in support of PCP's adoption sets the overall frame for the SDM's action in the field of performance.

This document is referred to as the "Reference and supporting material (EC) No 716/2014 article 5(C) Global cost-benefit analysis". With regards to the PCP CBA, the SESAR Deployment Manager shall pursue several objectives:

1) Monitoring that CBA's boundaries are met: the SDM shall ensure that PCP is implemented within the boundaries of the CBA and that, in particular, the targets assumed in the CBA for the 5 sensitivity drivers are met[6];

2) Addressing discrepancies behind the overall positive result of the CBA: whilst the PCP CBA shows an overall benefit of 2.4 billion € (Net Present Value) over the period 2014-2030, it highlights some issues on which the SDM shall be vigilant, such as:

- o AF5 and AF6 where CBA at AF level is negative;
- o AF1, AF2, AF3, AF4 where the different investments and benefits are not necessary, with similar ramp-up periods or payback timings;

3) Gathering actual costs[7] and updated expected benefits data of all on-going implementation projects in relation with PCP in order to continuously monitor their expected contribution to performance during execution. Moreover, these data could be used to update PCP CBA at the occasion of a PCP review.

[6] *Air Traffic Growth, Fuel and CO2 savings, Delay Cost Savings, reduction of costs for the ATM service provision, PCP investments costs ground and airborne*
[7] *Cost information is only available of CEF funded IP projects (FPA)*

4) For any completed project, monitoring the switch to operation and the actual contribution to performance. The actual contribution to performance shall be compared with the declared/expected contribution to performance set when initiating the project and monitored during the execution of the project. Comparison results will be used to adjust expected contributions to performance for other implementation projects as well as for the earlier benefits assessment in the R&D phase.

4.2. Performance Assessment and CBA Methodology

The SDM's performance assessment and CBA methodology is the cornerstone of the SDM's performance policy. It acts as a bridge between technological investments required to achieve new ATM functionalities required through the PCP Regulation and ATM performance improvement. It contributes to ensure that all benefits expected from the full PCP implementation will materialise whilst not exceeding the estimated cost. It is an essential tool in monitoring PCP implementation, assessing and monitoring the 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 ensure the whole PCP is implemented.

The performance assessment and CBA methodology describes the different steps taken to set the baseline against the performance which will then be monitored during SDP Execution activities. Detailed methodology is annexed to the Planning View, part of the Guidance Material to support the implementation of the SESAR Deployment Programme. In particular, the performance assessment and CBA methodology assumes that co-funding is awarded by the Commission and reflected by the operational stakeholders in their investment plans in accordance with relevant regulations, in particular on the Charging Scheme – Reg. (EU) No 391/2013 – and on the Performance Scheme, Reg. (EU) No 390/2013.

In particular, the Annex to the Planning View includes:

- Performance indicators and their corresponding CBA metrics that allow benefits to be quantified;
- A detailed "consistency check" table between the Performance Indicators used by the SDM, the KPIs of the SES II Performance scheme and the KPIs of the ATM Master Plan. The three sets of indicators are coordinated between the SDM, SJU and the PRB;
- Detailed explanation of the top-down approach and the bottom-up approach in measuring the expected benefits;
- Detailed explanation of the cost effectiveness analysis performed before submission.

5. Risk Management Plan

5.1. SDM Approach to Risk Management

The prompt detection and management of risks is key to ensuring a coordinated, timely and successful implementation of the SESAR Deployment Programme. The SDM Risk Management Approach is composed of three phases and it is built on an iterative approach, implemented during the execution of the Programme, so as to ensure the most efficient and effective management of any event which might have a negative impact on the Common Projects' implementation.

5.1.1. Risk Assessment

The first phase of the methodological approach is represented by the "Risk Assessment", composed of three sub-steps: Risk Identification, Risk Analysis and Risk Evaluation. The objectives of this phase are to identify events which might have a negative impact on SDP execution, to perform an in-depth analysis of the identified risks, and to evaluate them effectively, in terms of probability and impact.

Risk Identification

The identification and management of risks at SESAR Deployment Programme level is at the core of the SDM's remit. Risks at Programme level are defined as "*events which might have significantly negative impacts on the successful, synchronised and timely implementation of the Deployment Programme and of the Common Projects*". The identification of such risks is a continuous activity performed by the SDM throughout the Programme's entire lifespan:

- During the Programme's development, the SDM identifies risks at Programme Level, covering, for each risk, objectives affected, consequences / impacts, and mitigation actions;
- During the Execution activities, risks are identified by taking into account the results of the deployment activities directly coordinated by the SDM, and the analysis of external events which might have a negative impact on the implementation of the Programme.

Risk Analysis

During the "Risk Analysis" activities, previously identified risks are analysed to enable their evaluation. In particular, the SDM, in cooperation with the stakeholders involved in the deployment and with external stakeholders (if needed), analyses the identified risks, by allocating them to one of five well-defined categories: Cost, Time, Performance, Interdependencies or Quality.

