SESAR Deployment Programme 2021

Supporting Material to SDP Implementation

Short-Term Deployment Approach
CP1: best practices and success stories
Performance Assessment & CBA methodology
Risk Management Plan
Stakeholders' Deployment Roadmaps

Final Draft

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SDP 2021 – Supporting Material

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Short-term Deployment Approach 2021

The SESAR Deployment Programme illustrates the Deployment Approach to be followed in the deployment of each ATM Functionality included in the scope of the Common Project 1. The Deployment Approach for each AF (and Sub-AF) represents the possible sequencing of the deployment activities (e.g. of specific Families) associated to an ATM Functionality and it corresponds to the preferred approach to be followed by operational stakeholders impacted by the CP1 Regulation, and therefore requested to invest in the implementation of new technologies and/or operational improvements.

By construction, the SDP Families and the recommended Deployment Approaches per ATM Functionalities are stable in time and could only be changed at the occasion of an evolution of the Common Project regulations. Given the need to adjust and better steer the overall deployment activities in Europe, the Short-Term Deployment Approach is an evolving and periodically updated guidance material to operational stakeholders, best placed to identify the short-term elements to be addressed achieve the overall AFs deployment in accordance to the deadline set by the CP1 Regulation.

In this perspective, the intention is to integrate the stable Deployment Approach by proposing the required Short-Term Implementation Needs that should be addressed by operational stakeholders. These short-term implementation needs could also serve as the basis for the European Commission to identify priorities for awarding EU funding or financial incentives in support to Common Projects' deployment and ATM modernisation in general.

These short-term elements, identified through the SDP Families, may evolve, as the overall CP1 implementation progresses, and especially if new developments occur. This is therefore a living document whose aim is to reflect only the short-term needs.

The short-term Deployment Approach is supported by three fundamental pillars: technical considerations, status of implementation in Europe, and performance contributions. The combination of these three key pillars – which are detailed hereafter – will support the identification of the short-term Deployment Approach and will allow SDM to focus its efforts on monitoring and supporting the implementation of the identified Families by the required operational stakeholders.

Technical considerations

The technical aspects rely on the need to deploy a given Family in order to successfully achieve the overall AF or Sub-AF from a technology perspective (systems and procedures). This implicitly means that the Families identified in the short-term Deployment Approach are paramount to continue and progress with the deployment of the functionality. In some cases, it also happens that the Families within an AF are directly linked with Families belonging to a different AF (this is the case of AF5). In these cases, it is key to provide a transversal view by highlighting the internal dependencies.

Status of implementation in Europe

The status of CP1 implementation, based on the SDP Monitoring View, gives the actual picture of the current deployment of a given Family in the requested locations, vis-à-vis the geographical scope where the CP1 mandates the deployment of each ATM and sub-Functionality. As the SESAR Deployment Programme serves a tool to achieve the successful deployment on time of all sub-ATM Functionalities, there is a need to identify where there are still gaps in terms of implementation initiatives to be undertaken, and also to monitor how the deployment is progressing across Europe.

Depending on the implementation gaps identified within the SDP Monitoring View, it will be therefore paramount to push for its timely deployment by focusing stakeholders' effort and resources. The Families thus identified following these criteria will be part of the short-term Deployment Approach.

It is important to note that being part of the short-term Deployment Approach does not necessarily imply that a Family is the most important within a specific Sub-AF, either from a performance or technical perspective. This simply means that the Family is only considered important for short-term deployment if there are delays or a lack of implementation across Europe.

For example, a Family can be currently part of the short-term Deployment Approach due to the lack of on-going implementation projects, but it could be removed from the short-term deployment approach in the next update, should the implementation has progressed (i.e. implementation projects are in the pipeline). This could also be extended to the inclusion of another Family in the short-term Deployment Approach in the future, as a continuation of the implementation of the Sub-AF. There could also be the case that a Family requires an immediate focus due to the proximity of the deadline set in the CP1 Regulation and an overall lack of global implementation.

Performance aspects

Finally, the performance aspects must be taken into account in order to secure the positive CBA of the CP1, and the timely realisation of these benefits. Those Families that are mostly contributing to performance improvements, to digitalisation and to the objectives of the European Green Deal require special attention and focus, both from the deployment and monitoring perspective. Therefore, the short-term Deployment Approach will be complemented with a description of the performance contribution from each Family, and when possible, these benefits will be monetised extrapolating them until 2030.

It has to be noted that the monetisation of benefits, and the estimation of fuel, CO_2 and delay savings are based on the existing Implementation Projects under SDM direct coordination (i.e. real data) but also on an extrapolation of other projects and initiatives still to be implemented to achieve the full deployment of each Family.

How to interpret the short-term Deployment Approach diagrams

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

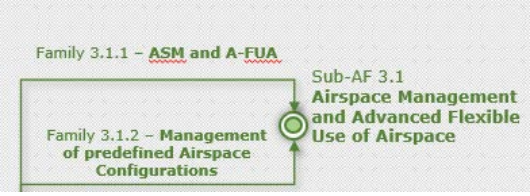


Figure 1 - Example of the sequencing of some Families

Deployment Approach diagrams: Families and sub-AFs

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

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

In the first example (Figure 1) it has been represented that Family 3.1.1 and 3.1.2 are contributing to the deployment of Sub-AF 3.1 – Airspace Management and Advanced Flexible Use of Airspace. At the same time, the chart depicts how Family 3.1.1 and 3.1.2 can be implemented in parallel.

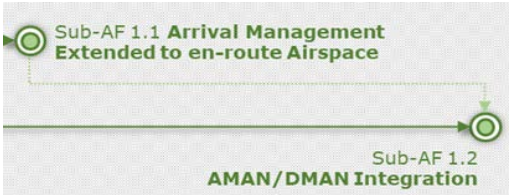


Figure 2 - Example of interdependencies between sub-ATM

To properly represent the sequencing and interdependencies of Families and sub-AFs, dotted lines have been added when a specific Family or a sub-ATM Functionality works as a predecessor or contributes to the full implementation of another sub-AF. The second example explains how the full implementation of sub-AF 1.1 (AMAN upgrade to included Extended Horizon function) is significantly contributing to the subsequent implementation of sub-AF 1.2 (AMAN/DMAN integration).

Finally, the Families whose deployment is deemed more urgent and thus should be considered as priorities for the short-term are highlighted in the graph with a star.

AF1 - Extended Arrival Management and Integrated AMAN/DMAN in the High-Density Terminal Manoeuvring Areas

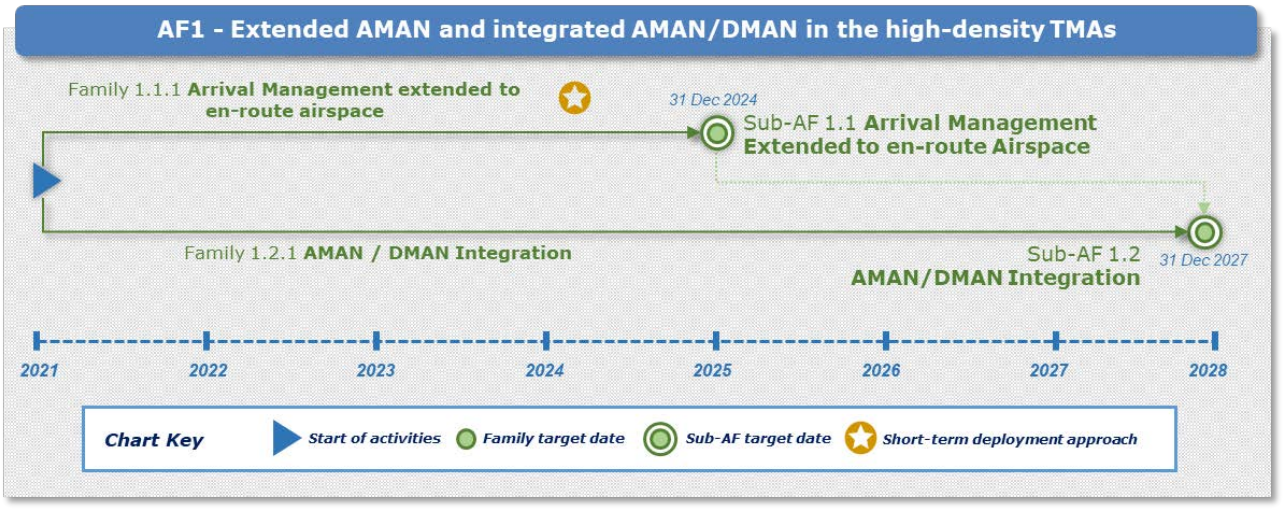


Figure 3 - AF1 Short Term Deployment Approach

Sub-AF 1.1 - Arrival Management extended to en-route airspace: Family 1.1.1 Arrival Management extended to en-route airspace is the unique Family of this Sub-AF, and with its implementation, Sub-AF 1.1 of the CP1 will be achieved. The required technology has been validated in SESAR and is considered mature for deployment, although additional local validations may be needed, in particularly in challenging environments where multiple CP1 airports are in close proximity affecting each other's arrival planning horizons.

With regards to the current status of implementation, the deployment of Extended AMAN is ongoing, having reached partial results from the Network Manager and in more than half of 18 applicable airports. Moreover, at some airports the deployment is almost completed (for instance, Copenhagen Kastrup, Frankfurt Airport and Munich Josef Franz Strauss).

The Regulation states that the Extended AMAN must be ready by January 1st, 2025, therefore, by the end of 2021 there will be 3 years left to complete the implementation in the remaining airports.

In order to timely implement AF1, operational stakeholder need to deploy in parallel both sub-AFs, that carries the same pre-requisite technology (AMAN). As per the Regulation AMAN/DMAN Integration must be ready by January 1st, 2028 (FOC 31/12/2027), therefore, by the end of 2021 there will be 6 years left to complete the implementation at listed Airports. It is suggested to focus on the full implementation of Extended AMAN in order to lay down the basis for Family 1.2.1.

The Performance contribution linked to the implementation of Family 1.1.1 is shown in the table below (cumulated values until 2030)[1]:

[1] Based on traffic forecast from Eurocontrol STATFOR - Scenario 2 (November 2020)

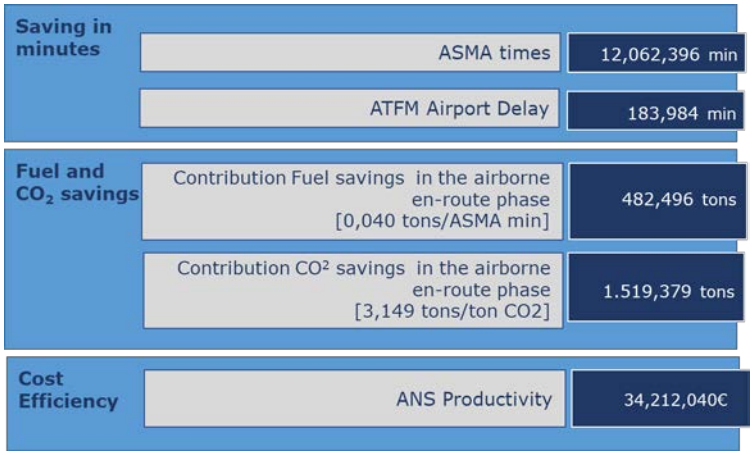


Figure 4 - Performance benefits for Family 1.1.1 full implementation

AF2 – Airport Integration and Throughput

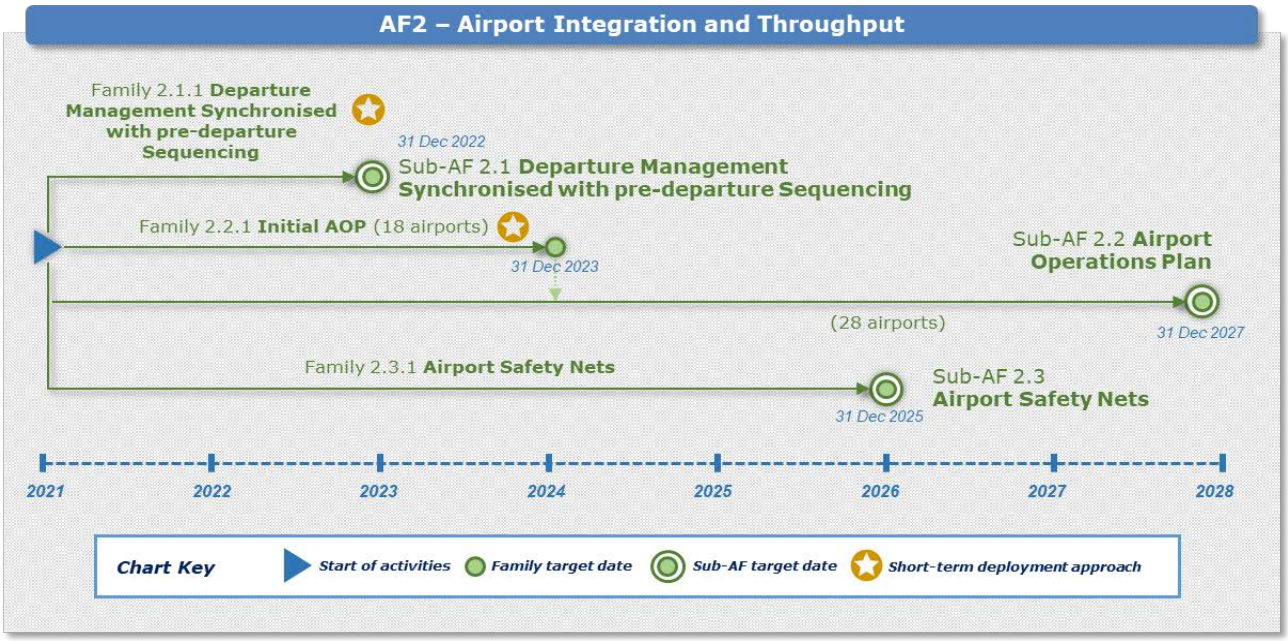


Figure 5 - AF2 Short Term Deployment Approach

The short-term deployment approach for AF2 should focus on the Families with a target date of 31/12/22 and 31/12/23, namely Families 2.1.1 and 2.2.1. It should be noted that 2.1.1 is also a prerequisite for 1.2.1. Both Families have dependencies with the implementation of Families 4.2.2 and Family 4.4.1. The aforementioned Families could be considered as a first performance package.

The Regulation states that the "Departure management, synchronised with pre-departure sequencing" must be ready by December 31st, 2022. Therefore, by the end of 2021 there will be 1 year left to complete the implementation of Family 2.1.1 at the remaining airports. According to the estimated typical duration to implement the related Families, the deployment plans for "Departure management, synchronised with pre-departure sequencing" should have already started and be in progress.

In addition, some elements of Family 2.2.1 "Initial Airport Operations Plan (AOP)" are essential prerequisites to implement Families 4.2.2 and 4.4.1. Therefore, according to the estimated typical duration to implement the Family 2.2.1, the deployment plans for "Initial Airport Operations Plan (AOP)" should have already started and be in progress for the 18 concerned airports.

The Performance contribution linked to the implementation of Familiy 2.1.1 is shown in the table below:

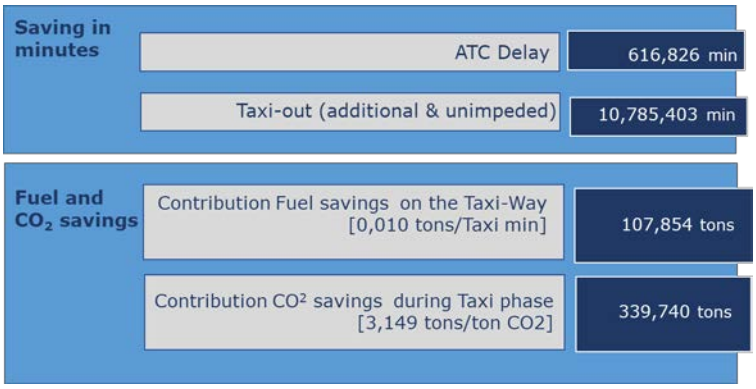


Figure 6 - Performance benefits for Family 2.1.1 full implementation

The Performance contribution linked to the implementation of Families 2.2.1 is shown in the table below (cumulated values until 2030)[2]:

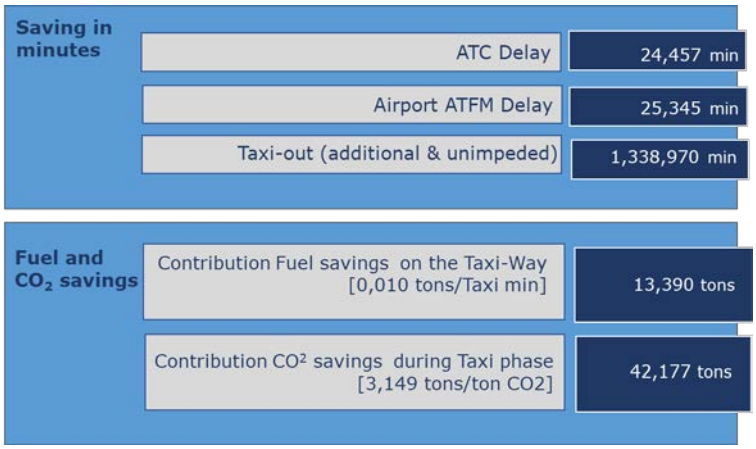


Figure 7 - Performance benefits for Family 2.2.1 full implementation

[2] Based on traffic forecast from Eurocontrol STATFOR - Scenario 2 (November 2020)

AF3 – Flexible ASM and Free Route Airspace

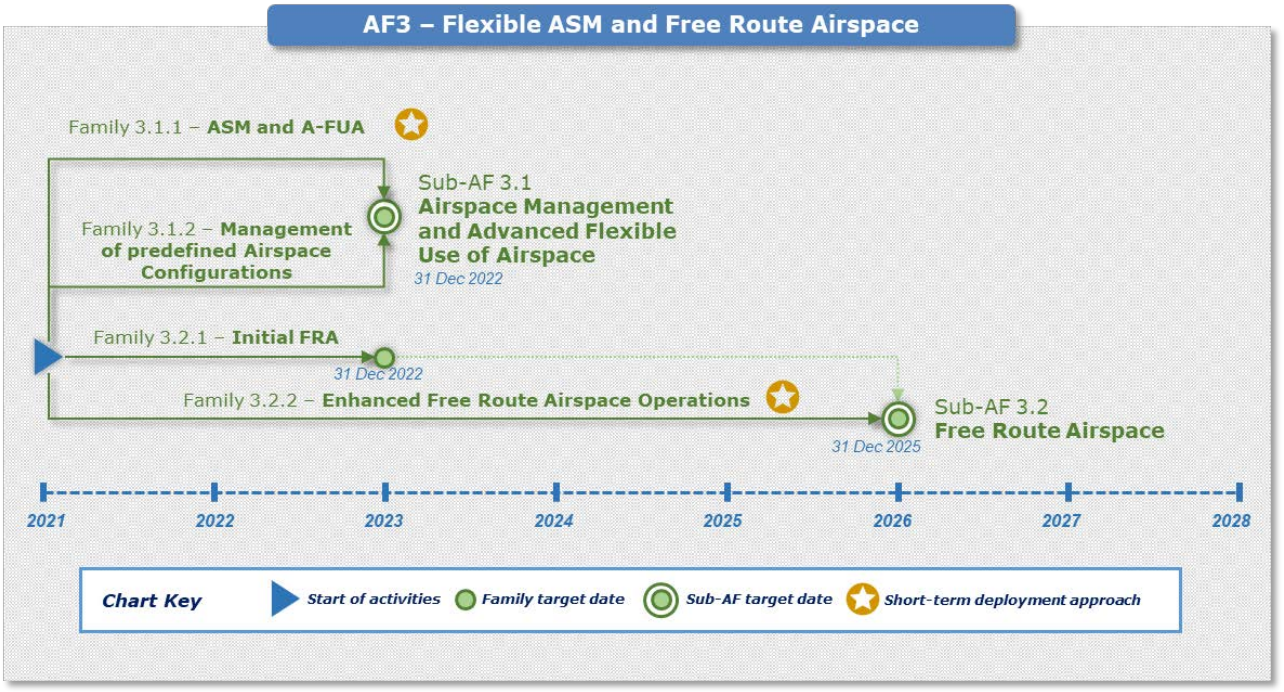


Figure 8 - AF3 Short Term Deployment Approach

Flexible airspace management and Initial FRA must be ready by January 1st, 2023, while the enhanced FRA operations, as described in Family 3.2.2, are targeted for January 1st, 2026.

