3. PROJECT VIEW

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SESAR
DEPLOYMENT MANAGER

3. Project view

As anticipated in Section 2.4, the "Project view" is to be considered as the core "operational" part of the Deployment Programme, fully consistent with the "Strategic view", providing a detailed and comprehensive description of each of the Programme Families, and including a complete view over the implementation level. The main objective of the Chapter 3 is to support the Operational Stakeholders in their implementation activities, providing them with the detailed picture of what has already been addressed and where the main focus has to be directed in order to guarantee the timely and synchronized implementation of the PCP.

As such, the content of the Project view includes the full list of all Implementation Initiatives awarded both within the 2014 CEF Transport Calls for Proposal and within the 2015 CEF Transport Calls for Proposal, as well as the implementation priorities that still need to be fulfilled in order to achieve the deployment of each Family. A more exhaustive description of each of the awarded IPs is presented within Annex A of the Programme.

In order to define the clearest "*operational*" picture of the Pilot Common Project and to provide involved stakeholders with all required information, the tables describing the main features and characteristics of each Family have been enhanced and re-organized in their structure. The tables now include the following information:

- **Family Number and Title**;
- **Main Sub-AF**;
- **Readiness for Implementation**, which indicates both the readiness for deployment of the Family and the time-wise urgency to be launched of the related implementation initiatives (High/Medium/Low, see also section 0)
- **Initial Operational Capability**, to clearly identify the start of the deployment[25];
- **Full Operational Capability**, to clearly identify the expected end of deployment[26];
- **Description and Scope**;
- **Interdependencies**, outlining other Families (or Sub-AFs) whose implementation is strictly connected to the Family's deployment;
- **Synchronization Needs**, which highlights the need for a coordinated deployment and for synchronizing the implementation activities in order to fully achieve the performance benefits; such synchronization efforts might involve several stakeholders, as well as different stakeholder categories;
- **Civil/Military Coordination**;
- **Stakeholders considered as gaps**, which identifies – in accordance to what is presented in the Monitoring view (section 5.1) – those stakeholder categories that

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

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

are requested by the PCP regulatory framework to invest in order to fill in the gaps and therefore are potentially eligible for co-funding under upcoming CEF Transport Calls;

- **Other stakeholders involved in the Family deployment**, which identifies stakeholder categories which have to be considered as contributors for the full operational deployment of the Family itself, without being necessarily requested by the PCP framework to invest;
- **Links to ICAO Global Navigation Plan ASBUs,** which outlines the links to Aviation System Block Upgrades (ASBU) included in the latest edition of the Global Air Navigation Plan
- **ATM Master Plan References**, which identifies the link to the latest edition of the ATM Master Plan, referring both to Level 2 and to Level 3;
- **SESAR Solutions and Very Large Scale Demonstrations**, which lists all related operational and technological improvements developed by SESAR members and the validation activities performed in real operational environments;
- **Guidance Material / Specifications / Standards**[27];
- **Means of Compliance and / or Certifications**;
- **Regulations**;
- **Cybersecurity Requirements**, which – for relevant Families – reports on the identified requirements to be considered in the deployment of the Family, having specific regard to the potential cyber-threats linked to the increased connectivity associated to the full PCP deployment;
- **Recommendation for IPs proposals**, which – in accordance to section 2.7.2 and to the outcomes of the Monitoring Exercise (included within Chapter 5) –list the main recommendations to operational stakeholders which aim at launching implementation initiatives linked to the Family.
- **Deployment Approach**, which aims at illustrating to potential candidate implementing Partners the suggested approach to be followed in order to deploy the Family. This field will present and describe the key milestones towards the Family implementation, trying to identify what activities shall be performed by each of the involved Stakeholder categories. Such milestones have been also used during the monitoring exercise launched on March 4th 2016, aiming at identifying the current status of implementation of the PCP throughout Europe.

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

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

The ATM Functionality #1 includes Extended Arrival Management (XMAN) and Performance Based Navigation (PBN) in high density Terminal Manoeuvring Areas. Extended Arrival management (XMAN) and Performance Based Navigation (PBN) in high density Terminal Manoeuvring Areas (TMAs) will improve the precision of the approach trajectory and facilitates air traffic sequencing at an earlier stage.

More in detail, Extended AMAN supports the extension of the planning horizon out to a minimum of 180-200 Nautical Miles, up to and including the Top of Descent of arrival flights. PBN in high density TMAs covers the development and implementation of fuel efficient and/or environmentally friendly procedures for Arrival and Departure RNP1 (Required Navigation Performance 1) Standard Instrument Departures (RNP 1 SIDs), Standard Arrival Routes (STARs), and RNP approach with vertical guidance (RNP APCH).

Accordingly, AF1 is structured in two Sub-AFs, including respectively two and five Families, as follows:

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

- Family 1.1.1: Basic AMAN
- Family 1.1.2: AMAN upgrade to include Extended Horizon function

Sub-AF 1.2 – Enhanced Terminal Airspace using RNP-Based Operations

- Family 1.2.1: RNP approaches with vertical guidance
- Family 1.2.2: Geographic Database for procedure design
- Family 1.2.3: RNP 1 operations in high density TMAs (ground capabilities)
- Family 1.2.4: RNP 1 operations in high density TMAs (aircraft capabilities)
- Family 1.2.5: Advanced RNP routes below Flight Level 310

The following chart highlights the overall structure of the ATM Functionality #1, namely its SUB AFs, Families and their relevant Implementation initiatives related to both 2014 CEF Call awarded projects and 2015 CEF Call candidate projects.

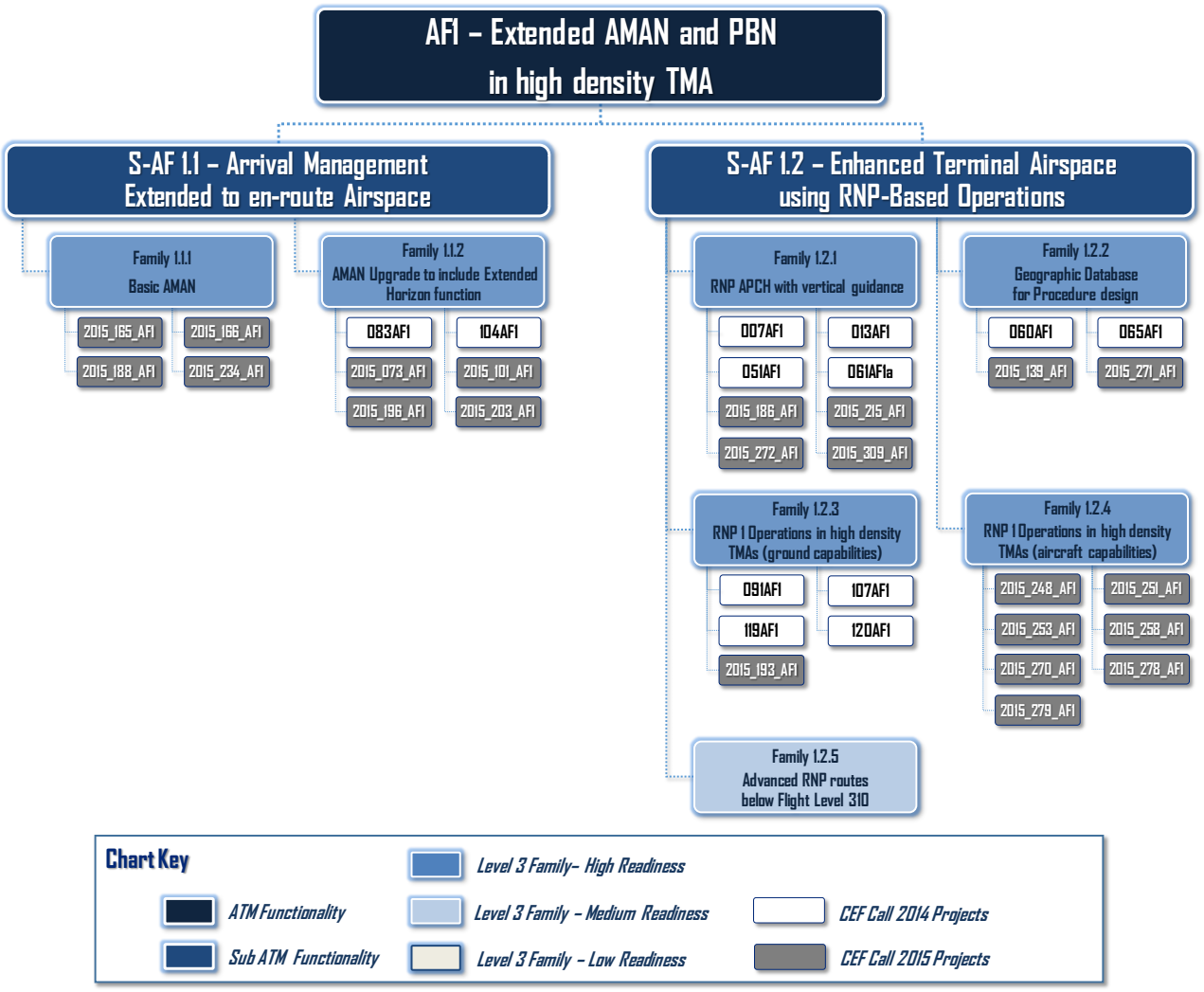


Fig. 15 – AF #1 Structure

The following Gantt chart shows the implementation roadmap for each Family included in AF1 in terms of start and end date of deployment, and it has been defined taking into account the target dates for each ATM Functionality and Sub-ATM Functionality, as stated in Regulation (EU) No 716/2014.

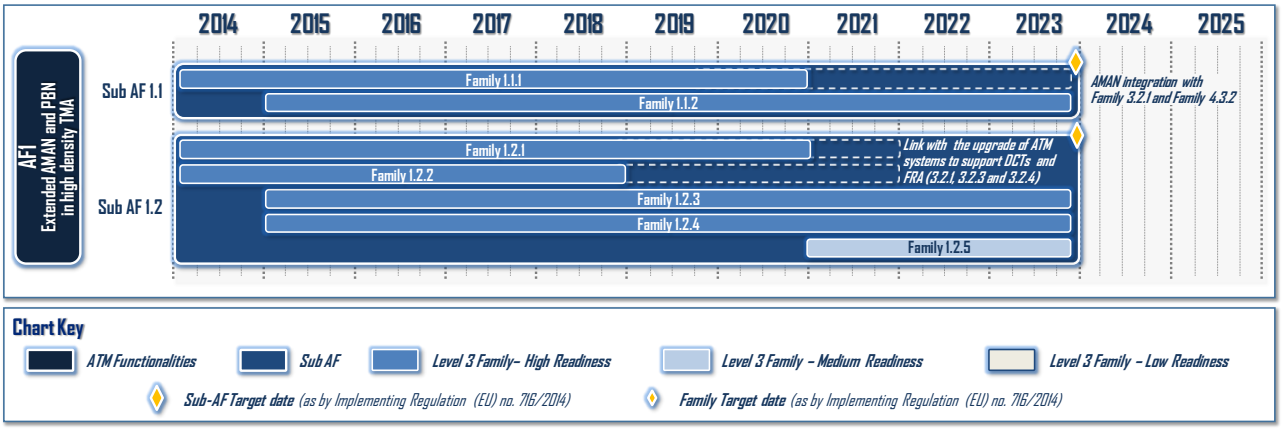


Fig. 16 – AF #1 Implementation Timeline

Family 1.1.1 – Basic AMAN

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

Description and Scope

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

Basic AMAN shall:

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

Interdependencies

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

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

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

Synchronization Needs

Ex-ante synchronization requirements, to be further assessed at the level of Local Implementation Projects. Integration with local ATM systems is necessary to process the flight plan and radar data, which requires defined interfaces to respective ATM system components (FDP, CWP, SDP)

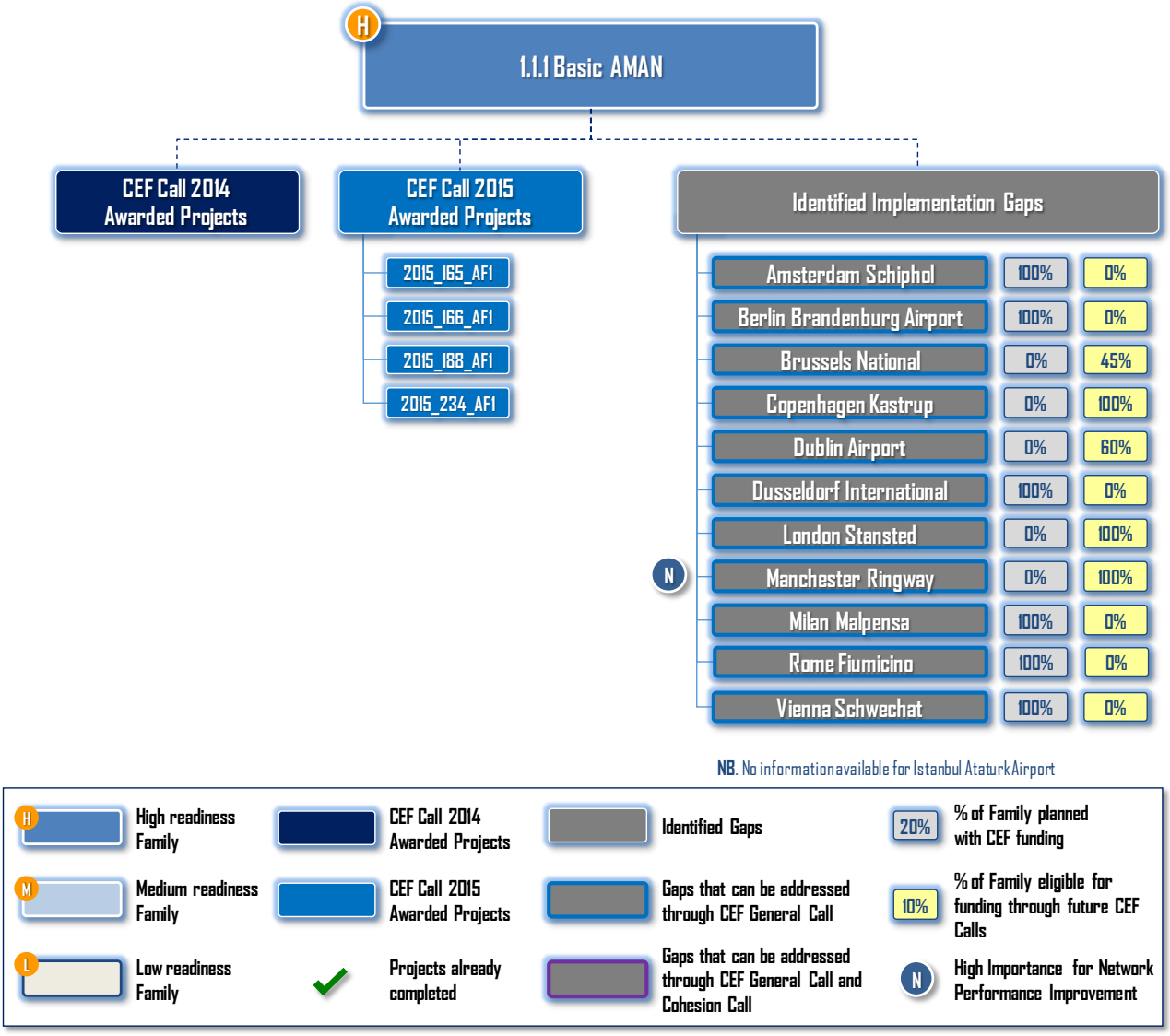
Civil / Military Coordination

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

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

Links to ICAO GANP ASBUs	B0-RSEQ (Improved Traffic Flow through Sequencing (AMAN/DMAN)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	TS-0102 Available
	ATM Master Plan Level 3 (Edition 2016)	ATC07.1
SESAR Solutions	N/A	
Very Large Scale Demonstrations	N/A	
Guidance Material / Specifications / Standards	Arrival Manager - Implementation Guidelines and Lessons Learned; Edition 0.1, 17/12/2010	
Means of compliance and / or Certification	None	
Regulations	None	
Cyber security requirements	None	
Recommendation for IPs proposal	Where deemed necessary for operational or organizational reasons, Basic AMAN may be implemented as an intermediate step towards Extended AMAN. It is recommended to take into consideration the results of Gap Analysis, as reported in the following WBS and within section 5.1	
Deployment Approach	The implementation of the Family would require the upgrade of the existing system and/or the installation of an AMAN planning tool supporting applicable sequencing procedures. Such installation would require a final acceptance of the tool and the integration with other existing systems **(MM1 – Installation and Integration)**.The applicable concept of operations shall also be broken down into documented and approved work procedures **(MM2 – Procedures available)**. The elaboration of such operational procedures could also require that the airspace structure and adjacent airports are taken into duly consideration. Before the start of the operational use of the AMAN planning tool, a safety assessment shall be performed successfully **(MM3 – Safety Assessment)** and all operational/technical staff involved shall be duly trained **(MM4 – Training)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM5 – Implementation completed)**.	

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



A dedicated table within Annex A encompasses the list of implementation initiatives associated to Family 1.1.1 awarded in the framework of 2015 CEF Call, along with a more detailed description of each Implementation Project. No Implementation Project associated to this Family has been awarded in 2014 CEF Call.

Family 1.1.2 – AMAN upgrade to include Extended Horizon function

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

Description and Scope

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

Arrival Management extended to en-route Airspace extends the AMAN horizon from the 100-120 nautical miles to 180-200 nautical miles from the arrival airport. Traffic sequencing/metering may be conducted in the en-route before top-of-decent, thus allowing the flight crew to optimise the flight profile.

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

Air Traffic Control (ATC) services in the TMAs implementing AMAN operations shall coordinate with Air Traffic Services (ATS) units responsible for adjacent en-route sectors. Input data to Extended AMAN need to be provided by the most accurate trajectory prediction information available (including EFD, CPR, etc.).

It should be noted that "AMAN upgrade to include Extended Horizon function" includes aspects such as:

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

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

Interdependencies

Family 1.1.1: Basic AMAN is a facilitator.

Family 1.2.5: Advanced RNP routes below FL 310 facilitates stable and efficient sequencing through the whole arrival phase.

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

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

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

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

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

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

Synchronization Needs

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

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

Civil / Military Coordination

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

Stakeholders considered as gaps	ANSPs, Network Manager,	
Other stakeholders involved in the Family deployment	Airport Operators, Military Authorities	
Links to ICAO GANP ASBUs	B0-RSEQ Improved Traffic Flow through Sequencing (AMAN/DMAN) B1-RSEQ Improved Airport Operations through Departure, Surface and Arrival Management	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	TS-0305 Available TS-0305-A Available (SESAR Release 4)
	ATM Master Plan Level 3 (Edition 2016)	ATC15.1, ATC15.2
SESAR Solutions	#05 "Extended Arrival Management (AMAN) horizon"	
Very Large Scale Demonstrations	**Release 7**: PJ.25; PJ.31 **Release 8**: PJ.25; PJ.31 **Release 9**: PJ.25; PJ.31	

Guidance Material / Specifications / Standards	ICAO Guidance Manual on Airport Traffic Synchronisation (2018) ICAO Doc 9426 Air Traffic Services Planning Manual (2018) EUROCAE Standard covering the Extended horizon AMAN upstream coordination service (AMAN SWIM Service) (2017) AMAN Information Extension to En Route Sectors - Concept of Operations; Edition 1.0, 5/06/2009 Eurocontrol Concept of Operations for Network Manager Support to Advanced Arrival Management Edition 1.0; Edition date: 24/10/2014 ECTL AMAN implementation guidance documentation (2018) ECTL Specifications On-Line Data Interchange (OLDI) Ed. 4.2.
Means of compliance and / or Certification	None
Regulations	None
Cyber security requirements	None
Recommendation for IPs proposal	It is recommended that Extended AMAN is implemented directly, although Basic AMAN can be deployed as an intermediate step. Upstream ATS units are obliged to support the Extended AMAN functionality for the airports within the PCP geographical scope. It is recommended that these upstream ATS units participate in the relevant deployment projects to ensure an effective operation. It is recommended to take into consideration the results of Gap Analysis.
Deployment Approach	The implementation of the Family would require the upgrade of the existing system and/or installation of an Extended AMAN planning tool, supporting applicable sequencing procedures. Such installation would require a final acceptance of the tool and the integration with other existing systems. If applicable, data exchange with the Network Manager is envisaged and local coordination with the Military Authority should be performed, whether necessary **(MM1 – Installation and integration completed including information exchange)**. The applicable concept of operations shall also be broken down into documented and approved work procedures, also considering the proper coordination with Network Manager **(MM2 – Procedures Available)**. The elaboration of such operational procedures could also require that the airspace structure and adjacent airports are taken into duly consideration. Adjacent ATSUs within the Extended horizon shall implement appropriate functionality in their systems, deploy training and develop procedures to fully support extended arrival management in their sectors **(MM3 – Upstream ATSU Implementation completed).** Before the start of the operational use of the Extended AMAN planning tool, a safety assessment shall be performed successfully **(MM4 – Safety Assessment)** and all operational/technical staff involved shall be duly trained **(MM5 – Training)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM6 – Implementation completed)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.

Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 1.1.2 awarded in 2014 or 2015 CEF Calls, along with a more detailed description of each Implementation Project.

Family 1.2.1 – RNP APCH with vertical guidance

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

Description and Scope

Implementation of environmentally friendly procedures (noise and GHG emissions) for approach using PBN in high-density TMAs, as specified in RNP APCH (Lateral Navigation/Vertical Navigation (LNAV/VNAV) and Localizer Performance with Vertical guidance (LPV) minima). Implement approach procedures with vertical guidance APV/Baro and/or APV/SBAS. For RNP APCH, the Lateral and Longitudinal Total System Error (TSE) shall be +/− 0,3 nautical mile for at least 95 % of flight time for the Final Approach Segment and on-board performance monitoring, alerting capability and high integrity navigation databases are required. RNP APCH capability requires inputs from Global Navigation Satellite System (GNSS).

Vertical Navigation in support of APV may be provided by GNSS Satellite Based Augmentation System (SBAS), by barometric altitude sensors or by alternative technical performance based equivalent means particularly for State aircraft where the appropriate certification processes are available. Flight Crew training may be required for operational approval. If mixed mode of operation (RNP APCH procedures together with conventional APCH procedures) is offered, harmonized and best-practise procedures for non-equipped RNP-APCH aircraft across the PCP applicability area should be considered in order to minimize controller workload, aircrew training burden and standardize airport controllers training.

Interdependencies

Family 1.2.2: Geographical database

Synchronization Needs

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

Civil / Military Coordination

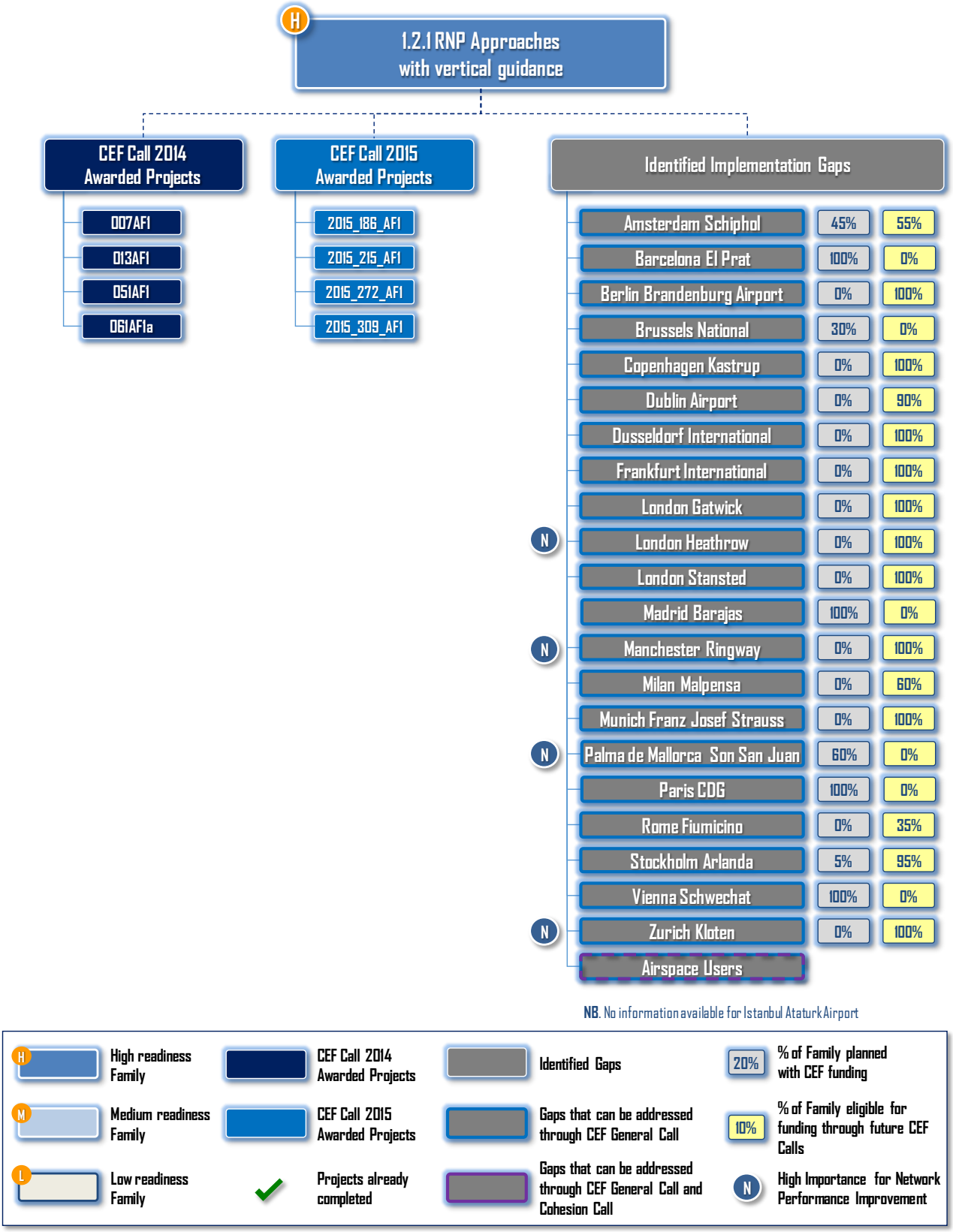
Coordination with military authorities (AU, ANSP, AD regulator) as required.

Stakeholders considered as gaps	ANSPs, Airport Operators, Airspace Users, Military Authorities (AU)

Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B0-APTA Optimization of Approach Procedures including Vertical Guidance	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AOM-0602 Available AOM-0604 Available AOM-0605 SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	NAV10
SESAR Solutions	#09 "Enhanced terminal operations with automatic RNP transition to ILS/GLS" #51 "Enhanced terminal operations with LPV procedures"	
Very Large Scale Demonstrations	**Release 7**: N/A **Release 8**: N/A **Release 9**: N/A	
Guidance Material / Specifications / Standards	ICAO Doc 9613 Performance-based Navigation Manual edition 4 ICAO Doc 9992 - Manual on the use of PBN in Airspace Design NOP 2014-2018/2019 ICAO Doc 8168 (PANS-OPS Vol. 1 & 2)	
Means of compliance and / or Certification	EASA RMT.0519 - Provision of requirements for airworthiness approval in support of global PBN operations in CS-ACNS EASA RMT.0445 - Technical requirement aSBASnd operation procedures for Airspace design including procedure design EASA AMC 20-28 (EGNOS) EASA AMC 20-27 (APV Baro)	
Regulations	PBN Regulation – EASA Opinion No 10/2016	
Cyber security requirements	None	
Recommendation for IPs proposal	Where RNP APCH procedures with vertical guidance are deployed, existing non-precision approach procedures should be considered for withdrawal. RNP Approach shall be implemented to all standard landing runways at airports within the PCP geographical scope. It is recommended to take into consideration the results of Gap Analysis.	
Deployment Approach	The implementation of the Family would require the design of RNP APCH procedures for all landing runways at the airport, also be taken into consideration that the coordination with the Military Authority should be performed, if deemed necessary **(MM1 – RNP APCH Procedure Design)**.	

	Such procedures shall then be duly validated, a safety assessment shall be performed and the Aeronautical Information System published **(MM2 – RNP APCH Procedure Validation, safety assessment and AIS publication)**. Once the public consultation has been finalised in accordance to the local regulation **(MM3 – Public Consultation)**, all operational and technical staff involved shall be duly trained **(MM4 – Training)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM5 – Implementation completed)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 1.2.1 awarded in 2014 or 2015 CEF Calls, along with a more detailed description of each Implementation Project.

Family 1.2.2 – Geographic Database for Procedure design

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

Description and Scope

Procurement/provision of geographic database to support procedure design including obstacle data as part of AIM.

The availability of an up-to-date and quality assured geographic database (including the obstacle items) of each TMA is a prerequisite to design new procedures such as RNP approaches.

Geographical databases could be used by AUs to validate procedures with regards to performance for different aircraft types.

PBN is in most cases based upon procedures including geographical positions expressed in latitude and longitude and not on radio beacons placed on ground, thus a geographical point will have a direct impact on safety and quality of navigation. A geographical point expressed in latitude and longitude can consist of up to 19 characters and the highest risk of introducing errors is when humans are handling this kind of information manually. Procedures and functions must be in place to ensure that the full chain from the originator of the information (land surveyor) to the database in the procedure design tools, the AIM databases and the on-board navigation databases is such that no errors are introduced.

Implementation of support procedures and functions to detect errors is one component in order to maintain the origin of the data and the quality attributes, but also secure means for communicating the geographical data is fundamental. Handling of latitude/longitude and other navigation data manually is not an option as the risk of introduction of errors is too high.

Interdependencies

Exchange of geographical data is included in AIM that is supposed to be a service within SWIM (AF5).

Synchronization Needs

Prerequisite for 1.2.1, 1.2.3 and 1.2.4.

Civil / Military Coordination

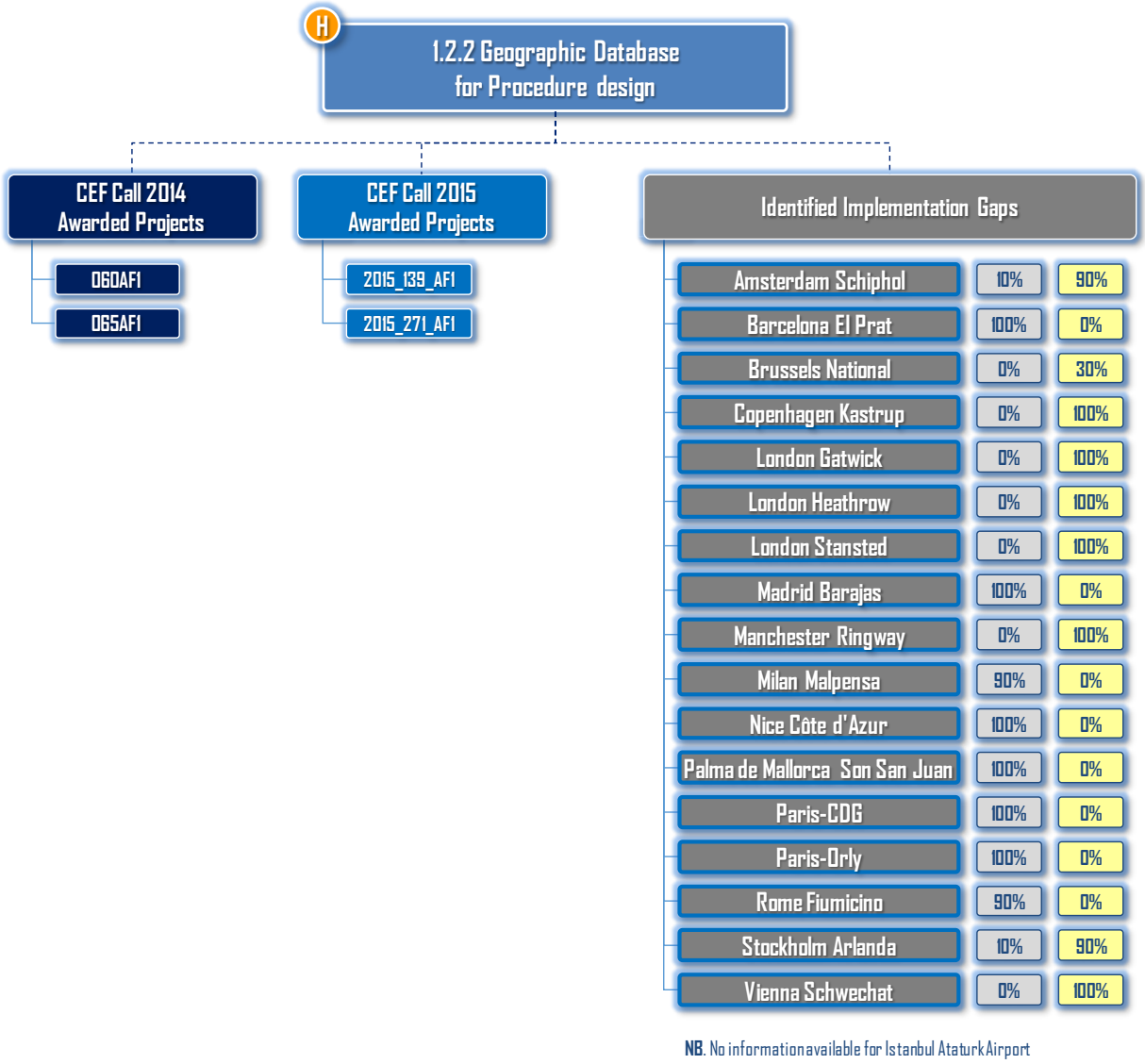
Coordination with military as required.

Stakeholders considered as gaps	ANSPs, Airport Operators

Other stakeholders involved in the Family deployment	Military Authorities	
Links to ICAO GANP ASBUs	B0-APTA Optimization of Approach Procedures including Vertical Guidance	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AOM-0602 Available AOM-0604 Available
	ATM Master Plan Level 3 (Edition 2016)	NAV10
SESAR Solutions	N/A	
Very Large Scale Demonstrations	N/A	
Guidance Material / Specifications / Standards	ICAO Doc 9613 Performance-based Navigation Manual ed. 4 ICAO Doc 9906 Quality assurance manual for flight procedure design ICAO Doc 9888 Noise Abatement Procedures ICAO Doc 9997 PBN Operational Approval Manual ICAO Doc 9992 Manual on the use of PBN in Airspace Design EUROCAE ED-76 / DO-200B ICAO Doc 8168 (PANS-OPS Vol. 1 & 2)	
Means of compliance and / or Certification	EASA Terrain Avoidance and Warning System (ETSO-C151B) EASA AMC/GM 2014/012R EASA RMT. 0477 - Technical requirements and operational procedures for aeronautical information services and aeronautical information management (2017)	
Regulations	EASA Opinion 02/2015, Technical requirements and operating procedures for the provision of data to airspace users for the purpose of air navigation Commission Regulation (EU). 73/2010 (ADQ IR) as amended by Commission Implementing Regulation (EU) 1029/2014 Commission Regulation (EU) No 139/2014 laying down requirements and administrative procedures related to aerodromes pursuant to Regulation (EC) No 216/2008	
Cyber security requirements	None	
Recommendation for IPs proposal	It is recommended to take into consideration the results of Gap Analysis.	
Deployment Approach	The implementation of the Family would require the upgrade of the existing system and/or installation of the Database tool, which would also need the data exchange functions to be	

	available. Such installation would require a final acceptance of the tool itself and the integration with other existing systems **(MM1 – Database tool created including data exchange functions)**, also taking into consideration that duly coordination with the Military Authority should be performed, as required. The Geographic Database shall be populated with the available geographical data, duly considering all the parameters to assure the quality of the data to be transferred **(MM2 – Database populated with quality assured data)**. Before the start of the operational use of the database, a safety assessment report shall be elaborated, delivered and approved **(MM3 – Safety Assessment)**, work procedures established and all the relevant staff shall be duly trained **(MM4 – Operational procedures established including training of staff)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM5 – Implementation completed)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 1.2.2 awarded in 2014 or 2015 CEF Calls, along with a more detailed description of each Implementation Project.

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

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

Description and Scope

Implementation of flexible and environmentally friendly procedures (noise and GHG emissions) for departure, arrival and initial approach using PBN/RNP in high density TMAs, as specified in RNP 1 specification with the use of the Radius to Fix (RF) path terminator for SIDs, STARs and transitions where benefits are evident for noise exposure, emissions and/or flight efficiency.

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

Enhance arrival/departure procedures in high-density TMAs to include RNP 1 defined SIDs, STARs providing higher efficiency and transitions with the use of the Radius to Fix (RF) attachment where there are opportunities to enhance flight efficiency, reduce noise exposure and/or emissions.

RNP 1 operations require the Lateral and Longitudinal Total System Error (TSE) to, be within +/− 1 nautical mile for at least 95 % of flight time and on-board performance monitoring, alerting capability and high integrity navigation databases. RNP 1 capability requires inputs from Global Navigation Satellite System (GNSS).

A redesign of TMA airspace may be required to take full advantage of the new flexible RNP based procedures independent of ground navigation aids.

Similarly, ATM systems upgrades should be considered for controller support tools such as MTCD, CDT, CORA etc, and safety nets like STCA, APW etc.

Where continuity of conventional navigation means is required alongside RNP1, issues related to mixed mode of operation (could include military/state aircraft, non-equipped aircraft) must be taken into account.

Interdependencies

Capability of ground systems and services should be synchronised with capability of aircraft and airspace users including military. PBN operations require availability of quality assured and accurate geographical data. See AF1 Family 1.2.2.

The implementation of PBN/RNP in High-Density TMAs should be coordinated as needed with implementation of PBN/RNP in adjacent airspace covered by Extended AMAN supporting stable and efficient sequencing. See Families 1.1.2 and 1.2.5.

Synchronization Needs

The deployment of PBN in high density TMAs shall be synchronized due to the potential network performance impact of delayed implementation in the airports within the geographical scope of PCP. Synchronization of deployment is a local issue and must

include all affected parties (ANSPs, airports, AUs and military).

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

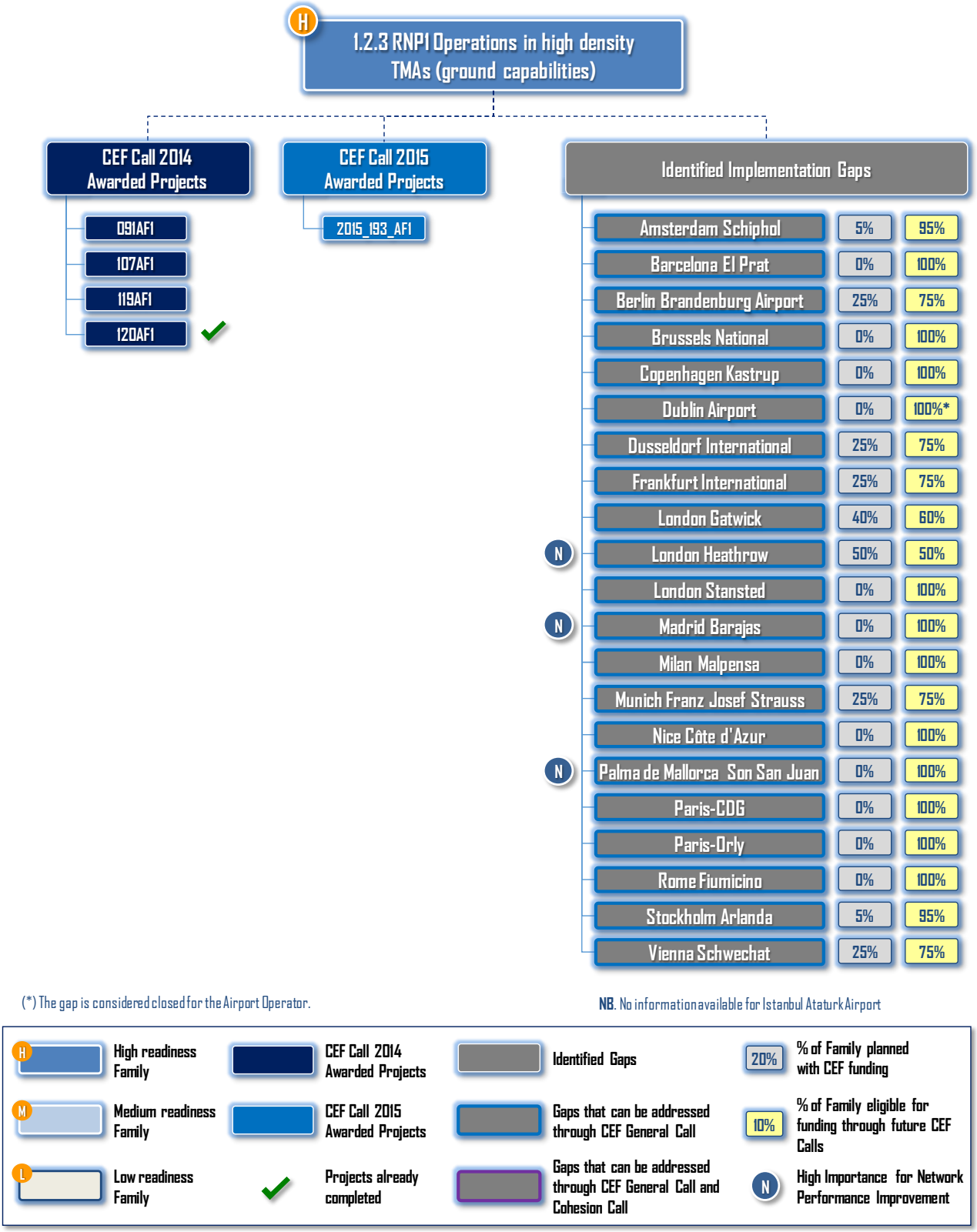
1.2.3, 1.2.4 and 1.2.5 should be coordinated and synchronised.

Civil / Military Coordination
Coordination with military authorities as required.

Stakeholders considered as gaps	ANSPs, Airport Operators	
Other stakeholders involved in the Family deployment	Military Authorities	
Links to ICAO GANP ASBUs	B0-FRTO Improved Operations through Enhanced En-route Trajectories B1-FRTO Improved Operations through Optimized ATS Routing B1-RSEQ Improved Airport Operations through Departure, Surface and Arrival Management	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AOM-0603 SESAR Release 2 AOM-0605 SESAR Release 5 AOM-0602 Available AOM-0601 Available
	ATM Master Plan Level 3 (Edition 2016)	NAV03
SESAR Solutions	#62 "P-RNAV in a complex TMA" #09 "Enhanced terminal operations with automatic RNP transition to ILS/GLS" #51 "Enhanced terminal operations with LPV procedures"	
Very Large Scale Demonstrations	**Release 7:** N/A **Release 8:** N/A **Release 9:** N/A	
Guidance Material / Specifications / Standards	ICAO Doc 9613 - Performance-based Navigation Manual ed. 4 ICAO Doc 9992 Manual on the use of PBN in Airspace Design ICAO Doc 8168 (PANS-OPS Vol. 1 & 2)	

	ECTL European Airspace Concept Handbook for PBN Implementation; Edition 3.0 EUROCAE ED-76A / DO-200B ICAO Guidance Manual on Airport Traffic Synchronisation (2018) ICAO Doc 9426 Air Traffic Services Planning Manual ICAO Doc 9689 Manual on Airspace Planning Methodology for the Determination of Separation Minima ICAO Doc 4444 PANS ATM, PBN Separation Standards (2018)
Means of compliance and / or Certification	EASA RMT.0445 - Technical requirement and operation procedures for Airspace design including procedure design
Regulations	PBN Regulation – EASA Opinion No 10/2016
Cyber security requirements	None
Recommendation for IPs proposal	It is recommended that implementation projects involve all major stakeholders concerning design, validation and public consultation of RNP1 procedures to achieve the full benefits. It is recommended to take into consideration the results of Gap Analysis.
Deployment Approach	The implementation of the Family would require the upgrade of the existing ATM systems and/or their installation. Such systems – Safety Nets being MTCD, STCA, CDT, CORA, etc – would also require the provision of their final acceptance and the integration with other existing systems considering that some of these components are included in Family 3.2.1 **(MM1 – ATM systems upgrade)**. Moreover, RNP1 routes to and from all landing and departure runways shall be designed, duly validated and their safety appropriately assessed **(MM2 – RNP Procedure Design and validation and safety assessment)**. While performing such activities, it should be taken into consideration that the the proper coordination with the Military Authority shall be performed, as required. RNP1 Procedures shall then be published for all runways **(MM3 – RNP AIS Implementation (publication))**, and, once the public consultation has been finalised in accordance to the local regulation **(MM4 – Public consultation)**, all operational and technical staff shall be appropriately trained **(MM5 – Training)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM6 – Implementation completed)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 1.2.3 awarded in 2014 or 2015 CEF Calls, along with a more detailed description of each Implementation Project.

Family 1.2.4 – RNP1 operations in high density TMAs (aircraft capabilities)

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

Description and Scope

Implementation of flexible and environmentally friendly procedures (noise and GHG emissions) for departure, arrival and initial approach using PBN/RNP in high density TMAs, as specified in RNP 1 specification with the use of the Radius to Fix (RF) path terminator for SIDs, STARs and transitions where benefits are evident for noise exposure, emissions and/or flight efficiency.

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

Enhance arrival/departure procedures in high-density TMAs to include RNP defined SIDs, STARs providing higher efficiency and transitions, and where benefits are evident with regards to noise exposure, flight efficiency and/or capacity, with the use of the Radius to Fix (RF) attachment.

RNP 1 operations require the lateral and longitudinal Total System Error (TSE) to, be within +/− 1 nautical mile for at least 95 % of flight time and on-board performance monitoring, alerting capability and high integrity navigation databases. RNP 1 capability requires inputs from Global Navigation Satellite System (GNSS).

Most new transport aircraft delivered today are PBN/RNP capable, but operational approval requires flight crew training and qualification/approval. To gain expected benefits from PBN/RNP procedures, a certain level of equipage/compliance rate is required amongst the majority of aircraft operating in a TMA and at an airport, subject to local considerations.

Retrofitting of transport-type military/state aircraft (including surveillance aircraft) and other RNP 1 non-compliant aircraft might be required or incentivised, subject to positive CBA and their contribution to performance targets. Alternative military technical performance based equivalent means should also be considered where the appropriate certification processes are available.

Interdependencies

Capability of ground systems and services should be synchronised with capability of the satellite based navigation function as required for aircraft and airspace users including military. PBN operations require availability of quality assured and accurate geographical data. See AF1, 1.2.2.

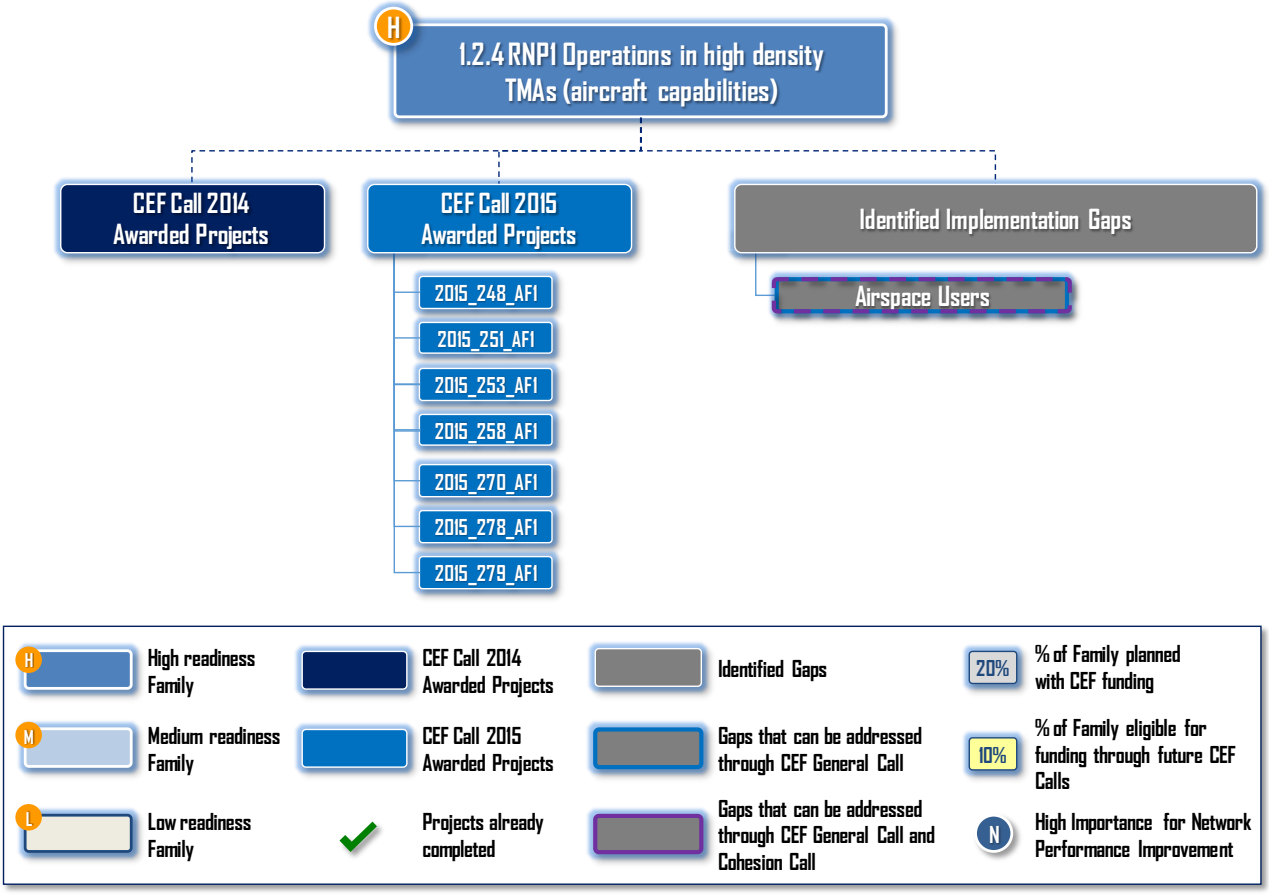
Synchronization Needs

The deployment of PBN in high density TMAs shall be coordinated due to the potential network performance impact of delayed implementation in the airports referred to in the geographical scope of PCP. Coordination of deployment of PBN procedures is a local

issue and must include all affected parties (ANSPs, airports, AUs and military). From a technical perspective, the adjustment/upgrade of ATM systems and procedural changes shall be synchronized with aircraft capabilities in order to ensure that the performance objectives are timely met. The synchronization of investments shall involve multiple airport operators ANSP and airspace users.		
Civil / Military Coordination		
N/A		
Stakeholders considered as gaps	Airspace Users, Military Authorities (AUs role)	
Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B0-FRTO Improved Operations through Enhanced En-route Trajectories B1-FRTO Improved Operations through Optimized ATS Routing B1-RSEQ Improved Airport Operations through Departure, Surface and Arrival Management	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AOM-0603 SESAR Release 2 AOM-0605 SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	NAV03
SESAR Solutions	#62 "P-RNAV in a complex TMA" #09 "Enhanced terminal operations with automatic RNP transition to ILS/GLS" #51 "Enhanced terminal operations with LPV procedures"	
Very Large Scale Demonstrations	**Release 7:** N/A **Release 8:** N/A **Release 9:** N/A	
Guidance Material / Specifications / Standards	ICAO 9613 Performance-based Navigation Manual edition 4 EUROCAE ED-76A / DO-200B	
Means of compliance and / or Certification	EASA RMT.0519 - Provision of requirements for airworthiness approval in support of global PBN operations in CS-ACNS	
Regulations	PBN Regulation – EASA Opinion No 10/2016	

Cyber security requirements	None
Recommendation for IPs proposal	It is recommended to take into consideration the results of Gap Analysis.
Deployment Approach	The implementation of the Family would require the commercial availability of a certified technical solution **(MM1 – Availability of technical solutions for aircraft types in operation)**. Procurement of suitable equipment for the aircraft shall be completed **(MM2 – Equipment procurement)**. Aircraft shall be equipped and flight crew shall be duly trained **(MM3 – Aircraft equipped and training of pilots)**. The execution of such activities is expected to lead the start of permanent operational use **(MM4 – Implementation completed)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



A dedicated table within Annex A encompasses the list of implementation initiatives associated to Family 1.2.4 awarded in the framework of 2015 CEF Call, along with a more detailed description of each Implementation Project. No Implementation Project associated to this Family has been awarded in 2014 CEF Call.