Risk Evaluation

The Risk evaluation step aims at assessing the risks previously identified and analysed, in terms of:

- Probability: likelihood that a given adverse event can have a negative impact on the coordinated and synchronised implementation of CPs;
- Impact: level of severity through which adverse events have an impact on the successful implementation of Common Projects.

Probability and Impact are assessed by the SDM through a qualitative evaluation, according to a five-level scale (Very low, Low, Medium, High, Very high). The Risk Matrix gives an overview of the possible categorisation of each risk. The SDM aggregates the result of the probability / impact analysis in order to define the risk level within the following scale: a) High, b) Medium, c) Low d) No Risk.

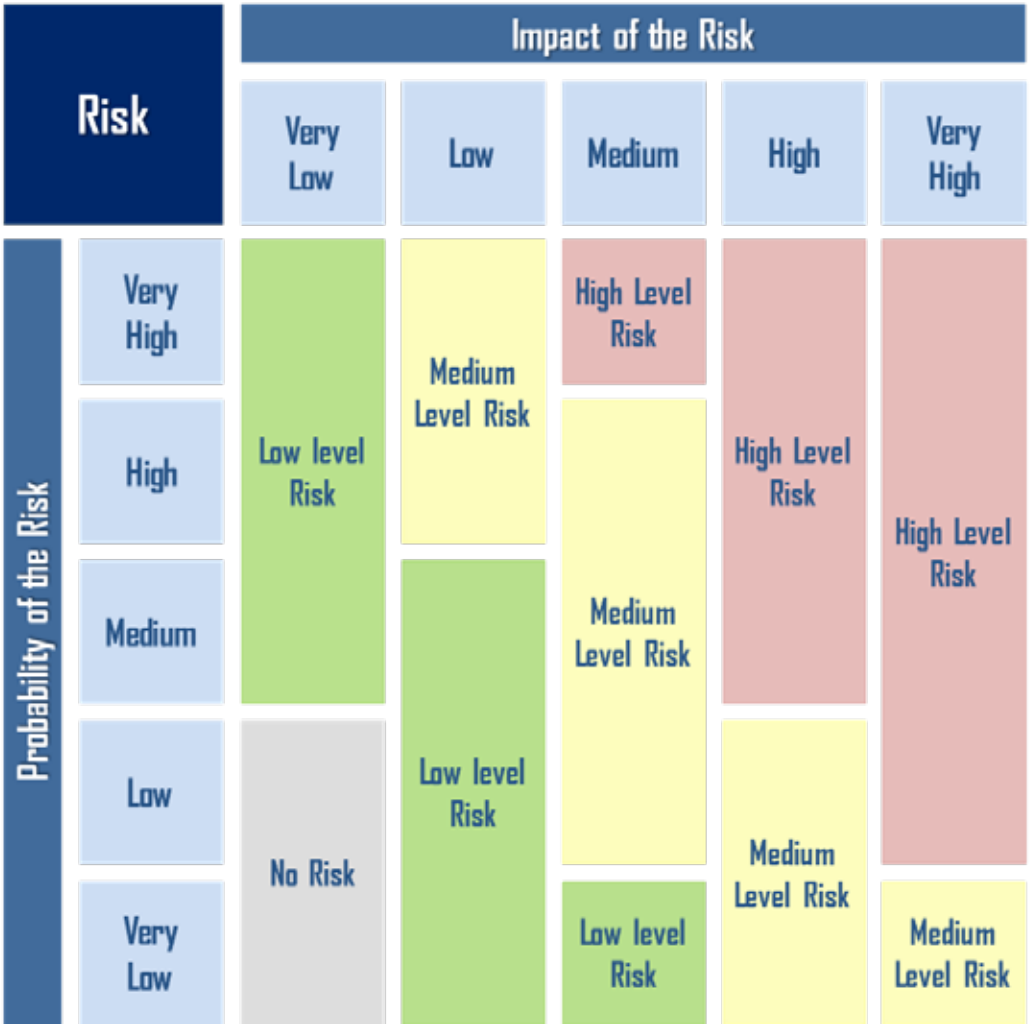


Fig. 29 - SESAR Deployment Manager Risk Matrix

5.1.2. Risk Mitigation

The second phase of the methodological approach is represented by "Risk mitigation", which aims at ensuring the prompt identification and implementation of mitigation actions with regard to each risk.

The SDM identifies the most suitable mitigation actions to be implemented which can lead to the resolution and closure of the risk. Specifically, mitigation actions are defined by the SDM in terms of owner, activities to be performed, and timing for implementation. In addition, the SDM is in charge of the follow-up of the mitigation actions, which is defined in terms of reporting frequency and content.