Considering the time left to complete the implementation in the mandated geographical scope, the short-term deployment approach for AF3 should focus on Family 3.1.1 ASM and A-FUA, being an enabler of Family 3.1.2 (Management of Predefined Airspace Configurations), and Family 3.2.2 Enhanced Free Route Airspace Operations, as Family 3.2.1 (Initial Free Route Airspace) is progressing at fast pace: currently 21 out of 29 States have implemented it, with the notable addition of Germany and MUAC in 2020, two of the most complex and busy airspaces in the whole European network). The table below reflects the total expected savings of Family 3.1.1

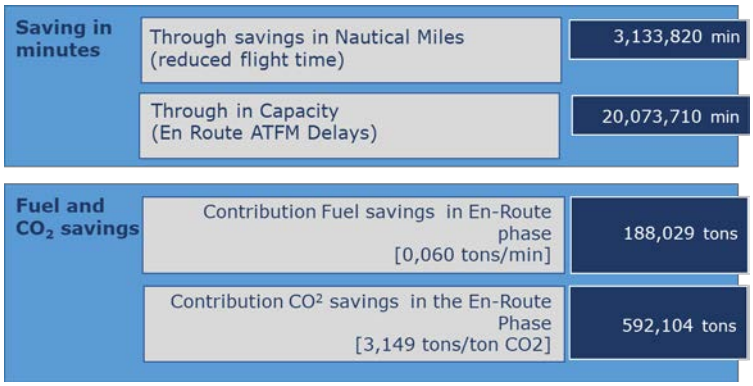


Figure 9 - Performance benefits for Family 3.1.1 full implementation

The table below reflects the total expected savings of Family 3.2.2, which are additional benefits to Family 3.2.1 (Initial FRA) (cumulated values until 2030)[3]

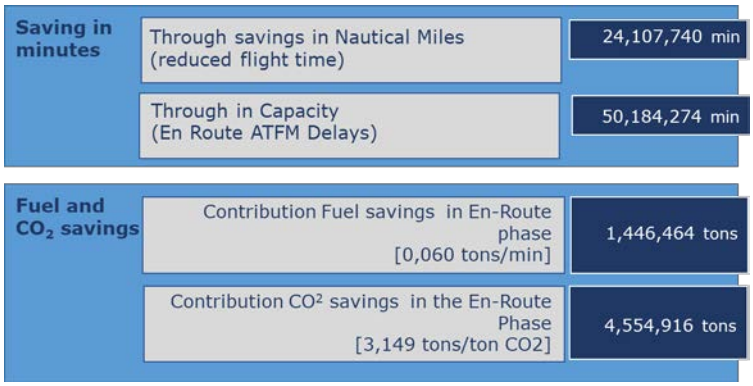


Figure 10 - Performance benefits for Family 3.2.2 full implementation

AF4 – Network Collaborative Management

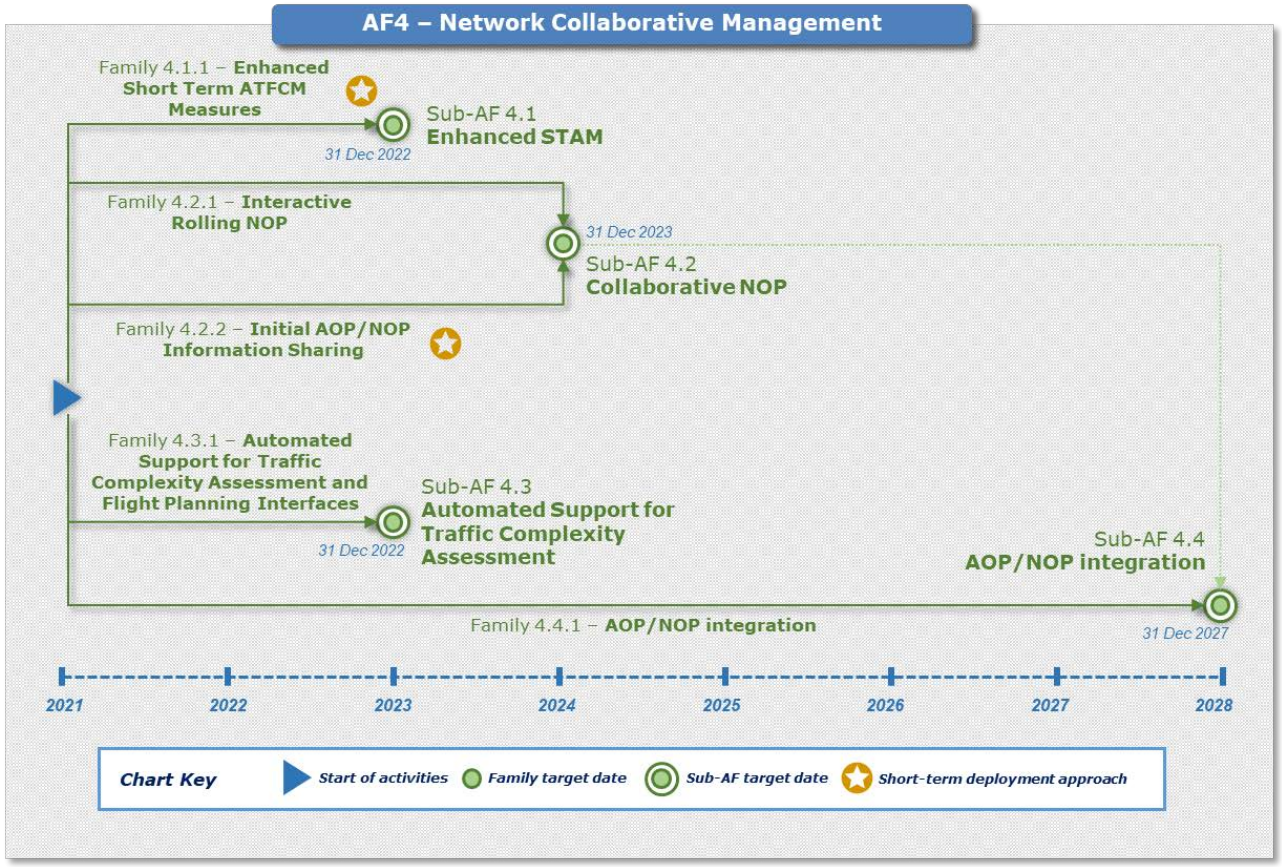


Figure 11 - AF4 Short Term Deployment Approach

The short-term deployment approach for AF 4 should focus on Family 4.1.1 Enhanced Short Term ATFCM Measures and Family 4.2.2 Initial AOP/NOP Information Sharing. Enhanced STAM is considered to be the cornerstone to ensure efficient working relationship between NM, FMP and airspace users. In terms of current status of implementation, the deployment of enhanced STAM is still at the planning / early deployment phase.

The Regulation states that enhanced STAM must be ready by December 31st, 2022. According to the estimated typical duration to implement the Family, in order to achieve the target date, the deployment

[3] Based on traffic forecast from Eurocontrol STATFOR - Scenario 2 (November 2020)

plans for enhanced STAM should have already started and be in progress. The integration of the airport is of utmost importance for the Network. For that reason, it is necessary to implement Family 4.2.2, even if several projects are already on going with the majority of airport.

The total expected savings of "En Route ATFM delays" are presenting the value of implementing Family 4.1.1 projects by showing the avoided delays (cumulated values until 2030)[4], which will occur if the technical part of SESAR related functionalities will not be implemented.

Figure 12 - Performance benefits for Family 4.1.1 full implementation

The total expected savings of "En Route ATFM delays" are presenting the value of implementing Family 4.2.2 projects by showing the avoided delays (cumulated values until 2030)[5], which will occur if the technical part of SESAR related functionalities will not be implemented.

Figure 13 - Performance benefits for Family 4.2.2 full implementation

[4] Based on traffic forecast from Eurocontrol STATFOR - Scenario 2 (November 2020)
[5] Based on traffic forecast from Eurocontrol STATFOR - Scenario 2 (November 2020)

AF5 – SWIM

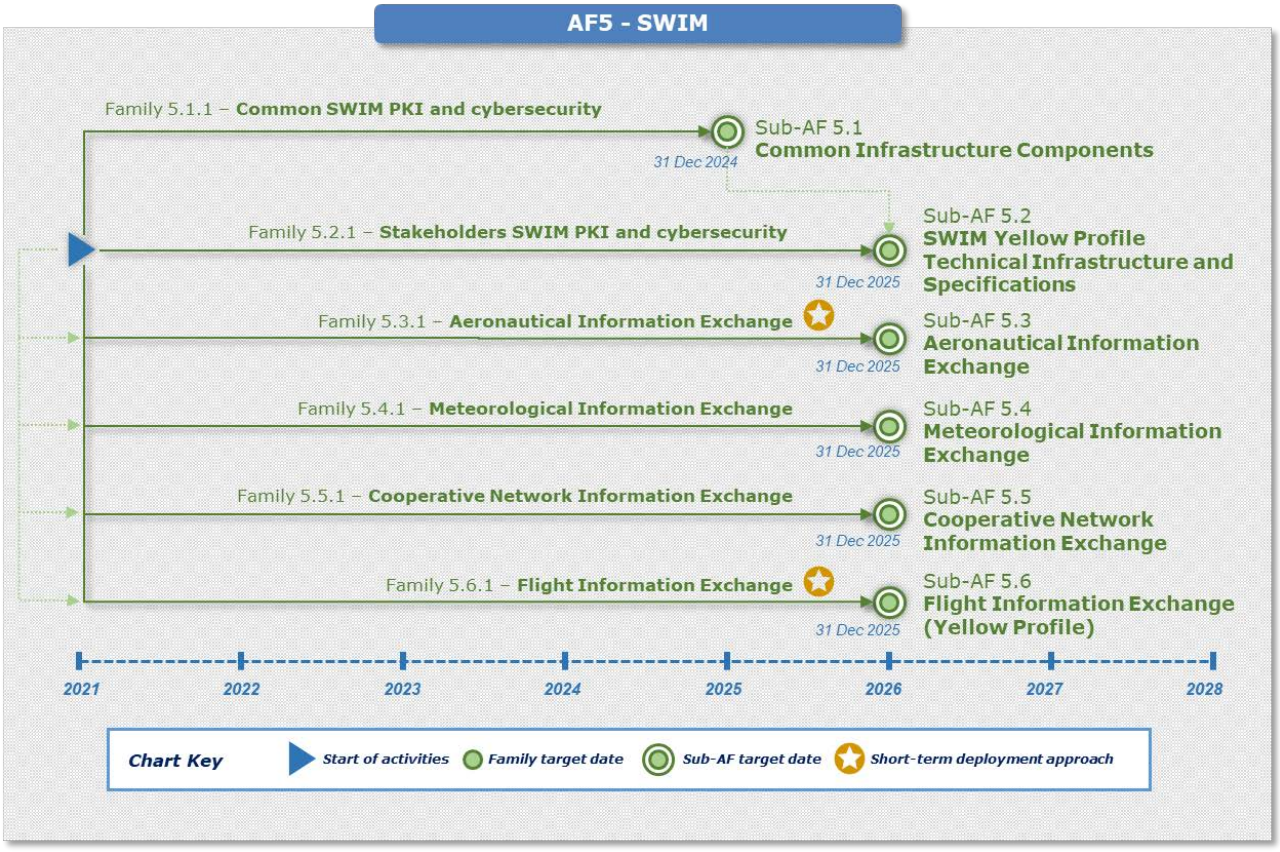


Figure 14 - AF5 Short Term Deployment Approach

SWIM is considered as being an enabler to all other AFs, which means that the sooner SWIM Services are implemented and available in the EU SWIM registry, the better it will be for the CP1 SWIM implementation. Despite the COVID-19, which main impact is the reduction of cash-flows and investments there is a need to identify priorities and short-term "*quick wins*" despite all AF5 Families are of high priority and can be run in parallel. As a prerequisite of the deployment approach, it is paramount that in the planning phase all roles and responsibilities (service provider/ service consumer) are defined for each implementing partner. It is recommended that the service provision implementation is completed at least one year prior to CP1 deadline, which gives to service consumers time to implement the required interface to effectively consume the service in operation.

The availability of SWIM services is paramount for successful CP1 SWIM deployment, thus it is key to focus on the families and services which have not been implemented at this point. Therefore a natural focus should be on Family 5.3.1 and Family 5.6.1 due to primarily four reasons.

1. There are quick wins to gain in both families as to services that are available already where an implementation of the consumption of the services is not costly and does not require much effort.
2. Aeronautical information management is part of Family 5.3.1 which is a key enabler for the overall digitalisation of ATM Globally
3. FF-ICE, which is a globally key concept and enabler for full Trajectory Based Operation which will bring benefit to the overall ATM chain. Its implementation is furthermore a cornerstone and baseline for fulfilment of many elements in the European Master Plan vision.
4. The progress of implementation needs to be accelerated in both families.

Family 5.3.1 Consist of two set of services

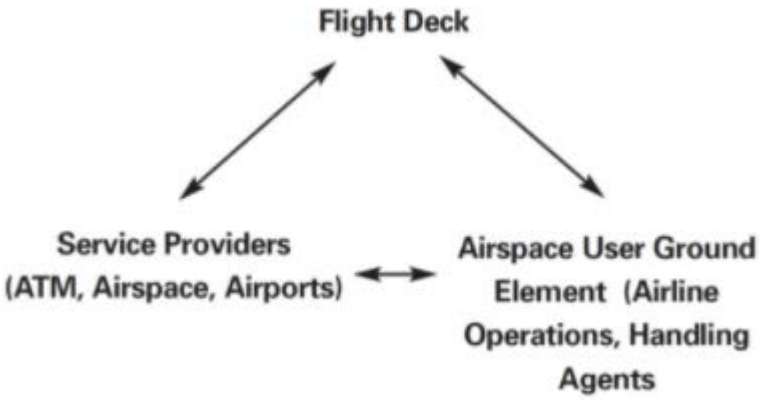
- Airspace management services
- Aeronautical Services

A harmonised implementation and management of Airspace management in EU is paramount and once CP1 requirements are implemented, EU will reach a big milestone to achieve a seamless handling of AIRSPACE throughout EU enabling an easier planning and flow of all traffic. Furthermore, it will be an important step towards automation within all impacted stakeholders. Today airspace management is managed in many different ways both including manual processes and automated processes, but this will be harmonised through the ASM services from CP1 detailed out in the SDP SWIM part. In support of Family 5.3.1 and the ASM services, the EUROCONTROL ASM tool (LARA) system is offering to users a relevant solution for Airspace Management (ASM) and A-FUA in Family 3.3.1 and 5.3.1. In example, LARA supports exchange of airspace status data at local and FAB level according to SWIM requirements and is fully compatible with latest NM B2B services. Nevertheless, it shall be noted that LARA need to be upgraded in order to be fully compliant with CP1 concerning the use of SWIM services to link ASM and ATC systems.

Family 5.6.1 Flight Information Exchange

This family consists primarily of FF-ICE which defines information requirements for flight planning, flow management and trajectory management and aims to be a cornerstone of the performance-based air navigation system. Very little progress has been achieved with regards to implementation of this family. FF-ICE will have global applicability and will support all members of the ATM community to achieve strategic, pre-tactical and tactical performance management. FF-ICE emphasises the need for information sharing to enable significant benefits. This family impacts and will benefit all stakeholders, reason why a harmonised approach to implement it is needed to globally ensure interoperability and avoid too long transition periods with continued operation of legacy systems and exchange mechanisms.

The future collaborative and dynamic flight information process will involve the full spectrum of the ATM Community members as envisaged in the ATM Global Operational Concept. The cornerstone of future air traffic management is the interaction between these various parties. FF-ICE will allow dynamic exchange of information.



The exchange of flight/flow information will assist the construction of the best possible integrated picture of the past, present and future ATM situation. This exchange of information enables improved decision making by the ATM actors involved in the entire duration of a flight, i.e. gate-to-gate, thus facilitating 4-D trajectory operations.

Family 5.6.1 is also the focus of the implementation of the Extended AMAN SWIM service where a harmonised approach is needed to ensure interoperability between all the stakeholders and it is one of the first visual benefits that SWIM provides - setting data free for the benefit of all stakeholder- even beyond ATM. Arrival sequence data with E -AMAN as a SWIM service will become available to new stakeholders at low cost enabling them to optimise their own processes creating benefits for the costumers.

Many stakeholders are already well advanced in their service implementations, but more should be done, as the completion of these services is of outmost importance. Furthermore, the registration of the services in the SWIM Registry should happen as soon as possible, after the SWIM compliance assessment, as these first services will be an inspiration for multiple service implementation EU wide and speed up the implementation on the SWIM service consumer side.

