Advanced Flexible Use of Airspace for Step 1 OSED

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Abstract

The concept of AFUA exploits to the maximum extent the operational improvements of Step 1 operations. It provides more flexibility by allowing dynamic airspace management in all phases of the operations, from initial planning to the execution phase, taking into account local traffic characteristics. The concept addressed by SESAR Solution #31 includes new ARES design principles, real time airspace status data exchange, their integration into national ASM system and its automated communication links between ASM, ATFCM and ATC actors and systems at local, regional and sub-regional levels. In this way AFUA concept fosters efficient collaborative decision making process and improves Network operating performance.

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Executive summary

Flexible Use of Airspace (FUA) is an airspace management concept described by the International Civil Aviation Organisation (ICAO) and developed by EUROCONTROL [7] according to which airspace should not be designated as either purely civil or military airspace, but should rather be considered as one continuum in which all users' requirements have to be accommodated to the maximum extent possible.

The Flexible Use of Airspace is defined by the (EC) Regulation 2150/2005 of 23 December 2005. [5] The application of FUA concept is governed by the defined there principles, however the flexible use of airspace concept adopted throughout Europe, has been interpreted differently. Consequently, the procedures applied by these countries vary considerably creating inconsistencies and limiting the efficiency of civil/military coordination and Network performance.

Since the application of the Regulation, the concept of flexible use of airspace was improved through several initiatives proposed by EUROCONTROL and coached by the stakeholders through the Airspace Management Sub Group (ASM SG) and associated task forces. European States took also initiatives to improve the flexible use of airspace at national level.

The concept of AFUA and its further developments intend to provide **more flexibility** by allowing dynamic airspace management in all phases of the operations, from initial planning to the execution phase, taking into account local traffic characteristics. The aim is to establish a **coherent** collaborative decision making process supported by the ATM systems. It aims also at making the intents and planning of AUs **more consistent and transparent** and at giving more flexibility between planning and execution phase as well as at exploiting any opportunities from the available airspace (early release of ARES).

The concept of AFUA is addressed by **SESAR Solution #31**: "Variable profile military reserved areas and enhanced (further automated) civil-military collaboration". The concept develops the following new operational elements:

- In the execution phase, the **exchange of ARES status information will be performed in real time (RTSA)**. The real time information will address pre-notification, activation, de-activation and modification of ARES use. This data should ideally be **shared** amongst the ASM support systems, the NM system, the ATC systems, and further processed to potential users like AOs and FMP via ETFMS.
- New ARES Variable Profile Area (**VPA**) design principles, their **integration into national ASM support systems** and its **automated communication links between the ASM, the NM and the ATC systems** in order to establish a ground network fostering and benefiting the demand and capacity balancing.

This concept also addresses the **application** of ARES VPA design principle and related AFUA processes in SESAR Step 1 **Free Route** operational environment.

In the same time, AFUA allows airspace structures to be designed in a way to better fulfil military needs and to better share the constraints with other airspace users.

This OSED contains a set of updated requirements as a result of the overall AFUA concept safety assessment and the completed validation exercises.

This OSED and the operational concept are updated accordingly with the outcome from five validation exercises (VP-015, VP-016, VP-017, VP-710 and VP-717) as in D52 Validation Report [11].

The validation activities are considered to **achieve V3** maturity level, however some gaps have been identified and some recommendations have been made to be undertaken in V4

Although the completed V3 validation activities showed operational benefits from AFUA, in order to take full advantage of RTSA the following elements need to be further refined during industrialisation phase:

- RTSA **data content** to convey the whole set of airspace status information needed by the concerned stakeholders;
- Level of **Automation** of supporting tools to improve the impact assessment duration and information exchange;
- **Refinement** of CDM processes and procedures.

This activity shall involve in a collaborative manner NM and AUs.

It has been showed as well that there is a need to refine the principles for identification of the eligible flights based on AUs' priorities reflected in relative values to their KPIs (for instance the shortest route is not always the most preferable one for the AU).

1 Introduction

1.1 Purpose of the document

The Operational Service and Environment Definition (OSED) describes the operational concept of AFUA as part of the Network Operations concept developed by SWP7.2. The OFA related to AFUA is OFA 05.03.01 Airspace Management and AFUA [10].

It defines the operational services, their environment, scenario and use cases and requirements.

The OSED is used as the basis for assessing and establishing operational, safety, performance and interoperability requirements for the related systems further detailed in the Safety and Performance Requirements (SPR) document and Interoperability requirements (INTEROP) document. The OSED identifies the operational services supported by several entities within the ATM community and includes the operational expectations of the related systems.

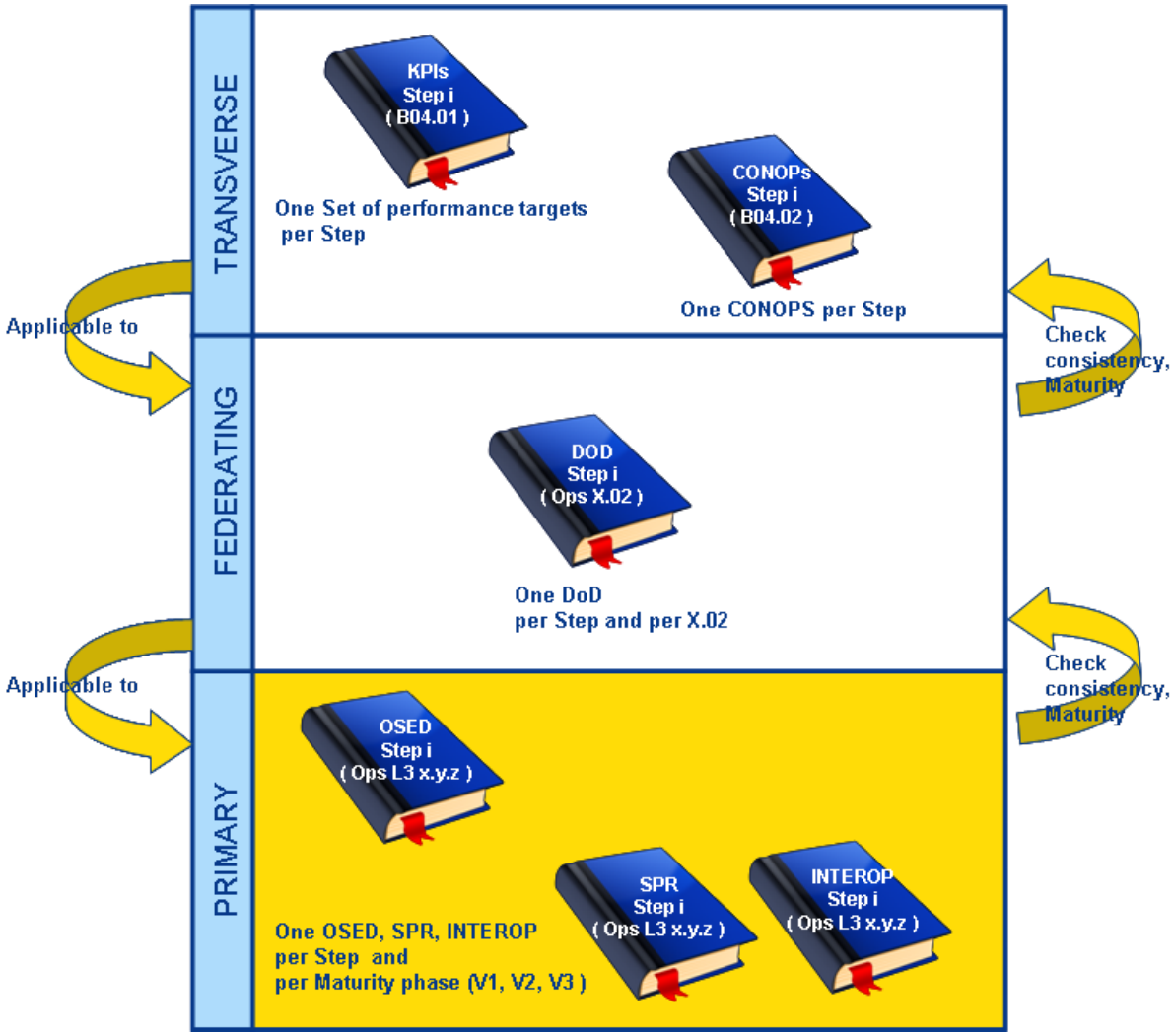

Figure 1: OSED document with regards to other SESAR deliverables

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

1.2 Scope

This OSED details the operational concept for the Operational Focus Area (OFA) 05.03.01 Airspace Management and AFUA. This OFA represents the set of dependent operational and technical improvements related to “Demand and capacity Balancing En-Route”.

Operational Improvement AOM-0206-A Flexible and modular ARES in accordance with the VPA design principle as well as Operational Improvement AOM-0202-A Automated Support for strategic, pre-tactical and tactical Civil-Military Coordination in Airspace Management (ASM) are connected to this OFA.

The concept of AFUA is part of the Network Operations concept developed by SWP7.2.

This OSED develops the AFUA concept related to:

- The implementation of modular airspace reservations/restrictions with the implementation of Variable Profile Area (VPA) design principles adapted from the concept of MVPA already implemented in Germany. The objective is to better respond to military requirements and other constraints e.g. meteorological constraints, while giving more freedom to other flights, and to achieve more flexibility from both civil and military;
- The implementation of an automated, harmonised and standardised booking process connecting the airspace users via an ASM support system to the NM system including the publication of AUP/UUP.
- The implementation of an automated, harmonised and standardised updating process connecting an ASM support system to an ATC system including an integrated visualisation at the pertinent CWP display.
- The continuous sharing of airspace planning and status between all ATM (Air Traffic Management) actors should limit the number of constraints.
- The implementation of a harmonised CDM process, supporting the ASM processes and services in order to have mutual agreements on optimum trajectories.
- The implementation of a harmonised and standardised technical standard for future B2B services in accordance with the current AIXM format.
- The continuous exchange of information concerning the ARES status in real time. This includes pre-notification, activation, de-activation and modification.

This OSED develops scenarios and the associated use cases that will define the operational requirements.

1.3 Intended readership

The intended audience is:

- P07.05.04 Members to provide the reference set of operational requirements related to the operational improvement AOM-0206-A Flexible and modular ARES in accordance with the VPA design principle and AOM-0202-A Automated Support for strategic, pre-tactical and tactical Civil-Military Coordination in Airspace Management (ASM);
- P10.05.01 and P13.02.01 for the development of INTEROP requirements and prototypes;
- 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;
- P08.01.05, P08.03.05 and P08.03.10 for modelling associated data and services;
- SWP11.01 for WOC and state AU operations and for civil AU - FOC

- 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

1.4 Structure of the document

The structure of the document is as follows:

- Chapter 1: general description the document structure and scope;
- Chapter 2: description of the operational concept;
- Chapter 3: description of the operating method;
- Chapter 4: description of the detailed operational environment;
- Chapter 5: description of use cases;
- Chapter 6: requirements;
- Chapter 7: indicates the references.

1.5 Background

Flexible Use of Airspace is an airspace management concept described by the International Civil Aviation Organisation (ICAO) and developed by EUROCONTROL [7] according to which airspace should not be designated as either purely civil or purely military airspace, but should rather be considered as one continuum in which all users' requirements have to be accommodated to the maximum extent possible .

The Flexible Use of Airspace (FUA) is defined by the (EC) Regulation N°2150/2005 of 23 December 2005 [5]. The concept of FUA is governed by the following principles:

- Coordination between civil and military authorities shall be organised at the Strategic, Pre-tactical and Execution phases of airspace management through the establishment of agreements and procedures in order to increase safety and flexibility of aircraft operations;
- Consistency between airspace management, air traffic flow management and air traffic services shall be established and maintained at the three levels of airspace management enumerated in the point above in order to ensure, for the benefit of all users, efficiency in airspace planning, allocation and use;
- The airspace reservation for exclusive or specific use of categories of user shall be a temporary nature, applied only during limited periods of time based on actual use and released as soon as the activity having caused its establishment ceases;
- Member States shall develop cooperation for the efficient and consistent application of the concept of flexible use of airspace across national borders and/or the boundaries of flight information regions, and shall in particular address cross-border activities; this cooperation shall cover all relevant legal, operational and technical issues;
- Air traffic services units and users shall make the best use of the available airspace.

Member States shall also ensure that systems are in place to permit a mutual provision of airspace data to allow the real-time activation, deactivation or reallocation of the airspace allocate at Medium-Short Term planning phase.

However, the flexible use of airspace concept adopted throughout Europe, has been interpreted differently. Consequently, the procedures applied by these countries vary considerably creating inconsistencies and limiting the efficiency of civil/military coordination and Network performances.

Since the application of the Regulation, the concept of flexible use of airspace was improved through several initiatives proposed by EUROCONTROL and coached by the stakeholders through the Airspace Management Sub Group (ASM SG) and associated task forces. European States took also initiatives to improve the flexible use of airspace at national level.

1.6 Glossary of terms

Term	Description	Source
Airspace Configuration	Is a pre-defined and coordinated organisation of routes and their associated airspace structures, temporary airspace reservations and ATC sectorisation.	[4]
Airspace Reservation	A defined volume of airspace temporarily reserved for exclusive or specific use by categories of users [4].	[4]
Ad hoc airspace	Not pre-defined airspace structures	[4]
Airspace Restriction	A defined volume of airspace within which, variously, activities dangerous to the flight of aircraft may be conducted at specified times (a “danger area”); or such airspace situated above the land areas or territorial waters of a State, within which the flight of aircraft is restricted in accordance with certain specified conditions (a restricted area); or airspace situated above the land areas or territorial waters of a State, within which the flight of aircraft is prohibited (a prohibited area) [4].	[4]
Airspace Structure	A specific volume of airspace designed to ensure the safe and optimal operation of aircraft [4].	[4]
Advanced Airspace Management System (AAMS)	System enables to accommodate real-time functions and dialogues for dynamic airspace allocation and to generate/distribute planned airspace usage information.	[9]
Controlling military unit	Any fixed or mobile military unit handling military air traffic and/or pursuing other activities which, owning to their specific nature, may require an airspace reservation or restriction [4].	[4]
Cross Border Airspace	An airspace structure extending across national borders and/or the boundaries of flight information regions [4].	[4]
FPL Buffer Zone (FBZ)	FPL Buffer Zone (FBZ) is the associated airspace which may be applied to a reserved/restricted airspace. The FBZ defines the lateral and vertical limits for the purpose of submitting a valid IFR FPL when such areas are active or planned to be active.	[4]
Real time airspace status (RTSA)	A RTSA message relates to the execution phase. It addresses an evaluation process performed at a specific time triggered by a specific event concerning the ARES status (activation, de-activation, modification) to match the existing plan (AUP / UUP) to the actual life performance. Identified delta will initiate a new plan. In addition it also addresses any change to existing plans (AUP / UUP) prior to their execution in real time, triggered by an event on the day of operation.	[9]

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.	[9]

Table 1: Glossary of terms

1.7 Acronyms and Terminology

Term	Definition
AA	Approved Agency
AAMS	Advanced Airspace Management System
AAS	Advanced Airspace Scheme (Schéma évolué de l'espace aérien)
ACC	Area Control Centre
ACM	Air Combat Manoeuvres
ADD	Architecture Definition Document
ADU	Air Defence Unit
EARNE	European ATS route network environment
AFUA	Advanced Flexible Use of Airspace
AHC	Aircraft Handling Characteristics
AIP	Aeronautical Information Publication
AIRAC	Aeronautical Information Regulation and Control (Régularisation et contrôle de la diffusion des renseignements aéronautiques)
AMC	Airspace Management Cell
ANSP	Air Navigation Service Provider
AO	Aircraft Operator
AOLO	Aircraft Operators Liaison Officer
AOM	Airspace Organisation and Management
APW	Area Proximity Warning
ARES	Airspace Reservation/Restriction
ASM	Airspace Management
ASM SG	Airspace Management Sub Group
ATC	Air Traffic Control
ATCO	Air Traffic Controller
ATFCM	Air Traffic Flow and Capacity Management
ATM	Air Traffic Management
ATS	Air Traffic Services
AU	Airspace User
AUP	Airspace Use Plan
BFM	Basic Fighter Manoeuvres
CAM	Civil Airspace Manager
CBA	Cross Border Area
CBO	Cross Border Operation
CDM	Collaborative Decision Making
CDR	Conditional Route
CONOPS	Concept of Operations
CIAM	CFMU Interface for Airspace management
CTA	Control Area
CTR	Control Zone
CWP	Controller Working Position
DCB	Demand Capacity Balancing

Term	Definition
DMA	Dynamic Mobile Area
DMEAN	Dynamic Management of the European Airspace Network (Gestion dynamique du réseau aérien européen)
DOD	Detailed Operational Description
DOW	Description of Work
E-ATMS	European Air Traffic Management System
EAUP	European Airspace Use Plan
EC	European Commission
ECAC	European Civil Aviation Conference (Conférence européenne de l'Aviation civile)
ETFMS	Enhanced Tactical Flow Management System
EUROAT	EUROCONTROL Specification for harmonized Rules for Operational Air Traffic under Instrument Flight Rules (IFR) inside controlled Airspace of the ECAC Area
EUUP	European Update airspace Use Plan
FAB	Functional Airspace Block
FBZ	Flight plan Buffer Zone
FIR	Flight Information Region
FMP	Flow Management Position
FOC	Flight Operations Centre
FPL	Flight Plan
FPS	Flight Planning System
FUA	Flexible Use of Airspace
GAT	General Air Traffic
HLAPB	High Level Airspace Policy Body
iADS	Intelligent ATFCM Design Solutions
iSBT	Initial implementation of the Shared Business Trajectory in Step 1
iSMT	Initial implementation of the Shared Mission Trajectory in Step 1
iRBT	Initial implementation of the Reference Business Trajectory in Step1
iRMT	Initial implementation of the Reference Mission Trajectory in Step 1
ICAO	International Civil Airspace Organisation
INTEROP	Interoperability Requirements
IER	Information Exchange Requirements
IFPS	Integrated Initial Flight Plan Processing System (Système intégré de traitement initial des plans de vol)
IFR	Instrument Flight Rules
IRS	Interface Requirements Specification
KPI	Key Performance Indicator
MAM	Military Airspace Manager
MVPA	Military Variable Profile Area
NM	Network Manager
NMF	Network Management Function
NMOC	Network Manager Operations Centre
NM ENV	Network Manager environmental database
NIMS	Network Information Management System
NOP	Network Operation Plan
OAT	Operational Air Traffic
OATTS	Operational Air Traffic Transit Service - système de transit COM-IFR
OCD	Operational Concept Description
OFA	Operational Focus Area
OI	Operational Improvement
OSED	Operational Services and Environment Definition
RBT	Reference Business Trajectory
RMT	Reference Mission Trajectory

Term	Definition
RTSA	Real Time Status of Airspace
SBT	Shared Business Trajectory
SES	Single European Sky
SESAR	Single European Sky ATM Research Programme
SESAR JU	SESAR Joint Undertaking
SESAR Programme	The programme which defines the Research and Development activities and Projects for the SJU.
SIMEX	SIMulation and EXperiment (CFMU)
SJU	SESAR Joint Undertaking (Agency of the European Commission)
SJU Work Programme	The programme which addresses all activities of the SESAR Joint Undertaking Agency.
SMT	Shared Mission trajectory
SOA	Service-Oriented Approach / Architecture (SESAR)
SPR	Safety and Performance Requirements
SUUP	Special UUP
SWIM	System Wide Information Management
TAD	Technical Architecture Description
TRA	Temporary Reserved Area
TRAMON	TRAffic MONitoring
TS	Technical Specification
TSA	Temporary Segregated Area
UDPP	User Driven Prioritisation Process
UIR	Upper Information Region
UUP	Updated Airspace Use Plan
VFR	Visual Flight Rules
VPA	Variable Profile Area
WOC	Wing Operation Centre

Table 2: Acronyms and Terminology

2 Summary of Operational Concept from DOD

This OSED details the operational concept of AFUA in Step 1 V3. In this step, a bottom up approach is privileged. The Network Operations Detailed Operational Description (DOD) of the WP 07.02 project is available [9]. Traceability to the DOD is ensured.

This chapter describes the list of Operational improvements (OIs) covered by AFUA/ASM Operational Focus Area (OFA) 05.03.01, a high level description of the operational concept and the operational services as identified by SWPB4.2. P07.05.04 aims at developments of two OIs as described in the table below.

2.1 Mapping tables

Relevant OI Steps ref. (coming from the definition phase)	Any new / changed OI step (textual form)	Operational Focus Area name	Story Board Step	Master or Contributing (M or C)	Contribution to the OI short description
AOM-0206-A Flexible and modular ARES in accordance with the VPA design principle	Step 1	Airspace Management & AFUA	1	M	The implementation of new AFUA structures provides more flexibility to the military and better responds to their airspace needs. The flexible construction of these airspaces limits the constraints on the other airspace users.
AOM-0202-A Automated Support for strategic, pre-tactical and tactical Civil-Military Coordination in Airspace Management (ASM)	Step 1	Airspace Management & AFUA	1	M	Civil-military coordination for Airspace Management (ASM) is enhanced by automated exchange of ASM-data in real time

Table 3: List of relevant OIs within the OFA

Scenario identification	Use Case Identification	Reference to DOD section where it is described
Long Term Planning	UC-NL-02 Provide Military daily training Plans	4.2.1
	UC-NL-03 Provide large national or multinational exercises Plans	
Medium / Short Term Planning	UC-NP-07 Submission of Airspace Reservation Requests	4.2.2
	UC-NP-08 Submission of iOAT Flight Plans (iOAT FPL)	
	UC-NP-21 Collaboratively Agree and Implement Airspace Configuration	
	UC-NP-25 Publish and Update Airspace Configuration	
Execution Phase	UC-NE-15 Update Airspace Status in Real Time	4.2.3

Table 4: List of relevant DOD Scenarios and Use Cases

Operational Environment	Class of environment	Reference to DOD section where it is described
Airspace classification/Management	Access to each of these three different environments (U, K, N airspace classification) by civil and military airspace users, either simultaneously or separately, will be governed by commonly agreed rules and procedures	3.1.6

Table 5: List of relevant DOD Environments

Table 6: List of the relevant DOD Processes and Services – see Section 2.3 Processes and Services (P&S)

DOD Requirement Identification	DOD requirement title	Reference to DOD section where it is described
REQ-07.02-DOD-0001.0001	Commonly agree and facilitate on a reference trajectory	6.1
REQ-07.02-DOD-0001.0002	Enabling Free Route inside a FAB	6.1
REQ-07.02-DOD-0001.0004	Complexity and Workload assessment tools supporting Free Route	6.1
REQ-07.02-DOD-0001.0005	Flexibly adapt military airspace structures	6.1
REQ-07.02-DOD-0001.0006	Improve predictability of sector capacities	6.1
REQ-07.02-DOD-0001.0010	Dynamically manage the Network Operations Plan	6.1
REQ-07.02-DOD-0001.0011	Assessing Network Performance through all phases	6.1
REQ-07.02-DOD-0001.0012	Enhanced real-time Civil Military Coordination	6.1
REQ-07.02-DOD-0001.0017	Security - collaborative support	6.2.2
REQ-07.02-DOD-0001.0018	Security - resilience and self-protection	6.2.2
REQ-07.02-DOD-0001.0019	Security - transition to implementation	6.2.2
REQ-07.02-DOD-0001.0013	Fuel Efficiency: Reduction in fuel burn for Step 1	6.2.5.
REQ-07.02-DOD-0001.0014	Cost Effectiveness: Reduction in cost per flight for Step 1	6.2.3
REQ-07.02-DOD-0001.0015	Capacity: Increase in airspace capacity for Step 1	6.2.4
REQ-07.02-DOD-0001.0020	Capacity: Increase in TMA capacity for Step 1	6.2.4
REQ-07.02-DOD-0001.0016	Predictability: Improvement in predictability for Step 1	6.2.7
REQ-07.02-DOD-0001.0021	Human Performance – Role of the Human	6.2.12
REQ-07.02-DOD-0001.0022	Human Performance – Technical Systems	6.2.12
REQ-07.02-DOD-0001.0023	Human Performance – Team and Communication	6.2.12
REQ-07.02-DOD-0001.0024	Human Performance – Transition Factors	6.2.12
REQ-07.02-DOD-AMAP.1000	Capacity: Increase in En-Route capacity using VPA in Step 1	6.2.4.2
REQ-07.02-DOD-AMAP.1010	Capacity: Increase in TMA capacity using VPA in Step 1	6.2.4.2
REQ-07.02-DOD-AMAP.1020	Fuel Efficiency: Reducing emissions and fuel consumption with better use of airspace and more direct profiles in Step 1.	6.2.5.2
REQ-07.02-DOD-AMAP.1030	Safety: Improvement due to the enhanced alignment of demand & sectorisation in Step 1	6.2.5.3

Table 7: List of the relevant DOD Requirements

2.2 Operational Concept Description

2.2.1 Advanced Flexible Use of Airspace

The concept of AFUA provides more flexibility to all users by allowing dynamic airspace management in all phases of the operations - from initial planning, the execution phase and post-operational analysis phase.

