Advanced Flexible Use of Airspace Interoperability Requirements for Step 1

Document information	
Project Title	Flexible Airspace Management
Project Number	07.05.04
Project Manager	EUROCONTROL
Deliverable Name	Advanced Flexible Use of Airspace Interoperability Requirements for Step 1
Deliverable ID	D46
Edition	00.04.01
Template Version	03.00.00
Task contributors	
ENAIRE, EUROCONTROL, NORACON	

Abstract

The following document provides the interoperability requirements for Step 1 developments supporting the integration of the Advance Flexible Use of Airspace (AFUA) concept in Network Operations. The concept is addressed by SESAR Solution #31. The purpose of this document is to describe the interoperability requirements that will support the automated processes to update the airspace status in real time via interfacing an ASM support system with NM and ATC systems

Authoring & Approval

Prepared By - *Authors of the document.*		
Name & Company	**Position & Title**	**Date**
███████████ EUROCONTROL	████████████	02/03/2016
███████████ EUROCONTROL TRS	████████████	02/03/2016

Reviewed By - *Reviewers internal to the project.*		
Name & Company	**Position & Title**	**Date**
████████████ Spanish AF	████████████	24/02/2016
█████████ NATS		24/02/2016
█████████ RAF		24/02/2016
█████████████ Lufthansa Systems		24/02/2016
████████ AD&S		24/02/2016
██████████ UK MOD		24/02/2016
█████████ EUROCONTROL		24/02/2016
████████ EUROCONTROL		24/02/2016
██████████ EUROCONTROL		24/02/2016
█████████ German AF		24/02/2016
████████████ EUROCONTROL		24/02/2016
███████ EUROCONTROL		24/02/2016
█████████ NORACON		24/02/2016
████████████ UK MOD		24/02/2016
███████████ DFS		24/02/2016
███████████ ENAV		24/02/2016
█████████ TRS		24/02/2016
████████████ EUROCONTROL		24/02/2016
████████████ INECO		24/02/2016
██████████ NORACON		24/02/2016
██████████ Lufthansa		24/02/2016
████████████ Lufthansa Systems		24/02/2016
█████████ DFS		24/02/2016
██████████ Royal NL AF		24/02/2016
█████████ DFS		24/02/2016

Reviewed By - *Other SESAR projects, Airspace Users, staff association, military, Industrial Support, other organisations.*		
Name & Company	**Position & Title**	**Date**
█████████ NATS	████████████	24/02/2016
████████ INDRA		24/02/2016
████████████ INDRA		24/02/2016
█████████ NATS		24/02/2016
███████████ EUROCONTROL		24/02/2016
███████████ EUROCONTROL		24/02/2016

founding members

Reviewed By - *Other SESAR projects, Airspace Users, staff association, military, Industrial Support, other organisations.*

Name & Company	Position & Title	Date
▮▮▮▮ DSNA	▮▮▮	24/02/2016
▮▮▮▮ EUROCONTROL		24/02/2016
▮▮▮▮ Cassidian		24/02/2016
▮▮▮▮ EUROCONTROL		24/02/2016
▮▮▮▮ EUROCONTROL		24/02/2016
▮▮▮▮ DSNA		24/02/2016
▮▮▮▮ NORACON		24/02/2016
▮▮▮▮ DFS		24/02/2016
▮▮▮▮ EUROCONTROL		24/02/2016
▮▮▮▮ Airbus Defence and Space		24/02/2016
▮▮▮▮ ENAIRE		24/02/2016
▮▮▮▮ DFS		24/02/2016
▮▮▮▮ EUROCONTROL		24/02/2016
▮▮▮▮ DFS		24/02/2016
▮▮▮▮ DFS		24/02/2016
▮▮▮▮ EUROCONTROL		24/02/2016
▮▮▮▮ EUROCONTROL		24/02/2016
▮▮▮▮ ENAIRE		24/02/2016
▮▮▮▮ EUROCONTROL		24/02/2016
▮▮▮▮ NATS		24/02/2016

Approved for submission to the SJU By - *Representatives of the company involved in the project.*

Name & Company	Position & Title	Date
▮▮▮▮ EUROCONTROL	▮▮▮	29/02/2016
▮▮▮▮ EUROCONTROL		29/02/2016
▮▮▮▮ ENAIRE		29/02/2016
▮▮▮▮ DFS		29/02/2016
▮▮▮▮ ENAV		29/02/2016
▮▮▮▮ INDRA		29/02/2016
▮▮▮▮ NATS		29/02/2016
▮▮▮▮ DSNA		29/02/2016
▮▮▮▮ SELEX		29/02/2016
▮▮▮▮ NORACON		29/02/2016

Rejected By - *Representatives of the company involved in the project.*

Name & Company	Position & Title	Date
None		

Rational for rejection

Rational for rejection
None.

Document History

Edition	Date	Status	Author	Justification
00.00.01	06/09/2013	Draft		Initial draft after VP 710 and 717 integration
00.00.02	02/10/2013	Draft		Updated after Review
00.00.03	30/10/2013	Draft		Updated after Review
00.03.00	28/11/2013	Final		Delivered to SJU. This version was 07.05.02-D41
00.03.01	05/11/2014	Draft		Overall Update
00.03.02	29/04/2015	Draft		SJU Assessment review to edition 00.03.00 D41 and QM comments
00.03.03	07/07/2015	Draft		Requirements and overall document update
00.03.04	26/11/2015	Draft		Consistency check with OSED and SPR
00.03.05	10/02/2016	Final Draft		Document for Internal and Peer Review
00.04.00	02/03/2016	Final		Document for Hand-over to the SJU
00.04.01	18/04/2016	Final		SJU delivery comments

Intellectual Property Rights (foreground)

This deliverable consists of SJU foreground.

Table of Contents

List of tables

List of figures

founding members

Avenue de Cortenbergh 100 | B -1000 Bruxelles
www.sesarju.eu

Executive summary

This document is the Interoperability requirements V3 Step 1 within SESAR Project 07.05.04 (merged with P07.05.02). It provides the interoperability requirements for Step 1 developments supporting the integration of the Advance Flexible Use of Airspace (AFUA) concept in network operations. which is addressed by SESAR Solution #31: "Variable profile military reserved areas and enhanced (further automated) civil-military collaboration".

This INTEROP document completes the operational requirements, processes and services defined in the OSED 07.05.04-D45 [8] by describing the interoperability requirements for interfacing ASM support systems with ATC system and the Network Manager system.

The interoperability requirements identified are focusing on ground-ground data exchange and intend to ensure that relevant information is timely and correctly transmitted among ASM support systems and the different Air Traffic Management (ATM) systems by using the available technology and future developments within SESAR.

This document reflects the requirements update in AFUA OSED and SPR.

1 Introduction

1.1 Purpose of the document

This is the INTEROP Step 1 document developed in SESAR Project 07.05.04. The initial integration of the AFUA in the network should start with automated processes providing the right information to the relevant actors facilitating the decision making process (CDM). The purpose of this document is to provide the interoperability requirements for the processes and services described in the OSED document [8] by describing the ground-ground interfaces and data exchange between ASM support systems, the Network Manager and the ATC system to support the ASM/ATFCM processes in all phases.

These interoperability requirements describe how and when the information will be exchanged amongst identified systems, in order to ensure that all actors involved have a common situational awareness enhancing the real time airspace status update. These requirements are linked with the Functional blocks as defined in the TAD of projects 7.02 (Aeronautical Information Provision, Cooperative Airspace Management and Aeronautical Information Provision) [14] and 10.01.07 (Legacy Ground-Ground Datalink Communications (GGDC) [13]).