5.1.3. Risk Monitoring

The third phase of the approach aims at ensuring that risks and related mitigation actions are effectively monitored over time, in order to verify their evolution. The following activities are performed by the SDM:

1. Each risk is assigned to a specific SDM expert (or team of experts) in order to continuously monitor its evolution, interact with the relevant stakeholders, and periodically report to SDM management with regards to the evolution of the risk and the degree of success of the mitigation actions;
2. The internal "risk register" is continuously maintained, in order to provide updated information on the evolution of risks' and mitigation actions' whenever needed.

5.2. PCP Risks and Mitigation Actions

In accordance with its responsibility of "ensuring effective management of risks", as stated at Article 9 (d) of Reg. (EU) No 409/2013, the SESAR Deployment Manager identified, assessed and evaluated all risks whose occurrence could affect the implementation of the SESAR Deployment Programme and of the Common Projects.

Taking into account the principles underpinning the Single European Sky initiative and the need to directly involve all interested parties in Risk Management activities, SDM has been liaising directly with those stakeholders potentially affected by the SDP-level risks, as well as with the potential candidates to undertake Mitigation Actions to limit their impact.

In parallel, the SESAR Deployment Manager is working closely with the SESAR Joint Undertaking in order to ensure that the risks listed in the Deployment Programme are well-connected and linked with the risks listed in the ATM Master Plan, especially with regard to implementation-related issues.

As a result of this process, the following risks have been identified:

1. Misalignment between SDP and operational stakeholders' investment plans
2. PCP Implementation outside the framework of SESAR Deployment FPA
3. Failure to adequately achieve full military involvement
4. Failure to provide required standards and regulations on time
5. Failure to ensure global interoperability

Misalignment between EU co-funding profile and readiness for implementation

6. Late definition / failure to establish SWIM Governance
7. Late implementation of AF6: Initial Trajectory Information Sharing
8. Late delivery of IOP SESAR Solutions
9. Late industrialisation decisions
10. Unaddressed cyber-security vulnerabilities
11. Misalignment in Full Operational Capability dates
12. Lack of adherence to SESAR Deployment Programme

In accordance with the proposed Risk Assessment Approach, the risks have been assessed and consequently positioned on the SESAR Deployment Programme Risk Evaluation Matrix as illustrated in the figure below.

The following tables have been developed to identify and present those risks with higher relevance to the successful and timely implementation of the SESAR Deployment Programme. The tables detailing the SDP-level risks and the associated Mitigation Actions are structured in order to illustrate the following elements:

- the title of the Risk;
- the objectives most likely to be impacted by the identified Risk;
- the indication of their potential impact on the PCP implementation, as well as its probability of occurrence. Each element is scored on a three- level scale, based on a qualitative assessment performed by the SESAR Deployment Manager, in cooperation with other relevant SES bodies;
- the envisaged consequences / impacts which might stem from the risk occurrence;
- the Mitigation Actions to be implemented (either by the SDM or by other stakeholders) in order to reduce the likelihood of the risk occurrence, or to mitigate its impacts.