Family 1.2.5 – Advanced RNP routes below FL 310

1.2.5 – Advanced RNP routes below Flight Level 310			
Main Sub-AF	S-AF 1.2 Enhanced TMA using RNP-Based Operations		
Readiness for implementation	Medium		
Initial Operational Capability	01/01/2021	**Full Operational Capability**	01/01/2024

Description and Scope

Connectivity between Free Route Airspace and TMAs through the implementation of Advanced RNP routes below FL 310. In case Free route is not implemented below flight level 310, the implementation of PBN routes covered by Advanced RNP specification should be considered to link the TMAs with the lower limit of the FRA in those areas where it can provide increased performance benefits (safety, capacity, environmental impact, cost effectiveness, etc). The intention is to provide consistent navigation from en-route to landing. The most appropriate PBN type and navigation application/accuracy should be chosen depending on the actual local situation.

Aircraft and crew need to be Advanced RNP en-route capable and approved.

Aircraft capabilities may require upgrades either as retro-fit or forward fit. Retrofitting of non RNP capable aircraft might be required or incentivised, subject to positive CBA. For military/state aircraft, compliance with RNP may also be based on alternative technical performance based equivalent means. In a PBN environment, procedures shall be in place to handle non equipped aircraft where the appropriate certification processes are available. PBN routes structure below FL 310 should be properly coordinated with NM according to the standard process for CACD database validation.

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

Interdependencies

Family 1.1.2: AMAN upgrade to include Extended Horizon function

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

Family 1.2.4: RNP 1 Operations in high density TMAs (aircraft capabilities)

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

Family 3.2.4: Free Route Airspace

Synchronization Needs

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

Civil / Military Coordination

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

Stakeholders considered as gaps	ANSPs, Network Manager, Military Authorities	
Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B0-FRTO Improved Operations through Enhanced En-route Trajectories B1-FRTO Improved Operations through Optimized ATS Routing	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AOM-0603 SESAR Release 2 AOM-0404 SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	NAV03 – Pending developments of the PBN Implementing Regulation
SESAR Solutions	#62 "P-RNAV in a complex TMA" #10 Optimised Route Network using Advanced RNP	
Very Large Scale Demonstrations	**Release 7:** N/A **Release 8:** N/A **Release 9:** N/A	
Guidance Material / Specifications / Standards	Network Strategy Plan (NSP): SO 3/2 and SO 3/3 ICAO Doc 9613 Performance-based Navigation Manual edition 4 ICAO PANS ATM for RNAV/RNP, BRNAV ICAO Doc 9992 Manual on the use of PBN in Airspace Design ICAO Doc 8168 (PANS-OPS Vol. 1 & 2) EUROCAE ED-76A / DO-200B ICAO Doc 9426 Air Traffic Services Planning Manual ICAO Doc 9689 Manual on Airspace Planning methodology for the Determination of Separation Minima ICAO Doc 4444 PANS ATM, PBN Separation Standards (2018)	
Means of compliance and / or Certification	EASA RMT.0445 - Technical requirement and operation procedures for Airspace design including procedure design EASA RMT.0519 - Provision of requirements for airworthiness approval in support of global PBN operations in CS-ACNS	
Regulations	PBN Regulation – EASA Opinion No 10/2016	
Cyber security requirements	None	

Recommendation for IPs proposal	It is recommended to take into consideration the results of Gap Analysis.
Deployment Approach	The implementation of the Family would require the upgrade of the existing ATM systems and/or their installation. Such systems – Safety Nets being MTCD, STCA, CDT, CORA, APW, MSAW and FDP and CWP, etc – would also require the provision of their final acceptance and the integration with other existing systems, also considering that some of these components are included in Family 3.2.1 **(MM1 – ATM systems upgrade)**. Advanced RNP routes below Flight Level 310 shall be designed, duly validated and their safety appropriately assessed, also coordinating such activities with the Military Authority, as required **(MM2 – RNP Procedure Design and validation and safety assessment)**. In this respect, in order to accommodate a vertical profile, consideration should be given to the performance of representative aircraft and the effects produced by winds. Advanced RNP AIS procedures, including routes to and from all TMA entry/exit points, shall be published **(MM3 – RNP AIS Implementation (publication))** and all operational and technical staff shall be appropriately trained **(MM4 – Training)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM5 – Implementation completed)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.

M
1.2.5 Implement Advanced RNP routes below Flight Level 310
CEF Call 2014 Awarded Projects
CEF Call 2015 Awarded Projects
Identified Implementation Gaps
Amsterdam Schiphol 20% 80%
Barcelona El Prat 0% 100%
Berlin Brandenburg Airport 20% 80%
Brussels National 0% 100%
Copenhagen Kastrup 0% 100%
Dusseldorf International 20% 80%
Frankfurt International 20% 80%
London Gatwick - -
N London Heathrow - -
London Stansted - -
N Madrid Barajas 0% 100%
N Manchester Ringway - -
Milan Malpensa 0% 100%
Munich Franz Josef Strauss 20% 80%
Nice Côte d'Azur 0% 100%
Oslo Gardermoen 0% 100%
N Palma de Mallorca Son San Juan 0% 100%
Paris-CDG 0% 100%
Paris-Orly 0% 100%
Rome Fiumicino 0% 100%
Stockholm Arlanda 0% 100%
Vienna Schwechat 0% 100%
N Zurich Kloten 0% 100%
Network Manager 0% 65%
NB. No information available for Istanbul Ataturk Airport
H High readiness Family
M Medium readiness Family
L Low readiness Family
CEF Call 2014 Awarded Projects
CEF Call 2015 Awarded Projects
Projects already completed
Identified Gaps
Gaps that can be addressed through CEF General Call
Gaps that can be addressed through CEF General Call and Cohesion Call
20% % of Family planned with CEF funding
10% % of Family eligible for funding through future CEF Calls
N High Importance for Network Performance Improvement

AF #2 – Airport Integration and Throughput

Airports are the nodes of the air-traffic network in Europe. It is therefore of great importance to achieve a seamless integration of airports in the pan-European network management and to ensure that airports do not become bottlenecks, limiting the capacity of the European ATM-system.

The Pilot Common Project, set forth in Regulation (EU) No 716/2014, identifies 25 airports that are critical to the network, either because they play a significant role for the air-transport in their region or because they are located in a high-density Terminal Manoeuvring Area (TMA).

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

Together with aspects from other AFs (mainly AF1– Extended AMAN and PBN in high density TMA, AF4 – Network Collaborative Management, and AF5 – Initial SWIM), the objectives of AF2 shall be achieved through the following Sub-AFs and related Families:

Sub-AF 2.1 Departure Management synchronised with Pre-Departure Sequencing

- Family 2.1.1 – Initial DMAN
- Family 2.1.2 – Electronic Flight Strips (EFS)
- Family 2.1.3 – Basic A-CDM
- Family 2.1.4 – Initial Airport Operations Plan (AOP)

Sub-AF 2.2 Departure Management integrating Surface Management Constraints

- Family 2.2.1 – A-SMGCS Level 1 and 2

Sub-AF 2.3 Time Based Separation for Final Approach

- Family 2.3.1 – Time Based Separation (TBS)

Sub-AF 2.4 Automated Assistance to Controller for Surface Movement Planning and Routing

- Family 2.4.1 – A-SMGCS Routing and Planning Functions

Sub-AF 2.5 Airport Safety Nets

- Family 2.5.1 – Airport Safety Nets associated with A-SMGCS (Level 2)
- Family 2.5.2 – Vehicle and aircraft systems contributing to Airport Safety Nets

The following chart highlights the overall structure of the ATM Functionality #2, namely its SUB AFs, Families and their relevant Implementation initiatives related to both 2014 CEF Call awarded projects and 2015 CEF Call candidate projects.

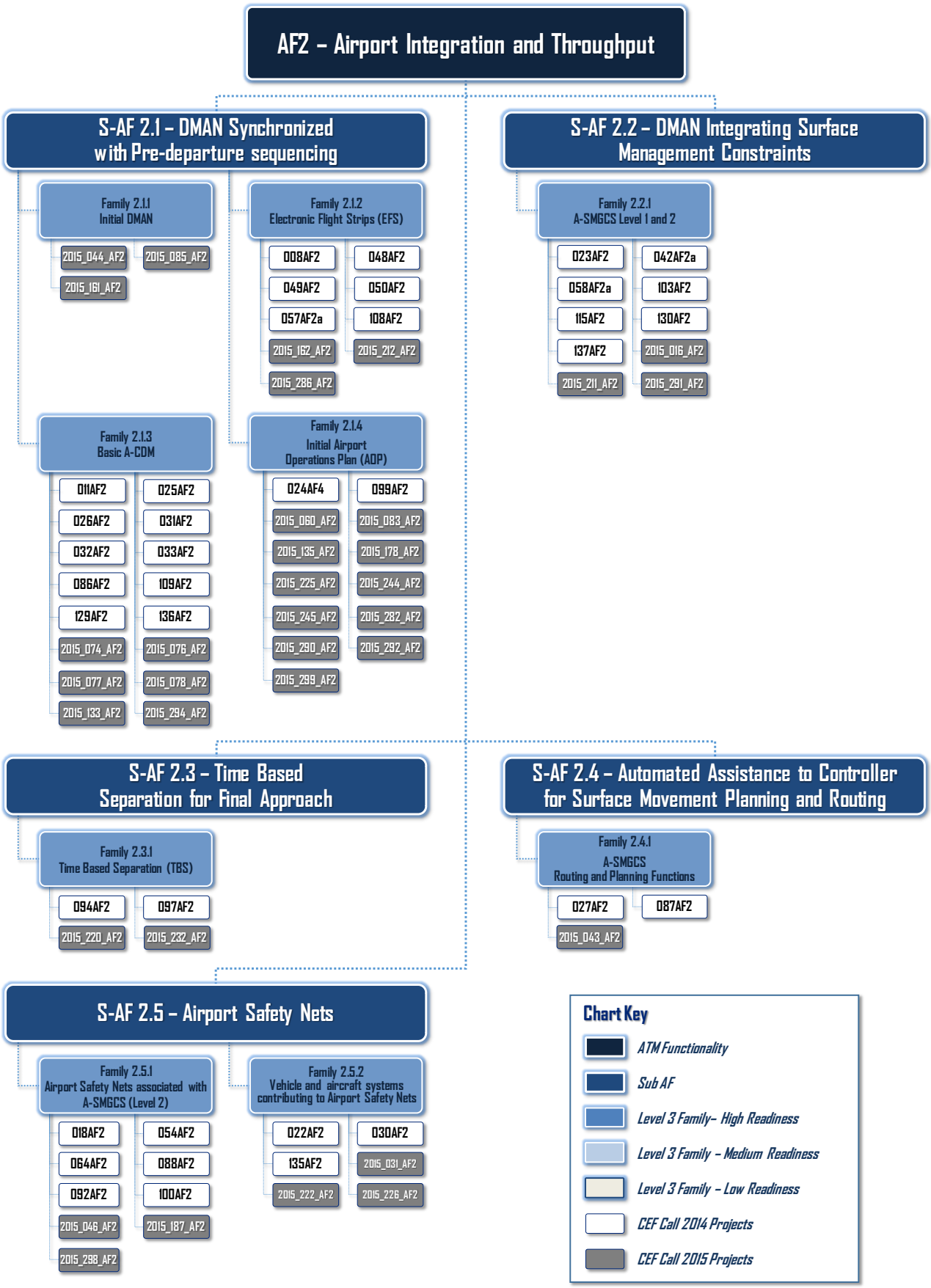
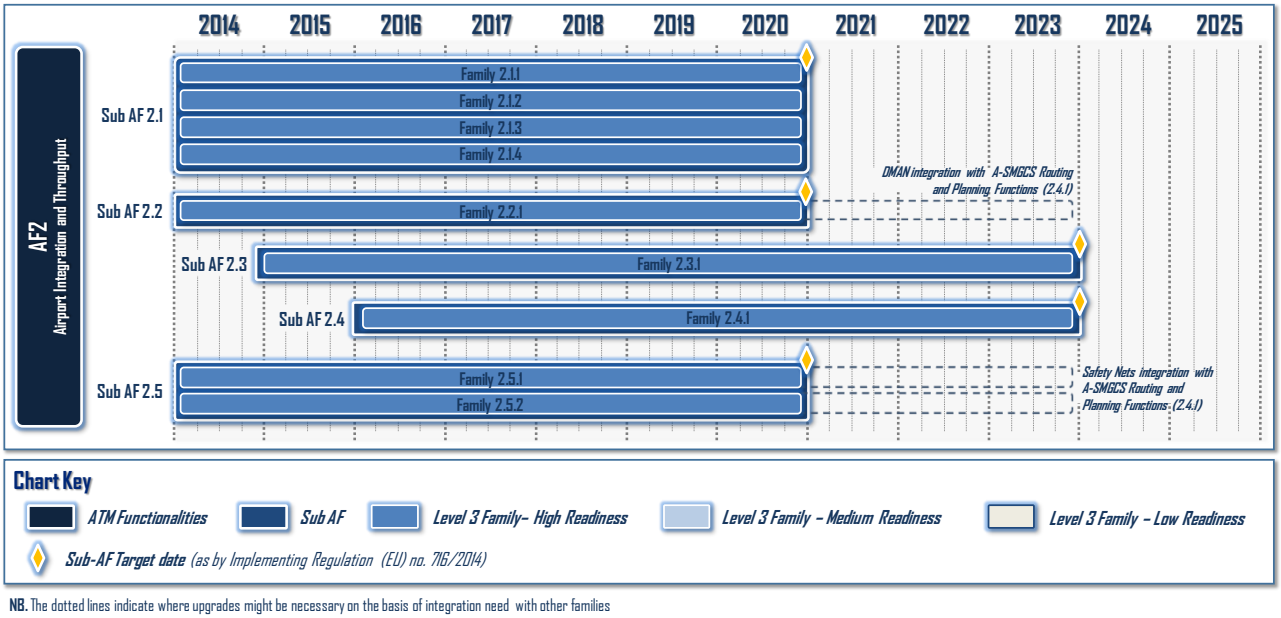


Fig. 17 – AF #2 Structure

The following Gantt chart shows the implementation roadmap for each Family included in AF2 in terms of start and end date of deployment, and it has been defined taking into account the target dates for each ATM Functionality and Sub-ATM Functionality, as stated in Regulation (EU) No 716/2014.



NB. The dotted lines indicate where upgrades might be necessary on the basis of integration need with other families

Fig. 18 – AF #2 Implementation Timeline

Family 2.1.1 – Initial DMAN

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

Description and Scope

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

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

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

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

Interdependencies

Family 2.1.2 EFS

Family 2.1.3 A-CDM

Family 2.1.4 iAOP

Family 2.2.1 A-SMGCS level 1-2

Family 2.4.1 A-SMGCS Routing and Planning Functions

Synchronization Needs

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

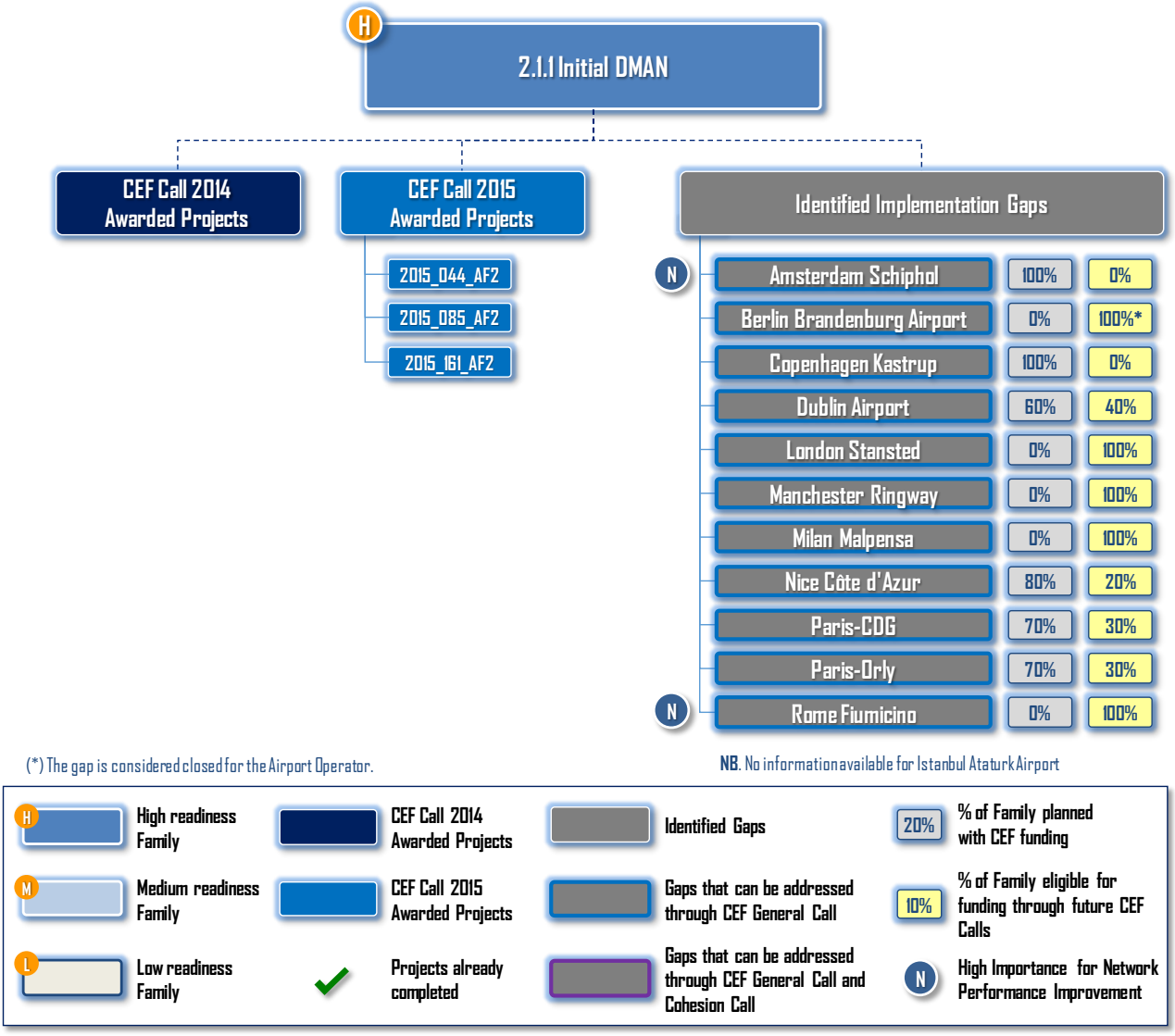
Civil / Military Coordination

Applicable to those airports open to civil and military operations

Stakeholders considered as gaps	ANSPs, Airport Operators	
Other stakeholders involved in the Family deployment	Airspace Users, Military Authorities, Ground Handling Companies	
Links to ICAO GANP ASBUs	B0-RSEQ (Improved Traffic Flow through Sequencing (AMAN/DMAN) B1-RSEQ Improved Airport Operations through Departure, Surface and Arrival Management	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AOM-0602 Available
	ATM Master Plan Level 3 (Edition 2016)	AOP05
SESAR Solutions	N/A	
Very Large Scale Demonstrations	N/A	
Guidance Material / Specifications / Standards	ED-141 Minimum Technical Specification for the Airport Collaborative Decision Making (Airport-CDM) ED-145 Airport-CDM Interface Specification ICAO Guidance Manual on Airport Traffic Synchronisation (2018) ICAO Doc 9426 Air Traffic Services Planning Manual (2018) ICAO Doc 9830 Advanced Surface Movement Guidance and Control Systems (A-SMGCS) Manual (2018) Updated ECTL Airport CDM Manual (2017) ECTL Airport CDM Implementation Manual Version 4	
Means of compliance and / or Certification	ETSI EN 303 212 (CS on A-CDM) ETSI Communication 2010/C168/04 A-CDM Community Specification Update on EN 303 212 v.1.1.1 (2019)	
Regulations	None	
Cyber security requirements	None	
Recommendation for IPs proposal	It is recommended to take into consideration the three following elements of S-AF2.1: Family 2.1.1, Family 2.1.3 and Family 2.1.4 which are necessary to achieve the "Departure Management Synchronised with Pre-departure sequencing". It is further recommended to take into consideration the results of Gap Analysis.	

Deployment Approach	The implementation of the Family would require the DMAN system to implement Target Take Off Time (TTOT) & Target Startup Approval Time (TSAT) **(MM1 – System implemented for TTOT and TSAT)** according to PDS principles, also taking into consideration all necessary constraints (such as runway holding time, slot adherence, departure routes, airspace user preferences, night curfew, evacuation of stand/gate for arriving aircraft, adverse conditions including de-icing, actual taxi/runway capacity, current constraints, inbound flights information, etc.). Such system shall then be integrated in the local environment with the Electronic Flight Strip systems, updated as well in order to properly support the DMAN **(MM2 – Integration in local environment with EFS)**. Before the start of the operational use, DMAN operational procedures shall be elaborated and then published **(MM3 – Operational Procedures)**, all relevant staff shall be duly trained **(MM4 – Training)**, a safety assessment successfully performed and contextual report shall be made available **(MM5 – Safety assessment)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM6 – Implementation completed)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



A dedicated table within Annex A encompasses the list of implementation initiatives associated to Family 2.1.1 awarded in the framework of 2015 CEF Call, along with a more detailed description of each Implementation Project. No Implementation Project associated to this Family has been awarded in 2014 CEF Call.

Family 2.1.2 – Electronic Flight Strips (EFS)

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

Description and Scope

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

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

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

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

EFS shall support Airport Safety Nets.

Interdependencies

Family 2.1.1 Initial DMAN

Family 2.1.3 Basic A-CDM

Family 2.2.1 A-SMGCS Level 1 and 2

Family 2.3.1 Time Based Separation (TBS)

Family 2.4.1 A-SMGCS Planning and Routing Functions

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

Family 1.1.1 Basic AMAN

Family 1.1.2 AMAN Upgrade to include Extended Horizon function

Synchronization Needs

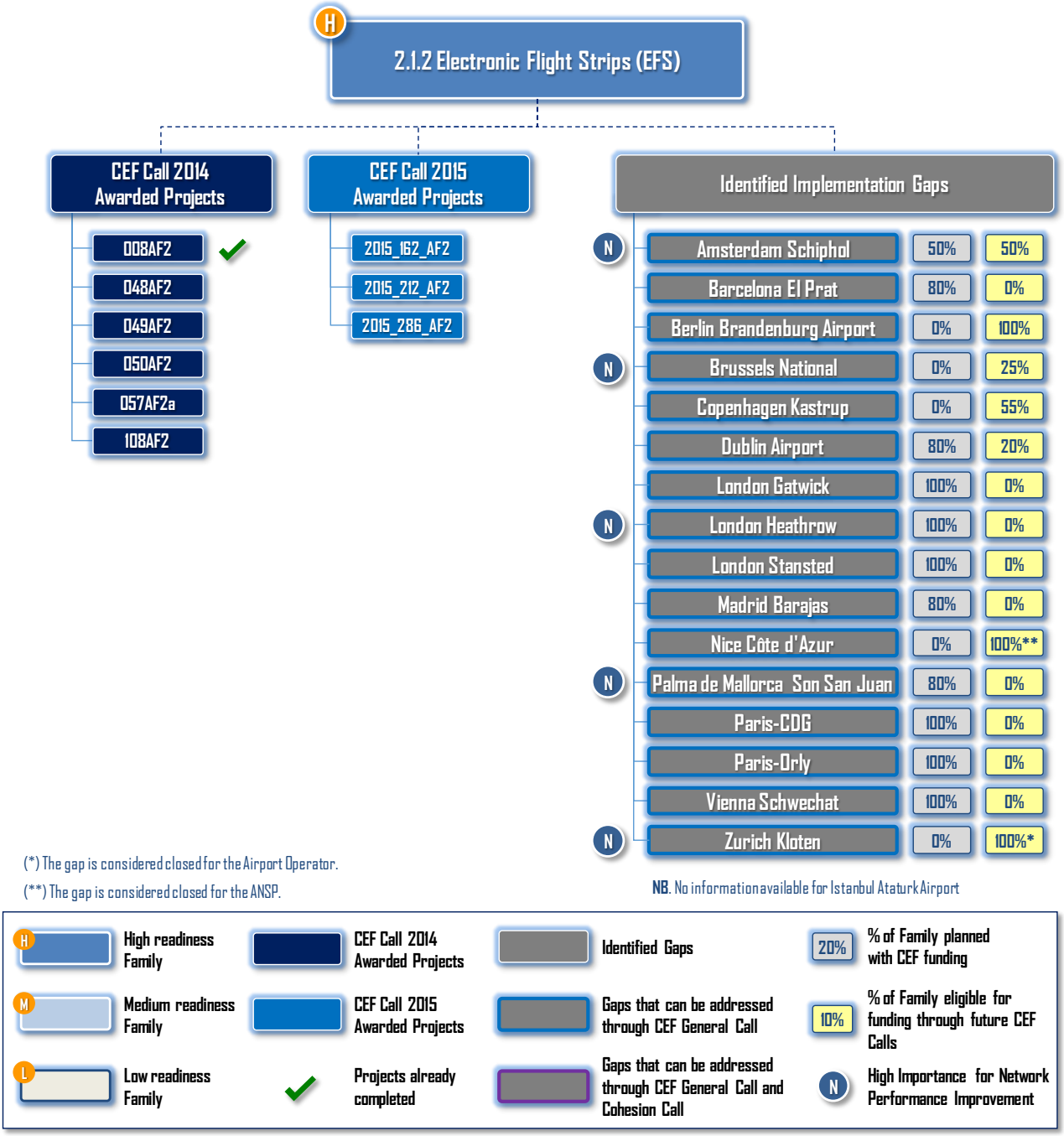
ANSPs, Airport Operators.

Civil / Military Coordination

Applicable to those airports open to civil and military operations

Stakeholders considered as gaps	ANSPs, Airport Operators	
Other stakeholders involved in the Family deployment	Military Authorities	
Links to ICAO GANP ASBUs	None	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AO-0201 (only AERODROME-ATC-36 enabler) Available
	ATM Master Plan Level 3 (Edition 2016)	AOP12
SESAR Solutions	N/A	
Very Large Scale Demonstrations	N/A	
Guidance Material / Specifications / Standards	None	
Means of compliance and / or Certification	None	
Regulations	None	
Cyber security requirements	None	
Recommendation for IPs proposal	This Family 2.1.2 is a pre-requisite for Families 2.4.1, 2.5.1 & 2.5.2, and could be seen as an enabler for Families 2.2.1 and 2.3.1. It is recommended to take into consideration the results of Gap Analysis.	
Deployment Approach	The deployment of the Family would require the implementation of the Electronic Flight Strips (EFS) in the tower; dedicated EFS shall also be installed in the apron and approach positions for the relevant airports **(MM1 – System support to basic procedures)**. In order for the system to be properly implemented, EFS Operational Procedures shall be elaborated and subsequently published **(MM2 – Operational Procedures)**, all relevant staff shall be duly trained **(MM3 – Training)**, a safety assessment shall be successfully performed and contextual report shall be made available **(MM4 – Safety assessment)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM5 – Implementation completed)**.	

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 2.1.2 awarded in 2014 or 2015 CEF Calls, along with a more detailed description of each Implementation Project.

Family 2.1.3 – Basic A-CDM

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

Description and Scope

A-CDM is the concept, which aims at improving operational efficiency at airports and improves their integration into the Air Traffic Flow and Capacity Management (ATFCM) by increasing information sharing and improving cooperation between all relevant stakeholders (local ANSP, airport operator, aircraft operators, NM, other airport service providers). Those elements allow the airport partners to achieve a common situational awareness and improve traffic event predictability.

The Airport CDM concept is built on the following elements:

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

Interdependencies

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

Synchronization Needs		
ANSPs, Airport Operators, Network Manager		
Civil / Military Coordination		
Applicable to those airports open to civil and military operations		
Stakeholders considered as gaps	ANSPs, Airport Operators	
Other stakeholders involved in the Family deployment	Airspace Users, Network Manager, Military Authorities, Ground Handling Companies	
Links to ICAO GANP ASBUs	B0-ACDM Improved Airport Operations through Airport-CDM B1-ACDM Optimized Airport Operations through A-CDM Total Airport Management B1-AMET Enhanced Operational Decisions through Integrated Meteorological Information (Planning and Near-term Service)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AO-0501 Available AO-0601 Available AO-0602 Available AO-0603 Available
	ATM Master Plan Level 3 (Edition 2016)	AOP05
SESAR Solutions	N/A	
Very Large Scale Demonstrations	N/A	
Guidance Material / Specifications / Standards	ED-141 Minimum Technical Specification for Airport-CDM ED-145 Airport CDM Interface Specification ED-146 Guidelines for Test and Validation related to A-CDM interoperability ECTL Airport CDM Implementation Manual Version 4 Updated ECTL CDM Manual ICAO Doc 9971 - Manual on Collaborative Air Traffic Flow Management (CDM part) ECTL Aeronautical Information Exchange Model v.5.1 FIXM 3.0 (Flight Information Exchange Model) ICAO Meteorological Information Exchange Model (IWXXM)	

	ICAO Doc 9971 - Manual on Collaborative Air Traffic Flow Management (3rd Part Airport CDM (2018) ICAO Doc 10003 - Manual on the digital exchange of aeronautical information ICAO Doc 8896 - Manual of Aeronautical Meteorological Practice ICAO Doc 9328 - Manual of Runway Visual Range Observing and Reporting Practices ICAO Doc 9377 - Manual on Coordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services ICAO Doc 9817 - Manual on Low-level Wind Shear ICAO Doc 9837 - Manual on Automatic Meteorological Observing Systems at Aerodromes
Means of compliance and / or Certification	ETSI EN 303 212 (CS on A-CDM) ETSI Communication 2010/C168/04 A-CDM Community Specification Update on EN 303 212 v1.1.1 (2019
Regulations	None
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them
Recommendation for IPs proposal	It is recommended to take into consideration the three following elements of S-AF2.1: F211, F213 and F214 which are necessary to achieve the "Departure Management Synchronised with Pre-departure sequencing". SDM therefore strongly recommends that all projects related to Basic A-CDM shall be completed as early as possible before the defined FOC Date of the Sub-AF to allow for the deployment of subsequent solutions. It is recommended to implement Family 2.1.3 as soon as possible since Airport CDM is part of the critical initiatives to resolve and mitigate the impacts of current capacity constraints and potential bottlenecks, which might hinder the overall performance at network level. It is recommended liaising between different stakeholders (both within the same stakeholder category and between different categories) to draft and present joint proposals in the framework of upcoming Calls. It is recommended to take into consideration the results of Gap Analysis.
Deployment Approach	The implementation of the Family would require to conduct an information sharing process in order to allow the airport and local partners to achieve a common situational awareness **(MM1 – Information sharing)**. Basic A-CDM implementation shall further be supported by the execution of all the elements of the A-CDM "Milestone Approach" described in the CDM Manual **(MM2**

	– A-CDM "Milestone Approach"), in conjunction with the fulfilment of all the elements of the "variabtimes", described in the A-CDM Manual as well **(MM3 – Variable taxi-times implementation)**. Furthermore, all measures whose implementation allows the mitigation of adverse situations (initial APOC, CDM cell, etc) shall be put into use **(MM4 – Adverse conditions implementation)**. Following the implementation of all elements of the "Flight Update Message" described in the CDM Manual and the FUM Implementation Guide **(MM5 – FUM Implementation)**, the application of all elements of the "Departure Planning Information" messages reported on the CDM Manual and the DPI Implementation Guide shall be performed **(MM6 – DPI Implementation)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM7 – Implementation completed)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.

Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 2.1.3 awarded in 2014 or 2015 CEF Calls, along with a more detailed description of each Implementation Project.

Family 2.1.4 – Initial Airport Operational Plan (AOP)

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

Description and Scope

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

The AOP is a single, common and collaboratively agreed rolling plan available to all airport stakeholders whose purpose is to provide common situational awareness and to form the basis upon which stakeholder decisions relating to process optimization can be made. The ATM stakeholders' planning processes and working methods are included in the AOP.

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

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

- Flight trajectory data: Information sharing related to Flight Progress Information Elements of an Inbound/Outbound/airport transit Trajectory to/from/at Airport.
- Airport Resources data: Airside and landside resources such as runway capacity & configuration, or parking stands.
- Local weather data: Information sharing related to MET Information Elements of airport.

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

Interdependencies

Family 2.1.1 Initial DMAN

Family 2.1.3 Basic A-CDM

Family 4.2.4 AOP/NOP Information Sharing

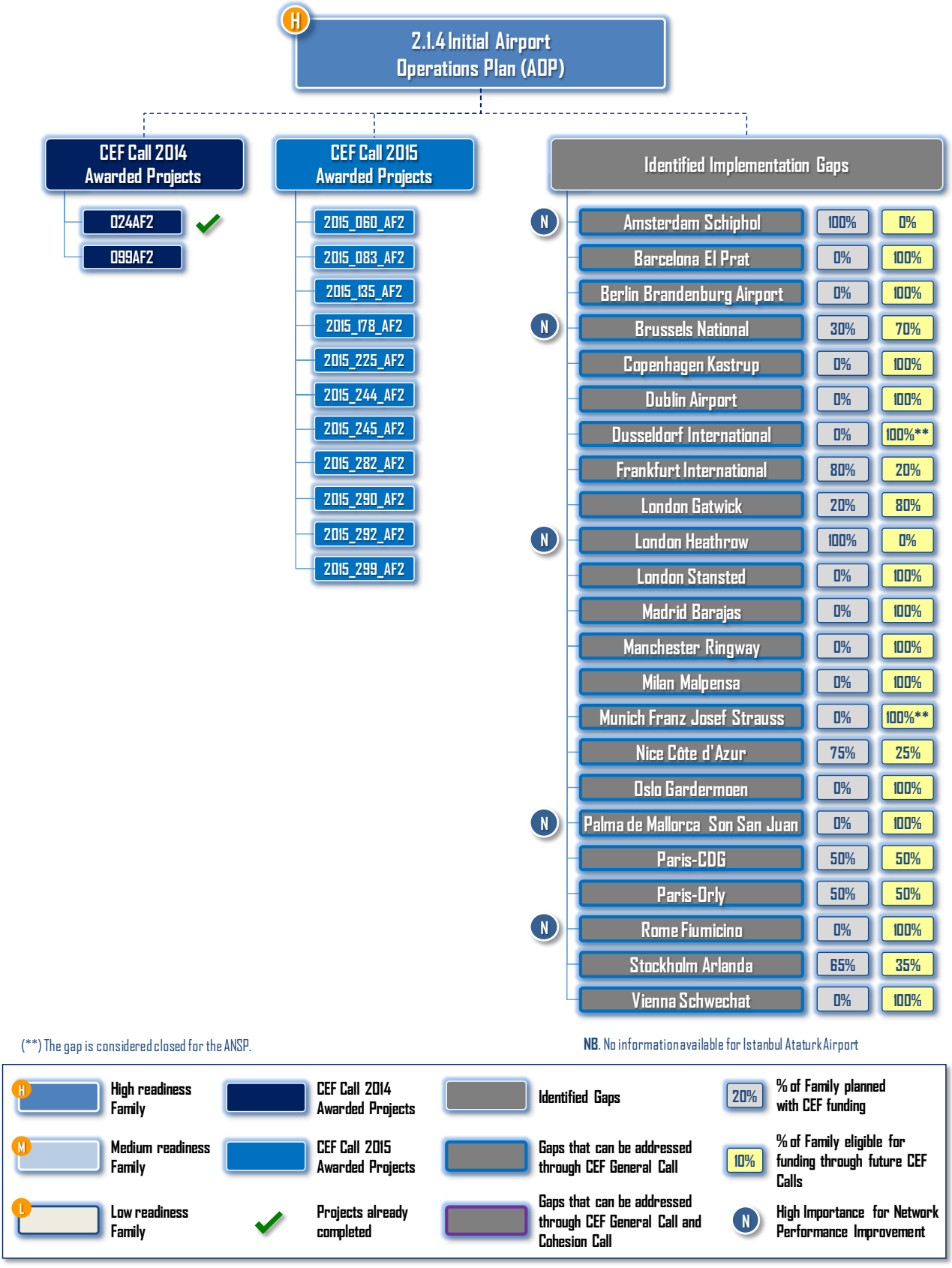
The full AOP implementation requires synchronisation with the NOP (see AF4 "interactive

Rolling NOP"). The implementation of this synchronisation is targeted by Family 4.2.4 "AOP/NOP information sharing". Family 5.3.1 Aeronautical Information Exchange / Service in support of A-CDM and iAOP Family 5.4.1 Upgrade / Implement Meteorological Information Exchange System / Service Family 5.5.1 Interface and data Requirements of AF4 NOP and of A-CDM and iAOP Family 5.6.1 Flight Information System / Service in support of A-CDM and iAOP		
Synchronization Needs		
ANSPs, Airport Operators.		
Civil / Military Coordination		
Applicable to those airports open to civil and military operations.		
Stakeholders considered as gaps	ANSPs, Airport Operators	
Other stakeholders involved in the Family deployment	Airspace Users, Military Authorities, Network Manager, MET Service Providers	
Links to ICAO GANP ASBUs	B1-ACDM Optimized Airport Operations through A-CDM Total Airport Management B1-AMET Enhanced Operational Decisions through Integrated Meteorological Information (Planning and Near-term Service) B1-RSEQ Improved Airport Operations through Departure, Surface and Arrival Management	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AO-0801-A (AIRPORT-03) SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	AOP11
SESAR Solutions	#21 Airport Operations Plan and AOP-NOP Seamless Integration	
Very Large Scale Demonstrations	**Release 7:** PJ. 28 **Release 8:** PJ. 28 **Release 9:** PJ. 28	
Guidance Material / Specifications / Standards	Updated ECTL Airport CDM Manual (2017) ECTL Airport CDM Implementation Manual Version 4 ICAO Guidance Manual on Airport Traffic Synchronisation (2018) ICAO Doc 9426 Air Traffic Services Planning Manual (2018) ICAO Doc 9830 Advanced Surface Movement Guidance and Control Systems (A-SMGCS) Manual (2018) ECTL Aeronautical Information Exchange Model v5.1	

	FIXM 3.0 Flight Information Exchange Model ICAO Meteorological Information Exchange Model (IWXXM) ICAO Doc 9971 Manual on Collaborative Air Traffic Flow Management (3rd Airport CDM) (2018) ICAO Doc 10003 Manual on the digital exchange of aeronautical information ICAO Doc 8896 Manual of Aeronautical Meteorological Practice ICAO Doc 9328 Manual of Runway Visual Range Observing and Reporting Practices ICAO Doc 9377 Manual on Coordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services ICAO Doc 9817 Manual on Low-level Wind Shear ICAO Doc 9837 Manual on Automatic Meteorological Observing Systems at Aerodromes
Means of compliance and / or Certification	ETSI EN 303 212 (CS on A-CDM) ETSI Communication 2010/C168/04 A-CDM Community Specification Update on EN 303 212 v1.1.1 (2019
Regulations	None
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them
Recommendation for IPs proposal	Family 2.1.4 can be considered as pre-requisite to Family 4.2.4, hence should be implemented as soon as possible not waiting for Family 4.2.4 to be ready/completed. Family 2.1.4 can also be seen as an extension of the Airport Operational Database. It is recommended to take into consideration the three following elements of S-AF2.1: F211, F213 and F214 which are necessary to achieve the "Departure Management Synchronised with Pre-departure sequencing". It is recommended to implement Family 2.1.4 as soon as possible since Initial AOP is part of the critical initiatives to resolve and mitigate the impacts of current capacity constraints and potential bottlenecks, which might hinder the overall performance at network level. It is recommended liaising between different stakeholders (both within the same stakeholder category and between different categories) to draft and present joint proposals in the framework of upcoming Calls. It is recommended to take into consideration the results of Gap Analysis.
Deployment Approach	The implementation of the Family would require the process of information sharing related to Flight Progress Information

	Elements of an inbound / outbound airport transit Trajectory to / from / at the airport, as described in the OFA 05.01.01 document **(MM1 – Flight trajectory data implementation)**. The Initial Airport Operations Plan (AOP) deployment would also need the installation of the necessary airside and landside resources, such as runway capacity, runway configuration and parking stands **(MM2 – Airport resources data implementation)**. Moreover, and information sharing process related to MET Information Elements of Airport, as outlined in the OFA 05.01.01 document, shall be duly performed **(MM3 – Local weather data implementation)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM4 – Implementation completed)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 2.1.4 awarded in 2014 or 2015 CEF Calls, along with a more detailed description of each Implementation Project.

Family 2.2.1 – A-SMGCS level 1 and 2

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

Description and Scope

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

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

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

Traffic will be controlled through the use of appropriate procedures allowing the issuance of information and clearances to traffic on the basis of A-SMGCS level 1 surveillance data. A-SMGCS level 2 is a level 1 system complemented by the A-SMGCS function to detect potential conflicts on runways, taxiways and intrusions into restricted areas and provide the controllers with appropriate alerts.

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

Interdependencies

Family 2.1.1 Initial DMAN

Family 2.1.2 Electronic Flight Strips (EFS)

Family 2.1.3 Basic A-CDM

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

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

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

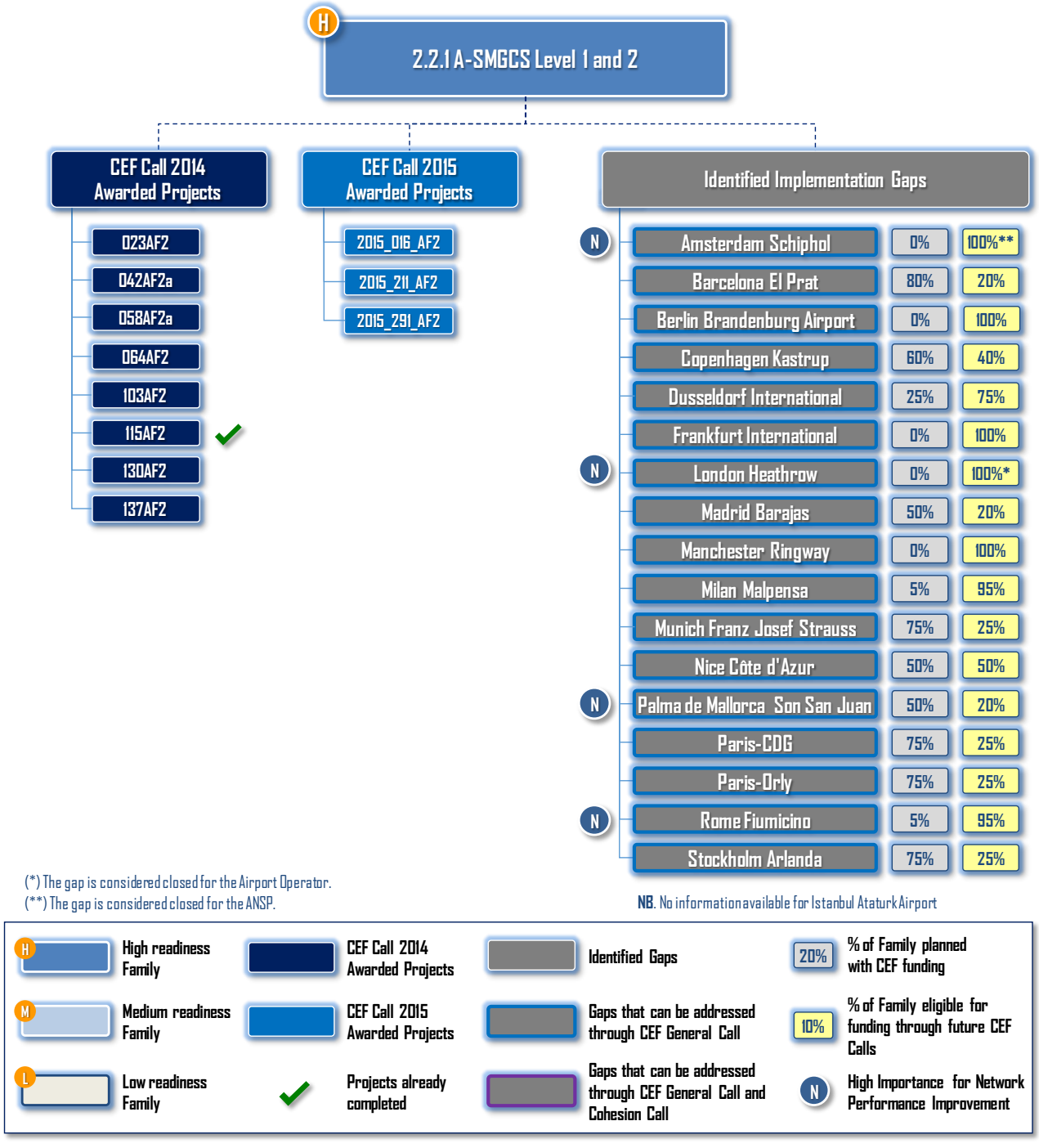
- Airport Conformance Monitoring shall integrate A-SMGCS Surveillance data (Family 2.2.1), Surface Movement Routing and Planning (Family 2.4.1) and controller routing clearances.
- A-SMGCS shall include a function to generate and distribute the appropriate alerts. These alerts shall be implemented as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

Synchronization Needs		
ANSPs and Airport Operators.		
Civil / Military Coordination		
Applicable to those airports open to civil and military operations		
Stakeholders considered as gaps	ANSPs, Airport Operators	
Other stakeholders involved in the Family deployment	Military Authorities	
Links to ICAO GANP ASBUs	B0-ASUR Initial Capability for Ground Surveillance B0-SURF Safety and Efficiency of Surface Operations (A-SMGCS Level 1-2) B1-RSEQ Improved Airport Operations through Departure, Surface and Arrival Management	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AO-0201 Available AO-0102 Available
	ATM Master Plan Level 3 (Edition 2016)	AOP04.1, AOP04.2
SESAR Solutions	N/A	
Very Large Scale Demonstrations	N/A	
Guidance Material / Specifications / Standards	ED-87C EUROCAE A-SMGCS MASPS EUROCAE Update of ED-87C to include the new functions routing and planning and additional safety nets ED-87D (2017) EUROCAE ED-117A MOPS for MLAT EUROCAE ED 116-A MOPS for Surface Movement Radar Sensor Systems for Use in A-SMGCS (2019) EUROCAE ED 128-A Guidelines for Surveillance Data Fusion in A-SMGCS (2018) Updated ECTL A-SMGCS Manual ICAO Doc 9830 A-SMGCS Manual, First Edition ICAO Guidance Manual on Airport Traffic Synchronisation (2018) ICAO Doc 9426 Air Traffic Services Planning Manual (2018)	

	ICAO Doc 9830 Advanced Surface Movement Guidance and Control Systems (A-SMGCS) Manual (2018) ED-102A/DO-260B MOPS for 1090 MHz Extended Squitter Automatic Dependent Surveillance – Broadcast (ADS-B) and Traffic Information Services – Broadcast (TIS-B) ICAO Doc 9871 Technical Provisions for Mode S Services and Extended Squitter EUROCAE ED-163 Safety, Performance and Interoperability Requirements document for ADS-B Airport Surface surveillance application (ADS-B APT) ICAO Doc 7030/5 (EUR/NAT) Regional Supplementary Procedures, Section 6.5.6 and 6.5.7 ICAO Doc 9924 Aeronautical Surveillance Manual
Means of compliance and / or Certification	A-SMGCS; Part 1: Community Specification (EN 303 213-1-1) Update of EN 303 213-1 Part 1 on the basis of the EUROCAE A-SMGCS MASPS (ED-87C) (2017) Update of EN 303 213-1 Part 1 on the basis of the EUROCAE A-SMGCS MASPS (ED-87D) (2019-2020) A-SMGCS; Part 2: Community Specification (EN 303 213-2-2) Update of EN 303 213-1 Part 2 on the basis of the EUROCAE A-SMGCS MASPS (ED-87C) (2017) Update of EN 303 213-1 Part 2 on the basis of the EUROCAE A-SMGCS MASPS (ED-87D) (2019-2020) A-SMGCS; Part 3: Community Specification for a deployed cooperative sensor including its interfaces (EN 303 213-3) A-SMGCS; Part 4: Community Specification for a deployed non-cooperative sensor including its interfaces; Sub-part 1: Generic requirements for non-cooperative sensor (EN 303 213-4-1) A-SMGCS; Part 4: Community Specification for a deployed non-cooperative sensor including its interfaces; Sub-part 2: Specific requirements for a deployed Surface Movement Radar sensor (EN 303 213-4-2) A-SMGCS; Part 5: Harmonized EN covering the essential requirements of article 3.2 of the Directive 2014/53/EU for multilateration equipment; Sub-part 1: receivers and interrogators (EN 303 213-5-1) (2017) A-SMGCS; Part 5: Harmonized EN covering the essential requirements of article 3.2 of the Directive 2014/53/EU for multilateration equipment; Sub-part 2: reference and vehicle transmitters (EN 303 213-5-2) (2017) A-SMGCS; Part 6: Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive for deployed surface movement radar sensors; Sub-part 1: X-band sensors using pulsed signals and transmitting power up to 100 kW (EN 303 213-6-1)

Regulations	None
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them
Recommendation for IPs proposal	Family 2.2.1 is a pre-requisite for further deployment, especially in Sub-AF 2.4 and 2.5. SDM therefore strongly recommends that all projects related to A-SMGCS Level 1 and 2 shall be completed as early as possible before the defined FOC Date of the Sub-AF to allow for the deployment of subsequent solutions. It is recommended to take into consideration the results of Gap Analysis.
Deployment Approach	The implementation of the Family would require the installation of the A-SMGCS Level 1 background systems (e.g. surface movement radar(s), multilateration, etc.) **(MM1 – A-SMGCS Level 1 installation)**, which shall be complemented by the set up of the A-SMGCS Level 2 system, the RIMCAS, also including the equipage of the relevant vehicles with transponders **(MM2 – A-SMGCS Level 2 installation)**. Before the start of the operational use, A-SMGCS Level 1 and 2 Operational Procedures shall be elaborated and then published **(MM3 – Operational Procedures)**, all relevant staff shall be duly trained **(MM4 – Training)**, a safety assessment shall be successfully performed and contextual report shall be made available **(MM5 – Safety Assessment)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM6 – Implementation completed)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 2.2.1 awarded in 2014 or 2015 CEF Calls, along with a more detailed description of each Implementation Project.