These requirements will be an input for system projects P10.05.01 and service modelling related project P08.03.01 that will continue with a more detailed description of interfaces and data exchanges (IER).

This document reflects the requirements update in AFUA OSED [8] and SPR [12].

1.2 Scope

The concept of AFUA is part of the Network Operations concept developed by SWP07.02. The interoperability requirements within this document address the Operational Focus Area 05.03.01 Advanced Flexible Use of Airspace and Airspace Management. This OFA represents the set of dependent operational and technical improvements related to "Demand and capacity Balancing En-Route".
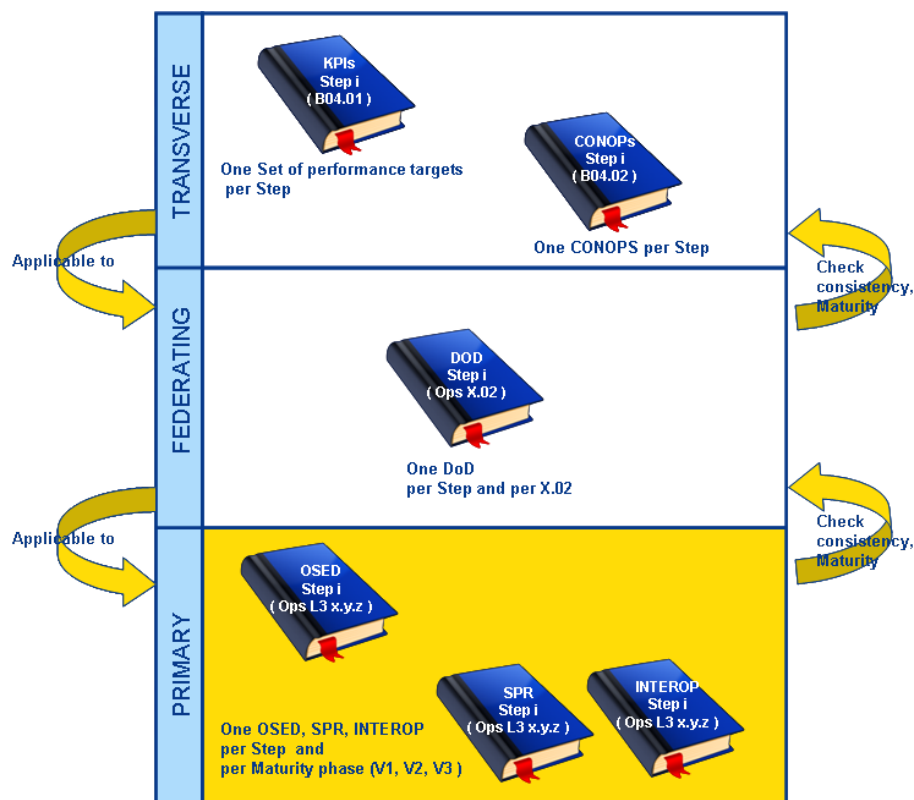
Figure 1: INTEROP document with regards to other SESAR deliverables

In Figure 1, the Steps are driven by the OI Steps addressed by the project in the Integrated Roadmap document.

Project P07.05.02 is part of the Demand and Capacity Balancing service family and will contribute to the following ATM Services:

- o Demand and capacity balancing services (Planning),
- o Demand and capacity balancing services (Execution).

This INTEROP is allocated to OFA 05.03.01 Airspace Management and AFUA. It is linked for Step 1 to:

- OI AOM-0202-A: Automated Support for strategic, pre-tactical and tactical Civil-Military Coordination in Airspace Management (ASM).
- OI AOM-0206-A: Flexible and modular ARES in accordance with the VPA design principle.

This INTEROP is today compliant with Integration Roadmap DS14 [4].

1.3 Intended readership

The intended audience is:

- SWP7/13 for consolidation into the Network Operations concept;
- P07.05.04 Members to provide the reference set of operational requirements related to the operational improvement AOM-0206-A Flexible Military Airspace Structures and AOM-0202-A Automated Support for Real Time Civil-Military Coordination in Airspace Management;
- SWP7.2 for consolidation into the Network Operations concept;

- P07.06.01 for developments in NOP
- P07.06.02 for developments in optimised AUs' operations
- P4.2 and P4.5 for the consistency between planning and execution;
- P08.03.10 for modelling associated data and services;
- SWP11.01 for WOC and state AU operations
- SESAR JU owner
- P16.06.01 for safety support and coordination;
- P16.06.02 for security support and coordination;
- P16.06.05 for human performance support and coordination;
- AU concept development and coordination
- AOs concept development and coordination
- Military concept development and coordination
- ANSP concept development and coordination
- B05 Performance Expert
- Inputs from other projects

P07.05.04 and P10.05.01 are main contributors for providing the Technical Specification that will support the consistency and completeness of the Interoperability requirements developed within this document.

EUROCONTROL produced specifications for an interface between ASM support system and an ATC system (airspace status) describing the application level and messages exchanged between both systems.

EUROCONTROL and DFS realised a Feasibility Study into providing B2B services between the NM systems and client ASM support systems (STANLY ACOS and LARA) in order to support the ASM/ATFCM process, ref [7].

1.4 Glossary of terms

Term	Description
Airspace Reservation	A defined volume of airspace temporarily reserved for exclusive or specific use by categories of users.[15]
Airspace Structure	A specific volume of airspace designed to ensure the safe and optimal operation of aircraft.[15]
Advanced Flexible Use of Airspace	An airspace management concept in which airspace is managed as a single entity and in which there are no fixed structures and airspace reservations for special airspace activity are allocated in real time.[16]
Actor	An implementation independent unit of responsibility that performs an action to achieve an effect that contributes to a desired end state.[2]
Airspace Management	The process by which airspace options are selected and applied to meet the needs of the ATM community.[15]
ASM Support System	A system supporting the airspace management process and the civil-military coordination by providing real-time exchange of airspace management data between involved actors, enables the collaborative decision making and an enhanced situational awareness throughout the airspace management process and support the collection of statistical ASM data.[15]
eAMI messages	The electronic Airspace Management Information (e-AMI) contains information on the allocation of airspace and conditional route usage. Through consolidated and validated electronic e-AMI messages, users can

Term	Description
	therefore make full use of the benefits offered by automated data processing.[15]
Interoperability	The ability of one device or system to work with another.[2]
Variable Profile Area	VPA is a new airspace design principle based on flexible allocation and management of small fixed predefined modules of airspace. These modules are designed to fulfil airspace users' needs individually or as a combination of modules as an ARES, dependant on individual mission profiles.[16]

Table 1: Glossary of terms

1.5 Acronyms and Terminology

Term	Definition
ACN	Aeronautical Communication Network
ADD	Architecture Definition Document
ADR	Airspace Data Repository
ADXP	ATS Data Exchange Presentation
AFTN	Aeronautical Fixed Telecommunication Network
AFUA	Advanced Flexible Use of Airspace
AFS	Aeronautical Fixed Service
AICM	Aeronautical Information Conceptual Model
AIP	Aeronautical Information Publication
AIXM	Aeronautical Information Exchange Model
AMC	Airspace Management Cell
AMHS	Air Traffic Services Message Handling System
AOC	Airline Operational Control
ARES	Airspace Reservation/Restriction
ASM	Airspace Management
ATC	Air Traffic Control
ATFCM	Air Traffic Flow and Capacity Management
ATM	Air Traffic Management
ATS	Air Traffic Service