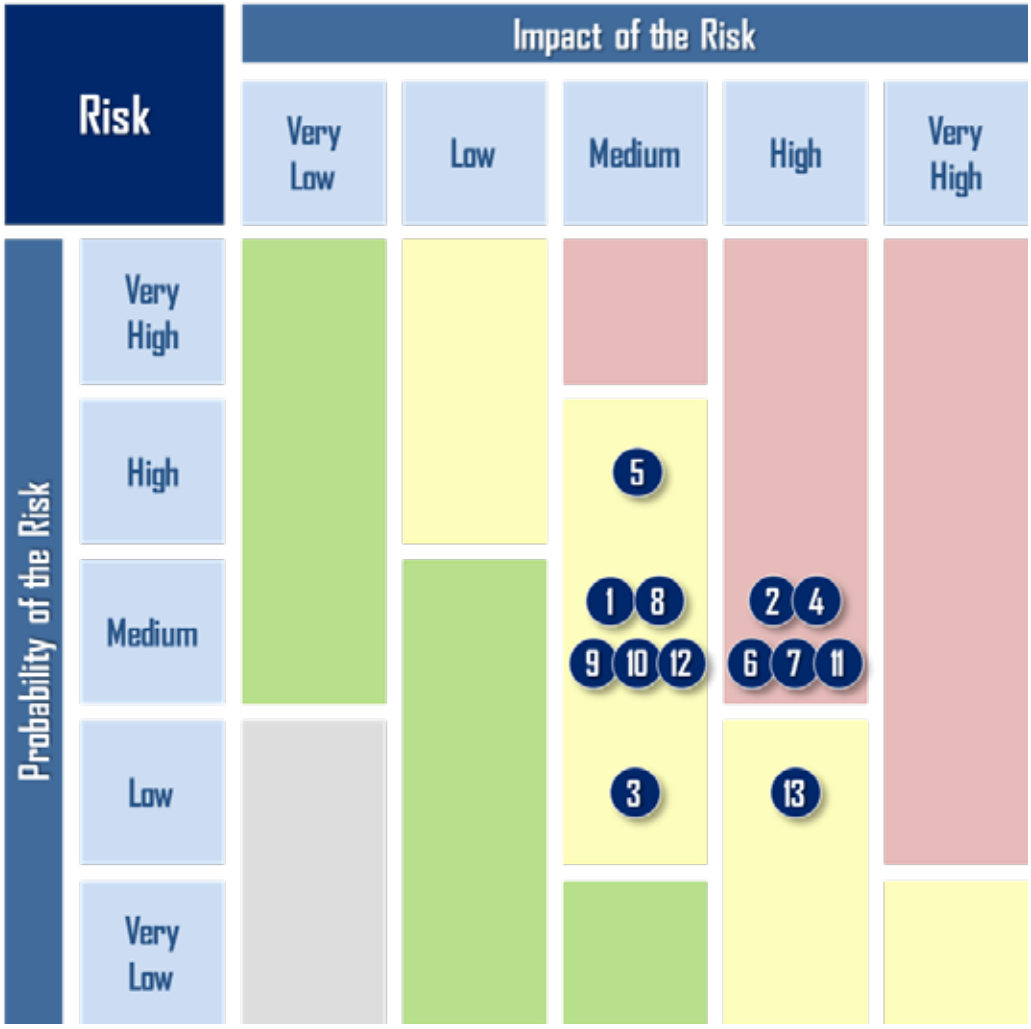


Fig. 30 - SESAR Deployment Programme Risk Matrix (2017 Edition update)

SESAR Deployment Programme – Risks and associated Mitigation Action

<table>
<tr><td>1</td><td colspan="4">Misalignment between SDP and operational stakeholders' investment plans</td><td colspan="2">Medium Level Risk</td></tr>
<tr><td>Objectives affected by the Risk</td><td>Timely PCP implementation and release of associated benefits</td><td>Impact</td><td>Medium</td><td>Probability</td><td>Medium</td></tr>
<tr><td>Consequences and impacts</td><td colspan="5">The gap analysis showed that there are Families that are not implemented yet or only partially implemented in the PCP geographical scope. The impact of the late implementation of the Families identified as high relevance could lead to a potential delay to overall PCP implementation. Furthermore, in some cases the deployment of prerequisites is lagging behind, with potential impacts on the subsequent investment end dates.

When this situation occurs, the delivery of performance benefits would be delayed accordingly. Additionally, late or missed investment could also have a negative impact on other stakeholder categories, jeopardising the achievement of full PCP objectives.</td></tr>
<tr><td>Mitigation Actions</td><td colspan="5">By SESAR Deployment Manager
• Strong promotion of the SESAR Deployment, together with dedicated local face to face meetings between the SDM and "concerned stakeholders" and/or group/platform of stakeholders (e.g. at country and/or airport level);
• Stress at local level the need to adhere to the SESAR Deployment Programme and close the implementation gaps in the high readiness Families as a priority;
• Strong promotion and information initiatives in order to emphasize the need to proceed with the deployment of prerequisites and enablers for the Pilot Common Project;
• Enhancement of the transversal approach and buy-in for a synchronized approach in deploying PCP, among Airspace Users, Airports and ANSPs, supporting the alignment between the Programme and stakeholders' investment plans;
• Preparation and distribution of information packages to the operational stakeholders to support/facilitate the submission of the IPs both at technical and financial/administrative level;
• Support/facilitate the submission of proposals through a dedicated and timely process (anticipated as much as possible) on Indications of Interest;
• Facilitation of stronger partnership between the operational stakeholders in preparation for the upcoming Calls, both at local and European level;
• Request demonstration of local coordination with other relevant stakeholders by projects leaders prior to projects submission to CEF calls;
• Synchronisation / coordination activity on identified projects by the SDM, through all phases, from their preparation towards the submission to INEA until the project execution;
• Close correlation between requests for payment by the Implementation Projects to the SDM and their effective transmission to INEA by the SDM.
• Organise dedicated meetings and/or communication flows in order to ascertain why a project was not awarded and to check whether it can be successfully submitted within next Calls for proposal.

By other Stakeholders/Authorities
European Commission to support the implementation with future Calls in order to foster the flow of Implementation Projects throughout the whole CEF timeframe.</td></tr>
</table>

2	PCP Implementation outside the framework of SESAR Deployment FPA			High Level Risk	
Objectives affected by the Risk	PCP Benefits	Impact	High	Probability	Medium
Consequences and impacts	Within its current mandate, the SDM should prioritise its effort to monitor the progress of implementation only for those projects awarded through the SESAR deployment FPA. The collection of the information is performed through the monitoring process associated with the Execution Phase for the EU funded projects and is performed three times per year. Should a significant part of PCP be implemented outside the SESAR deployment FPA and not properly monitored by the SDM, this could lead to an incomplete picture of the PCP's implementation status and to an impact on overall performance analysis.				
Mitigation Actions	**By SESAR Deployment Manager** • To annually perform a dedicated Monitoring Exercise, engaging operational stakeholders operating both inside and outside the SESAR Framework Partnership Agreement, in order to keep track of all implementation initiatives contributing to the implementation of Common Projects across Europe. **By other Stakeholders/Authorities** • EC to streamline the EU reporting processes in order to avoid any unnecessary duplication and potential inconsistencies.				