Family 2.3.1 – Time Based Separation (TBS)

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

Description and Scope

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

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

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

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

Interdependencies

Family 1.1.1 Basic AMAN.

Family 1.1.2 AMAN Upgrade to include Extended Horizon Function.

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

Families 5.4.1 and/or 2.1.4, for Meteorological Information.

Synchronization Needs

Aircraft operators, ANSPs and Airport Operators.

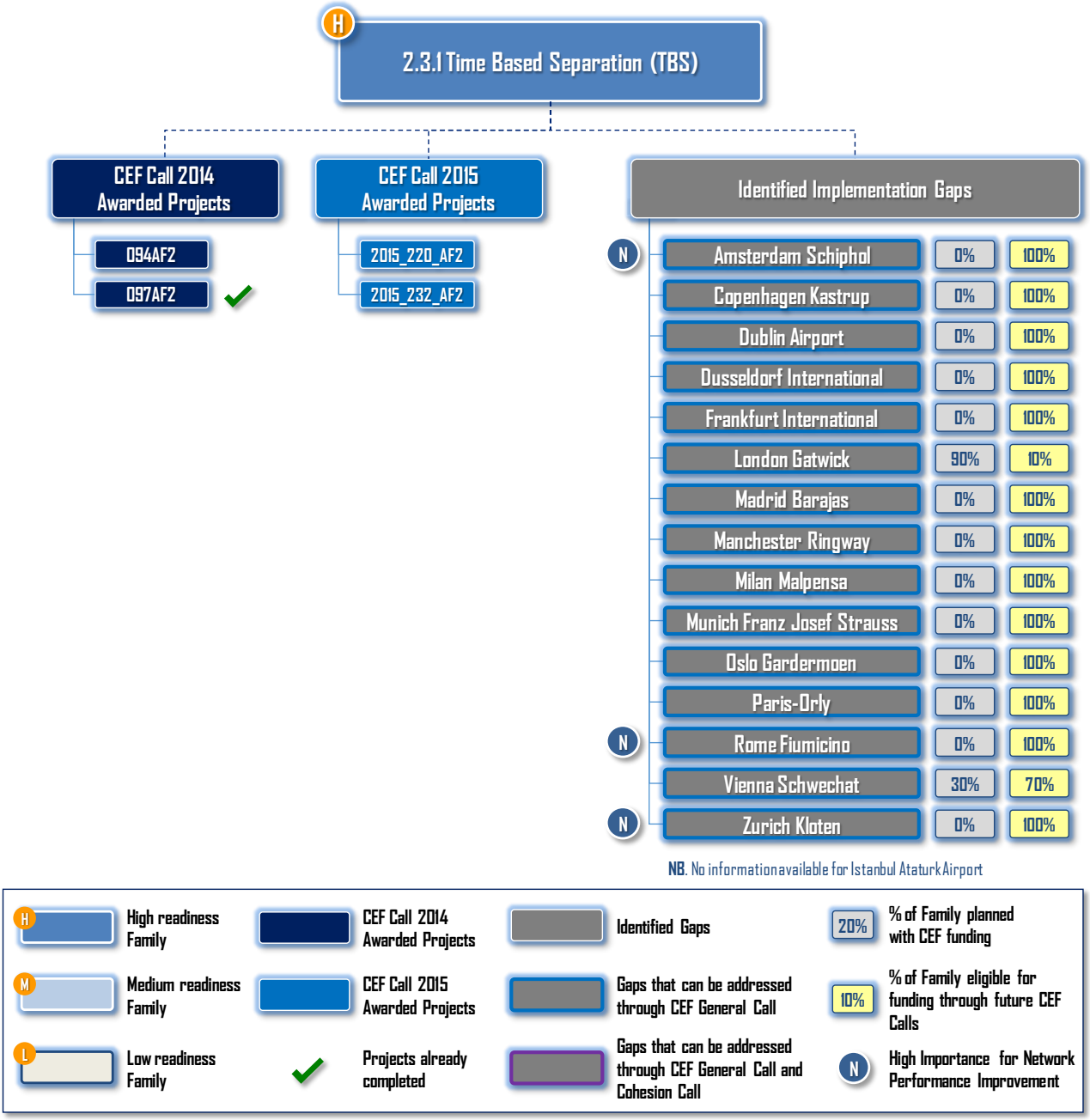
Civil / Military Coordination

Applicable to those airports open to civil and military operations

Stakeholders considered as gaps	ANSPs, Airport Operators	
Other stakeholders involved in the Family deployment	Airspace Users, Military Authorities	
Links to ICAO GANP ASBUs	B1-AMET Enhanced Operational Decisions through Integrated Meteorological Information (Planning and Near-term Service) B2-WAKE Advanced Wake Turbulence Separation (Time-based)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AO-0303 SESAR Release 2
	ATM Master Plan Level 3 (Edition 2016)	AOP10
SESAR Solutions	#64 "Time Based Separation"	
Very Large Scale Demonstrations	**Release 7:** PJ.28 **Release 8:** PJ.28 **Release 9:** PJ.28	
Guidance Material / Specifications / Standards	ECTL Time Based Operation (TBS) Specification for Final Approach ICAO Meteorological Information Exchange Model (IWXXM) ICAO Doc 10003 Manual on the digital exchange of aeronautical information ICAO Doc 8896 Manual of Aeronautical Meteorological Practice ICAO Doc 9328 Manual of Runway Visual Range Observing and Reporting Practices ICAO Doc 9377 Manual on Coordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services ICAO Doc 9817 Manual on Low-level Wind Shear ICAO Doc 9837 Manual on Automatic Meteorological Observing Systems at Aerodromes	
Means of compliance and / or Certification	None	
Regulations	None	
Cyber security requirements	None	

Recommendation for IPs proposal	It is recommended to implement Family 2.3.1 as soon as possible since TBS is part of the critical initiatives to resolve and mitigate the impacts of current capacity constraints and potential bottlenecks, which might hinder the overall performance at network level. It is recommended liaising between different stakeholders (both within the same stakeholder category and between different categories) to draft and present joint proposals in the framework of upcoming Calls. It is recommended to take into consideration the results of Gap Analysis.
Deployment Approach	The implementation of the Family would require the integration of the Time Based Separation (TBS) tool in the local environment (including necessary upgrades for other systems, e.g. AMAN, EFS, etc.). The AMAN system compatibility with the TBS support tool shall be ensured; CWP shall be modified in order to integrate the tool with the safety net; wind conditions shall be provided to the tool as well as automatic monitoring and alerting **(MM1 – Integration in local environment)**. Before the start of operational use of the tool, TBS Operational Procedures shall be elaborated and subsequently published **(MM2 – Operational Procedures)**, Air Traffic Controller and Flight Crews shall be duly trained **(MM3 – Training)**, a safety assessment shall be successfully performed and contextual report shall be made available **(MM4 – Safety Assessment)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM5 – Implementation completed)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 2.3.1 awarded in 2014 or 2015 CEF Calls, along with a more detailed description of each Implementation Project.

Family 2.4.1 – A-SMGCS Routing and Planning Functions

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

Description and Scope

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

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

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

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

Ref S-AF 2.2, 2.4 and 2.5:

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

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

Interdependencies
Family 2.1.1, Implementation of Initial DMAN and Family 2.5.2 Implementation of vehicle and aircraft systems contributing to airport safety nets, shall contribute to Family 2.4.1 Family 2.1.2, EFS Family 2.2.1, A-SMGCS Level 1 and airport safety nets associated with A-SMGCS Level 2 are pre-requisites for Family 2.4.1
Synchronization Needs
Aircraft Operators, Ground Handling Companies, ANSPs and Airport Operators.
Civil / Military Coordination
Applicable to those airports open to civil and military operations

Stakeholders considered as gaps	ANSPs, Airport Operators	
Other stakeholders involved in the Family deployment	Ground Handling Companies, Aircraft Operators, Military Authorities	
Links to ICAO GANP ASBUs	B1-RSEQ Improved Airport Operations through Departure, Surface and Arrival Management B2-SURF Optimized Surface Routing and Safety Benefits (A-SMGCS Level 3-4 and SVS)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AO-0205 SESAR Release 5 TS-0202 SESAR Release 4 TS-0203 SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	AOP13
SESAR Solutions	#22 Automated Assistance to Controller for Surface Movement Planning and Routing #106 DMAN Baseline for integrated AMAN DMAN #53 Pre-Departure Sequencing supported by Route Planning #14 Departure Management integrating Surface Management constraints	
Very Large Scale Demonstrations	**Release 7:** PJ. 28 **Release 8:** PJ. 28 **Release 9:** PJ. 28	

Guidance Material / Specifications / Standards	Updated ECTL Airport CDM Manual (2017) ECTL Updated A-SMGCS specification EUROCAE ED-87C A-SMGCS MASPS EUROCAE Update of ED-87C to include the new functions: routing & planning and additional safety nets ED-87D (2017) ICAO Guidance Manual on Airport Traffic Synchronisation (2018) ICAO Doc 9426 Air Traffic Services Planning Manual (2018) Doc 9830, Advanced Surface Movement Guidance and Control Systems (A-SMGCS) (2018)
Means of compliance and / or Certification	Update of ETSI EN 303 213-1 and -2 on the basis of the EUROCAE A-SMGCS MASPS (ED-87 C) (2017) Update of ETSI EN 303 213-1 and -2 on the basis of the EUROCAE A-SMGCS MASPS (ED-87 D) (2019) A-SMGCS; Part 1: Community Specification (EN 303 213-1-1) A-SMGCS; Part 2: Community Specification (EN 303 213-2-2)
Regulations	None
Cyber security requirements	None
Recommendation for IPs proposal	Some functionalities of Families 2.5.1 and 2.5.2 depend on the implementation of A-SMGCS Routing and Planning Functions (Family 2.4.1) which has a later FOC date (01/01/2024). Where necessary it is therefore recommended to synchronise Families 2.5.1 and 2.5.2 with Family 2.4.1 or to integrate those relevant functionalities in the respective 2.4.1 IP. It is recommended liaising between different stakeholders (both within the same stakeholder category and between different categories) to draft and present joint proposals in the framework of upcoming Calls. It is recommended to take into consideration the results of Gap Analysis.
Deployment Approach	The implementation of the Family would require the upgrade of the A-SMGCS routing and planning functions in order to support taxi route clearance modified by ATCOs (Sub-AF 2.4); the interface between DMAN and A-SMGCS routing functions shall be developed and also the identification of mobiles (aircraft and vehicles) shall be ensured **(MM1 – Installation and integration in local environment with A-SMGCS, EFS and DMAN)**. Before the start of the operational use, A-SMGCS Planning and Routing Operational Procedures shall be elaborated and then published **(MM2 – Operational Procedures)**, all relevant staff shall be duly trained **(MM3 – Training)**, a safety assessment shall be successfully performed and contextual report shall be made available **(MM4 – Safety Assessment)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM5 – Implementation completed)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.

Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 2.4.1 awarded in 2014 or 2015 CEF Calls, along with a more detailed description of each Implementation Project.

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

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

Description and Scope

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

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

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

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

Interdependencies

Family 2.1.2 EFS is a pre-requisite for Family 2.5.1

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

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

Synchronization Needs

ANSPs and Airport Operators.

Civil / Military Coordination

Applicable to those airports open to civil and military operations

Stakeholders considered as gaps	ANSPs, Airport Operators	
Other stakeholders involved in the Family deployment	Military Authorities	
Links to ICAO GANP ASBUs	B0-SURF Safety and Efficiency of Surface Operations (A-SMGCS Level 1-2) B1-RSEQ Improved Airport Operations through Departure, Surface and Arrival Management	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AO-0104-A SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	AOP12
SESAR Solutions	#02 "Airport Safety Nets for controllers: conformance monitoring alerts and detection of conflicting ATC clearances"	
Very Large Scale Demonstrations	**Release 7:** PJ.28 **Release 8:** PJ.28 **Release 9:** PJ.28	
Guidance Material / Specifications / Standards	EUROCAE ED-87-C A-SMGCS MASPS EUROCAE Update of ED-87C to include the new functions: routing & planning and additional safety nets ED-87D (2017) ECTL Specifications for A-SMGCS (2017) ICAO Guidance Manual on Airport Traffic Synchronisation (2018) ICAO Doc 9426 Air Traffic Services Planning Manual (2018) ICAO Doc 9830 Advanced Surface Movement Guidance and Control Systems (A-SMGCS) Manual (2018) EUROCAE ED-163 Safety, Performance and Interoperability Requirements document for ADS-B Airport Surface surveillance application (ADS-B APT) Avionics standards developed by RTCA SC-186/EUROCAE WG-51 for ADS-B ICAO Doc 7030/5 (EUR/NAT) Regional Supplementary Procedures, Section 6.5.6 and 6.5.7 ICAO Doc 9830 Advanced Surface Movement Guidance and Control Systems (A-SMGCS) Manual	

	ICAO Doc 9871 Technical Provisions for Mode S Services and Extended Squitter ICAO Doc 9924 Aeronautical Surveillance Manual
Means of compliance and / or Certification	A-SMGCS; Part 2: Community Specification (EN 303 213-2-2) Update of ETSI EN 303 213-1 and -2 on the basis of the EUROCAE A-SMGCS MASPS (ED-87 C) (2017) Update of ETSI EN 303 213-1 and -2 on the basis of the EUROCAE A-SMGCS MASPS (ED-87 D) (2019)
Regulations	None
Cyber security requirements	None
Recommendation for IPs proposal	Some functionalities of this Family depend on the implementation of A-SMGCS Routing and Planning Functions (Family 2.4.1) which has a later FOC date (01/01/2024). Where necessary it is therefore recommended to synchronise with Family 2.4.1 or to integrate those functionalities in the respective 2.4.1 IP. It is recommended liaising between different stakeholders (both within the same stakeholder category and between different categories) to draft and present joint proposals in the framework of upcoming Calls. It is recommended to take into consideration the results of Gap Analysis.
Deployment Approach	The implementation of the Family would require the upgrade of the existing ATC systems and their integration in the local environment, in order to support the Airport Safety Nets (Sub-AF 2.5), systems that shall also be integrated with A-SMGCS and EFS **(MM1 – Installation and integration in local environment with A-SMGCS and EFS)**. Before the start of the operational use, the Airport Safety Nets Operational Procedures associated to A-SMGCS Level 2 shall be elaborated and subsequently published **(MM2 – Operational Procedures)**, all relevant staff shall be duly trained **(MM3 – Training)**, a safety assessment shall be successfully performed and contextual report shall be made available **(MM4 – Safety Assessment)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM5 – Implementation completed)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.

Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 2.5.1 awarded in 2014 or 2015 CEF Calls, along with a more detailed description of each Implementation Project.

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

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

Description and Scope

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

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

The scope of this Family includes:

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

This leads to an improved situational awareness and thus improves the quality of the overall safety net. The main benefit is related to the increase of runway usage awareness, and consequently an increase of runway safety and of the whole airport manoeuvring area. On-board aircraft and vehicle systems and technology uses airport data coupled with on-board aircraft sensors to monitor the movement of aircraft and vehicles on the airport surface and provide relevant information to the drivers, the flight crew and the ATC. The on-board aircraft and vehicle systems detect potential and actual risk of collision with other traffic on the manoeuvring area and provide the drivers and the flight crew with the appropriate alert.

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

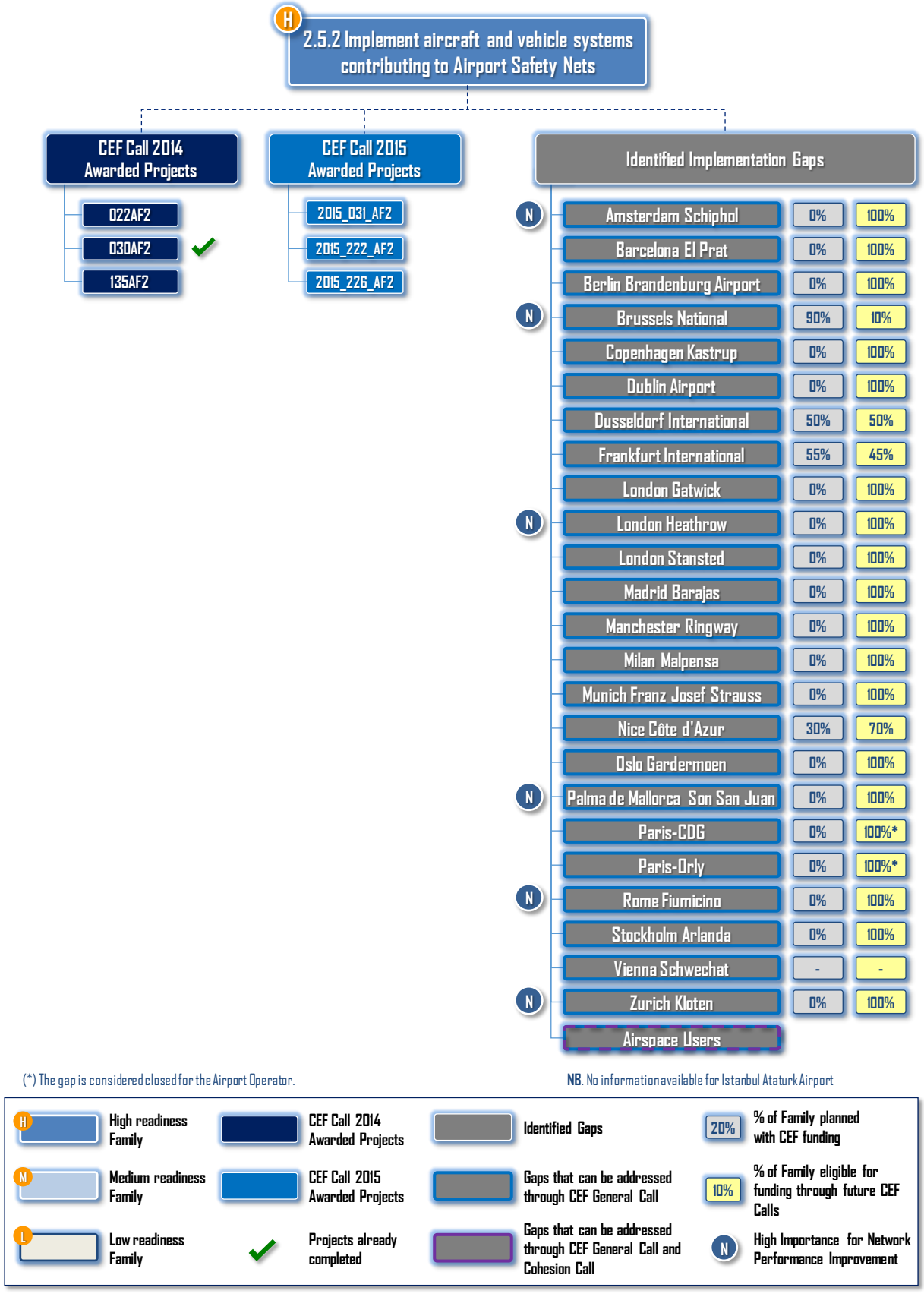
Interdependencies

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

Family 2.4.1 A-SMGCS Planning and Routing Functions can be foreseen as a pre-requisite for Family 2.5.2 Family 2.5.1 is a pre-requisite for Family 2.5.2 to ensure full safety performance is achieved		
Synchronization Needs		
Aircraft operators, ANSPs and Airport Operators.		
Civil / Military Coordination		
Applicable to those airports open to civil and military operations		
Stakeholders considered as gaps	ANSPs, Airport Operators, Airspace Users	
Other stakeholders involved in the Family deployment	Military Authorities	
Links to ICAO GANP ASBUs	B1-SURF Enhanced Safety and Efficiency of Surface Operations – SURF, SURF-IA and Enhanced Vision Systems (EVS) B2-SURF Optimized Surface Routing and Safety Benefits (A-SMGCS Level 3-4 and SVS)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AO-0104-A SESAR Release 5 AO-0105 SESAR Release 5 AO-0204 SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	AOP04.1
SESAR Solutions	#02 "Airport Safety Nets for controllers: conformance monitoring alerts and detection of conflicting ATC clearances" #04 "Enhanced Traffic Situational Awareness and Airport Safety Nets for the vehicle drivers"	
Very Large Scale Demonstrations	**Release 7:** PJ.28 **Release 8:** PJ.28 **Release 9:** PJ.28	
Guidance Material / Specifications / Standards	EUROCAE Update of ED-87C to include the new functions: routing & planning and additional safety nets ED-87D (2017) EUROCAE ED-179B/DO-315B MASPS for Enhanced Vision Systems, Synthetic Vision Systems, Combined Vision Systems and Enhanced Flight Vision Systems EUROCAE ED-194A/DO-317A, MOPS for Aircraft Surveillance Applications (ASA) System	

	EUROCAE ED-165 / DO-322 Safety, Performance and Interoperability Requirements Document For ATSA-SURF Application ICAO Doc 9994 Manual on Airborne Surveillance Applications (Edition 1) (SURF) ICAO Doc 8168 PANS OPS (SURF IA)
Means of compliance and / or Certification	Update of ETSI EN 303 213-2 on the basis of the EUROCAE A-SMGCS MASPS (ED-87 D) (Vehicles only) (2019)
Regulations	None
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them
Recommendation for IPs proposal	Some functionalities of this Family depend on the implementation of A-SMGCS Routing and Planning Functions (Family 2.4.1) which has a later FOC date (01/01/2024). Where necessary it is therefore recommended to synchronise with Family 2.4.1 or to integrate those functionalities in the respective 2.4.1 IP. It is recommended liaising between different stakeholders (both within the same stakeholder category and between different categories) to draft and present joint proposals in the framework of upcoming Calls. It is recommended to take into consideration the results of Gap Analysis.
Deployment Approach	The implementation of the Family would require to relevant equipment for vehicles and aircraft to be delivered and implemented in order to be integrated in the local environment. ATC systems shall be concurrently upgraded and installed in order to support Airport Safety Nets (Sub-AF 2.5) **(MM1 – Installation and integration)**. Before the start of the operational use, Operational Procedures related to such systems shall be elaborated and subsequently published **(MM2 – Operational Procedures)**, all relevant staff shall be duly trained **(MM3 – Training)**, a safety assessment shall be successfully performed and contextual report shall be made available **(MM4 – Safety Assessment)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM5 – Implementation completed)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 2.5.2 awarded in 2014 or 2015 CEF Calls, along with a more detailed description of each Implementation Project.

AF #3 – Flexible ASM and Free Route

The management of airspace in terms of advanced flexibility and free route is the future for the optimization of its utilization. The main aims of the ATM Functionality #3 are to produce most benefits to the environment, in terms of emissions reduction, as well as to the airspace users, with respect to the desired trajectories.

These objectives may be achieved by combining the following operations:

- Implementation of ASM management systems, tools, airspace structure, and procedure that support an advanced Flexible Use of Airspace. The aim is to ease, safely and flexibly, segregations and reservations of portions of airspace when needed, for exclusive usage, providing, at the same time, minimum impact on other airspace users.
- Implementation of harmonized DCTs and Free Route Airspace throughout Europe, with necessary support by system upgrades and tools, that enable flights to be conducted taking into account, as much as possible, their preferred route, without the typical constraints of fixed route network and rigid airspace structure.

For this reason, AF3 is structured in two Sub-AFs with their related Families:

S-AF3.1 – Airspace Management and Advanced Flexible Use of Airspace, requiring close coordination and cooperative decision making among all stakeholders (civil and military), ASM tools, real time data management, and exchange for most flexible airspace use and configuration for best adaptation to users' needs.

- Family 3.1.1 – ASM Tool to support AFUA
- Family 3.1.2 – ASM management of real time airspace data
- Family 3.1.3 – Full rolling ASM/ATFCM process and ASM information sharing
- Family 3.1.4 – Management of Dynamic Airspace Configurations

S-AF3.2 – Free Route, requiring important changes in airspace structure and significant upgrade of all stakeholders' systems to support DCTs and Free Route implementation operations, in a synchronized European scenario, regardless of border limitations.

- Family 3.2.1 – Upgrade of ATM Systems (NM, ANSPs, AUs) to support Direct Routings (DCTs) and Free Route Airspace (FRA)
- Family 3.2.3 – Implement Published Direct Routings (DCTs)
- Family 3.2.4 – Implement Free Route Airspace

The following chart highlights the overall structure of the ATM Functionality #3, namely its SUB AFs, Families and their relevant Implementation initiatives related to both 2014 CEF Call awarded projects and 2015 CEF Call candidate projects.

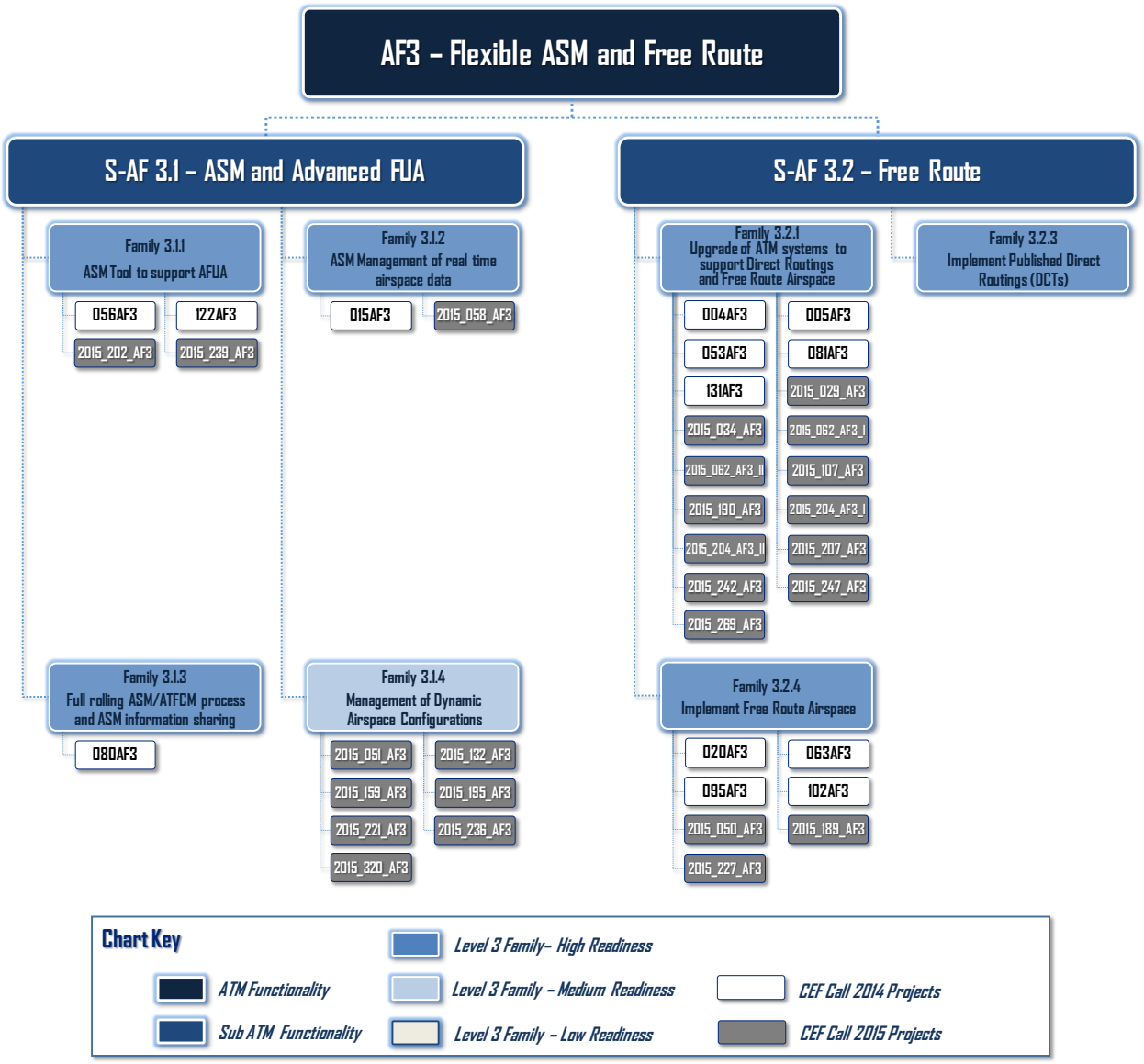


Fig. 19 – AF #3 Structure

The following Gantt chart shows the implementation roadmap for each Family included in AF3 in terms of start and end date of deployment, and it has been defined taking into account the target dates for each ATM Functionality and Sub-ATM Functionality, as stated in Regulation (EU) No 716/2014.

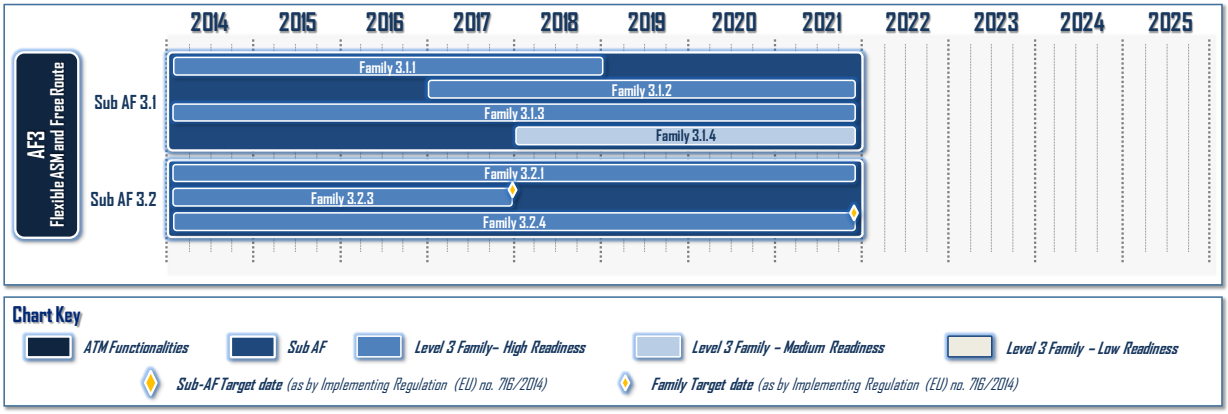


Fig. 20 – AF #3 Implementation Timeline

Family 3.1.1 – ASM tool to support AFUA

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

Description and Scope

Deployment of automated ASM systems and their interoperability with NM systems and neighbouring ASM systems, to manage ARES, resulting from civil-military co-ordination, more flexibly according to airspace users' needs.

Automated ASM support system shall:

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

Interdependencies

Prerequisite for:

Fam. 3.1.2 ASM management of real time airspace data

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

Interdependency with:

S-AF 5.3 Aeronautical information exchange

S-AF 5.5 Cooperative Network Information Exchange

Synchronization Needs

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

Civil / Military Coordination

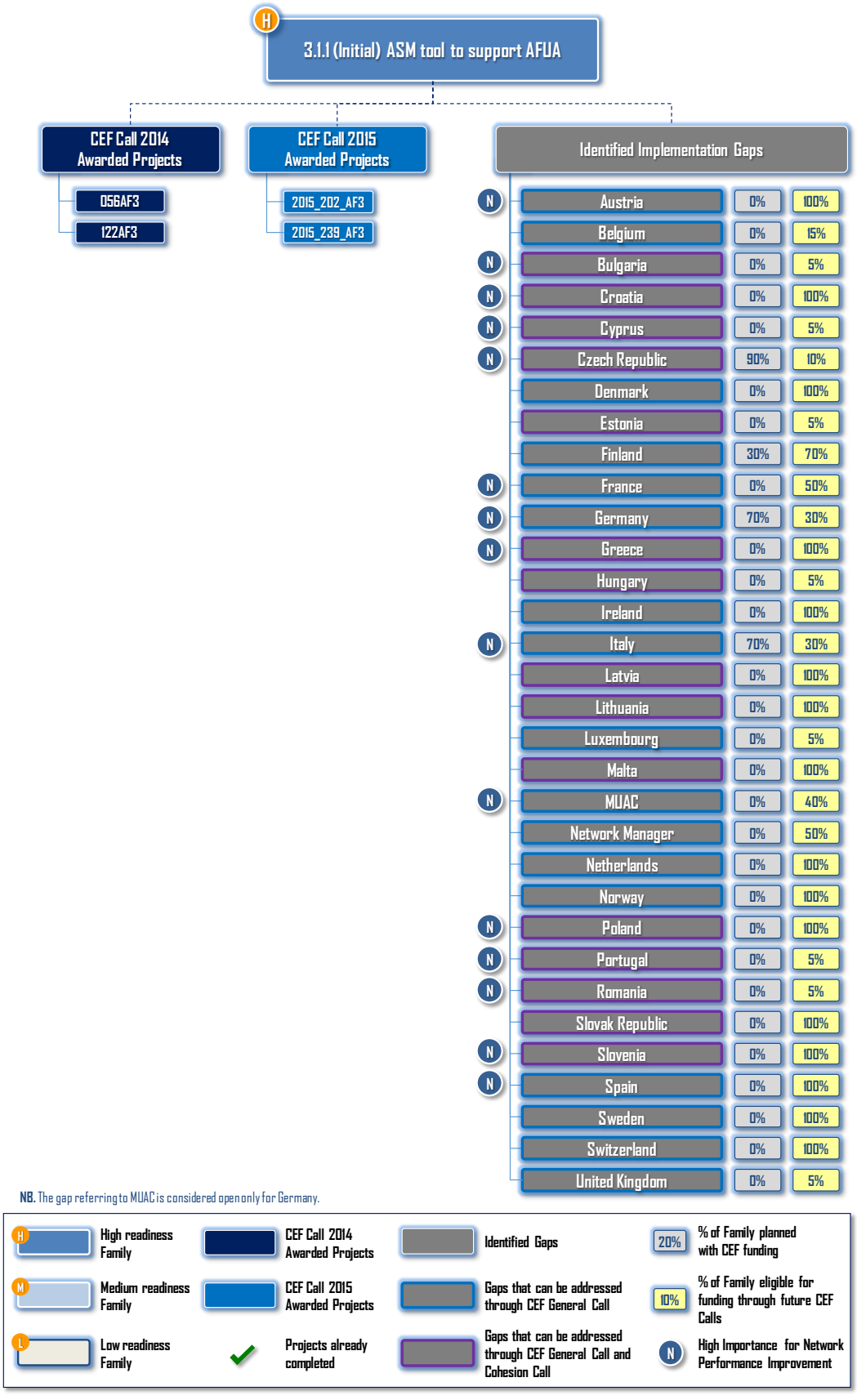
A civil-military coordination is beneficial for procedural and operational purposes as well as for systems in order to process ARES Status data.

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

Stakeholders considered as gaps	Civil-Military ANSPs, Network Manager and Military AUs	
Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B0-FRTO Improved Operations through Enhanced En-route Trajectories	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AOM-0202 Available
	ATM Master Plan Level 3 (Edition 2016)	AOM19.1
SESAR Solutions	N/A	
Very Large Scale Demonstrations	N/A	
Guidance Material / Specifications / Standards	Network Strategy Plan (NSP): SO 3/2 and SO 3/3 ERNIP Part 3 - Handbook for Airspace Management - Guidelines for Airspace Management; (Nov. 2015) ECTL LARA Local and sub-Regional Airspace Management Support System: edition 23/01/2015 ECTL Advanced FUA Concept edition 1.0 24/07/2015 ECTL Aeronautical Information Exchange Model v5.1	
Means of compliance and / or Certification	Communication 2009/C 2196/05 Community Specifications for the application of the Flexible Use of Airspace (FUA)	
Regulations	Commission Regulation (EC) 2150/2005 Commission Regulation (EC) 677/2011 as amended by Commission Implementing Regulation (EU) 970/2014	
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them.	

Recommendation for IPs proposal	ASM tool implementation allows data exchange with NM and neighbouring ANSPs in support of ARES coordination and it covers the pre-requisite for 3.1.2 and 3.1.3. It is recommended to take into consideration the results of Gap Analysis.
Deployment Approach	The implementation of the Family requires the successful installation of the ASM Tool, as an enabler for the proper support of the civil - military coordination **(MM1 – ASM tool installation)**. Monitoring and operational validation activities shall be completed in order for the ASM Tool to ensure interoperability (via B2B) (**MM2 – ASM tool integration**). Before the start of operational use of the ASM Tool, procedures for operational and technical use of the system shall be provided (**MM3 – Procedures available**), all safety assessments required shall be duly executed and all the output documents shall be then timely released (**MM4 – Safety assessment**). The execution of such activities is expected to lead to the start of permanent operational use (**MM5 – Implementation completed**).

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 3.1.1 awarded in 2014 or 2015 CEF Calls, along with a more detailed description of each Implementation Project.

Family 3.1.2 – ASM Management of real time airspace data

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

Description and Scope

The airspace management (ASM) is enhanced by automated exchange services of ASM data during the tactical execution phases continuously in real time. ASM information (real-time ARES status) are shared between ASM systems, civil and military ATS units/systems and communicated to NM in the tactical and execution phases. These data, consisting of pre-notification of activation, notification of activation, de-activation, modification and release, are collected, saved and processed, with the need to be exchanged between ASM stakeholders and made available by the NM system, to ATM actors and all airspace users not involved in ASM process but concerned by these data.

The scope of this family encompasses:

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

Interdependencies

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

Other dependencies:

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

S-AF 5.3 - Aeronautical information exchange

S-AF 5.5 - Cooperative Network Information Exchange

Synchronization Needs

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

Civil / Military Coordination

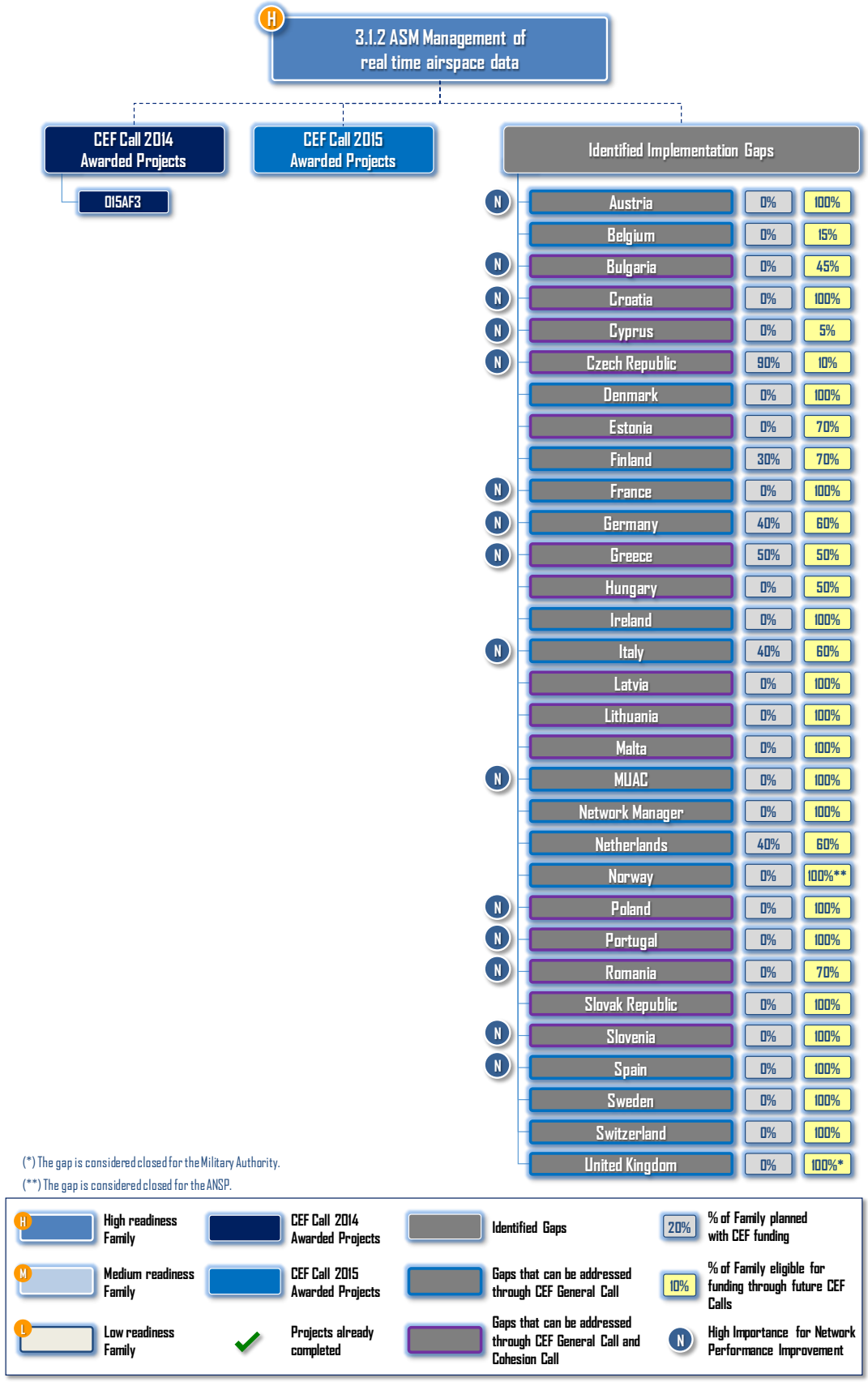
A civil-military coordination is beneficial for procedural and operational purposes as well as for systems in order to process ARES Status data.

Enablers for civ-mil coordination are support systems and procedures to share real time ASM information and manage ASM level 3. This initiative is to upgrade the local ASM support systems or implement other means to meet the requirements of civil military coordination at level 3.

Stakeholders considered as gaps	Civil-Military ANSPs, Network Manager, Military AUs	
Other stakeholders involved in the Family deployment	Airspace Users (CFSPs)	
Links to ICAO GANP ASBUs	B0-FRTO Improved Operations through Enhanced En-route Trajectories	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AOM-0206-A SESAR Release 5 AOM-0202-A SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	AOM19.2
SESAR Solutions	#31 "Variable profile military reserved areas and enhanced (further automated) civil-military collaboration"	
Very Large Scale Demonstrations	**Release 7:** N/A **Release 8:** N/A **Release 9:** N/A	
Guidance Material / Specifications / Standards	Network Strategy Plan (NSP): SO 3/2 and SO 3/3 Directions of work for enhancing the ASM/ATFCM/ATS processing in the short and medium term 2012-2017 - Edition 1.0 (Date: 14/11/11) ECTL Specification for ASM Systems Interfaces Supporting Advanced Flexible Use of Airspace ECTL LARA Local and sub-Regional Airspace Management Support System: edition 23/01/2015 ECTL Advanced FUA Concept edition 1.0 24/07/2015 ERNIP Part 3 - Handbook for Airspace Management - Guidelines for Airspace Management; November 2015 Aeronautical Information Exchange Model (AIXM) v5.1	
Means of compliance and / or Certification	Communication 2009/C 2196/05 Community Specifications for the application of the Flexible Use of Airspace (FUA)	
Regulations	Commission Regulation (EC) 2150/2005 Commission Regulation (EC) 677/2011 as amended by Commission Implementing Regulation (EU) 970/2014	
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some	

	components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them
Recommendation for IPs proposal	The scope of this family might require changes in ATM systems, AU systems and NM systems, which need to be undertaken after the deployment of ASM tools in support of real time airspace status updates, in planning and execution phase. It is recommended to take into consideration the results of Gap Analysis
Deployment Approach	The implementation of the Family requires the successful upgrade of the ASM tool **(MM1 – Upgrade of ASM tool)**, to support a continuous real time data exchange during the tactical phase and thus in order to manage airspace data and airspace status **(MM2 – System updates for the exchange of real time airspace data)**. All the relevant data shall be integrated into the ATM Systems, the interoperability with the Network Manager system and with other ASM systems shall be carefully monitored and verified **(MM3 – Systems integration with ATM, ASM and NM systems)**. Before the start of operational use of the ASM System, procedures for operational and technical use of the system shall be provided **(MM4 – Procedures available)**, all safety assessments required shall be duly executed and all the output documents shall be then timely released **(MM5 – Safety assessment)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM6 – Implementation completed)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 3.1.2 awarded in 2014 CEF Call, along with a more detailed description of each Implementation Project. No IP has been awarded in 2015 CEF Call.

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

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

Description and Scope

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

This will be supported by the sharing of military airspace and civil data and by continuously updating Airspace Reservation information and other civil demand information among the authorized users and approved agencies in order to enhance the coordination of Cross Border Operations including Cross Border Area, and to optimise the whole network operations based on the richest and most correct information.

ASM information sharing addresses the required system support improvements able to ensure a seamless data flow and their management in the frame of the enhanced CDM process. It includes requirements aiming to improve the notification to airspace users based on automation of data exchange.