AFUA concept in SESAR's time based environment (Step 1) implements structures that are designed to optimally fulfil military needs and better share the airspace resources with all airspace users.

Implementation of AFUA concept Step 1 provides for:

- **Military:** The dynamic management of airspace will allow the planning and management of military operations much closer to the time of operation if required. The automation provided by ASM support tools improves the civil-military decision making process and gives additional features, like forecast, which improves visibility and transparency in planning and execution phases. It ensures the optimum satisfaction of military Airspace requirements.
- **Civil:** The dynamic management of airspace will allow the planning and management of a better Demand and Capacity Balancing at the three levels of airspace management
- **All:** In order to ensure optimum use of available airspace by all airspace users, the need for direct co-ordination and a collaborative dialogue between civil and military Local Network Management agencies (AMC, ACC…) and the Network Manager will require system support and communications to allow for real-time updating of the airspace database (in planning and execution phase). This will provide improved coordination between military and civilian airspace users and an enhanced mutual awareness of airspace activity of both civil and military operations. Additionally, this more effective and flexible use of the airspace will increase capacity by reduction of the workload at Execution phase.
- **Network operations plan** implements the Network Strategic Plan at operational level for the next 2 – 5 years. Consequently it focuses at operational implementation cascaded down into shorter term plans down to the daily level. It includes the route network improvement plan ERNIP and the scares resources plans. It addresses:
    - Re-enforcement of capacity planning;
    - Airspace design and utilisation actions;
    - Use of network planning tools and data;
    - Preparation of system changes/special events;
    - Deployment of flight efficiency improvement actions;
    - Proposals and support for operational improvements;
    - Network procedures (ATFCM/ASM/ATS);
    - Deployment of network systems and programmes.

  The planning and execution phases of operations are reflected in NOP:

- **Before Day of operations:** Local and Regional actors (ACCs, AMCs) in close coordination with Network Manager will assess the impact of airspace demand and develop solutions through a CDM process to optimise network, regional and local capacity. This process will be continuously an iterative and interactive development and refinement of the forecast that is built into an AUP (UUP) promulgated the day before the operations.
- **Day of Operations:** Changes to the Network Operations Plan will be coordinated amongst the relevant network actors. Such short notice requests for route activation and updates of military requests, significant weather phenomena, unexpected ground or space infrastructure opportunities/limitations, critical events, etc. should be coordinated through integrated and user-friendly systems permitting a shared situational awareness and a pertinent decision making process; thus, exploiting the airspace in a dynamic manner (but still within the ASM planning process), minimising the impact of any disruptions and taking benefit of any opportunity. Any airspace changes would be shared through UUPs promulgation and update of the environmental database.

The following operational improvements are relevant within the scope of AFUA/ASM OFA:

- Provide static and dynamic airspace data in a standardised AIXM format as a common basis for Airspace Management and AIM Operations.

- Improve the ASM/NM interoperability by developing and validating the interface between ASM support systems and NM systems allowing sharing information on airspace planning and real time airspace status.
- Analyse the impact of VPA management on the current NM operations and systems to validate the use of modular ARES (Airspace Reservation/Restriction) and the benefits provided by this concept.

- **Moving Airspace Management into Day of Operation**

  Allocation of airspace reservation (ARES) through more dynamic airspace management enabling dynamic responses to short notice civil or military airspace requirements (up to 3 hours before operations) or very short term changes (e.g. bad weather). This relies in particular on increased collaboration between ASM/ATFCM partners and scenarios providing flexibility with regard to daily airspace and route requirements, and adequate highly reactive system support [AOM-0201 – to be considered as context for Step 1].

- **Variable Profile Areas (VPA)**

  Modular temporary airspace structures and reserved areas are introduced to enable sub-divisions, new areas or revised airspace requirements closer to air bases (60 NM radius) and define different airspace scenarios to all geographical levels. The design of Variable Profile Areas is a common principle used in the European airspace design; it is part of the Advanced Airspace Scheme (AAS) operational concept evolved from the DMEAN operational concept.

  The objective is to offer greater flexibility to accommodate military requirements by defining different airspace scenarios with acceptable network impact through extension or sub-division of military training areas (TSA/TRA/CBA) adjusted to match the military training and operational requirements for each type of mission [AOM-0206-A].

- Enhanced civil-military coordination, including real time status of airspace update, for ASM using B2B services between local ASM support system and NM systems and integration of airspace status from ASM system into ATC system. B2B exchanges comprise AUP and UUP exchange and the ability for the local ASM support system to send updates of static airspace data to the NM system to be validated on the next AIRAC cycle. Additionally, ASM, NM and ATC systems shall be able to process real time airspace status data. ATC actors (e.g. ATCO) automatically receive real time airspace status information update from the local ASM support system and / or input such real time airspace status information actively via their individual CWP into the ATC system that processes it further into an ASM support system [AOM-0202-A].
- **Real-time coordination is further enhanced through "what-if" functionalities** and automated support to airspace booking and airspace management (e.g. integrated toolset allowing the Local Airspace Manager (AMC) and other parties to design, plan, allocate, open and close airspace structures on line on the day of operations) [AOM-0202-A] (coordinate with OFA "Airspace Management and AFUA")

- **Flexible military airspace structures**

  The activation of ad-hoc airspace structure (ARES) within predefined airspace configuration at short notice is offered to respond to short-term airspace users' requirements. In Step 1, changes in the airspace status are not uplinked to the pilot yet but are shared with all other concerned airspace users by the system, i.e. Network Manager (ASM and ATFCM functions), ANSPs, civil and military Airspace Users (FOC/WOC) [AOM-0206-A].

The possibility for ad-hoc structure delineation at short notice is offered to respond to short-term airspace users' requirements not covered by pre-defined structures and/or scenarios. Additionally, changes in the real-time airspace status are to be uplinked (Step 2) to the aircrew by the system. The objective is to better respond to military airspace requirements and/or meteorological constraints while giving more freedom to GAT flights to select the preferred route trajectories and to achieve more flexibility from both civil and military partners.

- **Harmonised EUROCONTROL ECAC area rules for OAT-IFR and GAT interface (EUROAT)**

OAT operation across Europe is improved by harmonising relevant national OAT rules for pan-European IFR-OAT.

The needs of military aviation and ATM support are often beyond the scope of civil aviation and therefore not sufficiently covered by ICAO provisions for General Air Traffic (GAT). This requires the military to use Operational Air Traffic (OAT) as the means to provide the regulatory provisions and ATM arrangements necessary for successful military training and mission accomplishment.

However, each State has developed different OAT rules, which need to be harmonised in line with the Functional Airspace Blocks (FAB) principles. Therefore, the EUROCONTROL Member States requested the Agency to develop EUROAT (harmonised European OAT rules for IFR-OAT) and OATTS (which aims at harmonising the IFR OAT transit service) to further enhance civil-military coordination and in particular to progress and implement the interoperability of GAT and OAT structures and operations, [AOM-0301 – to be considered as context for Step1].

- **Further improvements to route network and airspace including cross-border sectorisation and further routeing options**

The route network continues to be enhanced in accordance with Advance Airspace Scheme principles to further optimise airspace structures (route/sector) across airspace boundaries, to better align routes and sectors with traffic flows and to accommodate more efficiently the various types of airspace users (e.g. specialisation of routes and sectors where needed to enhance productivity and reduce controller workload). An increasing number of cross-border ATC sectors will emerge to support improved flight trajectories along with FABs development. More and more route options are made available thanks to flexible use of airspace and predictability of those options will increase.

This step is unavoidable before the target concept; routes will continue to characterise the airspace for the most part while optimum trajectories may be used in selected airspaces. Routes will be based on principles of route network design and sectorisation independent of national boundaries and adapted to main traffic flows.

- **Allocation of Airspace/Route structure though dynamic management**.

The system provides support for decision making based on pre-defined sector sizing and constraint management in order to pre-deconflict traffic and optimise use of controller work force [CM-0102-A – to be considered as context for Step 1] (addressed by WP4; to be coordinated with OFA “Enhanced ATFCM Process”).

2.2.2 Expected operational improvements:

As a result of the implementation of AFUA concept following operational improvements are expected:

- A harmonized airspace structure design dependent on the different types of mission;
- Continuous planning process enabled by system support and sharing of information in real time;
- Harmonized Collaborative Decision Making (CDM) processes enabled by information sharing process, common automated tools and standard procedures;
- Automated display of future airspace demand and coordination of airspace status changes (at ground and airborne level) during mission planning as a traffic prediction;
- Automated display of airspace status and coordination of airspace status changes (at ground level only for step 1) during mission execution in real time;
- Dynamic modification of airspace structure and associated route network;
- Moving pre-tactical airspace management into the day of operations;
- 'What-if' tool functions designed to enhance collaborative decision making between civil and military Local Network Management agencies;
- Easily interpretable visual display which allows Local Network Management agencies to understand fully the impact of airspace allocation decisions and provides the ability to fine tune airspace allocation in order to make best use of available airspace (e.g. iADS);
- Mutual awareness of airspace demand and the factors affecting the demand, as well as a graphical 'what-if' function to simulate changes to requested bookings and aircraft routings, improves coordination and allows airspace capacity to be optimized for the benefit of both civil and military airspace users at local level, as well as contributing to network level optimization.

2.2.3 Expected benefits

Implementing AFUA concept shall provide benefits in different areas:

- **Safety**: the sharing of the airspace planning and the real status will provide common situation awareness to all ATM actors.
- **Environmental sustainability**: the flexibility provided by the implementation of VPA will offer more plannable airspace. It will contribute to reduce emissions through the use of more optimum trajectories.
- **Capacity**: facilitating the sharing of used military training areas will increase the capacity when and where needed for the benefit of civil airspace users whilst safeguarding the military mission effectiveness. The ARES will be tailored to the individual mission meeting the real need. The availability of ARES status information in real time will additionally improve the situational awareness for the DCB process in order to optimise the airspace configuration.
- **Efficiency**: thanks to VPA design principle the military will have the real volume of airspace needed for each of their missions. Defining the segregated areas based on mission requirements will provide more airspace available for the other airspace users and more options for optimal routings.
- **Civil-Military cooperation & coordination**: The implementation of VPA will offer several combinations of modules to allocate the requested volume of airspace and additional opportunities to accommodate traffic flow demand with military mission needs. It should facilitate the negotiation process to allocate ARES. The implementation of VPA will provide opportunities to accommodate traffic flow demand with military mission needs and will improve efficiency.

2.3 Processes and Services (P&S)

According to SWPB4.2 Initial service Taxonomy document [6] the AFUA concept is part of The Air Traffic Management (ATM) Network Management Service Group.

The ATM network management service group assures stability of the whole ATM network coping with the traffic demand and also threats such as weather phenomena and loss of significant assets as airports or runways for whatever reason.

2.3.1 Processes

Relevant AFUA processes have been transformed into and described using the Business Process Model and Notation (BPMN).

Models from 07.02 can be viewed directly on the European ATM Architecture portal, which is updated twice a year, after each EATMA iteration cycle. OFA 05.02.01 activity views can be found on:

OFA05.03.01 Airspace Management and AFUA;

For a quick reference Table 8 lists the processes with a short description.

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	
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	

Table 8: List of Processes

2.3.2 Services

The following functional services are defined to support the AFUA processes defined in previous chapter.

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 9: Services

These services are supported by IER services. Taking into account the SOA architectural principles, the high level business processes covering the IERs have been purposely decomposed into several autonomous services instead of doing a naïve one-to-one mapping between business processes and SOA services.

As an example, a general service "Negotiate Airspace Reservation" service that would have covered all the business activities about Airspace reservation could have been proposed. Rather, the Negotiate Airspace Reservation business process has been decomposed into 5 different SOA services (see below).
One of the reasons is to make the services more reusable, more stateless and more agnostic.

For example, the "Query Airspace Reservation" function has been taken out of this business process so that this service can be used by any actor in the ATFM community outside any actual reservation request.

Following this principle, 10 services to cover the interactions of the fore-mentioned IERs have been identified:

- Query Airspace Reservation service
- Submit Airspace Reservation service
- Negotiate Airspace Reservation service
- Query Regional AUP
- Submit local AUP
- Negotiate local AUP
- AUP simulation service
- Activate Airspace Reservation service
- Deactivate Airspace Reservation service
- Query Airspace Activations service

The AFUA principle requires ASM support systems and NM system to share a common definition of Airspace static data. As illustrated in **Figure 2 Static Airspace Status update**, connecting the ASM support systems with the NM systems will provide static airspace data and AUP / UUP update to NM systems, facilitating as an initial step the collaborative decision making process.

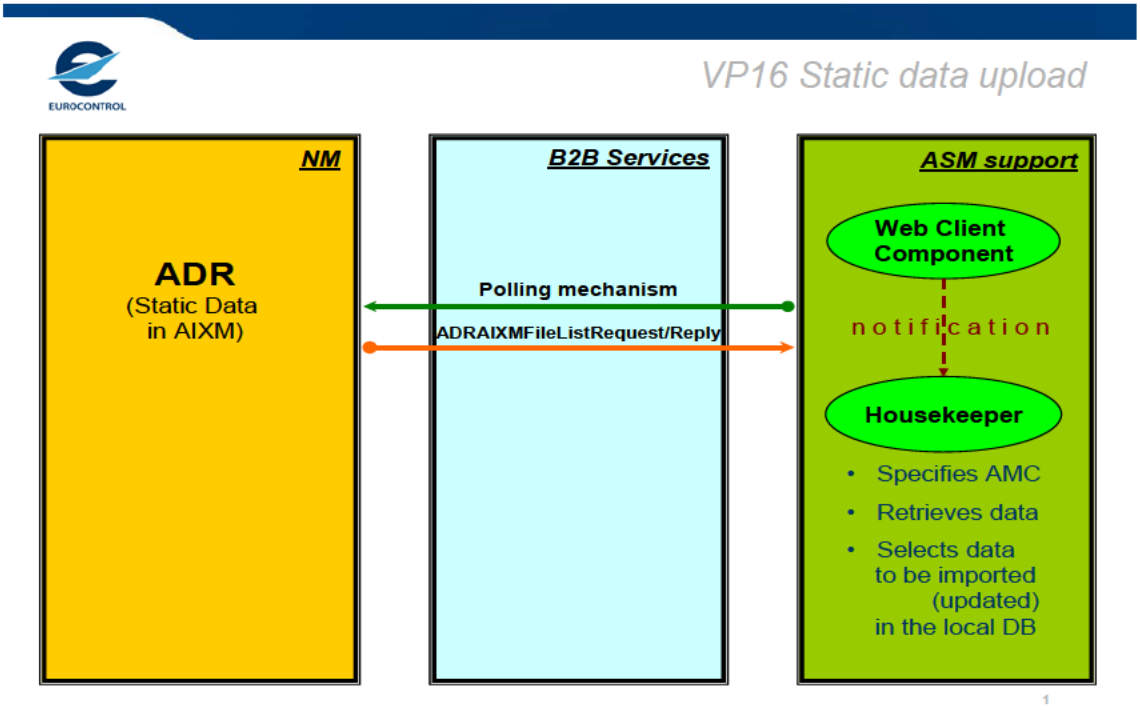

Figure 2 Static Airspace Status update

The short term planning and execution phases require the sharing of updated information on airspace usage. Therefore, ASM support systems will provide static airspace status and AUP / UUP updates (RTSA). The validation activities [11] further refined the interoperability requirements [12] to interface ASM support systems with NM systems in order to provide automatically the static airspace and AUP / UUP data to the network managers and the FMPs.

For the connection between the ASM support system and the ATC system (**Figure 3: Information flow of real time update of ARES status**), the following procedures and technical specifications will be developed:

- Activation/de-activation process of an ARES, automated until the update on the controller working position;
- Interface ASM support systems with ATC systems. As it is considered that the NM and the ATC systems are known as they represent current existing systems in operation, the ASM support systems will be explained below.

The validations demonstrated the feasibility and the operational benefits of updating the real airspace status automatically in ATC systems via ASM support systems.

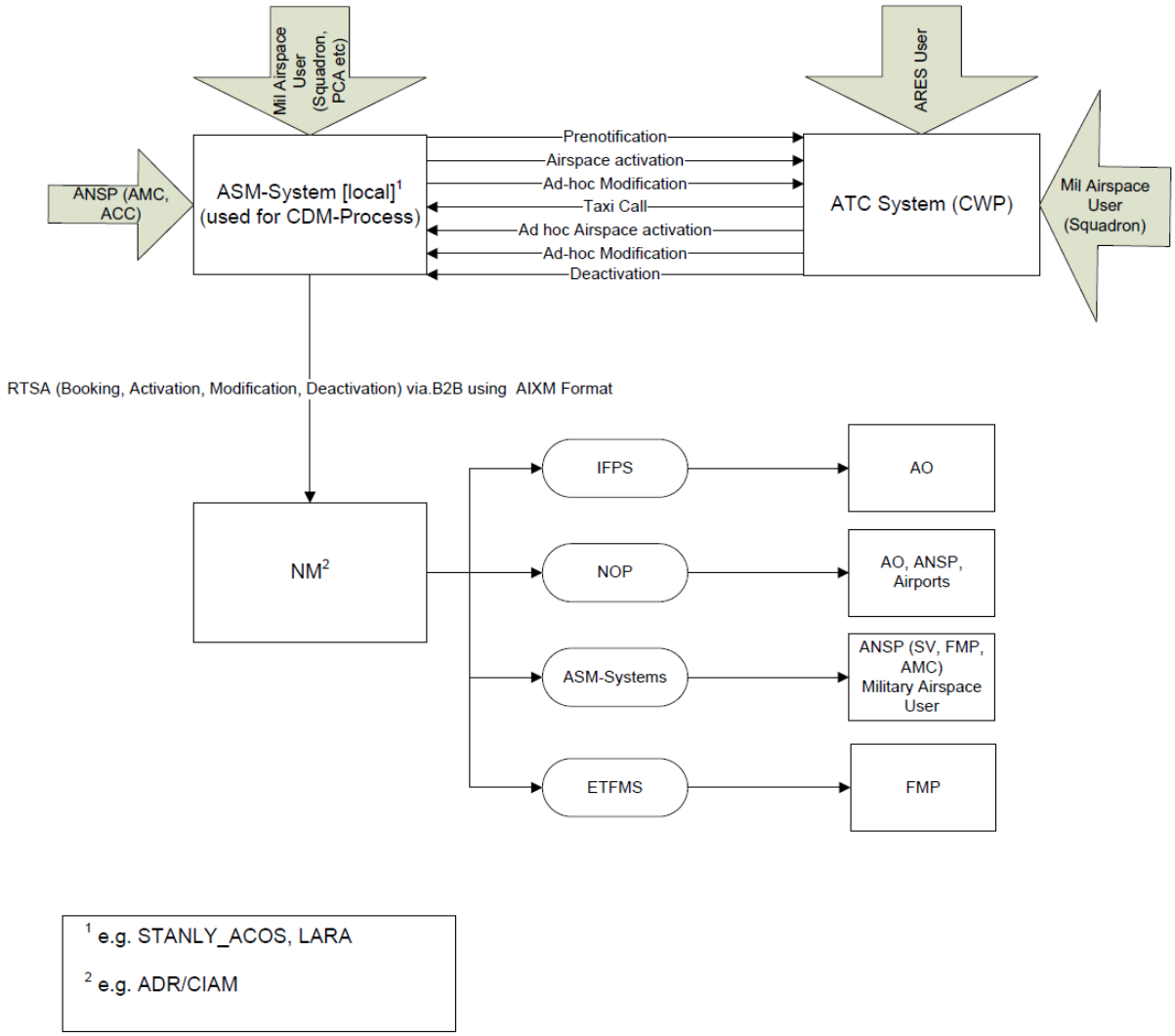

Figure 3: Information flow of real time update of ARES status

2.3.3 Mapping to Service portfolio and Systems

Section 5.2.5 of DOD [9] is transformed into and available in the models from 07.02 on the European ATM Architecture portal, which is updated twice a year, after each EATMA iteration cycle.

The OFA05.03.01 activity views can be found on:

OFA05.03.01 Airspace Management and AFUA;

3 Detailed Operating Method

3.1 Previous Operating Method

The current operating method is based on (EC) Regulation 2150/2005 of 23 December 2005 [5] laying down common rules for the flexible use of airspace. Flexible use of airspace is an airspace management concept described by the ICAO and developed by EUROCONTROL in the ASM Handbook [4].

Based on this, States implemented the Flexible use of Airspace, organised their national airspace and developed their own procedures.

The airspace management is organized in three phases:

- Long Term planning phase,
- Medium-Short Term planning phase,
- Execution phase.

3.1.1 Long Term Planning phase

A High Level Airspace Policy Body (HLAPB) is established at national level. It formulates the national Airspace Management policy. It is responsible for:

- Airspace design;
- Definition of rules and instructions for the usage of airspace;
- Prioritisation;
- Reassessment of national airspace.

It is agreed that certain types of activities require ARES for their exclusive use and for a limited period of time. Different models of ARES are defined. All of these area types may be Airspace Management Cell (AMC) manageable or not AMC manageable. The conditions of tactical crossing depend on the type of operations conducted within the areas. They are published in the national Aeronautical Information Publication (AIP).

For particular operations, the airspace can be reorganised for a limited period of time corresponding to these operations and in coordination with all airspace users and service providers impacted. Normally, temporary airspace structures are published in an AIP Supplement (AIP SUP) or NOTAM.

In addition to the ATS route network, Conditional routes (CDR) are designed to allow more direct or alternative routes.

At least yearly, the HLAPB should:

- Establish joint civil/military processes for the periodic assessment of airspace efficiency and effectiveness of procedures at all three ASM Levels;
- Ensure the definition and application of AFUA KPAs and KPIs to monitor ATM performance against civil and military airspace users' needs at national and network level;
- Assess AFUA effectiveness in terms of the impact on civil and military airspace users, ATM provision and civil/military coordination;
- Ensure the use of KPAs of safety, capacity, cost-effectiveness and environment to measure the efficient and flexible use of airspace procedures and operations NM systems, ASM support systems and ATC systems should record and store data related to those KPAs/KPIs.

- Define rules and instructions on how to manage airspace at Level 2 and level 3.

3.1.2 Medium-Short Term Planning phase

Medium-Short Term planning phase consists of the day-to-day management and temporary allocation of airspace through national or sub-regional AMC and in coordination with the NMOC.

The AMC receives the AU's planning, organises the coordination and allocates the airspace. A draft Airspace Use Plan (AUP) is forwarded to the NM through the "CFMU Interface for Airspace Management" (CIAM).

The NMOC promulgates the European AUP (EAUP), consolidating all national AUPs, that is used by Aircraft Operators (AOs) for flight planning purpose.

The AMC refines the airspace allocation with information received from Approved Agencies (AA). Some countries draft an Updated airspace Use Plan (UUP). It can be used at local or sub-regional level only or forwarded to the NMOC for the promulgation of EUUPs.

3.1.3 Execution phase

The Execution phase, embedded in the day of operations, consists of the real time activation, deactivation or modification of the airspace allocated in the planning phase.

ARES is activated by the authorized unit, e.g. ATS/ADU and/or AMC, responsible for airspace management in the area. The activation information may be relayed to other affected units through the use of telephone or ASM support systems. The activation of a planned ARES is notified with a pre-notification of "x minutes"[1] (parameter) allowing the controller to tactically re-route the traffic that could interfere with the area.

In the event that the ARES is not activated and/or used according to the time parameters specified on ASM Level 1, the authorized unit/ATS and/or AMC will ascertain user intentions.

3.2 New SESAR Operating Methods

3.2.1 General

This section describes new operating methods introduced by this concept.