Term	Definition
AUP	Airspace Use Plan
B2B	Business-To-Business
CACD	Central Airspace & Capacity Database
CADF	Centralised Airspace Data Function (ECAC) (Fonction de centralisation des données concernant l'espace aérien de la CEAC)
CBA	Cross Border Area
CBO	Cross Border Operation
CDR	Conditional Route
CFMU	Central Flow Management Unit
CWP	Control Working Position
EAUP	European Airspace Use Plan
e-AMI	Electronic Airspace Management Information
e-ASM	Electronic Airspace Management
E-ATMS	European Air Traffic Management System
ETFMS	Enhanced Tactical Flow Management System
FOC	Flight Operations Centre
FAB	Functional Airspace Block
FMP	Flow Management Position
IER	Information Exchange Requirements
INTEROP	Interoperability Requirements
LAM	Logical Acknowledgement Message
NOTAM	Notice to Airmen
NM	Network Manager
NMOC	Network Manager Operations Centre
OFA	Operational Focus Area
OI	Operational Improvement
OSED	Operational Services and Environment Definition

Term	Definition
RAD	Route Availability Document
RSA	Restricted Segregated Areas
SESAR	Single European Sky ATM Research Programme
SESAR Programme	The programme which defines the Research and Development activities and Projects for the SJU.
SJU	SESAR Joint Undertaking (Agency of the European Commission)
SJU Work Programme	The programme which addresses all activities of the SESAR Joint Undertaking Agency.
SOA	Service Oriented Architecture
SUP AIP	AIP Supplements
SWIM	System Wide Information Management
TAD	Technical Architecture Description
TS	Technical Specification
UUP	Updated Airspace Use Plan
WOC	Wing Operations Centre

Table 2: Acronyms and Terminology

2 System Description

This section provides a high level description of the selected technology supporting the applications and services defined in the OSED, ref [8].

2.1 High Level description and rationale of the selected technology

In Step 1 V3, project P07.05.04 will focus on the interfaces for AFUA at ground-ground level between the different ATM sub-systems to ensure common situational awareness in the planning and execution phase.

To ensure this interoperability during Validation activities, the stakeholders involved in the AFUA concept development and validation activities agreed to validate concept elements by means of already developed prototype systems in order to demonstrate the system interoperability and feasibility of SWIM technical profile TP (B2B) as well as the applicability of data exchange standards (AIXM 5.1). They provide access to both data and services via a system-to-system interface over the extranet, allowing the NM customers to exploit and use the information in their own systems, according to their business needs. Therefore physical services allocated to the system functionalities were designed in conformity with industrial standards stakeholders operational and system requirements. It was recognised by stakeholders and respective WP8 experts that the services designed within FT-09/SVA-008 activities have the same or similar functionalities versus services used by the systems in the validation activities but they cannot be compliant with SWIM criteria.

However, the objective for Solution's deployment is to support the interoperability required through SWIM (System Wide Information Management) compliant services.

The NM B2B web connections/functions are entirely based on Web standards and follow the standards defined within SESAR to support ASM B2B connections/functions; the exchanged data follows standard data models.

The data exchange format for all B2B connections/functions to support ASM will be via AIXM 5.1 and its e-ASM extension.

- AIXM is a data exchange specification that uses the Extensible Markup Language (XML) technology in order to define features and messages used to exchange information about the aeronautical data contained in AICM. AIXM 5.1 provides an extensible, modular aeronautical information exchange standard that can be used to satisfy information exchange requirements for current and future aeronautical information applications.

   o AICM is a conceptual/logical model that uses entities, attributes and relationships in order to describe aeronautical features such as airports, runways, navaids, obstacles, routes, terminal procedures, airspace structures, services and related aeronautical data.

- e-ASM is an extension to AIXM 5.1 that supports European Airspace Management. The e-ASM specification has been developed to provide a common data model and a common data encoding format for data that needs to be exchanged digitally between tools and systems involved in the dynamic airspace management process.

The Airspace Data Repository (ADR) publishes e-AMI messages to ensure a more dynamic dissemination of the ASM decisions.

The electronic Airspace Management Information (e-AMI) is part of the NM B2B web connections/functions. The objective of this service is to cope with the extension of the ASM process in the tactical phase. The e-AMI will provide the view on the availability of routes (closure and opening of CDRs and ATS routes) and on the airspace allocations according to the approved ASM procedures.

The On-Line Data Interchange (OLDI) standard supports the messages exchange between ATC (civil and military / Air Defence unit) and ASM support systems. The ATS Data Exchange Presentation (ADEXP) provides a format for use in on-line computer to computer message exchange. In the future the message exchange will be supported by SWIM.

The ADEXP format has been specified for exchanging coordination messages to automate the operational coordination and the exchange of information for situational awareness and the coordination of ARES requests between civil and military ATC/Air Defence units. ADEXP provides a format for use in on-line, computer to computer message exchange and for message exchange over switched messaging networks.

Those coordination messages ensure the timely delivery of operational information related to co-ordination through standardized data extraction and transmission capabilities.

To support the exchanges between the ASM support systems and the corresponding NOTAM Office, the ASM support systems provide the functionality to send a NOTAM request, when needed, to the appropriate NOTAM office. This service is provided by the Aeronautical Fixed Service (AFS) through the ATS Message Handling System (AMHS).

The AMHS is the replacement[1] of the AFTN/CIDIN technology (which is close to its obsolescence) and is an integral part of the CNS/ATM concept. The European AMHS makes use of a TCP/IP network infrastructure aligned with the recent evolution of the Aeronautical Communication Network (ACN) concept for ground communications. This entails the transitions from X.25 equipment and protocols to the IP technology, IPv4 / IPv6 in the future.

AMHS connectivity will be an important step towards the network centric architecture System Wide Information Management (SWIM), to be implemented in the sequence of SESAR Target Concept which requires all ATM actors, including military ATC/Air Defence, to be able to exchange information in a distributed and fully automated way.

Technologies and protocol mentioned previously reflect mostly the existing technologies, nevertheless they are not limited to them.

Consequently, medium and longer term civil-military interoperability solutions are likely to include higher levels of connectivity and exchange of aeronautical messaging services including compatible security levels.

2.1.1 B2B connections between the Network Manager and an ASM Support Systems

Following B2B connections describe the exchanges between the Network Manager and local ASM Support Systems in the framework of the ADR developments to enable ASM / ATFCM processes.

2.1.1.1 General Description

The Airspace Services B2B connection/function group provides services concerning the management and the publication of airspace information. This group consists of two types of services:

- Airspace Structure Service: services for querying and modifying airspace structure;

- Airspace Availability Service: services for querying and modifying the airspace availability; this includes the support of the Advanced Flexible Use of Airspace activities (regarding eAUP/UUP coordination) and the RAD. The requests of the Airspace Availability Service are:

---

[1] *AMHS will replace AFTN and CIDIN networks with effect from early 2009 approximately, but will not migrate to operation over PENS until later. Since many military units today rely on AFTN terminals to transfer aeronautical data such as flight plans, NOTAMS, meteorological data, etc., military access to AMHS will remain a civil-military interoperability requirement, probably through local agreements with civil ANSPs.*

- o EAUP Chain Retrieval Request / EAUP Chain Retrieval Reply
- o EAUP CDR Request / EAUP CDR Reply
- o EAUP CDR Compare Request / EAUP CDR Compare Reply
- o EAUP RSA[2] Request / EAUP RSA Reply
- o EAUP RSA Compare Request / EAUP RSA Compare Reply

2.1.1.2 B2B data exchange from the ASM support systems to the Network Manager

- Sending national airspace plans to support the AUP/UUP update process:

  - o Send AUP/UUP to the CADF in both, "Draft/Intended" version and "Ready" version. In the same way, the CADF will send messages to the ASM support systems proposing changes, resulting from the network impact assessment, to update the AUP/UUP only when it is in "DRAFT" status. Once the AUP/UUP status changes to "READY", the network impact assessment can continue for traffic demand aspects but proposed changes in terms of allocated ARES should not be sent.