AF6 – Initial Trajectory Information Sharing

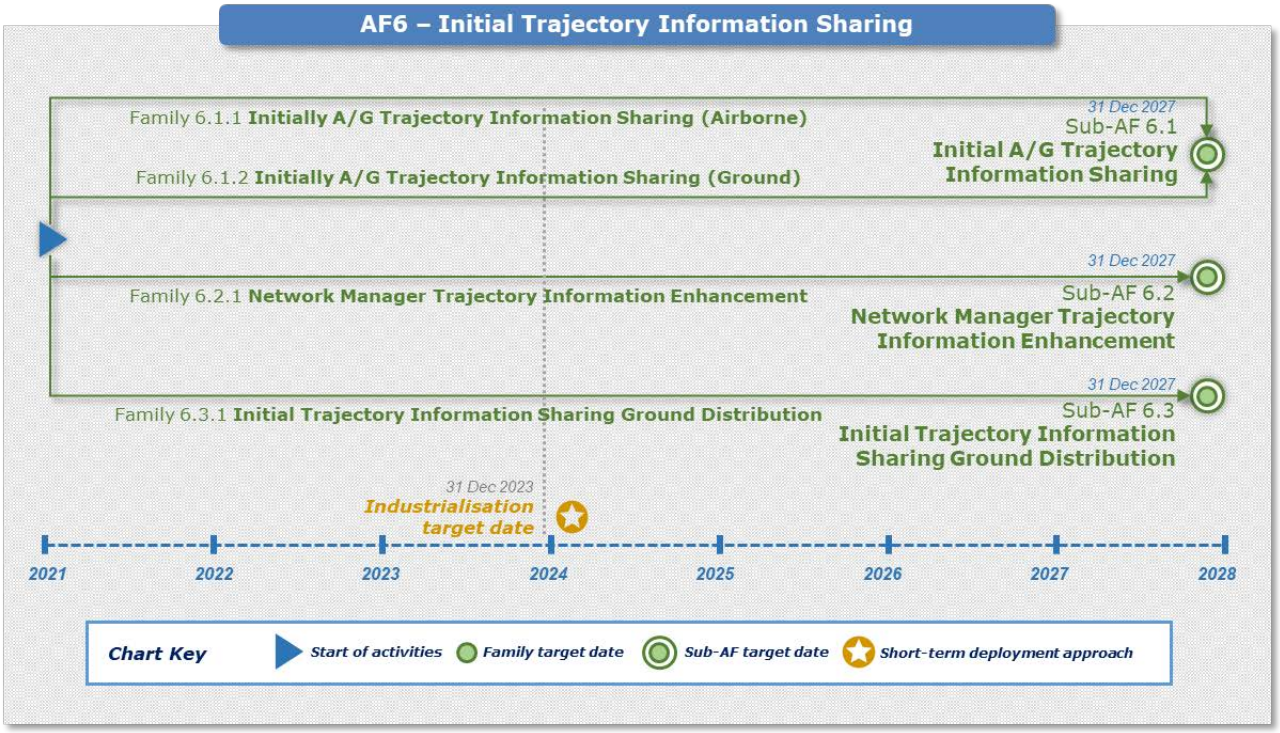


Figure 15 - AF6 Short Term Deployment Approach

All the Families in AF6 are subject to an industrialisation target date at the end of 2023. For this reason, none of them can be prioritised. However, it is of utmost importance to monitor the activities that will lead to the successful achievement of this intermediate check. If at this date AF6 Families are found not to be ready for implementation, they will be withdrawn from the common project regulation.

The main activity to be monitored for Family 6.1.1 is the equipage and related retrofit. Aircraft operators shall ensure the procurement of ADS-C/EPP functionalities and their compliance to ATS B2 services (for aircraft affected by the mandate). Therefore, the implementation process by aircraft operators regarding the changed aircraft configuration definition needs to start in a timely manner.

For Families 6.1.2 and 6.3.1 it is essential to assess the outcome of SESAR PJ38 (the successor of PJ31) that intends to demonstrate the feasibility and the operational advantages of the implementation of a European ADS-C/EPP Common Service. The successful validation of the ADS-C Common Service (PJ38) before end of 2023 and subsequent service specifications would contribute to the achievement of the industrialisation target date.

Finally, Family 6.2.1 requires further validation activities in SESAR 3. In particular, NM system shall be improved in order to be able to receive the EPP data and may use the elements of EPP data for updating and improving post-departure trajectories with more accurate predictions.

The Initial 4D Trajectory Management concept was developed as a key feature of “Trajectory-Based Operations” (TBO), which are at the core of the SESAR concept, enabling:

- Enhanced predictive capabilities and reactivity of the network with the objective of taking most strategic ATM actions;

- Information sharing and collaborative processes providing more flexibility for the airspace users when changes are required.

4D Trajectory Management is a key feature with improvements to both the aircraft avionics and the ATM automation systems, as well as procedures, human factors, standardisation and regulation. Initial Trajectory Sharing (AF6) operations are the first step of evolution from current systems towards the Trajectory Based Operations concept of operations and the overall benefits are expected to be substantial for all KPAs, they include:

- Improved predictability,
- ANS productivity gains (Cost Effectiveness),
- Capacity gains in both en-route and TMA airspace,
- Flight Efficiency improvements in Time & Fuel/CO_2.

Therefore, AF6 as an enabling technology is contributing to all KPAs: Capacity, Operational Efficiency, Environment and Cost Efficiency.

CP1: best practices and success stories

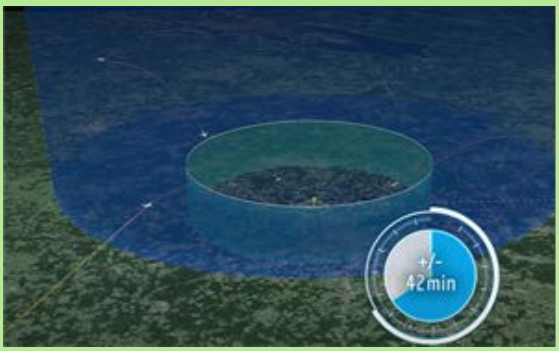
Article 11 of the recently amended Implementing Regulation (EU) n. 409/2013 requires the SESAR Deployment Programme and its supporting material to make reference to the "*best practices required to implement common projects*". The core document already indicates the suggested approach to implement and put into operational use each and every Family included in the SDP scope, thanks to thorough description of the activities to be performed and the definition of the so-called *deployment milestones* to be reached by all impacted stakeholders.

Complementing such view, the present supporting material provides some concrete examples of how CP1 deployment activities have been conducted up to now. Out of the 343 Implementation Projects currently coordinated by SDM, a restricted set of initiatives has been therefore selected to provide examples of how CP1 deployment could be synchronised amongst different stakeholders, often thanks to cooperation and joint efforts that go beyond National boundaries.

In particular, the following pages illustrate some of the most relevant success stories carried out in the last six years by European operational stakeholders, organised per ATM functionality. A specific focus has been devoted both on the relevance of such projects for the overall Network operations and on the operational performance improvements that these Implementation Projects will enable in the upcoming decade.

AF 1 – Extended Arrival Management and Integrated AMAN/DMAN in the High Density Terminal Manouvering Areas

XMAN – Cross-center Arrival Management



Whilst in the past aircraft were often forced into "holding" stacks around large airport due to congestion or to unavailability of runways, Extended AMAN allows Air Traffic Controllers to **sequence incoming flights way before the beginning of descent to the ground** and to inform pilots on how to adjust their aircraft speed accordingly.

The XMAN initiative has been deployed by major ANSPs to ensure **a coordinated implementation of Extended AMAN in the central part of Europe**, around some of the busiest European airports, such as: **Barcelona, Berlin, Dusseldorf, Frankfurt, London, Munich, Nice, Paris, Vienna and Zurich**. Together, these airports usually welcome **more than 500 million passengers** on an annual basis and correspond to the backbone of the European Air Traffic Management network.

Early use of aircraft speed control and adjustment for sequencing purposes enables the **reduction of fuel burn for arriving flights**, which translates into significant savings for Airspace Users and into the **decrease of carbon emissions** in the area surrounding the airport. Even considering the lower traffic due to Covid-19, the equivalent of the benefits delivered by the XMAN initiative is still estimated to enable **hundreds of thousands of tons of reduced CO_2 emissions**.

DFS Deutsche Flugsicherung · dgac DSNA · Luchtverkeersleiding Nederland Air Traffic Control the Netherlands · EUROCONTROL · Air Navigation Services of the Czech Republic · skyguide

AF 2 – Airport Integration and Throughput

Departure Management in Copenhagen

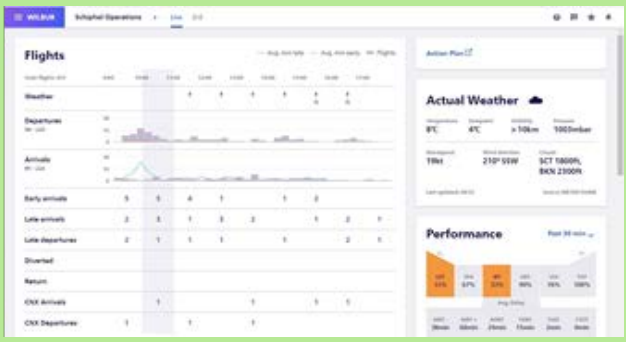
Improving the flow of departing aircraft is a critical tool to **reduce congestion within the largest and busiest airports**: temporary unavailability of runways, heavy traffic in peak season and unfavorable weather conditions shall always be carefully managed to **avoid the creation of potential bottlenecks** on the ground.

With the successful implementation of Departure Management improvements in 2018, operations in Copenhagen have gotten significantly smoother, allowing for the **most efficient use of the airport resources and infrastructure**: departing aircraft are guided from the airport gates to one of the three runways, and their departures are automatically sequenced taking into account any potential constraints (e.g. construction and maintenance works) but also Airspace Users' operational preferences.

Improving the Departure Management has made **operations in Copenhagen more predictable and punctual**, reducing waiting times for aircraft queuing before departure: with shorter waiting times and improved taxi times (around 105.000 minutes saved in the next 10 years only), **Airspace Users are also likely to lower their fuel consumption** and reduce emissions around the airport: the estimate is a carbon emissions reduction of more than 3.000 tons. At the same time, the improved Departure Management delivered **improvements in terms of safety and resilience**, due to the reduction of unexpected events.

Copenhagen Airports CPH NAVIAIR

Initial Airport Operations Plan at Amsterdam Schiphol



Daily operations at large European airports requires continuous coordination between all local stakeholders: not only the airport operators and the local ANSPs, but also several airlines, ground handlers, emergency services, MET providers, etc. The Airport Operations Plan is the **single common rolling plan to bring together and coordinate all local stakeholders** to improve airport processes and the overall passenger experience.

With **6 runways**, **223 aircraft stands**, up to **500.000 aircraft movements** and 70 million passengers per year, Amsterdam Schiphol is surely an airport where the coordinated management of all airport resources plays a vital role. With the joint establishment of the Airport Operations Center and the Airport Operations Plan, all local stakeholders will use the same platform to plan and monitor operations, to jointly take decisions and to **enhance the airport performance as a whole**.

The AOP implementation will make **operations at Schiphol more predictable and resilient** to disruptions: this will allow to maintain capacity even in unfavorable weather conditions, and to **reduce queuing and ground congestion in the airport**. More efficient operations mean **less delays**, **less fuel burnt** by aircraft and a **reduced environmental footprint for the airport**: it is estimated that a fully-functioning initial AOP in Schiphol will enable savings for **around 1.2 million of minutes saved for passengers** up to 2030.

Schiphol

Royal Netherlands Meteorological Institute
Ministry of Infrastructure and the Environment

Deploying Airport Safety Nets across the largest European airports

Regardless of the volumes of traffic to be handled, airports shall always maintain the **highest level of safety for airside operations**: large hubs operating multiple runways, especially those with a complex layout, need automation tools and safety systems to **detect potential conflicts, prevent hazards and accidents**.

To this end, 15 operational stakeholders have launched in 2016 a joint initiative to deploy and harmonize their ATM systems to **enhance the safety of European passengers across 13 European airports**: by implementing and upgrading their airport surface movement systems, stakeholders are ensuring **a safer trip to up to 520 mln passenger per year** under normal conditions.

As part of the initiative, airports are synchronising the implementation of new ground systems and functionalities to detect and prevent deviations from normal operations, reduce runway incursions and increase the safety and efficiency of aircraft movements across the aerodrome. **Safer operations also bring benefits from an environmental perspective**: when aircraft are moving efficiently through shorter taxi times on the ground, they consume less fuel, thus **reducing CO_2 and noise emissions**.

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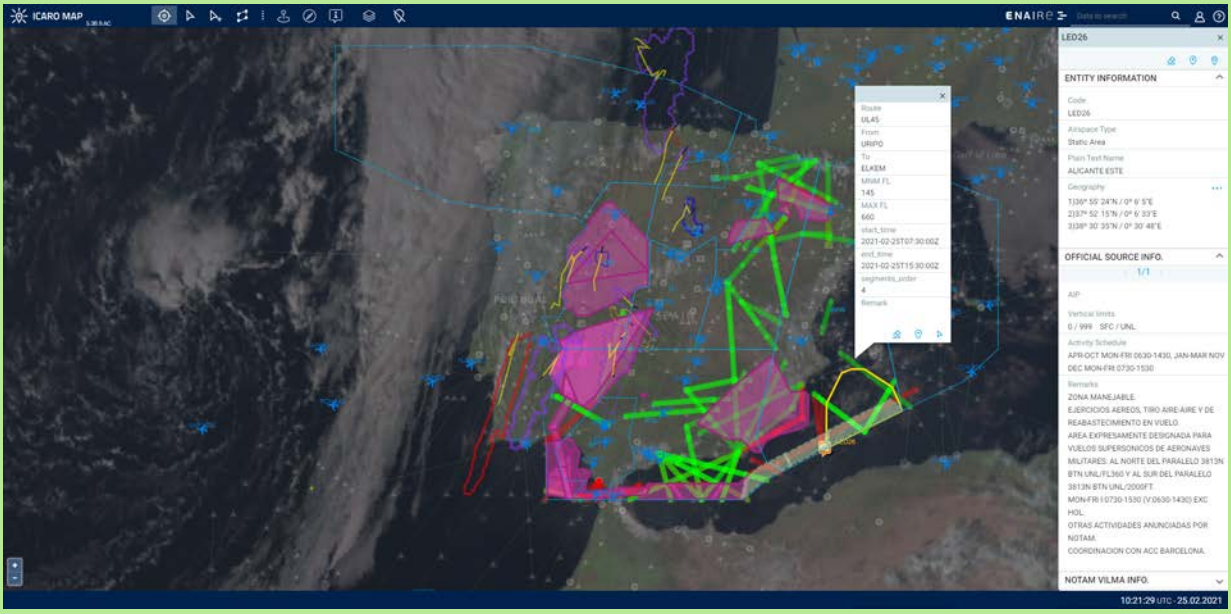
AF 3 – Flexible ASM and Free Route Airspace

Deployment of LARA System in Spain



Overcoming the traditional segregation between "civil" and "military" airspace areas, the Advanced Flexible Use of Airspace (A-FUA) concept transforms **airspace into an asset to be used flexibly on the basis of the needs of different Airspace Users**. A-FUA improves the efficiency of airspace utilization ensuring its optimal organization and **easing potential existing bottlenecks**.

The successful deployment of **LARA (Local And sub-Regional ASM support system)**, a common civil-military Airspace management coordination system **deployed by ENAIRE and the Spanish Air Force**, was designed to pursue this objective: the LARA system enables collaborative decision-making between civil and military partners (also beyond Spanish national borders) and simplify online airspace reservations.

The implementation is part of a group of interrelated initiatives led by ENAIRE to **upgrade and digitalize all its ATM systems**: the projects are set to improve predictability, flexibility and flight efficiency of en-route operations, also increasing the overall capacity of the Spanish airspace. When in full operations, this group of projects will **save around 130 Million Euros until 2030**.

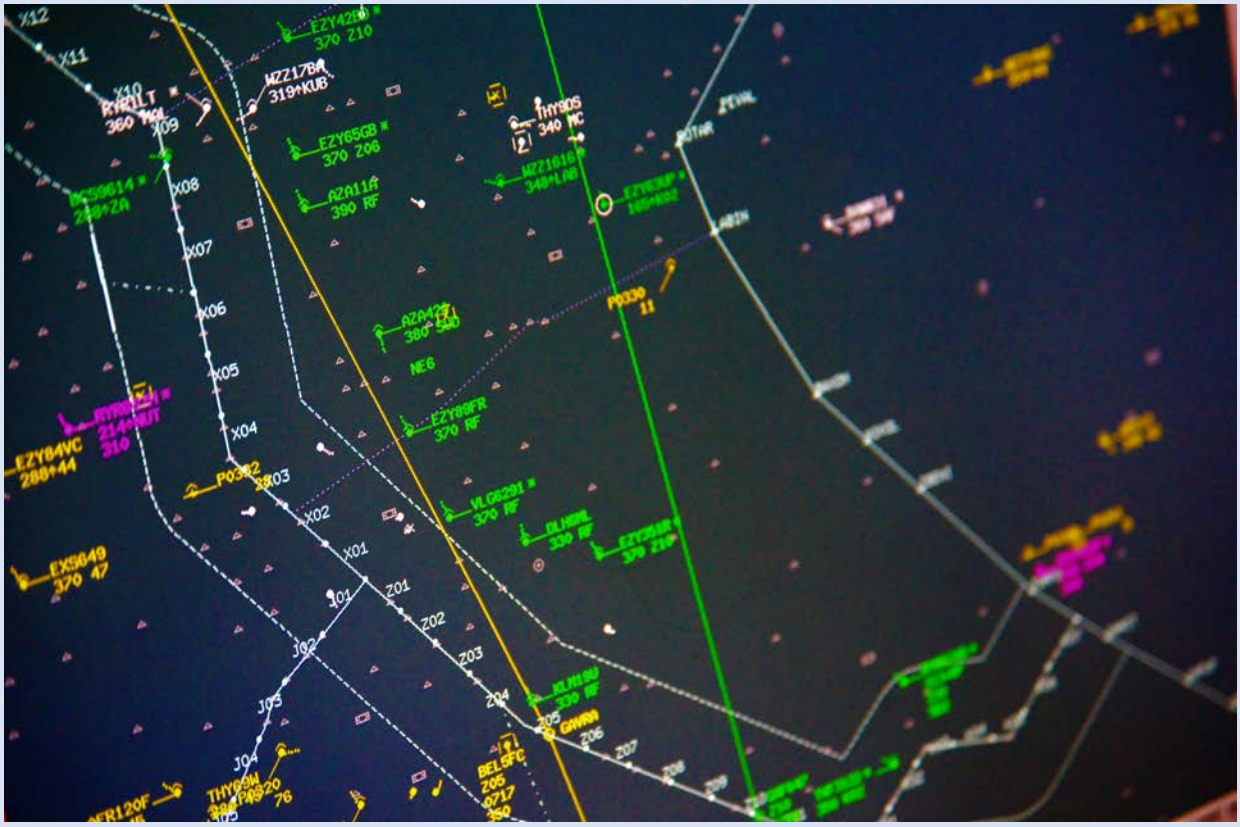
Upgrading NM systems for pre-defined airspace configurations

The activation and management of pre-defined airspace configurations is **one of the most advanced solutions to allow flexibility to meet civil and military airspace users' demands**. Military and civil air navigation service providers, the Network Manager and airspace users collaboratively define specific configurations (in terms of **airspace structure, ATC sectorization and airspace reservations**) to be applied within a dedicated geographic area and/or time period to satisfy civil and military requirements.

To support and assist this solution, the **Network Manager is upgrading its systems and modify the operational procedures** to allow timely and automatic exchange of information related to the pre-defined airspace configurations to all relevant stakeholders.