This AFUA concept focuses on the implementation of the following new Airspace management related improvements in Step 1:

- the VPA design principle, and
- the sharing of airspace planning and real time airspace status between national Airspace Manageable Cells, ATC, FMPs, FOC/WOCs and Network Manager.

[1] The parameters behind "x minutes" are not specifically quantified because they can depend on, or express particular operational needs. The value of that parameter, nevertheless, does not affect the described concept elements.

3.2.2 Assumptions

For the development of this OSED following assumptions were made by the SWP 07.05.04 project:

- AMC non manageable airspace will be still considered in AFUA;
- ASM support systems are implemented and interoperable;
- ARES can be static or flexibly managed in accordance with VPA design principles, depending on the mission characteristics;
- SWIM partially implemented and operational via B2B services[2];
- ARES user can be airborne, ground or maritime based user.

3.2.3 Airspace Organisation and Management Process

In Step 1, this process does not differ to the existing process with the 3 Levels of Airspace Management as described in section 4.1.

HLAPB is established at national level and may have an equivalent entity at FAB level depending on the agreements between States.

HLAPB is responsible for analysing and possibly modifying the design of ARES according VPA principles when such modularity is considered as the best solution.

Because HLAPB activities are by nature political and administrative, processes cannot be described as they can be at the other levels of management.

A modular design (VPA) for new airspace requirements is introduced to enable sub-divisions, new areas or revised airspace requirements closer to air bases (maximum 60 NM radius) and define different airspace scenarios to address local, sub-regional and network impact. The design of modular ARES shall become a common principle used in the European airspace.

3.2.3.1 Long term planning

This planning could start years in advance. The military develop their national training policy and plans. National and international exercises are coordinated between military authorities. Airlines operators develop their business model and identify future flight programmes.

Supported by the WOC/FOC, data related to the long term planning are shared as soon as they have reached a certain level of maturity. Those data are refined when additional information is available. At an early stage, data are limited to the following type of information:

- Planned exercises: data related to planned exercises shall include as much as possible dates, impacted FIR/UIR, volume of flights, concerned airspace portions/volumes, general time slots;
- Volume of flights expected for each exercises; distribution between Visual Flight Rules (VFR) and Instrument Flight Rules (IFR);

[2] SWIM compliant services were not used (and thus not validated) in VP-710 exercise. However, from a concept point of view, the Assumptions listed in this section and throughout the document were confirmed with regards to the new operating methods. It means then that there is a gap in the Validation: the validation of the SWIM compliancy of the services that should be done during the Industrialisation phase. The OSED is right with the concept but unfortunately the validation exercises didn't allow validating SWIM compliant services but services which are similar in the logic.

- Special events having an impact on the network e.g. International Conference Summit, Olympic Games, Air Shows, Competitions, etc.
- ANSPs' needs (modification of airspace structure, new routes, etc.)

For those who are equipped, those data are loaded in the ASM support system. Those data are available also in the Network Operations Plan (NOP). A flow chart showing the process and actors involved is depicted below.

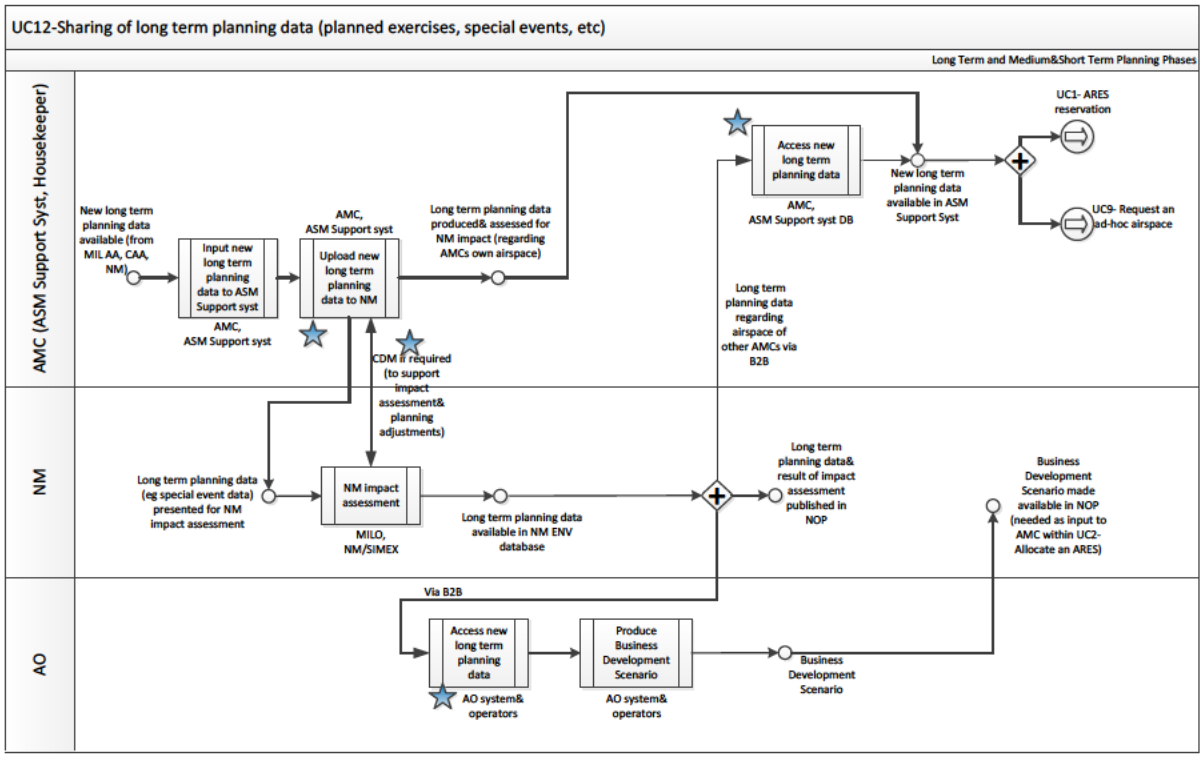

Figure 4: Long Term Planning Process

3.2.3.2 Medium / Short term planning

Medium/Short term planning is shared by all airspace users with the NM system through the NOP:

- With the support of an ASM support systems, the military share their airspace needs,
- Civil airspace users provide their flight intentions,
- ANSPs express their expected airspace needs.

The system shall highlight conflicts between airspace demands.

This information is shared in real time with all actors connected via SWIM to the NM system. The planning process is improved by sharing the planning in real time.

However, an initial de-confliction is made from the military side between military requests and from the civil side between the civil requests with the support of the ASM support systems before the AMCs start analysing the impact on the network in their respective areas of responsibility.

The AMC, at sub-regional and local levels, analyse the airspace demands, identify conflicts and coordinate with the requestor to solve conflicts.

Supported by What-if and simulation tools, the Regional Network Manager and the Airspace Managers verify the network performance and propose alternatives solutions to the airspace users (civil and/or military).

As soon as the network reaches a certain level of stability, and not later than X (parameter) hours before operations, the Network Operations Plan is agreed and requested airspaces are allocated.

The Network Operations Plan is accessible to all actors through SWIM.

The military provide their airspace planning linked, or not linked, to a trajectory, e.g. specific military activities like gunnery exercises are not linked to a trajectory, and are considered as constraints. These activities are in general constraints to ground facilities and can't be moved. Any parameters like weather forecasts are taken into account for updating the trajectory and the linked airspace volumes.

The system shall identify the trajectories impacted by the airspace volume. A warning shall be provided to the trajectory owner for updating the trajectory.

The airspace users update their trajectory according to these constraints or trajectory linked airspace volumes.

The Airspace Managers in coordination with the Regional Network Manager continuously analyse the impact on the Network. As soon as the network reaches a certain level of stability, and not later than X hours before operations, the initial Shared Business/Mission Trajectories (iSBT, iSMT) are agreed and become initial Reference Business/Mission Trajectories (iRBT, iRMT). The associated airspace volumes become Reference allocated.

Based on the initial data available, traffic forecast and specific constraints already known (e.g. low capacity, special events, high complexity), the Network Manager in coordination with the airspace managers perform an impact assessment and applies the resulting measures in order to ensure optimum sector configurations.

The result of CDM is accessible to all actors in the NOP via SWIM.

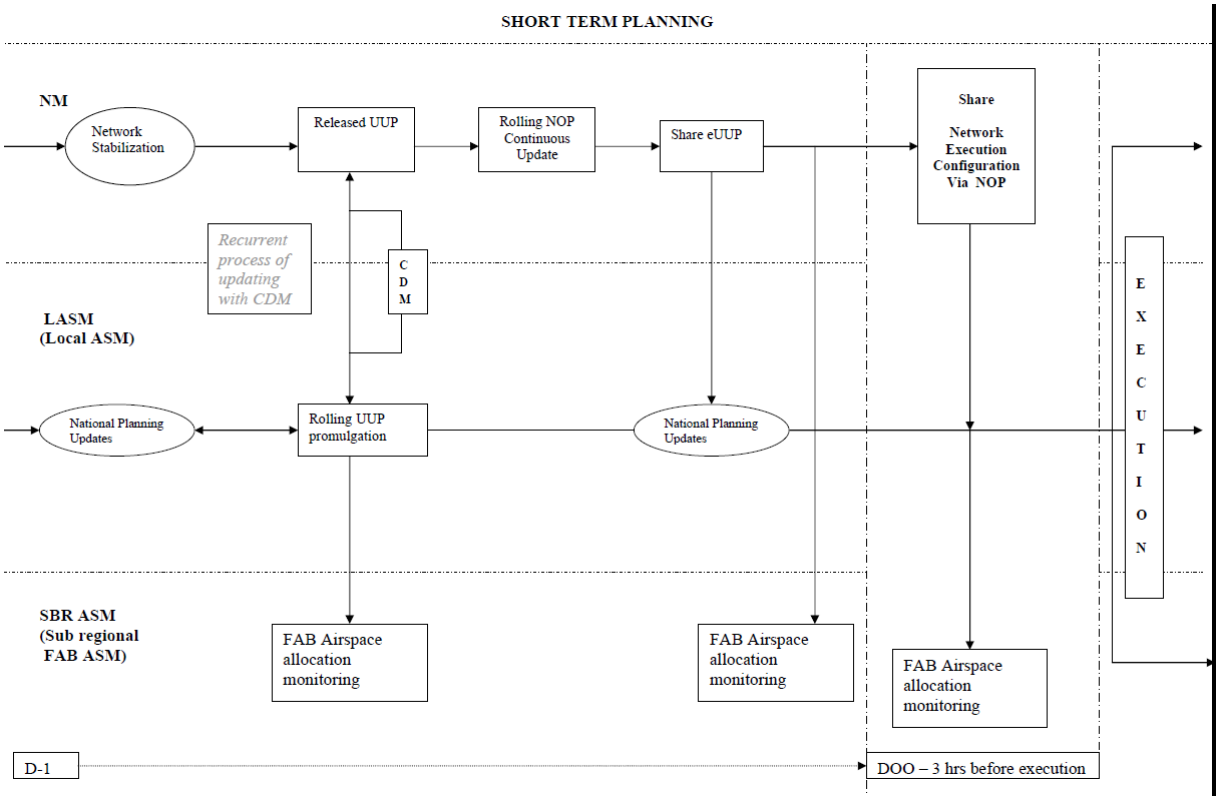

Figure 5: Short Term Planning Process

3.2.3.2.1 Sharing airspace planning

The targeted situation is a continuous airspace status update and sharing process in real time. With the support of automated ASM support systems and NM systems, the planning is shared continuously between all actors in real time. Therefore related updates allow an assessment, notification to users and initiate a potential flight plan change process.

The data on real time use of the airspace will enable more precise tactical capacity management by the local or sub-regional capacity managers. Following the input of precise real time data, impact assessments at local and regional levels can be triggered in order to reflect potential changes of capacity available.

Starting at the strategic phase, impact assessments should be done at local and regional levels. Figures can be developed and agreed with all FMPs. In such a way, the tactical link between ASM and NM will be ensured.

In any case, the ACC/UAC concerned and the local NMF will always remain the final decision making body based on the real-time capacity values/rates and the opening scheme.

In case of new availabilities of areas previously allocated, the process will ensure that capacity made available will not be wasted and used whenever possible.

Where time buffers exist for the CDRs to be made available for planning, the airspace is often not made available at all due to short deactivation period. With real-time airspace information made available to the regional manager the airspace which was not available before due to imposed time

buffers will be available immediately and will be available for a longer period of time for planning, thus providing additional flight efficiency.

The network manager will use the information about real use of the airspace in order to improve the flight profile of those eligible flights that could take benefits from the information about the new airspace status.

As soon as the real time data about ARES is made available to the network manager, the network manager Flight Efficiency Support position (AOLO) will identify flights that may benefit from these opportunities and rerouting proposals will be sent to the relevant AOs whenever eligible flights are still in the conditions to re-file their FPL. Considering the tactical nature of the airspace changes, some eligible flights could be already flying; in this case, tactical ATC interventions are applied. A flow chart showing the process and actors involved is depicted below on Figure 6.

3.2.3.3 Execution phase

In case of new availabilities of areas previously allocated, the process will ensure that capacity made available due to unplanned and unpredictable tactical changes will not be wasted and used whenever possible.

The Execution phase of AFUA consists of the real-time activation, deactivation or modification of the airspace allocated in the planning phase.

The activation is notified with an automated pre-notification and visualisation on CWP of “x minutes”[3] (parameter) allowing the controller to clear the ARES airspace volume before being activated.

The dynamic airspace management enables responses to short notice civil or military airspace requirements (up to 3 hours before operations) or very short term changes due to bad weather for example. Due to operational or weather considerations, civil and/or military ATS units and/or controlling military units can, after adequate co-ordination, amend the published AUP/UUPs decisions concerning the availability of a CDR or the allocation of an ARES. The change could also be a new ad hoc request for airspace allocation. This requires consideration of various issues, including:

- The control of access into the airspace in which the ARES is situated;
- Any adverse impact on the ATFCM measures in force;
- Any significant effect on eligible flights, which had planned to fly or operate along potential CDRs on the basis of related (potentially outdated) information in the AUP/UUPs;
- Possible impact on sector configurations.

It must allow the network, either to take benefit from early release, cancellation, or to cope with timeframe extension if required at very short notice. Additionally, the information about activation, de-activation and potential modification will be distributed via the NMF to related stakeholders using an automated process in real-time.

In case of new availabilities of areas previously allocated, the process ensures that capacity made available is not wasted and used whenever possible. This benefits the overall NM process.

X minutes (parameter) prior the activation, calculated from the first user entering the area or from the very first activity starting inside the area, the responsible unit initiates the process of activating the

[3] “X minutes” in this scenario was not a subject of the validation. It should be defined according the particular operational need.

area. With the support of the ASM support systems and connected ATC systems, this process is automated. Any military controlling unit or ATS unit impacted by the activation is notified accordingly.

It is foreseen that this process is fully automated including the update on the Controller Working Position (CWP) display.

The same process is followed for the de-activation of the ARES. However, there is no pre-notification for de-activating an ARES. It is effective immediately.

ARES is activated by the authorized unit e.g. ATS/ADU and/or AMC responsible for airspace management in the area. The activation or de-activation information will be relayed to all related units, using automated ASM support systems.

Activation, modifications or de-activation of an allocated ARES may in certain circumstances lead to the revision of a flight trajectory and/or FPL. This revised trajectory is coordinated between the AO, the pilot and the ATCO. A flow chart showing the process and actors involved is depicted below on Figure 6.

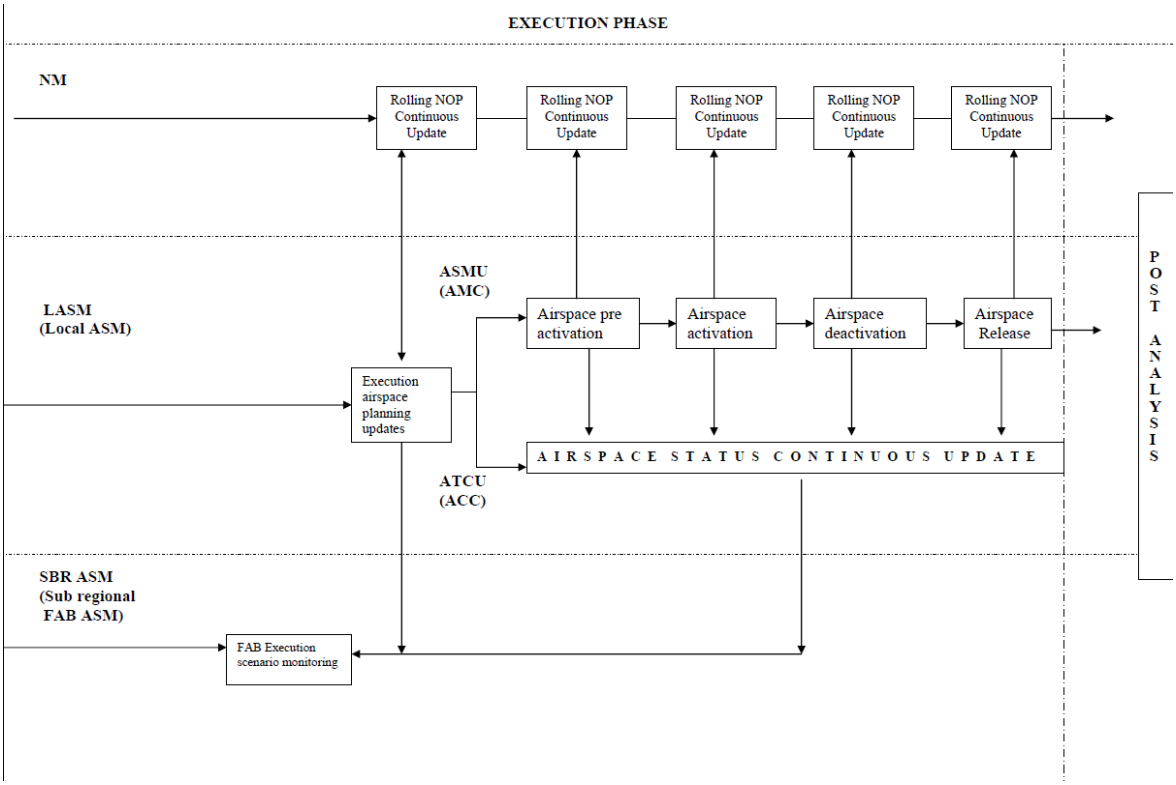

Figure 6: Execution Phase, process and actors

3.2.3.4 Post Flight analysis

This phase starts directly after on block time following the landing of an individual flight. Analysis activities should start after having available all pertinent data to the operation, in order to assess the performance of AFUA. It is important to continuously monitor the efficiency of the AFUA in order to adapt and improve it when necessary.

The performance targets according to Validation Strategy and Integrated Validation Plan for SESAR Step 1 for Network Operations (WP7) [8] are:

KPA	KPI	OFA Code	Step	Perf Target
Safety	Safety Improvement	OFA05.03.01	S1	-0,24%
Environment - Fuel Efficiency	Change in Average Fuel Burn per Flight	OFA05.03.01	S1	-0,19%
Airspace Capacity - TMA	Increase in IFR Movements per airspace volume per unit time (most challenging TMA environment)	OFA05.03.01	S1	0,25%
Airspace Capacity - En-Route	Increase in IFR Movements per airspace volume per unit time (most challenging En-Route environment)	OFA05.03.01	S1	1,00%

Table 10: Performance targets per KPA/KPI

It is also important to identify KPAs and KPIs related to military airspace users that are the primary users impacted by the implementation and the application of AFUA. It's why it is also important to take into account KPAs and KPIs defined in EUROCONTROL Specification for the Application of the Flexible Use of Airspace [7] that are still relevant for monitoring the efficiency of AFUA.

3.2.3.4.1 Other considerations

The following issues are not addressed as KPA / KPI, but are of utmost relevance and mandatory for the AFUA concept:

- Connection between ASM support system and NM system:
  - Static airspace update
  - AUP / UUP update
- Connection between ASM support system and ATC system:
  - Display on Supervisor position
  - Display on CWP
- VPA beneficial to "old" ARES
  - Capacity in ATS Routes Network operational environment
  - Flight efficiency
  - Fuel burned
  - CO_2 Emissions

The further delineation of KPA and KPI is shown in the SESAR 07.05.04 SPR document. It includes the "Military Mission Effectiveness" KPA which is not considered in SESAR at all, but, seeing AFUA as CDM approach, consequently mandatory to be developed and respected.

3.2.4 Fixed airspace structures

For specific missions and under certain circumstances, fixed airspace structures (TSAs/TRAs) shall remain. The following list provides reasons why fixed structures will still remain:

- The activity is linked to ground installations.
- The area is close to an airbase limiting transit time. It shall be noted that the airbase locations were often defined for historical and political reasons to protect the population from possible threat. An economic dimension also exists (provision of employment opportunities in sparsely populated areas).
- In high traffic density area (TMA around large airports), the creation of new areas shall be avoided.
- Geographical position and average traffic demand: that location was chosen because the impact on other airspace users was limited.

- Due to terrain issues: limited training over mountains e.g. no supersonic flights in winter – equipment limitations (A/C capability).
- Legal issues (no supersonic above land or UAS only in restricted areas and not above high density of population).
- Environmental issues: e.g. low level flight over cities above x inhabitant per square meters is not authorized or limitations for supersonic flights for example, etc.
- Existing fixed route structure that limit the possibility of creating new areas.
- Sharing the information on airspace activation (e.g. in cases of new reservation or in-flight ARES request/modification).
- Safety issues.

Any of these particular reasons should be taken into account before designing a VPA.

3.2.5 Concept of VPA

3.2.5.1 General

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. An ARES designed in accordance with VPA principle can be any type of airspace reservation or restriction as defined by the SES Regulation [5] consisting of either individual or a combination of modules.

In a trajectory environment as defined in the SESAR Step 2 concept, the ARES will be fully embedded in the trajectory and negotiated through collaborative decision making process (CDM). In the concept of VPA, ARES modules are flexibly configured matching operational needs by requesting the number of modules appropriate to the individual mission.

Free route and fixed route network environment are considered in Step 1 and Step 2 SESAR concept. All phases of the flight from trajectory development to post flight analysis are described.

Civil and military airspace users are considered as ARES users in this process.

3.2.5.2 Creation of ARES according to the VPA principle

The ARES VPA modules are designed to facilitate multiple airspace allocation solutions suitable for various mission profiles as well as to fit the overall network with regard to the ARES VPA grid size and shape. The representation in **Figure 7: Example of a VPA** is an illustration only.

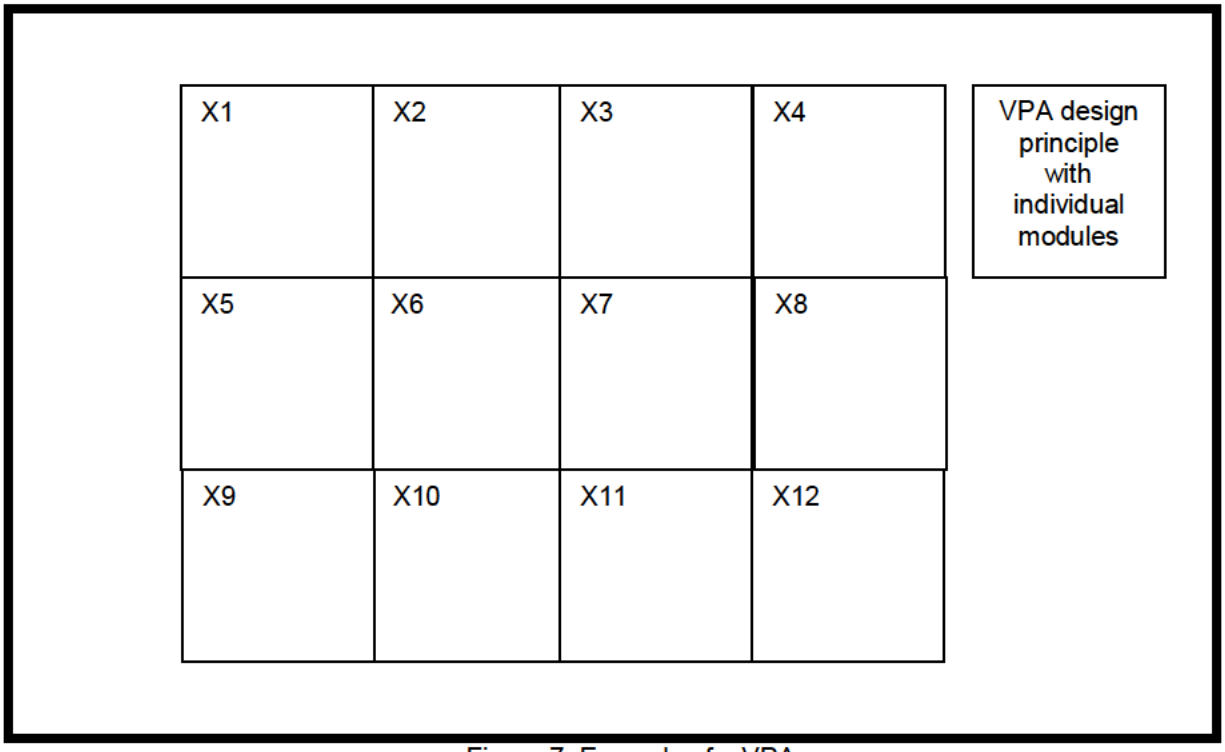

Figure 7: Example of a VPA

The basic unit, a module, shall be defined by the HLAPB. However, some principles are identified:

- The construction of the ARES modules shall allow the maximum of flexibility and offer several combinations that can fit the individual airspace users' needs.
- Smaller basic unit volume provide more flexibility, particularly interesting in a high density traffic area e.g. 15x15 NM;
- Vertical limits shall be adaptable depending on the mission type, mission objectives, aircraft capabilities, etc.;
- Any combination of modules shall be possible;
- The type of ARES shall be automatically defined as TSA/TRA, excluding transiting other aircraft than those involved in the mission the ARES was designed for;
- The route network associated with the VPA has been taken into account in the area design to enable capacity optimization and different airspace allocation and rerouting scenarios.