- Sending event data:

  - o The ASM support systems shall feed the Network Manager with advanced information on major military exercises and State events (e.g. Olympics, typically and successively starting from one year in advance).
  - o The ASM support systems allow updating this event data by adding specifics to those events when necessary.

- Sending updated airspace status to update the Network Manager with real time information concerning the activation, de-activation and modification of areas and CDRs.

2.1.1.3 B2B data exchange from the Network Manger to an ASM support systems

- This service provides the consolidated European AUP/UUP with changes to airspace and conditional route usage, and supports automatic data processing. CACD operational data will be available to download in AIXM 5.1 format.

- Exchange of consolidated and consistent airspace data using AIXM 5.1 as common format to ensure all actors have the same description of the airspace to support their operations.

- Enable the ASM support systems end-users to know the impact of an airspace request on the network by providing ATFCM data. The aim is to assess the potential impact of the ARES before it has been requested, that way military and civil users can choose airspaces were network congestion is lower while achieving their mission / business objectives.

2.1.2 Information messages exchange between the ATC system and an ASM support systems

The ASM support systems and the ATC system are connected in B2B sharing the airspace planning and status, however, the ATC system is updated with the current airspace status only in the execution phase. The process is very similar for ARES activation and de-activation or modification.

---

[2] *Original abbreviation taken from document CFMU 14.0 - Airspace Services B2B Reference Manual,it will be named ARES in the future*

The exchange of information between the ASM support systems and ATC systems regarding the ARES status will be supported by On-line Data Interchange (OLDI) by means of a message represented in ADEXP format.

Each time that an ARES is close to activation, the ASM support systems send a pre-notification message to the corresponding ATC system. To ensure the correct reception of the message, the ATC system acknowledges the ASM support systems through a LAM message (in the OLDI Protocol). Then, the information is automatically updated at the CWP.

When an activated ARES is requested to be modified (de-activated/ cancelled) at very short notice the message exchange process is the same as described above but in this case there's no pre-notification message to the ATC system, instead of that, the ASM support systems send a message to the ATC system and the information is automatically updated at the CWP, taking into account the changes on the original ARES.

When the activity in the ARES has finished, the ASM support systems send a de-activation message to the ATC system (at this stage there's no need of pre-notification message). After the reception, the ATC system acknowledges through a LAM message and the information is automatically updated at the CWP.

2.2 Assumptions

To support the interoperability between the different systems above mentioned the following assumptions have been made:

- ADR is partially implemented and the two core databases of the ADR (CACD & EAD/SDO) are aligned with AIXM 5.1;

- The ASM support systems have their own database and guarantees data ownership and confidentiality to support the ASM processes;

- The proper functioning of the software used by the systems to be validated constitutes an integral part of the individual software design process which is not addressed here to be validated;

- It is assumed that roles identified within the document are using the ASM support systems.

2.2.1 High-level link to SWIM

According to the SESAR concept of operations, the System Wide Information Management (SWIM) will be the network that will allow the overall European ATM systems and the different ATM stakeholders to interoperate.

The principles of the advanced flexible use of airspace (AFUA) are based on the dynamic airspace management in all phases of the operations, from initial planning to the execution phase. This requires a more automated exchange of information between civil and military users as well as specific tools.

While ASM support systems keep military and civil ATM stakeholders involved in all phases of the ASM process, SWIM will be the network through which the actors will have access to the necessary information services, and will support the promulgation of airspace information whenever it changes, to guarantee common situational awareness among stakeholders.

The civil – military coordination demands continuous exchange of reliable and updated information. To cover this requirement SWIM will be an important driver for new and updated standards that will enable the interoperability and standardization of information services, allowing military and civil ATM stakeholders to implement network management information into their business processes in a harmonized way.

SWIM will be based on Service Oriented Architecture (SOA) and open and standard mainstream technologies that will support users and their applications to share information in a transparent and efficient manner.

3   Interoperability Requirements

This section provides the interoperability requirements based on the operational requirements developed in the OSED.

3.1 Requirements for ATM Applications

The interoperability requirements are used to define the minimum technical and functional requirements that provide the basis for ensuring compatibility between the different elements of the ATM systems using a specific technology.

The integration of the AFUA concept into Network Operations is provided by an Airspace Management support system. The ASM support systems support the ASM/ATFCM processes by improving the common situation awareness and the collaborative decision making among the involved actors during all phases of the operation.

The picture below represents the network established between all clients of the ASM support systems at local, take note that this figure shall not prevent the existence of Sub-Regional Airspace Manager as pertinent to FAB developments.
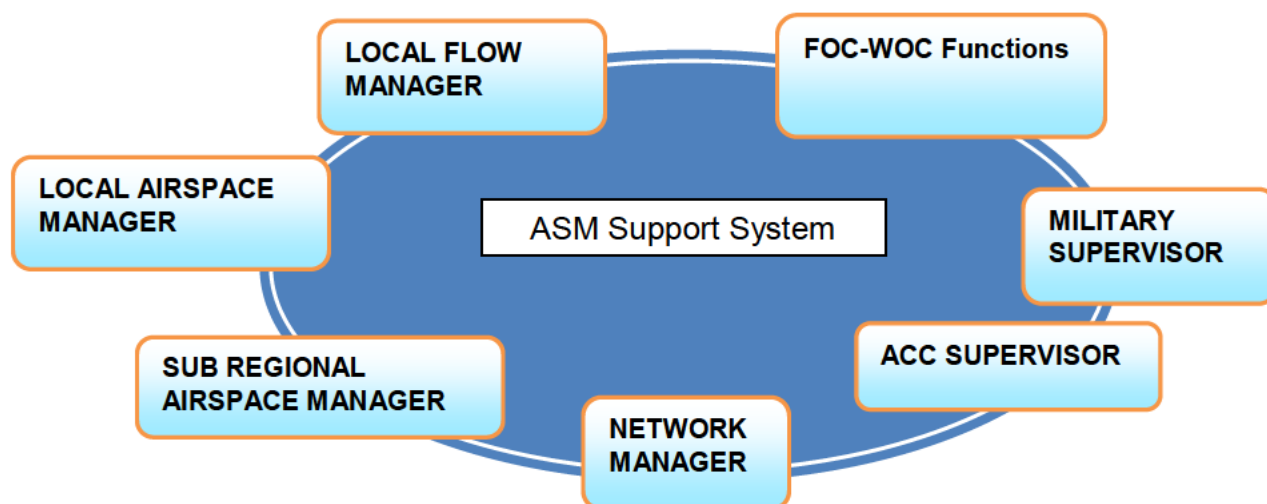
Figure 2: ASM support systems Clients

All actors represented above have access to the ASM support systems but have different functions and access levels according to their responsibility. Every role has certain privileges to book airspaces, check the status of ARES requests, approve certain reservations and have access to specific functionalities of the ASM support systems. The administrator assigns those privileges and manages new and existing users, including their usernames and passwords.

All the information regarding airspace planning and airspace status update is shared by connecting the ASM support systems with relevant ASM players as depicted in Figure 2, ATC and the Network Manager systems.

In the execution phase, the exchange of information corresponds to the activation/ de-activation and modification in real time of the ARES allocated in the medium/short term planning phase. This information is shared in real time with the Network Manager and ATC system.