The scope of this family encompasses:

- Process/system upgrade supporting a full rolling ASM/ATFCM and dynamic ASM/ATFCM process allowing data sharing to all operational stakeholders, although some States with limited airspace booking needs may fully rely on NM system capabilities
- Technical changes supporting Rolling AUP
- Rolling UUP for procedure 3
- Initial implementation of FUA/EU restriction and FBZ in NM system and local/regional ASM systems
- Full implementation of new AUP template
- Define AIXM coding for the AUP changes introduced
- Process/System changes for full management of Airspace structure taking into account AUP/UUP information
- Process/System changes for initial CDM
- Process/System changes relevant to CDM for FRA impact assessment on network
- Harmonise cross border CDRs notifications
- Harmonisation of ARES notifications
- Implement Graphical display of AUP/UUP on NOP Portal (with lateral/vertical limits indication)

- Process/system improvements supporting sharing of information of airspace configuration via AUP/UUP
- ASM management and data sharing shall be addressed also to an environment where airspace is managed dynamically with no fixed-route network
- ASM systems adapted to continuously exchange ASM information.
- AU system upgrades for ASM data sharing

Interdependencies

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

Fam. 3.1.2 – ASM management of real-time data

Fam. 3.1.4 - Management of dynamic airspace configurations

S-AF 5.3 - Aeronautical Information Exchange

S-AF 5.5 – Cooperative Network Information Exchange

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

Synchronization Needs

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

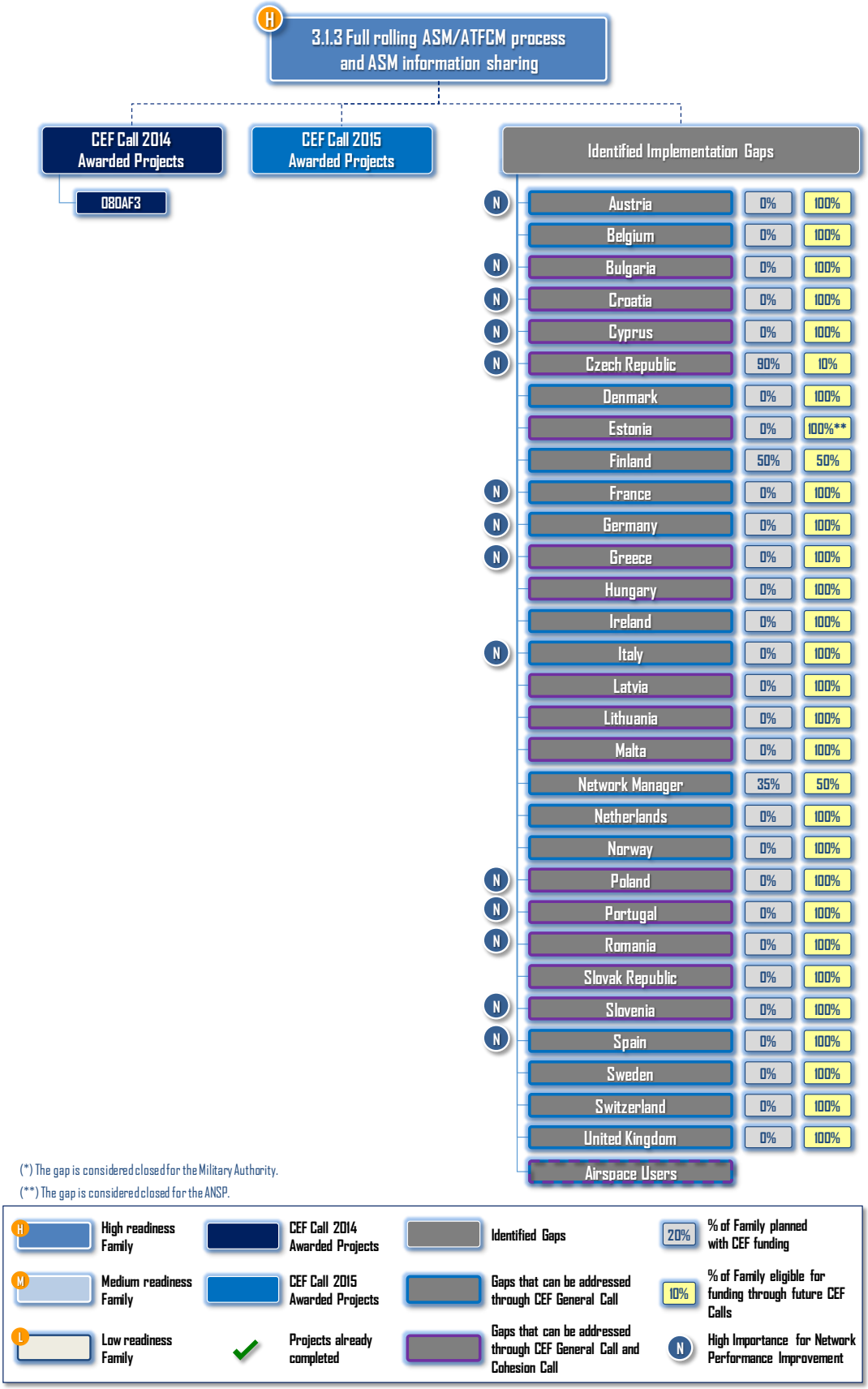
Civil / Military Coordination

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

Stakeholders considered as gaps	Civil-Military ANSPs, Civil-Military AUs (CFSPs), Network Manager	
Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B0-FRTO Improved Operations through Enhanced En-route Trajectories	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AOM-0202-A SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	AOM19.3
SESAR Solutions	#31 "Variable profile military reserved areas and enhanced (further automated) civil-military collaboration"	
Very Large Scale Demonstrations	**Release 7:** N/A **Release 8:** N/A **Release 9:** N/A	
Guidance Material / Specifications / Standards	ECTL Specification for ASM Systems Interfaces Supporting Advanced Flexible Use of Airspace Network Strategy Plan (NSP): SO 3/2 and SO 3/3 ERNIP Part 3 - Handbook for Airspace Management - Guidelines	

	for Airspace Management; November 2015 NOP User Guide; Edition:19.0-92 Date:25/03/2015 Responsibilities Document for the application of Air Traffic Flow Management (ATFM); Edition 1.0; Edition Date: 25/10/2012 ECTL Advanced FUA Concept edition 1.0 24/07/2015 ECTL Aeronautical Information Exchange Model v5.1
Means of compliance and / or Certification	Communication 2009/C 2196/05 Community Specifications for the application of the Flexible Use of Airspace (FUA)
Regulations	Commission Regulation (EC) 2150/2005 Commission Regulation (EC) 677/2011 as amended by Commission Implementing Regulation (EU) 970/2014
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them
Recommendation for IPs proposal	This family is a key feature for the European airspace planning process and the continuous update of information about: ARES via AUP/UUP, traffic demand and necessary data among all stakeholders in a full rolling process. All involved stakeholders should submit proposals for process/systems updates in order to achieve full management of shared information. It is recommended to take into consideration the results of Gap Analysis.
Deployment Approach	The implementation of the Family would require the systems to be upgraded in order to include technical changes needed for rolling AUP, rolling UUP Procedure 3, new AUP Template, CDM impacting FRA, graphical display areas on NOP, management and data sharing also referred to FRA airspace **(MM1 – System updates for the full rolling ASM/ATFCM process and ASM information sharing)**. All Stakeholders Systems, being ASM Systems, AU Systems and NM Systems, shall be integrated for information and data sharing, which shall then be properly monitored and verified **(MM2 – Integration completed)**. Before the start of operational use of the system, procedures for its operational and technical use shall be provided **(MM3 – Procedures available)**, all safety assessments required shall be duly executed and all the output documents shall be then timely released **(MM4 – Safety assessment)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM5 – Implementation completed)**.

Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 3.1.2 awarded in 2014 CEF Call, along with a more detailed description of each Implementation Project. No IP has been awarded in 2015 CEF Call.



Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 3.1.3 awarded in 2014 CEF Call, along with a more detailed description of each Implementation Project. No IP has been awarded in 2015 CEF Call.

Family 3.1.4 – Management of dynamic airspace configurations

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

Description and Scope

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

The Airspace configurations are pre-defined and coordinated airspace structures (based on CDRs, DCTs, FRA, including ARES, VPA/DMA and so on) and ATC dynamic sectorisation, to meet airspace needs in terms of capacity and/or flight efficiency. Airspace configurations and ATC flexible sectors configuration are already used when the flows and constraints can be predicted well in advance (e.g. weekend routes or seasonal flows of traffic). A more efficient and dynamic process involving the NM, ATFCM, ATC and military would require new functionalities and procedures and well defined collaborative decision making processes at pre-tactical level.

Dynamic Airspace Configuration focuses on defining a reference to Dynamic Airspace Configuration concept, including roles and responsibilities in an advanced CDM process.

The ASM performance analysis should assess the flight efficiency gains resulting from the rolling ASM/ATFCM process implementation. The Capacity aspects need also to be addressed.

The scope of this family encompasses:

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

Interdependencies

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

Fam. 3.1.2 ASM Management of real time airspace data

S-AF 5.3 - Aeronautical Information Exchange

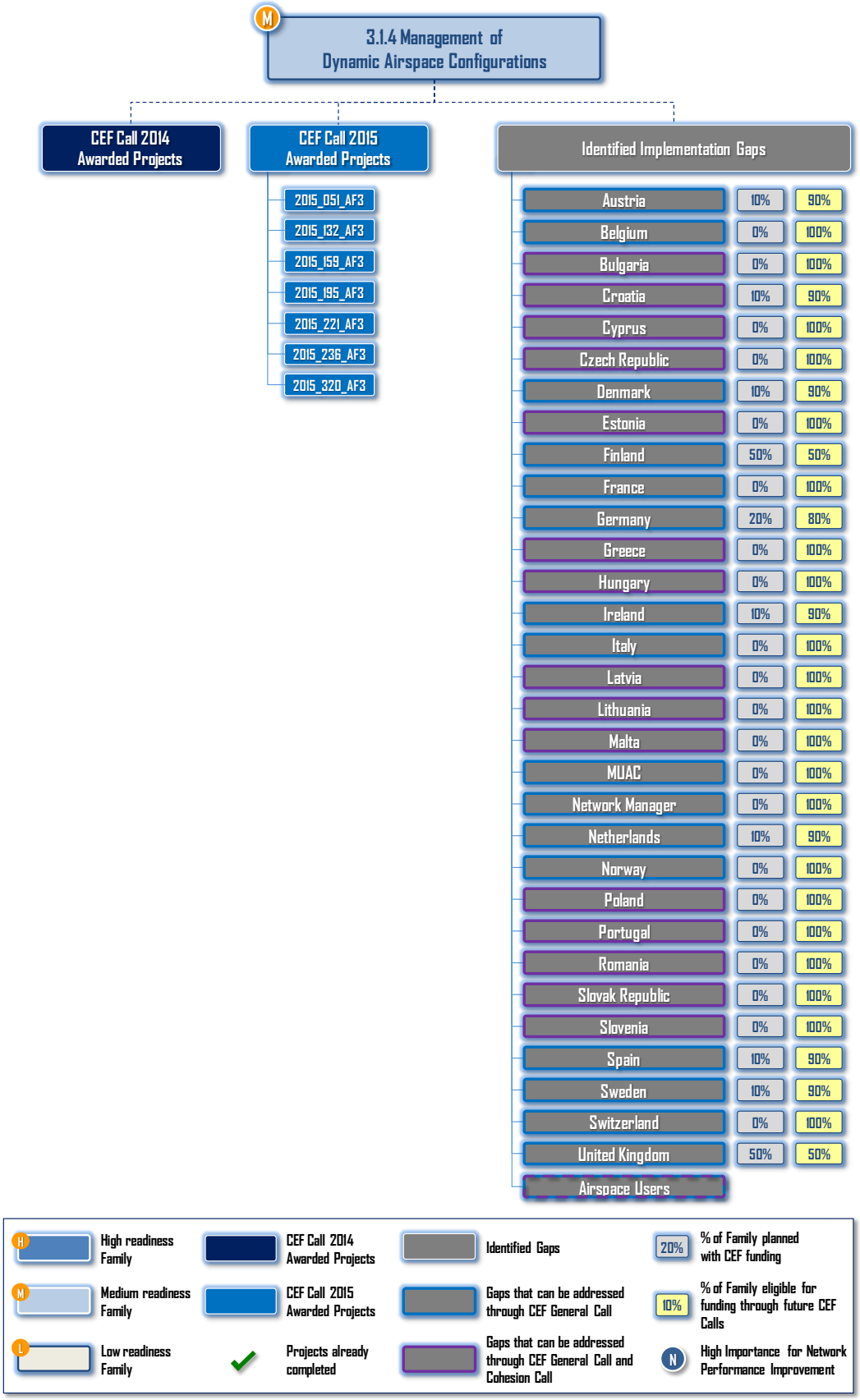
S-AF 5.5 – Cooperative Network Information Exchange

Synchronization Needs
Operational and technical synchronisation between NM, National Airspace Management Cells, Civil and Military AUs and Civil-Military ANSPs is required.
Civil / Military Coordination
A civil-military coordination is beneficial for procedural and operational purposes as well as for systems in order to process ARES Status data.

Stakeholders considered as gaps	Civil-Military ANSPs, Network Manager	
Other stakeholders involved in the Family deployment	Military Authorities	
Links to ICAO GANP ASBUs	B0-FRTO Improved Operations through Enhanced En-route Trajectories	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	CM-0102-A SESAR Release 2 AOM-0805 SESAR 2020 Second Wave AOM-0809 SESAR 2020 Second Wave
	ATM Master Plan Level 3 (Edition 2016)	AOM19.4
SESAR Solutions	#66 "Automated Support for Dynamic Sectorisation" PJ.08-01 "Management of Dynamic Airspace configurations"	
Very Large Scale Demonstrations	**Release 7:** N/A **Release 8:** N/A **Release 9:** N/A	
Guidance Material / Specifications / Standards	EUROCAE ED-136 VoIP ATM System Operational and Technical Requirements EUROCAE ED-137B Interop. Standards for VoIP ATM Components Update of ED-137B Part 2 Network Design Guideline EUROCAE ED-138 VoIP Network Requirements and Performance for VoIP ATM Systems Network Strategy Plan (NSP): SO 3/2 and SO 3/3 ECTL Advanced FUA Concept edition 1.0 24/07/2015 ERNIP Part 3 - Handbook for Airspace Management - Guidelines for Airspace Management; November 2015	
Means of compliance and / or Certification	None	

Regulations	Commission Regulation (EC) No 2150/2005
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them.
Recommendation for IPs proposal	The deployment of predefined airspace configuration could start from the beginning of 2018 onwards. IP proposals should be focused on concept and study of ASM solutions achieving a more efficient process (included new system functionalities, if envisaged) supporting optimized airspace structure and availability, ATC dynamic sectors management, to enhance flight efficiency and alleviate capacity problems with reference to predefined airspace configurations. It is recommended to take into consideration the results of Gap Analysis.
Deployment Approach	The implementation of the Family would require the definition of a pre-defined airspace configuration concept, providing deliverables such as CONOPS, while also sharing roles and responsibilities in an advanced CDM perspective **(MM1 – Pre-defined airspace configuration concept definition)**. ATM systems shall be subsequently upgraded, with particular reference to the ANSP and NM System, including VoIP communications in support of airspace structure availability and its dynamic configuration management, addressed also to DCTs and FRA environment **(MM2 – ATM systems upgrade)**. The installation of new software and/or tools shall be successfully completed **(MM3 – SW/Tools installation)** and the ANSP-NM integration of such SWs/Tools among all Stakeholders systems shall be closely monitored and verified **(MM4 – SW/Tools integration)**. Before the start of operational use of the system, procedures for its operational and technical use shall be provided **(MM5 – Procedures available)**, all safety assessments required shall be duly executed and all the output documents shall be then timely released **(MM6 – Safety assessment)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM7 – Implementation completed)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



A dedicated table within Annex A encompasses the list of implementation initiatives associated to Family 3.1.4 awarded in 2015 CEF Call, along with a more detailed description of each Implementation Project. No Implementation Project associated to this Family has been awarded in 2014 CEF Call.

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

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

Description and Scope

NM systems have been upgraded to support Free Route operations that can be done by means of published DCTs (initial step) or directly FRA. Only some corrections and tuning are required for DCTs. The NM system upgrades related to dynamic re-routing, ATFCM planning and execution and traffic load management are part of AF 4 families, namely 4.1.2 and 4.4.2.

The AU flight plan filing systems (CFSP) should be upgraded (e.g. to support long DCT segments and handling of LAT/LONG, if required). Specific attention should be given to the management of any ASM/ATFCM constraint in a FRA environment, and to the necessary standardisation of free route implementation concerning the flight planning requirements. The ANSP system upgrades include the FDPS (e.g. management of FPL trajectories including LAT/LONG management, if required), the Controller Working Position (CWP) and the HMI which need to support DCTs/FRA. ATC systems may also be upgraded, for example, with CPDLC messages handling LAT/LONG, CPDLC reception and use data from aircraft coming from ADS-C EPP when these data link services are implemented. Although the above mentioned requirements do not make a direct reference to Multi-Sector Planner/Extended ATC Planner (MSP/EAP) function, the indirect links do exist and MSP/EAP deployment in the context of DCTs/FRA should be considered. The system upgrades can be clustered in 3 points:

1. For State/Regional (e.g. cross-border) DCTs they shall encompass:
   - NM systems:
     - FPL processing and checking
     - Dynamic rerouting
     - Calculation and management of traffic load
   - AU systems:
     - FPL route planning for a complete flight taking into account the differences of implementation and limitations (e.g. in terms of opening time and/or flight level constraints) throughout the entire flight.
     - Long DCT with or without calculated intermediate points.
   - ATC systems:
     - FDPS supporting airspace structure managing trajectories according to flight planning
     - CWP and HMI supporting appropriate display and functions as required by operational needs
2. For State/Regional (e.g. cross-border) FRA deployment they shall encompass the upgrades listed in point 1) plus:

- NM systems:
  - IFPS routing proposal
  - Specific ASM improvements for FRA
  - Network impact assessment for FRA
  - CACD adaptations for FRA national deployment
- AU systems:
  - Capability to take into account the different constraints, e.g.: ATS, DCT/FRA, RAD, scenarios, FL constraints on part of the route only, etc,
  - FPL route planning for a complete flight taking into account the differences of implementation (DCT, FRA with or without partial implementation) throughout the entire flight.
- ATC systems:
  - FDP to calculate ground 4D trajectories within AoI and editing function for 4D trajectories including Cross AoR Points (COP management)
  - ASM/ATFCM for FRA management
  - MTCD (detecting conflicts between A/C and A/C)
  - CORA (conflict probe and passive conflict resolution advisor)
  - MONA (conformance monitoring aids)
  - ATC clearances beyond AoR
  - ATC to ATC Flight Data Exchange (Basic OLDI and SYSCO)
  - Dynamic sectorization and constraint management
  - Dynamic Area Proximity Warning (APW) - Integration with ASM tools
  - Provision/integration of FP and real time data related to the FRA traffic to the Military ATS units
  - Depending on traffic load and complexity, besides MTCD and CORA, ANSPs should consider the deployment of Conflict Detection Tools which include the Tactical Controller Tool (TCT), using the tactical trajectory and managing the clearances along that trajectory

3. For Pan-European FRA deployment they shall encompass the upgrades listed in point 2) plus:
   - NM systems:
     - CACD environmental database adaptations for FRA cross-border operations
     - B2B data exchange for cross border FRA
   - ATC systems:
     - COP management for FRA supporting Cross Border COP handling
     - Tactical Controller Tool (TCT), managing the Cross Border clearances
   - AU systems:
     - optimisation of free routing trajectory taking into account the ATM constraints including possible differences of FRA lower limit implementations throughout the flight

Interdependencies

Enabler for:

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

Linked with:

- 4.1.2 STAM phase 2
- 4.4.2 Traffic Complexity tools

For some modifications (including MSP) linked with:

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

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

Synchronization Needs
Synchronisation between NM, AU and ANSPs is required.

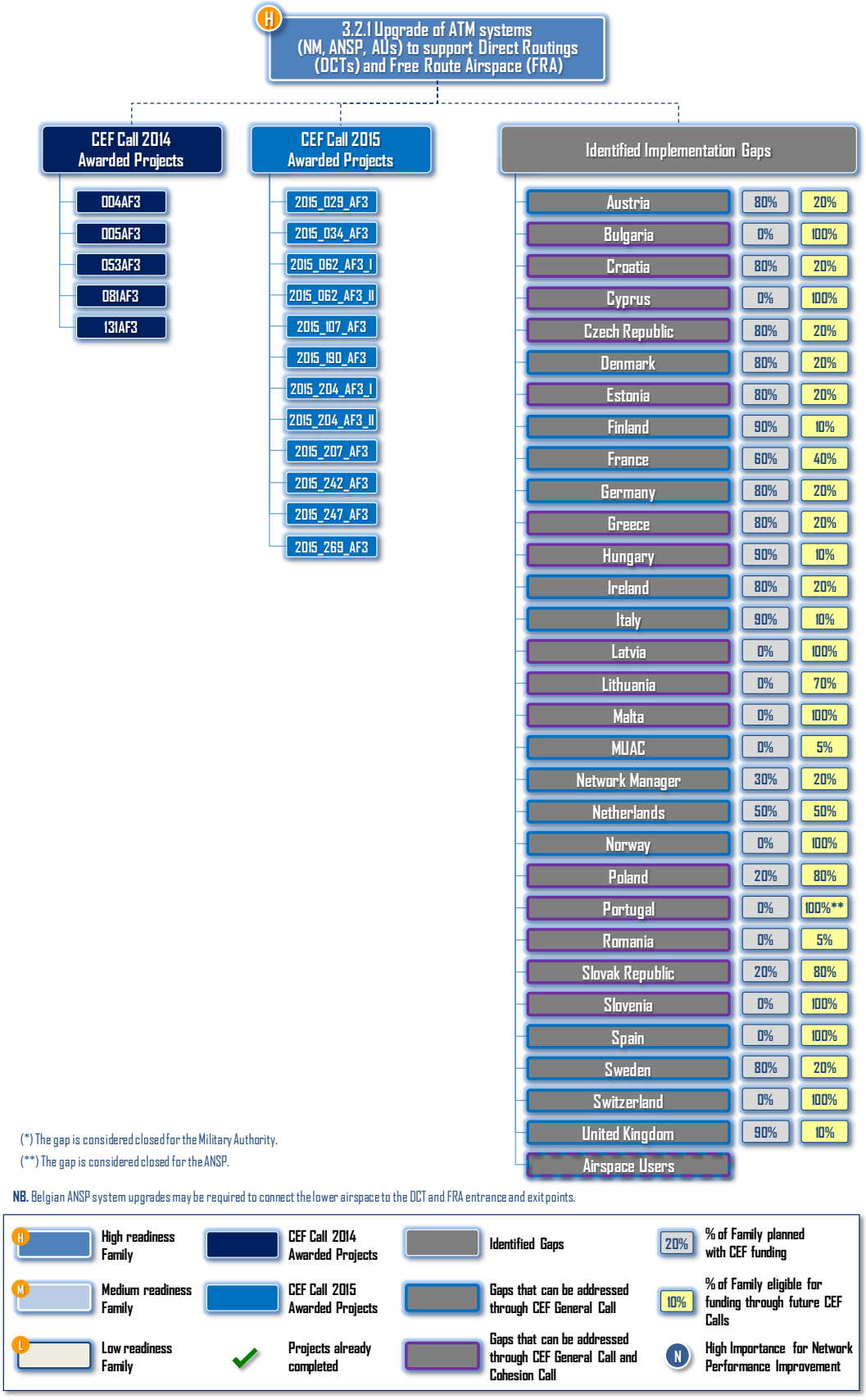
Civil / Military Coordination
Civil-military Coordination is beneficial for, i.e. Basic Flight Data (BFD) and Change Flight Data (CFD), other. Military ATC Systems shall be capable to process all DCT Information.

Stakeholders considered as gaps	Civil-military ANSPs, Civil-Military AUs (CFSPs) Network Manager	
Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B1-FRTO Improved Operations through Optimized ATS Routing	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	CM-0202 Available CM-0203 Available AOM-0500 SESAR Release 5 AOM-0501 SESAR Release 5 AOM-0505 SESAR Release 8 CM-0102-A SESAR Release 2
	ATM Master Plan Level 3 (Edition 2016)	AOM21.1, AOM21.2, ATC02.8, ATC12.1, ATC17, ITY-COTR
SESAR Solutions	#32 "Free Route through the use of Direct Routing" #65 "User Preferred Routing" #33 "Free Route through Free Routing for Flights both in cruise and vertically evolving above a specified Flight Level" PJ.06-01 "Optimized traffic management to enable Free Routing in high and very high complexity environments" #66 "Automated Support for Dynamic Sectorisation"	
Very Large Scale Demonstrations	**Release 7:** N/A **Release 8:** N/A **Release 9:** N/A	

Guidance Material / Specifications / Standards	Updated ECTL Extended MTCD Specifications (2017) Updated ECTL Monitoring Aids (MONA) Specification ECTL Trajectory Prediction Specification ECTL Area Proximity Warning (APW) Guidelines Network Strategy Plan (NSP): SO 3/1 SO 4/1 NM IFPS Users Manual Edition:19.0.1 (20/03/2015) ICAO Doc 9426 Air Traffic Services Planning Manual ICAO Doc 4444 PANS ATM PBN Separation Standards (2018)
Means of compliance and / or Certification	Community Specifications for On-Line Data Interchange (OLDI) edition 4.2
Regulations	Commission Regulation (EC)No 2150/2005 Commission Regulation (EU) No 677/2011, as amended by Commission Implementing Regulation (EU) No 970/2014
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them
Recommendation for IPs proposal	It is recommendable that ANSPs, NM and AUs submit IPs for procurement/upgrade of their systems for DCT/FRA operations. The stakeholders that deployed the system upgrades related to DCT/FRA should be encouraged to consider further upgrades related to cross-border, National/Regional and Pan-European deployment, in the perspective that large scale deployments (e.g.: at FAB level, 24h, with minimum entry/exit conditions/constraints) are recommendable as producing most benefits, and that these would be maximized with future Pan-European deployment. It is recommended to take into consideration the results of Gap Analysis.
Deployment Approach	The implementation of the Family would require the definition of CONOPS for the system/functions **(MM1 – Concept of the new system/functions definition)**, the preparation of the related technical and operational specifications **(MM2 – Operational and technical requirements preparation)** and the signature of the contract(s) for the supplying, installation and integration of such system/functions (**MM3 – Procurement of new system/functions**). In order for the system/functions to be set for operational use, the Factory as well as the Site acceptance test and validation

	shall be successfully performed **(MM4 – Factory Acceptance Test for new system/functions, MM5 – Site Acceptance Test for new system/functions)**, both illustrated in the Family description. Such updated systems shall then be installed **(MM6 – Systems installation)** and their integration, in particular ANSP-ANSP for OLDI and SYSCO, NM-ANSP for FRA airspace definition and NM-CFSP for flight planning requirements, shall be carefully monitored and verified **(MM7 – Systems integration)**. Further activities shall be performed to make such systems available and, more in detail, tailored procedures shall be established and provided for the operational/technical use of the new SWs/tools **(MM8 – Procedures available)**, all safety assessments required shall be duly executed and all the output documents shall then be timely released **(MM9 – Safety assessment)**, all relevant personnel involved shall be appropriately trained **(MM10 – Training of personnel)**, the transition plan prepared and the related transition phase initiated **(MM11 – Transition from legacy system to new one)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM12 – Implementation completed)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 3.2.1 awarded in 2014 or 2015 CEF Calls, along with a more detailed description of each Implementation Project.

Family 3.2.3 – Implement Published Direct Routings (DCTs)

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

Description and Scope

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

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

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

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

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

Interdependencies

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

S-AF-3.1 ASM and Advanced FUA

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

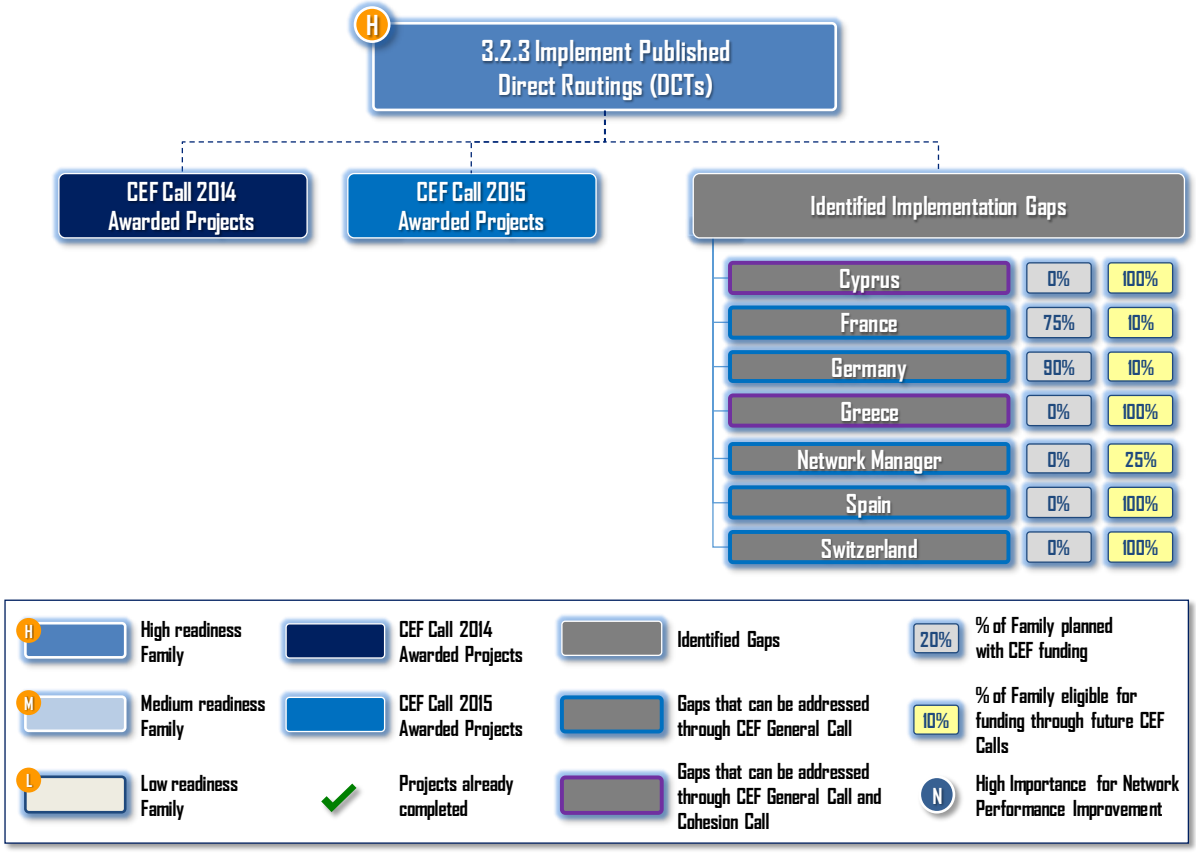
Synchronization Needs

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

Civil / Military Coordination		
Civil-Military Coordination is beneficial for correct publication of the routes, to have ARES data available as soon as possible for planning and navigation purposes, for interfaces upgrade and full interoperability.		
Stakeholders considered as gaps	Civil-Military ANSPs, Network Manager	
Other stakeholders involved in the Family deployment	Civil-Military AUs	
Links to ICAO GANP ASBUs	B1-FRTO Improved Operations through Optimized ATS Routing	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AOM-0500 SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	AOM21.1
SESAR Solutions	#32 "Free Route through the use of Direct Routing" #65 "User Preferred Routing"	
Very Large Scale Demonstrations	**Release 7:** N/A **Release 8:** N/A **Release 9:** N/A	
Guidance Material / Specifications / Standards	Network Strategy Plan (NSP): SO 3/1 European Route Network Improvement Plan (ERNIP) Part 1 Edition June 2015 European Route Network Improvement Plan (ERNIP) Part 2 - European ATS Route Network - Edition June 2015 European Route Network Improvement Plan (ERNIP) Part 4 - Route Availability Document User's Manual; (11/2014) NM European Airspace Design Methodology – Guidelines (06/2015) ICAO Doc 9426 Air Traffic Services Planning Manual ICAO Doc 4444 PANS ATM PBN Separation Standards (2018)	
Means of compliance and / or Certification	None	
Regulations	Commission Regulation (EC) 2150/2005 Commission Regulation (EC) 677/2011 as amended by 970/2014	
Cyber security requirements	None	

Recommendation for IPs proposal	DCTs deadline is 1 January 2018 since it is considered being an intermediate step (not mandatory) towards FRA implementation. Only stakeholders that haven't already deployed or are not currently deploying FRA should submit IPs for this family. It is recommended to take into consideration the results of Gap Analysis.
Deployment Approach	The implementation of the Family would require the definition of features and operational use of the airspace where the DCTs are going to be implemented, also taking into consideration that local coordination with the Military Authority shall be performed **(MM1 – DCT airspace definition)**; fast and real time simulations shall be executed, if required, and later, whether its involvement is envisaged, NM could validate such simulations **(MM2 – Fast and Realtime Simulation)**. Operational procedures shall be provided **(MM3 – Procedures available)** and Direct Routings shall be published into the relevant aeronautical documents **(MM4 – Publication of Direct Routings)**, all safety assessments required shall be duly executed and all the output documents shall be then timely released **(MM5 – Safety assessment)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM6 – Implementation completed)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



Family 3.2.4 – Implement Free Route Airspace

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

Description and Scope

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

Free Route Airspace (FRA) is a specified airspace within which users may freely plan a route between defined FRA entry points and defined FRA exit points, with the possibility to route via intermediate (published or unpublished) waypoints, without reference to the ATS route network, subject to airspace availability. Within this airspace, flights remain subject to air traffic control. Reg. 716/2014 requires FRA deployment at and above FL310 within the end of 2021.

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

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

FRA shall be published in aeronautical publications as described in the European Route Network Improvement Plan of the Network Manager.

FRA deployment may be deployed at national level, progressing to FAB Regional level and expressing most benefits at Pan-European level deployment.

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

Interdependencies

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

S-AF-3.1 – ASM and Advanced FUA

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

Synchronization Needs

There is the need to coordinate/synchronize efforts (operational procedure and aircraft capabilities) between ANSPs, NM, Military and Airspace Users to ensure the return of

investment and/or the start of operational benefits. Coordinated activities and implementation at State, FAB, Regional and Pan-European level are required.

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

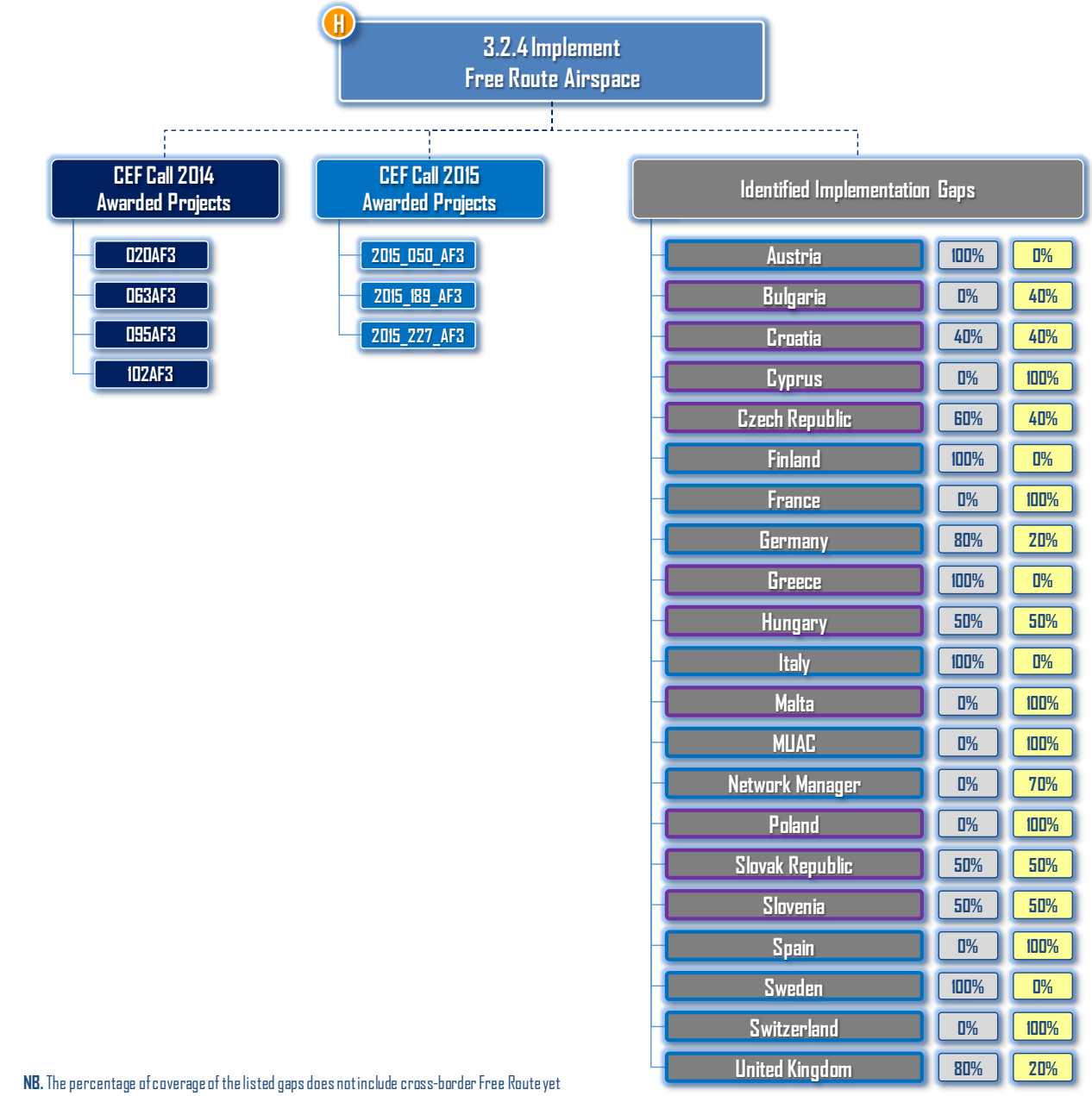
Civil / Military Coordination

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

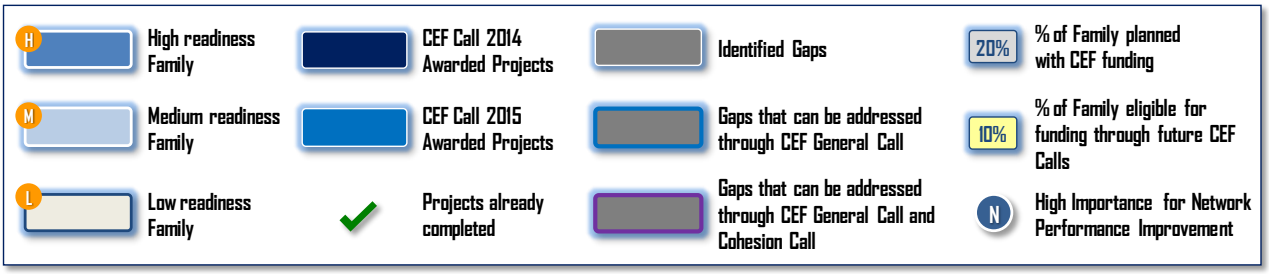
Stakeholders considered as gaps	Civil-Military ANSPs, Network Manager	
Other stakeholders involved in the Family deployment	Civil-Military AUs	
Links to ICAO GANP ASBUs	B1-FRTO Improved Operations through Optimized ATS Routing	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AOM-0501 SESAR Release 5 AOM-0500 SESAR Release 5 AOM-0505 SESAR Release 8
	ATM Master Plan Level 3 (Edition 2016)	AOM21.2
SESAR Solutions	#33 "Free Route through Free Routing for Flights both in cruise and vertically evolving above a specified Flight Level" #65 "User Preferred Routing" PJ.06-01 "Optimized traffic management to enable Free Routing in high and very high complexity environments"	
Very Large Scale Demonstrations	**Release 7:** N/A **Release 8:** N/A **Release 9:** N/A	
Guidance Material / Specifications / Standards	Network Strategy Plan (NSP): SO 3/1 European Route Network Improvement Plan (ERNIP) Part 1 dition June 2015 European Route Network Improvement Plan (ERNIP) Part 2 - European ATS Route Network - Edition June 2015 European Route Network Improvement Plan (ERNIP) Part 4 - Route Availability Document User's Manual; Edition Nov. 2014	

	NM European Airspace Design Methodology - Guidelines; Edition June 2015 ICAO Doc 9426 Air Traffic Services Planning Manual ICAO Doc 4444 PANS ATM PBN Separation Standards (2018)
Means of compliance and / or Certification	None
Regulations	Commission Regulation (EC) 2150/2005 Commission Regulation (EC) 677/2011 as amended by 970/2014
Cyber security requirements	None
Recommendation for IPs proposal	FRA deployment is mandatory above FL305. Large scale deployments (e.g.: at FAB level, 24h, with minimum entry/exit conditions/constraints) are recommendable as producing most benefits that would be maximized considering future Pan-European FRA deployment. It is recommended to take into consideration the results of Gap Analysis
Deployment Approach	The implementation of the Family would require the definition of features and operational concepts of airspace at least above FL305, where FRA is going to be implemented, also ensuring that local coordination with the military needs to be performed **(MM1 – Free Route Airspace definition)**. In this respect, the initial implementation (FRA deployment with limitations e.g. in respect of FL, lateral dimension or timing) shall be planned, but the FRA CONOPS should address the PCP full scope and requirements. In order for the Free Route Airspace to be implemented, fast and real time simulations shall be executed, if required, and later, whether its involvement is envisaged, NM shall validate such simulations **(MM2 – Fast and Realtime Simulation)**. Operational procedures shall be provided **(MM3 – Procedures available)** and Free Route Airspace shall be published into the relevant aeronautical documents **(MM4 – Publication of Free Route Airspace)**, all safety assessments required shall be duly executed and all the output documents shall be then timely released **(MM5 – Safety assessment)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM6 – Implementation completed)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



NB. The percentage of coverage of the listed gaps does not include cross-border Free Route yet



Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 3.2.4 awarded in 2014 or 2015 CEF Calls, along with a more detailed description of each Implementation Project.

AF #4 – Network Collaborative Management

The ATM Functionality #4, Network Collaborative Management, has the objective of enhancing the European ATM network performance, notably capacity and flight efficiency, through the exchange, modification and management of aircraft trajectory information. Flow Management shall move to a Cooperative Traffic Management (CTM) environment, optimizing the delivery of traffic into sectors and airports whilst acknowledging the requirement for Air Traffic Flow and Capacity Management (ATFCM) measures.

AF4 is structured in four Sub-AFs with their related Families, as follows:

Sub-AF4.1 – Enhanced Short Term ATFCM Measures

- Family 4.1.1 – STAM Phase 1 (mainly related to what already exists)
- Family 4.1.2 – STAM Phase 2 (with coordination between local entities – such as ANSP, Airport and AU – and NM tools)

Sub-AF4.2 – Collaborative NOP, which is about the exchange of information between Stakeholders via a central repository

- Family 4.2.2 – Interactive Rolling NOP (NM platform and its usage)
- Family 4.2.3 – Interface ATM Systems to NM Systems (information exchange between ANSP, AU and NM)
- Family 4.2.4 – AOP/NOP Information Sharing (information exchange between Airports – see Family 2.1.4 for AOP – and NM)

Sub-AF4.3 – Calculated Take-off Time to Target Times for ATFCM purposes

- Family 4.3.1 – Target Time for ATFCM purposes (including the validated part)
- Family 4.3.2 – Reconciled Target Times for ATFCM and arrival sequencing(including a more ambitious yet still to be fully validated concept)

Sub-AF4.4 – Automated Support for Traffic Complexity Assessment

- Family 4.4.2 – Traffic Complexity Tools

The following chart highlights the overall structure of the ATM Functionality #4, namely its SUB AFs, Families and their relevant Implementation initiatives related to both 2014 CEF Call awarded projects and 2015 CEF Call candidate projects.

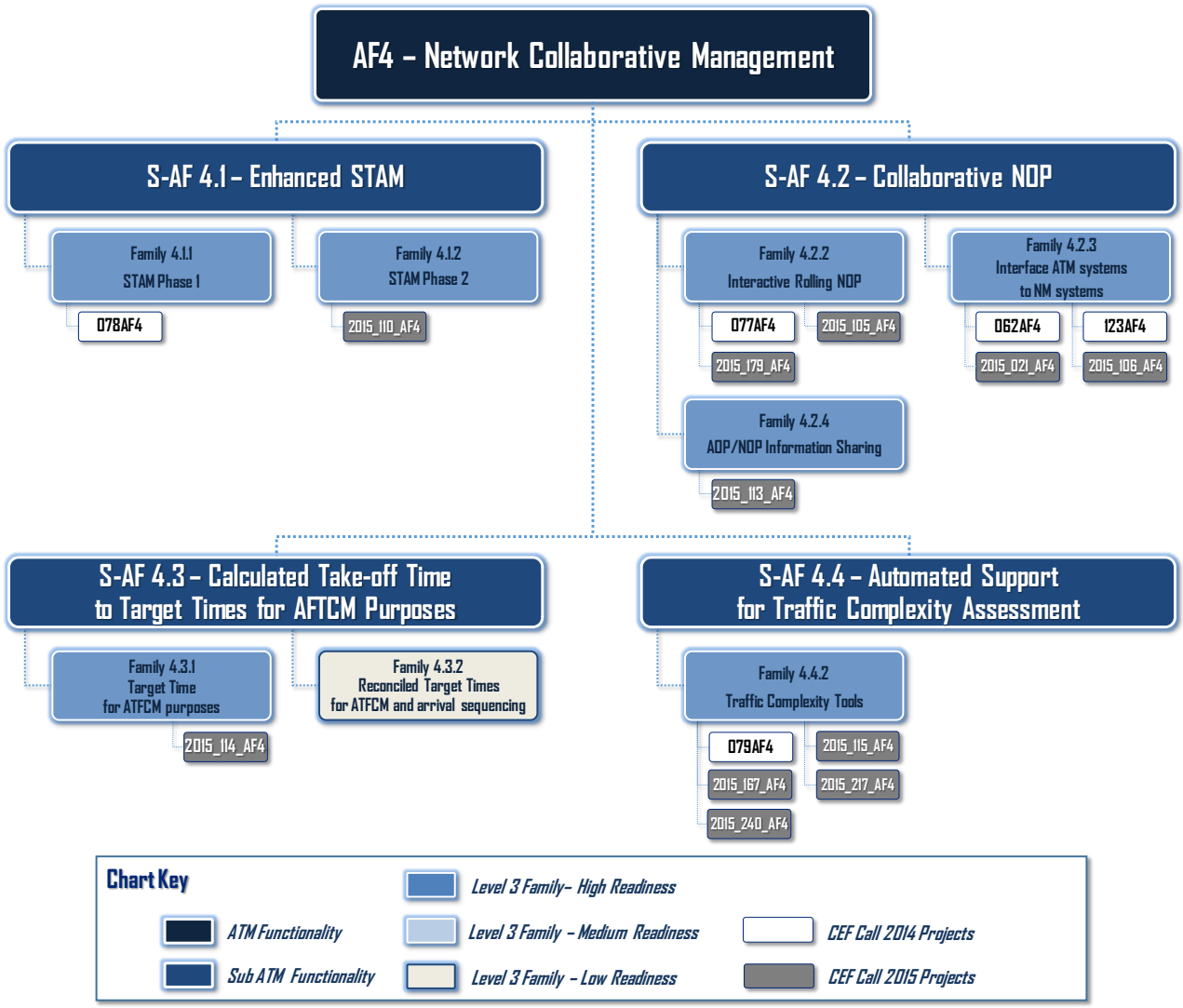


Fig. 21 – AF #4 Structure

The following Gantt chart shows the implementation roadmap for each Family included in AF4 in terms of start and end date of deployment, and it has been defined taking into account the target dates for each ATM Functionality and Sub-ATM Functionality, as stated in Regulation (EU) No 716/2014.

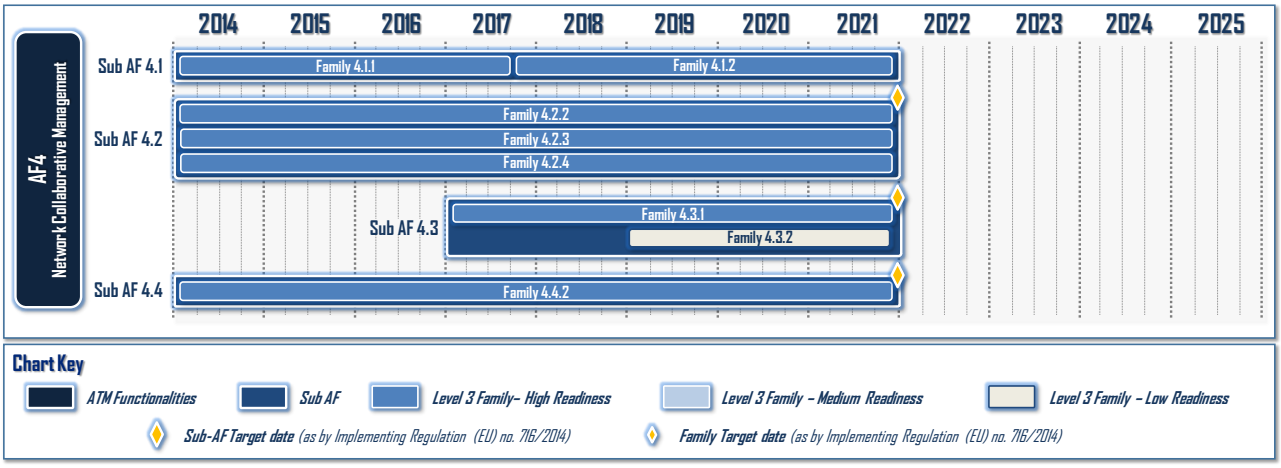


Fig. 22 – AF #4 Implementation Timeline

Family 4.1.1 – STAM phase 1

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

Description and Scope

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

In order to close the gap between ATC and ATFCM, local operational procedures need to be developed. The aim is to improve the efficiency of the system using flow management techniques close to the real time operations with direct impact on tactical capacity management, occupancy counts and tactical action on traffic. The target of the Short Term ATFCM Measures (STAM) phase 1 is to replace En Route CASA regulations for situations when imbalances are manageable via STAM phase 1.
STAM phase 1 is mainly procedural implementation using the occupancy counts instead of entry counts for a better evaluation of overload, hot spot detection, limitation a need for regulations and implementation of STAM measure at local level. Each FMP needs to develop the STAM FCM procedure.

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

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

Interdependencies

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

Fam. 4.4.2 - Traffic Complexity tools

Synchronization Needs

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

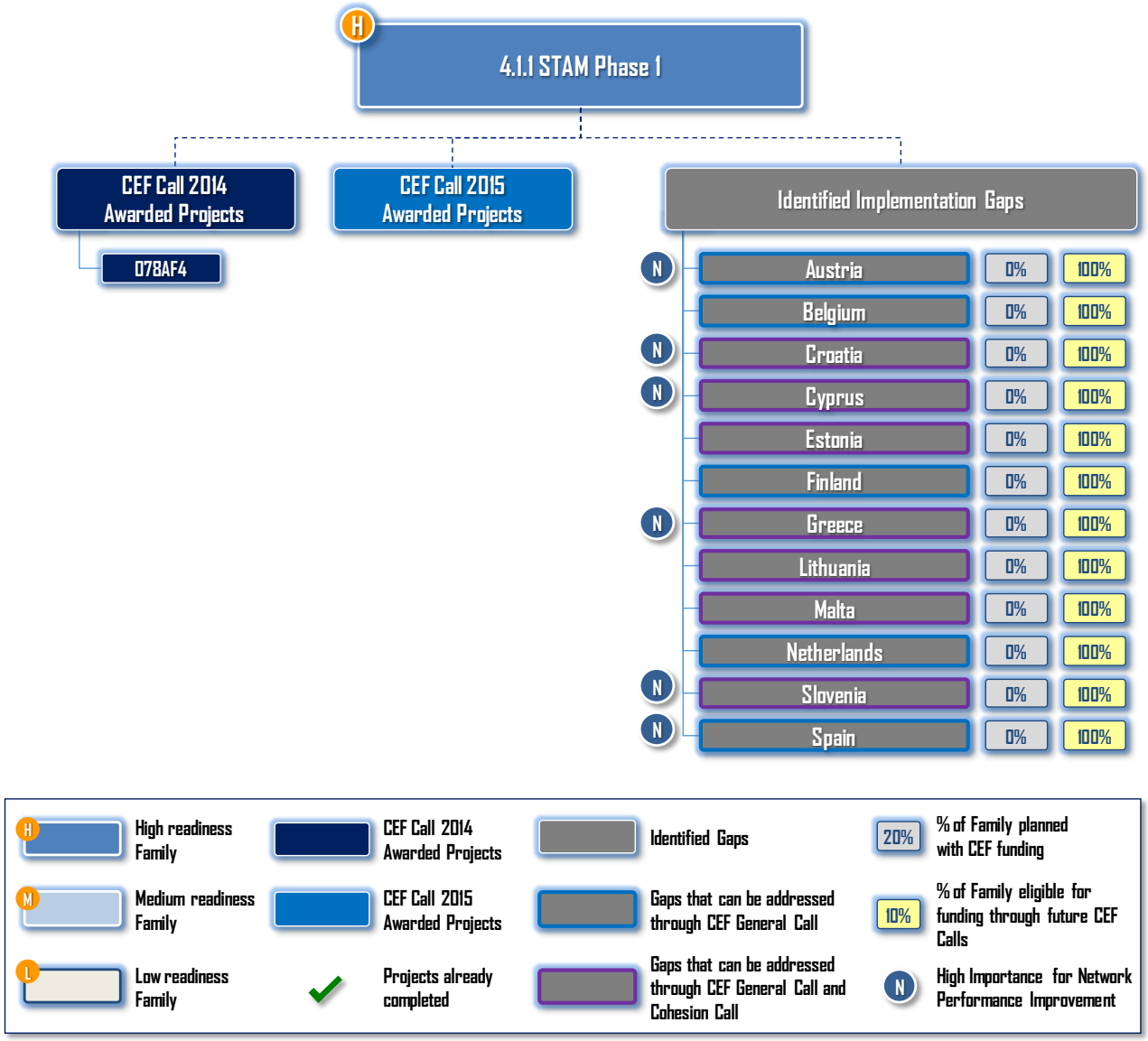
Civil / Military Coordination

Yes, depending on the civil-military ATS organisation

Stakeholders considered as gaps	ANSPs, Network Manager

Other stakeholders involved in the Family deployment	Airspace Users, Airports, Military Authorities	
Links to ICAO GANP ASBUs	B0-NOPS Improved Flow Performance through Planning based on a Network-wide view	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	DCB-0205 Available
	ATM Master Plan Level 3 (Edition 2016)	FCM04.1
SESAR Solutions	N/A	
Very Large Scale Demonstrations	N/A	
Guidance Material / Specifications / Standards	Network Strategy Plan (NSP): SO 4/3 SO 5/4 NM ATFCM Operations Manual; Edition 19,1 (29/04/2015) ICAO Doc 9971 Manual on Collaborative Air Traffic Flow Management (ATFM part)	
Means of compliance and / or Certification	None	
Regulations	None	
Cyber security requirements	None	
Recommendation for IPs proposal	STAM Phase 1 would deliver additional capacity just relying on better utilisation of the available resources by moving from the hourly sector capacity rates to the occupancy counts. However, STAM phase 1 is not a mandatory step towards STAM phase 2. It is recommended to take into consideration the results of Gap Analysis.	
Deployment Approach	The implementation of the Family would require the development of the STAM phase 1 concept of operations, including the identification of local measures. Such development will potentially include the use of occupancy from NM tool (including the definition of OTMV), to be performed in coordination with Network Manager **(MM1 – STAM phase 1 concept of operations development).** Following the concept of operations development, local procedures shall be developed and made available for operational use; such activity could be performed in coordination with neighbouring ACC and/or NM **(MM2 – Procedures available)**. The local operational documentation shall also be developed **(MM3 – Operational guidance documentation development)**. All operational personnel shall be duly trained **(MM4 – Training)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM5 – Implementation completed)**.	