Thanks to an increased awareness of all stakeholders and the capability to better adapt to all users' needs, NM system upgrades will enable: **better adaptation of available capacity to traffic variations** and to military reserved airspace; an **increase in ATCO productivity**; **reduced routing for civil and military traffic** across the European Network, ultimately **saving time for all passengers** and facilitating **more efficient flight routes**: inter-alia the project is expected to allow savings for **around 40.000 tons of carbon emissions** until 2030.

Free Route Airspace in Italy



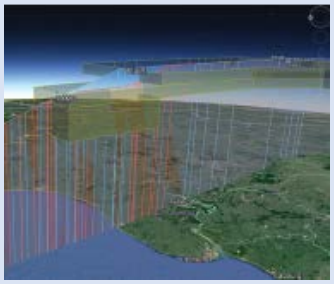
Allowing Airspace Users to close as far as possible to their preferred route – without constraints due to the operational characteristics of traditional route network or any route availability restrictions – enables a significant **reduction of the environmental footprint**, as airlines will fly **shorter flight trajectories** and massively **reduce jet fuel consumption and carbon emissions**.

The implementation of Free Route Airspace within all 730.000 square kilometers of airspace by ENAV is a game changer for the **environmental sustainability of ATM operations in Italy**. Completed in 2018, and supported by ATM system upgrades still undergoing, the deployment initiative enables airspace users to fly their own preferred trajectory from Flight Level 305 in the Italian Airspace, thanks also to the **seamless integration of the four Area Control Centres** (Rome, Milan, Padua and Brindisi). Vertical connectivity to ease the flight planning on the transition into Free Route Airspace extends from Flight Level 165: **flight times are now shorter**, and fuel consumption as well carbon emissions per flight have been reduced.

Since its entering into operations and up to the next decade, Free Route in Italy and the related systems upgrade estimate that they can allow quantified **savings for almost 19 mln minutes of flight**, as well as 1,15 mln tons of jet fuel: in total, this translates into a reduction **more than 3,59 mln tons of CO_2 emissions**. These elements equate to more than **1.6 billion euros of monetised benefits** for European passengers.

Increasing airspace capacity in the European Core Area





One of the key objectives of the Common Project 1 is to safely accommodate air traffic demand across Europe under all circumstances: European Air Navigation Service Providers are upgrading and enhancing their ATM systems to allow airlines to **offer passengers destinations, schedules and routes they want**, without any safety hazard.

With this specific goal, **DSNA, DFS and LVNL** have worked in the last six years to deploy and put into operations new tools and system upgrades in their Area Control Centers, enabling a **smoother and more fluid traffic control**. The result will be the capability for three fundamental ANSPs to manage air traffic more efficiently, and to absorb future increase in number of flights without increasing delays.

Despite the expected slow recovery of air traffic demand, the availability of top-notch ATM systems in central Europe, **one of the busiest airspaces worldwide**, will enable massive delays avoidance in the upcoming years. Together, the different projects are expected to deliver save **millions of minutes of passengers' time**: this – in turn – equates to benefits in the range of **billions of euros** for the European aviation.

Borealis Free Route Airspace

The Borealis Free Route Airspace is a wide-range modernisation programme aimed at **deploying cross-border Free Route operations within the whole Northern European airspace**, thanks to the adoption of new technologies and an increased collaboration between several ANSPs.

Thanks to this programme, airspace users will be allowed to **freely plan and choose their preferred routes when flying across the skies of Denmark, Estonia, Finland, Iceland, Ireland Latvia, Norway, Sweden and the United Kingdom** (almost 12.5 million square kilometers). Already today, airlines entering the European airspace from the Russian border are now allowed to fly all above Scandinavia **as if in one single airspace**.

It is anticipated that the initiative will enable massive **savings of fuel burnt** by Airspace Users per year, thanks to more direct and shorter flight paths across the Northern European Sky. This in turn will translate into significant reductions of **CO_2 emissions**, helping to moderate the environmental footprint of operations.

South-East Europe Free Route Airspace (SEE FRA)

The 24/7 South-East Europe Free Route Airspace (SEE FRA) concept builds on the night FRA implementation in the **airspaces of Budapest, București and Sofia CTAs (SEEN FRA) and it was fully implemented in 2019.** Starting **from January 2021, the aircraft operators are able to plan their flights freely across the airspace of Bulgaria, Hungary, Romania and Slovakia 24/7 without the limitations of the geographical boundaries.** This represents a first expansion of the SEE FRA project, thus making possible cross border free route operations across the airspace of the four States, being one of the largest free route airspace blocks in Europe. Moreover, it is **currently planned that Moldovan airspace will be added to 24H SEE FRA operations in February 2022**, the associated activities being planned for 2021/2022.

The new flight planning rules significantly **optimize the flight trajectories by not only using the shortest connections but also allowing the use of the most effective routings** when the impacts on the flights are inevitable e.g adverse weather avoidance.

According to the simulations, SEE FRA contributes to a significant **reduction of emissions and of millions of miles (NM) daily**, from the total mileage.

BULATSA
BULGARIAN AIR TRAFFIC SERVICES AUTHORITY

HungaroControl
Hungarian Air Navigation Services

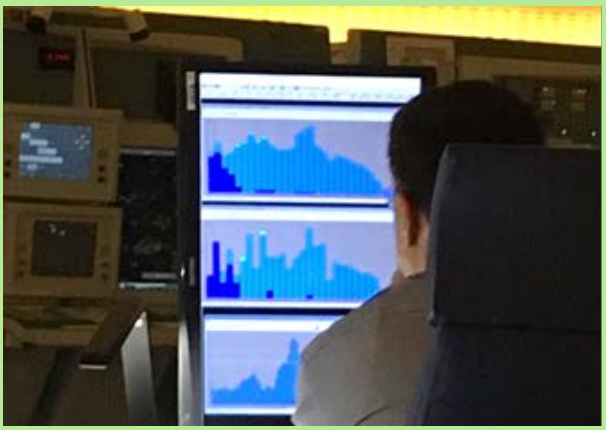
LPS SR

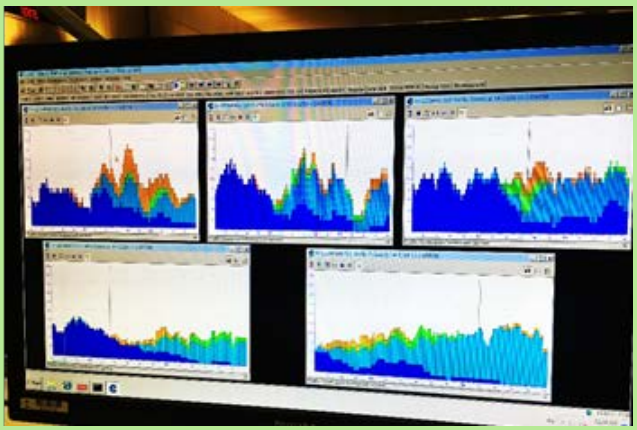
MOLDATSA

romatsa
romanian air traffic services administration

AF 4 – Network Collaborative Management

Short Term Air Traffic Flow and Capacity Management in Spain





Managing traffic flows to **avoid bottlenecks and network congestion** is a key objective for all air navigation service providers in Europe. Applying short-term flight level caps, rerouting or even ground delays to a limited number of flights could **reduce traffic peaks and ensure smoother operations** for the overall network.

Since 2019, ENAIRE is able to swiftly apply such Short Term ATFCM measures across all its Area Control Centers, managing more than **2.2 mln square kilometers airspace**. This goes to the benefit of up to 2 million flights per year, translating into less delays and **shorter flight paths for almost 250 million passengers on a yearly basis**.

Through a CEF-funded implementation initiative, launched in February 2017 and successfully closed in January 2019, ENAIRE developed the necessary concept of operations, operational procedures and guidance material to make sure that the optimised management of traffic demand and capacity reduces traffic congestion **not only within Spanish airspace, but also in the adjacent countries**.

ENAIRE

Integrating even further the Airports in the Network

Both European airports and the European ATM Network as a whole operate according to their own pre-defined operations plans: the **Airport Operations Plan (AOP)** and the **Network Operations Plan (NOP)**. To further optimize operations at ground or en-route level and avoid any bottleneck, the AOP and the NOP shall be fully integrated, therefore allowing **seamless data and information exchanges amongst all relevant stakeholders**.

The Network Manager and several airport operators have already started a joint initiative to **allow interfaces between the NOP and at least 17 AOPs from the largest European hubs**. Thanks to these interfaces, **predictability of traffic** will significantly increase and have a positive impact on the **reduction of ATFM and reactionary delays**. These benefits will add to the ones delivered by the implementation of the Airport Operations Plans (like the reduction of taxi-out waiting times, the increased resilience to unfavorable weather conditions or unexpected events).

Once fully in operation, the project is expected to save **almost 3,8 million minutes of flight** to European passenger in the next decade, which corresponds to around **143 million euros of monetised benefits**.

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SESAR DEPLOYMENT MANAGER

Managing Traffic Complexity over the Czech Republic

High volumes of traffic, unexpected delays or weather disruption can increase the complexity and en-route congestion over certain regions, especially during peak hours or in the summer period. To enable controllers to carefully manage en-route operations and **avoid bottlenecks to the Network**, ANSPs have introduced automated tools to measure and **monitor complexity levels and to resolve potential conflicts**.

Air Navigation Services of the Czech Republic, thanks to an implementation initiative successfully closed in November 2018, established and put into operational use a tool to calculate traffic load figures and indicate any potential deviation from defined thresholds. The new tool assists the Flow Manager Position (FMP) in the Prague ACC also to model and resolve potential complexity overloads and to maintain the **optimal use of the airspace capacity even in the busiest season**.

Given the **geographical location of Czech Republic** and its proximity to large hubs, the availability of such automated tools is an asset for the whole European network when facing capacity constraints: it is estimated to have **saved around 160.000 minutes of passengers' time in 2019 only**, and it will enable similar benefits once the traffic recovers to pre-pandemic volumes.

Air Navigation Services of the Czech Republic

AF5 – SWIM

Making the ATM infrastructure more secure via stakeholders' cooperation

Building a **secure information exchange infrastructure** is a must for the European ATM industry: a key step in such direction is the establishment of **a common cybersecurity trust framework** as well as its associated policies and requirements. Starting in 2018, EUROCONTROL has been leading and coordinating **29 stakeholders** in the definition and establishment of a European Aviation Common Public Key Infrastructure (EACP) to which individual stakeholders will be able to connect and receive digital certificates to enable secure SWIM communications across Europe.

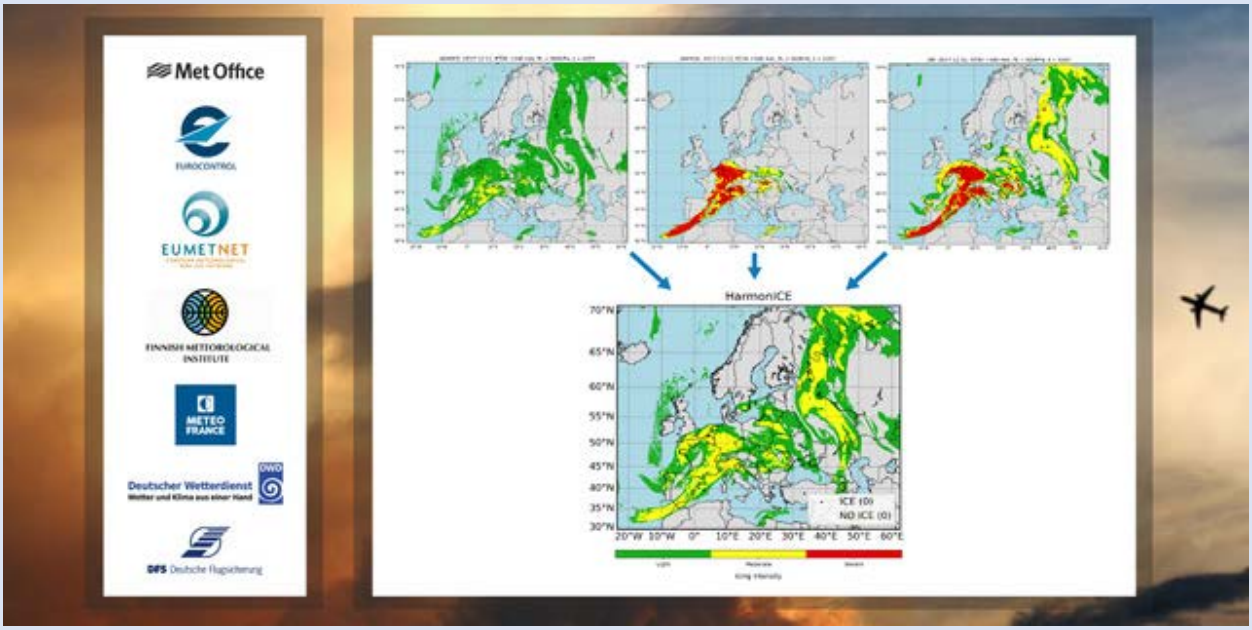
The project will improve the **security of the exchange of information between stakeholders**, thanks to **user identification & authentication and encryption/decryption** where needed: this will **reduce the likelihood to get disruptions of services** due to corruption of information, unauthorised accesses or even **potential cyberthreats**. The engagement of the pioneer project contributors will **benefit the whole ATM community.**

More efficient Flight Planning across Sweden

By the end 2019, LFV has developed and implemented an **Integration Platform to serve all civil and military stakeholders operating within the Swedish Airspace**. The availability of all necessary network information and data in a SWIM-compliant format over the Integration Platform enables the first base for a more efficient flight planning for airlines, military, drones and any other airspace user. This information will be used to deliver a **more efficient use of fuel and reduced flight times** as well as other benefits. The Integration Platform also improves coordination between LFV and other stakeholders including those from neighboring countries, collaboration within COOPANS, and the Network Manager.

Whilst implementing the Platform, LFV also progressed in its **transition towards the Aeronautical Information Management**, which would allow the provision and exchange of quality-assured digital aeronautical data with all parties. Increasing the **awareness of all stakeholders**, this initiative lays the foundation for **increasing the predictability of air traffic**, enabling a better usage of airspace and **avoiding unnecessary fuel burn and emissions**.

Sharing weather information to all European stakeholders



The timely availability of meteorological information to all relevant stakeholders is the primary solution to **mitigate the impact of bad weather on aviation operations**, both in the air and on the ground. Airlines, airports and air navigation service providers can **improve their planning** to avoid unfavorable conditions, but they need **immediate access to actual observations and forecast weather data**.

To this purpose, European MET service providers are finalising the setup of their **new SWIM service access points**, where all ATM stakeholders can retrieve relevant MET information for their operations. This includes **high-quality and real-time 3D weather radar data**, probability forecasts for winter weather conditions and forecasts of weather hazards (including **icing, turbulence and convection,** etc.) offering **a single, harmonised, pan-European view of these weather phenomena** to help enhance situational awareness.

The availability of all this information will not only enable an improved planning of operations and **reduce unexpected delays**, but it will also support **optimised flight paths for Airspace Users**, with positive effects on the environment due to **less consumption of fossil fuels**.

EUMETNET · METEO FRANCE · Met Office · Deutscher Wetterdienst Wetter und Klima aus einer Hand · DWD

DFS Deutsche Flugsicherung · EUROCONTROL · FINNISH METEOROLOGICAL INSTITUTE

AF6 – Initial Trajectory Information Sharing

The groundwork for TBO in Europe: Data-Link large scale adoption

In October 2016, the European Commission **mandated the SESAR Deployment Manager to coordinate and manage the implementation of Datalink in Europe**, a key enabler for the implementation of the Initial Trajectory Information Sharing as defined by CP1 Regulation.

After defining a realistic roadmap for all initiatives to be performed both on ground and airborne side, more than **25 organisations** (ANSPs, Airlines, communication service providers, industry partners, etc.) have worked together on a two-fold path: on one side, to **implement a sound solution to ensure DLS operations** in the short-to-medium term, whilst on the other defining the future system architecture and governance that will **cope with the needs of the whole aeronautical community** in the longer-run.

As a result, despite some remaining operational issues in the process of being solved, **Datalink is more used than ever in Europe**, and stakeholders can focus their efforts to **deploy a target solution which will finally be fully harmonised in Europe and support trajectory-based operations in the future**.

ENAIRE · enav · DFS Deutsche Flugsicherung · NATS · dgac DSNA · Lufthansa · HungaroControl Hungarian Air Navigation Services · NAV PORTUGAL · EUROCONTROL · HELLENIC CIVIL AVIATION AUTHORITY · austro CONTROL · ARINC · SITA · POLSKA AGENCJA ŻEGLUGI POWIETRZNEJ POLISH AIR NAVIGATION SERVICES AGENCY www.pansa.pl · Fintraffic · LGS Latvijas Gaisa Satiksme · BULATSA · SLOVENIA CONTROL · inmarsat · MATS · EANS · RYANAIR · LPS SR · LFV AIR NAVIGATION SERVICES OF SWEDEN · CROATIA CONTROL · ALTYS TECHNOLOGIES · THALES · ON ORO NAVIGACIJA

Upgrading Ryanair fleet to enable Trajectory Information Sharing

Synchronising investments between airborne and ground stakeholders is mandatory to ensure that performance improvements are immediately available for European passengers. In particular, upgrading or installing **new-generation avionics on aircraft** is a key step to enable the **introduction of initial trajectory-based operations** and to facilitate communications and exchange of operational data.

As part of a wide-range set of investments from major European Airspace users, **Ryanair** successfully completed in early 2020 the **equipping and upgrading of its Boeing 737-800 fleet** with "best-in-class" avionics to facilitate data transmissions between the air and the ground. Thanks to this initiative, the full Ryanair fleet is now capable of **transmitting and receiving data at a higher speed, minimising the message latency**. Improved performance from Europe's largest airline is a **massive step forward** to support the **future large-scale adoption of AF6** in Europe.

CP1 Risk Management Plan

Among the duties of the SESAR Deployment Manager, Article 9 of Regulation (EU) n. 409/2013 lists the "*effective management of risks*" linked to its scope and remit of activities. An adequate level of coordination and synchronisation amongst the relevant stakeholders shall indeed be established not only with regard to the definition of a common roadmap for deployment and its implementation, but also to the identification and management of potential risks.

The SESAR Deployment Programme therefore serves as the frame for identifying, listing and assessing the most relevant risks that might hinder or jeopardise the objectives of the SESAR deployment activities: the definition of a potential risk and the identification of the potential effects that it might bring also require the definition of actions and interventions that might reduce the likelihood of the risk itself, or at least mitigate its effects.

It is worth mentioning that risk management activities are by definition a continuous process, foreseeing constant monitoring of the implementation work to ascertain the status of different risks, as well as the appropriateness of the mitigation actions undertaken as a response. Therefore, the SESAR Deployment Manager – in cooperation with the European Commission, the relevant organisations and SES bodies and all involved stakeholders – is committed to regularly review the proposed list of risks and their status to ensure that ATM modernisation continues on a smooth and stable path.