For creation of ARES based on VPA principle in Free Route operational environment following additional considerations need to be taken into account:

- Creating a large training area even into one of the busiest locations of an airspace could be possible if VPA design principles are applied efficiently and the need to do so is identified. This would require further optimisation of ARES usage vs. civil traffic to gain maximum benefits
- Applying the VPA design principle reduces the impact military training has on civil traffic while still allowing the military to carry out their mission objectives as planned.

3.2.5.3 Management of an ARES (VPA design principle)

The HLAPB defines the primacy rules and conditions for the allocation and management of the ARES and the associated route network. A Fixed Route Network (ATS routes, CDRs) can be designed

within ARES and managed according to the rules elaborated for both planning and execution purposes. The major air traffic flows are the key elements for creating fixed route network.

Partitions of ARES can be allocated to concerned military airspace users at the same time that Free Route Airspace is allocated to other airspace users.

According to the nature of ARES, (segregated), the part of fixed route network concerned will be closed or useable through coordination agreements. This action should limit controller workload in high density traffic areas (limiting tactical rerouting) and increase predictability for the Aircraft Operators (AOs) (more efficient flight planning).

Depending on the mission, the ARES may be fully segregated not allowing the penetration under any circumstances. The degree of permeability shall be included in the request.

The airspace request shall include the levels and time associated to the airspace usage and the degree of permeability.

The VPA modules are requested by the military airspace user and negotiated with the Airspace Managers through a CDM process. The best possible ARES configuration is allocated to accommodate both mission requirements and air traffic flow demand.

In Free route operational environment, management of an ARES (VPA design principle) following additional aspects should be taken into account:

- Optimisation of VPA ARES allocation should take into account aircraft type since that can have a significant impact on fuel consumption and emissions;
- The distance of the MIL areas from the air force base should be optimised as this can cause significant extra mileage to MIL aircraft;
- VPA ARES should be reserved and allocated according to need.

3.2.5.4 Publication

The ARES designed with VPA principles shall be published in the national AIPs. The overall area and all modules shall be identified, named and published.

Status of exact VPAs ARES booking shall be updated on the NOP.

For application of VPA design principle in Free Route environment, the FBZ (Flight plan Buffer Zone) concept should be respected and published on the NOP to notify all users times and the volume of airspace to be avoided for flight planning purposes.

The naming convention can be:

- A “neutral” name, e.g. VPAx.
- Any VPA is primarily defined as a TSA in AIPs, but subject to national, sub-regional or regional decision it can vary.

3.2.6 Airspace status and Real Time Airspace Status Update

Information on the real use of the airspace will be used to verify whether the planned airspace use is congruent with actual airspace use. Thus, in providing such an evaluation, it initiates a new planning process that will allow for a better demand and capacity balancing as well as support for a more efficient and effective use of related airspace configurations. Such activity will automatically trigger, if

decided so after, impact assessment at local and regional level updated flight planning activities but could (or will) only trigger up to date information to achieve shared situational awareness between potential airspace users and the ATCOs responsible for service provision (here potential direct clearances). To steer such CDM processes during the day of operation, including the execution phase, clearly defined procedures and communication standards to enable automated processes have been developed.

So far, for the traffic demand identification, the network manager uses flights plan data updated with the surveillance information (Correlated Position Reports - CPRs) in post-operations analysis. Based on that data, traffic spreading is calculated and taken into account for ATFCM purposes.

The use of information about the real airspace use together with CPRs will allow to better connect the actual status of airspace with the traffic flows, thus will provide opportunity to bring together planning and actual use of ARES.

The planning, updated with real time airspace status data, will ensure shared Situational Awareness (SA). This shared SA is reflected via a shared environmental database to improve network operations.

The following potential benefits for network operations are identified:

- Promote use of the airspace/capacity based on the real time airspace status data;
- Safety improvement (shared SA);
- More accurate and relevant ATFCM measures due to ASM/ATFCM operations based on real use of airspace and not only on intentions/plans;
- Input to Post Ops Analysis and KPA/KPI assessment, thus improving the ASM/ATFCM strategic and pre-tactical phases;
- Once implemented, a Pan-European shared Situation Awareness of airspace utilisation will be achieved.

The completed V3 validation activities showed that in order to take full advantage of RTSA message the following elements need to be refined during industrialisation phase:

- RTSA data content to convey the whole set of airspace status information needed by the concerned stakeholders;
- Level of Automation of FOC and NM tools to improve the impact assessment duration and information exchange (such as eligible flight list, RTSA data, etc.);
- Refinement of CDM processes and procedures (mainly, the FOC and the AOLO function of NM) with regards to the elements mentioned above.

This activity shall involve in a collaborative manner NM and AUs.

It has been showed as well that there is a need to refine the principles for identification of the eligible flights based on AUs' priorities reflected in relative values to their KPIs (for instance the shortest route is not always the most preferable one for the AU).

3.3 Differences between new and previous Operating Methods

This OSED introduces following new operating methods, practises and elements in airspace organisation and management within Step 1 that are in the scope of SWP07.05.04 project:

- ARES in accordance with the VPA design principle to be implemented on a pan-European scale. Such ARES design in accordance with the VPA principle is a combination of several modules that allow more flexibility for the network but still fulfil the military demands.

- In addition, the negotiation process between civil and military will be facilitated with the use of automated ASM support systems enabled to process VPA related data. The different possible combinations of modules provide in the planning and execution phase more available airspace for those flights affected by ARES activation.
- The booking process (request, allocation and use of an ARES) is facilitated by the deployment of (automated) ASM support systems. They provide shared situation awareness to all ATM actors in real time and indicate possible booking conflicts via prediction tools.
- The ASM support systems contribute and support the ASM/ATFCM CDM process by indicating booking conflicts to be solved by the airspace managers at any level: local, sub-regional or regional (network) level, and allowing efficient coordination between actors concerned.
- The airspace planning status and real time airspace status is continuously shared between the actors. Any changes not only of the airspace planning but also of actual airspace status can be taken into account immediately by the airspace managers, ATCOs, FMPs, NM and FOC/WOCs to improve their operations.
- The objective is AMC, ATCO, FMP, NM, and other interested parties are notified about the real time airspace status. Provision, use and sharing of the real time airspace status information on top of the airspace use plans and their updates will:

    - Promote use of the airspace/capacity as soon as it is made available.
    - Enable more accurate and relevant ATFCM measures due to ASM/ATFCM operations based on real use of airspace and not only on intentions
    - Improve Post-Ops Analysis and KPA/KPI assessment thus improving the ASM/ATFCM strategic and pre-tactical phases
    - Potential Pan European Situation Awareness of airspace utilisation

- The sharing in real time of both planned and real time airspace status via the NOP provides a Pan-European airspace situation awareness and contributes to safety improvements, capacity optimisation and flight efficiency increase network wise.
- The process to modify, activate or de activate an ARES is automated to update the CWP, NMF and other connected and interested stakeholders in real time.

4 Detailed Operational Environment

This section describes the expected operational environment for the airspace management services defined in SESAR Step 1.

4.1 Operational Characteristics

This section describes the generic characteristics of the network in which the airspace management services are expected to be used. Assumptions are defined to set up the scene.

4.1.1 Assumptions

To facilitate the reading, ARES means any airspace reservation/restriction as defined in [4]. It is assumed that the military are the primary users of ARES. The processes described in this OSED start when the Military request a volume of airspace. However, this process is identical when a civil airspace user or an FMP requests airspace for specific use.

The ASM functionalities, currently defined in ASM support systems are considered to be an integral part of related Wing Operations Centre (WOC) / Flight Operations Centre (FOC) functions.

As defined in the SESAR concept, the airspace is treated as a single continuum. Any specific airspace users' needs, which impose operational constraints in both space and time, will be accommodated through ARES.

In Step 1, those volumes of airspace remain fixed airspace. ARES are defined at ASM Level 1 and published. The application of VPA design principle to ARES ensures more flexibility in airspace management by providing multiple combinations. The airspace is dynamically managed to provide the most efficient NOP.

The ARES is booked according to the user's needs.

4.1.2 Traffic characteristics

The generic traffic characteristics can be defined as: anytime, anywhere in Europe, busy or quiet in European ATS route network environment (EARNE).

4.1.3 Free routing

In Step 1, the Free Routing concept will be implemented in some areas and as such it becomes an important characteristic of AFUA operational environment. Different implementations of the concept, based on common principles/rules are possible, depending of national/FAB organisation/decisions e.g. Direct Routing, which is a published segment of a great circle between 2 published waypoints. In Direct Routing Airspace, the airspace is defined laterally and vertically with a set of entry/exit conditions where published direct routings are available. Within this airspace, flights remain subject to air traffic control.

The aim of Free routing in Step 1 is to enable AUs to file a flight plan with at least a significant part of the intended route which is not defined according to published route segments but specified by the airspace users. Nevertheless, for transition purposes between FRA and fixed ATS route network environment, the use of a published entry and exit waypoint is mandatory.

In step 1, Free Route operations are plannable at FAB level and made available to the maximum extent (up to H24 when and where possible) depending on the complexity (low to medium) of the airspace and the traffic demand [AOM-0501] and [AOM-0500].

Within defined airspace volumes above a particular level at particular times where the various states of free routing options exist, the flight planning of optimum trajectories will be possible (implementation dependent upon local initiatives) [AOM-0501] and [AOM-0500].

VPAs design, management and publication issues in Free Route Network operational environment in are addressed in chapter 3.2.5. of this document.

4.2 Roles and Responsibilities

Roles and responsibilities listed in this section are those already identified in 7.2 DOD [9].

4.2.1 High Level Airspace Policy Body

Role:

- Has a leading role within the Long Term Planning phase cycle activities at national level and at the sub-regional (FAB) level. It is responsible for assuring prerequisites for the most optimum operational Airspace Configuration for the volume(s) of airspace within its responsibility;
- Closely coordinates with the adjacent HL APBs (both in horizontal and vertical plane) in order to ensure that national /sub-regional airspace design projects are compatible and consistent with cross-border airspace policy.
- Closely coordinates with the Network Manager to obtain required information, data and expertise, and to ensure that national/sub-regional airspace design projects are compatible and consistent with all the plans, in particular with the overall Network Operations Plan;
- Enable seamless and synchronized operational transition between the neighbouring Airspace Configurations;
- Relies on the expertise of all the stakeholders within the CDM process, mainly on the national or sub-regional expertise as Flow Managers, Airspace Managers, Local Capacity / Traffic Managers, working in the area of its responsibility;
- Consults any of the stakeholders and users of the airspace (e.g. different service providers, civil or military airspace users, etc.) to collect their operational needs and provide advises if necessary;
- Supports National Supervisory Agencies (NSAs) (or its sub-regional equivalent) in performance monitoring activities.
- Establish joint civil/military processes for the periodic assessment of airspace efficiency and effectiveness of procedures at all three ASM levels;
- Ensure the definition and application of AFUA KPAs and KPIs to monitor ATM performance against civil and military airspace users' needs at national and network level;
- Assess AFUA effectiveness in terms of the impact on civil and military airspace users, ATM provision and civil/military coordination;
- Ensure the use of KPAs of safety, capacity, cost-effectiveness and environment to measure the efficient and flexible use of airspace procedures and operations.

Deliverables:

- Defined airspace policy for the volume of airspace under its responsibility, consistent with the European Network Strategy Plan;
- Defined coherent and consistent airspace policy with neighbours (States or FABs);
- Decisions related to airspace design, organisation and management enabling the most optimum Airspace Configuration definition and operational deployment;

- Define processes and procedures to enable Airspace Configuration definition and facilitate and coordinate operational deployment and implementation of the plans;
- Definition of processes and procedures for seamless and synchronized transition between different Airspace Configurations;
- Support National Supervisory Authority (NSA) (or its sub-regional equivalent) in definition of performance targets for the airspace under its responsibility, consistent with those at the European Network level;
- Agreed set of pre-defined Airspace Configurations applicable for the volume of airspace under its responsibility;
- Continuous review of the different European Plans to take into account new or changing demands on the airspace;
- Continuous update of the Airspace Data Repository (ADR) resulting from the airspace design and organisation changes under its responsibility.

4.2.2 Network Manager

The Network Manager acts as catalyst and facilitator for an efficient overall network management by all ATM stakeholders.

Role:

- Has a key role within the long-term planning phase to ensure the most efficient performance of the European Network;
- Monitors all the long-term local or sub-regional activities and identifies situations where the Network performance may be affected by national and/or sub-regional decisions;
- Closely coordinates with all the involved HLAPBs in order to ensure coherency of the European Network operations;
- Provides to the national/sub-regional HLAPBs all the required information, data and expertise;
- Prepares, through appropriate coordination, seasonal planning or plans for special events;
- Participates to airspace design activities and simulation activities to improve the overall process;
- At the end of the long-term planning phase, delivers an initial integrated Network Operations Plan based on the local/sub-regional activities outcomes;
- Ensures that any change to the airspace design, organisation and management, is accommodated in the ADR and reflected in the NOP as appropriate;
- Disseminates a consolidated regional airspace configuration;
- During the medium to short term phases the Network Manager will be working towards identifying and mitigating significant DCB issues strategically in coordination with AMCs, which affect the network at a regional level. Dependent upon the related ANSP involved, such mitigation is also likely to require Network Management influence at sub-regional and local levels. The factors that will influence NM to address DCB initiatives are likely to be broadly similar to today; rules and performance targets (2011 NM IR) governing the Department of Network Management (NM), seasonal variations (currently referred to as Axis), large scale military activity, and reductions in normal capacity, due to things like weather, major infrastructure implementation and industrial action;
- During DCB, the NM will be working closely with the Aircraft Operators, Airspace Manager, Flow Manager and Local Capacity Manager. The subsequent agreed outcomes are then published via the NOP Portal;
- The NM supports the Airspace User Driven Prioritisation Process (UDPP). The UDPP-Step1 process depends on CDM between the concerned Airspace Users at the local CDM-airport during operations, supported by a Network level global AU agreement on a set of rules;
- During the execution phase, he assures the stability of the NOP (Network Operations Plan), reacting to unexpected events, which impact on overall network performance, such as unusual meteorological conditions or loss of significant assets (e.g. runways, airports). Among other means, he will activate pre-agreed scenarios which will enable the Network Manager to restore Network stability;

- The activity addressed at Network level also includes the compilation of the NOP, the successive integration of Shared Business/Mission Trajectories, the collection and dissemination of constraints, the real-time identification of potential interactions between (accepted and agreed) Reference Business/Mission Trajectories and (newly published) Shared Business/Mission Trajectories and the communication of these interactions to the corresponding Airspace Users.

Deliverables:

- NOP creation, publication and maintenance

4.2.3 Airspace Manager (local/regional airspace manager)

This function focuses on medium to short term planning phase. It corresponds to ASM level 2. It can be implemented at National and/or Sub-Regional level as a result of the CDM process.

Role:

- The Airspace Manager (AM) is responsible for the medium to short term planning of national and potentially FAB level ASM right up to its operational implementation within European FUA (Flexible Use of Airspace) framework constraints. The AM role may in reality be filled by two actors: the Civil Airspace Manager (CAM) & the Military Airspace Manager (MAM), these actors would then have clear locally defined roles and areas of authority;
- The AM task is to manage the competing airspace demands from Civil and Military operations in a pragmatic way, taking account of relevant factors;

Deliverables:

- The output will involve the management of: CDR's, Euro (RAD) restrictions, exercise restriction, airspace allocation.
- Production and publication of the AUP/UUPs.
- This is resolved into an agreed plan, which is then communicated to FM, LTM and NM.

4.2.4 Wing Operation centre (WOC)

Developed with SWP11.01 Ref [13].

4.2.5 ACC Supervisor

Role:

- The ACC Supervisory role [15] is responsible for the general management of all activities in the Operations Room. It decides on staffing and manning of controller working positions in accordance with expected traffic demand. Supported by simulations of traffic load and of traffic complexity, and assisted by local traffic management, it takes decisions concerning the adaptation of sector configurations to balance capacity to forecast demand. Based on the results of simulations the required flow control measures may be implemented by ATFCM through a CDM process.
- For military side, ACC supervisor role corresponds to ATC Military Supervisor role. His tasks are similar to civil ACC Supervisory role tasks, except the ones related to ATFCM activities.

Deliverables:

- Provision of pertinent airspace configurations to meet the traffic requirements in its area of responsibility

4.2.6 FMP

Role:

- Impact assessment of ARES
  - Initial situation: An active training airspace is returned earlier than planned. The AMC reports that no further users want to use the booking.
  - After the AO have transmitted to NM a list of flights which would now plan to cross the training airspace, NM will start a SIMEX and forward it to the FMP via CHMI.
  - The FMP will then take the following steps to analyse the possible effects:
    - Analysis of current situation before/after comparison
    - Analysis of SIMEX regarding the predicted traffic load in the identified sectors at the affected times
    - Evaluation result/decision-making
    - Final communication of the result to the NM
- Preparation of airspace configurations in medium/short term planning
- Implementation of ATFCM measures in DCB inbalancing

Deliverables:

- Airspace configuration
- ATFCM measures implementation

4.2.7 Approved Agency (AA)

Approved Agencies are units which are authorised by States to deal with Airspace Managers for airspace allocation and utilisation matters.

Role:

- Their responsibilities include the submission of their needs for airspace to the AMC and of any update on their request;
- Negotiate for airspace to be allocated by AM within the European AFUA (Flexible Use of Airspace) framework constraints;
- They are also required to ensure that the airspace usage is in accordance with the agreed airspace use plan.

Deliverables:

- Prepare and submit national airspace requests to AMC for airspace utilisation, allocation and potential subsequent modification of the request.

4.2.8 ATCO

In the context of FUA concept, ATCO is involved in tactical ASM operations (ASM Level III) and carries out following responsibilities.

Role:

- Use of CDRs and the airspace according to ASM Level 2 airspace allocation decision;
- Control, coordinate, safe and expeditious conduct of air traffic, including the resolution of GAT and OAT conflicts;
- Use CDRs and the airspace according to real time reallocation of the airspace and the resolution of specific airspace problems and/or traffic situations between civil and military ATS units and/or controlling military units and/or controllers, as appropriate. Adequate real time coordination facilities and procedures are required to fully exploit the FUA concept at ASM levels 1 and 2. Flexibility in the use of airspace is enhanced by real time civil/military coordination capability. This flexibility depends on the potential offered by the joint use of airspace by civil and military traffic
- Coordinate with military ATS units in real time tactical condition of the airspace use and CDRs availability and changes to them as described in relevant LoAs
- Re-routing of the GAT flow at short notice and the control of the GAT on the newly re-opened CDR. If a reduction in the activation time of a TRA or TSA is agreed between units, the subsequent tactical release of airspace enables ATCO to use certain CDRs and re-route traffic flows at short notice.
- To enlarge or combine TRAs or TSAs, ATCO may be able to allocate, at short notice, some flight levels of an ATS route segment for temporary OAT use.

Deliverables:

- Safe flight control
- Airspace management at Level 3

4.3 Constraints

In step 1, only ground technical characteristics are defined. It is assumed that the following technical solutions are implemented in the NM, in AMC at sub-regional and local level, in ANSPs and military units:

- Ground-ground communications between civil and military units is supported by a pertinent network;
- Messages exchanged between ASM support system and ATC systems is supported by On-Line Data Interchange (OLDI)[4];
- Exchanges between ASM support systems and Airspace managers at Regional, sub-regional and local level is supported by AIXM 5.1.

[4] Although the concept of flight object (FO) shall reflect/exploit the AFUA operational developments it was not part of the validation activities due to the listed constraints and the lack of FO conceptual inputs. Nevertheless AFUA and presented new concept elements are not limited/restricted by FO.

5 Use Cases

5.1 Operational Scenario 1

5.1.1 Introduction

This scenario sets up the Mission Trajectory development along its overall life cycle including new AFUA structure, based on VPA design principle. The timeframe is within the horizon of initial implementation of Step 1 from the definition of airspace needs to post flight analysis. Although use cases' diagrams in this scenario represent the RTSA, the main focus in this scenario is the VPA design principle. Scenario 2 in section 5.2 develops mainly RTSA in early release of airspace where ARES is following VPA design principle or not.

5.1.1.1 Phases of Flight

- Planning phases:
  - Long term planning phase: this phase can start years in advance. The output at European level is the Network Strategic Plan.
  - Medium / Short term planning phase: according to SWP7.2 Operational Scenarios, this phase starts around 6 months in advance until the beginning of the Execution phase.
- Execution phase: according to the SESAR definition, the planning phase ends with the publication of eAUP/eUUP. It is assumed that this phase starts after the allocation of an ARES.
- Post analysis: this phase starts the day after operations until the publication of the annual performance report.

5.1.1.2 Airspace Users

In this scenario, only the military airspace users are considered because they are the primary users of ARES.

5.1.1.3 List of Actors

- Human Actors:
  - Military HQs: established at national level, they can be joint or not and are responsible for defining the training policy for the military.
  - HLAPB: can be established at national and/or FAB level. He is responsible for the airspace organisation and management at local and/or sub-regional level.
  - Squadron Tiger Leader: the squadron leader is responsible for defining the training needs for the next weeks.
  - Tiger 16: is the leader pilot for the 2 vs 2 mission described in this scenario.
  - Fighter 25: is the test flight pilot.
  - Approved Agency Beta: is the last body of the approval chain defined at national level.
  - Silver AMC: is a joint civil-military AMC established at national level.
  - Gold FAB: is a joint civil-military AMC established at FAB level.
  - Network Manager: is responsible for managing the entire network.
  - Military Supervisor Lima: is a supervisor in a military unit responsible for managing airspace and military traffic in his area of responsibility.
  - Civil Supervisor Mike: is a supervisor in an ATC responsible for managing airspace and civil traffic in his area of responsibility, including the internal coordination with FMP.
- System Actors:

- Military entity: is the body with function supporting the process described in this scenario.
- ASM support systems: systems supporting the airspace management process.
- NM systems: are systems supporting the network manager.
- ATC system: is a system supporting the execution phase.

- Means of Communication:

  - NIMS: this network is supported by an infrastructure named System Wise Information Management to which the different systems are connected.

5.1.1.4 Operational Improvements (OIs)

AOM-0206-A: Flexible and modular ARES in accordance with the VPA design principle

5.1.1.5 Additional information

This scenario starts when the military identify their airspace needs for day-to-day training. This scenario does not intend to describe a complex military exercise involving several units. It describes a generic process that can be applied in any particular situation for daily training.

Civil airspace users requesting an ARES are not considered in this scenario. However, the process describes is the same for any airspace user.

Whenever the AIXM format is referred to, the present updated version (AIXM 5.1) is considered.