3	Failure to adequately achieve full military involvement			Medium Level Risk	
Objectives affected by the Risk	Full and timely PCP implementation, associated benefits	Impact	Medium	Probability	Medium
Consequences and impacts	The lack of adequate military involvement, both at European and local level, could lead to an insufficient buy-in of the military community and to a "backlog" concerning the necessary investments in line with PCP and SDP priorities.				
Mitigation Actions	**By SESAR Deployment Manager** • Maintain the strong communication channel between the SDM and EDA in order to facilitate and accelerate dialogue with the military authorities (Cooperative Arrangement with EDA was signed on 29th June 2015); • Continue to liaise with EDA to further facilitate local coordination between the local civil stakeholders (level 3) and the military authorities; • Continue to support EDA in the promotion of the PCP and the SDP amongst military authorities; • Identify and highlight the areas where military Implementation Projects can be expected in the context of CEF Transport Calls; • Support implementing partners enabling local civil/military coordination. **By other Stakeholders/Authorities** • EDA to continue with promotion of the PCP amongst military authorities. • Military authorities to submit Implementation Projects to CEF Transport Calls, according to the SESAR Deployment Programme.				

4	Failure to provide required standards and regulations on time			High Level Risk	
Objectives affected by the Risk	Harmonised PCP implementation, associated benefits	Impact	High	Probability	Medium
Consequences and impacts	Some of the Families necessary for the full PCP implementation are not yet ready for deployment as indicated by their planned completion date of V3-phase (Pre- Industrial Development & Integration of E-OCVM – European Operational Concept Validation Methodology) and/or not covered by appropriate standards (ESOs and EUROCAE responsibilities), specifications and dedicated means of compliance (EASA responsibility). This issue could lead to a non-harmonised deployment, a lack of interoperability, integration problems and consequently to the need for reinvestments at a later stage to upgrade the deployed solutions to the required standards. Ultimately, this could have a negative impact on the operational deployment and the delivery of the expected benefits.				
Mitigation Actions	**By SESAR Deployment Manager** • Continue to reinforce synergies with: o The SJU for the prioritisation of the validation exercises and the Large Scale Demonstrations (SDM has signed the Cooperative Arrangement with the SJU); o EASA, EUROCAE and European Standardisation Organisations to align their work programmes with the deployment priorities, as identified in the European Standardisation Rolling Development Plan (RDP) (the SDM has signed the Cooperative Arrangement with EUROCAE); o EASCG (European ATM Standards Coordination Group) bringing together all relevant organisations; o The manufacturing industry and operational stakeholders to seek their assistance in contributing to the timely development of the necessary standards and marketing of the necessary hardware and software; o ICAO for standards and recommended practices, to ensure their timely provision as well as the alignment of their content with the deployment priorities. • Consider the readiness for deployment and specifically the availability of the appropriate standards as a prerequisite for the selection of PCP-related Implementation Projects seeking EU-funding support; **By other Stakeholders/Authorities** • Relevant stakeholders to refer to and use existing standards and regulatory material and/or updated material to the greatest extent to avoid new rulemaking and/or standardisation tasks. • EUROCAE members to adequately promote and provide resources to the working groups involved in the development of the required standards. • EC to promote stronger commitment by key players for timely delivery and necessary funding to bodies involved in critical development of standards and regulation to secure necessary resources. • Implementing stakeholders to report to the SDM on the identified issues experienced with standards and regulations, allowing the SDM to liaise with the relevant bodies.				