The content of this Risk Management Plan can be briefly summarised as of below:

- the overall approach and methodology adopted by the SESAR Deployment Manager with regard to risk management activities;
- the most relevant risks that could impact the timely execution of the SESAR Deployment Programme and the achievement of its objectives. The section also indicates the most relevant mitigation actions already established or to be undertaken to reduce the likelihood or the impact of all identified risks.

Approach to SESAR Deployment Risk Management

The SDM Risk Management Approach is built on an iterative approach: the objective is to timely detect and identify events that might put at risk the execution of the SESAR Deployment Programme, and to undertake actions to mitigate such risks.

Identifying adverse events and conditions that might hinder ATM modernisation

Risks at Programme level can be 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, to be performed by the SDM throughout the Programme's entire lifespan, either in its development / update or in its execution. Whenever a potential risk is identified, the SESAR Deployment Manager, in cooperation with all stakeholders and organisations involved in the SDP, carefully assess it on the basis of several drivers:

- costs, i.e. risk of significant increase in implementation costs vis-à-vis the expected baseline;
- time, i.e. risk of potential delays in the required ATM modernisation, in particular when such delays will endanger the compliance with the regulatory deployment target dates;
- performance, i.e. risk that might jeopardise the full or timely realisation of the performance improvements linked to the modernisation activities included in the SDP scope;
- interdependencies, i.e. risks of incurring into "domino effects", due to interdependencies and links between the implementation of different elements included in the Programme;
- quality, i.e. risks that could represent an obstacle to the achievement of the expected quality levels in the delivery.

As a result of such analysis, risks are then evaluated and clustered on the basis of their:

- **Probability**: the likelihood that a given adverse event can have a negative impact on the coordinated, successful, timely and synchronised implementation of the SESAR Deployment Programme;
- **Impact:** the level of severity through which the potential adverse events would have an impact on the successful implementation of the SESAR Deployment Programme. Combining the probability and

impact of each risk, SDM aggregates the result in order to define the risk level within the following scale: a) High Risk, b) Medium Risk, c) Low Risk.

Setting forth mitigation and recovery actions and monitor their implementation

Once risks are identified, the key objective of the SESAR Deployment Manager is to ensure the prompt identification and implementation of actions and initiatives that might reduce the probability of a defined unfavourable event to occur, or that might mitigate the outcomes of such adverse occurrence.

As part of this activity, the SDM cooperates with the relevant organisations and stakeholders to identify the most suitable initiatives that can lead to the resolution, mitigation or closure of the risk: all mitigation or recovery actions are typically defined in terms of owner(s), activities to be put in place, and timing for their execution. SDM also monitor on a continuous basis that these initiatives are activated, carried out and implemented, verifying its evolution and their fitness for purpose in time

CP1 Risks and Mitigation Actions: full set

In accordance with its responsibility of "*ensuring effective management of risks*", 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 Project On.

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.

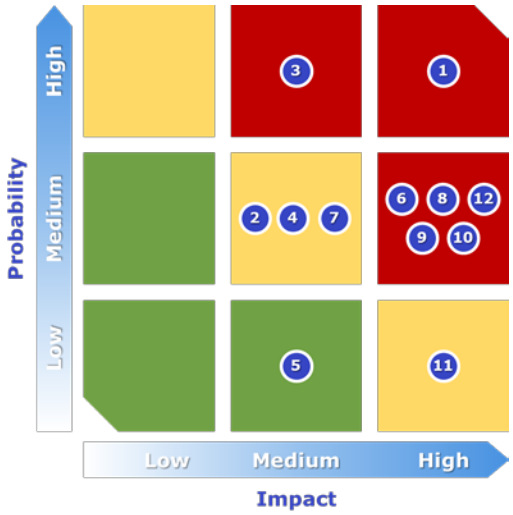
In parallel, the SESAR Deployment Manager is working closely with the SESAR Joint Undertaking in order to ensure that the risks listed in the Deployment Programme are well-connected and linked with the risks listed in the ATM Master Plan, especially with regard to implementation-related issues.

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

1. COVID-19 crisis impact in the stakeholders' investment plans;
2. Misalignment between SDP and operational stakeholders' investment plans;
3. CP1 Implementation outside the framework of SESAR Deployment FPA;
4. Failure to adequately achieve full military involvement;
5. Failure to engage properly all the new stakeholders impacted by CP1 in comparison to PCP (namely Airport Operators);
6. Failure to achieve the Industrialisation Target Date set for AF6;
7. Failure to ensure global interoperability;
8. Misalignment between EU co-funding profile and readiness for implementation;
9. Uncoordinated deployment of SWIM;
10. Unaddressed cyber-security vulnerabilities;
11. Lack of adherence to SESAR Deployment Programme;
12. Availability of COM complementary technologies supporting AF6.

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 dedicated figure.

High risks are highlighted are positioned in red areas, medium-level risks in the yellow ones, whilst low-level are located risks on green areas.



SDP 2021: Risk Matrix

The tables included in the following pages 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 CP1 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.

1	Covid-19 crisis impact in the stakeholders' investment plans	High Level Risk
Objectives	Monitor the impact of the Covid-19 in the stakeholders' investment plans to undertake the necessary supporting and mitigation actions	
Risk description	Since March 2020, the Covid-19 has massively negatively hit the air traffic, dropping immensely the traffic levels, which has drastically cut the stakeholders incomes and hence jeopardised their investment plans. This affects both civil and military stakeholders.	
Mitigation Actions	**By SESAR Deployment Manager** ▪ Strong monitoring of the ongoing implementation projects and plans reported by the stakeholders through the Monitoring View ▪ Coordinate with the stakeholders affected by the Covid-19 crisis potential mitigation actions, such as submitting projects to be funded through INEA CEF Calls. **By other Stakeholders / Authorities** ▪ EC to ensure enough resources to support implementation projects crucial to achieve the CP1 requirements	

2	Misalignment between SDP and operational stakeholders' investment plans	Medium Level Risk
Objectives	Timely CP1 implementation and release of associated benefits	
Risk description	The gap analysis showed that there are Families that are not implemented yet or only partially implemented in the CP1 geographical scope. The impact of the late implementation of the Families identified as high relevance could lead to a potential delay to overall CP1 implementation. When this situation occurs, the delivery of performance benefits would be delayed accordingly. Additionally, late or missed investments could also have a negative impact on other stakeholder categories, jeopardising the achievement of full CP1 objectives.	
Mitigation Actions	**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 Short-Term Deployment Approach Families; ▪ Enhancement of the transversal approach and buy-in for a synchronised approach in deploying CP1, 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; ▪ 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. ▪ For funded Projects: o request demonstration of local coordination with other relevant stakeholders by projects leaders prior to projects submission to CEF calls; o Synchronisation / coordination activity on identified projects by the SDM, through all phases, from their preparation towards the submission to INEA until the project execution; o Close correlation between requests for payment by the Implementation Projects to the SDM and their effective transmission to INEA by the SDM. **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.	

3	CP1 Implementation outside the framework of SESAR Deployment FPA	High Level Risk
Objectives	CP1 Benefits	
Risk description	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 at least twice per year. Should a significant part of CP1 be implemented outside the SESAR deployment FPA and not properly monitored by the SDM, this could lead to an incomplete picture of the CP1'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. Organise dedicated meetings and/or communication flows.	

4	Failure to adequately achieve full military involvement	Medium Level Risk
Objectives	Full and timely CP1 implementation, associated benefits	
Risk description	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 CP1 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 mil. authorities; ▪ Continue to support EDA in the promotion of the CP1 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 CP1 amongst military authorities. ▪ Military authorities to submit Implementation Projects to CEF Transport Calls, according to the SESAR Deployment Programme.	

5	Failure to engage properly all the new stakeholders impacted by CP1 in comparison to PCP (namely, Airport Operators)	Low Level Risk
Objectives	Engage new stakeholders in the deployment and monitoring of CP1 Functionalities	
Risk description	With the introduction of new Sub-Functionalities in comparison with the PCP, the CP1 is mandating new stakeholders to implement some of them. This is the case of Extended AOP, but also the case of SWIM where the geographical scope affects all EATMN. It could be that some stakeholders affected by the CP1 and who are not familiar with SESAR or with the previous PCP Regulation, have difficulties to understand the new requirements and the way they are described in the SDP. Maybe the overall SDM process to guide and monitor the ATM Functionalities implementation is something new for those stakeholders and they will need to be fully involved.	
Mitigation Actions	**By SESAR Deployment Manager** ▪ Ensure proper coordination with the new affected stakeholders by CP1, through the Stakeholders Consultation Platform and through the SDM liaison officers. ▪ Explain thoroughly the SDM process to guide and monitor the implementation of the ATM Functionalities to the new stakeholders ▪ Organise dedicated workshops for those ATM Functionalities that are affecting new stakeholders compared to the PCP **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, including projects from the new stakeholders.	

6	Failure to achieve the Industrialisation Target Date set for AF6	High Level Risk
Objectives	AF6 and Trajectory-Based Operations implementation, associated benefits	
Risk description	ATM Functionality 6 is not yet ready for deployment as indicated by the Industrialisation Target Date (Dec 2023). Standards and ground architecture definition are still missing and some work on R&D still needed. If all the required material is not ready by December 2023, this could lead to the removal of AF6 or some of the Sub-AFs which have not reached the required level of maturity from the CP1 Regulation. 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 would have a negative impact on the operational deployment and the delivery of the expected benefits related to Trajectory-Based Operations and the fulfilment of this EOC of the ATM Master Plan.	
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, EUROCONTROL, 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. o SDM to coordinate with FAA and manufacturing industry to assess interoperability impacts of EU deployment plans on global interoperability. ▪ Consider the readiness for deployment and specifically the availability of the appropriate standards as a prerequisite for the selection of CP1-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. ▪ Service providers, airspace users, manufacturing and institutional bodies to promote / provide resources to the working arrangements 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.	

7	Failure to ensure global interoperability	Medium Level Risk
Objectives	Harmonised CP1 implementation, associated benefits	
Risk description	The consequences of the lack of global interoperability are the potential misalignment for avionics and/or processes between Europe and all other 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** ▪ 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. ▪ SDM became formal member of EUROCAE in Q2 2019 with the aim of following the development of the relevant standards and also to contribute where needed. ▪ 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), AF6 (ADS-C/EPP) and Surveillance system implementation strategies.	

8	Misalignment between EU co-funding profile and readiness for implementation	High Level Risk
Objectives	Timely CP1 implementation, associated benefits	
Risk description	The outcome of the SESAR Deployment Programme gap analysis clearly states the need for additional Implementation Projects by operational stakeholders to achieve full CP1 deployment. Therefore, significant investments are still required. In particular, some key Families in the SESAR Deployment Programme related to AF6 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 AF6 implementation.	
Mitigation Actions	**By SESAR Deployment Manager** ▪ To continue the liaising with EC about the availability of grants to cover full CP1 requirements. ▪ To continue cooperating with SJU in order to emphasise the critical impact that the lack of maturity of some functionalities has on the overall implementation of the CP1. ▪ To carefully review the readiness of each Family in the periodic update of the supporting material for implementation associated with the SESAR Deployment Programme and cooperate under the coordination of the European Union Aviation Safety Agency to ensure that the industrialisation target date is met. **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 CP1 throughout the whole timeframe foreseen by the regulatory framework.	

9	Uncoordinated deployment of SWIM	High Level Risk
Objectives	Timely and harmonised CP1 implementation, associated benefits	
Risk description	In the absence of coordinated deployment, insufficient harmonization may create issues, especially when different stakeholders are providing the same service. Stakeholders need to agree on a common service definition or standard and on common procedures considering the operational needs. This would affect the other AFs with an earlier implementation target date having a dependency with SWIM services.	
Mitigation Actions	**By SESAR Deployment Manager** ▪ Continue to support the activities related to the coordination with all relevant stakeholders. ▪ The Implementing Project "Deploy SWIM Governance" coordinated by SDM was closed in 2020 and produced guidance material to support the coordination of SWIM deployment in EU. **By other Stakeholders / Authorities** ▪ Airports, ANSPs, Airspace Users, the Network Manager, Military Authorities and MET service providers to continue working together for the achievement of a harmonised SWIM deployment. ▪ Standard Development Organisations (SDO) supported by the industry to continue updating the Rolling Development Plan through the European ATM Standards Coordination Group (EASCG) and to support via the standardisation platform and the SWIM communities of interest the implementation and evolution of the SWIM specifications and supporting material	

10	Unaddressed cyber-security vulnerabilities	High Level Risk
Objectives	Timely CP1 implementation, associated benefits	
Risk description	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.	

11	Lack of adherence to SESAR Deployment Programme	Medium Level Risk
Objectives	Timely CP1 implementation, timely release of associated benefits	
Risk description	A lack of buy-in of the SESAR Deployment Programme would negatively affect the level of engagement and involvement in the implementation of the Common Project One 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 CP1.	
Mitigation Actions	**By SESAR Deployment Manager** ▪ Continue with the involvement and engagement of all operational stakeholders impacted by the CP1 regulation through the Stakeholder Consultation Platform. ▪ Continue considering the comments and suggestions formulated during consultation cycles by operational stakeholders.	

12	Availability of COM complementary technologies supporting AF6	High Level Risk
Objectives	AF6 sustainability and release of associated benefits	
Risk description	The analysis showed that the VDL Mode 2 Communication infrastructure used to transport ADS-C/EPP information initially has limited resources for the future. The coordinated and timely introduction of mature complementary technologies, transition from ATN/OSI to ATN/IPS protocol and implementation of a multilink management are therefore identified in the EU ATM Master Plan to support the AF6 services and ensure proper operation of DLS by alleviating VDLM2 link. The impact of the late implementation of complementary data communication technologies is identified as high risk for the sustainability of the mandated ADS-C/EPP use with the required performances in the long term. Should this situation occur, the delivery of performance benefits would be delayed accordingly. Additionally, late or missed investments could also have a negative impact on other stakeholder categories, jeopardising the achievement of full CP1 objectives.	
Mitigation Actions	**By SESAR Deployment Manager** ▪ Strong COM programme management ensuring: ➢ Close monitoring of development and industrialisation processes of complementary COM technologies ➢ Elaboration of a pan-European deployment programme enabling a sufficient volume of aircraft to equip with complementary technologies, before the forecasted loss of the VDL2 resources as well as supporting TBO operations. This programme should be coordinated with other European institutions and stakeholders, including EC, under the framework of the CNS Advisory Group ➢ Support of operational stakeholders in implementation of Implementation Projects ➢ Manage smooth and safe transition towards ATN/IPS protocols ▪ Strong promotion of the SESAR Deployment, together with dedicated face to face meetings between the SDM and “concerned stakeholders” and/or group/platform of stakeholders (e.g., at country and/or airport level); ▪ Close coordination with manufacturing industries to harmonise their planning to provide coordinated and appropriate solutions in time to concerned stakeholders to comply with CP1 in time; ▪ Enhancement of the transversal approach and buy-in for a synchronised approach in deploying CP1, 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; ▪ For funded Projects: o Request demonstration of local coordination with other relevant stakeholders by project leaders prior to projects submission to CEF calls; o 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.

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.

Performance Assessment and CBA Methodology

The Performance Approach

The Common Project One (CP1) has been adopted by the Commission after positive opinion of the EU Member States and endorsement by the operational stakeholders on the basis of a Cost Benefit Analysis (CBA) that demonstrated an overall benefit. Within the SESAR Deployment Programme (SDP), the performance approach aims at coordinating, synchronising and monitoring the implementation of the CP1 against the boundaries of the CBA that has triggered CP1 adoption in 2021.

To meet this objective, throughout the CP1 implementation phase the performance approach includes:

- The continuous improvement of the "Performance Assessment and CBA Methodology" that the SESAR Deployment Manager (SDM) has already applied in the development of the CP1 CBA, also building on and connecting with the methodologies used by other SES and SESAR bodies involved into performance. The current methodology is presented in the following chapter of the present document;
- The presentation of the CP1 CBA;
- The presentation of the CP1 expected contribution to performance;
- The presentation of the yearly updated views on the CP1 Families expected contribution to performance;
- The presentation of the yearly updated Deployment Programme Performance Assessment and CBA analysis, providing the full picture of the performance impact from the ongoing and completed projects that received CEF co-funding.

These tasks will be performed by the SDM in full acknowledgement and respect of its role within the SES performance framework, presented within the following paragraphs.

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, SDM's performance approach shall comply with SES overall performance framework, use common indicators and methodologies with other SES bodies dealing with performance and build on their expertise and early results.

The SESAR Deployment Manager, according to the regulatory framework set by Commission Implementing Regulations (EU) n. 409/2013 and n. 716/2014 as repealed by Implementing Regulation No 116/2021, 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[6] provided by technological investments.

Since implementation as from January 1st 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.

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. SDM is going to cooperate with the Performance Review Body (PRB) to ensure this compliance, in particular through the alignment of KPIs used by SDM and PRB allowing to follow the improvements in ATM.

[6] European Union-wide performance targets mean the targets referred to in Article 9 of Commission Implementing Regulation (EU) No 390/2013.

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, SDM has been closely cooperating with NM with the objective to build on 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 SDM has delivered in support to CP1's adoption sets the overall frame for SDM's action in the field of performance. With regards to the CP1 CBA, the SESAR Deployment Manager shall pursue several objectives:

1) Monitoring that CBA's boundaries are met: SDM shall monitor that CP1 is implemented within the boundaries of the CBA in terms of costs, benefits and Net Present Value (NPV);

2) Gathering actual costs and updated expected benefits data of all on-going implementation projects in relation with CP1 in order to continuously monitor their expected contribution to performance during execution. Moreover, these data could be used to update CP1 CBA at the occasion of a CP1 review.

3) 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 earlier benefits assessment in the R&D phase.

Performance Assessment and CBA Methodology

SDM's performance assessment and CBA methodology is the cornerstone of SDM's performance policy. It bridges between technological investments required to achieve new ATM functionalities required through the CP1 Regulation and ATM performance improvement. It contributes to ensure that all benefits expected from the whole CP1 implementation will materialise whilst not exceeding the estimated cost. It is an essential tool in monitoring CP1 implementation, assessing and monitoring cost and benefits of implementation projects submitted or not by operational stakeholders but also assessing the impact of "missing implementation projects", i.e., implementation projects not submitted timely and identifying solutions to recover such situations and get the whole CP1 implemented.

The performance assessment and CBA methodology describes the different steps taken to set the baseline against which performance will then be monitored during DP execution. In particular, the performance assessment and CBA methodology includes:

- The use of Key Performance Indicators (KPIs) and their corresponding metrics and monetisation values that allow quantifying benefits;
- The use of a top-down approach based on models and a bottom-up approach based on interaction with the Implementing Project Partners (IPP) in the measuring of the expected benefits;

To facilitate the monitoring and comparison with the initial Pilot Common Project CBA published in 2014 as a supporting material to the regulation (EC) 716/2014, the CP1 Deployment Programme Performance and CBA Methodology is using the same metrics or at least aligned ones. The assessment timeline is between 2014 and 2030 to take into account that the CP1 is the successor of the PCP and implementation started in 2014. Also, the same discount factor is used (8%), as commonly used in SESAR CBA consolidations and deliberately chosen as being very conservative.