5.1.1.6 Assumptions

- ASM support systems are implemented and interoperable;
- Airspace Data Repository (ADR) is fully operational;
- NOP is operational;
- NIMS enabled;
- ASM support systems and NM systems are interoperable;
- ASM support systems and ATC systems are interoperable;
- ARES user can be either airborne, ground or maritime-based;
- Equity is given to meeting the needs of civil Airspace Users and military airspace requirements;
- Protection of secure and sensitive military data is assured.

5.1.2 Scenario Introduction

The operational scenario describes the entire process from the airspace design – creation, adaptation of the airspace organisation and management - to post flight analysis. It starts in the Long Term Planning phase before the elaboration of the network strategic plan. This scenario describes the CDM process for a **day-to-day training**.

The operational scenario also describes the steps in the exchange of static (airspace structures) and dynamic (AUP/UUP) data between the NM and ASM support systems, and between ASM support systems via B2B in AIXM format.

For a better understanding and to limit the complexity, this scenario sets up an air-to-air mission composed of four assets from on airbase named base Alpha.

Assuming we are in 2015, the model of ARES shall be modular following the VPA design principle to give more flexibility by adapting the volume of reserved airspace to the real need.

We are 1 year in advance. The Military HQs have to define their training needs for the next year. It includes day-to-day training, national exercises, joint national exercises and international exercises.

Taking the particular case of Air Forces, the Head Quarter defines (not exhaustive list):

- The number of flight hours per pilot;
- The minimum qualification for operational people;
- The list of exercises that shall be planned and organised by the State;
- The contribution to planed exercises (which squadron, number of aircraft, which qualification, etc.);
- The expected contribution from other HQs and/or States;
- Airspace needs (volume, location, permanent, for exercises, etc.)

The output is a report defining the airspace needs for the next year. It is sent to the HLAPB to be taken into account when defining the future airspace structures.

It is important to note that this scenario is a pure theory. It intends to describe generic military operations as much as possible close to reality.

5.1.3 Scenario Text

Long Term Planning

On a regular basis, the HLAPB receives the airspace needs from the airspace users, civil and military. In addition to that requirement, the HLAPB analyses the annual performance report and identifies the area of improvement to fulfil the requirements.

The airspace organisation and management is a fully collaborative process between civil and military. At least once a year, the HLAPB reassess the airspace structures at two different levels: first one, at National level in coordination with AMCs and at Network level in coordination with the Network Manager.

The existing airspace structures were designed some years ago and reassessed continuously to fulfil new requirements. However, the civil traffic continues to grow and the military needs are evolving due to new technologies. The structure and functions of Armed Forces is totally modified compared to the last 10 years. There is less aircraft and units but with new weapons systems, the actual airspace structures don't fit to the full demand of the military requirements.

Due to the complexity of the airspace structure, it is not possible to start from a blank sheet. It means that the existing structures shall be adapted to improve the network regarding to the civil traffic increasing and respond to the military requirements.

Squadron Tiger is based on Base Alpha in the centre of the country. It usually flies in Area X at 20 NM from the airbase. It is now equipped with the last generation of fighters. Missions in this squadron are:

- Elementary training of operational pilots;
- Advanced training involving several formations in one mission.

Area X is a large area (60x80NM from FL100 to FL660). It responds to military requirements for certain types of mission. However, it was designed as a single and indivisible area in the past. It isn't

possible to book only part of it for basic manoeuvring requiring less volume. In addition, that area is located in an important node of civil traffic. The airspace demand from both civil and military is increasing. More flexibility shall be introduced. It will allow the military to request the exact volume of airspace needed and facilitate the traffic flow.

Area X is adapted in nine (9) subparts that will allow more flexibility in the CDM process for allocating the airspace. Five (5) CDRs are created and one is adapted to fulfil the civil needs. This proposal is assessed at network level before it becomes official.

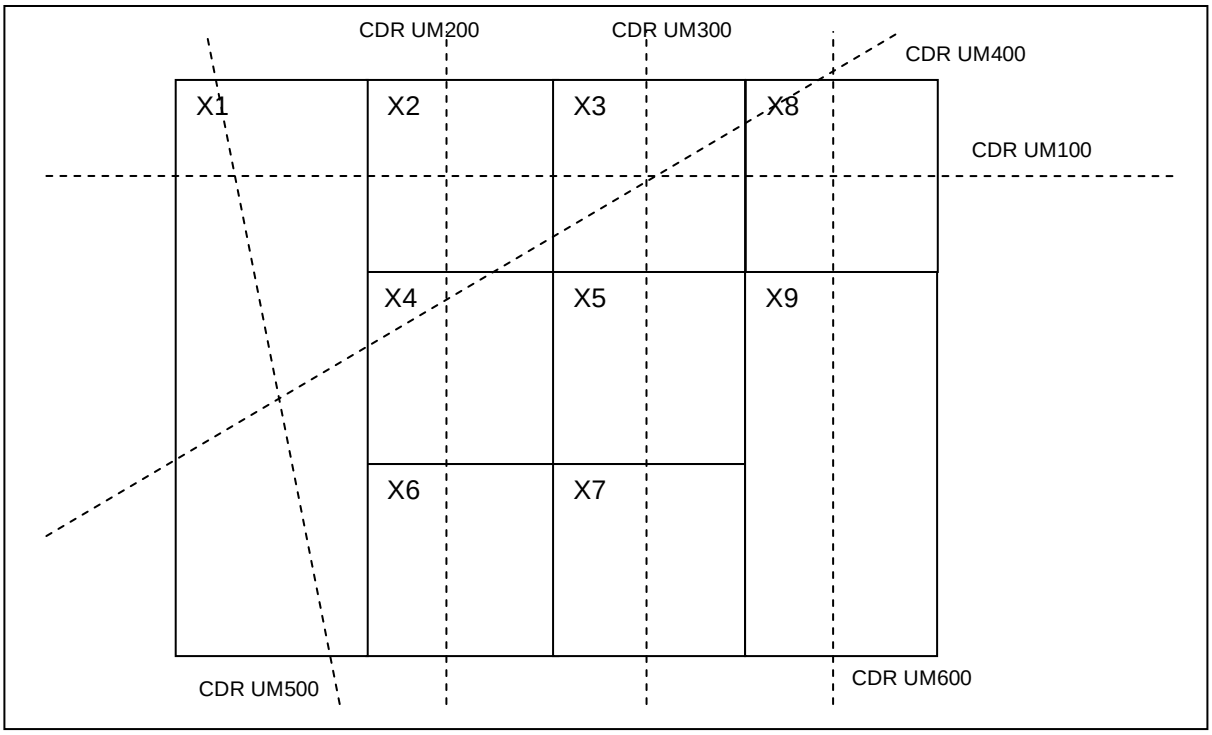

Figure 8: Area X and CDRs

The initial volume of Area X is not modified (60X80NM) but it is designed differently to provide more flexibility.

That designed proposal is agreed. The HLAPB now defines the rules for managing and using Area X. Priorities are defined based on the military requirements and peaks of civil traffic.

Area X and any sub-parts are published in the national AIP. Based on the AIRAC cycle, the ADR is updated. Data are available through SWIM.

Exchange of static data between NM systems, ASM support systems and between them

6 days prior the start of the validity period of the coming AIRAC cycle, the ASM support systems poll the NM systems for a new set of static data making use of the B2B services. After receiving a notification from the ASM support systems server that a new set of static data is available for download, the responsible ASM support systems' users download the latest data to be imported in the ASM support systems DB (database). Once the DB is populated/updated, the responsible user validates the data – the definitions of the newly introduced Area X and the associated to it sub-parts and CDR segments in the ASM support systems DB are consistent with the ones in the NM ENV**.[Use Case 11: Static data exchange]**

AO perspective

Within the long term planning phase, when business models and future flight intensions have evolved, the AU will start to gather and analyse all parameters that will have effect on the Business Trajectory. The complete set of data might build a Business Development Scenario and is evolving during the flight planning lifecycle depending on the development on the input parameter set. Since at this early stage of flight planning the data which will have an impact is not yet available (e.g. weather forecast), the information which can be shared is more or less limited to following information

1. Planned exercises or special flight operation (e.g. training flights)
2. Volume of flights expected for each exercise or type of operation
3. Special events (e.g. Olympic games)
4. Statistical/historical data from post ops analysis

A Business Development Scenario will include all boundary conditions of a flight and will be developed in an on-going process. If the AO has access to the ASM support systems, the data will be loaded into this system and also made available to the Network Operations Plan (NOP).

Medium – Short Term Planning

We are one (1) month in advance; Squadron Tiger Leader defines the training needs for the next month. He develops the training plan for his unit, defines the mission objectives and designates the leader for each mission. This plan doesn't provide any information related to the airspace needs. It is not shared with the ATM actors.

One week before operations, the users / pilots at SQN Tiger refine the planning, define the ARES for each mission and start the booking process for the ARES via ASM support systems.

The day before operation, Tiger 16 is preparing his mission. He verifies the objectives defined by Squadron Tiger Leader, checks the weather forecast and refine the airspace volume needed for that mission.

For this 2vs2 mission, the volume required is 40x60NM from FL150 to FL350. The mission is planned between 09h30 UTC to 10h30 UTC. This mission has a high priority. It is a pre-qualification for a wingman. In addition, this slot can't be moved because another mission is planned immediately after and the aircraft used for this first mission will be used for another slot at 11h00 UTC.

He refines / books an ARES by the use of ASM support systems. For that mission, he requests VPAX1, VPAX2, VPAX4 and VPAX6 from FL 150 to FL 350. Due to the nature of that mission requiring high profile manoeuvres, Tiger 16 requests an ARES **[Use case 1: Airspace reservation (Request an ARES Designed on VPA principle)]**.

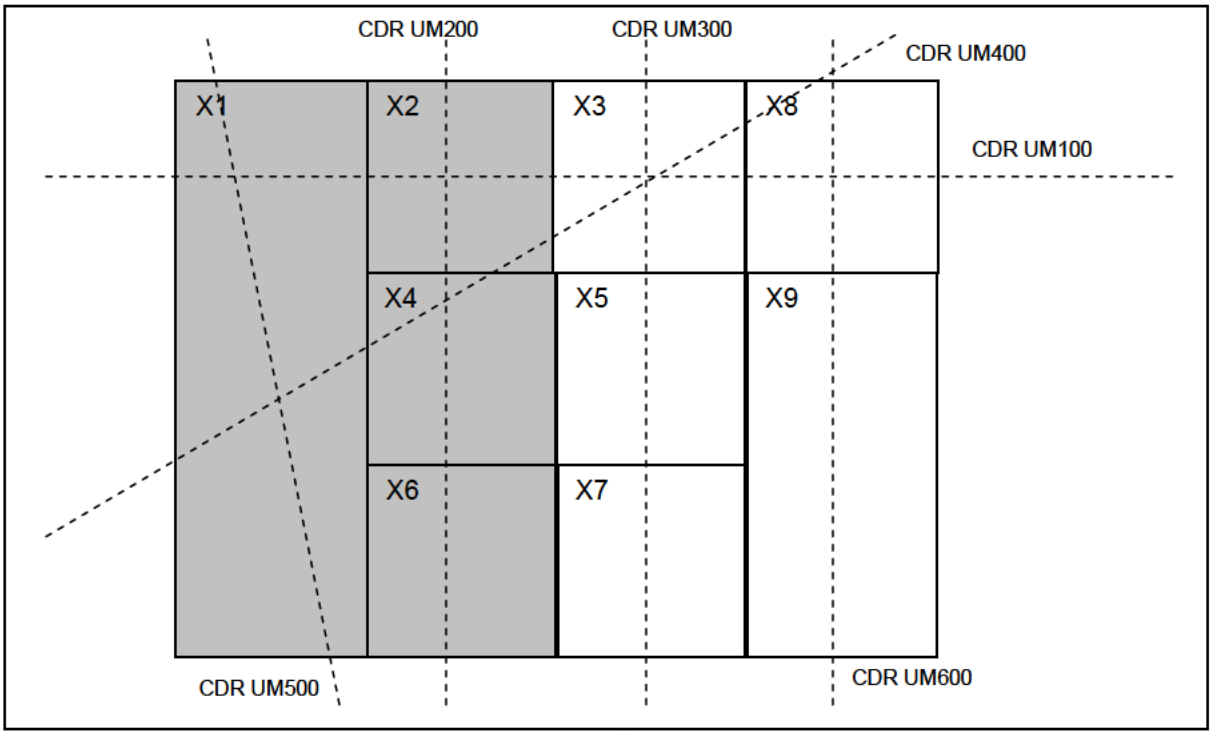

Figure 9: Request from Tiger 16

Squadron Tiger Leader confirms the booking through the ASM support system.

Another pilot (Fighter 25) from Squadron Fighter needs an ARES for a flight test. Via the ASM support systems, he requests VPAX2 (proposal to use UVX2 unit volume) from 09h30 UTC to 10h00 UTC and from FL100 to FL 500. This mission also has a high priority. It's impossible to start earlier; the aircraft will not be ready before 09h30 UTC.

The ASM support systems identify the conflict and highlight it. The Approved Agency (there is a need to show the link between requestor (pilot) and decision maker conflict solver). Beta verifies the requests to solve the conflict. For that specific area, the HQ has defined some priorities. However, in this particular case, both missions have the same priority for different reasons. Using the ASM support systems, he proposes to Tiger 16 to move his mission in VPAX4, VPAX5, VPAX6, VPAX7 and VPAX9. He will have the configuration of ARES with the same volume of airspace and it solves the conflict between both requests.

Tiger 16 accepts the proposal via the ASM support system.

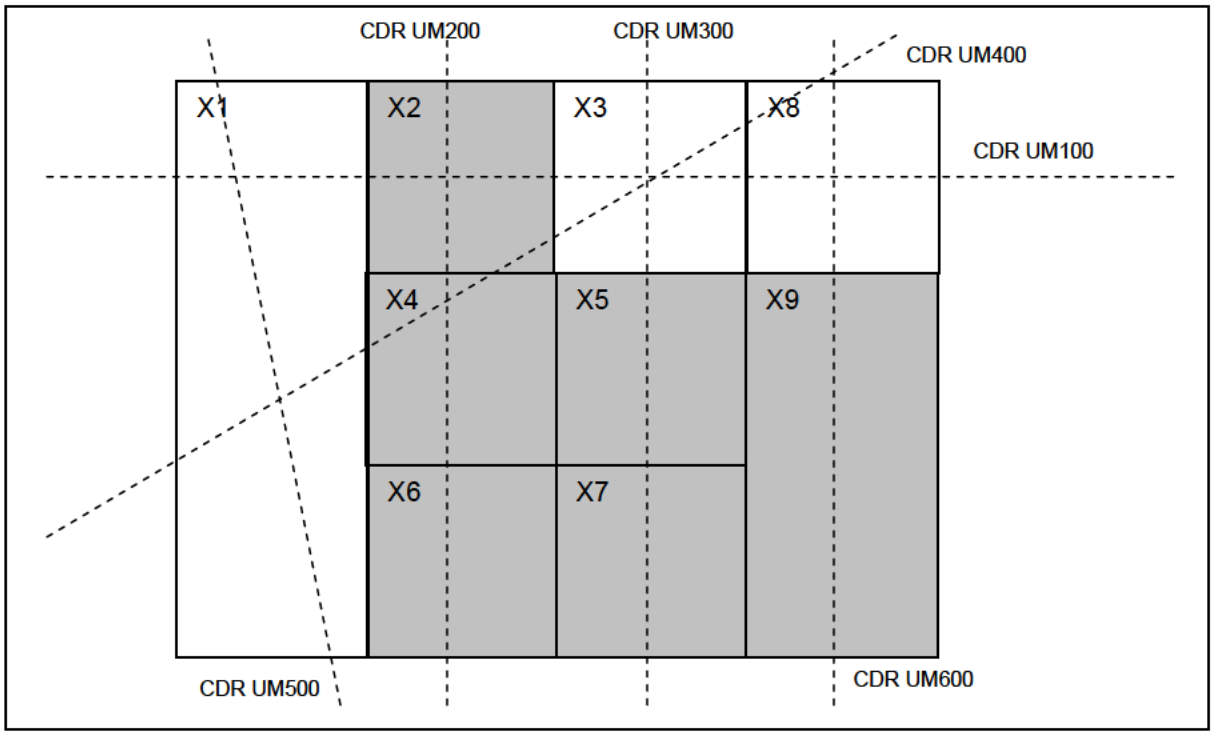

Figure 10: Military booking after de-confliction

The plan is deconflicted. Negotiation between civil and military can start. The Silver AMC compares the military needs with the civil needs, identifies possible imbalance and starts the negotiation according predefined rules and priorities defined by the HLAPB at ASM Level 1.

These bookings impact 4 CDRs. If a Flow Management Position (FMP) requests one or more CDRs impacted by the booking, the ASM support systems identify a conflict and highlight it.

Silver AMC identifies a peak of civil traffic between 09h00 UTC and 10h00 UTC in sector Z. This traffic demand is 15% over sector Z capacity. The solution to reduce the traffic flow to an acceptable level is to re-route part of it via CDR UM100. However, this solution doesn't fit the military requests. VPAX2 is requested between 09h00 UTC and 09h30 UTC.

This peak of traffic is not unusual. It is due to a big airport at 100 NM in the East. Each morning, there is a lot of traffic Westbound. The HLAPB has already predefined a rule at ASM Level 1, to be applied at ASM Level 2. Priority is given to civil traffic between 09h00 UTC and 10h30 UTC above FL350 any working day on this CDR.

According to this rule, the flight test in VPAX2 shall be moved in the South at least in VPAX4 or cancelled. A negotiation starts between Silver AMC, Tiger 16 and Fighter 25 via the ASM support systems. None of the other available volume fits the demand. CDR UM100 is still impacted. And it's not possible to limit the upper level to FL340 due to the particular type of mission requiring the aircraft to be tested in all configurations following maintenance.

There is only one solution. This test flight has to be moved in VPAX4. Silver AMC makes the proposal via the ASM support systems and explains it with free text. Tiger 16 understands that the other mission has a high priority. Without this test, a lot of mission could be cancelled due to the lack of aircraft. He accepts to reduce the volume of airspace for the first 30 minutes but insists to recover the entire volume after. Thanks to the ASM support systems, this negotiation process doesn't require other means of communication.

This solution solves both conflicts.

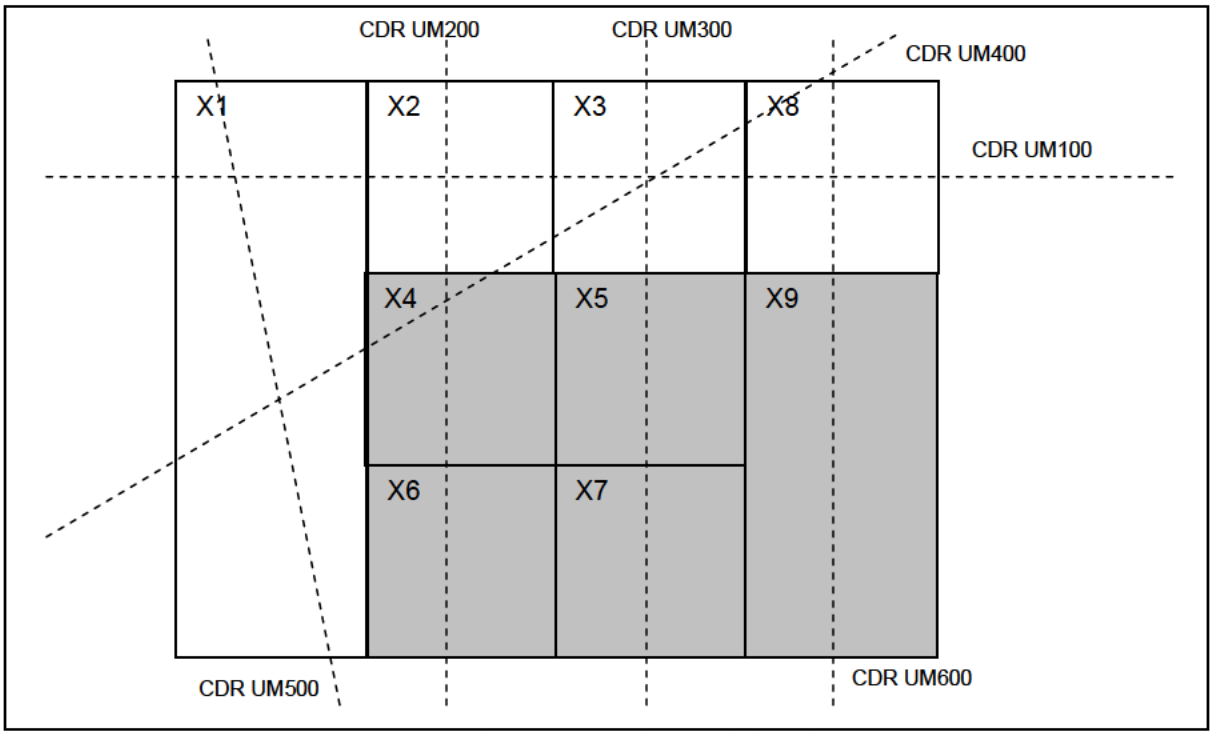

Figure 11: Military booking after negotiation at Local level

CDR 200 will be closed between 09h30 UTC and 10h00 UTC. CDRs 200, 300, 400 and 600 will be closed at and below FL 350 between 09h30 UTC and 10h30 UTC. The draft plan is updated. The sub-regional manager of Gold FAB can start the intra FAB negotiations if needed.[5]

The draft plan is agreed at sub-regional level. The Network Manager can start the Network impact assessment. There is no need for improvement or modification[6].

The Regional Network Plan is approved and promulgated by the sub-regional manager. Airspace is allocated. This status is reflected in the ASM support systems. The NOP is updated **[Use case 2: Allocate an ARES (VPA design principle)].**

Exchange of static data between NM system, ASM support systems and between them - latest updates

Prior the production of the AUP/UUP, the responsible user requests latest updates of the static data via the B2B services. Note that the process is identical with the process addressing the update of static data based on the AIRAC cycle.

Dynamic data (AUP/UUP) exchange between NM system, ASM support systems and between them

[5] We are in Step 1; Cross Border Operations are not addressed in this Step. The negotiation process at FAB level is not developed in this scenario.
[6] DCB is addressed by another project (P7.6.3).

Once the users' reservations in the ASM support systems are de-conflicted and the areas' planned allocation is considered mature, the user with privileges to produce AUP/UUP prepares a Draft AUP/UUP. The Draft AUP/UUP is sent to the NM system via the B2B for validation. Errors/warnings, if any, are sent back via the B2B to the ASM support systems user with the AUP/UUP privileges to be addressed/corrected.

The users of these B2B services can access the Draft AUPs/UUPs of the other users as soon as the Drafts are sent for validation or directly created on the NM site. Sharing the plans allow for coordination aiming at optimisation of the airspace allocation on sub-regional/regional level and better cooperation with the NM ASM function.

When the Draft AUP/UUP is considered mature, the ASM support systems user with the AUP/UUP privileges promotes it to "Ready" via the corresponding B2B service (note that this process includes the validation of the Draft AUP). When all AUPs/UUPs are in status "Ready", the CADF (CADF position in the NM Ops room is responsible for the production of the eAUP) produces the eAUP/eUUP and releases it. Once the eAUP/eUUP is published, the ASM support systems change the status of the reservations and the CDRs to "Allocated" according to the AUP/UUP **[Use Case 22: Exchange of AUP/UUP].**

Three hours (reference allocation status at the ARES) before the mission the day of operation. The estimated mission duration is 1 hour. Tiger 16 finalize his mission preparation:

- Refines the tactics;
- Identifies safety and security issues;
- Verifies the weather forecast;
- Plans a briefing with the Military controller if needed;
- Organises a pre-operation briefing with the other actors (e.g. wingmen)

Execution Phase of mission

The test flight is airborne. X minutes[7] before the activity starts in the ARES, the appropriate military authority pre-notifies the activation to the other supervisors impacted by the activation. He sends a message via ASM support systems to pre-activate the ARES. The ASM support systems automatically select the civil and military controlling units affected by the activation and send the message only to those supervisors. ACC supervisor receive a warning on their ASM support systems position to accept or refuse the activation.

After acknowledgment by all parties, the ASM support systems send a message to ATC systems to automatically update the status of the ARES in the system and update the Controller Working Position. The controllers, civil and military, can see that information on their working position. The outlines of this ARES are now visualised as pending on both, CWP and ASM support systems. The NM systems are updated with the new status.