5	Failure to ensure global interoperability			Medium Level Risk	
Objectives affected by the Risk	Harmonised PCP implementation, associated benefits	Impact	Medium	Probability	High
Consequences and impacts	The consequences of the lack of global interoperability are the potential misalignment for avionics and/or processes between the different aviation world regions (e.g. between SESAR/NextGen, as the ATM modernisation programmes), potential misalignment between the different avionics vs. ground systems and amongst ground systems themselves. The potential impact could be: • Civil and military Airspace users having to buy, certify, install, maintain, train and carry redundant systems; • Increased costs and workload for civil and military airspace users, as well as for airports and ANSPs; • Additional costs due to misalignments could overshadow operational benefits and efficiencies. This risk is strongly linked to Risk n. 4.				
Mitigation Actions	**By SESAR Deployment Manager** SESAR Deployment Manager has appointed an International Relations Manager to handle this specific risk. The SDM and SJU coordinate with FAA (NextGen and ATO) under the EU/US MoC on this specific topic to ensure adequate actions in securing requirements and timelines of major ATM operation & technical changes through alignment of the Master Plan and the SESAR Deployment Programme with the NextGen Implementation Plan. With respect to ICAO activities on global harmonisation, the SDM is working closely with the members of the ICAO working groups nominated by European States as required, under the political guidance of EC and in close cooperation with the SJU, to ensure a timely and acceptable alignment with the European deployment priorities. Special focus is being given to European deployment alignment with ICAO GANP/ASBUs update activities. Furthermore, the SDM is seeking assistance from the manufacturing industry (notably airborne equipment manufacturers) on the issue of global interoperability and alignment of industrialisation and deployment roadmaps. **By other Stakeholders/Authorities** • The SJU with the SDM to promote SESAR requirements based on a full life cycle view, towards FAA/NextGen and ICAO GANP/ASBU activities. • Relevant stakeholders to adequately promote the SESAR deployment needs to the working groups involved on European and global level. • EC to promote interoperable and synchronised mandates, with the US and globally. High priority to be given to Data Link Systems (both Air/Ground and Ground/Ground) and Surveillance system implementation strategies.				

6	Misalignment between EU co-funding profile and readiness for implementation			High Level Risk	
Objectives affected by the Risk	Timely PCP implementation, associated benefits	Impact	High	Probability	Medium
Consequences and impacts	The outcome of the SESAR Deployment Programme gap analysis clearly states the need for additional Implementation Projects by operational stakeholders to achieve full PCP deployment. Therefore, significant investments are still required. In particular, some key Families in the SESAR Deployment Programme are not yet ready for implementation due to an insufficient level of maturity. The conjunction of both constraints could lead to a significant time gap in PCP implementation.				
Mitigation Actions	**By SESAR Deployment Manager** • To continue the liaising with EC about the availability of grants to cover full PCP requirements. • To continue cooperating with SJU in order to emphasize the critical impact that the lack of maturity of some functionalities has on the overall implementation of the PCP. • To carefully review the readiness of each Family in the periodic update of the guidance material for implementation associated with the SESAR Deployment Programme (i.e. the Planning View). **By other Stakeholders/Authorities** Align co-funding profiles (Calls and available co-funding) to the foreseen evolution of Families' readiness for implementation, ensuring smooth implementation of PCP throughout the whole timeframe foreseen by the regulatory framework.				

7	Late definition / failure to establish SWIM governance			High Level Risk	
Objectives affected by the Risk	Timely and harmonised PCP implementation, associated benefits	Impact	High	Probability	Medium
Consequences and impacts	Implementation of SWIM-technology could be delayed significantly and/or SWIM interoperability could be substantially impaired due to a lack of SWIM-governance in place.				
Mitigation Actions	**By SESAR Deployment Manager** Continue to support the activities related to the establishment of the SWIM Governance and all the relevant stakeholders. The SDM established and chaired a dedicated SWIM Governance Focus Team, which drafted a SWIM Governance strategy detailing the Action Plan for its implementation. Execution of 3 actions in accordance with the Action Plan has been completed and this forms the basis for a new SWIM Governance project. Airports, ANSPs, Airspace Users, Military Authorities and MET service providers have successfully submitted a multi-stakeholder Implementation Project related to SWIM Governance for CEF Call 2016, which was kicked off in February 2017. **By other Stakeholders/Authorities** Airports, ANSPs, Airspace Users, the Network Manager, Military Authorities and MET service providers to work together for the achievement of SWIM Governance definition.				

8	Late implementation of AF6: Initial Trajectory Information Sharing			Medium Level Risk	
Objectives affected by the Risk	Timely PCP implementation, associated benefits	Impact	High	Probability	Medium
Consequences and impacts	DLS is an essential prerequisite for the business trajectory (Initial Trajectory Information Sharing) which is the backbone of the SESAR operational concept. Therefore, benefits from a considerable portion of SESAR solutions would be severely inhibited unless AF6 is fully implemented to achieve the required VDL Mode 2 network performance and capacity as well as the integration of the EPP into the ATM systems.				
Mitigation Actions	**By SESAR Deployment Manager** • Monitoring the implementation of the DLS in line with the requirements of the "Data Link Services (DLS) Recovery Plan", which focuses on the implementation of the ELSA recommendations. • The SDM to perform its role as DLS Implementation Project Manager in accordance with EC mandate. • Support operational stakeholders in the implementation of the "Data Link Services (DLS) Recovery Plan". • Cooperate with EASA, the NM, EUROCAE and the SJU in the definition of all the complementary activities needed for the full deployment of Datalink Services in support of the i4D trajectory. **By other Stakeholders/Authorities** • To adhere to the requirements laid down within the "Data Link Services (DLS) Recovery Plan" and follow SDM indications and consultation steps. • EASA, EUROCAE and the NM to fulfil the mandates received by EC in full cooperation with the SDM.				