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



A dedicated table within Annex A encompasses the list of implementation initiatives associated to Family 1.1.1 awarded in 2014 CEF Call, along with a more detailed description of each Implementation Project. No Implementation Project associated to this Family has been awarded in 2015 CEF Call.

Family 4.1.2 – STAM Phase 2

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

Description and Scope

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

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

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

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

ANSPs and AUs shall deploy:

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

Interdependencies

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

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

Synchronization Needs

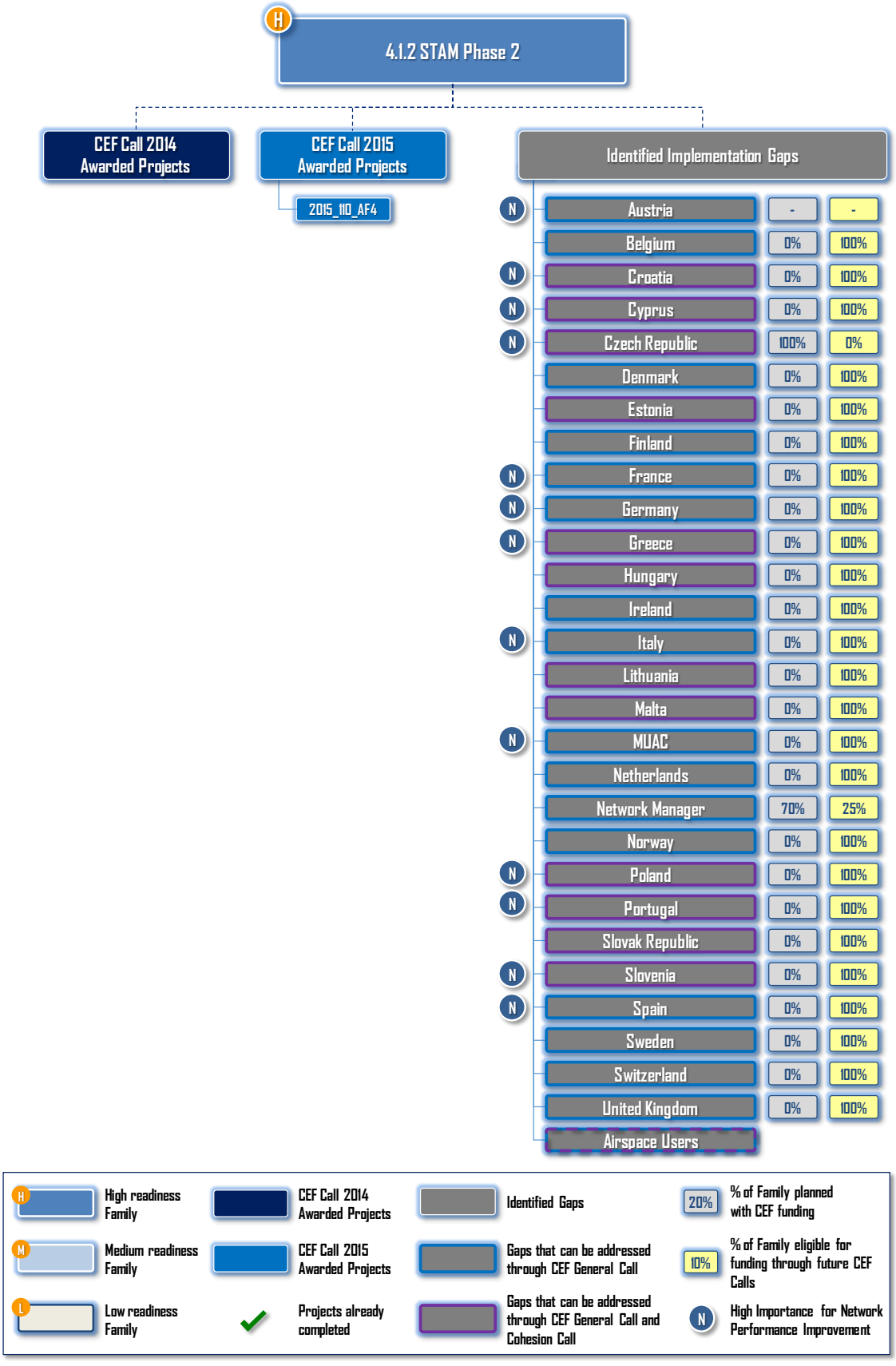
Upgrade of NM systems is required for STAM phase 2.

Synchronisation is necessary between neighbouring ACCs.

Civil / Military Coordination		
Yes, depending on civil/military organization		
Stakeholders considered as gaps	Network Manager, ANSPs, Airport Operators, Airspace Users (CFSP)	
Other stakeholders involved in the Family deployment	Military Authorities	
Links to ICAO GANP ASBUs	B1-NOPS Enhanced Flow Performance through Network Operational Planning	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	DCB-0308 SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	FCM04.2
SESAR Solutions	#17 "Advanced Short ATFCM Measures (STAM)"	
Very Large Scale Demonstrations	**Release 7:** PJ.24 **Release 8:** PJ.24 **Release 9:** PJ.24	
Guidance Material / Specifications / Standards	NM Enhanced Short Term ATFCM guidance material Network Strategy Plan (NSP): SO 4/3; SO 5/4 ICAO Doc 9971 Manual on Collaborative Air Traffic Flow Management (ATFM part)	
Means of compliance and / or Certification	None	
Regulations	None	
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them	
Recommendation for IPs proposal	The proposal should refer to the further NM developments for STAM phase 2. ANSPs and eventually AUs should consider submitting proposals for STAM phase 2 deployments (local tool and/or NM tool utilisation). It is recommended to take into consideration the results of Gap Analysis.	

Deployment Approach	The implementation of the Family would require the development of the STAM phase 2 concept of operations, including the definition of roles and responsibilities of all actors, as well as the identification of the overall process. If required, local coordination with the military and/or with the airport should be performed **(MM1 – STAM phase 2 concept of operations development)**. The Network Manager should implement system improvements based on operational requirements in order to facilitate the coordination with local stakeholders **(MM2 – Upgrade of NM-systems)**. ANSPs shall install local tools capable to support STAM measure or to ensure the local implementation of the NM STAM stool. Military and airports could be involved in such installation **(MM3 – Installation of STAM support tool)**. ANSPs shall then issue local/sub regional procedures for the use of the local tool, in coordination with NM (and - if required - Airport and Military) **(MM4 – Local/sub regional procedures available)**. Network Manager shall define common procedure for coordination and consequentially develop operational guidance documentation for this purpose **(MM5 – Development of operational guidance documentation for coordination)**. ANSPs and NM shall adapt and integrate their systems in order to allow the required data exchange and functionalities; it is worth noting that such activities are not required if NM tool is used **(MM6 – Integration of local STAM support systems with NM)**. All involved operational staff from ANSPs and NM shall be duly trained **(MM7 – Training)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM8 – Implementation completed)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



A dedicated table within Annex A encompasses the list of implementation initiatives associated to Family 4.1.2 awarded in 2015 CEF Call, along with a more detailed description of each Implementation Project. No Implementation Project associated to this Family has been awarded in 2014 CEF Call.

Family 4.2.2 – Interactive Rolling NOP

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

Description and Scope

Network operations are driven by enhanced stakeholders' participation in a rolling cooperative process (Civil & Military airspace users, ANSPs, Airports, NM, outside EUR interfaces). By continuously sharing latest flight intentions resulting in demand and available capacity, defining measures in the network operations plan, realising the plan as a target by all actors taking into account operational updates, evaluating operations against performance targets and updating the plan.

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

An initial implementation of the Interactive Rolling NOP was achieved through the deployment of the NOP Portal, providing a limited initial view of the Network Situation, with very limited collaboration and tailoring capabilities.

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

This platform supports the network collaborative rolling processes from strategic to real-time operations, including capabilities for online performance monitoring integrated and feeding back into the collaborative network planning. Also, the platform provides access to post-operational data for offline analysis and performance reporting.

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

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

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

Interdependencies

Family 4.2.4 AOP/NOP information sharing

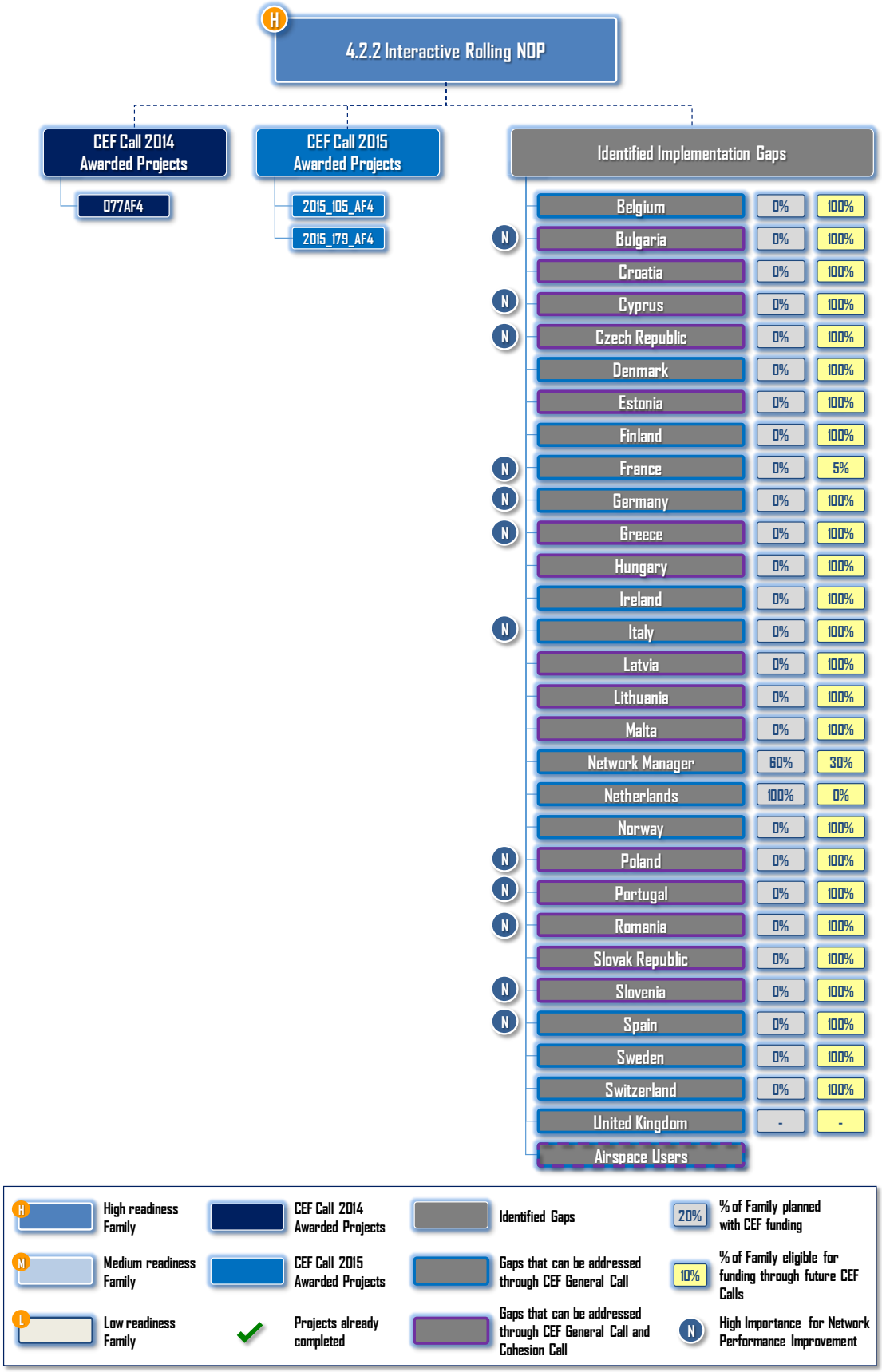
Family 4.1.2 STAM phase 2 need the new platform to be deployed.

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

Dependency on AF5 for the SWIM infrastructure and SWIM interfaces		
Synchronization Needs		
The deployment of Network Collaborative Management functionality shall be coordinated due to the potential network performance impact of delayed implementation in a wide geographical scope involving a number of stakeholders. From a technical perspective the deployment of targeted system and procedural changes shall be synchronized to ensure that the performance objectives are met.		
Civil / Military Coordination		
Yes, especially for interface requirement		
Stakeholders considered as gaps	Network Manager, ANSPs, Airspace Users(CFSP)	
Other stakeholders involved in the Family deployment	Airport Operators, Military Authorities,	
Links to ICAO GANP ASBUs	B1-NOPS Enhanced Flow Performance through Network Operational Planning	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	DCB-0103-A SESAR Release 5 DCB-0102 Available
	ATM Master Plan Level 3 (Edition 2016)	FCM05
SESAR Solutions	#20 "Collaborative NOP for Step 1"	
Very Large Scale Demonstrations	**Release 7:** PJ.24 **Release 8:** PJ.24 **Release 9:** PJ.24	
Guidance Material / Specifications / Standards	Collaborative NOP Network Strategy Plan (NSP): SO 2/1 SO 2/2 SO 2/3 and SO 2/4 NOP User Guide; Edition:19.0-92 Date:25/03/2015	
Means of compliance and / or Certification	None	
Regulations	None	
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with	

	appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them
Recommendation for IPs proposal	It will be a basic platform for info sharing between all stakeholders. IPs proposals are expected by NM (as provider of the platform) but in terms of deployment the different stakeholders are impacted, as processes need to be put in place locally to use the platform. It is recommended to take into consideration the results of Gap Analysis.
Deployment Approach	The implementation of the Family would require the Network Manager to provide B2B and HMI interfaces with other OPS actors for any relevant data exchange needed for ATM Functionalities 4 **(MM1 – NM to deploy Interactive Rolling NOP platform)**. Network Manager shall also define procedures and provide documentation for the use of the system **(MM2 – NM to develop guidance material)**. ANPSs shall then define and make available procedures for the use of interfaces; it is worth noting that airport and military could be also involved if required **(MM3 – Procedures available at local side)**. All involved operational staff from ANSPs, NM and - if required airports and militaries - shall be duly trained **(MM4 – Training)**.The execution of such activities is expected to lead to the start of permanent operational use **(MM5 – Implementation completed)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 4.2.2 awarded in 2014 or 2015 CEF Calls, along with a more detailed description of each Implementation Project.

Family 4.2.3 – Interface ATM systems to NM systems

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

Description and Scope

This Family addresses the message exchange between NM systems, ANSPs ATM system and AU/FOC /WOC flight plan fling systems in respect of collaborative flight planning, improving flight plan distribution and enhanced tactical flow management.

The exchanges of following messages between NM, ATM and AU/FOC systems are addressed by this Family as:

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

The EFPL will include the planned 4D trajectory of the flight as well as flight performance data in addition to ICAO 2012 FPL data.

The first phase that will be implemented should address only the exchange of EFPL information between AUs and NM.

The transmission of EFPL data to ANSP (flight plan distribution) will be implemented when transition to FF-ICE provisions is achieved. ANSPs automatically provide AFP message to NM for following events:

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

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

Subsequently, as the FIXM version corresponding to FF-ICE/1 becomes available, the EFPL will be migrated to FIXM.

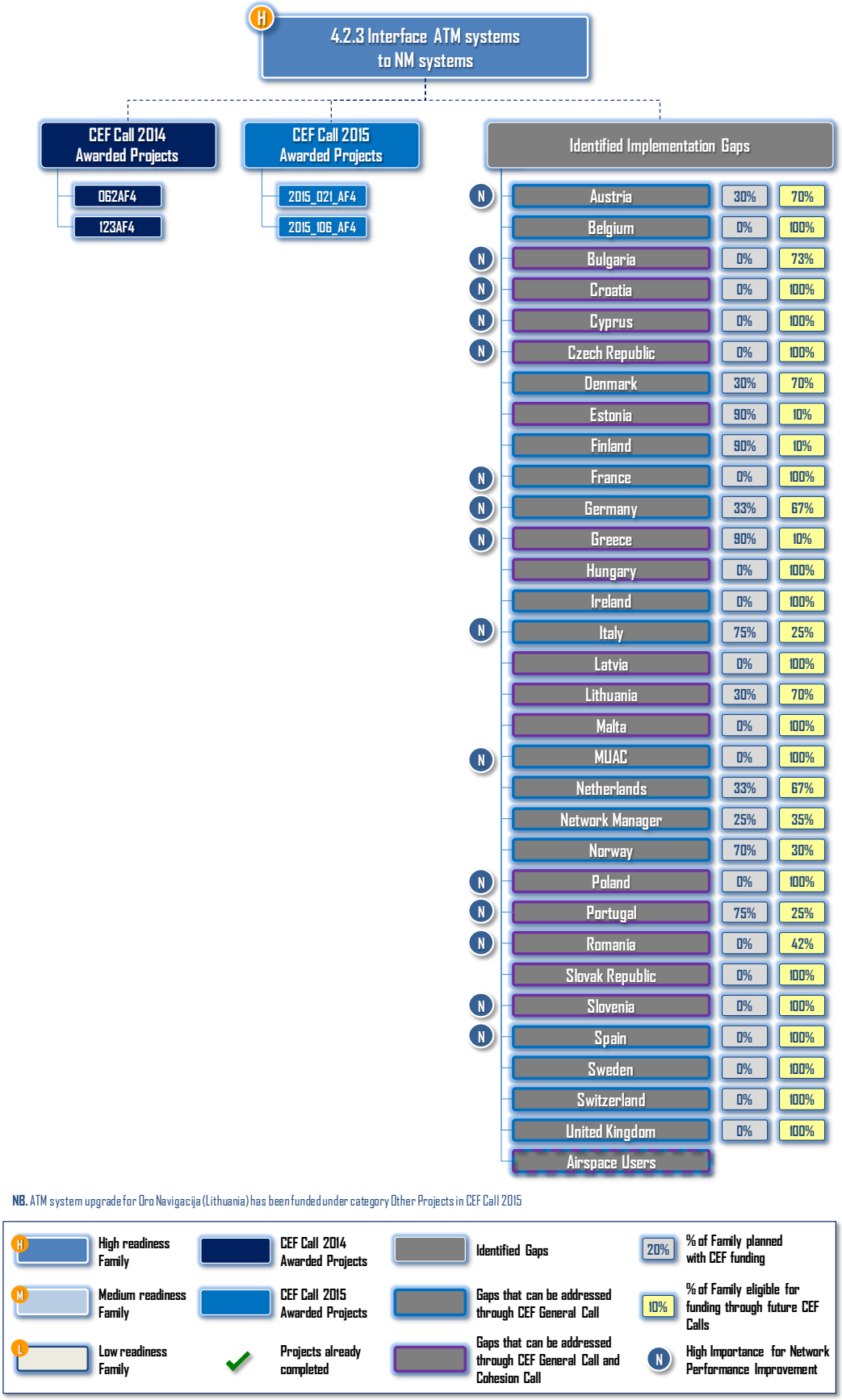
As a first Step toward the implementation of the Mission Trajectory concept, military environmental data will be processed by FDPS and IFPS (reference Sub-Family 3.1).

Despite not in the PCP, an Improved OAT FPL should be considered as an enabler processed by IFPS to describe the trajectory including the information about ARES to be used, in order to have a more comprehensive view of airspace demand.
Interdependencies
Fam. 4.4.2 - Traffic Complexity tools Dependency on AF5 for the SWIM Infrastructure and SWIM interfaces. Link with AF6 (EPP)
Synchronization Needs
Synchronisation is required for AFP between NM and ANSPs. For EFPL deployment, the synchronisation between NM, AU and ANSP is required for the development and deployment phase.
Civil / Military Coordination
Yes, required.

Stakeholders considered as gaps	ANSPs, Airspace Users (CFSPs), Network Manager, Military Authorities	
Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B1-FICE Increased Interoperability, Efficiency and Capacity through Flight and Flow Information for a Collaborative Environment Step-1 (FF-ICE/1) application before Departure B1-NOPS Enhanced Flow Performance through Network Operational Planning	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	IS-0102 Available AUO-0203 SESAR Release 5 AUO-0215 SESAR Release 7
	ATM Master Plan Level 3 (Edition 2016)	FCM03, FCM08
SESAR Solutions	#37 "Extended Flight Plan"; PJ.18-01 "Mission Trajectories"	
Very Large Scale Demonstrations	**Release 7:** PJ. 24 **Release 8:** PJ. 24 **Release 9:** PJ. 24	
Guidance Material / Specifications / Standards	Network Strategy Plan (NSP): SO 4/2 and SO 5/1 NM Flight Progress Messages Document – Edition 2.1 (03/2015)	
Means of compliance and / or Certification	Community Specifications 0101 Edition 1.1 Specification for the Initial Flight Plan	

Regulations	None
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them
Recommendation for IPs proposal	The exchanges of collaborative flight planning messages are essential for improving the Pan-European flight predictability. It should be considered to prime importance to address the existing gaps for the provision of CPRs, AFP and FSA messages to NM. ANSPs which not yet provide these messages to NM should consider submitting IP proposal. NM and AUs should consider submitting IP proposal for EFPL and iOAT flight plan. It is recommended to take into consideration the results of Gap Analysis.
Deployment Approach	The implementation of the Family would require ANSPs (and - if needed - airports) to upgrade their systems in order to generate messages to NM and for NM to receive and process, and distribute as required (including FSA, CPR, AFP, APL, ACH messages). The involvement of militaries is necessary for GAT (EFPL) and OAT FPL **(MM1 – System upgrade to send messages to NM)**. ANSPs (and - if needed - airports) are also required to upgrade their systems in order to receive and process messages coming from Network Manager, using the guidance material developed by NM for Family 4.2.2 **(MM2 – System upgrade to receive messages from NM)**. ANSPs (and airports - if needed) shall perform pre-implementation trials **(MM3 – Integration test with NM)**. Operational procedures for the use of new messages shall be defined and made available **(MM4 – Procedures available)**. A safety assessment for associated operational and system changes shall be performed successfully **(MM5 – Safety Assessment)** and all operational/technical staff involved shall be duly trained **(MM6 – Training)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM7 – Implementation completed)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 4.2.3 awarded in 2014 or 2015 CEF Calls, along with a more detailed description of each Implementation Project.

Family 4.2.4 – AOP/NOP information sharing

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

Description and Scope

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

The AOP is a single, common and collaboratively agreed rolling plan available to all airport stakeholders whose purpose is to provide common situational awareness and to form the basis upon which stakeholder decisions relating to process optimization can be made.

In order to improve the European ATM network performance, notably capacity and flight efficiency through exchange, modification and management of trajectory information there is a clear need for information sharing between the AOP and the NOP (Network Operation Plan). The integration of AOP and NOP provides a rolling picture of the network situation used by stakeholders to prepare their plans and their inputs to the network CDM processes (e.g. negotiation of airspace configurations). As such the collaborative NOP will be fully integrated in ATM stakeholders' planning processes and working methods.

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

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

Interdependencies

Family 4.2.2 and Family 2.1.4

Family 5.4.1

Synchronization Needs

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

Civil / Military Coordination		
Yes, depending on civil/military ATS organization		
Stakeholders considered as gaps	Network Manager, Airport Operators	
Other stakeholders involved in the Family deployment	ANSPs, Military Authorities, MET Service Providers,	
Links to ICAO GANP ASBUs	B0-NOPS Improved Flow Performance through Planning based on a Network-wide view	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	DCB-0103-A SESAR Release 5 AO-0801-A SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	FCM05
SESAR Solutions	#20 "Collaborative NOP for Step 1" #21 "Airport Operations Plan and AOP-NOP Seamless Integration"	
Very Large Scale Demonstrations	**Release 7:** PJ.24, 28 **Release 8:** PJ.24, 28 **Release 9:** PJ.24, 28	
Guidance Material / Specifications / Standards	NM AOP/NOP Interface Specifications and Guidance Material Network Strategy Plan (NSP): SO 4/3 SO 06/2; and SO 6/4 ICAO Doc 9971 Manual on Collaborative Air Traffic Flow Management (ATFM part)	
Means of compliance and / or Certification	None	
Regulations	None	
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them	

Recommendation for IPs proposal	In order to achieve full performance of Family 4.2.4, it is recommended to implement Family 2.1.4 since it is part of the critical initiatives to resolve and mitigate the impacts of current capacity constraints and potential bottlenecks, which might hinder the overall performance at network level. For that reason, it is highly recommended that NM define the interface between AOP and NOP to be in a position to deploy AOP/NOP integration as soon as AOP is available. It is recommended to take into consideration the results of Gap Analysis, considering also the Gap Analysis of Family 2.1.4.
Deployment Approach	The implementation of the Family would require the Network Manager to adapt their system to receive and process information coming from AOP and distribute as required to operational stakeholders **(MM1 – NM to develop interface for AOP integration)**. Network Manager shall also develop the required procedures and the associated documentation to support the utilisation of interfaces **(MM2 – NM to develop operational guidance documentation)**. All interested systems shall be updated in order to allow the system-to-system data exchange and to enable all necessary functionalities. Military could be involved in such activities **(MM3 – Integration of AOP with NOP)**. The procedures for generating and/or using messages shall be elaborated, with the involvement of ANSPs and Militaries, if necessary **(MM4 – Procedures available)**. All involved operational staff shall be duly trained **(MM5 – Training)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM6 – Implementation completed)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.

A dedicated table within Annex A encompasses the list of implementation initiatives associated to Family 4.2.4 awarded in 2015 CEF Call, along with a more detailed description of each Implementation Project. No Implementation Project associated to this Family has been awarded in 2014 CEF Call.

Family 4.3.1 – Target Time for ATFCM purposes

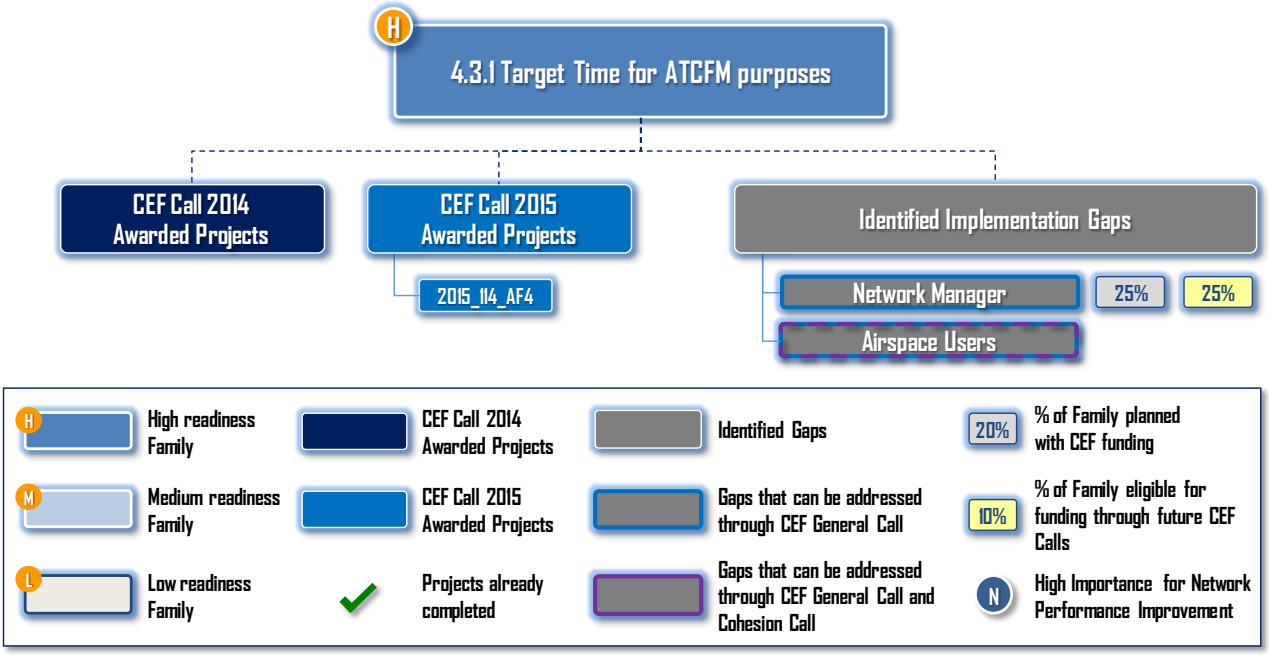
4.3.1 – Target Time for ATFCM purposes			
Main Sub-AF	Sub-AF 4.3 CTOT to Target Time for ATFCM Purposes		
Readiness for implementation	High		
Initial Operational Capability	01/01/2017	**Full Operational Capability**	01/01/2022

Description and Scope
First Step: NM system should transmit calculated target time at the most penalising regulation reference point in addition to CTOT to all concerned users. Those users should be able to manage this new feature and potential system upgrades should be foreseen. Second step (to be validated in 2016): This first step, particularly in case of unique Airport regulation, either linked to ground (AOP) or arrival sequencing (AMAN, extended-AMAN), will permit an early partial optimisation from a local point of view via the transmission of local TTA/TTO to NM. NM will be in charge of assessing the network impact leading eventually to coordination with the originator, and of transmission of CTOT and TTA/TTO to the concerned flight. This process will be limited to the planning phase and transmission of CTOT and updated CTOT as per standard processes. It will also enhance the slot swapping process.
Interdependencies
Fam 4.1.2 STAM phase 2 (coordination with originator of TT) Fam 1.1.2 Extended AMAN Fam 2.1.4 Initial AOP
Synchronization Needs
Coordination between NM and other stakeholder for eventual local implementation
Civil / Military Coordination
Not foreseen

Stakeholders considered as gaps	Network Manager, Airspace Users (CFSP)
Other stakeholders involved in the Family deployment	ANSPs, Airport Operators, Military Authorities
Links to ICAO GANP ASBUs	B0-NOPS Improved Flow Performance through Planning based on a Network-wide view

ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	DCB-0208 SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	FCM07.1
SESAR Solutions	#18 "CTOT and TTA"	
Very Large Scale Demonstrations	**Release 7:** PJ.24 **Release 8:** PJ.24 **Release 9:** PJ.24	
Guidance Material / Specifications / Standards	Network Strategy Plan (NSP): SO 4/3, SO 5/4 ICAO Doc 9971 Manual on Collaborative Air Traffic Flow Management (ATFM part)	
Means of compliance and / or Certification	None	
Regulations	None	
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them	
Recommendation for IPs proposal	After a first step for the transmission by NM of target time on the constrained area on top of CTOT, airport and ANSP could consider submitting IP's proposal for the deployment of this Family. AUs need to update their system to take target times into account in their planning procedure. It is recommended to take into consideration the results of Gap Analysis.	
Deployment Approach	The implementation of the Family would require the Network Manager to provide description and guidance upon the interfaces between the NM systems and other systems (e.g. AU), as well as the related procedures **(MM1 – NM to provide guidance on use of target time)**. All systems of the involved stakeholder dedicated to Target Times processing and use shall also be updated **(MM2 – System upgrades)**. Procedures for all involved actors (NM/ANSPs and airports for planning purposes) to facilitate Target Times for ATFCM purposes shall be developed and made available **(MM3 – Procedures available)**. All involved operational staff shall be duly trained **(MM4 – Training)**.The execution of such activities is expected to lead to the start of permanent operational use **(MM5 – Implementation completed)**.	

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



A dedicated table within Annex A encompasses the list of implementation initiatives associated to Family 4.3.1 awarded in 2015 CEF Call, along with a more detailed description of each Implementation Project. No Implementation Project associated to this Family has been awarded in 2014 CEF Call.

Family 4.3.2 – Reconciled target times for ATFCM and arrival sequencing

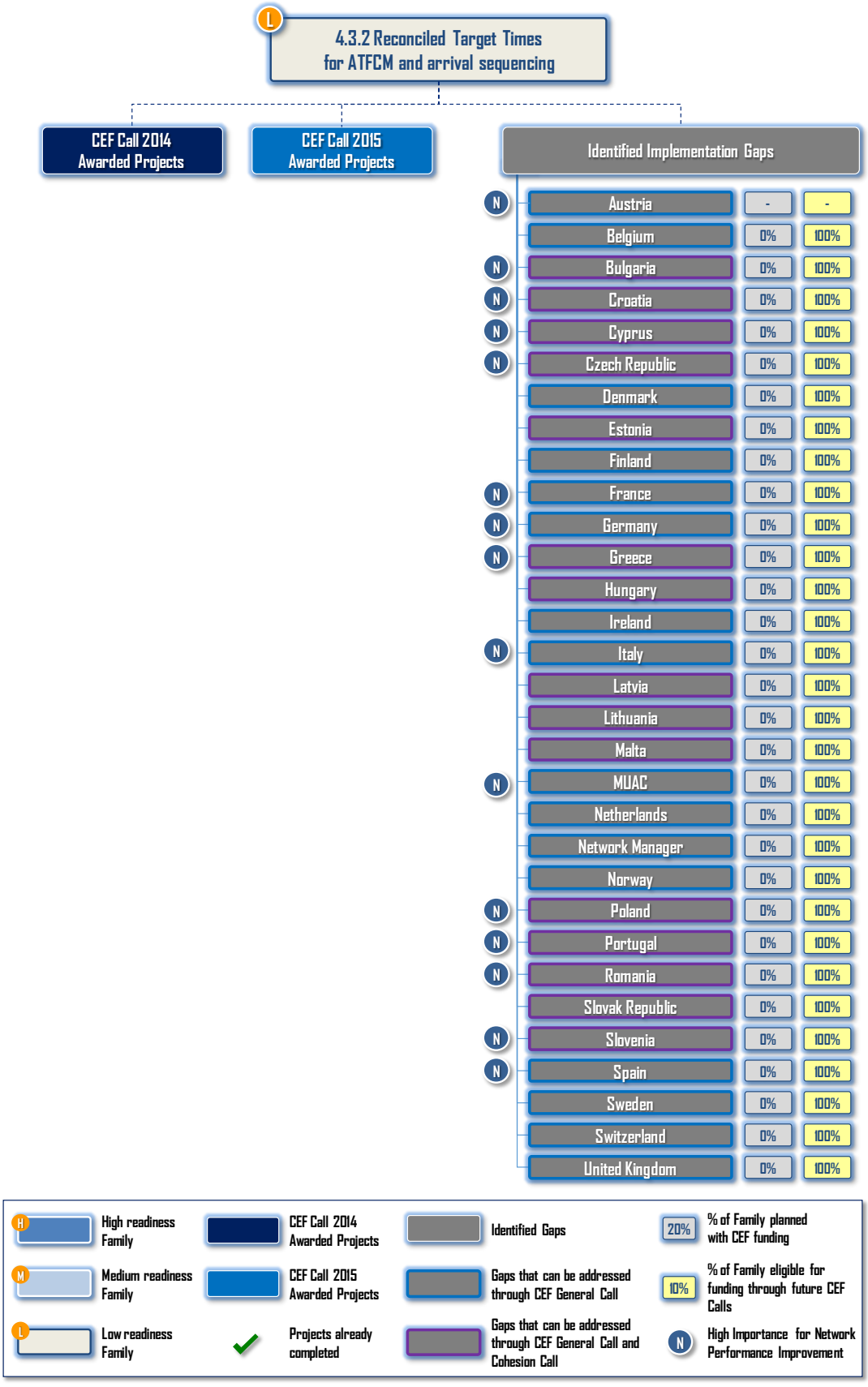
4.3.2 – Reconciled Target Times for ATFCM and Arrival Sequencing			
Main Sub-AF	Sub-AF 4.3 CTOT to Target Time for ATFCM Purposes		
Readiness for implementation	Low		
Initial Operational Capability	01/01/2019	**Full Operational Capability**	01/01/2022

Description and Scope
The scope of this Family contains the process, procedure and system upgrades related to the reconciliation of multiple local Target Time constraints, coming from Airport (AOP), ANSP (either AMAN/extended AMAN or en-Route) or Network DCB process. To this end, the potential solution will be coordinated and disseminated to the different stakeholders (supported by the Network CDM Information Platform and within the context of the NOP) at the Local and Network levels. Once coherence and agreement is achieved, the implementation will be initiated. Considering the current status of development work, the concept still needs to be validated at SJU level.
Interdependencies
Family 1.1.2 (extended AMAN), Family 2.1.4 (iAOP), Family 4.1.2 (STAM phase 2), Family 4.3.1 - Target Time for ATFCM purposes
Synchronization Needs
Synchronisation required between NM, airport and ANSP
Civil / Military Coordination
Yes, depending on civil/military ATS organization and concept of operation.

Stakeholders considered as gaps	ANSPs, Airport Operators, Airspace Users(CFSP), Network Manager	
Other stakeholders involved in the Family deployment	Military Authorities	
Links to ICAO GANP ASBUs	B1-NOPS Enhanced Flow Performance through Network Operational Planning	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	DCB-0213 SESAR Release 9 DCB-0208 SESAR Release 5

	ATM Master Plan Level 3 (Edition 2016)	FCM07.2
SESAR Solutions	PJ.09-02 "Integrated Local DCB Processes" #18 "CTOT and TTA"	
Very Large Scale Demonstrations	N/A	
Guidance Material / Specifications / Standards	NM CTOT to TTA for ATFCM Network Strategy Plan (NSP): SO 4/3, SO 5/4, SO 6/5	
Means of compliance and / or Certification	None	
Regulations	None	
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them	
Recommendation for IPs proposal	Considering the current status of development work, SDM considers that the concept still needs to be validated at SJU level.	
Deployment Approach	The implementation of the Family would require the definition of the concept of operations for reconciled target times for ATFCM and arrival sequencing; such activities shall include - where necessary - the local coordination with the military **(MM1 – Concept of operation defined)**. NM shall upgrade their system to reconciliate the different target time, as required by the defined concept **(MM2 – NM system upgrade for reconciliated TT)**. NM shall also produce the proper guidance documentation on the use of reconciliated target time and the definition of the interfaces for system-to-system data exchange **(MM3 – NM to develop guidance material for reconciliated TT)**. System shall be upgraded in order to process reconciliated Target Time and to allow their use **(MM4 – System upgrades available to process reconciliated target time)**. Procedures for all involved operational stakeholders to operate reconciliated Target Times for ATFCM purposes shall be made available **(MM5 – Procedures available)**. A safety assessment for associated operational and system changes shall be performed successfully **(MM6 – Safety Assessment)** and all operational/technical staff involved shall be duly trained **(MM7 – Training)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM8 – Implementation completed)**.	

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



No

Family 4.4.2 – Traffic Complexity tools

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

Description and Scope

The traffic complexity tools continuously monitor sector demand and evaluate traffic complexity (by applying predefined complexity metrics) according to a predetermined qualitative scale. The predicted complexity coupled with traffic demand enables ATFCM to take timely action to adjust capacity, or request the traffic profile changes in coordination with ATC and airspace users. The rigid application of ATFCM regulations based on standard capacity thresholds as the pre-dominant tactical capacity measure needs to be replaced by a close working relationship between ANSPs and Network Manager, which would monitor both the real demand, the sector capacity and their dynamic management. The scope of this Family shall include:

- ANSP to implement Local Traffic Complexity tools and procedures. The Traffic Complexity tool continuously monitor and evaluate current and expected traffic loads and estimated controller's workload . It provides a support in the determination of solutions in order to plan airspace, sectors and staff to handle the predicted traffic. It is suggested that ANSPs develop concept for the complexity tools utilisation before considering the procurement/upgrades of ATM systems with this functionality
- The local complexity tools need to receive process and integrate EFD provided by NM. This is needed in order to supplement the local traffic counts with the flight plan data from ETFMS;
- The NM systems adaptation activities deal with improving the quality of the planned trajectory (processing of ATC information part of 4.2.3 Family, processing of EFPL and improved OAT FPL information part of 4.2.3 Family, support to mixed mode operations, Implementation of traffic count methodologies that do not impact trajectory calculation) thus enhancing NM complexity assessment.

Implementation of scenario management tools in support of traffic complexity. It will rely on the planned trajectory and allows simulating options optimising the use of available capacity. It will help NM operations identify possible mitigation strategies to be applied at network or local level, in coordination with FMPs and airspace users if applicable.

Interdependencies

Fam. 4.1.1 - STAM Phase 1

Fam. 4.1.2 - STAM Phase 2

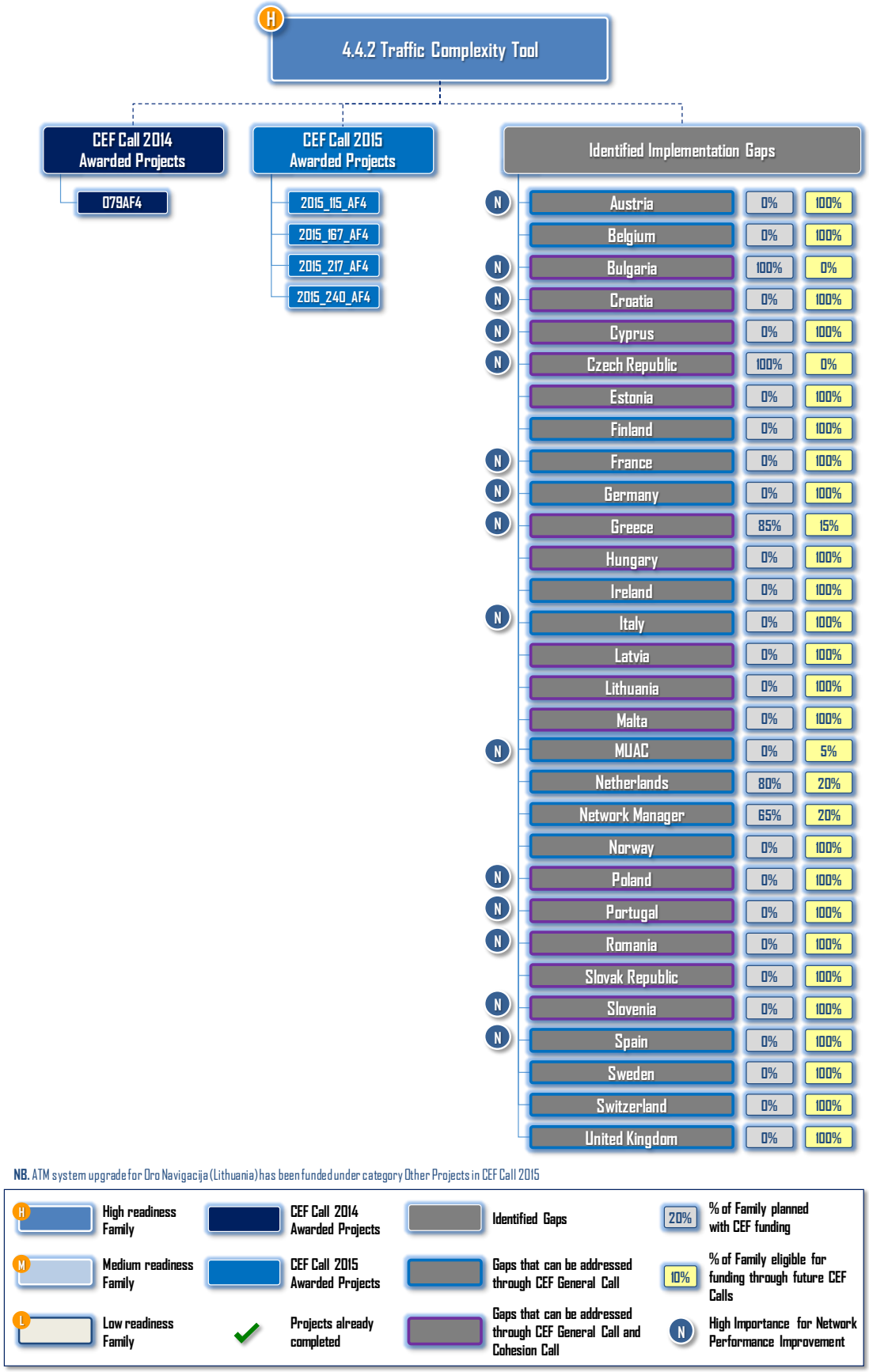
Fam. 4.2.3 - Interface ATM system to NMS and 4.2.4 AOP/NOP integration

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

Synchronization Needs		
Synchronisation between NM and ANSPs is required		
Civil / Military Coordination		
Yes, depending on civil/military ATS organization		
Stakeholders considered as gaps	ANSPs, Network Manager	
Other stakeholders involved in the Family deployment	Military Authorities	
Links to ICAO GANP ASBUs	B1-NOPS Enhanced Flow Performance through Network Operational Planning	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	CM-0103-A SESAR Release 5 CM-0101 Available IS-0102 Available
	ATM Master Plan Level 3 (Edition 2016)	FCM06
SESAR Solutions	#19 "Automated support for Traffic Complexity Detection and Resolution"	
Very Large Scale Demonstrations	**Release 7:** PJ.24 **Release 8:** PJ.24 **Release 9:** PJ.24	
Guidance Material / Specifications / Standards	NM Automated Support for Traffic Complexity Assessment guidance material Network Strategy Plan (NSP): SO 4/3 and SO 5/4 NM Flight Progress Messages Document; Edition 2.1 (03/2015)	
Means of compliance and / or Certification	None	
Regulations	None	
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with	

	appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them
Recommendation for IPs proposal	Taking into account that complexity tools need to be deployed in collaboration between ANSPs and NM, particularly at ATC planning level, the IP proposal should be mainly focused on ANSPs and NM system upgrades. It is recommended to take into consideration the results of Gap Analysis.
Deployment Approach	The implementation of the Family would require the development and definition of the concept of operations, encompassing the overall process, including roles and responsibilities of the involved stakeholders. Such activity could require local coordination with the military, if necessary **(MM1 – Concept of operations developed)**. Network Manager shall develop and provide guidance documentation as basis for required operational procedures and systems **(MM2 – Operational guidance documentation developed)**. NM shall adapt its systems in support of complexity assessments, including the exchange of associated data **(MM3 – Adaptation of NM-systems)**. Local stakeholders shall implement complexity tool in the local systems, or adapt the NM tool for the required usage **(MM4 – Installation of local complexity tool)**. If required for a smooth exchange of data and information, the implementation of system-to-system interfaces shall be performed **(MM5 – Integration of local tool with NM)**. Procedures for operational stakeholders for facilitating the use of the tool shall be defined and made available **(MM6 – Procedures available)**. All involved operational staff shall be duly trained **(MM7 - Training)**.The execution of such activities is expected to lead to the start of permanent operational use **(MM8 – Implementation completed)**.