3.1.1 Interoperability requirements between the ASM support systems and the Network Manager

The ASM support systems require to be updated with consolidated information on airspace and ATFCM data to support the collaborative decision making in real time, in the same way the Network Manager needs to be fed with consolidated information on airspace user's preferences and airspace status to ensure an efficient management of Network operations. The ATFCM system as considered in this document is any system supporting the Network Manager in all phases of the flight lifecycle.
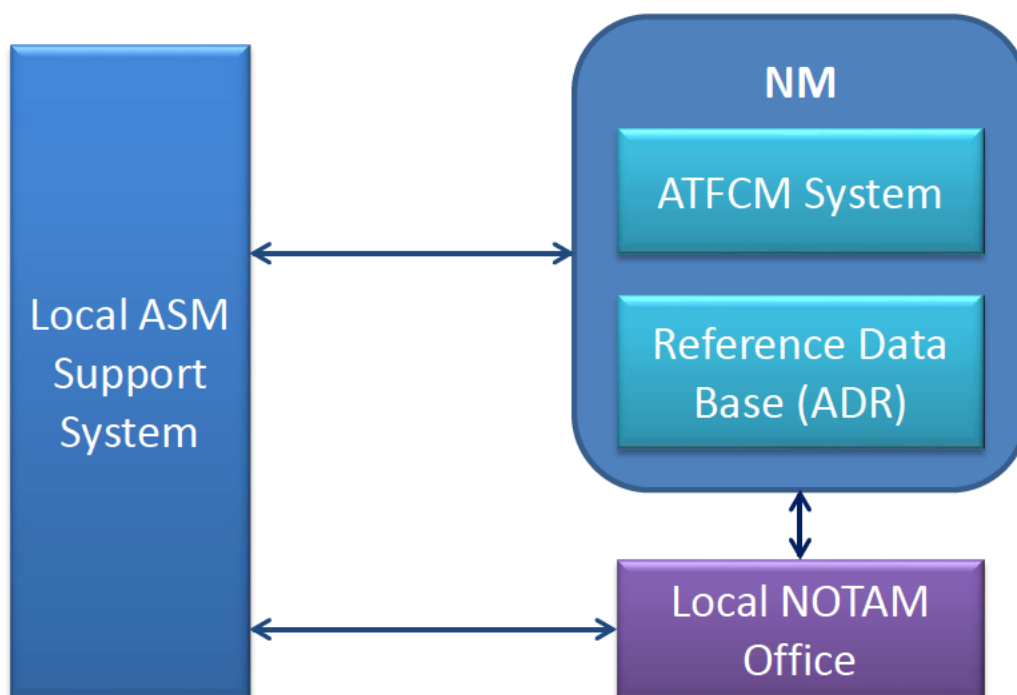
Figure 3: Interoperability between the ASM Support System and ATFCM sub-systems

The connection to a NM Reference Data Base (ADR in the future) will enable to the ASM support systems and the ATFCM system to be kept updated with the latest information on airspace planning and status. The exchange of information is based on standard data models supported by B2B connections/functions.

The NM Reference Data Base contributes to the ASM/ATFCM process by providing the following information to the ASM support systems:

- Environment Data: the NM Reference Data Base provides validated static airspace data for operation and temporary changes introduced by NOTAM, SUP AIP and RAD.
- ATFCM data: the NM Reference Data Base provides consolidated Air Traffic Flow and Capacity Management (ATFCM) data including information about traffic demand, areas of potential network congestion and Route Network demand (CDRs and ATS routes)

At the same time, the ASM support systems feeds the NM Reference Data Base with essential data by providing information in real time regarding airspace planning and airspace status (take into consideration all airspace structures) situation through:

- Event data. The ASM support systems provide a schedule for long term ATFCM events (military, special, axis, etc.) to the NM Reference Data Base supporting the update of the event calendar on the Network Operations Portal (NOP);
- National planning data: The ASM support systems will send information when available or requested on the airspace planning situation for further distribution to interested parties for demand and capacity balancing purposes;
- Airspace activation/de-activation/modification: the ASM support systems will provide information on any change produced on an ARES to balance demand and capacity in real time.

[REQ]

Identifier	REQ-07.05.02-INTEROP-0301.0001
Requirement	The ASM support systems and the Reference Data Base (ADR) shall be connected to keep airspace planning and status updated ensuring data consistency
Title	Database consistency
Status	<Validated>
Rationale	Ensure updated and consolidated airspace data for all the actors
Category	<Interoperability>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	Aeronautical Data Collection	N/A
<ALLOCATED TO>	<Functional block>	Aeronautical Data Storage and Maintenance	N/A
<ALLOCATED_TO>	<Functional block>	Cooperative Airspace Management	N/A
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0017	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0018	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0410	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0420	<Full>

[REQ]

Identifier	REQ-07.05.02-INTEROP-0301.0002
Requirement	The ASM support systems and the reference data base shall exchange airspace information through e-AMI messages
Title	Airspace information exchange messages
Status	<Validated>
Rationale	Ensure updated and consolidated airspace data for all the actors trough standardised messages.
Category	<Interoperability>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	Cooperative Airspace Management	N/A
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0017	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0018	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0410	<Full>

| <SATISFIES> | <ATMS Requirement> | REQ-07.05.02-SPR-PERF.0420 | <Full> |

[REQ]

Identifier	REQ-07.05.02-INTEROP-0301.0003
Requirement	The ASM support systems and the Reference Data Base shall exchange Airspace Data using a common format (AIXM 5.1)
Title	Airspace data exchange format
Status	<Validated>
Rationale	Ensure updated and consolidated airspace data for all the actors through standardised format
Category	<Interoperability>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	Cooperative Airspace Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0017	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0018	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0410	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0420	<Full>

[REQ]

Identifier	REQ-07.05.02-INTEROP-0301.0004
Requirement	The ASM support systems shall allow the submission of NOTAM proposals to the local NOTAM office (NOF) when the opening or closing of certain airspaces require the publication of a NOTAM
Title	Exchange of NOTAM messages
Status	<Validated>
Rationale	Ensure common situation awareness between all the roles
Category	<Interoperability>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	Cooperative Airspace Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0018	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0410	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0420	<Full>

[REQ]

Identifier	REQ-07.05.02-INTEROP-0301.0005
Requirement	The ASM support systems shall submit NOTAM proposals via AMHS
Title	NOTAM messages exchange communication mean
Status	<Validated>
Rationale	Ensure common situation awareness between all the roles
Category	<Interoperability>

Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Cooperative Airspace Management	N/A
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0017	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0410	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0420	<Full>

The following figure represents the actors involved in the coordination of short notice airspace requirements.
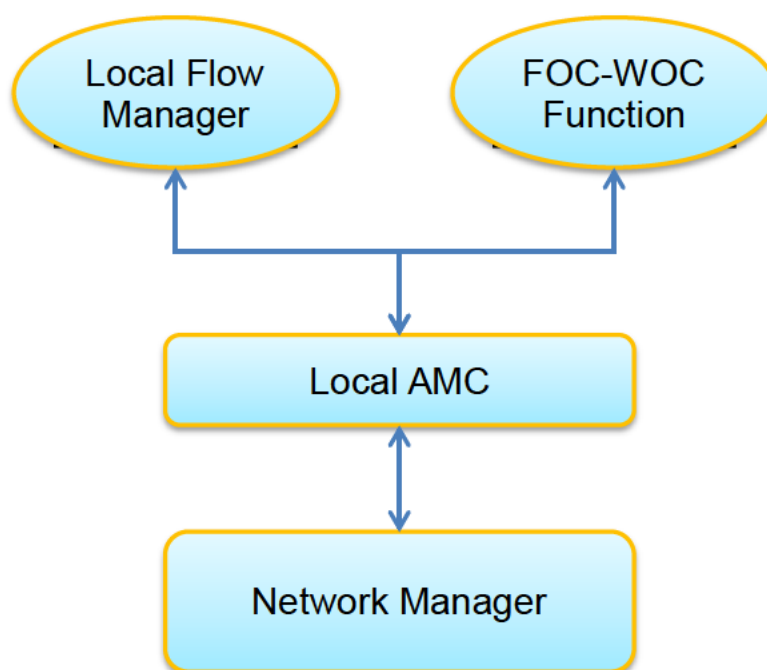
Figure 4: Actors involved in the coordination of an ARES request

The main players are the Airspace Manager and the requestors. Airspace data is available and can only be updated in the ASM support systems by those actors. Civil and military actors request the area that best meets their needs on an ARES requests, after an internal de confliction with the support of prediction tools. The local Airspace Manager analyses the ARES requests and produces and amends the published AUP/UUPs according to the airspace users' needs. This plan is provided to the Network Manager in the form of a message.