When the ARES becomes effectively pending, the ASM support systems send a message to the ATC system to automatically make the ARES active. The controller working position is updated. The outlines of the ARES are now presented differently to make a clear distinction between pre-notification and activation.

The same process is applied in parallel to activate the ARES for the 2vs2 mission **[Use case 3: ARES Activation (VPA design principle)].**

[7] "X minutes" in this scenario was not a subject of the validation. It should be defined according the particular operational need.

30 minutes after, the first mission is over and returns to base. The military authority doesn't de-activate VPAX4 because it is now used by the 2vs2 mission. However, the ASM support systems are updated to reflect the exact use of airspace and facilitate the coordination between civil and military controllers.

40 minutes after starting his training, the leader receives an alarm in his cockpit regarding his weapon systems. This alarm is not critical and does not need an immediate return to base but he wants to analyse what's happening. For this, he needs additional airspace volume. He explains the situation to the Military controller and requests a volume of 20x60 NM but limited vertically from FL 250 to FL 350.

The military supervisor coordinates with the civil supervisors this new request. It will be limited in time. Through the ASM support systems, the military supervisor extends the initial requests by adding VPAX2, VPAX3 and VPAX8 to that mission from FL 250 to FL 350 and modifies the other activated VPAX with these layers. There isn't any pre-notification in this particular case because the activation becomes effective immediately. As for a normal activation, the ASM support systems automatically identify the controlling units impacted by this ad-hoc airspace. It sends a message to the ATC system. Following the confirmation and acknowledgement process, all involved ATCO and Supervisor are informed, the status of the ad-hoc airspace is updated in the ATC system. The ARES is visualised on both CWP and ASM support systems. The ATC system is also updated to take into account the new layers for the previous VPA. This update is necessary to adapt the Area Proximity Warning (APW) to the exact airspace configuration and avoid false alert **[Use case 4: Ad hoc airspace request].**

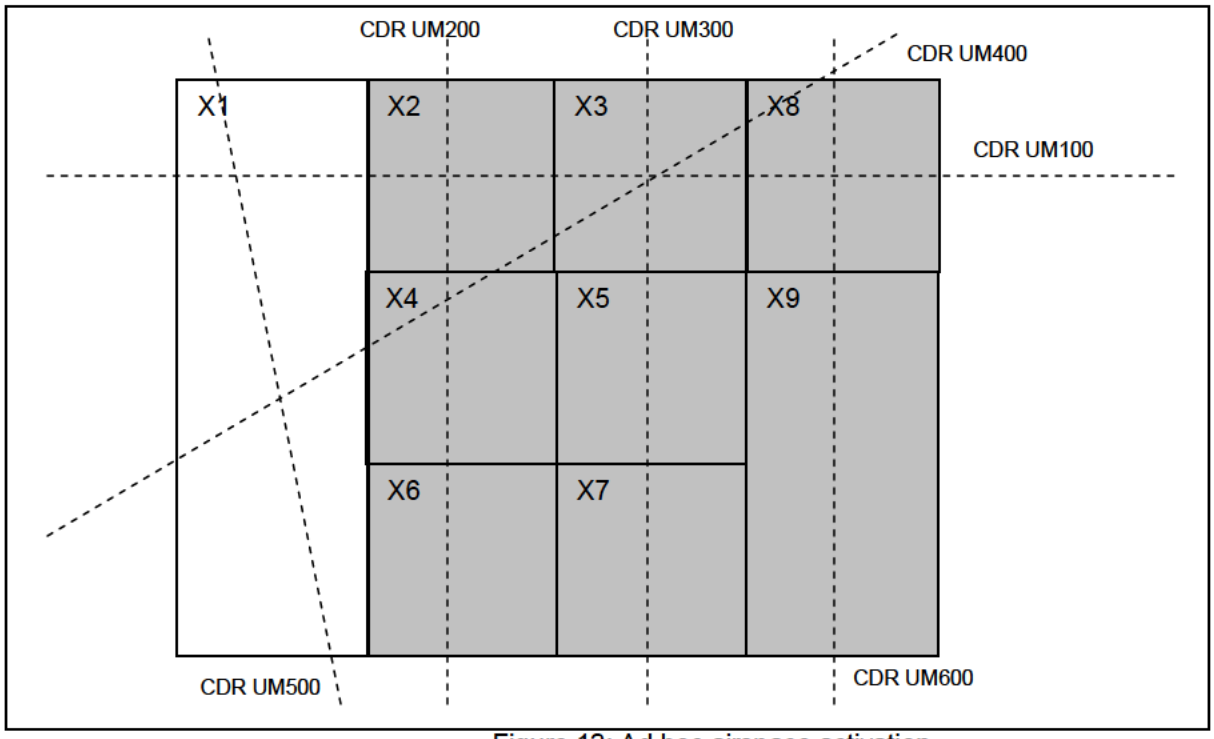

Figure 12: Ad hoc airspace activation

The NM system and the NOP are updated with the new ARES.

10 minutes later, the leader informs the controller that he should terminate the mission early due to technical failure. There is no emergency. The Military controller organises the hand-over and informs the military supervisor. The ARES is released 10 minutes in advance.

With the ASM support system, he deactivates the ARES. The system identifies automatically the controlling units impacted by the deactivation and sends a message to the supervisors. Each of them

acknowledges and accepts the deactivation. As soon as the ASM support systems receive the acknowledgement, it sends a message to the ATC systems. The status of the ARES is updated in the ATC system and on the CWP. The ARES is not any more visualised on the CWP. The ASM support systems and the NM systems are updated **[Use case 5: ARES Deactivation].**

Unfortunately, an activity was planned 1 hour later in another ARES with the same aircraft. The mission has to be cancelled. The requestor cancels the mission via the ASM support system. Doing that, the NM systems are automatically updated to take opportunity of this released airspace **[Use case 6: Cancel a booking].**

The NM systems recalculate capacity figures in order to reflect change of the capacity available. This figure is coordinated and agreed by CDM with all FMPs.

In addition, the Network Manager Flight Efficiency support position will use that information. The NM systems identify eligible flights that could take benefits from this airspace released and mission cancellation. The NM systems calculate rerouting proposals and send to the relevant AOs to take advantage of this additional available airspace.

AOs re-file their Flight Plan (FPL) according this information **[Use case 7: Identify eligible flights].**

Post Ops phase

Up to 6 months after the mission, all actors have to prepare the annual performance report **[Use case 8: Post Ops analysis].**

The following KPAs are identified:

- For the military: Planning efficiency, Mission effectiveness,
- For the civil: Capacity, Efficiency,
- For both: Flexibility, Environment sustainability.

First of all, the military HQs want to analyse the over booking. Last year for several reasons, the average of spare missions was too high. The units received clear directives to improve their bookings and avoid as much as possible over booking.

Then they want to analyse the mission effectiveness. The parameters are:

- The area location (transit time from/to the airbase),
- The volume agreed against the volume requested,
- The slot allocate against the slot agreed.

In order to verify the flexibility and to improve the planning for the next year, the military want to analyse the tactical changes in airspace volume. When and where additional volume was requested and agreed or not. When, where and why the initial volumes shape was modified**.** The airspace managers want to analyse at local, sub-regional and regional level the capacity and the efficiency.

Also, the Airspace managers want to analyse if the ANSPs and the civil AUs took the opportunity of early released airspace or additional plannable airspace thanks to the implementation of VPA.

The civil and military airspace users want to analyse the environmental impact of their activities.

5.1.4 Use Cases

5.1.4.1 Use case 11: Static Airspace Data Update

Process diagram

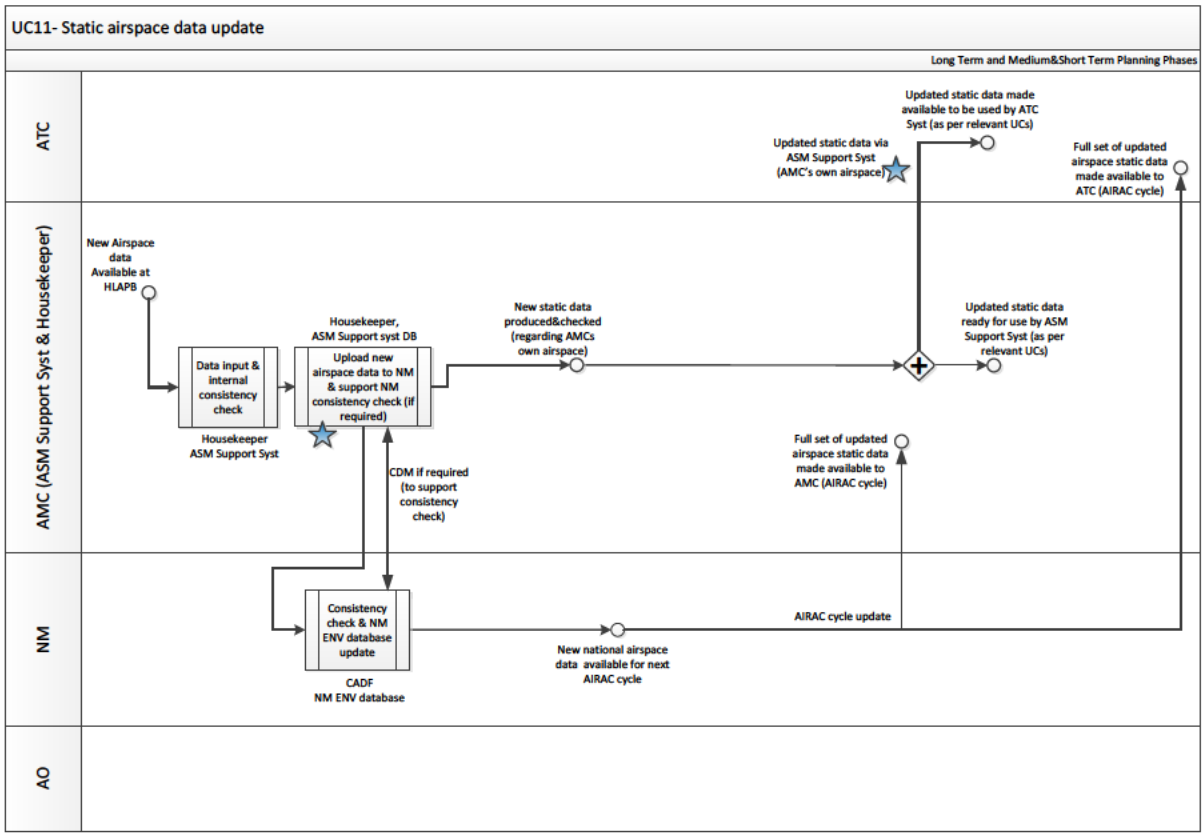

Figure 13 UC11 Static Airspace Data Update

Scope

This Use Case describes the process of exchange of static data between the NM system and ASM support systems.

Primary actor

- The Housekeeper (the user responsible for DB maintenance).

Supporting actors

- ASM support systems.

Pre-conditions

Area X and the associated sub-areas are published in the AIP/available in the NM ENV database for the next AIRAC cycle.

Post conditions

Area X and its sub-areas definitions are uploaded in the DB of the ASM support systems

Success End State

Area X and its sub-areas definitions are uploaded in the DB of the ASM support systems and the DBs of the ASM and NM systems are consistent.

Failure End State

Area X and its sub-areas definitions are not uploaded in the DB of the ASM support systems or the DBs of the ASM and NM systems are not consistent.

Notes

None.

Trigger

This use case is triggered by the ASM support systems notifying the Housekeeper/responsible user for the static data/new update.

Main Flow

The ASM support systems poll via the B2B services the NM (ADR DB) and notifies the Housekeeper/responsible user for the new set of static data available for download. The Housekeeper/responsible user specifies the data to be imported and persisted in the ASM support systems DB. The Housekeeper/responsible user validates the consistency and correctness of the updated data set.

Alternative Flow

In case the Area X and its sub-areas definitions are not uploaded in the DB of the ASM support systems, the process shall be repeated. In case the Area X and its sub-areas definitions are not consistent with the definitions in the NM ENV, the Housekeeper/responsible user amends the definitions manually.

5.1.4.2 Use case 12: Share Long Term Planning Data

Process Diagram

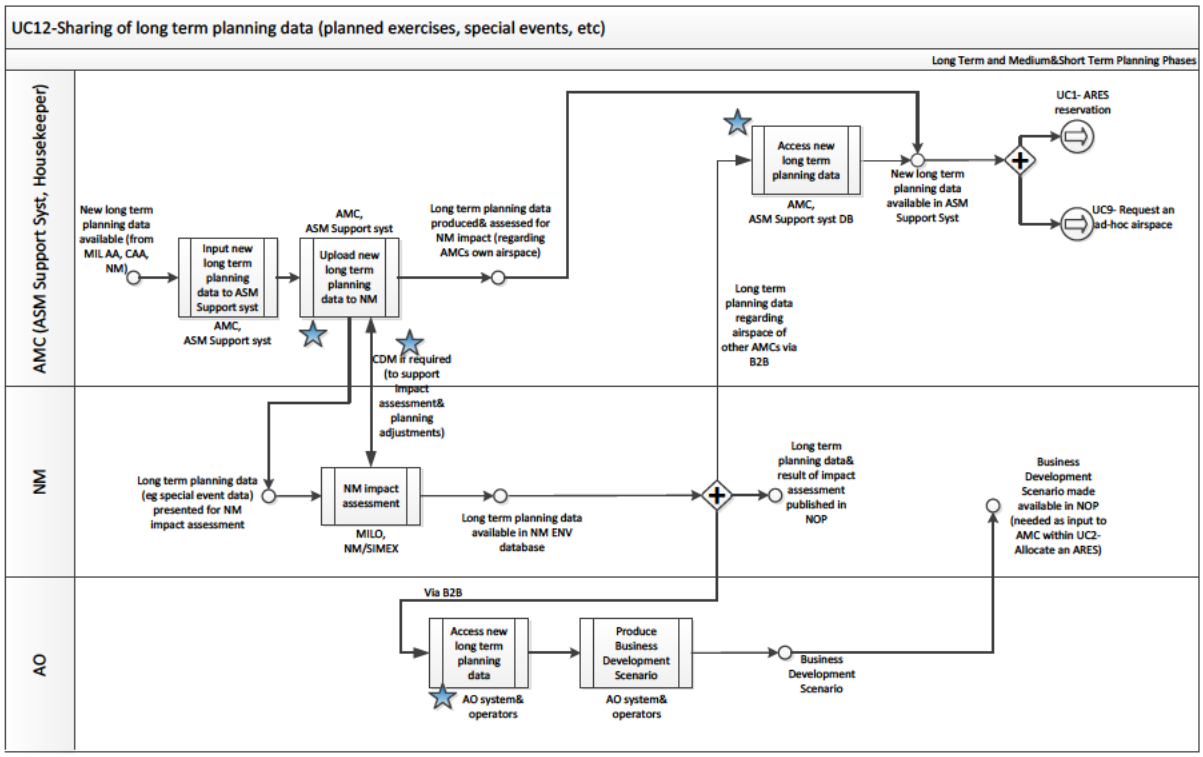

Figure 14 UC12 Share LT Planning

Scope

This Use Case describes the process of sharing the long term planning data.

Primary Actors

- AUs,
- AMC,
- AOs,
- The Housekeeper (the user responsible for DB maintenance).

Supporting Actors

- ASM support systems,
- WOC/FOC systems.

Pre-conditions

- A High Level Airspace Policy Body (HLAPB) is established at national level.
- The Long Term Planning Phase is executed by the relevant actors.

Post conditions

Long term planning data is shared in the NOP.

Success End State

Complete Long term planning data is available in the NOP.

Failure End State

Partial Long term planning data is available in the NOP.

Notes

None.

Trigger

This use case is triggered by the AUs and AOs by providing to AMC their intents.

Main Flow

The AMC uploads available data via ASM support systems and NM ENV is updated. AMC, AUs and AOs update their systems with NM ENV.

Alternative Flow

None.

5.1.4.3 Use case 1: Airspace reservation (Request an ARES Designed on VPA principle)

Process diagram

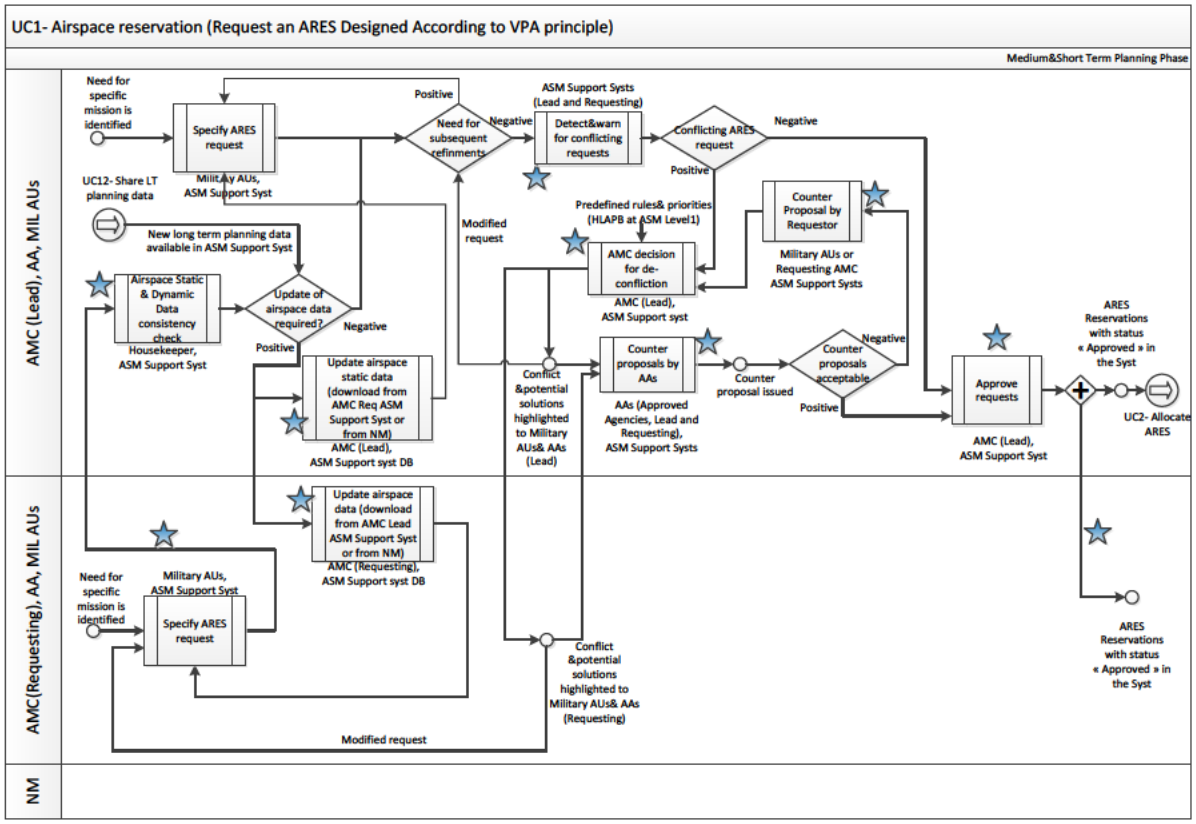

Figure 15 UC1 - Airspace Reservation

Scope

The use case describes how airspace reservation requests will be submitted by military aircraft operators to the Network Manager in the form of long-term exercise schedules.

This Use case has been identified within the OSED V3 Task. The reference scenario is developed in section 5.1. This Use case described the initial booking process updated until the ARES is negotiated and allocated.

This Use case starts when the military initiates the process to book an ARES to protect a specific activity.

Primary actor

The requestor (referring to the operational scenario in this case - WOC), is the primary actor. He identifies the airspace needs and requests an ARES for a specific mission.

Supporting actors

- Approved Agency.

Pre-conditions

- ARES is created and published.

Post conditions

- ARES is requested.

Success End State

The ARES is requested and accepted by the Approved Agency.

Failure End State

The ARES request is not booked.

Notes

None.

Trigger

This Use case is triggered when the military identifies a need for a restricted or segregated airspace to protect a specific activity.

Main Flow

As soon as the airspace volume is identified, the Squadron Leader requests the ARES via an ASM support system. This initial booking is not complete and some data are missing. But it should be possible to update continuously this booking until the end of the negotiation process.

[1] Squadron Tiger Leader requests an ARES. Using the ASM support system, he defines:

- The ARES;
- The date;
- The slot for the mission (start and end time);
- The priority.

[2] Tiger 16 is preparing his mission the day before operations. Doing that, he can confirm the request and update it. He can modify any of the information provided by Squadron Tiger Leader. He defines:

- ARES (VPAX1, X2, X4 and X6) he needs to book;
- Upper and Lower levels;
- Penetration status – segregation or restriction.

In addition to these information required for airspace management, he adds some useful information for the other military, the AA and/or for post ops analysis:

- Call sign;
- Number and type of aircraft;

- Aerodrome of departure (ADEP);
- Aerodrome of destination (ADES);
- Mission type;
- Link with another mission (if existing).

[3] The booking process follows the approval chain defined at national level:

- Squadron Tiger Leader confirms the booking;

[4] The ASM support systems identify a conflict between 2 requests. It highlights it to be taken into account by the WOC and/or the AA.

[5] The AA makes a counter proposal to Tiger 16 to solve the conflict. Using the ASM support systems, he proposes to request VPAX4, X5, X6, X7 and X9 with the same parameters (slot, levels, and penetration status). This process is made in parallel to the booking and doesn't change the planning until a solution is found.

[6] Tiger 16 receives an alarm informing of this counter proposal.

[7] The ASM support systems give the choice to accept, reject or propose another solution to the AA.

[8] This proposal is consistent with his initial request. Tiger 16 accepts it via the ASM support systems.

[9] The AA approves both requests. They have now the status "Approved" in the system.

Alternative Flow 1

This alternative flow starts at [8] when Tiger 16 decides to make a counter proposal.

[8] Tiger 16 rejects the counter proposal. With this proposal, he will increase the transit time between the airbase and the ARES limiting too much the available training time.

[9] Tiger 16 proposes to move the other mission in VPAX3 and maintain his initial request.

[10] Fighter 25 receives an alarm with this counter proposal.

[11] This counter proposal is acceptable. Using the ASM support system, he accepts the proposal.

This solves the conflict between both requests.

[12] The AA approves both requests. They have now the status "Approved" in the system.

Alternative Flow 2

This alternative flow starts at [8] when Tiger 16 decides to reject the counter proposal.

[8] This proposal will increase the transit time between the airbase and the ARES limiting too much the available training time. After coordination with Squadron Tiger Leader, he decides to reject the counter proposal.

[9] The AA cannot propose another solution that is suitable for both parts.

[10] The AA doesn't approve this booking.

[11] The ARES is not booked. Fighter 16 should cancel or delay his booking.