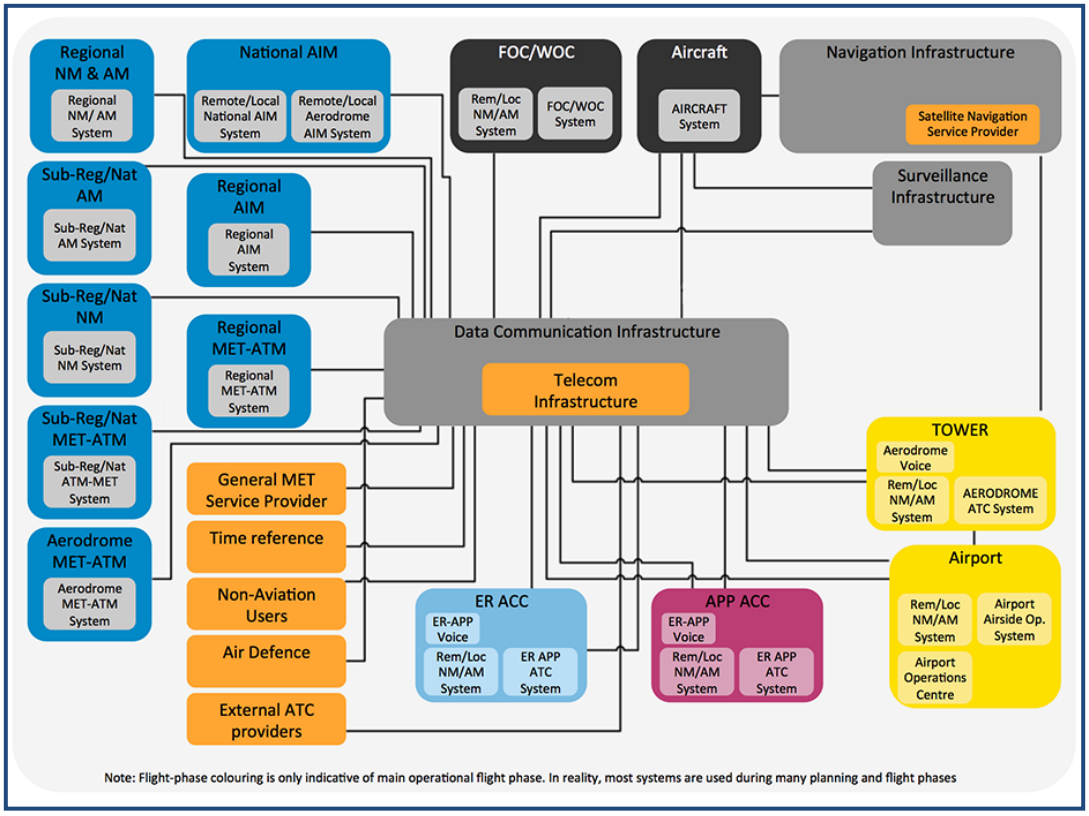
The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 4.4.2 awarded in 2014 or 2015 CEF Calls, along with a more detailed description of each Implementation Project.

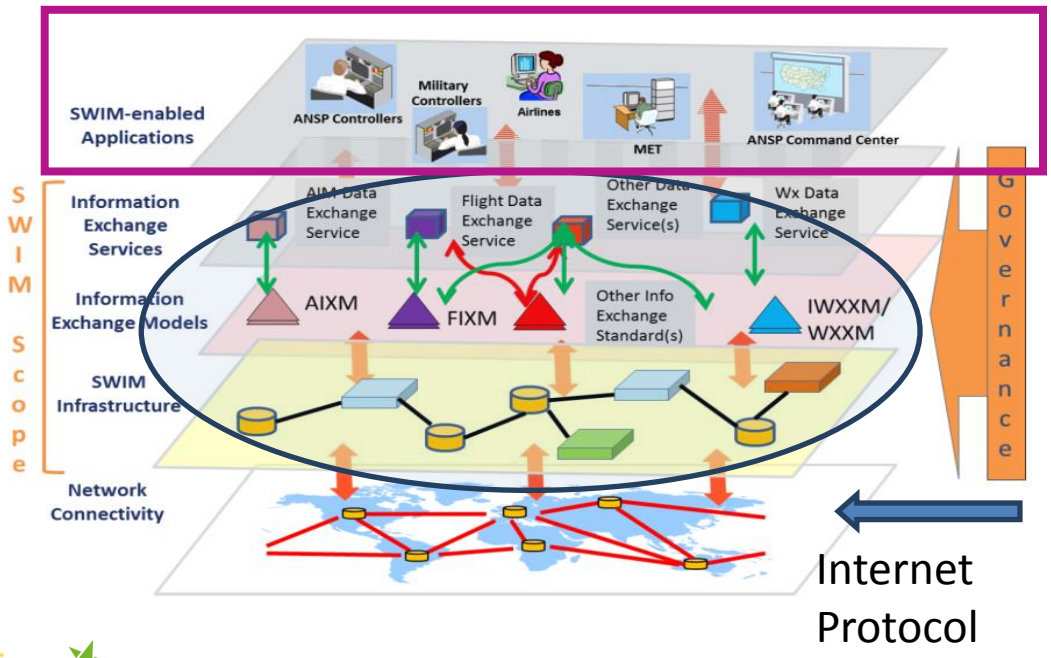
AF #5 – Initial SWIM

SWIM Infrastructure is included in the SESAR EATM Architecture Data Communication Infrastructure and in the lower layers of the ATM systems connected to the Data Communication Infrastructure.



SESAR EATM Architecture

The SWIM Infrastructure supports the exchanges of SWIM ATM information between the Operational Stakeholders. Initial SWIM, iSWIM as called in the PCP, is limited to some **Ground-Ground Aeronautical, Meteorological, Cooperative Network and Flight Data Information exchanges.**



Based on the ICAO definition of SWIM depicted above, according to which "SWIM comprises **standards**, **infrastructure** and **governance** enabling the management of information and its exchange between operational stakeholders via **interoperable services**", the DP 2015 had developed 9 Families as a guideline for the operational stakeholders to implement initial SWIM projects. Taking on board the lessons learned from the 2014 and 2015 CEF Transport Calls for Proposal, as well as the updated outputs of SESAR1 and the updated European ATM Master Plan, DP 2016 envisages ATM Functionality #5 as organized in 12 Families: two new Families are dealing with Security implementation and one new Family with Flight Object implementation.

A first set is dealing with the necessary common components/structures/developments the operational stakeholders have to put in place together to facilitate the SWIM interoperability and interconnectivity:

- 5.1.1: PENS1: the first implementation of PENS ending in June 2018
- 5.1.2: NewPENS: the new PENS implementation, with a new stronger governance, launched very beginning 2016 replacing PENS1 after a transition period (2017-2018)
- 5.1.3: SWIM Governance and Registry implementing the necessary structures and processes for SWIM operation and evolution
- 5.1.4 (NEW): PKI and Cybersecurity developing the necessary common security requirements to guarantee a common secure SWIM implementation

A second set is dealing with the dedicated infrastructure that each operational stakeholder has to implement within its own architecture to be able to support the SWIM information exchanges:

- 5.2.1: dedicated Internet Protocol Network Services to support IP exchanges
- 5.2.2: dedicated SWIM infrastructure (middleware) to support SWIM Profiles
- 5.2.3 (NEW): dedicated PKI and Cybersecurity components and processes to meet local security requirements in line with common ones defined in 5.1.4

A third and last set is dealing with the different kinds of ATM information exchanges defined in the PCP, including the interdependencies with the other AFs:

- 5.3.1: The Aeronautical Information Exchanges
- 5.4.1: The Meteorological Information Exchanges
- 5.5.1: The Cooperative Network Information Exchanges
- 5.6.1: The Flight Information Exchanges
- 5.6.2 (NEW): The Flight Object Information Exchanges

Finally, Appendix 1 containing a list of services, developed in the context of SESAR 1 or services deployed or planned by NM, provides to the Stakeholders a partial coverage of the PCP ATM information exchanges defining the SWIM implementation starting point to be then expanded step by step by the SWIM Governance.

The following chart highlights the overall structure of the ATM Functionality #5, namely its SUB AFs, Families and their relevant Implementation initiatives related to both 2014 and 2015 CEF Call awarded projects.

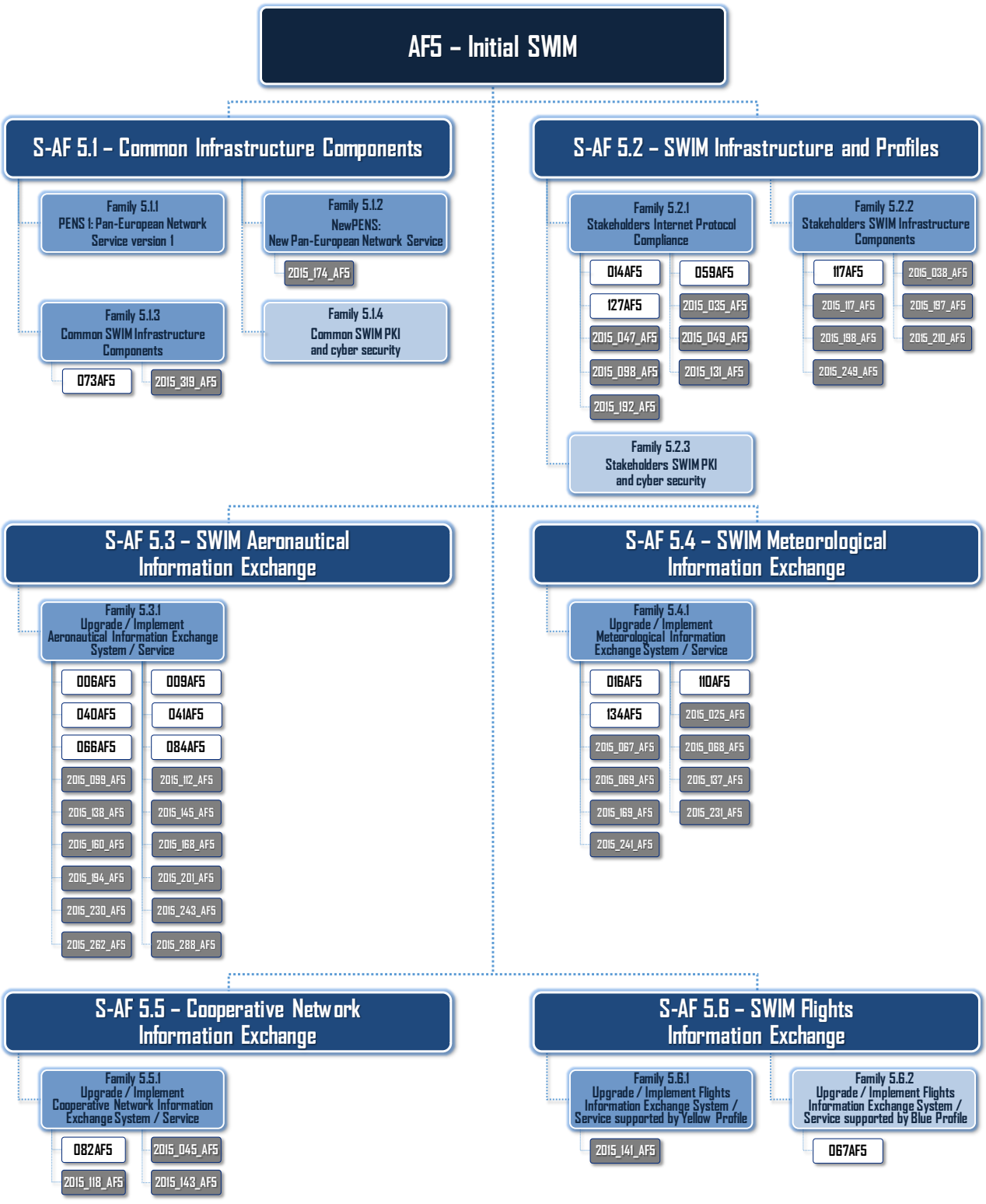


Fig. 23 – AF #5 Structure

The following Gantt chart shows the implementation roadmap for each Family included in AF5 in terms of start and end date of deployment, and it has been defined taking into account the target dates for each ATM Functionality and Sub-ATM Functionality, as stated in Regulation (EU) No 716/2014.

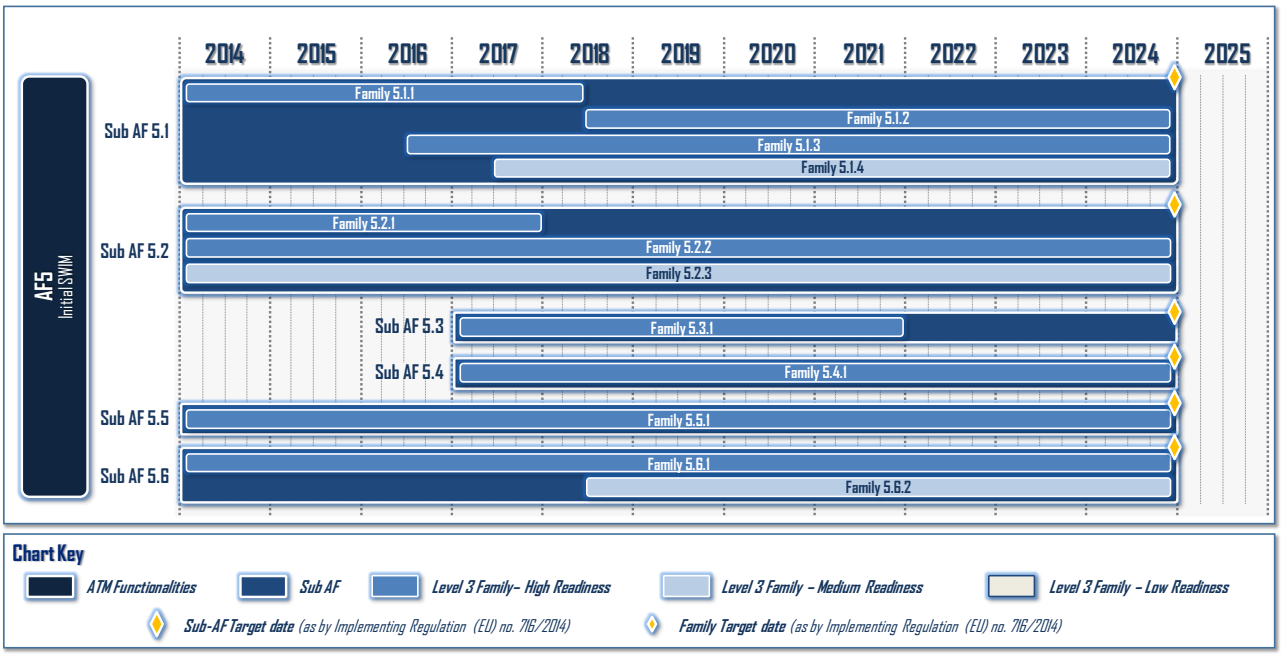


Fig. 24 – AF #5 Implementation Timeline

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

5.1.1 – PENS1: Pan-European Network Service version 1			
Main Sub-AF	Sub-AF 5.1 Common Infrastructure Components		
Readiness for implementation	High		
Initial Operational Capability	Before 2014 PENS1 has been deployed from 2009 by NM and ANSPs	**Full Operational Capability**	30/06/2018 PENS1 is planned to end in June 2018 before to be replaced by NewPENS

Description and Scope

An Internet Protocol (version6) Network connectivity is necessary to support the SWIM Exchanges. The current PENS (Pan European Network Service), called PENS1, supports the exchanges of the current ATM information based on Internet Protocol (version 4, 6).

PENS1, provided by SITA, is expected to terminate in June 2018, but a new PENS, called NewPENS, is planned to be deployed from beginning 2017 to replace PENS1 with a transition period (2017-mid 2018) to guarantee the continuity of operations.

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

The scope of this Projects Family aims at implementing projects for ANSPs not yet PENS1 user and having planned to implement IOP / FO before June 2018.

Interdependencies

5.1.2 (NewPENS) to guarantee the transition from PENS1 to NewPENS

5.3.1, 5.4.1, 5.5.1, 5.6.1

5.6.2 (Flight Object Exchanges)

PENS1 shall be able to manage ATM VoIP communications proposed as an enabler in Family 3.1.4

Synchronization Needs

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

Civil / Military Coordination

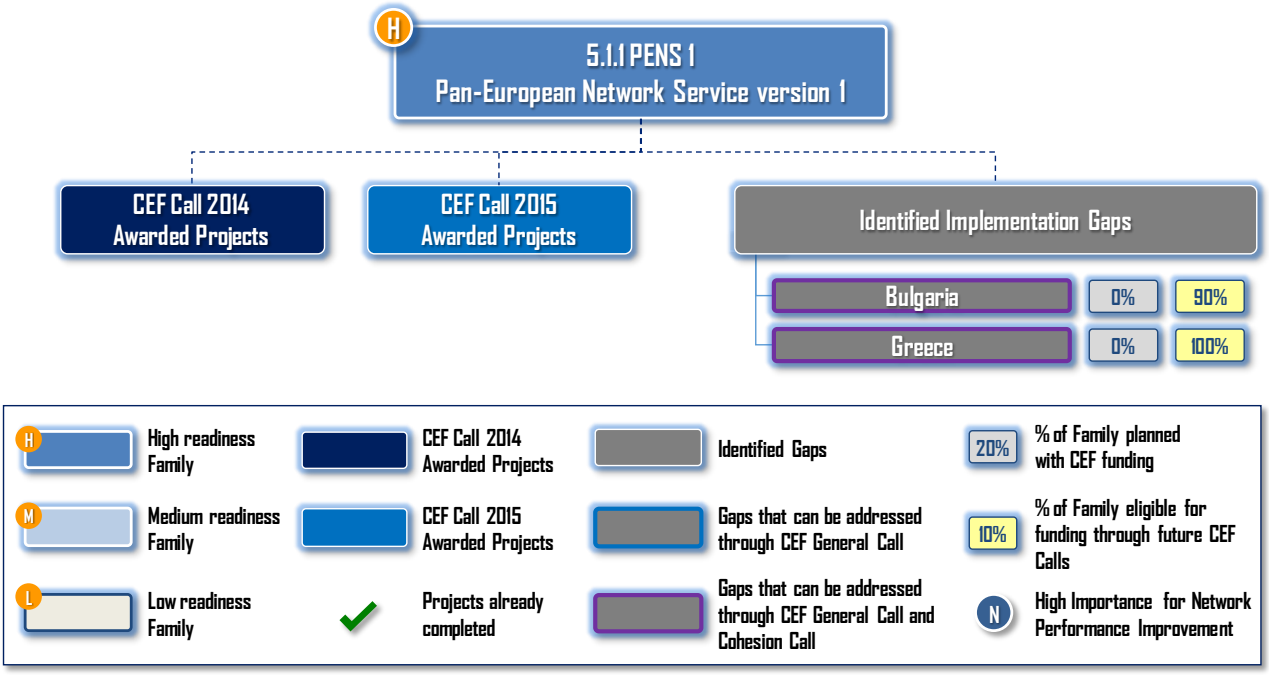
Where States have agreed or intend to share information between civil and military ANSPs via the NewPENS it is essential that migrations to IP Network Services are coordinated between all parties.

Stakeholders considered as gaps	ANSPs, Network Manager, Military ANSPs who require direct interconnections to civil ANSPs

Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B1-SWIM Performance Improvement through the Application of System-Wide Information Management (SWIM)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	CTE-C06a-PENS-Phase 1 Available
	ATM Master Plan Level 3 (Edition 2016)	None
SESAR Solutions	N/A	
Very Large Scale Demonstrations	N/A	
Guidance Material / Specifications / Standards	CEN ATM information security EN 16495 (Version 2) (2017) PENS 1 documents (PSSG) Internet Protocol version 4 and 6 for Unicast and Multicast (RFC) ECTL Stand/Spec on TI SWIM Yellow Profile definition (2017) ECTL Stand/Spec on TI SWIM Blue Profile Definition (2020) ICAO Doc 10039 – Manual on System Wide Information Management concept	
Means of compliance and / or Certification	None	
Regulations	None	
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them.	
Recommendation for IPs proposal	Any ANSP, not yet PENS user, planning to implement IOP FO before mid 2018 is invited to present a project to become a PENS1 user. PENS is also able to support all the ATM information exchanges even if the Commission Implementing Regulation (EU) No 716/2014 is requiring PENS only for the Blue Profile required for Flight Object. So any OS, not yet PENS user, could present an IP to become a PENS user.	
Deployment Approach	The implementation of the Family would require the signature of both the PENS1 CPA (Common Procurement Agreement) with EUROCONTROL and the Amendment with the Network Service Provider **(MM1 – PENS1 CPA (Common Procurement**	

	Agreement) and Amendment signed). The Network Service Provider shall then install its routers in the Operational Stakeholder premises in order for the OS to gain access(es) to PENS1 **(MM2 – PENS1 access(es) installed)**, connect with the Operational Stakeholder IP Network in a secure manner **(MM3 – PENS1 connection(s) installed integrated including security measures)**. Before the start of operational use, the planning of end-to-end network services deployment (test, validation, operation) shall be completed with other Operational Stakeholders, such as NM, ANSPs, AUs, Airport Operators, etc **(MM4 – Planning of the Network Services)**. The execution of such activities is expected to lead to the start of permanent operational use meaning that all end-to-end network services shall be in operation, supporting Yellow and Blue Profiles **(MM5 – Network Services in Operation)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



No Implementation Initiatives related to this Family has been neither awarded nor submitted for 2014 CEF Call or CEF Call 2015, respectively.

Family 5.1.2 – NewPENS: New Pan-European Network Service

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

Description and Scope

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

NewPENS will replace PENS1 terminating in June 2018. The PCP stipulates "*To support the blue SWIM TI Profile (for Flight Object), very high and high capacity centres shall be connected to Pan-European Network Services (PENS)*". So civil and military ANSPs, planning to implement IOP FO, have to be NewPENS users.

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

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

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

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

A transition phase to migrate from PENS1 to NewPENS is then expected from 2017 to mid 2018, date of the full operation of NewPENS and of the PENS1 termination.

The coordination with same initiatives in other ICAO Regions should be relevant for worldwide interoperability.

Interdependencies

With 5.1.1 (PENS1), 5.3.1, 5.4.1, 5.5.1, 5.6.1 (Flights Information Exchanges) and 5.6.2 (FO) and possible interdependencies with all the projects Families dealing with ATM Information exchanges using NewPENS. NewPENS shall be also able to manage ATM VoIP communications as an enabler in Family 3.1.4.

Synchronization Needs

The synchronization and coordination will be performed by the NewPENS Governance bodies in place from the beginning 2016.

Any NewPENS user has, when entering NewPENS by signing the NewPENS CPA (Common Procurement Agreement) and later, after the contract awarding, the dedicated Amendment, a representative in the NewPENS Governance bodies (TMB, PEB, PENS Boards).

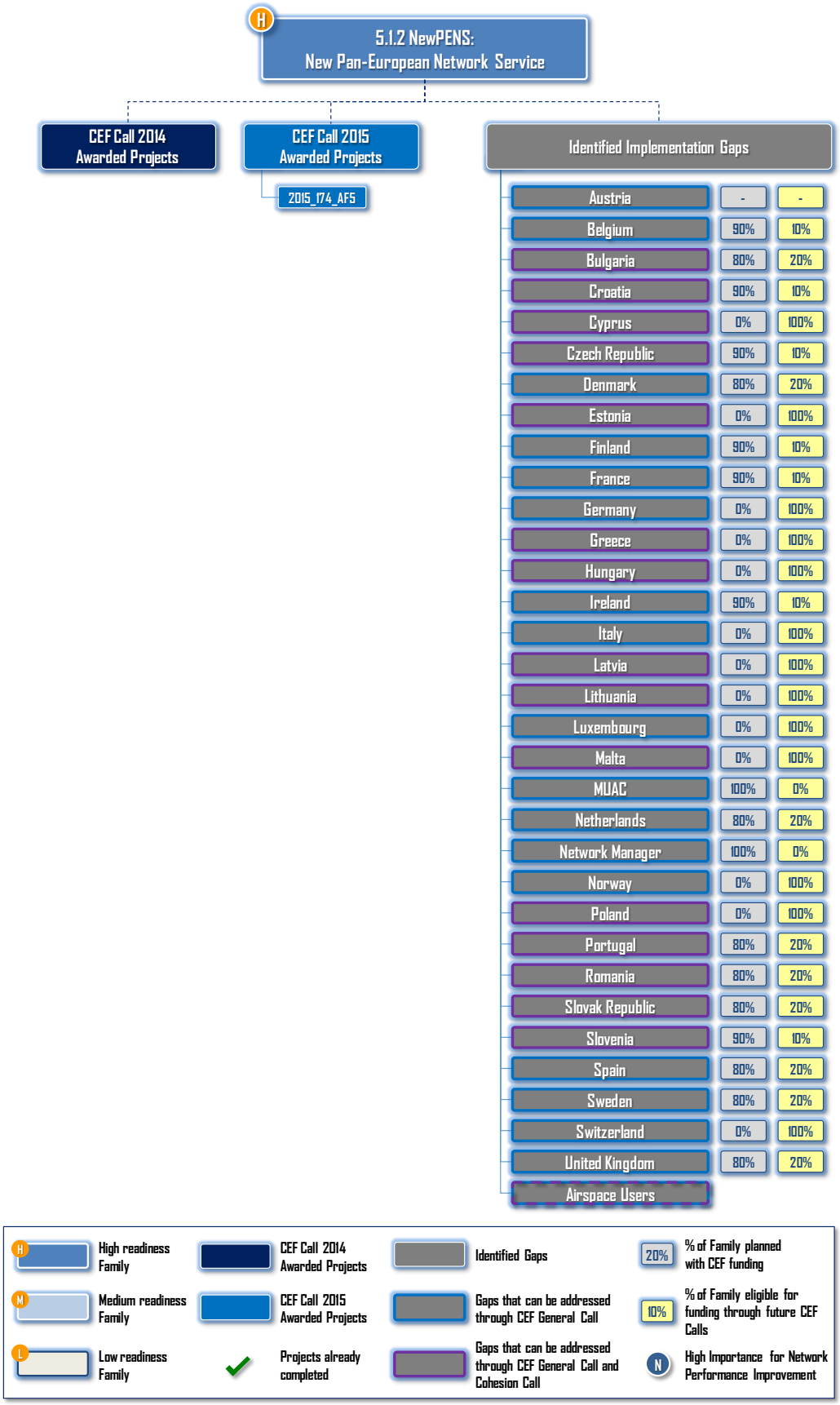
Civil / Military Coordination

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

Stakeholders considered as gaps	ANSPs, Airport Operators, Airspace Users, Network Manager, Military Authorities, MET Service Providers	
Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B1-SWIM Performance Improvement through the Application of System-Wide Information Management (SWIM)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	CTE-C06b-PENS-Phase 2 SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	COM12
SESAR Solutions	N/A	
Very Large Scale Demonstrations	**Release 7:** PJ. 24, 27 **Release 8:** PJ. 24, 27 **Release 9:** PJ. 24, 27	
Guidance Material / Specifications / Standards	CEN ATM Information security EN 16495 (Version 2) (2017) NewPENS documents (PENS Executive Board) (2018) Internet Protocol version 4 and 6 for Unicast and Multicast (RFC) ECTL Stand/Spec on TI SWIM Yellow Profile definition (2017)	

	ECTL Stand/Spec on TI SWIM Blue Profile Definition (2020) ICAO Doc 10039 Manual on System Wide Information Management concept
Means of compliance and / or Certification	None
Regulations	None
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them
Recommendation for IPs proposal	Within the framework of the CEF 2015 several Stakeholders has made an IP proposal led by EUROCONTROL to set-up NewPENS. Now any OS is invited to propose an IP for becoming a NewPENS user. NewPENS is able to support all the ATM information exchanges even if the Commission Implementing Regulation (EU) No 716/2014 is requiring PENS only for the Blue Profile required for Flight Object.
Deployment Approach	The implementation of the Family would require the signature of both the NewPENS CPA (Common Procurement Agreement) with EUROCONTROL and the Amendment with the Network Service Provider **(MM1 – NewPENS CPA (Common Procurement Agreement and Amendment signed**). The Network Service Provider shall then install its routers in the Operational Stakeholder premises in order for the OS to gain access(es) to NewPENS **(MM2 – NewPENS access(es) installed)**, connect with the Operational Stakeholder IP Network in a secure manner **(MM3 – NewPENS connection(s) installed integrated including security measures)**. Before the start of operational use, the planning of end-to-end network services deployment including the possible transitions from PENS1 to NewPENS (test, validation, operation) shall be completed with other Operational Stakeholders, such as NM, ANSPs, AUs, Airport Operators, etc **(MM4 – Planning of the Network Services)**. The execution of such activities is expected to lead to the start of permanent operational use, meaning that all end-to-end network services shall be in operation, supporting Yellow and Blue Profiles **(MM5 – Network Services in Operation)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



A dedicated table within Annex A encompasses the list of implementation initiatives associated to Family 5.1.2 awarded as 2015 CEF Call candidate project, along with a more detailed description of its content.

Family 5.1.3 – Common SWIM Infrastructure Components

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

Description and Scope

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

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

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

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

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

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

The current Family is dealing with the **common** components **governance and registry** while the Family "Stakeholder SWIM Infrastructure Components" (5.2.2) is dealing with the dedicated **stakeholders**' components. The Public Key and Security Infrastructure is dealt with in two separate Families, Family 5.1.4 for the common part and Family 5.2.3 for the stakeholder implementation.

The scope of this Family is the implementation of the SWIM common components SWIM governance and SWIM registry.

The **SWIM governance** consists of bodies including civil and military stakeholders and of processes that together steer the operation of SWIM and ensure its controlled evolution. SWIM governance

- manages the common components, in particular the registry
- contributes to the elaboration of SWIM standards
- maintains the SWIM Compliance Framework and governs the compliance assessments
- devises the policies for the provision and the consumption of the SWIM services, i.e.
  - the compliance policy,
  - the information security policy and

- the service policy.
- Coordinates the service implementation
- Coordinates the migration from legacy protocols
- Devises and carries out the processes for the evolution of SWIM, e.g. change management, the service lifecycle, etc.

A **SWIM registry** managed by the SWIM governance bodies, is the common information repository. It allows the discovery of existing services by providing the service catalogue (list of service models and service implementations). Furthermore it supports the implementation of SWIM by providing reference documents such as the ATM Information Reference Model (AIRM), the AIRM and the ISRM Foundations, SWIM TI Profile definitions, compliance framework and criteria, SWIM Governance policies, etc.

Interdependencies

Family 5.1.3, dealing with common SWIM components, is complemented for each Stakeholder by Family 5.2.2, for security by Families 5.1.4 and 5.2.3 and is a prerequisite for the full implementation of Families 5.3.1, 5.4.1, 5.5.1 and 5.6.1 even if their implementation has already started based on the material provided by SESAR 1 and the NM.

Synchronization Needs

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

Civil / Military Coordination

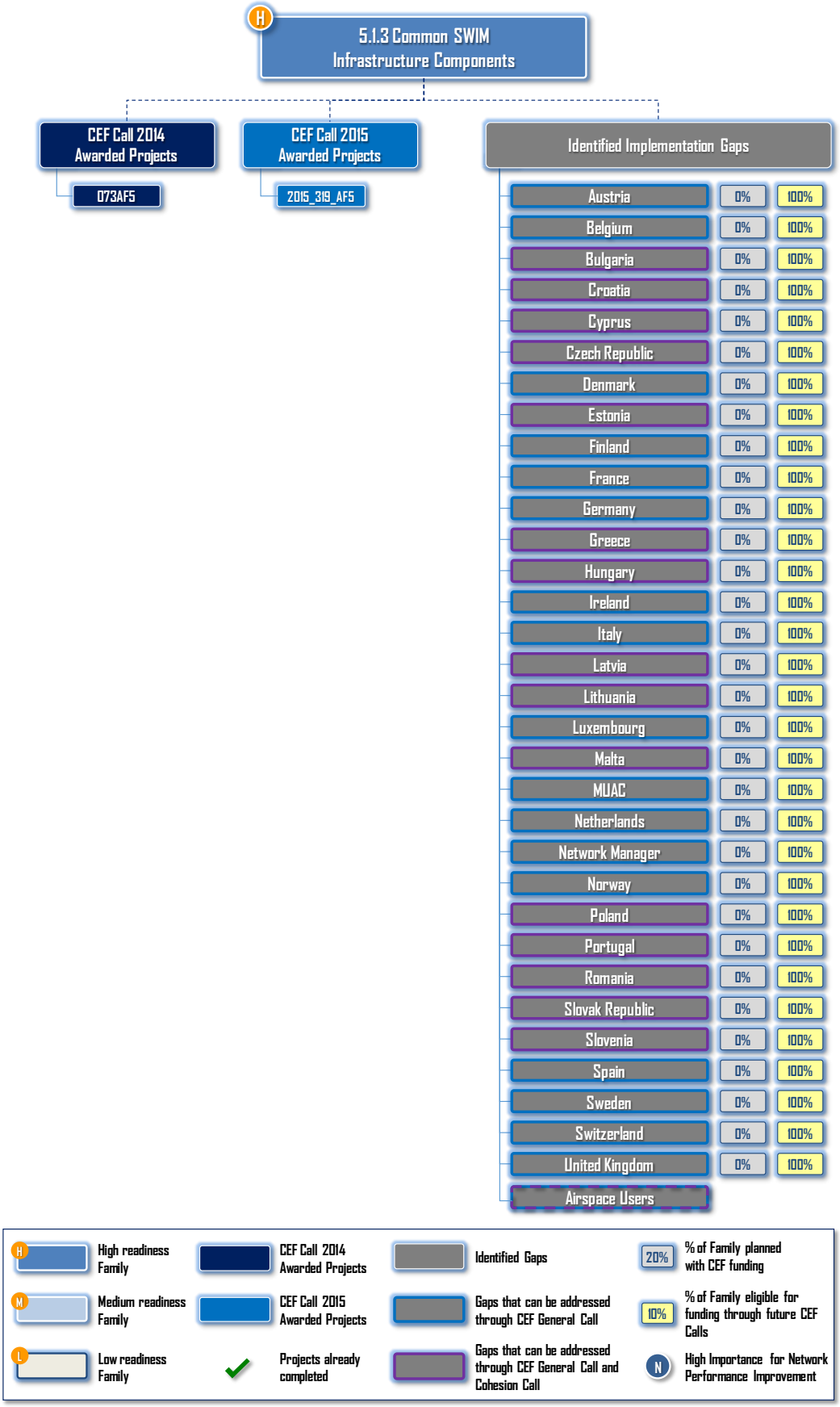
Military must be represented in the SWIM Governance bodies and their specific needs must be considered in the identified processes

Stakeholders considered as gaps	ANSPs, Airport Operators, Airspace Users, Network Manager, Military Authorities, MET Service Providers	
Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B1-SWIM Performance Improvement through the Application of System-Wide Information Management (SWIM)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	IS-0901-A SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	INF08.1, INF08.2
SESAR Solutions	#46 "Initial SWIM"	
Very Large Scale Demonstrations	**Release 7:** PJ.24, 27 **Release 8:** PJ.24, 27 **Release 9:** PJ.24, 27	

Guidance Material / Specifications / Standards	CEN ATM information security EN 16495 (Version 2) (2017) ECTL SWIM Foundation material (2017) ECTL AIRM (2017) ECTL AIRM Rulebook (2017) ECTL ATM Information Service Rulebook (2017) ECTL Compliance framework (2017) ECTL Stand/Spec on TI SWIM Yellow Profile definition (2017) ECTL Stand/Spec on TI SWIM Blue Profile Definition (2020) ICAO Doc 10039 Manual on System Wide Information Management concept
Means of compliance and / or Certification	None
Regulations	None
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them
Recommendation for IPs proposal	An implementation initiative engaging a wide number of stakeholders from all categories (ANSPs, AOs, AUs) has already been launched, addressing the setup and initial operation of a SWIM Governance structure and the associated processes. This initiative will refine and implement the entire SWIM Governance framework initiated in SESAR1, which has a direct impact on all IPs related to the implementation of AF5, specifically the Families 5.1.3, 5.1.4, 5.2.2, 5.2.3, 5.3.1, 5.4.1, 5.5.1, 5.6.1 and 5.6.2. For this reason, stakeholders are invited to express their interest in joining the SWIM Governance structure.
Deployment Approach	The implementation of the Family requires the refinement of the structure of the SWIM Governance and the processes for performing governance developed during SESAR 1, in order to meet the needs of iSWIM deployment. This structure and the related processes shall subsequently be put in operation. Concerned Stakeholder: Chairman of the SWIM Steering Group (currently the leader of the SWIM Governance IP, i.e. DSNA). (**MM1 – SWIM governance structure and processes set up**). The Stakeholder shall agree to adhere to the principles of SWIM Governance and to follow the processes defined by the SWIM Governance structure. Moreover, the stakeholder can actively participate in the SWIM Governance structure, i.e. by participating in one or more of the groups. Concerned stakeholders: All stakeholders mandated to implement AF5

	according to the PCP (**MM1.1 – Adhesion to the SWIM Governance principles**). The concept of the design-time registry for SWIM devised during SESAR 1 shall be refined to meet the requirements of iSWIM deployment. Concerned stakeholder: Chairman of the SWIM Steering Group (currently the leader of the SWIM Governance IP, i.e. DSNA) (**MM2 – SWIM Registry refined (concept) and adopted by the SWIM Governance**). The SWIM Registry as a tool shall be developed and then tested. Concerned stakeholder: Chairman of the SWIM Steering Group (currently the leader of the SWIM Governance IP, i.e. DSNA) (**MM3 – SWIM Registry developed and adopted by the SWIM Governance**). The SWIM Registry tool shall be deployed and made available for Operational Stakeholders to use. Concerned stakeholder: Chairman of the SWIM Steering Group (currently the leader of the SWIM Governance IP, i.e. DSNA) (**MM4 – SWIM Registry deployed and declared ready for use by the SWIM Governance**). For full implementation of the Family the Stakeholder is expected to actively use the registry, i.e. registers his own services, uses the registry to discover services, uses the registry to retrieve SWIM standards and guidance material. Concerned stakeholders: All stakeholders mandated to implement AF5 according to the PCP (**MM5 – SWIM Registry used by concerned OS**).

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 5.1.3 awarded in 2014 or 2015 CEF Calls, along with a more detailed description of each Implementation Project.

Family 5.1.4 – Common SWIM PKI and Cybersecurity

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

Description and Scope

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

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

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

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

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

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

The Family 5.1.3 is dealing with the **common** components **governance and registry** while the Family "Stakeholder SWIM Infrastructure Components" (5.2.2) is dealing with the dedicated **stakeholders**' components. The Public Key Infrastructure and cybersecurity are dealt with in two separate Families, Family 5.1.4 for the common part and Family 5.2.3 for the stakeholder implementation. The scope of this Family is the implementation of the SWIM common components cybersecurity and PKI.

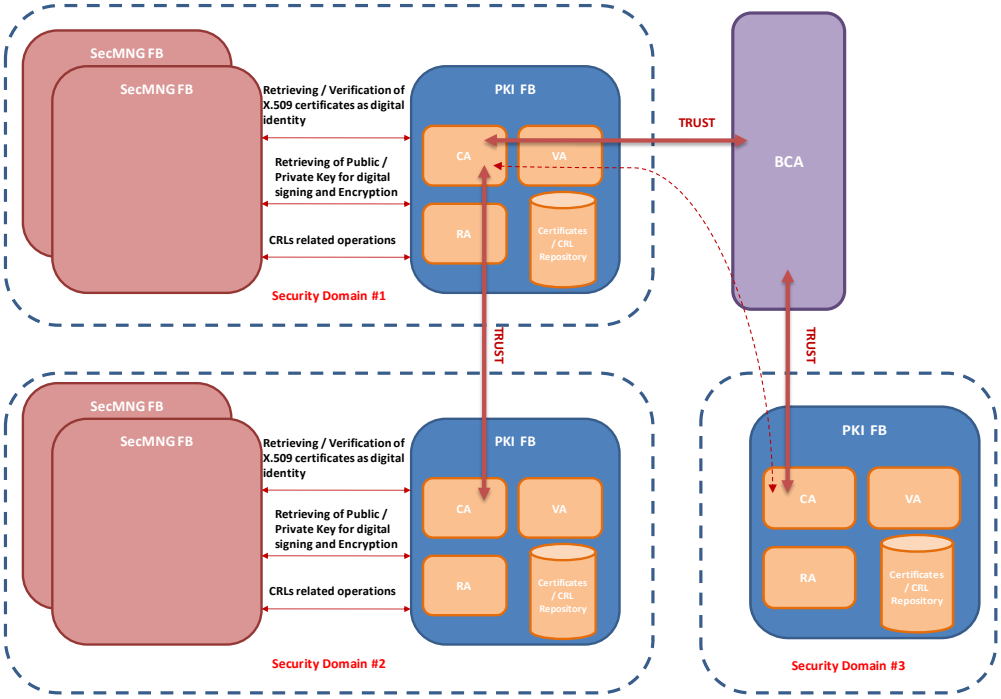
It shall support users from all civil and military stakeholders.

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

- Processes related to signing, emitting, maintaining and revoking certificates
- Objectives and requirements for:
  - Confidentiality
  - Integrity
  - Non-repudiation
  - Accountability
  - Authenticity
  - Safety
- Rules and processes for delegating a certificate

- Establishment and tasks of bridge authorities
- Establishment and tasks of a root certification authority

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



FB: Functional Block

CA: Certificate Authority

VA: Validation Authority

RA: Registration Authority

CRL: Certificate Revocation Lists

BCA: Bridge Certificate Authority

Interdependencies

Families 5.1.4 and 5.2.3 is a prerequisite for the full secure implementation of Families 5.1.3, 5.2.2, 5.3.1, 5.4.1, 5.5.1, 5.6.1 and 5.6.2 even if their implementation has already started with some current draft, mature enough, material provided by SESAR 1 and the NM.

Synchronization Needs

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

Civil / Military Coordination

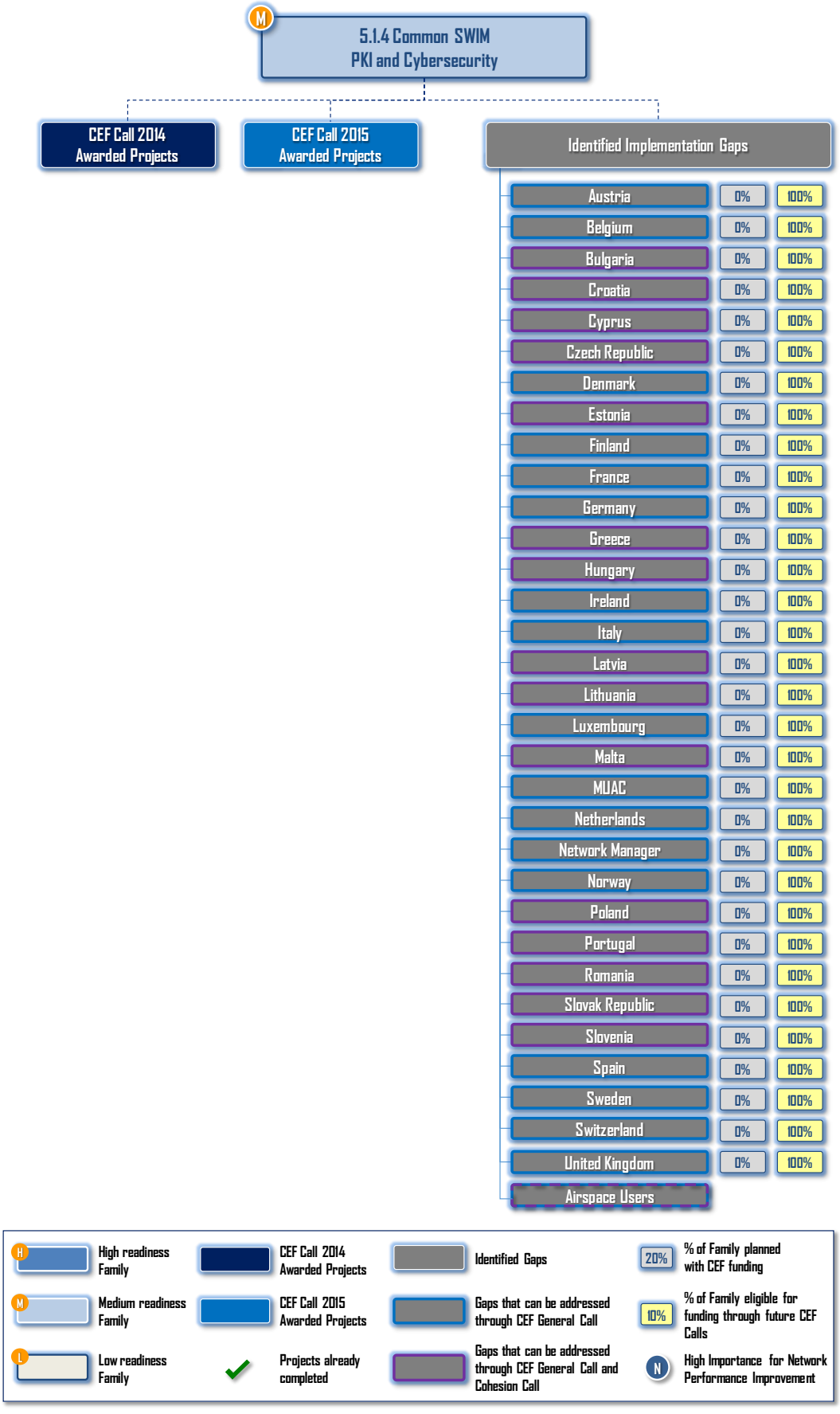
It is recommended that data security and confidentiality is managed as an integrated requirement.

Stakeholders considered as gaps	ANSPs, Airport Operators, Airspace Users, Network Manager, Military Authorities, MET Service Providers

Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B1-SWIM Performance Improvement through the Application of System-Wide Information Management (SWIM)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	IS-0901-A SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	INF08.1, INF08.2
SESAR Solutions	#46 "Initial SWIM"	
Very Large Scale Demonstrations	**Release 7:** PJ.24, 27 **Release 8:** PJ.24, 27 **Release 9:** PJ.24, 27	
Guidance Material / Specifications / Standards	CEN ATM information security EN 16495 (Version 2) (2017) ECTL SWIM Foundation material (2017) ECTL AIRM (2017) ECTL AIRM Rulebook (2017) ECTL ATM Information Service Rulebook (2017) ECTL Compliance framework (2017) ECTL Stand/Spec on TI SWIM Yellow Profile definition (2017) ECTL Stand/Spec on TI SWIM Blue Profile Definition (2020) x.509 (ITU) ICAO Doc 10039 Manual on System Wide Information Management concept	
Means of compliance and / or Certification	None	
Regulations	None	
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them	
Recommendation for IPs proposal	It is recommended that stakeholders launch a common Implementing Project, in coordination with the SWIM Governance, dealing with the topics of security and cybersecurity of SWIM, in particular the PKI. While the technical specification	

	of PKI is mature, its application (organizational setup, processes etc.) in the ATM domain is not, hence the project would have to tackle the completion of this topic early on to ensure its implementation by all stakeholders within the FOC date stipulated by the Commission Implementing Regulation (EU) No 716/2014.
Deployment Approach	The implementation of this Family at first requires the setup of the SWIM Governance structure and the establishment of the governance processes **(MM.1 - SWIM governance structure and processes set up)**. In turn stakeholders would have to agree to adhere to the policies and processes put in place by the SWIM Governance, in particular the security policy **(MM.1.1 - Adhesion to the SWIM Governance principles)**. Based on these agreements the SWIM Governance can ensure and steer the implementation of PKI. In a first step the concept for this component needs to be refined to meet the requirements for iSWIM deployment **(MM.2.1- PKI refined (concept) and adopted by the SWIM Governance)**. Thereafter the PKI component will be developed **(MM.3.1 - PKI developed and adopted by the SWIM Governance**) and deployed **(MM.4.1 - PKI deployed and declared ready for use by the SWIM Governance)**. The Family implementation is finished once the PKI infrastructure is used operationally by the stakeholders **(MM.5.1- PKI used by concerned OS)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.


M
5.1.4 Common SWIM PKI and Cybersecurity
CEF Call 2014 Awarded Projects
CEF Call 2015 Awarded Projects
Identified Implementation Gaps
Austria 0% 100%
Belgium 0% 100%
Bulgaria 0% 100%
Croatia 0% 100%
Cyprus 0% 100%
Czech Republic 0% 100%
Denmark 0% 100%
Estonia 0% 100%
Finland 0% 100%
France 0% 100%
Germany 0% 100%
Greece 0% 100%
Hungary 0% 100%
Ireland 0% 100%
Italy 0% 100%
Latvia 0% 100%
Lithuania 0% 100%
Luxembourg 0% 100%
Malta 0% 100%
MUAC 0% 100%
Netherlands 0% 100%
Network Manager 0% 100%
Norway 0% 100%
Poland 0% 100%
Portugal 0% 100%
Romania 0% 100%
Slovak Republic 0% 100%
Slovenia 0% 100%
Spain 0% 100%
Sweden 0% 100%
Switzerland 0% 100%
United Kingdom 0% 100%
Airspace Users
H
High readiness Family
M
Medium readiness Family
L
Low readiness Family
CEF Call 2014 Awarded Projects
CEF Call 2015 Awarded Projects
Projects already completed
Identified Gaps
Gaps that can be addressed through CEF General Call
Gaps that can be addressed through CEF General Call and Cohesion Call
20%
% of Family planned with CEF funding
10%
% of Family eligible for funding through future CEF Calls
N
High Importance for Network Performance Improvement

Family 5.2.1 – Stakeholders Internet Protocol Compliance

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

Description and Scope

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

So a strong SWIM prerequisite is to be IP-compliant. This Family is dealing with the necessary Internet Protocol compliance for each civil and military stakeholder to be able to support future SWIM information exchanges through SWIM Yellow and Blue profiles based on Internet Protocol. The scope of this Projects Family aims mainly at implementing on civil and military stakeholder side Internet Protocol Network connectivity to be able to exchange ATM information.

Interdependencies

All AF5 Families.