The link between the Network Manager and the ASM support systems (provided by B2B connections/functions) shall be established to provide this message and any update on it.

[REQ]

Identifier	REQ-07.05.02-INTEROP-0301.0006
Requirement	Civil and military users shall exchange their ARES requests in a AIXM 5.1 format
Title	ARES request through electronic format
Status	<Validated>

Rationale	To avoid misunderstanding and translation through standardised format
Category	<Interoperability>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	Cooperative Airspace Management	N/A
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-NL01.0010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-NL01.0011	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-NL01.0012	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-NL01.0013	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-NL01.0014	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-PERF.0316	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0400	<Full>

[REQ]

Identifier	REQ-07.05.02-INTEROP-0301.0007
Requirement	Civil and military requestors shall have the same ARES request status information in real time
Title	ARES request status sharing
Status	<Validated>
Rationale	Ensure common situation awareness between all the roles
Category	<Interoperability>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	Cooperative Airspace Management	N/A
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0017	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0018	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0021	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-PERF.0312	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-PERF.0313	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0410	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0420	<Full>

[REQ]

Identifier	REQ-07.05.02-INTEROP-0301.0008
Requirement	The ASM support systems shall allow for the exchange of the AUP/UUP data between the local Airspace Manager and the Network Manager
Title	AUP/UUP data exchange
Status	<Validated>
Rationale	To ensure the coordination of the plan for the initial allocation of ARES
Category	<Interoperability>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	Cooperative Airspace Management	N/A
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-AOM1.0009	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0018	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-NL01.0015	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-NL01.0016	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0410	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0420	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0430	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0440	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0450	<Full>

[REQ]

Identifier	REQ-07.05.02-INTEROP-0301.0009
Requirement	The exchange of the AUP/UUP shall be supported by a message in AIXM 5.1 format
Title	AUP/UUP data exchange format
Status	<Validated>
Rationale	Coordination of the plan for the initial allocation of ARES through standardised format
Category	<Interoperability>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	Cooperative Airspace Management	N/A
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0017	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0410	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0420	<Full>

The real time status of the ARES, allocated in the previous planning phase, is updated and shared among all ATM actors through the Network Manager.
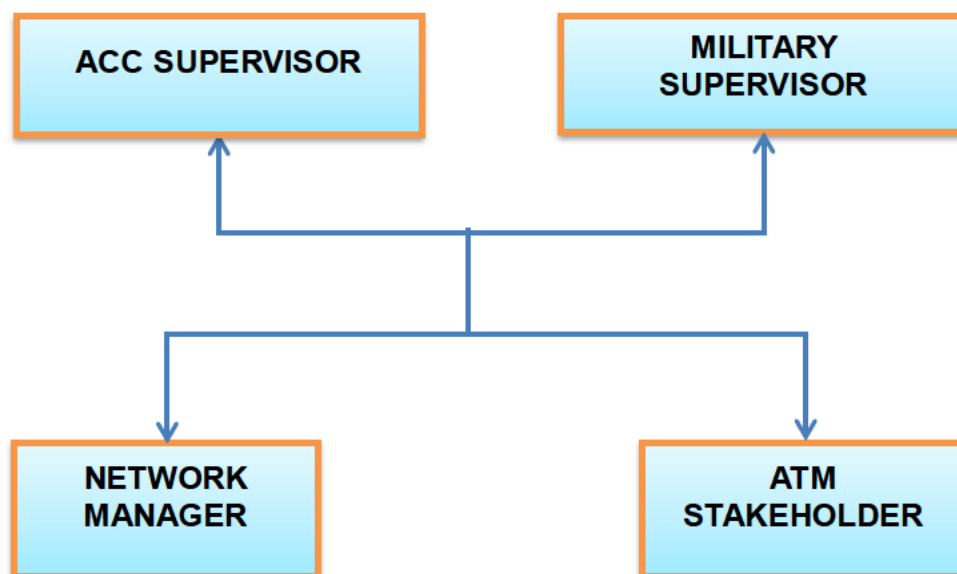
Figure 5: Actors interacting in the Execution Phase

The main players interacting through ASM support systems are any military and civil ATC units impacted by the activation, de-activation or modification of an ARES. Once the affected ATC units have confirmed the activation/ de-activation or modification of the ARES through the ASM support systems, the information regarding the ARES status shall be updated in the ATFCM system and in the NM Reference Data Base, making it available for the Network Manager and any other ATM stakeholder interested in having the latest information on airspace use data in order to optimize their operations.

[REQ]

Identifier	REQ-07.05.02-INTEROP-0301.0010
Requirement	The ASM support systems shall ensure the update of the ARES status in the NM system
Title	Update of ARES status in NM system
Status	<Validated>
Rationale	Ensure common situation awareness
Category	<Interoperability>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	Cooperative Airspace Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0017	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0018	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0021	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0410	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0420	<Full>

[REQ]

Identifier	REQ-07.05.02-INTEROP-0301.0011

Requirement	The update of the ARES status in the NM system shall occur once affected units have validated the ARES activation/ de activation or modification
Title	Condition for update of ARES status in NM system
Status	<Validated>
Rationale	Ensure common situation awareness
Category	<Interoperability>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	Cooperative Airspace Management	N/A
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0017	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0018	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0021	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0410	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0420	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0480	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0500	<Full>

3.1.2 Interoperability requirements between an ASM Support System and the ATC system

To support AFUA concept in the execution phase, it is necessary that once the ARES has been activated, modified and/or de-activated, the information is automatically updated in the ATC system. Although the ATC system and the ASM support systems are continuously connected, the ARES status update only takes place in the execution phase.
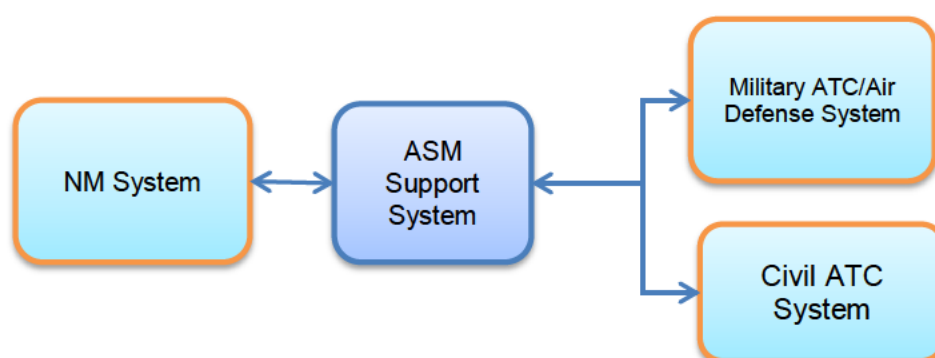

Figure 6: Interoperability in the Execution Phase

The civil supervisor and the military supervisor are the main actors interacting through the ASM support systems before the ARES status is updated and displayed in the ATC system.