Full life-cycle mode

The objective is to provide a monitoring of the CP1 benefits in a full life-cycle mode: starting from high-level benefits estimates as foreseen in the initial CP1 CBA, through more accurate expectations of benefits as monitored during the implementation phase of the projects, to a final benefit determination after the projects have been implemented.

The benefits can include quantitative benefits, such as cost savings or operational efficiency improvements, as well as qualitative benefits, such as noise reduction or social economic impacts.

To illustrate the continuous process, the project performance assessment life-cycle could be represented as in the following figure:

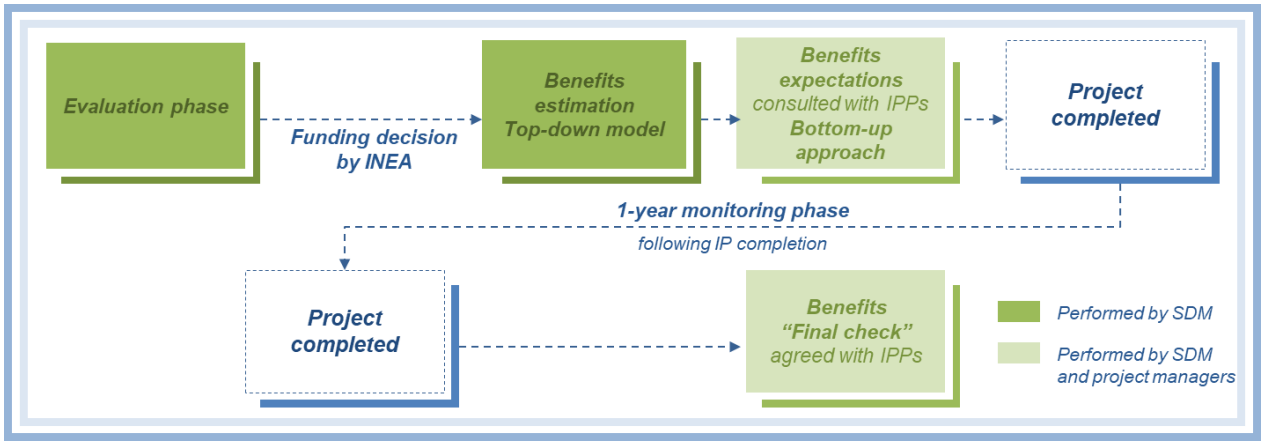


Figure 16 - Project performance assessment life-cycle

Evaluation phase

SDM assesses the cost-effectiveness of the implementing projects before INEA makes its final decision about funding. At this stage SDM provides a pre-assessment which ensures that the proposed implementation projects are financially realistic. The calculation is made to check that the planned costs and expected benefits of the project are in line with the costs and benefits of their functionality in the CP1 CBA. The main parameters considered are the costs and the gap coverage of the project within the Family, without using any KPI such as savings of minutes or Nautical Miles.

Execution phase

The awarded projects are subject to a more accurate performance assessment with a top-down approach: a CBA is performed at project level, or thread of projects (a thread is a group of projects whose benefits are inter-related). The top-down benefit evaluation enables to calculate the expected cumulated benefits until 2030, based on KPI improvements.

Once these expected benefits are calculated, the results are presented and discussed with IP leaders (bottom-up approach). As a result of the discussion, a realistic benefit expectation consensus is reached and accepted by all parties.

After completion phase

The proposed methodology to be used after completion of projects must be consistent with the one in the execution phase: in particular, as the most relevant KPIs have already been defined in the execution phase, the same should ideally be used after completion to allow comparison between ex-ante and ex-post situation. However, the difference in the final check is that the objective is not to use a model to estimate performance improvements, but to compare the agreed KPI metrics before and after implementation.

It should be noted that the performance of completed projects can be monitored after a period of a minimum of one year of operations, in order to have a more accurate measurement.

From expectations to actual results

While the CP1 CBA and the underlying methodology constitute the general reference for performance expectations at ATM Functionality (AF) level, the projects' contribution to performance and their CBAs are identified and quantified at a greater level of detail. As time passes and more actual information is available, the methodology allows to fine tune from the initial overall top-down approach to a continuous bottom-up approach conducted with the implementing partners and finally to turn from expectations to actual results both on cost and benefits sides. As the global CBA of the deployment programme is built by summing the parts being deployed and the ones already completed, the picture progressively turns from an estimated CBA to a CBA with actual results.

Sources for the calculations

The translation of CP1 into SDP and then into projects induces a significant refinement of the costs compared to the assumptions made before implementation. At the same time, additional inputs from the implementing stakeholders and new analysis from the SDM, in close cooperation with the Network Manager, allow refining the benefits side. In a similar manner, it can be noted that the CP1 CBA was built with more refined and reliable data sources than the ones originally used in 2013 for the PCP CBA by the SESAR Joint Undertaking (SJU).

As the costs of the implementing projects are being directly provided by the implementing partners, and the performance domain is only related to benefits, **the Performance Assessment and CBA Methodology for the monitoring of implementing projects mainly covers the process of identifying and quantifying the benefits**.

Performance gains and monetised or non-monetised benefits are based on performance-related data to be collected through expert judgment or actual data once a project is completed, as well as relevant inputs from the Network Manager like the National Operational Plan (NOP) and the European Route Network Improvement Plan (ERNIP). Once projects are awarded and running, these analysis and subsequent monitoring are to be done with the methodology initially defined in the Deployment Programme.

Models used in the performance assessment

Grouping of projects into threads

In many cases, projects are combined into “threads” to facilitate the calculation of the performance gains and associated benefits: a thread is a group of projects whose benefits are inter-related.

Indeed, in many cases individual implementing projects (IPs) cannot be assessed alone: study projects aiming to find an appropriate implementation method, interdependent projects, cross-border initiatives, infrastructure enabler projects etc. In such cases, a grouping of projects is needed to have a more realistic assessment which also includes synergies. In practice, threads are usually composed of one to three-four interrelated IPs.

Of course, after the performance and benefits calculation is performed, consolidation occurs both on benefits and on costs to build a global CBA for the specific thread.

Top-down model for AF1 and AF2

To define the benefit expectations during the execution phase, a top-down model is used at the first stage of the evaluation.

For AF1 and AF2, SDM is using a model (see the following figure) with defined improvement percentages for each Family and each relevant performance indicator, based on different sources: SJU SESAR Deliverables, Flights Demo Reports and expert judgement.

ATM Functionalities	AF1		AF2			
	Sub-AF 1.1	Sub-AF1.2	Sub-AF2.1	Sub-AF2.2		Sub-AF2.3
KPI	1.1.1 – E-AMAN	1.2.1 AMAN/DMAN integration	2.1.1 - DMAN sync. with pre-dep. Seq.	2.2.1 - Initial Apt Op. Plan	2.2.2 - Extended AOP	2.3.1 - Airport Saf. Net associated with A-SMGCS Level 1&2
ASMA Time (unimpeded)	3,0%	1,0%				
ASMA Time (additional)	1,0%	0,1%				
Airport ATFM Delay	1,0%	0,1%		0,1%	0,01%	
Taxi In Time (additional)				0,1%	0,01%	0,5%
Taxi Out Time (unimpeded)		2,0%	0,9%			
Taxi Out Time (additional)		2,0%	7,0%	1,2%	0,1%	10,0%
ATC Delay		0,3%	3,0%	0,1%	0,01%	25,0%
Operational Cancellations			22,5%	18,4%		

Figure 17 - Benefit expectations' top-down model

The performance gains are then calculated on a yearly basis based on the KPI improvement percentage of the Family in the model, multiplied by the reference KPI value for the selected location (for instance the level of taxi delays in minutes at the selected airport), multiplied by the gap coverage of the project (or thread) within the Family, finally multiplied by the volume of traffic for the given location. Some correction factors for specific locations or projects may also be used in the calculation.

Performance gains in units (minutes, tons of fuel…) are then converted into Euro values by using the appropriate monetisation factors (see paragraph on monetisation factors below).

The yearly benefits are then used to calculate a total undiscounted or discounted benefit on the CP1 CBA reference period (2014-2030) according to an assumption of ramp-up over time (how the benefits progressively reach 100% of the expected yearly value).

Network Manager simulations for AF3 and AF4

For AF3 and AF4 the assessments made by the Network Manager take into consideration a harmonised network approach. The Network Manager ensures the consistency between the Network Operations Plan, the European Route Network Improvement Plan Part 2 and the relevant projects proposed in the context of AF3 and AF4. This consistency must be maintained for all the subsequent updates of the Deployment Programme and the gaps identification.

Capacity Assessment with respect to the AF3 and AF4 projects:

- The capacity assessment is based on the Capacity Assessment and Planning Guidance document that has been approved by the Network Manager Board in June 2013, as part of the Network Operations Plan Approval. The reference to this document is given in all the successive editions of the Network Operations Plan.
- In the capacity assessment, the percentages of improvement brought by the project or thread are taken into account together with the flight profiles derived from STATFOR data assuming routing via the shortest routes available on the future ATS route network, with generally unconstrained vertical profiles.
- The Network Manager has ensured a full consistency between the last available version of the Network Operations Plan and the evaluation of the operational performance potential of the AF3 and AF4 projects. This potential is covered either by the projects proposed by various operational stakeholders as part of the CEF Call or is included in the gap analysis.
- The Network Manager developed a do-nothing scenario that was then compared to the potential of the various AF3 and AF4 related projects listed in the last available version of the Network Operations Plan. The assessments take into consideration a harmonised network approach.

Flight Efficiency Assessment with respect to the AF3 and AF4 projects:

- The flight efficiency assessment is based on the overall flight efficiency evaluations made in the context of the last version of the European Route Network Improvement Plan, Part 2 – ARN Version.
- The Network Manager has ensured a full consistency between the European Route Network Improvement Plan, Part 2 last ARN version and the evaluation of the operational performance potential of the AF3 and AF4 projects with respect to flight efficiency. This potential is covered either by the projects proposed by various operational stakeholders as part of a CEF Call or is included in the gap analysis.
- The evaluations made in the previous editions of the European Route Network Improvement Plan, Part 2 demonstrated that the operational performance improvements achieved were in line year on year with the estimations made.

KPAs, KPIs and their monetisation

The Key Performance Areas (KPAs) that are monitored at deployment level are those of the SES performance regulation (EU IR 390/2013) and those reflected in the ATM Master Plan.

There are **six Key Performance Areas (KPAs)** where direct and quantifiable benefits for the European ATM and aviation are foreseen:

KPAs	Targets
Cost Efficiency (ANS productivity)	Reduced en-route and TMA costs
Capacity	Reduced departure delays
Operational Efficiency	Reduced flight time and fuel burn

KPAs	Targets
Environment	Reduced CO_2 emissions
Safety	High standards
Security	High standards

Table 1 - KPAs

As Safety and Security are not monetised at this stage, the monetised benefits come from the following KPAs: Cost Efficiency (ANS productivity), Capacity, Operational Efficiency and Environment. The following table gives the Key Performance Indicators (KPIs) used by SDM, in relation to their KPAs.

KPAs	KPIs
Cost Efficiency (ANS productivity)	**Gate to Gate ANS cost (in €)**
Capacity	**Departure Delay (in minute):** • Airport ATFM Delay • En-Route ATFM Delay • ATC Delay
	Cancellations (in number of events)
Operational Efficiency	**Flight Time (in minute):** • Unimpeded ASMA[7] Time • Additional ASMA Time • Unimpeded Taxi-in Time • Additional Taxi-in Time • Unimpeded Taxi-out Time • Additional Taxi-out Time • Horizontal Flight Time
	Fuel consumption (in tons of fuel)
Environment	**CO_2 emissions (in tons of CO_2)**

Table 2 - KPAs and KPIs

The detailed definition of the KPIs is in line with Implementing Regulation (EU) No 390/2013 and the Performance Review Unit dashboard (PRU), which can be found on the website of the PRU.

The Table above does not mention the master KPI "Horizontal Flight Efficiency" which measures the savings in Nautical Miles during the horizontal phase of the flight, because these Nautical Miles savings are converted into the following three categories of savings: minutes (KPI "Horizontal Flight Time"), tons of Fuel (part of the KPI "Fuel consumption") and tons of CO_2 (part of the KPI "CO_2 emissions").

It must be stressed that **"En-Route ATFM delay" savings are calculated in reference to a "do-nothing" scenario** which foresees a strong increase of these delays in case no CP1 investment is made.

The below Figure shows the KPIs grouped by the operational environment to which they are related. KPIs shown in green refer to "strategic" inefficiencies, for example due to current airspace design, and refer to delay reductions included in airline schedules (flight plan).

KPIs shown in blue refer to "tactical" inefficiencies caused by unpredictable delays on the day of operations that exceeds the delay buffer foreseen in the flight plan.

[7] ASMA: Arrival Sequencing and Metering Area

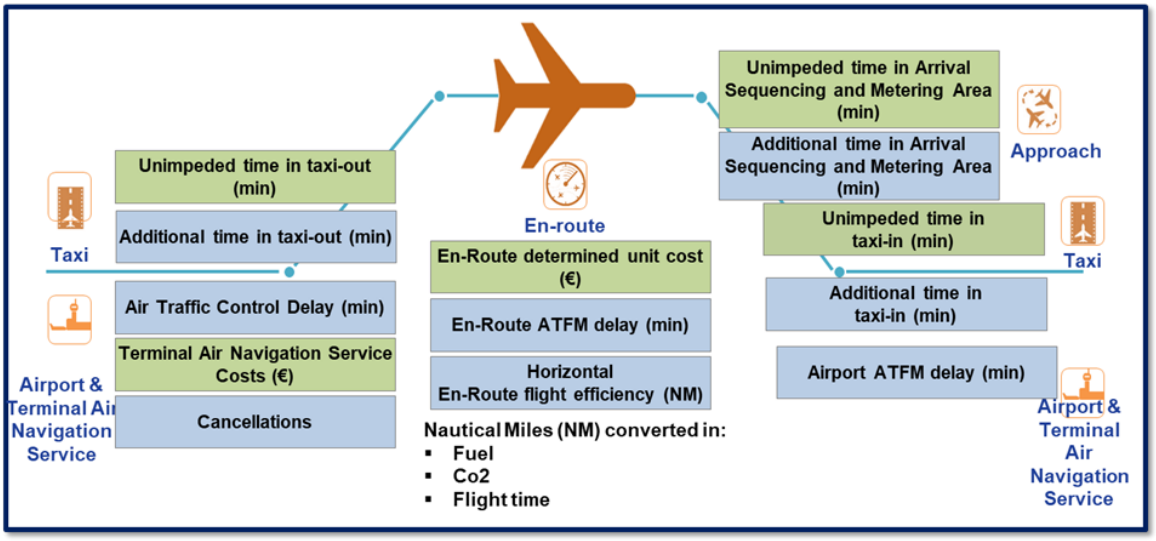


Figure 18 - KPIs and related operational environments

For each KPI, improvements can be monetised by multiplying the savings (expressed in their respective unit) by a valorisation factor: euros per minute, euros per ton of fuel or ton of CO_2 etc. It should be noted that **the valorisation factors currently in use in the Deployment Programme are no longer the same as initially used for the initial PCP CBA ref. PCP EC-716-2014 Article 4c.** They have been updated with the values derived from the version 08 of the Eurocontrol "Standard Inputs for Cost and Benefits Analyses" published in January 2018.

Valorisation factors	Category	Value
ATC delay ATFM delay (En Route, Airport)	Tactical Ground Delay	38€/minute
ASMA (additional Time) Taxi In /Out (additional Time)	Tactical Airborne Delay	45€/minute
ASMA (unimpeded) Taxi Out (unimpeded)	Strategic airborne Delay	37€/minute
Horizontal Flight Time	Airborne Strategic Cost	37€/minute
Fuel consumption	Kg	0.78€/Kg (from 2020 onwards)
CO_2 emissions	Ton	22€/Ton (from 2020 onwards)
Cancellations	Per cancellation	17,650€/cancellation

Table 3 - Valorisation factors

In the SESAR Deployment Programme, an update of the monetisation factors will be performed whenever deemed necessary, in particular following the release of a new version of the Eurocontrol "Standard Inputs for Cost and Benefits Analyses". For Fuel and CO2 price, in the CP1 CBA the actual prices were used for the past years (2014-2019) and forecasts from official sources were used for the future (2020-2030):

Year	2014	2015	2016	2017	2018	2019	2020-2030
Fuel Price	698 €	487 €	370 €	458 €	571 €	560 €	780 €
CO_2 Price	7.20 €	8.22 €	6.55 €	8.09 €	24.63 €	21.69 €	22.00 €

In the Deployment Programme, a continuous update of fuel and CO_2 price will be performed to give the most realistic and up-to-date view of the benefits: after each calendar year-end, once the actual past fuel and CO_2 prices and more updated forecasts are available, the above assumptions may be reviewed.

Ex-post assessment: The Final Check

During the deployment phase of an implementing project (IP) funded through CEF Calls, SDM first estimates the benefits through a top-down approach, mainly based on evaluations of SDM experts. This estimate is continuously fine-tuned and updated through a bottom-up approach, based on discussion with stakeholders and project managers. After the project has been fully implemented with all milestones and deliverables completed, SDM conducts the ex-post performance analysis (Final Check). The full process and methodology were established and approved through the SDM's Stakeholders Consultation Platform (SCP) in 2018 and described in the report "Performance Assessment Methodology for Completed Projects".

The ex-post performance analysis basically consists in comparing a measured performance after implementation to the situation before implementation: this comparison, is supposed to (i) demonstrate measured performance improvements and (ii) allow the comparison with ex-ante improvements expectations. This analysis is useful at project level, to assess if the expected advancement has been reached locally, but also at Common Project level (CP1 and further CPs), to assess how a full set of implemented functionalities will have impacted the network performance.

The performance evaluation of each implementation project must be approached as a continuous process, where the same core methodology is used at each stage to avoid distortion and misalignment. After completion phase the proposed methodology to be used must be consistent with the one in the execution phase: in particular, as the most relevant KPIs have already been defined in the execution phase, the same should ideally be used after completion to allow comparison between ex-ante and ex-post situation.

A nine-step procedure was established to measure the actual performance of completed projects. It is represented in the Figure below.