5.1.4.4 Use case 2: Allocate an ARES (VPA design principle)

Process diagram

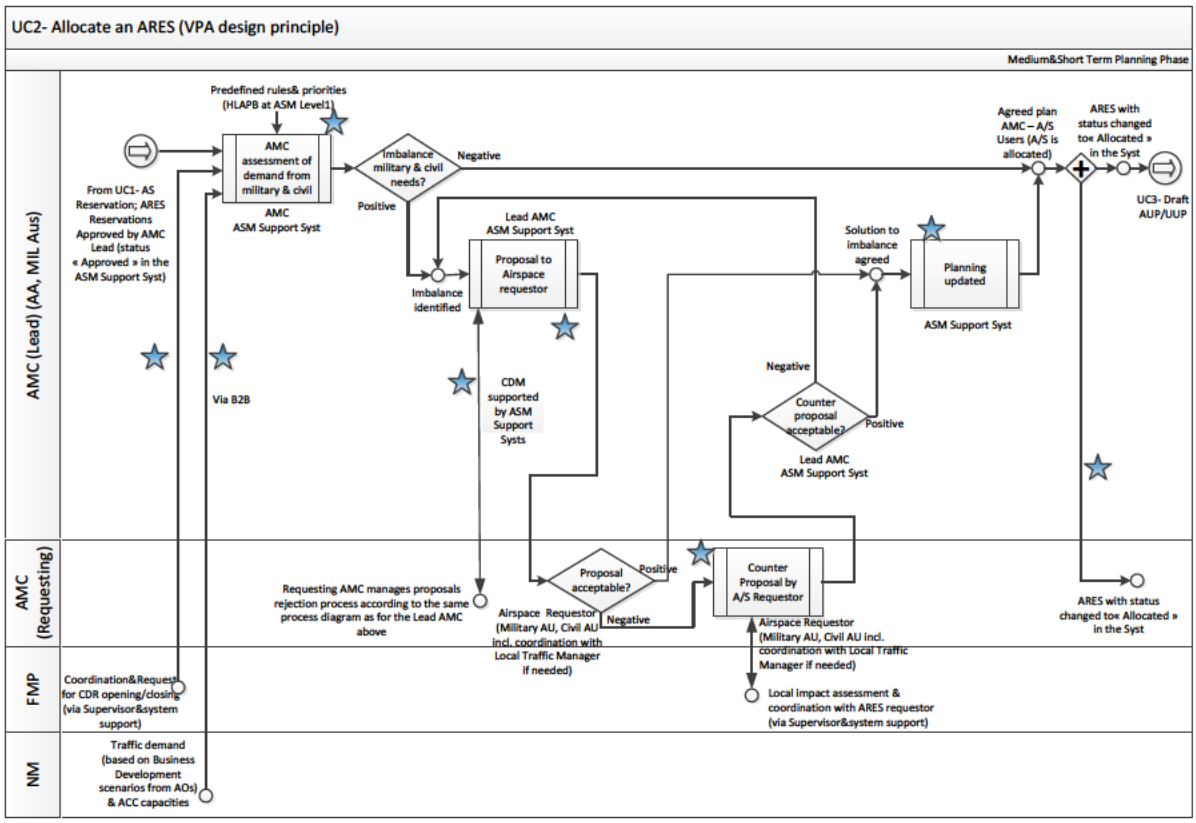

Figure 16 UC2 Allocate ARES

Scope

This Use case has been identified within the OSED V3 Task. The reference scenario is developed in section 5.1. This Use case describes the negotiation process between the airspace managers and the WOC until the ARES is allocated.

This Use case describes the negotiation process between civil and military for allocating the airspace taking into account predefined rules and priorities defined by the HLAPB at ASM Level 1 and the traffic demand.

Primary actor

- AMC (national and FAB level),
- Network Manager.

Supporting actors

- WOC,
- Approved Agency.

Pre-conditions

- The ARES are approved by the AA,
- Traffic demand is known (at least historical data are available),
- ARES is allocated,
- ARES is not allocated.

Notes

None.

Trigger

This Use case starts when the ARES are approved by the AA at national level and the traffic demand is known at least historical data are available. Capacities of ACCs are known. Silver AMC compares civil and military needs and identifies possible imbalance between demand and capacity.

Main Flow

[1] Both requests are interfering with a peak of civil traffic in sector Z.

[2] To reduce the overload, ACC A has requested to open CDR UM100 via the ASM support systems.

According the rules defined at ASM Level 1, priority is given to civil traffic between 09h00 UTC and 10h30 UTC above FL350 any working day on this CDR.

[3] Silver AMC via the ASM support systems make a proposal to Fighter 25 to move his mission in VPAX4.

[4] Using the communication tool within the ASM support systems, AMC Silver explains the proposal to Fighter 25.

[5] Fighter 25 receives an alarm with this proposal.

However, this proposal creates a conflict with Tiger 16's request.

[6] Silver AMC explains also the situation to Tiger 16 via the communication tool of the ASM support systems.

[7] Fighter 25 accepts the proposal. The most important for him is to perform the test.

[8] Tiger 16 accepts the proposal under the condition to recover the entire area when the test flight is complete.

[9] The planning is updated accordingly and automatically.

[10] Tiger 16 creates a new request to integrate VPAX4 after the flight test is complete.

This new request follows the process as described in Use case 1. The planning is agreed. AS defined in the operational scenario, the process at FAB level is not described in Step 1.

[11] The ASM support system prepares and proposes the NOTAMs (if required) to close the impacted CDRs.

Silver AMC is responsible for closing those CDRs following the national process.

[12] Silver AMC initiates the AUP via the ASM support systems to be populated in the NM systems connected in B2B.

The Network Manager assesses the network performance. The plan is agreed without modification.

Alternative flow

None.

5.1.4.5 Use case 3: Draft AUP/UUP

Process diagram

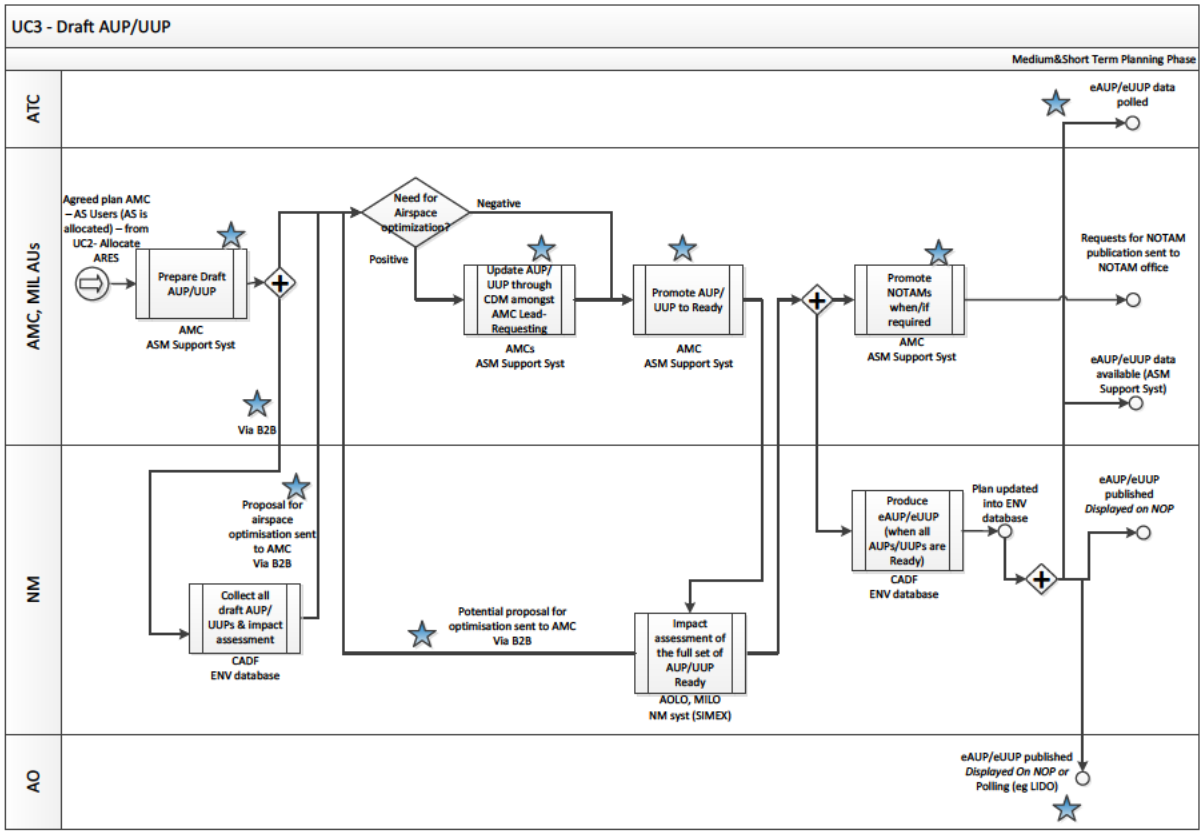

Figure 17 UC3 Draft AUP/UUP

Scope

This Use Case describes the process of exchange of dynamic data (AUP/UUP) between the NM and ASM support systems.

Primary actor

AMC user (the user responsible for the production of the AUP/UUP).

Supporting actors

None.

Pre-conditions

ARES are introduced in the ASM support systems

Post conditions

The AUP/UUP is promoted to status “Ready”.

Success End State

The AUP/UUP is promoted to status “Ready”.

Failure End State

The AUP/UUP cannot be validated by the NM.

Notes

None.

Trigger

This use case is triggered by the AMC User when initiating the Draft AUP/UUP

Main Flow

At x time, the AMC user prepares in the ASM support systems the Draft AUP/UUP for the D-day. The Draft AUP/UUP consists of the ARES data and the CDR segments availability as a result of the ARES expansion (note that the expansion includes all types of CDR segments and all CDR segments managed by the AMC as lead AMC). It is assumed that requests for NOTAM publications regarding closures of CDR 1 are sent to the relevant NOTAM office.

The AMC user sends via B2B services the Draft AUP/UUP for validation. The validation request returns a response that the AUP/UUP is OK.

The AMC user accesses the other AMCs’ AUPs/UUPs and if require optimises the airspace allocation. Note that the sent Draft AUPs/UUPs are accessible to all AMC users via the B2B services.

Once the draft AUP/UUP is considered matured and the planned airspace allocation consolidated, the AMC user promotes via the B2B the AUP/UUP to status “Ready”.

Alternative Flow

If the draft AUP/UUP cannot be validated, the validation B2B service returns errors:

- In case the required NOTAM for closer of CDR1 is not issued (i.e. is not in the NM DB), publish the required NOTAM.
- In case the static data is not consistent, update the static data, coordinate it with the affected users and commence the AUP/UUP drafting process again.

5.1.4.6 Use case 4: ARES Activation (VPA design principle)

Process diagram

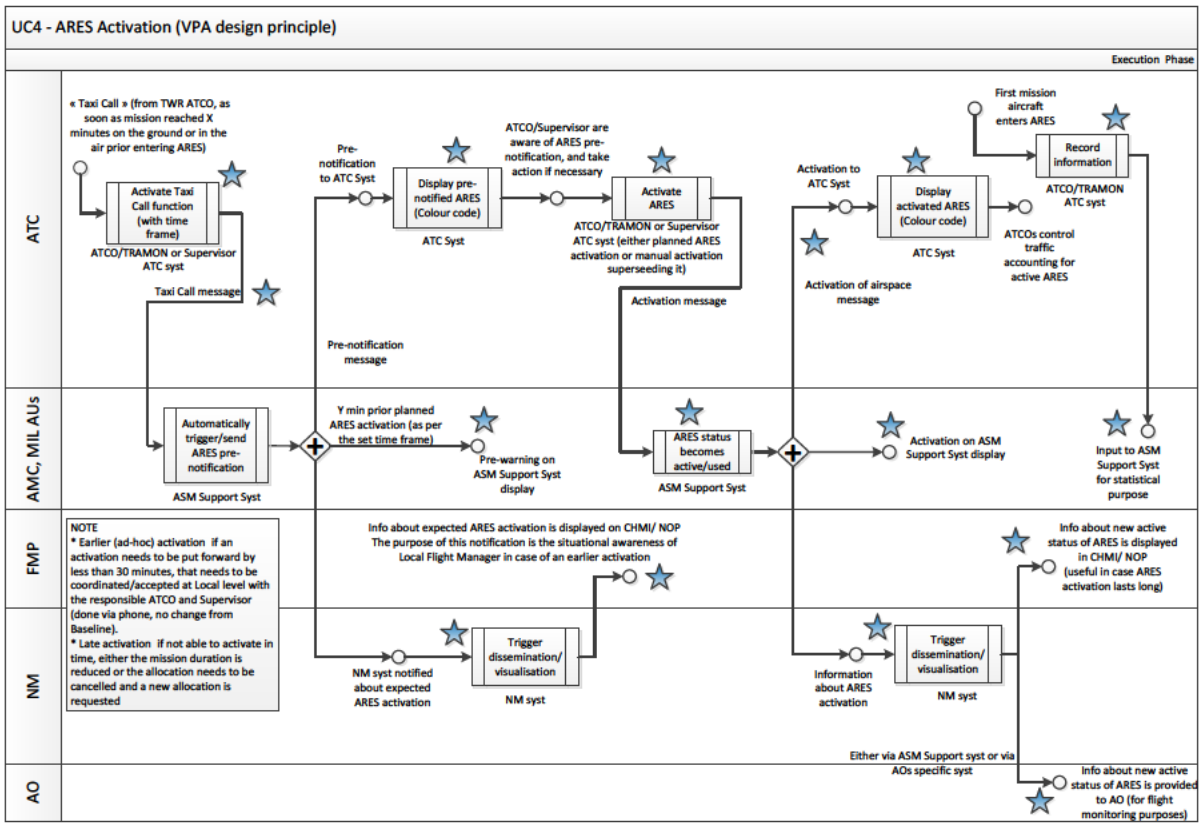

Figure 18 UC4 ARES Activation

Scope

This Use Case describes the process of activation of a planned ARES (VPA) and the process of updating the airspace status on the CWP.

Primary actor

Responsible supervisor(s)/airspace manager(s)/ Tower controller.

Supporting actors

- WOC/FOC System,
- ASM support systems,
- NMOC,
- NOP.

Pre-conditions

An ARES is published or approved. The current time is X minutes[8] prior the scheduled ARES.

Post conditions

The ARES is activated.

Success End State

The ARES is activated. Note, that the ARES could be purposely not activated which shall be consider as a success end state as well.

Failure End State

ARES is not activated.

Notes

None.

Trigger

This use case is triggered by the Tower controller by giving a “Taxi Call”[9].

Main Flow

As soon as the aircraft planned for a mission in the VPA start to taxi, the military tower controller calls the responsible ATC ATCO (TRAMON). The TRAMON then activates the TAXI Call function via the ATC system choosing a time frame coordinated with the calling Tower controller (pre-set X minutes). This time frame reflects the time needed by the mission to reach the VPA. The ATC system updates the ASM support systems.

The ASM support systems subsequently send a notification to the Network Management Function (NMF) system.

The Demand and Capacity Balancing (DCB) tool (ETFMS) then is triggered to visualize this information at the predefined FMP (the relevancy is depending on the concerned airspace) using a pop-up. This pop-up disappears with acknowledging/dismissing. The usage of the DCB tool is not hampered by the pop-up.

X minutes prior planned arrival of the mission the ASM support systems highlights the pre-warning on their displays additionally giving an acoustical signal and sends a pre-notification to the predefined ATC systems. This leads to a visualization of the allocated ARES outlines in the ASM support systems and at the CWPs in an appropriate way so the relevant ATCOs get aware, that the airspace is booked for a military mission arriving in X minutes. ATC will now get the airspace clear of civil traffic. This visualization will maintain until the status of the ARES gets changed. Prior/with the mission entering the VPA in order to start with their training the TRAMON activates the ARES via the ATC system, automatically changing the airspace status in “active/used” in the ASM support systems

[8] “X minutes” in this scenario was not a subject of the validation. It should be defined according the particular operational need.

[9] “Taxi call” is used as a specific example for the purpose of the VP-710 exercise but for the concept descr bed in this OSED, it represents any kind of pre-notification message for ARES activation.

and also updating additional predefined ATC systems (via the ASM support systems). The outlines of the ARES will now appear at the CWPs in an appropriate way signalling the usage.

The ASM support systems send a notification to the NMF system.

NM processes this information

As soon as the first authorized aircraft enters the ARES for the first time, this information will be recorded by the TRAMON via the ATC system. The TRAMON input is sent to the ASM support systems for documentation purpose.

Alternative Flow

If the TRAMON function is at a military site the Tower controller informs this unit about the taxiing. The TAXI Call function then is initiated by the military controlling unit (following the rules explained in the main flow part) by entering the information direct into the ASM support systems. For activating the ARES (active/used) coordination with the responsible ATC ATCO is required. The activation then can be done by the ATC ATCO via the ATC system or the military Aircraft Controller via the ASM support systems.

In case the mission is controlled by a military controlling unit this unit is also responsible to record the first authorized entry of a participating aircraft.

5.1.4.7 Use case 5: ARES Deactivation

Process diagram

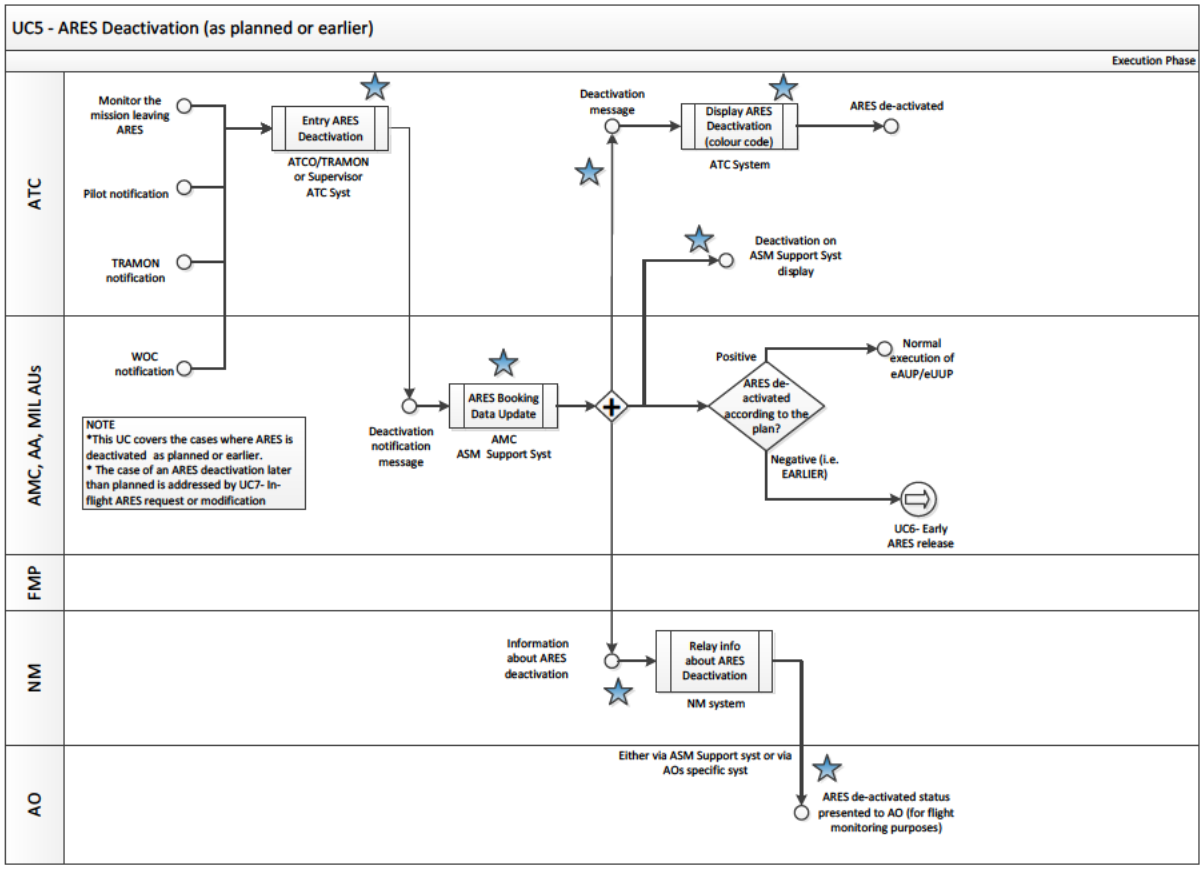

Figure 19 UC5 Ares Deactivation

Scope

This Use Case describes the process of deactivation of an ARES and the process of updating the airspace status on the CWP.

Primary actors

- Responsible supervisor(s)/airspace manager(s),
- WOC.

Supporting actors

- WOC/FOC system,
- ASM support systems,
- NMOC,
- NOP.

Pre-conditions

The ARES is active.

Post conditions

The ARES is deactivated.

Success End State

The ARES is deactivated.

Failure End State

The ARES is not deactivated.

Notes

None.

Trigger

The use case is triggered by the ARES user with leaving the ARES.

Main Flow

As soon as all ARES user finally left the area (with the end of the booked usage time latest) the ARES will be deactivated by the TRAMON via the ATC system. The ATC system sends a message to the ASM support systems updating the status of the ARES. This leads to an automatic, highlighted change of the airspace status becoming “not used” in the ASM support systems giving an acoustical signal and also updating the predefined ATC system. The outlines of the ARES will now disappear at the CWP.

The ASM support systems also send an update message with the airspace status and the automatically calculated availability of the affected CDRs to the NMF system.

The DCB tool then is triggered to visualize the airspace status information at the predefined FMP (the relevancy is depending on the concerned airspace) using a pop-up.

Alternative Flow

If the user of the ARES is controlled by a military aircraft controller the deactivation can be done by the military controlling unit by entering the information direct into the ASM support systems.

Success End State

1. The primary actor has retrieved the de-activation of an activated ARES (VPA) in the FOC system or,
2. The primary actor has retrieved the de-activation of an activated ARES (VPA) in the ASM support systems or,
3. The primary actor has retrieved the de-activation of an activated ARES (VPA) in the NOP.

Failure End State

1. The primary actor has not retrieved the de-activation of an activated ARES (VPA) in the FOC system or,
2. The primary actor has not retrieved the de-activation of an activated ARES (VPA) in the ASM support systems or,
3. The primary actor has not retrieved the de-activation of an activated ARES (VPA) in the NOP.

Note: In case the confirmation-acknowledgement process has not been finished before scheduled de-activation time, the status of the ARES shall not be displayed as “de-active” but shall be displayed as “active”.

5.1.4.8 Use Case 7: In-flight ARES Request or Modification

Process Diagram

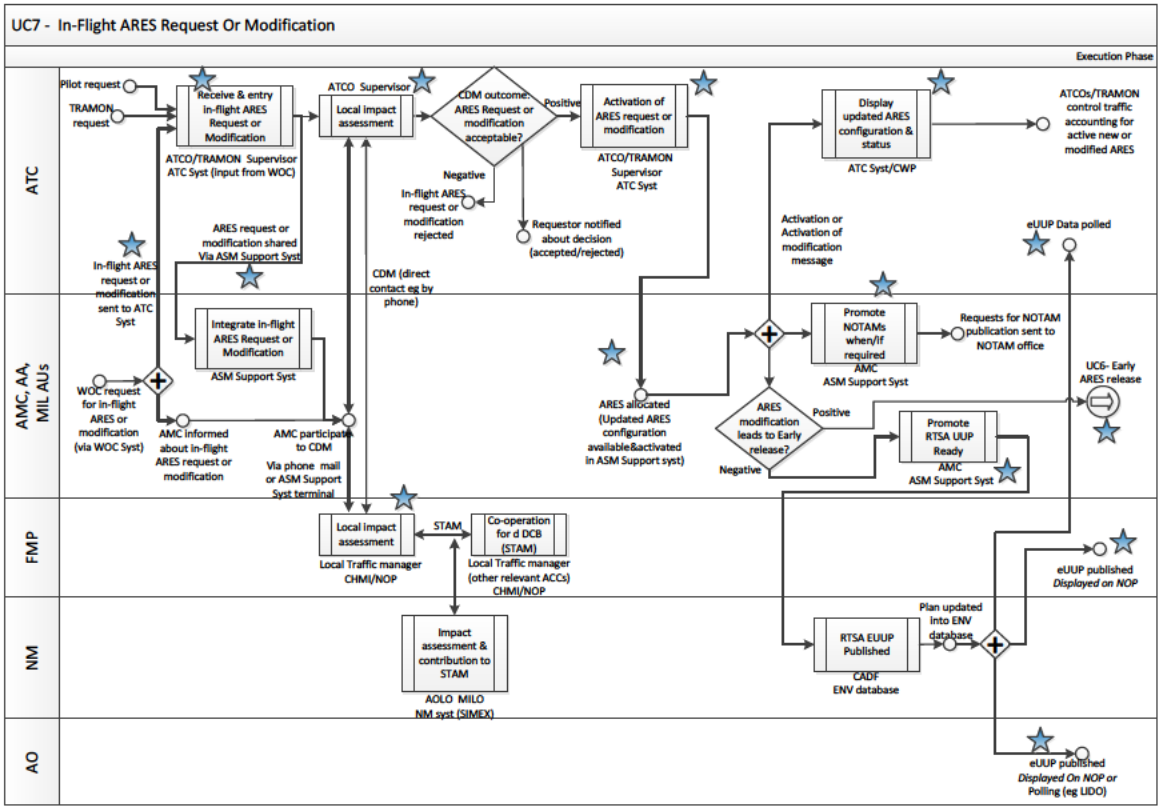

Figure 20 UC7 In-flight ARES Request or Modification

Scope

This Use Case describes the process of modification/request of an ARES in-flight (i.e. during the Execution of an AUP/UUP). The “in-flight” factor implies to have a very short reaction time and thus the modification is not reflected (yet) in the AUP/UUP (this is the main difference with UC8).