Before the ARES becomes active, the ASM support systems trigger an action to the military unit responsible for the exercise (military supervisor) to confirm the activation of the area. Afterwards, the ASM support systems send a pre-notification message to acknowledge the imminent activation of an

founding members

ARES to the control units affected by the exercise (civil supervisor). The ACC Supervisor acknowledges this information by sending an acknowledge message through the ASM support systems.

Once civil and military supervisors finish the activation process, the ASM support systems send a message to update the ARES status on the ATC system, updating the control working position and the ATFCM system.

The communication between the ASM support systems and the ATC system shall be established by interchanging messages in ADEXP format.

For this purpose it is necessary that:

- The message exchanged shall be the same for civil and military ATC / Air Defence systems.
- Before an ARES is activated the ASM support systems shall generate a pre-notification message in ATC systems to ensure that the controller is aware about the status of the ARES and take the appropriate actions before the activation.
- Any change on the ARES status (activation/ de-activation or modification) shall be automatically updated at the control working position and the ASM support systems.
- If the military activity is cancelled, it shall be considered as an ARES de-activation.
  - The network shall be able to process any type of modification of an allocated ARES, either to take benefit from early de-activation/cancellation or to cope with timeframe extension whenever required.
  - Modifications that suppose an impact on the agreed trajectory (cancellation, postponement or extension), can conduct in certain circumstances to the revision of a trajectory. This revised trajectory is coordinated between the pilot and the executive controller. However, this process and the interoperability requirements are out of the scope of Step 1 and will be further described in Step 2.

There shall be a cross-check between the ASM support systems, the NM system, the NM Reference Data Base and the ATC system(s) to ensure that data are correct all the time. Nevertheless, this data correctness is part of the software assurance level (SWAL), which is not validated through 7.5.4 validation approach.

[REQ]

Identifier	REQ-07.05.02-INTEROP-0301.0012
Requirement	The ASM support systems shall be connected to the civil and Military ATC/Air Defence System
Title	Connection between ASM and ATC
Status	<Validated>
Rationale	To ensure the exchange of airspace status information between the ASM support systems and ATC systems
Category	<Interoperability>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Cooperative Airspace Management	N/A
<ALLOCATED_TO>	<Functional block>	Ground-Ground Legacy Datalink Communications (GGDC)	N/A
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0017	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0021	<Full>

<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0560	<Full>

[REQ]

Identifier	REQ-07.05.02-INTEROP-0301.0013
Requirement	The ASM support systems and the civil and military ATC/ Air Defence System shall allow for the exchange of data messages to activate / de activate and modify an ARES
Title	ARES status message exchange between ASM and ATC systems
Status	<Validated>
Rationale	Activation / De activation and modification of an ARES shall be an automated process between ground systems
Category	<Interoperability>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	Cooperative Airspace Management	N/A
<ALLOCATED_TO>	<Functional block>	Ground-Ground Legacy Datalink Communications (GGDC)	N/A
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0017	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0019	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0020	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0021	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0550	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0560	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0570	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0580	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0590	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0600	<Full>

[REQ]

Identifier	REQ-07.05.02-INTEROP-0301.0014
Requirement	The exchange of data messages for ARES activation / de activation and modification between the ASM support systems and civil and military ATC / Air Defence Systems shall be in ADEXP format
Title	ARES status message exchange format between ASM and ATC systems
Status	<Validated>
Rationale	To ensure data correctness exchange between the ASM support systems ant the civil and military ATC/ Air Defence System
Category	<Interoperability>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	Cooperative Airspace Management	N/A
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0017	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0019	<Full>

<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0020	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0021	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0550	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0560	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0580	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0600	<Full>

[REQ]

Identifier	REQ-07.05.02-INTEROP-0301.0015
Requirement	The civil and military ATC / Air Defence System shall allow to update the effective activation / de activation and modification of an ARES on the CWP when such processes have been confirmed by the affected units through the ASM support systems
Title	Airspace status update on CWP
Status	<Deleted>
Rationale	To ensure the airspace status is accurately updated in the CWP
Category	<Interoperability>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-07.05.02-INTEROP-0301.0016
Requirement	The civil and Military ATC / Air Defence System shall send a LAM message to the ASM support systems
Title	ARES message confirmation between ATC and ASM systems
Status	<Validated>
Rationale	To acknowledge the reception and correct processing of ARES activation / de activation and modification messages
Category	<Interoperability>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	Cooperative Airspace Management	N/A
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0017	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0019	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0020	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0021	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0550	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0560	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0570	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0580	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0590	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0600	<Full>

3.2 Dynamic functions / operations

This section of the document provides any interoperability requirements associated to the dynamic aspects of using the tools and systems described in the preceding section.

This section provides the technical detail for the operational air traffic service descriptions in the OSED [8], limited to ground-ground communications and includes the interoperability requirements.

Process	Description	Network Operations phase	WP7.2 High Level Process served	Comment
Airspace Organisation and Management	To capture and analyse airspace needs and demand data and collaboratively agree and implement airspace configuration in order to create ARES based on user needs	Plan Network Management Operations	Plan European Airspace Organisation and Management	Airspace design
Airspace Reservation	To submit and progressively update (book) long and medium term exercise schedules and daily training airspace demand requests		Forecast and Plan Network Traffic Demand	Long term planning
Airspace Allocation	To solve conflicts, negotiate and allocate an ARES based on mission and network (flow) requirements			Medium/Short term planning
	To capture ARES/mission change requests and collaboratively refine airspace allocation, time horizon permitting			Short term planning
Airspace Activation/De-activation	To collaboratively activate and de-activate the agreed and allocated airspace configurations	Execute Network Management Operations	Manage Airspace Allocation and Network Capacity	Not described exhaustively in WP7.2 DOD
Post OPS Analysis	To analyse post OPS data according to collaboratively agreed KPIs and as required to generate improvement proposals to the airspace organisation and/or management processes	Manage Network Performance	Monitor Network Operational KPI	Described in the WP7.2 DOD

Table 3: Processes

The following functional services support the AFUA processes.

Service	Description	Served Process
ARES VPA design principle application	To accommodate airspace users' needs when an ARES is needed	Airspace Organisation and Management

Airspace booking	To reserve an ARES following an approval chain	Airspace Reservation
Airspace Booking Conflict Management	To solve any booking conflict in a specific approval chain	Airspace Allocation
Airspace Negotiation	To negotiate reservation of an ARES between civil and military	Airspace Allocation
Airspace Allocation	To complete the process of reservation by allocating one airspace to one airspace user	Airspace Allocation
Airspace Activation / Airspace De activation	To provide in real time status of an airspace allocated in the Airspace Reservation process	Airspace Activation/ De activation
Airspace Modification	To inform the ATM actors when an activity is complete in an ARES	Airspace Activation/ De activation
Capacity analysis	To compare the initial capacity declared with the capacity available due to activation of an ARES	Post-ops Analysis

Table 4: Services

3.2.1 Interoperability Requirements for Process/ Service Airspace Organisation and Management

The processes and services of the Airspace Organisation and Management are typical Level 1 tasks to be performed in accordance with the FUA regulation (EC 2150/2005). Following this regulated process the airspace users operate their tasks in a coordinated way to create an airspace configuration that ensures the operational efficiency. Once this airspace configuration has been commonly accepted and becomes part of a rolling updating process its details should be entered into the NM Reference Data Base for that particular volume of airspace. This airspace configuration should ideally reflect the creation of VPAs as a design principle for ARES.