Synchronization Needs

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

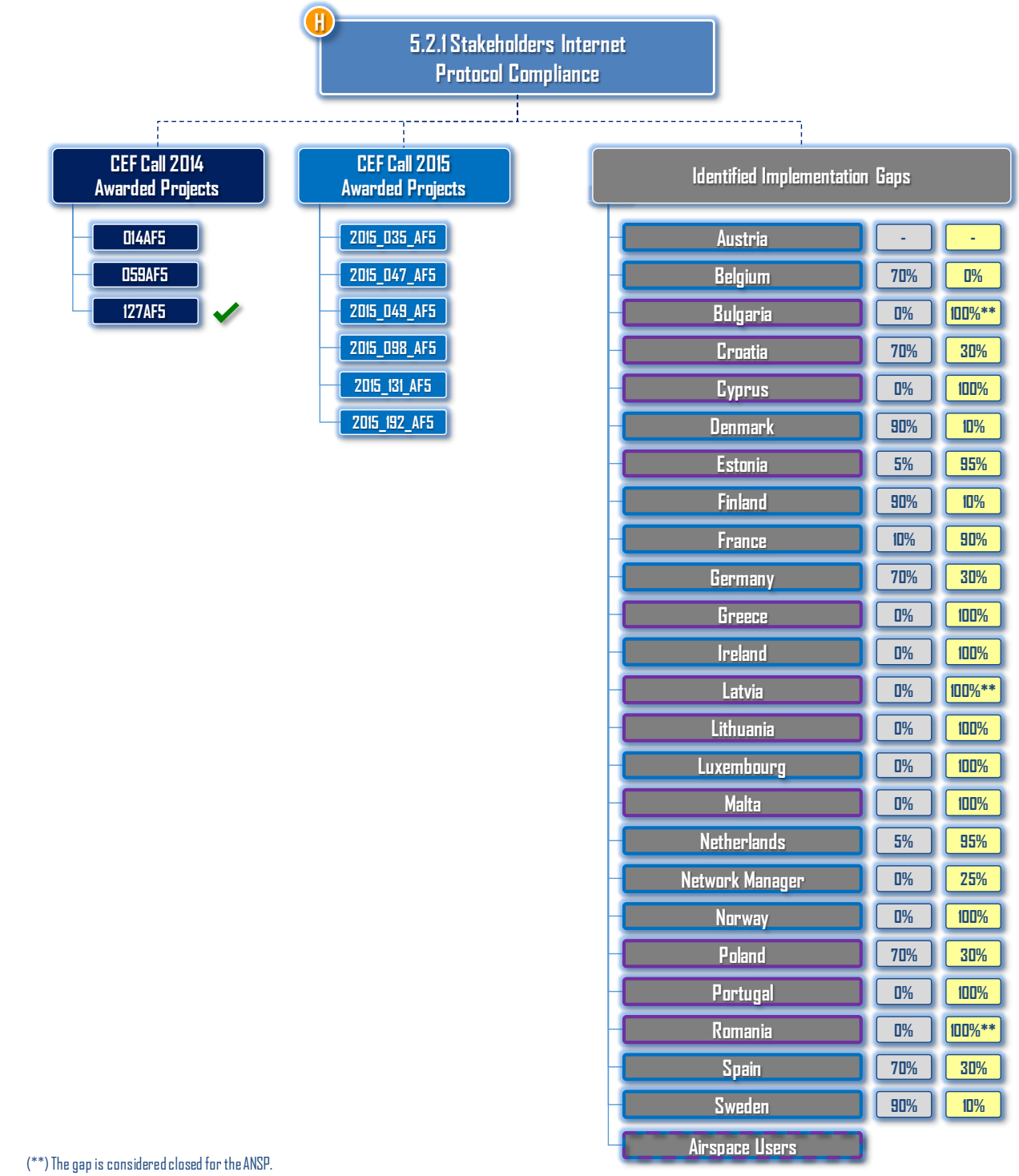
Civil / Military Coordination

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

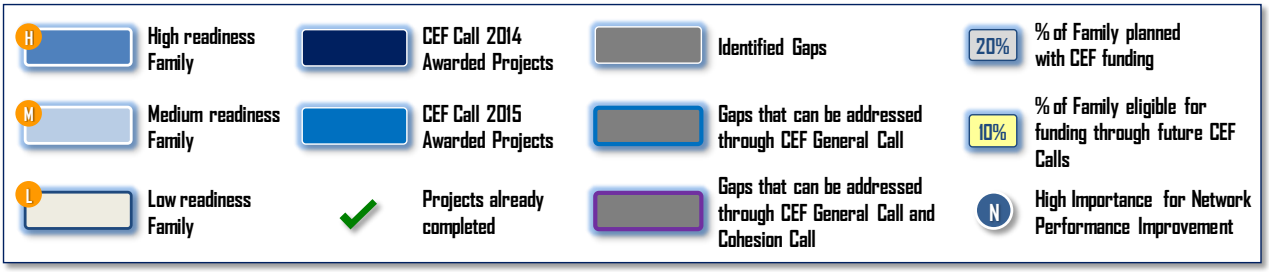
Stakeholders considered as gaps	ANSPs, Airport Operators, Airspace Users, Network Manager, Military Authorities, MET Service Providers
Other stakeholders involved in the Family deployment	None
Links to ICAO GANP ASBUs	B1-SWIM Performance Improvement through the Application of System-Wide Information Management (SWIM)

ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	CTE-C06 Available
	ATM Master Plan Level 3 (Edition 2016)	INF08.1
SESAR Solutions	N/A	
Very Large Scale Demonstrations	N/A	
Guidance Material / Specifications / Standards	CEN ATM information security EN 16495 (Version 2) (2017) ECTL Stand/Spec on TI SWIM Yellow Profile definition (2017) ECTL Stand/Spec on TI SWIM Blue Profile Definition (2020) Internet Protocol version 4 and 6 for Unicast and Multicast (RFC) ICAO Doc 10039 Manual on System Wide Information Management concept	
Means of compliance and / or Certification	None	
Regulations	None	
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them	
Recommendation for IPs proposal	Stakeholders not yet compliant are highly invited to present implementation projects for achieving IP compliance. It is recommended to take into consideration the results of Gap Analysis.	
Deployment Approach	The implementation of the Family would require the deployment of the Internet Protocol Services in order to ensure the handling of the Yellow Profile. References: SESAR 14.01.04.D43-004-SWIM-TI Yellow Profile Technical Specification 3.1, 14.01.04.D43-005-SWIM-TI Blue Profile Technical Specification 3.1, 14.01.04.D43-SWIM Profiles Interface Bindings Catalogue. (**MM1 – Internet Protocol based Network supporting Yellow Profile**). The Internet Protocol Services shall then be deployed in order to support the Blue Profile. References: SESAR 14.01.04.D43-004-SWIM-TI Yellow Profile Technical Specification 3.1, 14.01.04.D43-005-SWIM-TI Blue Profile Technical Specification 3.1, 14.01.04.D43-SWIM Profiles Interface Bindings Catalogue. (**MM2 – Internet Protocol based Network supporting Blue Profile**).	

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



(**) The gap is considered closed for the ANSP.



Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 5.2.1 awarded in 2014 or 2015 CEF Calls, along with a more detailed description of each Implementation Project.

Family 5.2.2 – Stakeholders SWIM Infrastructures Components

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

Description and Scope

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

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

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

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

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

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

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

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

This Family has also to address the Stakeholder transition issues from legacy protocol (AFTN, AMHS, FMTP,) to SWIM environment.

Note that the definition of the Yellow Profile does not target contexts, in which

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

are required. These constraints mainly apply if Yellow Profile is deployed using public

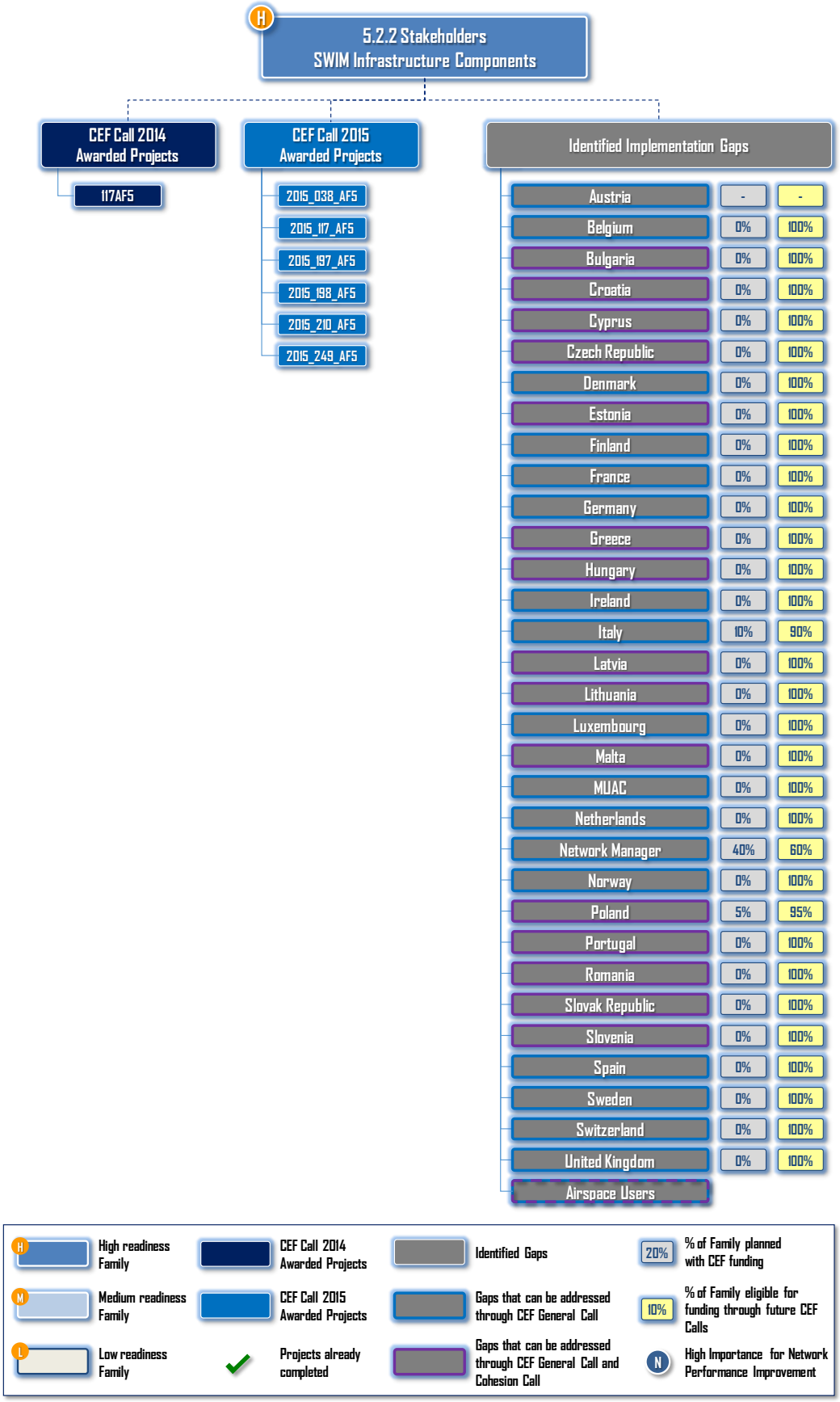
internet as the transport medium, which cannot guarantee an appropriate QoS level. For this reason it is recommended to analyse the QoS requirements of the services deployed on top vis-à-vis the QoS level available by the public internet and to use a service with guaranteed QoS**,** for example PENS/NewPENS, as underlying transport medium if the required QoS level is not achievable by public internet.
Interdependencies
5.1.3, 5.1.4, 5.2.3, 5.3.1, 5.4.1, 5.5.1, 5.6.1, 5.6.2
Synchronization Needs
It is essential that appropriate SWIM Governance Structure and Processes are established to develop and monitor an agreed SWIM implementation roadmap. Strong coordination and synchronisation is necessary between all stakeholders (including military) to implement their SWIM infrastructure according to the agreed SWIM roadmap.
Civil / Military Coordination
Yes, civil/military coordination is required

Stakeholders considered as gaps	ANSPs, Airport Operators, Airspace Users, Network Manager, Military Authorities, MET Service Providers	
Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B1-SWIM Performance Improvement through the Application of System-Wide Information Management (SWIM)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	IS-0901-A SESAR Release 5 CM-0201-A SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	INF08.1, INF08.2
SESAR Solutions	#46 "Initial SWIM" #28 "Initial Ground-Ground Interoperability"	
Very Large Scale Demonstrations	**Release 7:** PJ.24, 27 **Release 8:** PJ.24, 27 **Release 9:** PJ.24, 27	
Guidance Material / Specifications / Standards	CEN ATM information security EN 16495 (Version 2) (2017) ECTL SWIM Foundation material (2017) ECTL AIRM (2017) ECTL AIRM Rulebook (2017) ECTL ATM Information Service Rulebook (2017) ECTL Compliance framework (2017) ECTL Stand/Spec on TI SWIM Yellow Profile definition (2017)	

	ECTL Stand/Spec on TI SWIM Blue Profile Definition (2020) ICAO Doc 10039 Manual on System Wide Information Management concept
Means of compliance and / or Certification	None
Regulations	None
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them
Recommendation for IPs proposal	According to their SWIM implementation planning, stakeholders are invited to propose IPs to implement their SWIM infrastructure as basis for the implementation of ATM information exchanges according to the PCP (aeronautical, meteorological, cooperative network and flight information exchange).
Deployment Approach	The implementation of the Family requires the definition of the future system architecture able to cover information exchanges in compliance with SWIM Governance policies: relevant profile Blue and/or Yellow shall be supported as well as technical monitoring and control. The concept shall also include SWIM enabled applications defined in AF1, AF2, AF3 and AF4 (**MM1 – Transition / architecture concept from legacy protocol (AFTN…) to SWIM environment available**). The SWIM information exchange implementation plan shall be defined in order to cover all information currently exchanged, but also include a plan for necessary changes or definition of procurement requirements to applications (AF1, AF2, AF3 and AF4). The implementation plan shall in detail describe the realization of the architecture defined in the previous milestone and it must be compliant with the relevant SWIM Governance policies. Furthermore, the plan shall specifically address the transition, ensuring flight safety and minimizing negative network effects (Part of Safety Case) and it may be linked to concrete implementation of SWIM-enabled applications (**MM2 – SWIM information exchange implementation plan available**). The Yellow TI profile middleware and, depending on QoS requirements, Public Internet Protocol Network or PENS access point shall be implemented; supporting technical monitoring and control shall be in place and operational; all relevant technical personnel shall be duly trained (**MM3 – Installation of local Infrastructure Components to support Yellow profile communications**). Blue TI profile middleware and PENS access point shall be established; supporting technical monitoring and control shall be

	in place and operational; all relevant technical personnel (ATSEP) shall be duly trained and new S/E ratings shall be issued (**MM4 – Installation of local Infrastructure Components to support Blue profile communications (FO)**). Before the start of operational use, the local infrastructure shall be both verified and validated, ready to support communication between SWIM-enabled applications. For the Blue TI profile, special care must be taken to ensure that all safety objectives from the safety case are met and documented. The local infrastructure must be compliant to the relevant SWIM Governance policies to guarantee interoperability within the SWIM network. The execution of such activities will lead to the start of permanent operational use (**MM5 – Implementation completed**).

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 5.2.2 awarded in 2014 or 2015 CEF Calls, along with a more detailed description of each Implementation Project.

Family 5.2.3 – Stakeholders SWIM PKI and Cybersecurity

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

Description and Scope

This Family is dealing with the **Stakeholder's SWIM PKI and cyber security** while the Family "Common SWIM PKI and cyber security" (5.1.4) is dealing with the common components, mainly the development of agreed common specifications. The scope of this Projects Family aims at implementing in each civil or military Stakeholder, in line with their own Security Management System approved by their National Supervisory Authority, the following Establish basic/generic public key infrastructure management.
This includes:

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

Key lifecycle Management includes:

- Creation of key pairs
- Updating keys
- Archiving keys
- Backup and recovery

- Training and certification of technical personnel
- Monitoring and control, in particular, establish a Security Operations Center to monitor and protect the IT systems against cyber attacks
- Procedure development covering normal and degraded operation. Technical standard operating procedures (SOPS) shall also cover certificate management.
- Local policies for authorising and mandating local organization to do certificate management.
- Definition of policies and procedures ensuring compliant certificate usage with respect to both common (AF 5.1.3) and local standards.
- Implementation of audit programmes ensuring continuous compliance with common and local policies and standards.

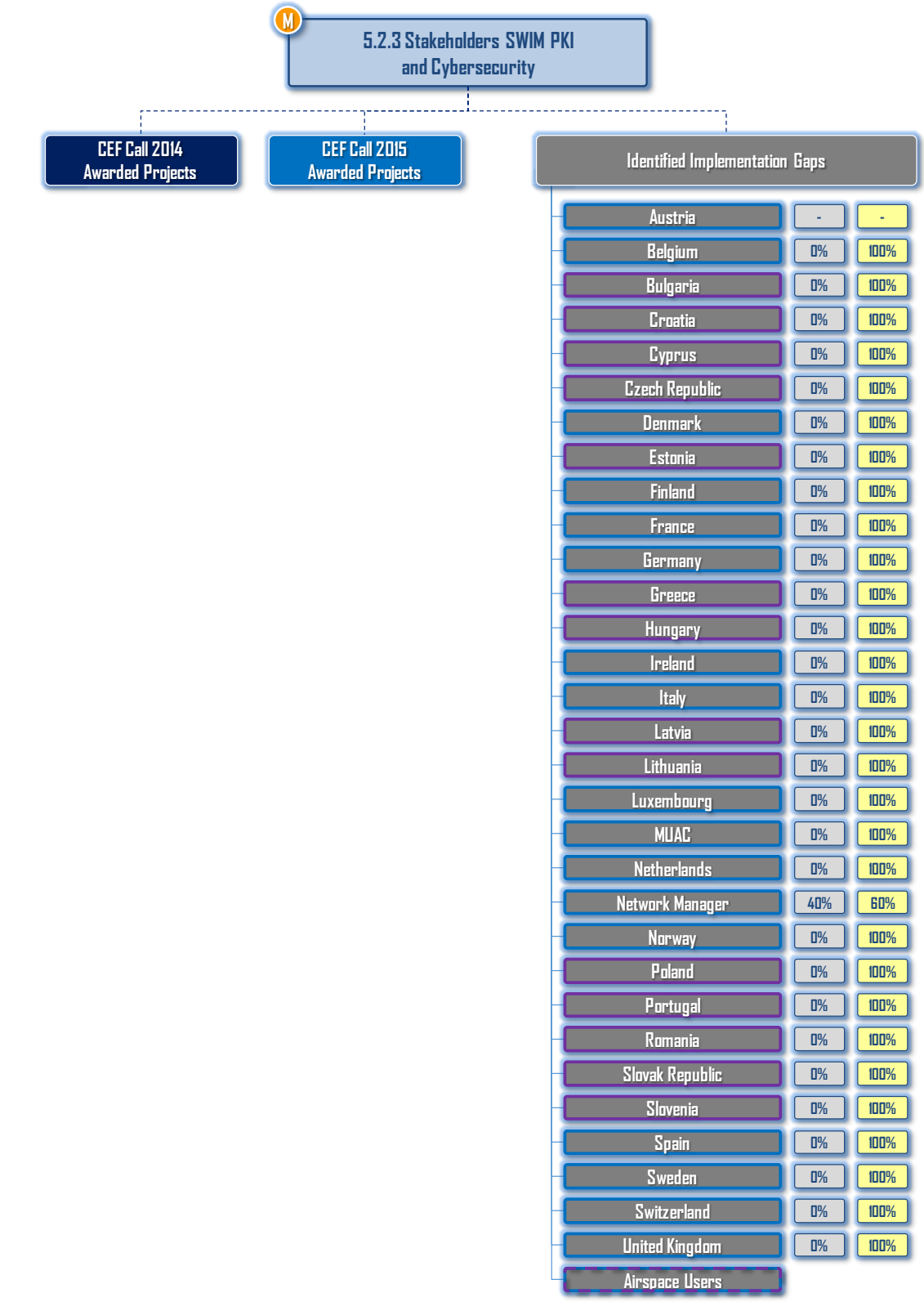
Interdependencies

5.1.3, 5.1.4, 5.2.2, 5.3.1, 5.4.1, 5.5.1, 5.6.1

Synchronization Needs		
It is essential that appropriate SWIM Governance Structure and Processes are established to develop and monitor an agreed SWIM implementation roadmap.		
Civil / Military Coordination		
Yes, civil/military coordination is required		
Stakeholders considered as gaps	ANSPs, Airport Operators, Airspace Users, Network Manager, Military Authorities, MET Service Providers	
Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B1-SWIM Performance Improvement through the Application of System-Wide Information Management (SWIM)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	IS-0901-A SESAR Release 5 CM-0201-A SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	INF08.1, INF08.2
SESAR Solutions	#46 "Initial SWIM" #28 "Initial Ground-Ground Interoperability"	
Very Large Scale Demonstrations	**Release 7:** PJ.23, 27 **Release 8:** PJ.23, 27 **Release 9:** PJ.23, 27	
Guidance Material / Specifications / Standards	CEN ATM information security EN 16495 (Version 2) (2017) ECTL Stand/Spec on TI SWIM Yellow Profile definition (2017) ECTL Stand/Spec on TI SWIM Blue Profile Definition (2020) x.509 (ITU) ICAO Doc 10039 Manual on SWIM concept	
Means of compliance and / or Certification	None	
Regulations	None	
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them	

Recommendation for IPs proposal	Stakeholders are invited to launch projects implementing local PKI and cyber security measures in line with a possible common project launched in the framework of the Family 5.1.4. Though changes to the use of PKI in the SWIM context are expected, PKI is very mature both regarding technology and management. The advantages of early implementation of PKI outweigh later changes to SWIM standards.
Deployment Approach	The implementation of the Family requires the definition of the future system architecture able to cover security for the information exchanges in compliance with SWIM Governance policies. The concept shall also take into account SWIM-enabled applications defined in AF1, AF2, AF3 and AF4 (**MM1 – Transition / architecture concept from legacy protocol (AFTN…) to SWIM environment available**). The SWIM information exchange implementation plan shall be defined or enhanced in order to cover the security required for all information exchanges. The implementation plan shall in detail describe the realization of the PKI defined in the previous milestone and it must be compliant with the relevant SWIM Governance policies. Furthermore, the plan shall specifically address the transition, ensuring flight safety and minimizing negative network effects (Part of Safety Case) and it may be linked to concrete implementation of the communication between SWIM-compliant applications (**MM2 – SWIM information exchange implementation plan available**). The PKI and further security measures defined within the Yellow SWIM TI profile shall be implemented; all relevant technical personnel shall be duly trained (**MM3 – Installation of local Infrastructure Components to support Yellow profile communications**). Before the start of operational use, the local security infrastructure shall be both verified and validated, ready to support communication between SWIM-enabled applications. The local security infrastructure must be compliant to the relevant SWIM Governance policies to guarantee interoperability within the SWIM network. The execution of these activities will lead to the start of permanent operational use (**MM5 – Implementation completed**).

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.


M
5.2.3 Stakeholders SWIM PKI and Cybersecurity
CEF Call 2014 Awarded Projects
CEF Call 2015 Awarded Projects
Identified Implementation Gaps
Austria - -
Belgium 0% 100%
Bulgaria 0% 100%
Croatia 0% 100%
Cyprus 0% 100%
Czech Republic 0% 100%
Denmark 0% 100%
Estonia 0% 100%
Finland 0% 100%
France 0% 100%
Germany 0% 100%
Greece 0% 100%
Hungary 0% 100%
Ireland 0% 100%
Italy 0% 100%
Latvia 0% 100%
Lithuania 0% 100%
Luxembourg 0% 100%
MUAC 0% 100%
Netherlands 0% 100%
Network Manager 40% 60%
Norway 0% 100%
Poland 0% 100%
Portugal 0% 100%
Romania 0% 100%
Slovak Republic 0% 100%
Slovenia 0% 100%
Spain 0% 100%
Sweden 0% 100%
Switzerland 0% 100%
United Kingdom 0% 100%
Airspace Users
H High readiness Family
M Medium readiness Family
L Low readiness Family
CEF Call 2014 Awarded Projects
CEF Call 2015 Awarded Projects
Projects already completed
Identified Gaps
Gaps that can be addressed through CEF General Call
Gaps that can be addressed through CEF General Call and Cohesion Call
20% % of Family planned with CEF funding
10% % of Family eligible for funding through future CEF Calls
N High Importance for Network Performance Improvement

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

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

Description and Scope

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

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

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

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

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

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

After the closure of SESAR1 in 2016 this list will be amended through the SWIM Governance to finally cover the whole PCP scope; the actual list of services will be available at any time in the registry managed by the SWIM Governance. The registry

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

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

Interdependencies

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

Interdependencies with families 5.1.1, 5.1.2, 5.1.4, 5.2.1, 5.2.2 and 5.2.3 for implementing the physical interconnection and the common and stakeholder-specific infrastructure components.

Interdependencies with all Families of S-AF 3.1 Airspace Management and Advanced Flexible Use of Airspace as well as with Family 3.2.1 - Upgrade of ATM systems (NM, ANSPs, AUs) to support Direct Routings (DCTs) and Free Routing Airspace (FRA).

Potential interdependency with all Families requiring aeronautical information for their full implementation.

Synchronization Needs

Synchronization will be needed between IPs intending to exchange data with the European Aeronautical Database (EAD) and the providers of EAD to ensure that the required functionality is available at the right point in time.

Civil / Military Coordination

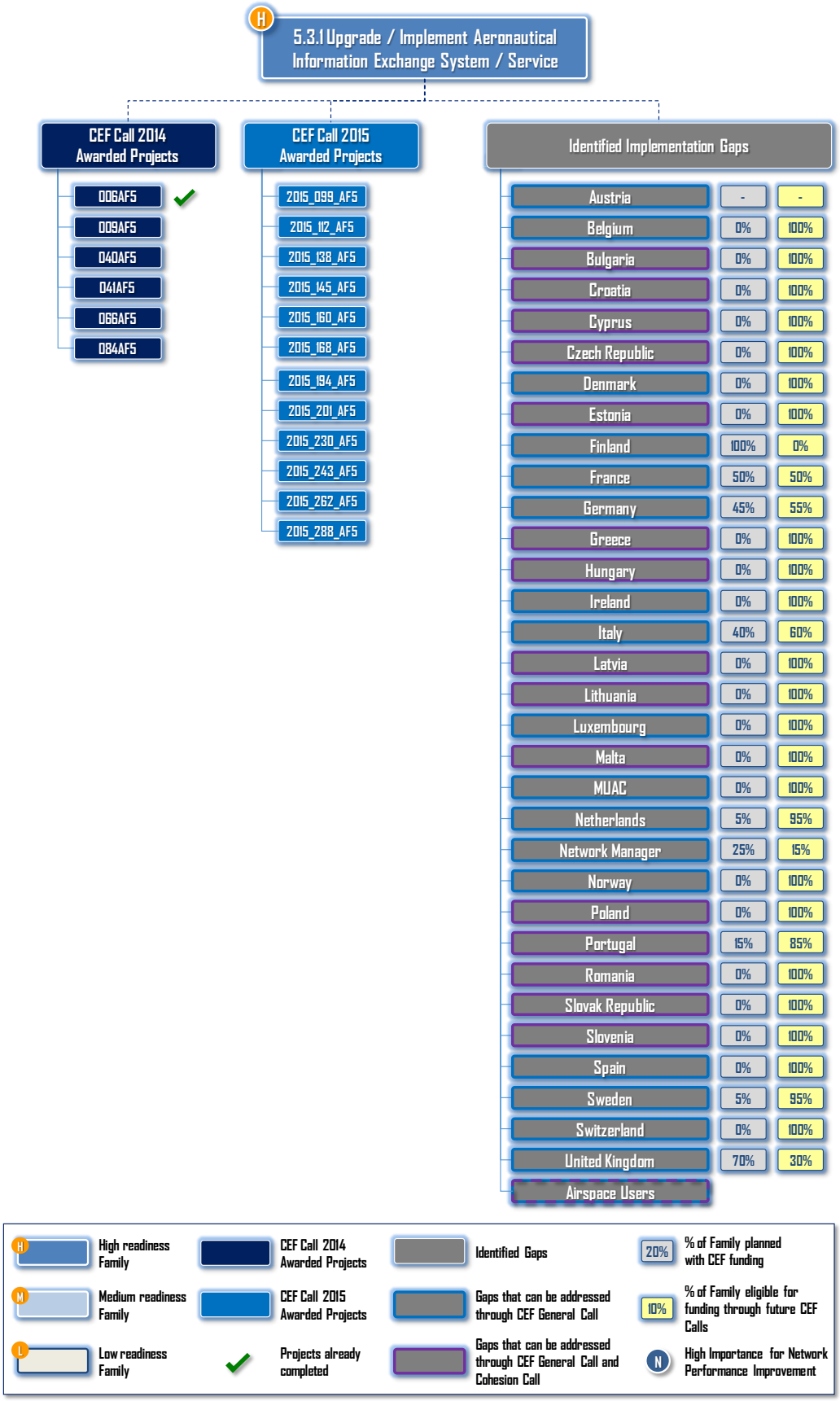
ARES information sharing needs coordination

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

SESAR Solutions	#46 "Initial SWIM"
Very Large Scale Demonstrations	**Release 7:** PJ.23, 27 **Release 8:** PJ.23, 27 **Release 9:** PJ.23, 27
Guidance Material / Specifications / Standards	ECTL SWIM Foundation material (2017) CEN ATM information security EN 16495 (Version 2) (2017) ECTL AIRM (2017) ECTL AIRM Rulebook (2017) ECTL ISRM Rulebook (2017) ECTL Stand/Spec on TI SWIM Yellow Profile definition (2017) 1. ECTL Aeronautical Information Exchange Model v5.1 ICAO IMP SARPs on AIRM (2018) ECTL Electronic e-AIP Specification EUROCAE ED-76A / DO-200B Standard for processing aeronautical data EUROCAE ED-98C TS User Requirements for terrain & obstacle data EUROCAE ED-99D TS User Requirements for Mapping information EUROCAE ED-119C Terrain, obstacles and aerodrome maps AIS Data Exchange Standard NM B2B technical documentation (for interoperability with NM) ICAO Doc 10039 Manual on System Wide Information Management concept ICAO PANS AIM ICAO Doc 8126 Aeronautical Information Services Manual (2018) OGC Aviation Domain WG – GML Profile for Aviation Data OGC/ISO – Web Feature Service (WFS)
Means of compliance and / or Certification	None
Regulations	Commission Regulation (EU). 73/2010 (ADQ IR) as amended by Commission Implementing Regulation (EU) 1029/2014
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them
Recommendation	Stakeholders are invited to deploy the services according to the SWIM Governance decisions by using Appendix 1 as a starting

for IPs proposal	point. For Services previously deployed, the Stakeholders have to upgrade, if necessary, according to the SWIM Governance material.
Deployment Approach	The implementation of this Family requires an analysis of upgrades and new implementations of services to be performed, as well as the development of a concept on how to tackle the transition for this Family. This analysis shall include the development of a roadmap of the transition and the identification of the relevant artefacts (Roadmap, services definition, AIRM version, XM models, Profiles, Safety and Security framework, compliance framework) (**MM1 – Transition concept from legacy protocol (AFTN…) to SWIM**). Before the start of operational use, the services required to fulfill Family 5.3.1 objectives shall be developed (**MM2 – New implementation or upgrade of Service developed**) and then validated (**MM3 – New implementation or upgrade of Service validated**). The deployment of the new or upgraded services shall be planned, in terms of test, validation, operation with other Stakeholders who are providers or consumers of the services: NM, ANSPs, AUs, Airport Operators, etc. (**MM4 – Planning of communications deployment**). The execution of these activities will lead to the start of permanent operational use for the Operational Stakeholders (**MM5 – Implementation completed**).

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 5.3.1 awarded in 2014 or 2015 CEF Calls, along with a more detailed description of each Implementation Project.

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

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

Description and Scope

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

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

This Family aims at upgrading or implementing Meteorological Information Exchange systems and services in accordance with SWIM principles. All Meteorological Information required for the implementation of the Families in AF1, AF3 and AF4[28] has to be

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

provided by services situated in Family 5.4.1; in this sense Family 5.4.1 constitutes the gateway between the meteorological and the ATM world.

The systems shall be upgraded or implemented to support the exchange of Meteorological Information as service provider or service consumer in WXXM,IWXXM, GRIB2 or HDF5 data formats; the service implementation shall comply with the Yellow SWIM TI Profile, either using the Public Internet or PENS1/NewPENS. The different communications paradigms of this profile shall be adapted for supporting the different levels of technical compliance of the stakeholders.

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

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

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

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

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

Interdependencies

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

Interdependencies with families 5.1.1, 5.1.2, 5.1.4, 5.2.1, 5.2.2 and 5.2.3 for implementing the physical interconnection and the common and stakeholder-specific infrastructure components.

Interdependencies with Families 2.1.4 – Initial Airport Operational Plan (AOP), 2.3.1 – Time Based Separation and 4.2.4 - AOP/NOP information Sharing regarding meteorological information and systems.

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

Synchronization Needs

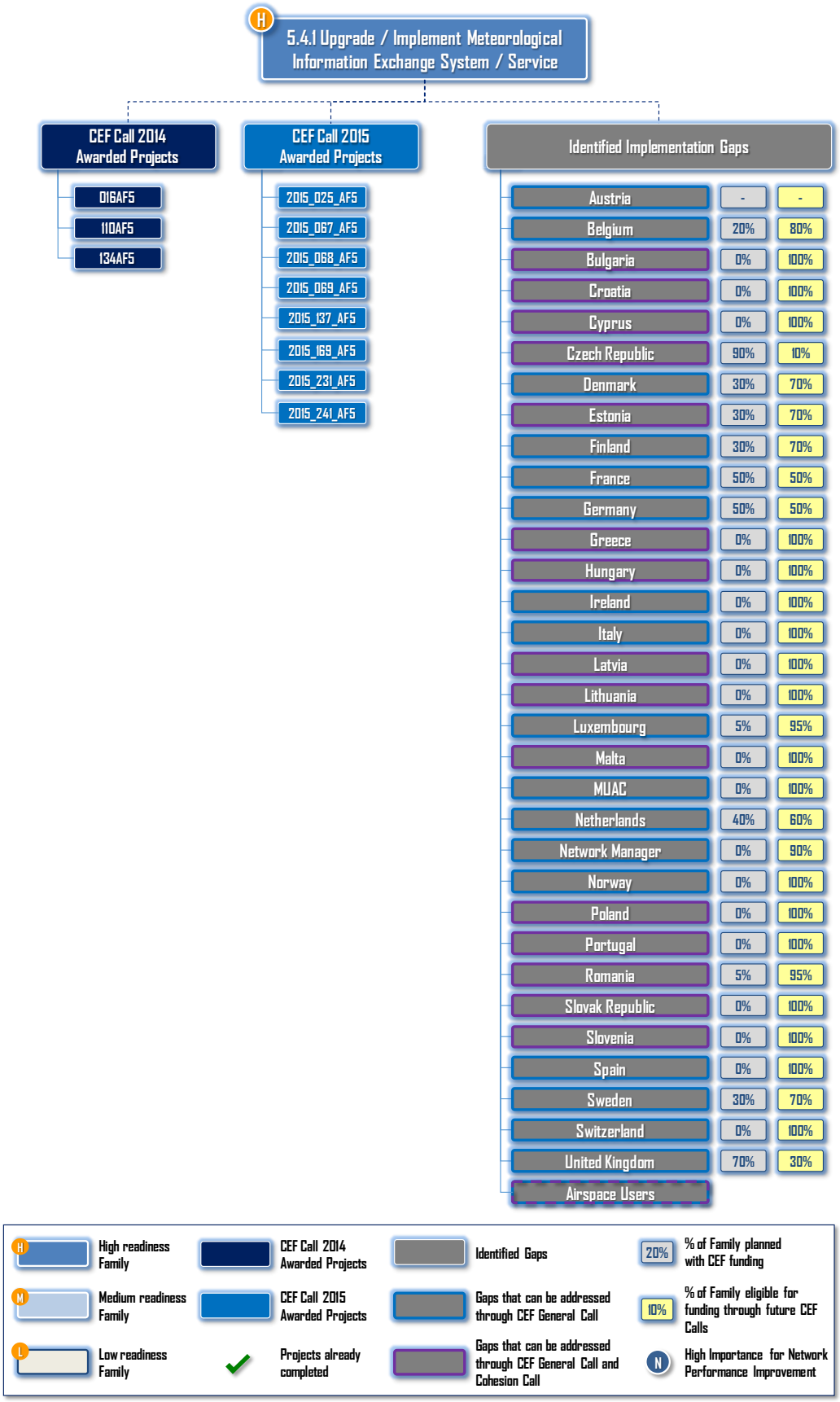
Civil / Military Coordination

Yes, civil/military coordination is required

Stakeholders considered as gaps	ANSPs, Airport Operators, Airspace Users, Network Manager, Military Authorities, MET Service Providers	
Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B1-AMET Enhanced Operational Decisions through Integrated Meteorological Information (Planning and Near-term Service)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	IS-0901-A SESAR Release 5 MET-0101 SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	INF08.1
SESAR Solutions	#35 "MET Information Exchange" #46 "Initial SWIM"	
Very Large Scale Demonstrations	**Release 7:** PJ.31 **Release 8:** PJ.31 **Release 9:** PJ.31	
Guidance Material / Specifications / Standards	CEN ATM information security EN 16495 (Version 2) (2017) EUROCAE ED-119C Terrain, obstacles and aerodrome maps AIS Data Exchange Standard ECTL SWIM Foundation material (2017) ECTL AIRM (2017) ECTL AIRM Rulebook (2017) ECTL ISRM Rulebook (2017) ECTL Compliance framework (2017) ECTL Stand/Spec on TI SWIM Yellow Profile definition (2017) ICAO IMP SARPs on AIRM (2018) EUROCAE MET SWIM Service (2020) ICAO/WMO IWXXM v.1.1 ECTL/FAA WXXM 2.0 GRIB2: WMO-No. 306, Manual on Codes Volume I.2 WMO HDF5 (www.hdfgroup.org/HDF5/doc/H5.format.html) ICAO Doc 10003 Manual on the digital exchange of aeronautical information ICAO Doc 8896 Manual of Aeronautical Meteorological Practice ICAO Doc 9328 Manual of Runway Visual Range Observing and Reporting Practices ICAO Doc 9377 Manual on Coordination between Air Traffic Services, Aeronautical Information Services and Aeronautical Meteorological Services ICAO Doc 9691 Manual on Volcanic Ash, Radioactive Material and Toxic Chemical Clouds ICAO Doc 9766 Handbook on the International Airways Volcano Watch (IAVW) Operational Procedures	

	ICAO Doc 9817 Manual on Low-level Wind Shear ICAO Doc 9837 Manual on Automatic Meteorological Observing Systems at Aerodromes ICAO Doc 10039 Manual on System Wide Information Management concept OGC Aviation Domain WG – GML Profile for Aviation Data OGC/ISO Web Feature Service (WFS) OpenGIS Web Map Service Interface (WMS) OGC Web Coverage Service (WCS)
Means of compliance and / or Certification	None
Regulations	None
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them
Recommendation for IPs proposal	Stakeholders are invited to deploy the services according to the SWIM Governance decisions by using Appendix 1 as a starting point. For Services previously deployed, the Stakeholders have to upgrade, if necessary, according to the SWIM Governance material.
Deployment Approach	The implementation of this Family requires an analysis of upgrades and new implementations of services to be performed, as well as the development of a concept on how to tackle the transition for this Family. This analysis shall include the development of a roadmap of the transition and the identification of the relevant artefacts (Roadmap, services definition, AIRM version, XM models, Profiles, Safety and Security framework, compliance framework) (**MM1 – Transition concept from legacy protocol (AFTN…) to SWIM**). Before the start of operational use, the services required to fulfill Family 5.4.1 objectives shall be developed (**MM2 – New implementation or upgrade of Service developed**) and then validated (**MM3 – New implementation or upgrade of Service validated**). The deployment of the new or upgraded services shall be planned, in terms of test, validation, operation with other Stakeholders who are providers or consumers of the services: NM, ANSPs, AUs, Airport Operators, etc. (**MM4 – Planning of communications deployment**). The execution of these activities will lead to the start of permanent operational use for the Operational Stakeholders (**MM5 – Implementation completed**).

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 5.4.1 awarded in 2014 or 2015 CEF Calls, along with a more detailed description of each Implementation Project.

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

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

Description and Scope

The Network Information will be freely exchanged between the systems of the operational stakeholders by means of defined cooperative network information B2B services, using the Yellow SWIM TI Profile.

The scope of the Family is the implementation by the operational stakeholders of the cooperative network information exchange with NM using the Yellow SWIM TI Profile for the sake of Air Traffic Flow and Capacity Management.

The information to be exchanged according to the PCP comprises:

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

- Synchronization of Network Operations Plan and all Airport Operations Plans,

- Departure and arrival planning information,

- ATFCM pre-tactical and tactical plans (regulations, re-routings, sector configurations, runway updates, monitoring values, capacities, traffic volume activations, scenarios, etc.),

- Short term ATFCM measures,

- ATFCM congestion points,

- Network events,

- Rerouting opportunities,

- Restrictions,

- Traffic counts information,

- Demand data (civil, military),

- Flow and Flight message exchange (flight exchanges are meant for ATFCM purpose),

- Airspace structure, availability and utilisation,

- Network and En-Route/Approach Operation Plans,

- Network impact assessment,

- Service availability information,

- General information messages (ATFCM Information Messages and headline news),

The systems shall be upgraded to support the exchange of information in compliance

with the Yellow SWIM TI Profile, either through the Public Internet or over PENS. The different communications paradigms of this profile shall be provided by the Network Manager, supporting the different levels of technical compliance of the stakeholders.

The list of SWIM services developed by NM and already available in operations that are in scope of 5.5.1 is the following.

- Airspace structure, availability and utilisation:
  - Download of complete AIXM 5.1 datasets with the following entities: AS, PT, RT, UT, AD, AZ, TV, TZ, RL, FW, RS
  - Incremental AIXM 5.1 data sets
  - Creation and update of Airspace Use Plan service for AMCs
  - Publication of the European Airspace Use Plan
- ATFCM pre-tactical and tactical plans
  - Retrieve regulation list and details, sector configuration plans, runways configuration plan, monitoring values, capacity plan, traffic volume activations
  - Create and update sector configurations plan, runways configuration plan, monitoring values, capacity plan, traffic volume activations
- Restrictions
  - Part of the airspace structure service
- Traffic counts information
  - Traffic counts (entry or occupancy, where relevant) by AO, by AD, by AZ, by AS, by PT, by TV
- General Information Messages
  - Retrieve ATFCM Information messages
- Flow and Flight message exchange (flight exchanges are meant for ATFCM purposes)
  - Retrieve flight lists by AO, AD, PT, AS, TV, AZ
  - Retrieve flight details

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

Appendix 1 provides a mapping between the PCP required information exchanges and the NM B2B services already operational (see above) and planned till 2018 that support those exchanges.

The Network Manager systems shall be adapted to support simultaneously the legacy messaging exchanges and the yellow SWIM profile information exchange, allowing for a progressive migration of the stakeholders to SWIM.
The exchange of data with NM via an HMI is covered in Family 4.2.2.
Security and availability shall be upgraded to support the strong dependencies caused by the system to system interactions.

Interdependencies

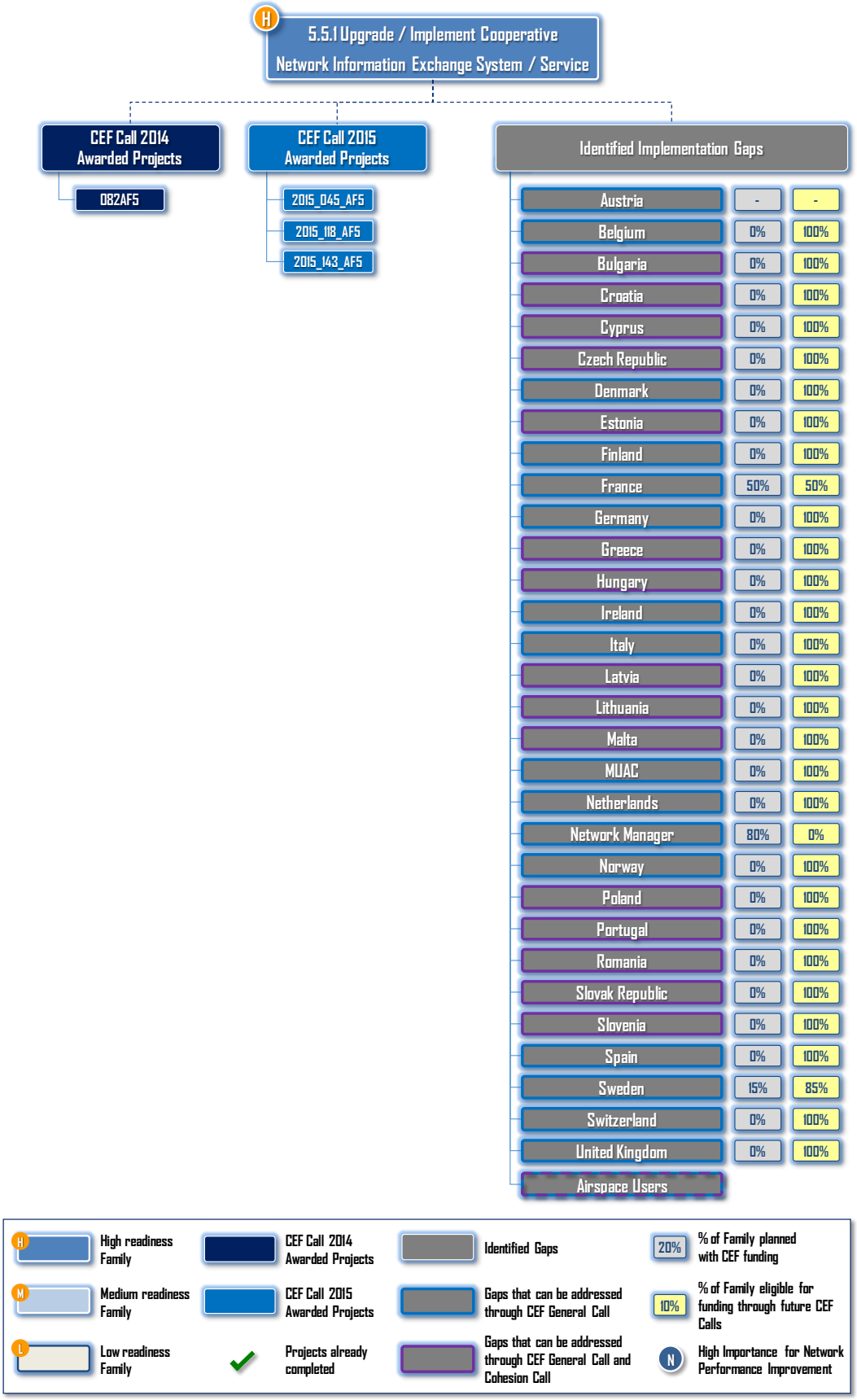
System-to–system interfaces for access to Network Information in other AFs (AF2.1.1, AF2.1.3, AF2.1.4, AF3.1.1, AF3.1.2, AF3.1.3, AF3.1.4, AF3.2.1, AF4.1.2, AF4.2.2, AF4.2.4, AF4.3.1, AF4.3.2 and AF4.4.2).

Interdependencies with families 5.1.1, 5.1.2, 5.1.4, 5.2.1, 5.2.2 and 5.2.3 for implementing the physical interconnection and the common and stakeholder-specific infrastructure components.

Synchronization Needs		
NM shall coordinate and support the stakeholders for the deployment of the information exchange with NM via the NM B2B services.		
Civil / Military Coordination		
Yes, civil/military coordination is required		
Stakeholders considered as gaps	ANSPs, Airport Operators, Airspace Users, Network Manager, Military Authorities	
Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B1-FICE Increased Interoperability, Efficiency and Capacity through Flight and Flow Information for a Collaborative Environment Step-1 (FF-ICE/1) application before Departure B1-NOPS Enhanced Flow Performance through Network Operational Planning	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	IS-0901-A SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	INF08.1
SESAR Solutions	#46 "Initial SWIM"	
Very Large Scale Demonstrations	**Release 7:** PJ.24,27 **Release 8:** PJ.24,27 **Release 9:** PJ.24,27	
Guidance Material / Specifications / Standards	CEN ATM information security EN 16495 (Version 2) (2017) ECTL SWIM Foundation material (2017) ECTL AIRM (2017) ECTL AIRM Rulebook (2017) ECTL ISRM Rulebook (2017) ECTL Compliance framework (2017) ECTL Stand/Spec on TI SWIM Yellow Profile definition (2017) FIXM v4 including flow management (FIXM development team) NM B2B Reference Manuals NM Technical roadmap available in the Network Operations Plan Network Strategy Plan (NSP): SO 2/2, SO 2/4, SO 5/2, SO5/4, SO5/5, SO6, SO7/6 ICAO Global Air Navigation Plan (GANP) ICAO Doc 10039 Manual on System Wide Information Management concept	

Means of compliance and / or Certification	None
Regulations	None
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them
Recommendation for IPs proposal	This is a multi-stakeholders initiative (NM and various Network users), thus stakeholders' initiatives should be synchronised to foster benefits. NM shall coordinate and support the stakeholders for the deployments of the NM services but it is not recommended to package deployments in a unique project.
Deployment Approach	The priority of each service implementation is dictated by the other AFs identified in the "Interdependencies" section. For each service the following implementation milestones, involving NM and the stakeholders, were identified: - Development of a concept and plan for how to migrate from current situation with legacy protocols to SWIM service implementation. Such analysis shall include the development of a roadmap of the transition and the identification of the relevant artefacts, including aspects of safety and security and compliance. The transition plan involves the impacted stakeholders via the Network Manager governance bodies **(MM1 – Transition concept from legacy protocol (AFTN…) to SWIM)**. - Specifications for each service shall be provided by the Network Manager allowing the stakeholders to start their development **(MM2 – Specification from NM available)** - Development and validation of the services by NM and corresponding developments and validations by the stakeholders **(MM3 – New implementation or upgrade of Service developed and MM4 – New implementation or upgrade of Service validated)** - Deployment plan shall be communicated and executed by NM **(MM5 – Planning of NM Communications deployment)** and by the stakeholders **(MM6 – Planning of communications deployment with NM completed)** - Start of permanent operational use of the service by the stakeholders **(MM7 – Implementation completed)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 5.5.1 awarded in 2014 or 2015 CEF Calls, along with a more detailed description of each Implementation Project.

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

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

Description and Scope

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

- Validate flight plan and routes

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

- Flights lists and detailed flight data

- Flight update message related (departure information)

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

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

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

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

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

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

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

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

specification etc.), allowing the consumers to develop applications that use those services.

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

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

Interdependencies

Interdependencies with families 5.1.1, 5.1.2, 5.1.4, 5.2.1, 5.2.2 and 5.2.3 for implementing the physical interconnection and the common and stakeholder-specific infrastructure components.

Interdependencies with AF1, AF2, AF3 and AF4.

Synchronization Needs

The coordination could be performed by the NM for the information exchanges performed with the NM.