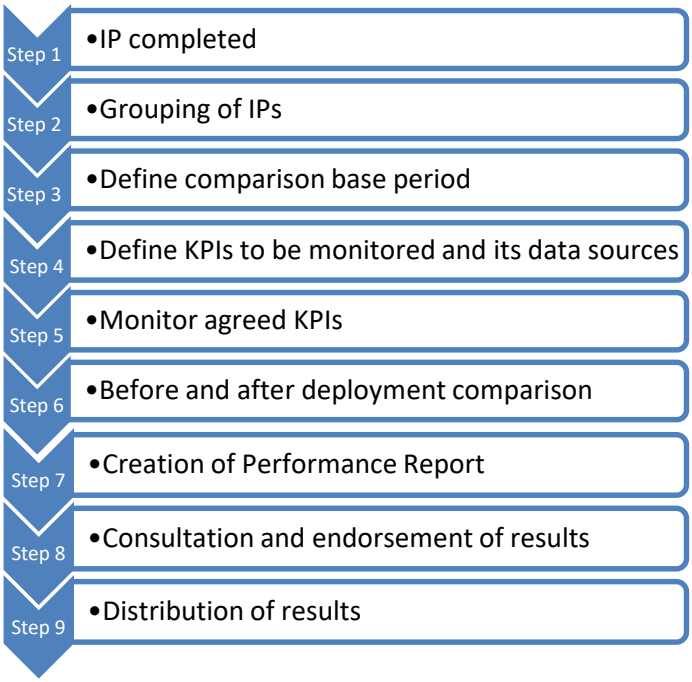


Figure 19 - Nine-step procedure to measure the actual performance of completed projects

Step 1 - Once the implementation project is completed, the project managers inform SDM and SDM confirms closure based on the final report and all supporting documentation uploaded in the STAR Tool. Finalisation is both populated within SDM teams and marked in STAR Tool.

Step 2 - After completion was confirmed on both implementing partner and SDM side, grouping of interrelated projects are needed in order to have a more realistic assessment including synergies and eliminate double counting of benefits. SDM and the project managers will decide whether the initial grouping ("thread") can be used or if it has to be extended with further IPs from later Calls in order to include all relevant IPs. Other possibilities of grouping may also appear to be relevant (e.g. stakeholder level, Family level etc.): this will happen based on SDM expert judgement and with confirmation and

approval of IPPs. In all cases, after a grouping of projects is made, the one-year monitoring period could only start when all IPs have been completed within the same group.

Step 3 - The reference periods for the performance measurement of "before implementation" and "after implementation" status should be agreed. These periods should well represent the situation improvement in the given area.

Step 4 - During the implementation phase, Key Performance Indicators (KPI) were chosen and monitored. If needs be, they can be revised and an agreement should be reached to make sure the KPIs are relevant after completion of the project. Sources of these measurable performance indicators should be, as a primary source, publicly available data remaining consistent during several years hence providing a reliable comparison base and unbiased way of measurement. In many cases, data sources can be found in publications of Eurocontrol and the Performance Review Unit (PRU). In cases when internal data from IPPs is proven to be reliable and substantial, especially from airlines and airports, it can be also a source of performance measurement.

Step 5 - A monitoring period of one year is necessary in order to have a more accurate measurement with substantial database about traffic and all impacted operations. This observation phase should allow SDM to better incorporate all benefits resulting from completed projects by eliminating seasonal fluctuations, comparing a significant number of events before and after implementation, isolating impacts of the change from other exogenous improvements, eliminating potential mixed-mode operations after implementation etc. In case the operational benefits are foreseen in a longer term, on request of project manager, this observation phase should be prolonged until sufficient data and example shows the project impact. After the minimum one-year observation period, all previously agreed data metrics will be collected from public sources and, if relevant, from IPPs as well.

Step 6 - The agreed KPI metrics before and after implementation are used to measure the project (or group of projects) impact on performance. One of the difficult parts of the analysis is to isolate the impact from all other factors contributing to the evolution of the performance: this could lead SDM and the concerned stakeholders to analyse whether correction factors are needed for some KPIs, to adapt the measured evolutions and use revised values. In particular, in some cases the use of correction factors may be justified by the need to measure benefits not as the difference between performance after implementation and before implementation, but as the difference between performance after implementation and without implementation, which is a different notion: whilst "before" implementation refers to a baseline data which can be measured, "without" implementation refers to a theoretical do-nothing scenario which may be different from the baseline data. In such case, the use of a do-nothing scenario will lead to two different types of benefits, whose addition represent the total benefits: "tangible" benefits, when comparing the KPI value after implementation (year N+1) with the baseline year's value (year N) and "intangible" benefits, when comparing the KPI value in the do-nothing scenario (for year N+1) with the baseline year's value (year N). As the do-nothing scenario is a theoretical construction and cannot be measured through public KPI sources, this difference will enable to calculate an "intangible" benefit[8] .

The estimation of such correction factors can only be conducted by expert judgment and agreed between SDM and the concerned stakeholders on a case-by-case basis.

Step 7 - Once all relevant KPI improvements are considered, all areas both qualitative and quantitative should be included in a Performance Report. Qualitative benefits can be described and quantitative benefits (if measurable) will be added in the report.

The Performance Report includes the project start/end date, costs, performance impact on the first year, and extrapolated benefits over the CBA timeframe (cumulated values until 2030).

Step 8 - Calculated benefits together with qualitative advantages of completed projects may be discussed with not only IP participants and project managers, but with other impacted stakeholders as well. For instance, as end users of many implementation projects are the Airspace Users, they could be closely associated to the final assessment. The Network Manager should also be associated for benefits in AF3 and AF4 and more generally to assess benefits at network level.

[8] The wording "intangible" must be understood as in finance or accounting, to designate an asset that is not touchable, but still has a real value.

Step 9 - The final results in the Performance Report assessment will be distributed to the project managers and within SDM. Furthermore, these results would be regularly shared with the main contributors of the SES and the European Commission and also with the public via a dedicated SDM webpage.

Covid impact

As the main challenge of aviation in 2020 and subsequent years, the COVID-19 pandemic is very significantly impacting the performance assessment of the Deployment Programme - because operational savings from the CP1 investments are closely linked to the volume of air traffic.

The impact of a decreased traffic on projects benefits is twofold:

- For all projects, there is a mechanical decrease of the overall benefits because the calculated savings per flight are multiplied by the number of flights;
- For projects having an impact on capacity, there is also a decrease of savings per individual flight, because the lower network activity does not allow the project to bring as much benefits as in a more congested airspace.

These two impacts are cumulative and in case of extreme traffic decrease as in the COVID situation, are leading to significant drops of benefits. It is therefore important to use a realistic and updated traffic forecast to assess the SESAR Deployment Programme results.

Eurocontrol has introduced its long-term traffic forecast in November 2020 with three different scenarios. At this stage, Scenario 2 with a 5-year recovery period compared to the 2019 traffic level is foreseen as the most acceptable scenario and was used by SDM for the CP1 performance assessment and CBA. Unless significant deviations appear in the near future, SDM will use the same scenario to perform the Deployment Programme Performance Assessment and CBA analysis providing the full picture of the performance impact from the ongoing and completed projects, to be included in the next release of the Performance View in the Execution Progress Report (EPR).

An update of the traffic scenario will be performed when necessary, in particular following the release of new traffic forecasts by STATFOR.

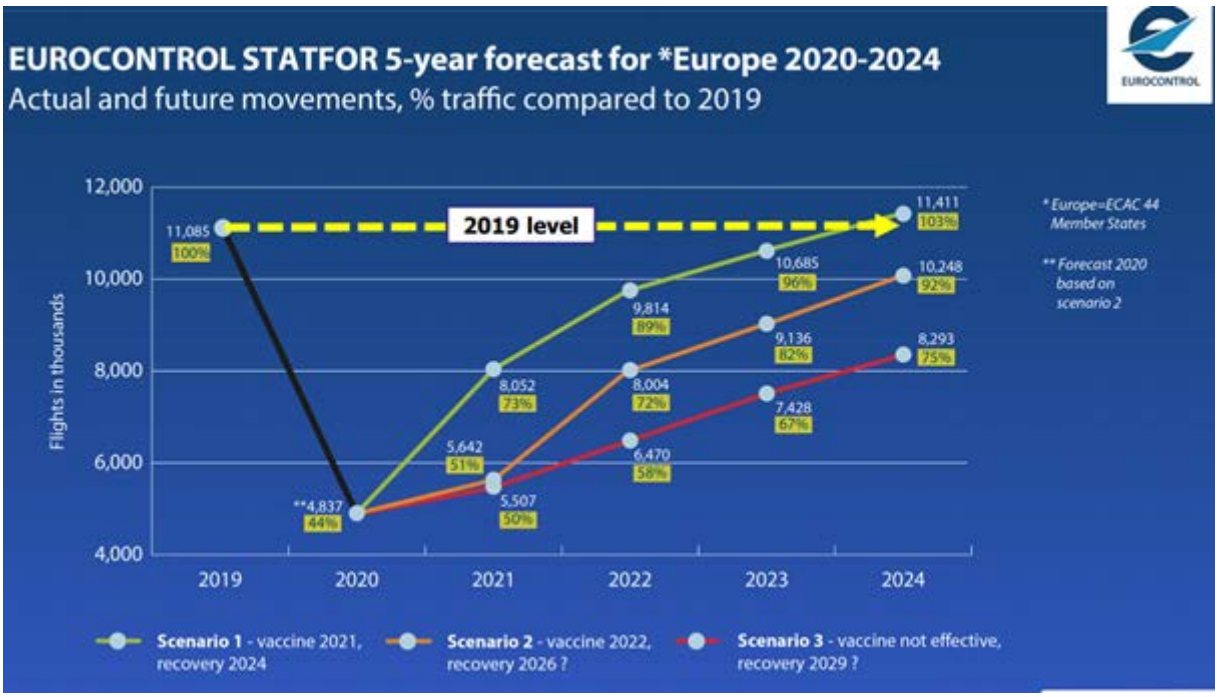


Figure 20 - 2020-2024 Europe traffic forecast by STATFOR

CP1 Stakeholders' Deployment Roadmaps

Aeronautical Information Service Providers (AISP)

AF5 - SWIM

AF5 - SWIM										
Sub-AF	Family	Service	DM	2021	2022	2023	2024	2025	2026	2027
Sub-AF 5.3 Aeronautical Information Exchange	Family 5.3.1 Aeronautical Information Exchange	*Digital NOTAM service*	1	*Provide Digital NOTAM service*						
		Digital Aerodrome Mapping Information Exchange	1	*Aerodrome mapping information ervice*						
		Aeronautical Information Features Exchange	1	*Aeronautical Information features service*						

Air Navigation Service Providers (ANSP)

AF1 - Extended AMAN and integrated AMAN / DMAN in the high-density TMAs

AF1 - Extended AMAN and integrated AMAN/DMAN in the high-density TMAs									
Sub-AF	Family	DM	2021	2022	2023	2024	2025	2026	2027
Sub-AF 1.1 Arrival Management extended to en-route airspace	**Family 1.1.1** Arrival Management extended to en-route airspace	1	*Upgrade ATC systems*						
		2	*Implement ATC procedures*						
		3	*Establish Bilateral Agreements*						
		4	*Safety assessment*						
		5	*Training*						
		6	*Operational Use*						
Sub-AF 1.2 AMAN/DMAN Integration	**Family 1.2.1** AMAN/DMAN Integration	1	*Couple AMAN and DMAN systems*						
		2	*Establish Bilateral Agreements*						
		3	*Upgrade CWP*						
		4	*Safety assessment*						
		5	*Training*						
		6	*Operational Use*						

AF2 - Airport Integration and Throughput

AF2 – Airport Integration and Throughput									
Sub-AF	Family	DM	2021	2022	2023	2024	2025	2026	2027
Sub-AF 2.1 Departure Management Synchronised with Pre-departure sequencing	**Family 2.1.1** Departure Management Synchronised with Pre-departure sequencing	1	*Develop procedures*						
		2	*Integrate system with ECI*						
		3	*Integrate systems with A-CDM*						
		4	*Integrate system with A-SMGCS*						
		5	*Safety assessment*						
		6	*Training*						
		7	*Operational use*						
Sub-AF 2.2 Airport Operations Plan	**Family 2.2.1** Initial AOP	1	*Implement data/operational elements*						
		2	*Data quality service*						
		3	*Safety assessment*						
		4	*Training*						
		5	*Operational Use*						
	Family 2.2.2 Extended AOP	1	*Implement data/operational elements*						
		2	*Implement Airport Performance Services*						
		3	*Data quality service*						
		4	*Safety assessment*						
		5	*Training*						
		6	*Operational use*						
Sub-AF 2.3 Airport Safety Nets	**Family 2.3.1** Airport Safety Nets	1	*Implement supporting RMCA systems*						
		2	*Implement supporting CATC and CMAC systems*						
		3	*Develop procedures*						
		4	*Safety assessment*						
		5	*Training*						
		6	*Operational use*						

AF3 - Flexible ASM and Free Route Airspace

AF3 – Flexible ASM and Free Route Airspace									
Sub-AF	**Family**	**DM**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Sub-AF 3.1 Airspace Management and Advanced Flexible Use of Airspace	**Family 3.1.1** ASM and A-FUA	1a	*Deploy support systems*						
		1b	*Adopt NM system*						
		2	*Implement procedures and processes*						
		3	*Adapt ASM systems*						
		4	*Implement interoperability with NM system*						
		5	*Implement interoperability to facilitate cross border operations*						
		6	*Optimise planning and allocation of airspace booking*						
		7	*Implement procedures related to ASM level 3 (tactical) information exchange*						
		8	*Adapt ASM and ATC systems for automatic ASM data exchanges*						
		9	*Adapt ASM system to manage airspace data information*						
		10	*Safety Assessment*						
		11	*Training*						
		12	*Operational use*						
	Family 3.1.2 Management of Predefined Airspace Configurations	1	*Adapt ATM systems*						
		2	*Implement procedures*						
		3	*Safety Assessment*						
		4	*Training*						
		5	*Operational use*						
Sub-AF 3.2 Free Route Airspace	**Family 3.2.1** Initial FRA	1	*Implement procedures and processes for network dimension*						
		2	*Improve system*						
		3	*Implement procedures and processes for local dimension*						
		4	*Safety assessment*						
		5	*Training*						
		6	*Operational Use*						
	Family 3.2.2 Enhanced Free Route Airspace Operations	1	*Implement process and procedures for network dimension*						
		2	*Improve system*						
		3	*Implement procedures and processes for local dimension*						
		4	*Safety assessment*						
		5	*Training*						
		6	*Operational Use*						

AF4 - Network Collaborative Management

AF4 – Network Collaborative Management									
Sub-AF	**Family**	**DM**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Sub-AF 4.1 Enhanced Short Term ATFCM Measures	**Family 4.1.1** Enhanced Short Term ATFCM Measures	1	*Develop procedures*						
		2a	*Upgrade local system*						
		2b	*Use NM application*						
		3	*Safety assessment*						
		4	*Training*						
		5	*Operational use*						
Sub-AF 4.2 Collaborative NOP	**Family 4.2.1** Interactive rolling NOP	1	*Use NM technical platform*						
		2	*Develop procedures*						
		3	*Adapt system*						
		4	*Safety assessment*						
		5	*Training*						
		6	*Operational use*						
	Family 4.2.2 Initial AOP/NOP Information Sharing	1	*Implement API and DPI*						
		2	*Implement B2B services*						
		3	*Data validation*						
		4	*Safety assessment*						
		5	*Training*						
		6	*Operational use*						
Sub-AF 4.3 Automated Support for Traffic Complexity Assessment	**Family 4.3.1** Automated Support for Traffic Complexity Assessment and Flight Planning interfaces	1	*Provide AFP automatically*						
		2	*Process APL and ACH*						
		3a	*Use NM system*						
		3b	*Implement local tool*						
		4b	*Process and integrate EFD*						
		5	*Develop procedures*						
		6	*Safety assessment*						
		7	*Training*						
		8	*Operational use*						
Sub-AF 4.4 AOP/NOP integration	**Family 4.4.1** AOP/NOP integration	1	*Define data and procedures*						

AF5 - SWIM

AF5 - SWIM											
Sub-AF	**Family**	**Service**	**DM**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Sub-AF 5.3 Aeronautical Information Exchange	**Family 5.3.1** Aeronautical Information Exchange	*Airspace structure service*	1	*Consume NM airspace structure*						
			2	*Use NM airspace structure*						
			3	*Provide AUP/UUP*						
			4	*Provide ARES information*						
			5	*Publish ARES service*						
			6	*Consume ARES information*						
			7	*Operational use*						
		Digital NOTAM service	1	*Consume DNOTAM service*						
			2	*Operational use*						
		Aeronautical Information Features Exchange	1	*Consume Aeronautical Information Features service*						
			2	*Operational use*						
Sub-AF 5.4 Meteorological Information Exchange	**Family 5.4.1** Meteorological Information Exchange	*Volcanic Ash Mass Concentration information Service*	1	*Consume volcanic ash mass information*						
			2	*Operational use*						
		Aerodrome Meteorological information Service	1	*Determine requirements for aerodrome MET information*						
			2	*Consume aerodrome MET information*						
			3	*Operational use*						
		En-Route and Approach Meteorological information Service	1	*Determine requirements for APP and ER MET information*						
			2	*Consume APP and ER MET information service*						
			3	*Operational use*						
		Network Meteorological Information Service	1	*Determine requirements for new network MET information*						
			2	*Consume network MET information service*						
			3	*Operational use*						
Sub-AF 5.5 Cooperative Network Information Exchange	**Family 5.5.1** Cooperative Network Information Exchange	*Flight Management Service*	1	*Consume NM flight update information*						
			2	*Operational use*						
		Short term ATFCM measures services (MCDM, eHelpdesk, STAM measures)	1	*Define STAM*						
			2	*Operational use*						
		ATFCM Tactical Updates Service (Airport Capacity and Enroute)	1	*Provide ATFCM tactical and pre tactical updates*						
			2	*Operational use*						
		Measures Service	1	*Provide traffic regulation proposals to NM*						
			2	*Operational use*						
		Counts service (ATFCM congestion points)	1	*Consume Counts service*						
			2	*Operational use*						
Sub-AF 5.6 Flight Information Exchange (Yellow Profile)	**Family 5.6.1** Flight Information Exchange	*Flight Data Request Service*	1	*Consume FF-ICE/R1 flight data request service*						
			2	*Operational use*						
		Notification service	1	*Consume FF-ICE/R1 notification service*						
			2	*Operational use*						
		Data Publication service	1	*Consume FF-ICE/R1 publication service*						
			2	*Operational use*						
		Extended AMAN service	1	*Provide E-AMAN data*						
			2	*Consume E-AMAN data*						
			3	*Operational use*						

AF6 - Initial Trajectory Information Sharing

AF6 – Initial Trajectory Information Sharing									
Sub-AF	**Family**	**DM**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Sub-AF 6.1 Initial Air-Ground Trajectory Information Sharing	**Family 6.1.2** Initial Air-Ground Trajectory Information Sharing (Ground Domain)	1	*Describe ADS-C/EPP data requirements*						
		2	*Deploy system*						
		3	*Safety assessment*						
		4	*Training*						
		5	*Operational use*						
Sub-AF 6.3 Initial Trajectory Information Sharing ground distribution	**Family 6.3.1** Initial Trajectory Information Sharing ground distribution	1	*Define ground distribution architecture*						
		2	*Deploy ground infrastructure*						
		3	*Connect ATS units to ground infratructure*						
		4	*Safety assessment*						
		5	*Training*						
		6	*Operational use*						

Airport Operators (AO)