9	Late delivery of IOP SESAR Solutions			Medium Level Risk	
Objectives affected by the Risk	Timely PCP implementation, associated benefits	Impact	Medium	Probability	Medium
Consequences and impacts	The PCP regulation requires the provision of Flight information exchanges through two different SWIM Technical Infrastructure (TI) profiles: • Yellow TI profile for Flight information exchanges which do not require real time performance; • Blue TI profile for the network intensive and real time exchanges of tactical Flight information data between ACCs and the Network Manager. The Blue profile is currently experiencing some delays in its operational validation and consequently the update of ED 133 is being postponed until these validations are over. The initial IOP (iIOP) from SESAR 1 and some planned SESAR 2020 activities will serve as the basis for validating the PCP IOP standard which will be published in 2020 by EUROCAE as ED-133 Revision. The ED-133 update proposals will be provided by the SJU in the form of a deliverable. These deliverables will feed the work of EUROCAE WG-59 who will remain in charge of publishing a final ED-133 revision in 2020. This postponement implies a potential overall delay of AF5 deployment (with specific regard to Sub-AF 5.6 Flight Information Exchange, and in particular to Family 5.6.2, dedicated to exchanges supported by Blue Profile), and other related AFs with respect to PCP deadlines (specifically, Sub-AF 3.2 Free Route, Family 4.3.2 Reconciled Target Times for ATFCM and arrival sequencing and Family 6.1.2 ATN B2 based services in ATSP domain).				
Mitigation Actions	**By SESAR Deployment Manager** • Continue the collaboration with SJU on the on-going IOP validation activities, to synchronise the IOP validation and deployment roadmaps; • Assess the industry's readiness for implementation **By other Stakeholders/Authorities** The SJU to continue the ongoing activities to deliver a complete SESAR Solution in 2018, allowing for a final ED-133 revision in 2020.				

10	Late industrialisation decisions				Medium Level Risk
Objectives affected by the Risk	Timely PCP implementation, associated benefits	Impact	Medium	Probability	Medium
Consequences and impacts	The industrialisation decision for developing the expected capabilities may not be made by the manufacturers if an adequate return on investment is not envisaged, even if the standards are available. This might be the case, in particular, for airborne functions where a mandate is not put in place.				
Mitigation Actions	**By SESAR Deployment Manager** • Activate cooperative arrangements and/or other means of cooperation with the Manufacturing Industry, in order to align expectations and share a common view of the capabilities required for deployment; • Identify alternative funding and financing mechanisms to support this development				

11	Unaddressed cyber-security vulnerabilities				High Level Risk
Objectives affected by the Risk	Timely PCP implementation, associated benefits	Impact	High	Probability	Medium
Consequences and impacts	Contrary to the traditional ATM systems, that used to work as a network of bespoke systems, the level of automation and interoperability within ATM, besides the usage of COTS systems and open standards, has increased. Moreover, the interactions between traditional actors and with new ones have also grown. These changes and technological improvements may, however, introduce vulnerabilities into the systems in the form of cyber-security risks, which is even more significant with the introduction of internet-based solutions. Since even low impact incidents could erode trust in the system, the implementation roadmap must ensure that delivered solutions are secure as a whole, thanks to a secure integration into operational ATM systems (including legacy systems), contributing as a result to a resilient European ATM system.				
Mitigation Actions	**By SESAR Deployment Manager** To identify in the SESAR Deployment Programme those Families which present a need of cybersecurity standards and regulations, together with the available cybersecurity standards and regulations. **By other Stakeholders/Authorities** • EC to ensure efforts on ATM cyber-security are coordinated, and assess policy options for strengthening cyber-security and resilience. • SJU to establish principles and processes for ensuring that cyber-security and resilience is included appropriately within the SESAR work programme.				

12	Misalignment in Full Operational Capability dates			Medium Level Risk	
Objectives affected by the Risk	Timely PCP implementation, associated benefits	Impact	Medium	Probability	Medium
Consequences and impacts	Dependencies between Families may cause misalignment between their Full Operational Capability target dates. For example, whilst some sub-functionalities in AF2 are supposed to be implemented by 2024, they are also a prerequisite for another AF/Sub-AF to be deployed by 2021. This could cause a delay to the achievement of the PCP deadlines, as a consequence of the un-readiness of the predecessors.				
Mitigation Actions	**By SESAR Deployment Manager** • Identify dependencies amongst Families which may cause misalignment between their FOC target dates. Inform applicants about the consequences and SDM proposed mitigation strategies; • Liaise with EC to present the results of the analysis and the possible impact on timely and full PCP deployment; • Support EC in the identification of inconsistencies during the PCP review process. **By other Stakeholders/Authorities** EC to launch the PCP review to resolve inconsistencies.				