[REQ]

Identifier	REQ-07.05.02-INTEROP-0302.0001
Requirement	The ASM support systems and Reference Data Base shall ensure the exchange of static airspace configuration messages
Title	Consistency of static airspace configuration data between ASM Support System and reference data base
Status	<Validated>
Rationale	The Reference data base contains the most updated information about airspace configuration, this will ensure data consistency with the ASM support systems when this airspace configuration changes.
Category	<Interoperability>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Aeronautical Data Storage and Maintenance	N/A
<ALLOCATED TO>	<Functional block>	Aeronautical Information Distribution	N/A
<ALLOCATED TO>	<Functional block>	Cooperative Airspace Management	N/A
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-AOM1.0001	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-EL01.0017	<Full>

<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0410	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0420	<Full>

3.2.2 Interoperability requirements for Process/Service Airspace Reservation

The processes and services which entail airspace booking activities are typically ASM Level 2 tasks. The reservation of an ARES from a military requester following a military approval chain is assumed to be performed using ASM support systems which in regard to interoperability do not create an additional need to define a respective internal interoperability requirement. The military and the civil requestor are expected to be clients of interoperable ASM support systems.

3.2.3 Interoperability requirements for Process/Service Airspace Allocation

The services corresponding to the airspace allocation are typically ASM Level 2 tasks and are split up into the following processes.

3.2.3.1 Conflict management

The resolution of any booking conflict in a specific approval chain is assumed to be performed inside the ASM support systems. At this point, the local and/or sub-regional airspace manager is aware of civil and military ARES requests and, with the support of ASM support systems, analyses its impact in network operations and identifies any conflict between ARES bookings. There is no interoperability requirement associated to this process/service

3.2.3.2 Airspace negotiation

The negotiation of an ARES reservation between civil and military users is assumed to be performed inside the ASM Support System. In case any conflict has been identified, the local and/or sub-regional airspace manager is responsible for negotiating with the requestor the resolution of such conflicts. There is no interoperability requirement associated to this process/service

3.2.3.3 Airspace allocation

The complete process of reservation, by allocating one airspace to one airspace user, and the interoperability requirements associated to such service have been previously defined in sub chapter 3.1.1

3.2.4 Interoperability requirements for Process/Service Activation / De-activation

The interoperability requirements associated to the processes and services of airspace activation/ de-activation have been previously defined in sub chapters 3.1.1 and 3.1.2

3.2.5 Interoperability requirements for Process/Service Post Operations Analysis

In accordance to the EC Regulation 2150/2005, the processes and services related to the Post-Operations analysis are designed to ensure the proper calculation of identified KPI's, which will provide an assessment of the efficiency of the AFUA by the relevant stakeholders.

The correct collection and storage of relevant data for performance assessment is assumed to be ASM support systems functionality, nevertheless the processing of such data to calculate the relevant AFUA KPI's will be a task for performance analysis tools.

[REQ]

Identifier	REQ-07.05.02-INTEROP-0302.0002
Requirement	The ASM support systems shall be able to exchange stored ASM data in a common format (AIXM5.1) to performance analysis tools via SWIM
Title	ASM support systems exchange stored ASM data
Status	<Validated>
Rationale	Provide post flight data to ensure the performance assessment of the AFUA concept
Category	<Interoperability>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	Cooperative Airspace Management	N/A
<ALLOCATED TO>	<Functional block>	Post Flight Analysis	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-PO01.0021	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0018	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0029	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0138	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0890	<Full>

[REQ]

Identifier	REQ-07.05.02-INTEROP-0302.0003
Requirement	ASM data shall be available for extraction and distribution once the execution phase has finished
Title	Availability of ASM data for post-ops analysis
Status	<Validated>
Rationale	Provide post flight data to ensure the performance assessment of the AFUA concept
Category	<Interoperability>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	Cooperative Airspace Management	N/A
<ALLOCATED TO>	<Functional block>	Post Flight Analysis	N/A
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-PO01.0021	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0018	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0020	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0029	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0138	<Full>

[REQ]

Identifier	REQ-07.05.02-INTEROP-0302.0004
Requirement	The ASM support systems shall be able to retrieve the KPI's defined within the AFUA concept from performance analysis tools

Title	ASM support systems and performance analysis tools
Status	<Validated>
Rationale	To enable ASM support systems to take into account AFUA KPIs in order to make a more efficient use of the ASM support systems and improve the performance of the Network by a more optimal Airspace Management
Category	<Interoperability>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Cooperative Airspace Management	N/A
<ALLOCATED TO>	<Functional block>	Post Flight Analysis	N/A
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-OSED-PO01.0021	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0018	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0019	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0021	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0028	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0029	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0030	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0031	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0045	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.05.02-SPR-PERF.0050	<Full>

3.3 Unique characteristics

The intent of the INTEROP is to harmonize technical and functional implementations so that all aircraft and ground system elements of the CNS/ATM system that contribute to ATM can interoperate. Nevertheless, some elements of the CNS/ATM system may have unique characteristics for a variety of reasons. These may include procedural constraints, legacy system feature, lack of standards for supporting functions and the need to accommodate mixes of technology and technical capability. These characteristics may impact interoperability and require operational procedures to accommodate the unique characteristics. For the moment, no unique characteristics have been identified in Step 1.

4   References

This section identifies the documents the INTEROP has to comply with (Applicable documents) or to be used as additional inputs.

4.1   Applicable Documents

This INTEROP complies with the requirements set out in the following documents:

[1] Template Toolbox Ed.04.00.00 22/03/2014
https://extranet.sesarju.eu/Programme%20Library/SESAR%20Template%20Toolbox.dot

[2] EUROCONTROL ATM Lexicon
https://extranet.eurocontrol.int/http://atmlexicon.eurocontrol.int/en/index.php/SESAR

[3] European Operational Concept Validation Methodology (E-OCVM) - 3.0 [February 2010]

4.2   Reference Documents

The following documents were used to provide input/guidance/further information/other:

[4] WPB.01 Integrated Roadmap DS14 version

[5] ED-78A Guidelines for Approval of the provision and use of Air Traffic Services supported by Data Communications

[6] ICAO Document 9694

[7] ASM_B2B_Services_FeasibilityStudy_V1.0

[8] SESAR P07.05.04-D45 OSED for Advanced Flexible Use of Airspace in Step 1, Edition 00.04.00

[9] EUROCONTROL SPECIFICATION for ATS Data Exchange Presentation (ADEXP)

[10] EUROCONTROL Specification For On-Line Data Interchange (OLDI) Edition 4.2

[11] INT07.05.02-INT High level requirements for ASM Tools, Edition 00.01.00, 12/01/2011

[12]SESAR P07.05.04-D47 Advanced Flexible Use of Airspace Safety and Performance Requirements for Step 1, Edition 00.04.00

[13]10.01.07-D120-Technical Architecture Description Cycle 2015 Edition 00.01.00 https://extranet.sesarju.eu/WP_10/Project_10.01.07/Project%20Plan/Work%20Area%20-%20Architecture/WP10.01.07-D120%20-Technical%20Architecture%20Description%20-%20Cycle%202015.doc

[14]07.02-D42 Step1 Network Subsystems Technical Architecture Edition 00.02.00 https://extranet.sesarju.eu/WP_07/Project_07.02/Project%20Plan/Step1/07.02-D42-Step%201%20TAD.doc

[15]European Route Network Improvement Plan (ERNIP) Part 3 Airspace Management Guidelines -The ASM Handbook Airspace Management Handbook for the Application of the Concept of the Flexible Use of Airspace, Edition Number : 5.1Edition Date : 23/10/2014 Status: Released Issue http://www.eurocontrol.int/sites/default/files/publication/files/ERNIP-ASM-Handbook-Part3.pdf

[16]SESAR 07.02-D28 Step 1 Release 4 Detailed Operational Description (DOD), Ed 00.03.00

-END OF DOCUMENT-