Civil / Military Coordination

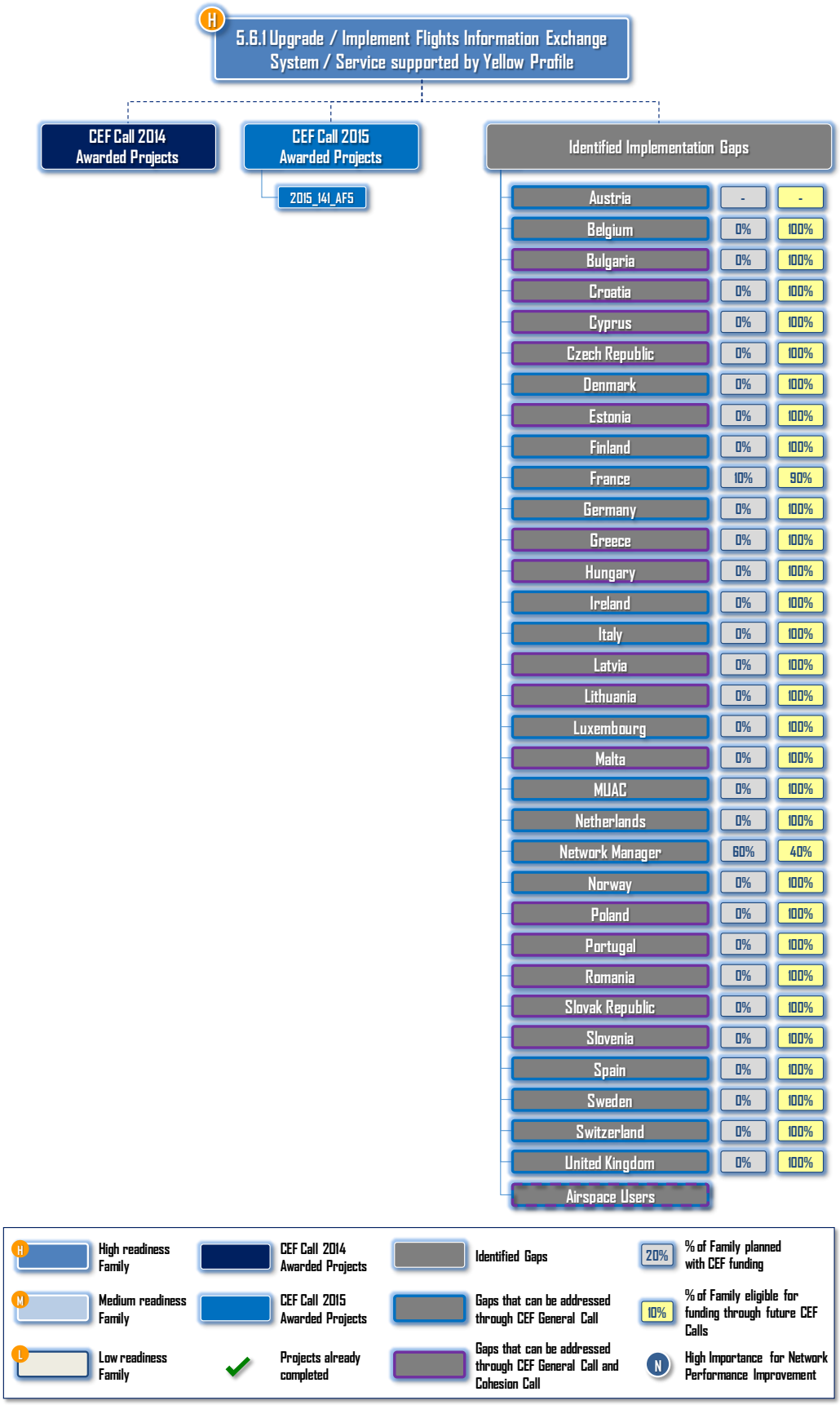
Particular needs from the military must be considered, when justified by civil-military interoperability needs. Where for operational security reasons there are restrictions to share the information specific mitigating measures must be introduced including higher level security measures or alternative exchange mechanisms.

Stakeholders considered as gaps	ANSPs, Airport Operators, Airspace Users, Network Manager, Military Authorities	
Other stakeholders involved in the Family deployment	None	
Links to ICAO GANP ASBUs	B1-FICE Increased Interoperability, Efficiency and Capacity through Flight and Flow Information for a Collaborative Environment Step-1 (FF-ICE/1) application before Departure B2-FICE Improved Coordination through Multi-centre Ground-Ground Integration (FF ICE, Step 1 and Flight Object, SWIM)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	IS-0901-A SESAR Release 5 CM-0201-A SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	INF08.1

SESAR Solutions	#46 "Initial SWIM" #28 "Initial Ground-Ground Interoperability"
Very Large Scale Demonstrations	**Release 7:** PJ. 24,27 **Release 8:** PJ. 24,27 **Release 9:** PJ. 24,27
Guidance Material / Specifications / Standards	CEN ATM information security EN 16495 (Version 2) (2017) ECTL SWIM Foundation material (2017) ECTL AIRM (2017) ECTL AIRM Rulebook (2017) ECTL ISRM Rulebook (2017) FIXM v4 (FIXM Development Team) ECTL Stand/Spec on TI SWIM Yellow Profile definition (2017) NM B2B Reference Manuals NM Technical roadmap available in the Network Operations Plan ICAO Doc 10039 Manual on System Wide Information Management concept
Means of compliance and / or Certification	CEN Community Specification on FDP (2019)
Regulations	None
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them
Recommendation for IPs proposal	Stakeholders are expected to submit IPs for the exchange of flight information via the SWIM Yellow Profile, either proposals that include the use of the NM B2B Flight Services or proposals for the provision of services in this domain. As stated above there are several information exchanges required as prerequisite for trajectory management. SDM explicitly encourages projects dealing with these information exchanges in preparation for the deployment of the families related to trajectory management.
Deployment Approach	The implementation of the Family would require the SWIM implementation analysis of transitions and new implementations to be performed, as well as the development of a concept on how to tackle the transition for this Family. Such analysis shall include the development of a roadmap of the transition and the identification of the relevant artefacts (Roadmap, services definition, AIRM version, XM models, Profiles, Safety and

	Security framework, compliance framework) **(MM1 – Transition concept from legacy protocol (AFTN…) to SWIM)**. The services required by Family 5.6.1 using Yellow Profile **(MM2 – New implementation or upgrade of services for Yellow Profile developed)** shall be developed. The services required by Family 5.6.1 using Yellow Profile **(MM3 – New implementation or upgrade of services for Yellow Profile validated)** shall be validated. The deployment of the services required by Family 5.6.1 using Yellow Profile shall be planned, in terms of test, validation, operation, with other Stakeholders, such as NM, ANSPs, AUs, Airport Operators, etc. **(MM4 – Planning of communications Yellow Profile deployment completed)**. The execution of such activities is expected to lead to the start of operational use by the Operational Stakeholders Yellow Profile **(MM5 – Implementation Yellow Profile completed)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 5.6.1 awarded in 2015 CEF Calls, along with a more detailed description of each Implementation Project.

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

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

Description and Scope

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

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

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

System requirements:

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

This Family aims at implementing Flight Object Exchange systems and services in accordance with SWIM principles.

The systems shall be implemented to support the Flight Object exchange in compliance with the Blue SWIM TI Profile over PENS1/NewPENS and the official versions of ED133. The service implementations shall be compliant with the applicable version of AIRM, the AIRM Foundation Material and the ISRM Foundation Material. The applicable version of these documents will at any time be available in the SWIM registry, which is maintained by the SWIM Governance.

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

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

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

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

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

Particular needs from the military must be considered, especially where for operational security reasons the information cannot and will not be shared.

Interdependencies

Interdependencies with families 5.1.1, 5.1.2, 5.1.4, 5.2.1, 5.2.2 and 5.2.3 for implementing the physical interconnection and the common and stakeholder-specific infrastructure components.

SWIM services related to FO enable flight data processing systems to flight data processing systems exchange of down-linked trajectory information between ATS units required by Initial Trajectory Information Sharing functionality referred in AF6.

Interdependencies with AF3 and AF4.

Synchronization Needs

The implementation of the Flight Object distribution and consumption shall be synchronized and coordinated at least by big area like FAB or neighbouring ANSPs. To implement Flight Object only in one ANSP has a limited interest. It could be relevant that a cluster of ANSPs presents IP to implement FO in their Airspace, especially synchronized with e.g. Free Route implementation.

Civil / Military Coordination

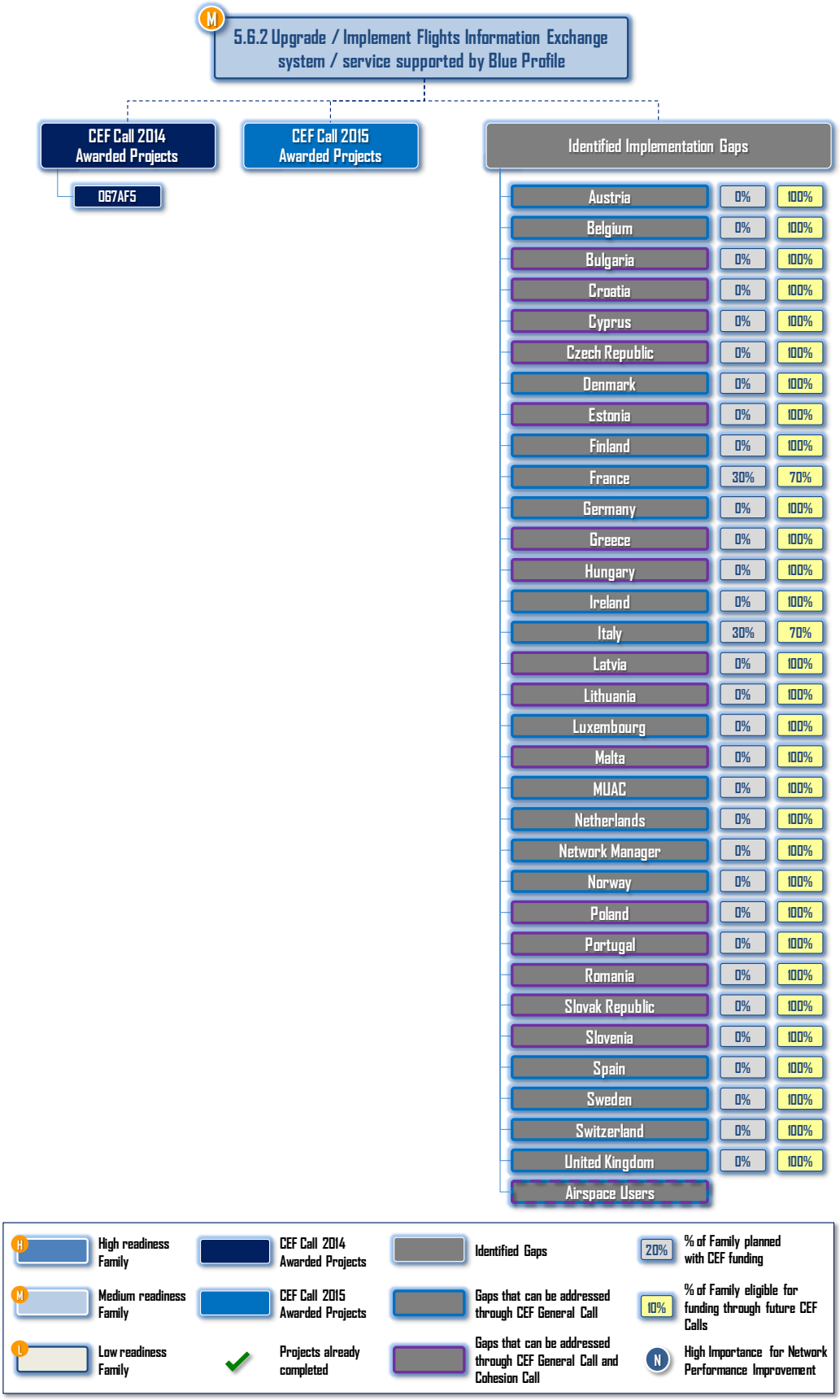
A civil-military coordination to exchange flight object data is beneficial to perform 4D trajectory management as well as identification process

Stakeholders considered as gaps	ANSPs, Network Manager	
Other stakeholders involved in the Family deployment	Military Authorities	
Links to ICAO GANP ASBUs	B1-FICE Increased Interoperability, Efficiency and Capacity through Flight and Flow Information for a Collaborative Environment Step-1 (FF-ICE/1) application before Departure B2-FICE Improved Coordination through Multi-centre Ground-Ground Integration (FF ICE, Step 1 and Flight Object, SWIM)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	IS-0901-A SESAR Release 5 CM-0201-A SESAR Release 5

	ATM Master Plan Level 3 (Edition 2016)	INF08.1
SESAR Solutions	#46 "Initial SWIM" #28 "Initial Ground-Ground Interoperability"	
Very Large Scale Demonstrations	**Release 7:** PJ. 24,27 **Release 8:** PJ. 24,27 **Release 9:** PJ. 24,27	
Guidance Material / Specifications / Standards	CEN ATM information security EN 16495 (Version 2) (2017) ECTL SWIM Foundation material (2017) ECTL AIRM (2017) ECTL AIRM Rulebook (2017) ECTL ISRM Rulebook (2017) EUROCAE ED-133 Flight Object Interoperability specification exchange EUROCAE ED-133A and potential future revisions (2020) ECTL Stand/Spec on TI SWIM Blue Profile definition (2017) Interoperability of Flight Data Processing (FDP) (TS 16071) ICAO Doc 10039 Manual on System Wide Information Management concept	
Means of compliance and / or Certification	CEN Update of TS 16071 to an EN when ED-133A is available (2019) CEF Community specifications on FDP (2019)	
Regulations	None	
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them	
Recommendation for IPs proposal	It could be relevant that a cluster of ANSPs, a FAB or neighbouring ANSPs, present common Implementing Projects to implement FO - based on the two SWIM services ATC Flight Object Control Service and Shared Flight Object Service and ED133 versions - in their Airspace especially synchronized with Free Route implementation. SDM is available to help ANSPs and NM for building implementation scenarios.	
Deployment Approach	The implementation of the Family would require the IOP implementation analysis of transitions and new implementations to be performed, as well as the development of a concept on how to tackle the transition for this Family. Such analysis shall include the development of a roadmap of the transition and the	

	identification of the relevant artefacts (Roadmap, services definition, AIRM version, XM models, Profiles, Safety and Security framework, compliance framework) **(MM1 – Transition concept from OLDI-FMTP to FO)**. The services required by Family 5.6.2 using both Blue Profile **(MM2 – New implementation or upgrade of services for Blue Profile developed)** shall be developed. The services required by Family 5.6.2 using Blue Profile **(MM3 – New implementation or upgrade of services for Blue Profile validated)** shall be validated. The deployment of the services required by Family 5.6.2 using Blue Profile shall be planned, in terms of test, validation, operation, with other Stakeholders, being NM, ANSPs, AUs, Airport Operators, etc **(MM4 – Planning of communications Blue Profile deployment completed)**. The execution of such activities is expected to lead to the start of operational use by the Operational Stakeholders for both Blue Profile **(MM5 – Implementation Blue Profile completed)**.

The following Work Breakdown Structure at Family level illustrates the list of all implementation priorities towards the timely implementation of the Pilot Common Project, including both 2014 and 2015 CEF Calls awarded projects.



Dedicated tables within Annex A encompass the list of implementation initiatives associated to Family 5.6.2 awarded in 2015 CEF Calls, along with a more detailed description of each Implementation Project.

AF #6 – Initial Trajectory Information Sharing

Note: In DP2016, the AF6 family contents are restructured as described below. Therefore, **families 6.1.1 to 6.1.4**, which already existed in DP2015 and before, **do not have the same contents as in previous versions** of the Deployment Programme. A table providing an overview of similarities between old and new versions of the AF6 families can be found at the end of this introduction.

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

After the first implementations of the DLS IR (i.e., "CPDLC"), it became apparent that the VDL Mode 2 network deployed within the scope of the DLS IR did not meet the performance requirements set by the DLS IR and the complementing standards. A detailed analysis of the network issues was conducted in the "ELSA study": "VDL Mode 2 Measurement, Analysis and Simulation Campaign". Major results and recommendations of this study have been incorporated in the family descriptions of AF6 (specifically, 6.1.3 and 6.1.4, as described below).

The AF6 families are grouped in the following three domains:

ATSP domain upgrades for Initial Trajectory Information Sharing
- 6.1.1 ATN B1 based services in ATSP domain
- 6.1.2 ATN B2 based services in ATSP domain

Communication domain upgrades for Initial Trajectory Information Sharing
- 6.1.3 A/G and G/G Multi Frequency DL Network in defined European Service Areas

Aircraft domain upgrades for Initial Trajectory Information Sharing
- 6.1.4 ATN B1 capability in Multi Frequency environment in aircraft domain
- 6.1.5 ATN B2 in aircraft domain

Families related to ATN Baseline 1 (ATN B1) target the implementation of the original DLS IR on ANSP (6.1.1) and Airspace User (6.1.4) side. These families enable CPDLC (beside other applications). Family 6.1.4 includes ELSA study's recommendations for the aircraft domain.

Families related to ATN Baseline 2 (ATN B2) target the implementation of trajectory information sharing on ANSP/NM (6.1.2) and Airspace User (6.1.5) side. These families enable the ADS-C EPP application, including the ground/ground dissemination of the trajectory information through flight object exchange.

Family 6.1.3 is related to the implementation of a air/ground and ground/ground network supporting ATN B1, ATN B2 and ACARS and providing
- in the short term, coverage and performance required to satisfy the DLS IR, and
- in the medium term, capacity to support the increased data volume expected with the introduction of trajectory downlinks with ADS-C EPP.

Operational benefits achieved by the implementation of AF6 are envisaged by the PCP in the areas of improved de-confliction and the reduction of tactical interventions as a result of improved use of target times and trajectory information. However, AF6 can also be regarded as an infrastructure provision, integrating the aircraft as a node into the ATM network.

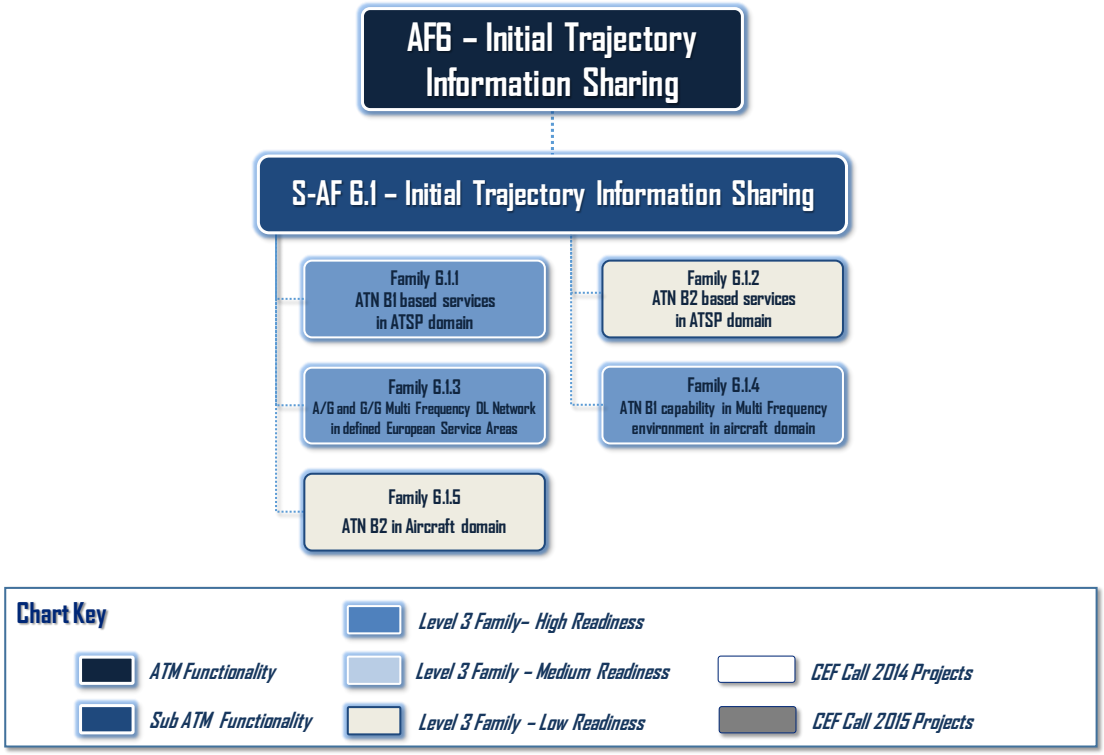


Fig. 25 – AF #6 Structure

Note: Mapping between DP2015 families and DP2016 families:

DP2015 Family	Original content (brief)	DP2016 Family	New content (brief)
6.1.1	ADS-C EPP (ATN B2), ANSPs	**6.1.2**	ADSC-EPP (ATN B2), ANSPs
6.1.2	CPDLC (DLS IR, ATN B1), all stakeholders	**6.1.1**	CPDLC (ATN B1), ANSPs
		6.1.3	Communication Network (ATN B1 & B2), CSPs/ANSPs
		6.1.4	CPDLC (ATN B1), AUs
6.1.3	VDL M2 capacity (ATN B2), CSPs/ANSPs	**6.1.3**	Communication Network (ATN B1 & B2), CSPs/ANSPs
6.1.4	ADS-C EPP (ATN B2), AUs	**6.1.5**	ADS-C EPP (ATN B2), AUs

The following Gantt chart shows the implementation roadmap for each Family included in AF6 in terms of start and end date of deployment, and it has been defined taking into account the target dates for the ATM Functionality, as stated in Regulation (EU) No 716/2014.

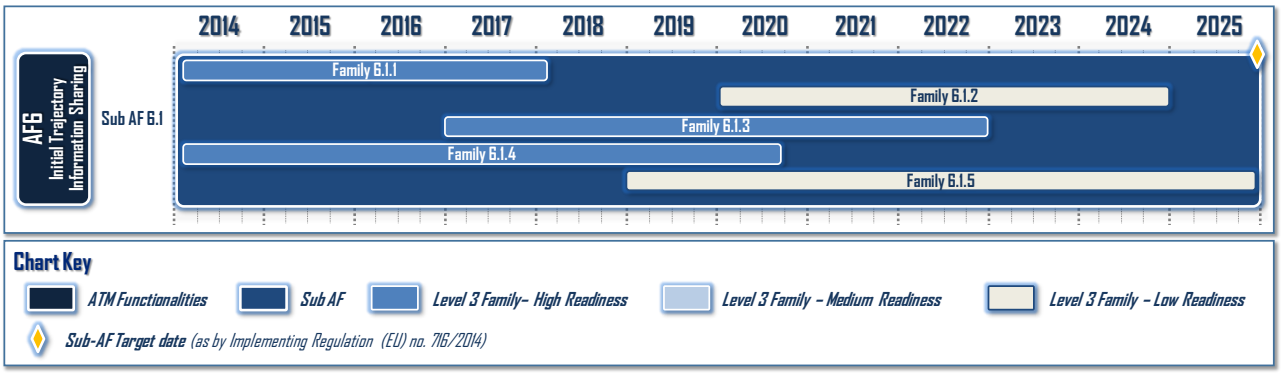


Fig. 26 – AF #6 Implementation Timeline

Family 6.1.1 – ATN B1 based services in ATSP domain

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

Description and Scope

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

This Family encompasses:

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

Interdependencies

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

Synchronization Needs
Family 6.1.4 targets the implementation of avionic systems supporting ATN B1 applications. Therefore, synchronisation between ANSPs and AUs is necessary.
Civil / Military Coordination
In certain circumstances military ANSPs may provide ATS services to traffic where DLS is implemented. In those cases, military ATM systems must be also adapted (taking into account their specificity).

Stakeholders considered as gaps	ANSPs	
Other stakeholders involved in the Family deployment	Military authorities, when relevant	
Links to ICAO GANP ASBUs	B0-TBO (Improved Safety and Efficiency through the Initial Application of Data Link En-route)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AUO-0301 Available
	ATM Master Plan Level 3 (Edition 2016)	ITY-AGDL
SESAR Solutions	N/A	
Very Large Scale Demonstrations	N/A	
Guidance Material / Specifications / Standards	Network Strategy Plan (NSP): SO 8.3 EUROCAE ED-100A/DO-258A, Interoperability Requirements for ATS Applications using ARINC 622 Data Communications. EUROCAE ED-110B/DO-280B, Interoperability Requirements Standard for Aeronautical Telecommunication Network Baseline 1 (Interop ATN B1) EUROCAE ED-154A/DO-305A, Future Air Navigation System 1/A - Aeronautical Telecommunication Network Interoperability Standard (FANS 1/A – ATN B1 Interop Standard). EUROCAE ED-120/DO-290, Safety and Performance Requirements Standard for Initial Air Traffic Data Link Services in Continental Airspace (SPR IC) EUROCAE ED-122/DO-306, Safety and Performance Standard for Air Traffic Data Link Services in Oceanic and Remote Airspace (Oceanic SPR Standard) EUROCAE ED-93, Minimum Aviation System Performance Specification for CNS/ATM message recording systems ICAO Doc 10037 ICAO GOLD edition 2 ICAO Doc 9694 Manual of Air Traffic Services DL Applications	

	ICAO Doc 9880 Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI Standards and Protocols, Part II — Ground-Ground Applications — Air Traffic Services Message Handling Services (ATSMHS) EUROCONTROL Specification for On-Line Data Interchange (OLDI) Edition 4.2 EUROCONTROL Specification on Data Link Services, Eurocontrol Spec-0116, Edition 2.1 ATC Data Link Operational Guidance Edition 6.0 17 December 2012 Link 2000+ Guidance to Ground Implementers edition 2.3 14 Oct 2014
Means of compliance and / or Certification	ETSI EN 303 214 (v.1.2.1) Data Link Services (DLS) System; Community Specification; Requirements for ground constituents and system testing EASA RMT.0524 – Data Link Services (Planned)
Regulations	Commission Regulation (EC) 1032/2006, as amended by Regulation (EC) 30/2009 Commission Regulation (EC) n. 29/2009, as amended by Regulation (EU) 2015/310 EASA Updated regulatory package on DL Operations (TBD)
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them.
Recommendation for IPs proposal	It is recommended to take into consideration Family 6.1.3 which is necessary to provide the required communication infrastructure. It is further recommended to take into consideration the results of the DLS survey, as reported within Section 5.1
Deployment Approach	The implementation of the Family would require the upgrade of the existing ATM systems and/or installation of new systems (e.g., data link front end processor). Such systems would also require the provision of their final acceptance and the integration with other existing systems, considering that some of these components are included in Family 6.1.3 **(MM1 – ATM systems upgrade)**. The applicable concept of operations shall also be broken down into documented and approved work procedures **(MM2 – Procedures available)**. Before the start of the operational use of CPDLC based services, a safety assessment shall be performed successfully **(MM3 – Safety Assessment)** and all operational/technical staff involved

	shall be duly trained **(MM4 – Training)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM5 – Implementation completed)**.

Family 6.1.2 – ATN B2 based services in ATSP domain

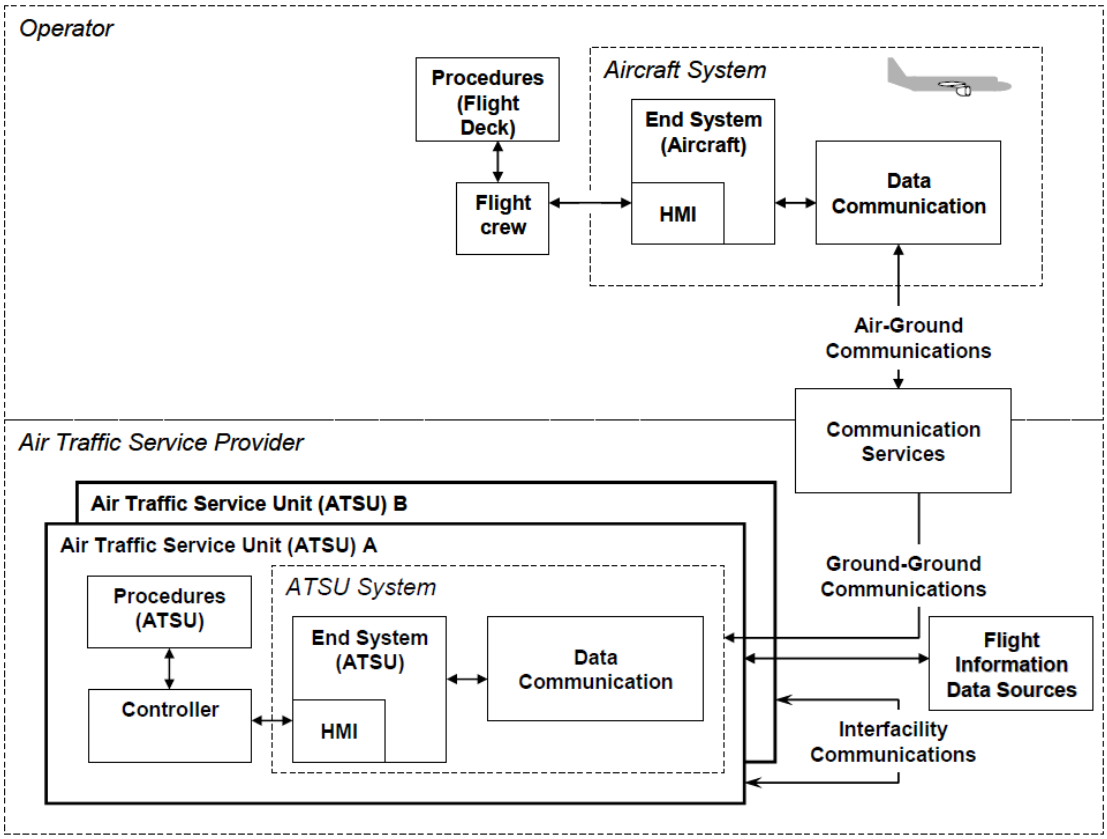
6.1.2 ATN B2 based services in ATSP domain			
Main Sub-AF	Sub-AF 6.1 Initial Trajectory Information Sharing		
Readiness for implementation	Low		
Initial Operational Capability	01/01/2020	**Full Operational Capability**	01/01/2025

Description and Scope

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

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

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



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

- ATSU (Air Traffic Service Unit) System:
  - Determine parameters for the appropriate ADS-C Contract Request
  - Process EPP data in FDP to derive performance benefits (includes FDP Trajectory Prediction, HMI, Controller support tools, Safety Nets as appropriate)

- NM Systems:
  - Process and integrate EPP data to derive network performance benefits
- ATSU Data Communication
  - Establish the appropriate ADS-C Contract with Aircraft System either directly or through delegation to an appropriate external function of Communication Services (involves Datalink Front End Processor (DL-FEP) and/or interfaces to external functions as appropriate)
  - Provide support for SWIM enabled interfacility sharing of EPP or EPP enhanced ground trajectory data.
- Communication Services

Interdependencies
6.1.3 is a necessary prerequisite providing the physical and logical network infrastructure. Families 5.6.1 and 5.6.2 provide the vehicle for interfacility exchange of EPP data
Synchronization Needs
6.1.5 is a mutual interdependency with this family, providing the airborne segment of the chain.
Civil / Military Coordination
This family must also support interoperability needs of military/state transport-type aircraft deemed to be ADS-C EPP capable

Stakeholders considered as gaps	ANSP, NM	
Other stakeholders involved in the Family deployment	Military authorities when relevant	
Links to ICAO GANP ASBUs	B1-TBO (Improved Traffic Synchronization and Initial Trajectory-based Operation)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	IS-0303-A (ER APP ATC 149a, ER APP ATC 119, ER APP ATC 100) SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	None
SESAR Solutions	N/A	
Very Large Scale Demonstrations	**Release 7:** PJ.24,25,31 **Release 8:** PJ.24,25,31 **Release 9:** PJ.24,25,31	
Guidance Material / Specifications / Standards	EUROCAE ATN B2 Standards ED-228A, ED-229A, ED-230A, ED-231A. EUROCAE WG-85 ED-75D	

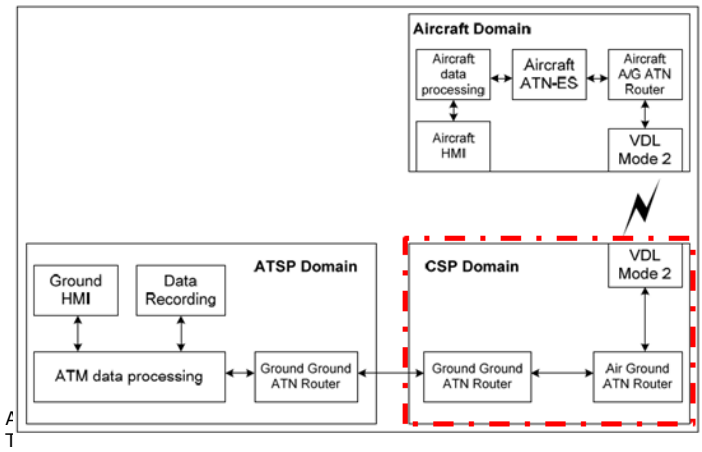
	ICAO CP Update Doc 9869 Manual on Required Communication Performance (RCP) ICAO Doc 9880 Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI Standards and Protocols ICAO Doc 10037 – ICAO GOLD edition 3 (2018) ICOA Doc 9694 Manual of Air Traffic Services Data Link Applications ICAO Doc 9896 Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) using the Internet Protocol Suite (IPS) Edition 3 ICAO Doc 9925 Manual on the Aeronautical Mobile Satellite (Route) Service Edition 2 ARINC 623 – Character oriented Air Traffic Service (ATS) applications
Means of compliance and / or Certification	ETSI Updated CS on Data Link (2020-not planned)
Regulations	None
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them.
Recommendation for IPs proposal	It is recommended to take into consideration Family 6.1.3 which is necessary to provide the required VDL Mode 2 communication infrastructure. It is further recommended to take into consideration the results of the DLS survey, as reported within Section 5.1
Deployment Approach	Implementing partners shall equip their respective systems with the required functionalities **(MM.1 - System Upgrade to support the acquisition and management of EPP data in the ground systems)**. This step shall be followed with a safety assessment campaign concluding on a safety assessment report providing a basis for an operational approval **(MM.2 – Safety Assessment)**. Upgraded systems shall be integrated in the existing systems **(MM.3 – Integration)**. The applicable concept of operations shall also be broken down into documented and approved work procedures **(MM.4 – Procedures available)** and all operational/technical staff involved shall be duly trained **(MM.5 – Training of OPS and technical staff)**. The execution of such activities is expected to lead to the start of permanent operational use **(MM.6 – Implementation completed)**.

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

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

Description and Scope

The Family 6.1.3 is related to the A/G and G/G Multi Frequency (MF) DL Network in defined European Service Areas [29], consisting in the European implementation of the A/G and G/G Network based on European Service Areas and VDL Mode 2 as part of ATN COM (COMmunication) domain components as identified in the following ETSI Architecture (highlighted in red in the picture):



N Data Link System Architecture (ETSI EN 303 214)

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

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

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

- Air-Ground (A/G) network that is the Radio Frequency (RF) network based on VDL M2[30] and,
- Ground-Ground (G/G) network[31] that is composed by:
  - ATN routing components and
  - ATS data distribution network needed to connect:
    - the ATN routing components among them
    - the ATN routing components with the A/G network and with ATSP domain.

Currently, ATN Data Link systems, based on VDL M2, are already implemented in some European Countries, but performance issues (provider and user aborts) have been

[29] Portions of airspace, homogeneous in terms of operational and technical needs to provide data-link services in a safe, secure and efficient way. They could be identical with FABs or as new entities established regardless of state boundaries.

[30] This network is used also for ACARS messages (ACARS over AVLC - AoA) as in each aircraft is possible to open only one VDL M2 communication session for both ATS and AOC services).

[31] The AOC messages transport is not considered here.

experienced during the operational use of ATN B1 services making it difficult to continue to use them in the current configuration.

With this regard, the EC has requested:

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

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

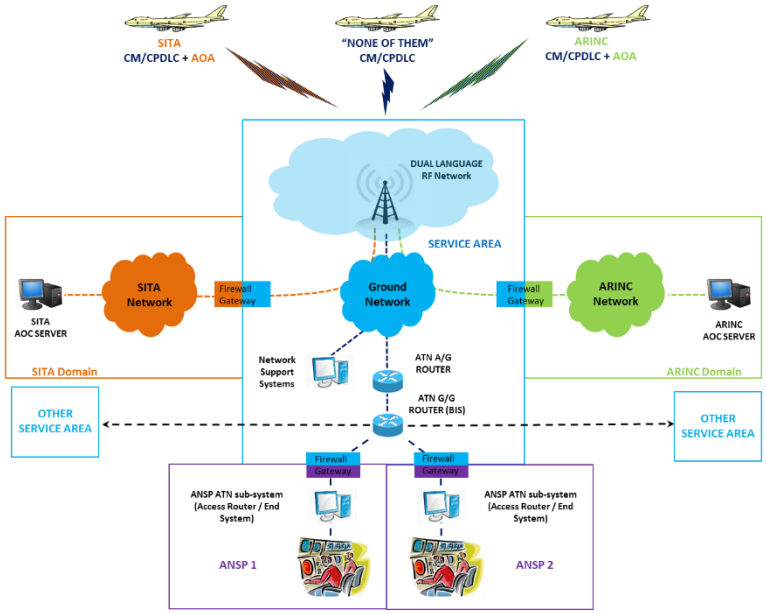
Starting from the EASA report, the following Ground Network recommendations have been elaborated by ELSA:

- improve the VHF Ground Station (VGS) network and fix the ground system issues:
  - use a dedicated channel for transmissions at the airport in regions with high traffic levels in en-route;
  - use alternative communication means for AOC in the airport domain (e.g., Wi-Fi, cellular, AeroMACS) to off-load the frequencies used for CPDLC;
  - progressively implement additional VDL2 frequencies in accordance with the traffic level;
  - optimise the en-route VGS network coverage;
  - ensure the availability of a fifth VDL2 frequency (at a minimum);
  - use the CSC as common control channel only, unless traffic level is very low;
  - implement ELSA recommended protocol optimisation: limit AVLC frame size;
  - fix the ELSA identified ground system problem;
- start implementing the transition roadmap to the MF VDL2 target technical solution: introduction of alternate channels using reserved frequencies [32], addition of frequencies, and transition to one managed MF VDL2 network per Service area.

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

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

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



Target high level architecture solution for the ATN COM infrastructure

Model D:

Model D description:

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

For each Service Area, the following components are included:

- RF network: MF VDL M2 VGS implementing Dual Language[33] technology
- Ground network: IP network for internal and external components connections (the AOC transport is not considered in the family scope)
- ATN Ground Network: composed by ATN A/G and G/G routers in a dedicated ATN
- domain
- Network support systems: monitoring, recording, billing and network management systems
- Network interfaces: Firewall/Gateways for external interfaces.

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

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

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

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

Towards Model D:

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

- **"Model A":** a country/region with a multiple VDL M2 networks implemented in the same airspace, using a One-GSIF[34] system on common frequencies;
- **"Model C":** a country/region with a single VDL M2 network implemented in the same airspace, using a Two-GSIF system on reserved frequencies;
- **No implementation yet**: a country/region that has not implemented any ATN COM infrastructure.

Due to the need to consider:

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

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

Model B description:

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

To make it possible to implement the Model B in a way suitable to meet the requirements, it is necessary to have at least five frequencies available in the high traffic area, considering the current situation of two operating CSPs. (EUR ICAO FMG is currently working on this topic). **The Model B has to be considered as a temporary step to reach the Model D.**

The following table recaps the Models described above:

Model	VDL RF operating Networks	VDL RF Frequency Use	GSIF on each Frequency announced by each Network	Existing today	Note
A	MULTIPLE	COMMON	ONE	YES	Current Central EU model
B	MULTIPLE	RESERVED	ONE	NO	**Target Short term evolution**
C	SINGLE	RESERVED	TWO	YES	Current model deployed in a limited area[35]
D	SINGLE	RESERVED	TWO	NO	**Target Long term model for EU VDL network evolution**

*Currently deployed by ENAV on Italian airspace.

[34] A One-GSIF system implements the "Single Language". A Two-GSIF system implements the "Dual Language".
[35] Currently deployed by ENAV on Italian airspace.

Stakeholders involved:

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

- in the short term, coverage and performance required to satisfy the DLS IR 29/2009 (ATN B1 services), amended by IR 310/2015 and considered as pre-requisite for PCP;
- in the medium term, capacity to support the increased data volume expected with the introduction of trajectory downlinks with EPP (part of ATN B2 services) for Initial trajectory information sharing (i4D) as requested by PCP.
  In this perspective, the SDM DL strategy has proposed to EC to achieve the target Model D by December 2022.

Interdependencies

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

+Synchronization Needs

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

Civil / Military Coordination

No special requirements.

Stakeholders considered as gaps	ANSPs	
Other stakeholders involved in the Family deployment	CSPs	
Links to ICAO GANP ASBUs	B0-TBO (Improved Safety and Efficiency through the Initial Application of Data Link En-route)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	N/A
	ATM Master Plan Level 3 (Edition 2016)	ITY-AGDL
SESAR Solutions	N/A	
Very Large Scale Demonstrations	N/A	
Guidance Material / Specifications / Standards	SJU/LC/0109-CFT – D1602 "VDL Mode 2 Measurement, Analysis and Simulation Campaign", Deliverable D11 – Final Report EUROCAE ED-92B - MOPS for an Airborne VDL Mode-2 System	

	Operating in the Frequency Range 118-136.975 MHz ICAO Doc 9776 Manual on VDL Mode 2 Technical Specifications ARINC Specification 631-6
Means of compliance and / or Certification	VHF air-ground Digital Link (VDL) Mode 2; Technical characteristics and methods of measurement for ground-based equipment; Part 1: Physical layer and MAC sub-layer ETSI EN 301 841-1 VHF air-ground Digital Link (VDL) Mode 2; Technical characteristics and methods of measurement for ground-based equipment; Part 2: Upper Layers; ETSI EN 301 841-2 VHF air-ground Digital Link (VDL) Mode 2, Part 3: Harmonized EN covering the essential requirements of the Directive 2014/53/EU ETSI EN 301 841-3
Regulations	IR (EC) No 29/2009 amended by IR (EU) No 2015/310
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks; it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them.
Recommendation for IPs proposal	Refer to Strategic View – Addendum - *DLS Implementation Strategy towards Initial Trajectory Information Sharing*.
Deployment Approach	Refer to Strategic View – Addendum - *DLS Implementation Strategy towards Initial Trajectory Information Sharing*.

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

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

Description and Scope

The purpose of this family is for civil and military aircraft operators concerned by DLS IR to upgrade to "best in class" avionic configurations as prescribed by ELSA and/or those having successfully passed subsequent and equivalent test and certification activities.

One of the outcomes of ELSA was a set of avionic configurations that were tested and demonstrated as sufficient to comply with the ATN/VDL2 performance expectations in multi-frequency (MF) environment. ELSA Final report (D11) refers to this set as "best in class"; select aircraft type families are covered, see below.

ELSA identified the need to continue testing efforts beyond the lifespan of the study itself to cover both newly emerging avionic configurations as well as other existing configurations that were not covered in the ELSA study.

ELSA proposed that ultimately, an effective end to end certification process for both ground and air components should be defined and implemented.

The current airborne routers and VHF Data Radio already labelled as "best in class" in the frame of the ELSA project are listed below:

1) Data Link Management Units (airborne routers)

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

2) On board VDR (VHF Data Radio)

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

Note: Regardless of the family's readiness for deployment, one outcome of the ELSA study is the need for an effective end-to-end system certification process including both ground and air components and reference material for the ground network infrastructure. Need to accelerate the delivery of supporting material.
Interdependencies
None
Synchronization Needs
6.1.1 and 6.1.3 addressing ground system capabilities for ATN B1 services
Civil / Military Coordination

Stakeholders considered as gaps	Airspace Users	
Other stakeholders involved in the Family deployment	Military authorities, when relevant (as AU)	
Links to ICAO GANP ASBUs	B0-TBO (Improved Safety and Efficiency through the Initial Application of Data Link En-route)	
ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	AUO-0301 Available
	ATM Master Plan Level 3 (Edition 2016)	ITY-AGDL
SESAR Solutions	N/A	
Very Large Scale Demonstrations	N/A	
Guidance Material / Specifications / Standards	SJU/LC/0109-CFT – D1602 "VDL Mode 2 Measurement, Analysis and Simulation Campaign", Deliverable D11 – Final Report EUROCAE ED-92B - MOPS for an Airborne VDL Mode-2 System Operating in the Frequency Range 118-136.975 MHz Network Strategy Plan (NSP): SO 8.3 EUROCAE ED-100A/DO-258A, Interoperability Requirements for ATS Applications using ARINC 622 Data Communications. EUROCAE ED-110B/DO-280B, Interoperability Requirements Standard for Aeronautical Telecommunication Network Baseline 1 (Interop ATN B1). EUROCAE ED-154A/DO-305A, Future Air Navigation System 1/A - Aeronautical Telecommunication Network Interoperability Standard (FANS 1/A – ATN B1 Interop Standard). EUROCAE ED-120/DO-290, Safety and Performance Requirements Standard For Initial Air Traffic Data Link Services	

	In Continental Airspace (SPR IC) EUROCAE ED-122/DO-306, Safety and Performance Standard for Air Traffic Data Link Services in Oceanic and Remote Airspace (Oceanic SPR Standard) EUROCAE ED-93, Minimum Aviation System Performance Specification for CNS/ATM message recording systems ICAO Doc 10037 - ICAO GOLD edition 2 ICOA Doc 9694 Manual of Air Traffic Services Data Link Applications ICAO Doc 9776 Manual on VDL Mode 2 Technical Specifications ICAO Doc 9880 Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI Standards and Protocols, Part II — Ground-Ground Applications — Air Traffic Services Message Handling Services (ATSMHS).
Means of compliance and / or Certification	CS-ACNS, 17 December 2013 - Community Specification on DL for aircraft implementations EASA RMT.0524 – Data Link Services (Planned)
Regulations	Commission Regulation (EC) 1032/2006, as amended by Regulation (EC) 30/2009 Commission Regulation (EC) n. 29/2009, as amended by Regulation (EU) 2015/310 Commission Regulation (EC) n. 965/2012 EASA updated regulatory package on Data Link operations (TBD)
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them.
Recommendation for IPs proposal	It is recommended to take into consideration the results of Gap Analysis, as reported within section 5.1
Deployment Approach	The deployment of this family is envisaged to commence with the procurement of required equipment or upgrade packages; this step is completed when the operator has taken delivery of all necessary hardware and software components **(MM.1 - Equipment procured)**. This step is followed by installation and integration in onboard systems of all aircraft in the respective fleet **(MM.2 - Aircraft equipped)**. Next step involves the elaboration and approval process of operational procedures and training packages **(MM.3 – Procedures and training available)**. Crews must undergo appropriate training with respect to the use of the equipment **(MM.4 – Training completed)**. Finally, the family is fully implemented when regular operations have commenced on a permanent basis **(MM.5 – Implementation completed)**.

Family 6.1.5 – ATN B2 in Aircraft domain

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

Description and Scope

According to the PCP, one objective of AF6 is that "at least 20 % of the aircraft operating within the airspace of European Civil Aviation Conference (ECAC) countries in the ICAO EUR region corresponding to at least 45 % of flights operating in those countries, are equipped with the capability to downlink aircraft trajectory using ADS-C EPP as from 1 January 2026"

This family aims at adapting aircraft systems to receive and process a ground initiated ADS-C Contract Request for EPP data. The avionic system shall, at the minimum, implement all EPP Data Operational Requirements [EPP DATA OR] listed in Annex B of ED-228A.

This family encompasses:

- Aircraft equipage
- Procedures and training

Interdependencies

6.1.4 is a prerequisite.

Synchronization Needs

6.1.2, 6.1.3 addressing ground system capabilities for EPP exchange

Civil / Military Coordination

Stakeholders considered as gaps	Airspace Users
Other stakeholders involved in the Family deployment	Military authorities, when relevant (as AU)
Links to ICAO GANP ASBUs	B1-TBO (Improved Traffic Synchronization and Initial Trajectory-based Operation)

ATM Master Plan References	**ATM Master Plan Level 2 (Dataset 16)**	IS-0303-A (A/C-37a) SESAR Release 5
	ATM Master Plan Level 3 (Edition 2016)	None
SESAR Solutions	N/A	
Very Large Scale Demonstrations	**Release 7:** PJ.24,25,31 **Release 8:** PJ.24,25,31 **Release 9:** PJ.24,25,31	
Guidance Material / Specifications / Standards	EUROCAE ATN B2 Standards ED-228A, ED-229A, ED-230A, ED-231A. EUROCAE WG-85 Update of ED75 to support initial 4D navigation capabilities as part of the package with EPP (ED-75D) ICAO CP Update Doc 9869 Manual on Required Communication Performance (RCP) ICAO Doc 9880 Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) using ISO/OSI Standards and Protocols ICAO Doc 10037 – ICAO GOLD edition 3 (2018) EUROCAE ED-154/DO-305 Future Air Navigation System 1/A Aeronautical telecommunication network interoperability standard (FANS 1/A ATN B1 Interop Standard) ICOA Doc 9694 Manual of Air Traffic Services Data Link Applications ICAO Doc 9896 Manual on Detailed Technical Specifications for the Aeronautical Telecommunication Network (ATN) using the Internet Protocol Suite (IPS) Edition 3 ICAO Doc 9925 Manual on the Aeronautical Mobile Satellite (Route) Service Edition 2 ARINC 623 – Character oriented Air Traffic Service (ATS) applications	
Means of compliance and / or Certification	ETSI Update CS on Data Link (2020 – not planned)	
Regulations	None	
Cyber security requirements	Modern ATM systems design is requiring enhanced connectivity and is using more and more common and open components, services and standards. This trend exposes systems to increased cybersecurity risks, it is therefore paramount to identify these risks, assess their possible impacts and mitigate them with appropriate measures. SDM is of the opinion that some components of this family are particularly exposed to these cybersecurity risks and that stakeholders should take appropriate action to mitigate them.	
Recommendation for IPs proposal	It is recommended to take into consideration the results of Gap Analysis, as reported within section 5.1.	

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