13	Lack of adherence to SESAR Deployment Programme			Medium Level Risk	
Objectives affected by the Risk	Timely PCP implementation, timely release of associated benefits	Impact	Medium	Probability	Medium
Consequences and impacts	A lack of buy-in of the SESAR Deployment Programme would negatively affect the level of engagement and involvement in the implementation of the Pilot Common Project and in the overall ATM modernisation effort. Such low engagement could result in lower investments (or no investments), thus affecting the overall implementation of the PCP.				
Mitigation Actions	**By SESAR Deployment Manager** • Continue with the involvement and engagement of all operational stakeholders impacted by the PCP regulation through the Stakeholder Consultation Platform. • Continue taking into account the comments and suggestions formulated during consultation cycles by operational stakeholders.				

6. List of Acronyms

Acronym	Meaning
A/G	Air / Ground
A-CDM	Airport Collaborative Decision Making
ADS-C	Automatic Dependent Surveillance – Contract
AF	ATM Functionality
ACARS	Aircraft Communications Addressing and Reporting System
AFP/ACH	ATC Flight Plan / ATC Flight Plan Change Message
AFUA	Advanced Flexible Use of Airspace
AMAN	Arrival Manager
ANSP	Air Navigation Service Providers
AOP	Airport Operations Plan
APCH	Approach
APV	Approach Procedure with Vertical guidance
ARES	Airspace REServations
ASBU	Aviation System Block Upgrade
ASM	AirSpace Management
A-SMGCS	Advanced Surface Movement Guidance and Control Systems
ATC	Air Traffic Control
ATCO	Air Traffic Control Officer
ATFCM	Air Traffic Flow and Capacity Management
ATM	Air Traffic Management
ATM MP	ATM Master Plan
ATN	Aeronautical Telecommunication Network
ATSP	Air Traffic Services Provision
AU	Airspace Users
CASA	Computer Assisted Slot Allocation
CBA	Cost Benefit Analysis
CCO	Continuous Climb Operations
CDM	Collaborative Decision Making
CDO	Continuous Descent Operations
CEF	Connecting Europe Facility
CPDLC	Controller Pilot Data Link Communications
CPs	Common Projects
CTM	Collaborative Traffic Management
CTOT	Calculated Take-Off time
DCB	Demand Capacity Balancing
DCT	Direct Routings
DL	Data Link
DLS	Data Link Services

Acronym	Meaning
DMAN	Departure Manager
DP	Deployment Programme
EASA	European Aviation Safety Agency
EASCG	European ATM Standards Coordination Groups
EATM	European Air Traffic Management
EDA	European Defence Agency
EFS	Electronic Flight Strips
EGNOS	European geostationary navigation overlay system
E-OCVM	European Operational Concept Validation Methodology
EPP	Extended Project Profile
ERNIP	European Route Network Improvement Plan
ESOs	European Standardization Organizations
EU	European Union
EUROCAE	European Organization for Civil Aviation Equipment
FAA	Federal Aviation Administration
FAB	Functional Airspace Block
FO	Flight Object
FMP	Flow Management Positions
FOC	Full Operational Capability
FPA	Framework Partnership Agreement
FRA	Free Route Airspace
G/G	Ground / Ground
GANIS	Global Air Navigation Industry Symposium
GANP	Global Air Navigation Plan
GHG	Greenhouse Gas
HMI	Human Machine Interface
ICAO	International Civil Aviation Organization
INEA	Innovative Network and Energy Agency
IOC	Initial Operational Capability
IOP	Interoperability
IP	Implementation Project
IP	Internet Protocol
IPP	Implementing Partners
IR	Implementing Regulation
KPAs	Key Performance Areas
MoC	Memorandum of Cooperation
NM	Network Manager
NOP	Network Operations Plan
NSP	Network Strategy Plan

Acronym	Meaning
OAT	Operational Air Traffic
OMTV	Occupancy Traffic Monitoring Values
PBN	Performance Base Navigation
PCP	Pilot Common Project
PENS	Pan European Network Service
PKI	Public Key Infrastructure
PMO	Project Management Office
PRB	Performance Review Body
RDP	Rolling Development Plan
RNP	Required Navigation Performance
SBAS	Satellite Based Augmentation System
SCP	Stakeholder Consultation Platform
SDM	SESAR Deployment Manager
SES	Single European Sky
SESAR	Single European Sky ATM Research
SID	Standard Instrument Departure
SJU	SESAR Joint Undertaking
STAM	Short Term ATFCM Measures
STAR	Standard Arrival Routes
STAR	SESAR Tool for ATM Roll-out
SWIM	System Wide Information Management
TBS	Time Based Separations
TI	Technical Infrastructure
TMA	Terminal Manoeuvring Area
TSAT	Target Start Up Approval Time
TSG	Thematic Sub-Groups
TTA	Target Time of Arrival
TTOT	Target Take Off Time
VDL	VHF Digital Link
WBS	Work Breakdown Structure
WOC	Wing Operations Center

Notes

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