AF1 - Extended AMAN and integrated AMAN / DMAN in the high-density TMAs

AF1 - Extended AMAN and integrated AMAN/DMAN in the high-density TMAs									
Sub-AF	**Family**	**DM**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Sub-AF 1.2 AMAN/DMAN Integration	**Family 1.2.1** AMAN/DMAN Integration	1	*Upgrade system to incorporate AMAN/DMAN information*						
		2	*Establish Bilateral Agreements*						
		3	*Safety assessment*						
		4	*Training*						
		5	*Operational use*						

AF2 - Airport Integration and Throughput

AF2 – Airport Integration and Throughput									
Sub-AF	**Family**	**DM**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Sub-AF 2.1 Departure Management Synchronised with Pre-departure sequencing	**Family 2.1.1** Departure Management Synchronised with Pre-departure sequencing	1	*Provide data to A-CDM*						
		2	*Develop procedures*						
		3	*Integrate DMAN with A-CDM*						
		4	*Integrate DMAN with ECI*						
		5	*Integrate DMAN with A-SMGCS*						
		6	*Safety assessment*						
		7	*Training*						
		8	*Operational use*						
Sub-AF 2.2 Airport Operations Plan	**Family 2.2.1** Initial AOP	1	*Implement iAOP elements*						
		2	*Data quality*						
		3	*Safety assessment*						
		4	*Training*						
		5	*Operational use*						
	Family 2.2.2 Extended AOP	1	*Implement Extended AOP elements*						
		2	*Implement airport performance service*						
		3	*Data quality*						
		4	*Safety asessment*						
		5	*Training*						
		6	*Operational use*						
Sub-AF 2.3 Airport Safety Nets	**Family 2.3.1** Airport Safety Nets	1	*Implement supporting RMCA systems*						
		2	*Implement supporting CATC and CMAC systems*						
		3	*Develop procedures*						
		4	*Safety assessment*						
		5	*Training*						
		6	*Operational use*						

AF4 - Network Collaborative Management

AF4 – Network Collaborative Management									
Sub-AF	**Family**	**DM**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Sub-AF 4.2 Collaborative NOP	**Family 4.2.2** Initial AOP/NOP Information Sharing	1	*Implement API and DPI*						
		2	*Implement B2B services*						
		3	*Data validation*						
		4	*Safety assessment*						
		5	*Training*						
		6	*Operational use*						
Sub-AF 4.4 AOP/NOP integration	**Family 4.4.1** AOP/NOP integration	1	*Define AOP/NOP integration*						
		2	*Prepare AOP for exchange with NOP*						
		3	*Safety assessment*						
		4	*Training*						
		5	*Operational use*						

AF5 - SWIM

AF5 - SWIM										
Sub-AF	Family	Service	DM	2021	2022	2023	2024	2025	2026	2027
Sub-AF 5.4 Meteorological Information Exchange	**Family 5.4.1** Meteorological Information Exchange	*Aerodrome Meteorological information Service*	1	*Determine requirements for aerodrome MET information*						
			2	*Consume aerodrome MET information*						
			3	*Operational use*						
Sub-AF 5.5 Cooperative Network Information Exchange	**Family 5.5.1** Cooperative Network Information Exchange	*Flight Management Service*	1	*Provide P-DPI*						
			2	*Provide API*						
			3	*Consume NM flight updated information*						
			4	*Operational use*						

Airspace Users (AU)

AF3 - Flexible ASM and Free Route Airspace

AF3 – Flexible ASM and Free Route Airspace									
Sub-AF	Family	DM	2021	2022	2023	2024	2025	2026	2027
Sub-AF 3.1 Airspace Management and Advanced Flexible Use of Airspace	**Family 3.1.1** ASM and A-FUA	1	*Adapt systems for EUAP/EUUP*						
		2	*Adapt systems for RRP*						
		3	*Training*						
		4	*Operational use*						
Sub-AF 3.2 Free Route Airspace	**Family 3.2.1** Initial FRA	1	*Improve system*						
		2	*Develop procedures and processes*						
		3	*Training*						
		4	*Operational use*						
	Family 3.2.2 Enhanced Free Route Airspace Operations	1	*Improve system*						
		2	*Develop procedures and processes*						
		3	*Training*						
		4	*Operational use*						

AF4 - Network Collaborative Management

AF4 – Network Collaborative Management									
Sub-AF	Family	DM	2021	2022	2023	2024	2025	2026	2027
Sub-AF 4.1 Enhanced Short Term ATFCM Measures	**Family 4.1.1** Enhanced Short Term ATFCM Measures	1	*Follow the validity of the flight plan and ATFM slot vs STAM measure*						
Sub-AF 4.2 Collaborative NOP	**Family 4.2.1** Interactive rolling NOP	1	*Develop procedures and processes*						

AF5 - SWIM

AF5 - SWIM										
Sub-AF	Family	Service	DM	2021	2022	2023	2024	2025	2026	2027
Sub-AF 5.3 Aeronautical Information Exchange	**Family 5.3.1** Aeronautical Information Exchange	*Airspace Availability Service*	1	*Consume airspace availability information*						
			2	*Operational use*						
Sub-AF 5.5 Cooperative Network Information Exchange	**Family 5.5.1** Cooperative Network Information Exchange	*Flight Management Service*	1	*Consume NM flight update information*						
		Measures Service	1	*Consume NM measure updates*						
			2	*Operational use*						
		Short term ATFCM measures services (MCDM, eHelpdesk, STAM measures)	1	*Collaborate on STAM application*						
			2	*Operational use*						
Sub-AF 5.6 Flight Information Exchange (Yellow Profile)	**Family 5.6.1** Flight Information Exchange	*Filing service*	1	*Consume FF-ICE/R1 filing service/trial*						
			2	*Operational use*						

AF6 - Initial Trajectory Information Sharing

AF6 – Initial Trajectory Information Sharing									
Sub-AF	Family	DM	2021	2022	2023	2024	2025	2026	2027
Sub-AF 6.1 Initial Air-Ground Trajectory Information Sharing	**Family 6.1.1** Initial Air-Ground Trajectory Information Sharing (Airborne Domain)	1	*Definition of new aircraft configuration*						
		2	*Training procedures*						
		3	*Train flight crews*						
		4	*Perform a/c acceptance process*						
		5	*Operational use*						

MET Providers

AF5 - SWIM

AF5 - SWIM										
Sub-AF	Family	Service	DM	2021	2022	2023	2024	2025	2026	2027
Sub-AF 5.4 Meteorological Information Exchange	**Family 5.4.1** Meteorological Information Exchange	*Volcanic Ash Mass Concentration information Service*	1	*Volcanic Ash SWIM compliant services operational*						
			2	*Consume volcanic ash mass information*						
			3	*Operational use*						
		Aerodrome Meteorological information Service	1	*Determine requirements for aerodrome MET information*						
			2	*Provide aerodrome MET information service*						
			3	*Provide enhanced aerodrome MET information service*						
		En-Route and Approach Meteorological information Service	1	*Determine requirements for APP and ER MET information*						
			2	*Provide APP and ER MET information service*						
			3	*Provide enahnced APP and ER MET information service*						
		Network Meteorological Information Service	1	*Determine requirements for new network MET information*						
			2	*Provide network MET information service*						
			3	*Provide enhanced network MET information service*						

Network Manager (NM)

AF3 - Flexible ASM and Free Route Airspace

AF3 – Flexible ASM and Free Route Airspace									
Sub-AF	**Family**	**DM**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Sub-AF 3.1 Airspace Management and Advanced Flexible Use of Airspace	**Family 3.1.1** ASM and A-FUA	1	*Adapt system for ASM/ATFCM*						
		2	*Implement procedures*						
		3	*Improve ASM notification process*						
		4	*Provide centralised airspace data*						
		5	*Safety assessment*						
		6	*Training*						
		7	*Operational use*						
	Family 3.1.2 Management of Predefined Airspace Configurations	1	*Adapt systems for airspace configuration*						
		2	*Implement procedures*						
		3	*Safety assessment*						
		4	*Training*						
		5	*Operational use*						
Sub-AF 3.2 Free Route Airspace	**Family 3.2.1** Initial FRA	1	*Implement system improvements*						
		2	*Implement procedures and processes*						
		3	*Safety assessment*						
		4	*Training*						
		5	*Operational use*						
	Family 3.2.2 Enhanced Free Route Airspace Operations	1	*Implement system improvements*						
		2	*Implement procedures and processes*						
		3	*Safety assessment*						
		4	*Training*						
		5	*Operational use*						

AF4 - Network Collaborative Management

AF4 – Network Collaborative Management									
Sub-AF	**Family**	**DM**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Sub-AF 4.1 Enhanced Short Term ATFCM Measures	**Family 4.1.1** Enhanced Short Term ATFCM Measures	1	*Procedures & system upgrade*						
		2	*Provide interface with local tool*						
		3	*Safety assessment*						
		4	*Training*						
		5	*Operational use*						
Sub-AF 4.2 Collaborative NOP	**Family 4.2.1** Interactive rolling NOP	1	*Enhance technical platform and services*						
		2	*Develop B2B services*						
		3	*Implement procedures*						
		4	*Adapt systems for TT sharing*						
		5	*Safety assessment*						
		6	*Training*						
		7	*Operational use*						
	Family 4.2.2 Initial AOP/NOP Information Sharing	1	*Develop API and DPI requirements*						
		2	*Enhance technical platform and services*						
		3	*Develop B2B services*						
		4	*Data validation*						
		5	*Safety assessment*						
		6	*Training*						
		7	*Operational use*						
Sub-AF 4.3 Automated Support for Traffic Complexity Assessment	**Family 4.3.1** Automated Support for Traffic Complexity Assessment and Flight Planning interfaces	1	*Implement Traffic complexity tools*						
		2	*Provide flight update information*						
		3	*Integration of AFP*						
		4	*Upgrade system for FF-ICE*						
		5	*Safety assessment*						
		6	*Training*						
		7	*Operational use*						
Sub-AF 4.4 AOP/NOP Integration	**Family 4.4.1** AOP/NOP integration	1	*Define integration data and procedures*						
		2	*Prepare NOP for integration*						
		3	*Safety assessment*						
		4	*Training*						
		5	*Operational use*						

AF5 - SWIM

AF5 - SWIM										
Sub-AF	Family	Service	DM	2021	2022	2023	2024	2025	2026	2027
Sub-AF 5.3 Aeronautical Information Exchange	**Family 5.3.1** Aeronautical Information Exchange	*Airspace structure service*	1	*Provide airspace structure*						
		Airspace availability Service	1	*Provide AUP/UUP management service*						
			2	*Provide airspace availability information*						
Sub-AF 5.4 Meteorological Information Exchange	**Family 5.4.1** Meteorological Information Exchange	*Volcanic Ash Mass Concentration information Service*	1	*Consume volcanic ash mass information*						
			2	*Operational use*						
		Aerodrome Meteorological information Service	1	*Consume aerodrome MET information service*						
			2	*Operational use*						
		En-Route and Approach Meteorological information Service	1	*Determine requirements for APP and ER MET information*						
			2	*Consume APP and ER MET information service*						
			3	*Operational use*						
		Network Meteorological Information Service	1	*Determine requirements for new network MET information*						
			2	*Consume network MET information service*						
			3	*Operational use*						
Sub-AF 5.5 Cooperative Network Information Exchange	**Family 5.5.1** Cooperative Network Information Exchange	*All*	1	*Upgrade systems for SWIM compliance*						
Sub-AF 5.6 Flight Information Exchange (Yellow Profile)	**Family 5.6.1** Flight Information Exchange	*All (except for Extended AMAN SWIM Service)*	1	*Develop FF-CIE/R1 filing, flight data request, notification, publication and tril services*						
			2	*Provide FF-CIE/R1 filing, flight data request, notification, publication and tril services*						

AF6 - Initial Trajectory Information Sharing

AF6 – Initial Trajectory Information Sharing										
Sub-AF	Family	DM	2021	2022	2023	2024	2025	2026	2027
Sub-AF 6.2 Network Manager Trajectory Information Enhancement	**Family 6.2.1** Network Manager Trajectory Information Enhancement	1	*Upgrade system*						
Sub-AF 6.3 Initial Trajectory Information Sharing ground distribution	**Family 6.3.1** Initial Trajectory Information Sharing ground distribution	1	*Define ground distribution architecture*						
		2	*Deploy ground infrastructure*						
		3	*NM systems receiving the EPP data*						

All stakeholders concerned

AF5 - SWIM

AF5 – SWIM										
Sub-AF	**Family**		**DM**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Sub-AF 5.1 Common Infrastructure Components	**Family 5.1.1** Common SWIM PKI and cyber security *All stakeholders concerned*		1	*Trust framework agreed*						
			2	*Interop Tests completed*						
			3	*CTF material available*						
			4	*Day-to-day operations contract signed*						
			5	*Operational use*						
Sub-AF 5.2 SWIM Yellow Profile Technical Infrastructure and Specifications	**Family 5.2.1** Stakeholders' SWIM PKI and cyber security	**Option A:** Using digital certificates issued by the Common PKI (EACP) on application level *All stakeholders concerned choosing option A*	1 a	*Local PKI framework*						
			2 a	*Continuous PKI audit process has been set up*						
			3 a	*Adapt systems to use PKI*						
			4 a	*Training*						
			5 a	*Implement cyber monitoring and control*						
		Option B: Using own PKI installation interacting with the Common PKI (EACP) *All stakeholders concerned choosing option B*	1 b	*Local PKI framework*						
			2 b	*Continuous PKI audit process has been set up*						
			3 b	*Adapt systems to use PKI*						
			4 b	*Implement local PKI*						
			5 b	*Training*						
			6 b	*Implement cyber monitoring and control*						

Military Stakeholders

AF3 - Flexible ASM and Free Route Airspace

AF3 – Flexible ASM and Free Route Airspace									
Sub-AF	**Family**	**DM**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Sub-AF 3.1 Airspace Management and Advanced Flexible Use of Airspace	**Family 3.1.1** ASM and A-FUA	1a	*Deploy support systems*						
		1b	*Adopt NM system*						
		2	*Implement procedures and processes*						
		3	*Adapt ASM systems*						
		4	*Implement interoperability with NM system*						
		5	*Implement interoperability to facilitate cross border operations*						
		6	*Optimise planning and allocation of airspace booking*						
		7	*Implement procedures related to ASM level 3 (tactical) information exchange*						
		8	*Adapt ASM and ATC systems for automatic ASM data exchanges*						
		9	*Adapt ASM system to manage airspace data information*						
		10	*Safety Assessment*						
		11	*Training*						
		12	*Operational use*						
	Family 3.1.2 Management of Predefined Airspace Configurations	1	*Adapt ATM systems*						
		2	*Implement procedures*						
		3	*Safety Assessment*						
		4	*Training*						
		5	*Operational use*						
Sub-AF 3.2 Free Route Airspace	**Family 3.2.1** Initial FRA	1	*Implement procedures and processes for network dimension*						
		2	*Improve system*						
		3	*Implement procedures and processes for local dimension*						
		4	*Safety assessment*						
		5	*Training*						
		6	*Operational Use*						
	Family 3.2.2 Enhanced Free Route Airspace Operations	1	*Implement process and procedures for network dimension*						
		2	*Improve system*						
		3	*Implement procedures and processes for local dimension*						
		4	*Safety assessment*						
		5	*Training*						
		6	*Operational Use*						

AF3 – Flexible ASM and Free Route Airspace									
Sub-AF	**Family**	**DM**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Sub-AF 3.1 Airspace Management and Advanced Flexible Use of Airspace	**Family 3.1.1** ASM and A-FUA	1	*Adapt systems for EUAP/EUUP*						
		2	*Adapt systems for RRP*						
		3	*Training*						
		4	*Operational use*						

AF5 – SWIM

AF5 – SWIM										
Sub-AF	**Family**		**DM**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Sub-AF 5.1 Common Infrastructure Components	**Family 5.1.1** Common SWIM PKI and cyber security *All stakeholders concerned*		1	*Trust framework agreed*						
			2	*Interop Tests completed*						
			3	*CTF material available*						
			4	*Day-to-day operations contract signed*						
			5	*Operational use*						
Sub-AF 5.2 SWIM Yellow Profile Technical Infrastructure and Specifications	**Family 5.2.1** Stakeholders' SWIM PKI and cyber security	**Option A:** Using digital certificates issued by the Common PKI (EACP) on application level *All stakeholders concerned choosing option A*	1 a	*Local PKI framework*						
			2 a	*Continuous PKI audit process has been set up*						
			3 a	*Adapt systems to use PKI*						
			4 a	*Training*						
			5 a	*Implement cyber monitoring and control*						
		Option B: Using own PKI installation interacting with the Common PKI (EACP) *All stakeholders concerned choosing option B*	1 b	*Local PKI framework*						
			2 b	*Continuous PKI audit process has been set up*						
			3 b	*Adapt systems to use PKI*						
			4 b	*Implement local PKI*						
			5 b	*Training*						
			6 b	*Implement cyber monitoring and control*						

AF5 - SWIM										
Sub-AF	**Family**	**Service**	**DM**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Sub-AF 5.3 Aeronautical Information Exchange	**Family 5.3.1** Aeronautical Information Exchange	*Airspace Availability Service*	1	*Consume airspace availability information*						
			2	*Operational use*						
Sub-AF 5.5 Cooperative Network Information Exchange	**Family 5.5.1** Cooperative Network Information Exchange	*Flight Management Service*	1	*Consume NM flight update information*						
		Measures Service	1	*Consume NM measure updates*						
			2	*Operational use*						
		Short term ATFCM measures services (MCDM, eHelpdesk, STAM measures)	1	*Collaborate on STAM application*						
			2	*Operational use*						
Sub-AF 5.6 Flight Information Exchange (Yellow Profile)	**Family 5.6.1** Flight Information Exchange	*Filing service*	1	*Consume FF-ICE/R1 filing service/trial*						
			2	*Operational use*						

AF6 - Initial Trajectory Information Sharing

AF6 – Initial Trajectory Information Sharing									
Sub-AF	**Family**	**DM**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Sub-AF 6.1 Initial Air-Ground Trajectory Information Sharing	**Family 6.1.2** Initial Air-Ground Trajectory Information Sharing (Ground Domain)	1	*Describe ADS-C/EPP data requirements*						
		2	*Deploy system*						
		3	*Safety assessment*						
		4	*Training*						
		5	*Operational use*						
Sub-AF 6.3 Initial Trajectory Information Sharing ground distribution	**Family 6.3.1** Initial Trajectory Information Sharing ground distribution	1	*Define ground distribution architecture*						
		2	*Deploy ground infrastructure*						
		3	*Connect ATS units to ground infratructure*						
		4	*Safety assessment*						
		5	*Training*						
		6	*Operational use*						

AF6 – Initial Trajectory Information Sharing									
Sub-AF	**Family**	**DM**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
Sub-AF 6.1 Initial Air-Ground Trajectory Information Sharing	**Family 6.1.1** Initial Air-Ground Trajectory Information Sharing (Airborne Domain)	1	*Definition of new aircraft configuration*						
		2	*Training procedures*						
		3	*Train flight crews*						
		4	*Perform a/c acceptance process*						
		5	*Operational use*						