Primary actors

- Responsible supervisor(s)/airspace manager(s),
- WOC,
- Pilot,
- TRAMON.

Supporting actors

- ASM support systems,
- ATC system.

Trigger

This use case is triggered by the user of the ARES when requesting additional airspace or a modification of ARES according to his requirements and/or situation.

Success End State

The activated ARES (VPA) outlined on the CWP.

Failure End State

NA

Main Flow

Following the request for additional airspace or if a change to the actual plan occurs update is initiated by the TRAMON via the ATC system, the responsible supervisor enters the request in the ASM support systems and activates the airspace. The ASM support systems send a message to the predefined ATC system. This leads to a visualization of the ARES outlines at the CWP appearing in the appropriate way.

Additionally, this information leads to an update of the NM system, triggered by the ASM support systems. The predefined FMP(s) will be informed by a pop-up in the DCB tool. This pop-up disappears with acknowledging/dismissing. The usage of the DCB tool is not hampered by the pop-up.

Alternative Flow

If the user of the ARES is controlled by a military aircraft controller updates are done by the military controlling unit by entering the information into the ASM support systems.

5.1.4.9 Use Case 8: ARES Reservation during eAUP/eUUP execution

Process Diagram

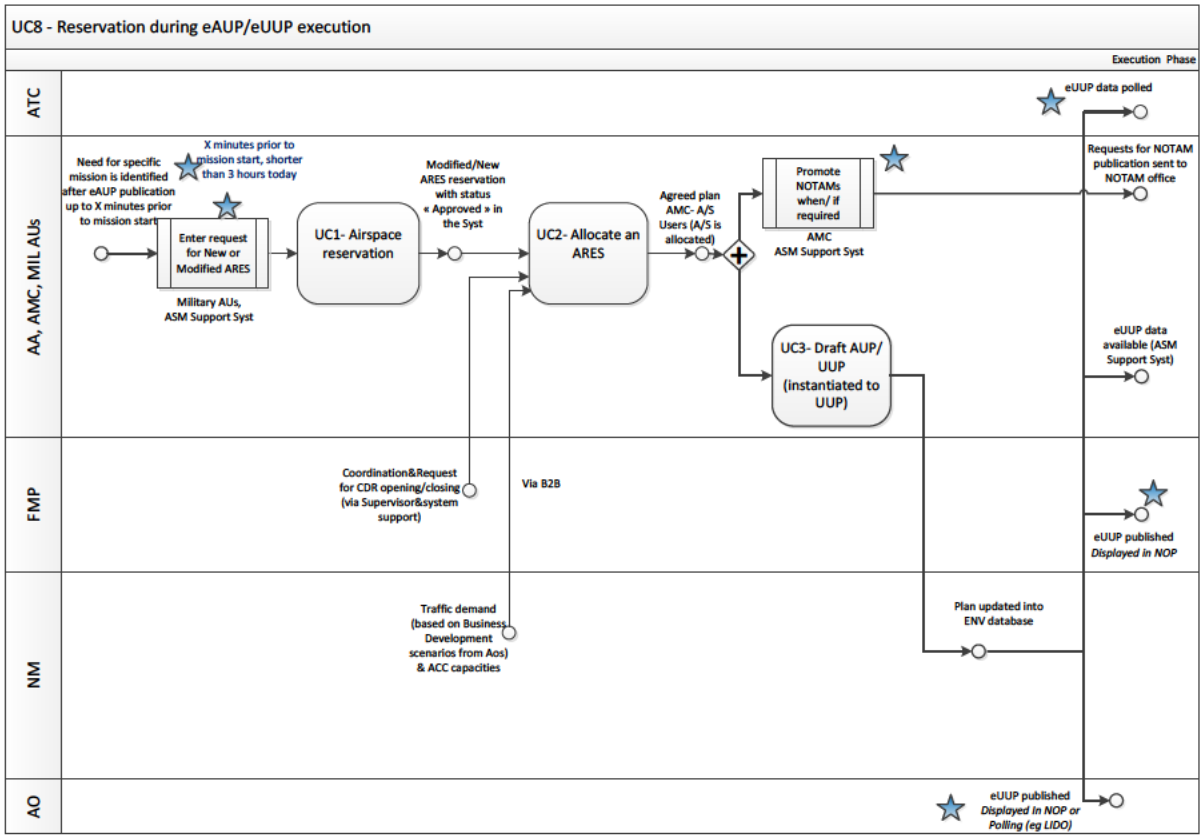

Figure 21 UC8 ARES Reservation during eAUP/eUUP execution

Scope

This Use Case describes the process of ARES reservation during the eAUP/eUUP execution.

Primary actors

- Responsible supervisor(s)/airspace manager(s),
- WOC,
- Pilot,
- TRAMON.

Supporting actors

- ASM support systems,
- ATC system.

Trigger

This use case is triggered by the user of the ARES when entering a new booking of the ARES after the time of execution of eAUP or during the execution of eUUP.

Success End State

The NMF system updated with approved booking of ARES (VPA)

Failure End State

NA

Main Flow

If an airspace user needs airspace for an additional mission/flight on the day of operation he will enter this mission/flight in the ASM support systems. After completion of the booking process (involving the ARES user, the Approved Agency, the ACC and the AMC) the ASM support systems will store the approved booking and calculate the affected CDRs.

Additionally, the ASM support systems will update the NMF system with this information.

The DCB tool then is triggered to visualize the airspace allocation information at the predefined FMP (the relevancy is depending on the concerned airspace) using a pop-up. This pop-up disappears with acknowledging/dismissing. The usage of the DCB tool is not hampered by the pop-up.

Alternative Flow

None.

5.1.4.10 Use case 9: Request an ad-hoc airspace

Process diagram

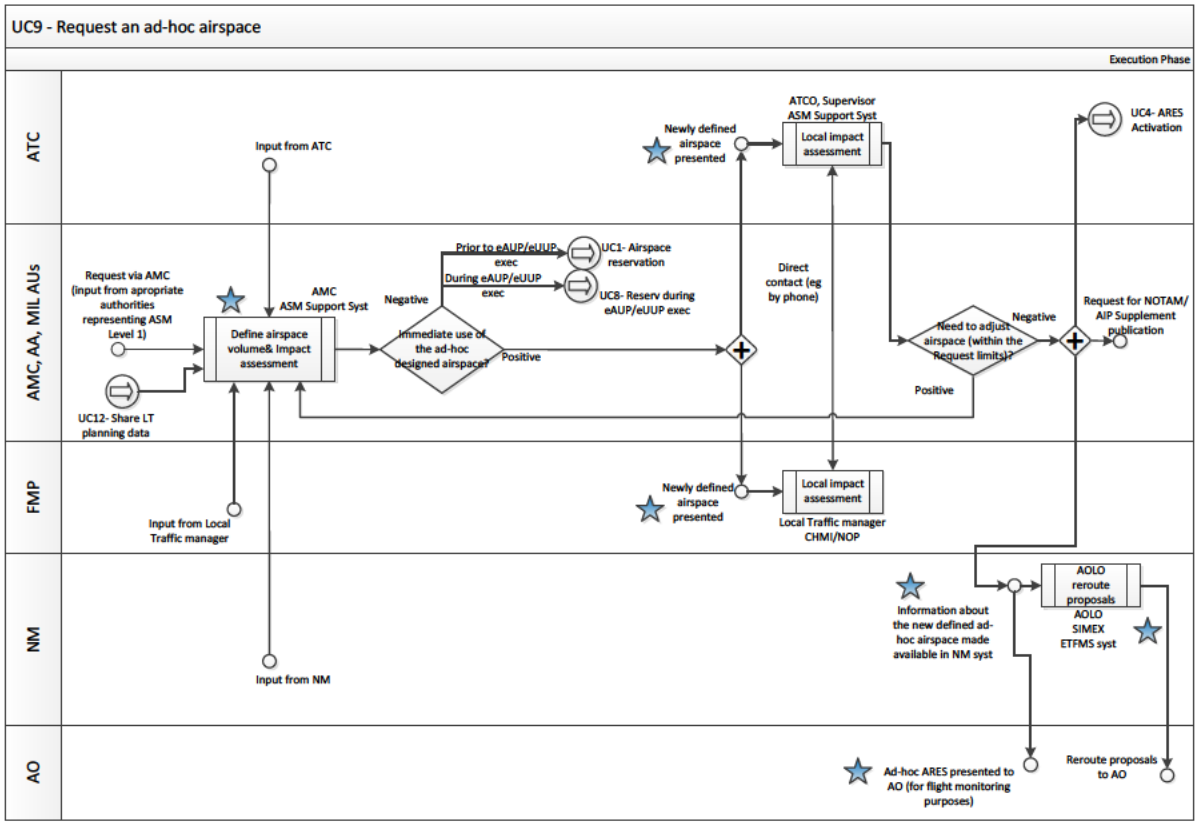

Figure 22 UC9 Request Ad-hoc Airspace

Scope

This Use Case describes the process of tactical allocation and activation of an airspace volume not included in the national airspace structure (ASM Level 1) and the process of updating the airspace status on the CWP.

Primary actor

- ASM Level 1,
- Acting HQ and pertinent bodies involved In national decision making process,
- Responsible supervisor(s)/airspace manager(s).

Supporting actors

- ASM support systems,
- ATC system.

Pre-conditions

The planned ARES is active.

Post conditions

The additional volume of airspace is activated.

Success End State

The additional volume of airspace is activated. Note, that the new volume of airspace could be purposely not activated which shall be consider as a success end state as well.

Failure End State

The additional volume of airspace is not activated.

Notes

None.

Trigger

This use case is triggered by the user of the ARES when requesting additional volume of airspace.

Main Flow

Following the request for additional volume of airspace, the responsible supervisor enters/specifies the request in the ASM support systems. The status of the new volume in the ASM support systems becomes “Pending” and the confirmation-acknowledgement process is initiated. The ASM support systems send a message to the ATC system (i.e. FDPS) to update the status of the new volume of airspace on the CWP to “Pending” and a notification to the responsible supervisor to confirm the activation.

The responsible supervisor confirms the activation of the new volume of airspace via the ASM support systems and the system sends a message to the counterpart supervisor, if any/relevant, to acknowledge the activation. Once the confirmation-acknowledgement process is completed the ASM support systems display the new volume of airspace as active, i.e. the status of the new volume of airspace is changed to “Active” and sends a message to the ATC system to update the status of the new volume on the CWP to “Active”.

In case that the confirmation-acknowledgement process for the activation of the new volume of airspace is not completed its status in the ASM support systems stay “Pending” until the end time of the reservation when the status of the ARES becomes “Inactive”.

Alternative Flow

None.

5.1.4.11 Use case 10: Cancel Reservation

Process Diagram

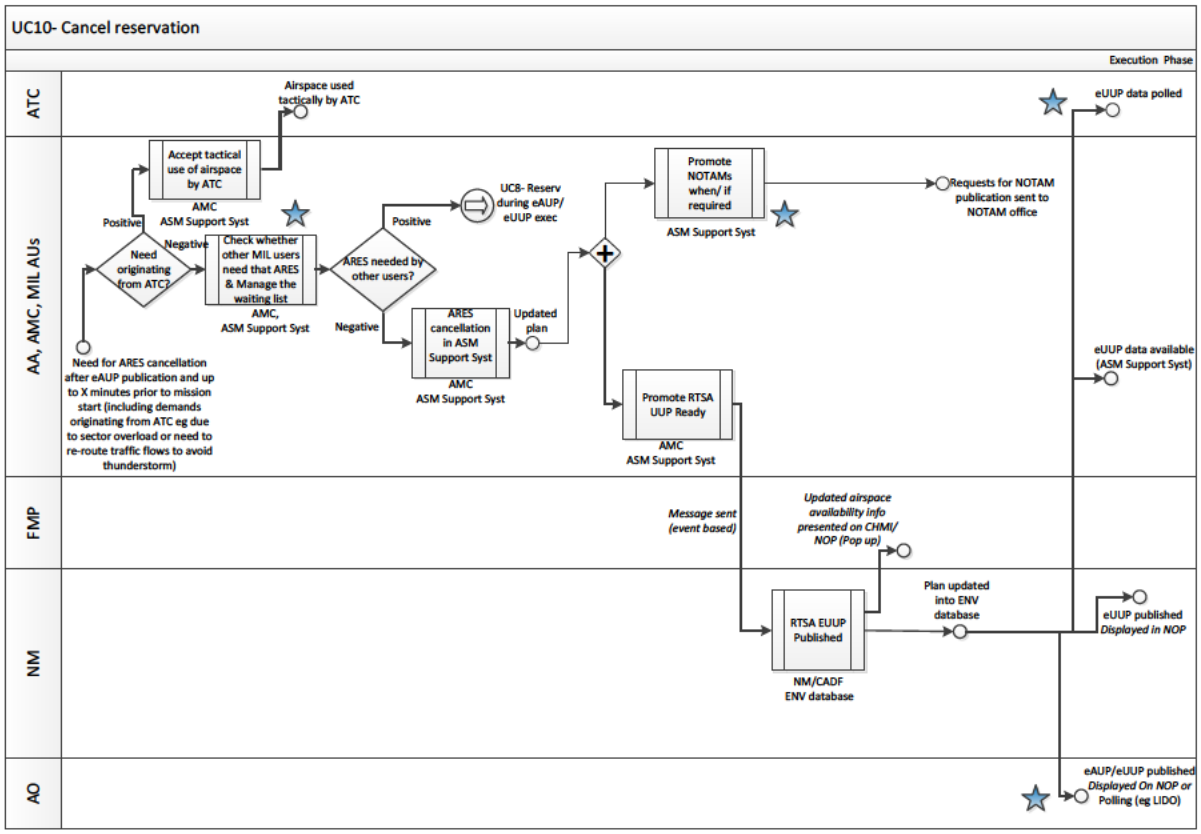

Figure 23 UC10 Cancel Reservation

Scope

This Use Case describes the process of cancelation of an ARES up to 30 min prior the mission execution.

Primary actor

- An Airspace user.

Supporting actors

- Responsible supervisor(s)/airspace manager(s).

Pre-conditions

An ARES is published or approved.

Post conditions

The ARES is cancelled.

Success End State

The ARES is cancelled.

Failure End State

The ARES is not cancelled.

Notes

None.

Trigger

This use case is triggered by a user of the ARES or the responsible supervisor when cancelling the ARES.

Main Flow

The user of the airspace or the responsible supervisor cancels the ARES by the use of the ASM support systems. The airspace structure remains “Inactive” and the ASM support systems do not send a message to the ATC system to update the status of the ARES.

In case the ASM support systems have already sent a message to the ATC systems to update the status of the ARES to “Pending” (i.e. the cancelation had happen when the status of the ARES is “Pending”) the ASM support systems send a message to the ATC systems to update the status of the ARES on the CWP to “Inactive” and the status of the ARES in the ASM support systems become “Inactive”.

If the cancellation occurs before the eAUP execution time an eUUP will be promulgated.

Alternative Flow

None.

5.1.4.12 Use case 13: Post ops analysis

Scope

The reference scenario is developed in section 5.1. This use case describes the process to perform a post ops analysis oriented at KPIs to be used for AFUA. The process is to monitor and manage the Network Performance using the Network Operational KPI, as listed in chapter 4.2.2.6 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.

Primary actor

- Military and civil aircraft operators,
- Network Manager,
- Airspace Managers.

Supporting actors

- Pilots.

Pre-conditions

Flight has been terminated, on block.

Post conditions

Individual flight has been analysed according to established KPIs and results will be used as lessons learned In order to improve the related KPAs and KPIs.

Success End State

Pertinent flight data has been analysed against relevant KPIs and result made available improve processes and services supporting flight planning, flight performance, network management and network performance.

Failure End State

Eligible flight has not been analysed and potential results will not be used to improve flight performance.

Notes

None.

Trigger

- Network Efficiency
- Demand and Capacity balancing

Main Flow

After on block time, relevant data to post ops analysis will be collected by pertinent units to perform their respective analysis. Result of assessment is merged and made available to improve processes and services supporting flight planning, flight performance, network management and network performance.

Alternative Flow

None

5.2 Operational Scenario 2

5.2.1 Introduction

This scenario sets up the Mission Trajectory Development along the overall life cycle including new AFUA structures, based on VPA design principle. It addresses the RTSA information. The timeframe is within the horizon of initial implementation of Step 1 for the execution phase. Planning and post ops analysis phases are comparable to Scenario 1. The following operational scenarios include the SESAR-relevant WOC/FOC processes related to respective use cases. These processes are of theoretical character and illustrate the use cases as described in chapter ***5.1.4.*** In the scenarios it is assumed, that the Airline Operator is using an FOC automated flight planning system (FPS).

5.2.1.1 Phases of Flight

According to the SESAR concept definition in the Execution phase the planning phase ends with the finalisation of the iSBT/iSMT which the user agrees to fly and the ANSPs and airports agree to facilitate. In this particular scenario, it is assumed that the VPA has been allocated as planned in the pre-tactical phase. Additionally, ARES not being allocated in the pre-tactical phase will be requested, allocated and used in the tactical phase.

The Execution Phase will start with the triggering of the iRBT. The iRBT is the reference trajectory that the flight crew will adhere to (nominal case) and the ATCO will support. In this phase, the ARES being allocated in the previous phase is either activated or de-activated depending on current situation.

This information is shared in real time with all stakeholders. From AO perspective, a release or de-activation of allocated airspace will provide more flexibility regarding planned airspace, while an ad-hoc activation will be a constraint.

Sufficient time for AOs to adapt their trajectories impacted by UUP, especially for airborne flights enabling a safe flight execution should be ensured.

5.2.1.2 Airspace Users

In this scenario, only the military airspace users are considered because they are the primary users of ARES.

5.2.1.3 List of Actors

The scenarios actors are listed below:

- Human Actors:
  - Snake Flight: is a BFM mission with two Typhoon as described in this scenario.
  - Blizzard Flight: is a BFM mission with two Typhoon as described in this scenario.
  - Thunder Flight: is an ACM mission with three Typhoon as described in this scenario.
  - Spider Flight: is a BFM mission with two Typhoon as described in this scenario.
  - Approved Agency (AMC): is the last body of the approval chain defined at national level. AMC is a joint civil-military AMC established at national level.
  - Network Manager Function: takes responsibility to managing the entire network.
  - Civil Supervisor: is a supervisor in an ACC responsible for managing airspace and traffic in his area of responsibility.
  - ATCO: is the responsible person to control the flights in his area of responsibility.
  - FMP: is the responsible position for flow management within an ACC.
- System Actors:
  - Military entity: *is the body with function* supporting the process described in this scenario.
  - ASM support system: is a system supporting the airspace management process.
  - NM systems: are systems supporting the network manager.
  - ATC system: is a system supporting the execution phase.
  - FPS system: is a system of the AO to allow for automated flight planning processes.
- Means of Communication:
  - NIMS: this network is supported by an infrastructure named System Wide Information Management to which the different systems are connected.

5.2.1.4 Operational Improvements (OIs)

AOM-0202-A: Automated Support for strategic, pre-tactical and tactical Civil-Military Coordination in Airspace Management (ASM).

5.2.1.5 Additional information

This scenario pre-sets the identification of military airspace needs for day-to-day training and definition of this mission planning for the day of operations.

This scenario does not intend to describe a complex military exercise involving several units. It describes a generic process that can be applied in any particular situation for daily training.

Civil airspace users requesting an ARES are not considered in this scenario. However, the process describes is the same for any airspace user.

The term “ASM support systems“ in the context of RTSA scenario 2 is always used in plural to indicate that not only the connection between an individual ASM support system and different related systems is addressed but also the connection between the ASM support systems themselves.

5.2.1.6 Assumptions

- ASM support systems are implemented and interoperable;
- NOP is operational
- NIMS enabled
- ASM support systems and NM systems are interoperable;
- ASM support systems and ATC systems are fully interoperable;
- Equity is given to meeting the needs of civil Airspace Users and military airspace requirements;
- Protection of secure and sensitive military data is assured.

5.2.2 Scenario Introduction

The operational scenario describes the RTSA data exchange between the NM, the ASM support systems and the FPS system via B2B services in AIXM format. Additionally, between ATC and ASM systems ADEXP format is used.

For a better understanding and to limit the complexity, this scenario sets up an air-to-air mission composed of four assets from on airbase named “base Alpha”.

Assuming the design of ARES is modular (i.e. following VPA design principle) to give more flexibility by adapting the volume of reserved airspace to the real need.

It is important to note that this scenario is a pure theory. It intends to describe generic military operations as much as possible close to reality.

5.2.3 Scenario Text

This scenario reflects on using the Variable Profile Area (VPA) concept as the reference scenario. The ARES therefore consists of several modules with a high band that can be booked variable

between FL250 – 660. The modules can be requested individual or in combinations (see figure below).

We are at the day of operations. The pre-tactical booking and allocation process has been completed. As example for this scenario the ED-R (TRA-VPA) 305 in Germany is taken.

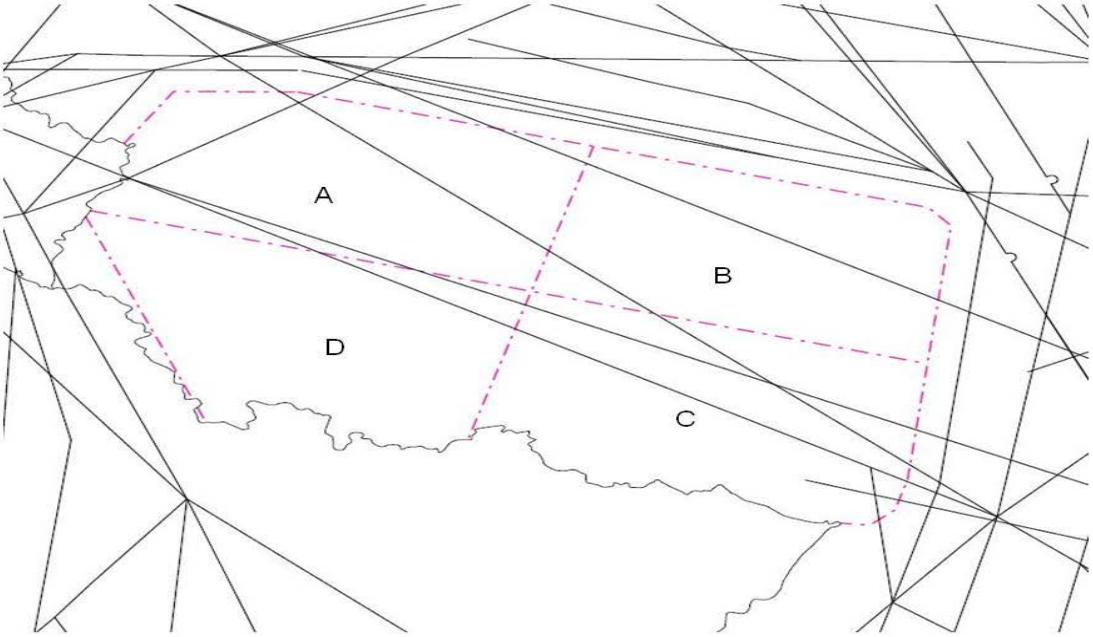

Figure 24: Graphical Overview of VPA

The following bookings have been requested via the AUP/UUP:

- Snake 1/2
    - Alpha
    - 2 x Typhoon
    - Modules A, B
    - 10:00-12:00 UTC
    - FL 250-350
    - BFM
- Blizzard 1/2
    - Alpha
    - 2 x Typhoon
    - Modules C, D
    - 12:00-13:00 UTC
    - FL 250-400
    - BFM
- Thunder 1-3
    - Alpha
    - 3 x Typhoon
    - Modules A, B

- 12:30-14:00 UTC
- FL 250-660
- ACM

Snake Mission

Due to problems in the refuelling of Snake 2, the take-off of the formation is delayed by several minutes.

At 10:05 Snake 1/2 starts taxiing. The Tower informs the responsible ATC ATCO (TRAMON) via telephone (Taxi-Call) forwarding the expected arrival time 10:15. The TRAMON then activates the TAXI Call function for the booked ARES accordingly, using the ATC system and thereby updating the ASM support systems. The ASM support systems highlight the pre-warning on its´ display (additionally giving an acoustical signal) and triggers the pre-notification of the ARES at all pre-defined ATC systems so the status of the booked segment outlines is visualized in a way indicating the pre-warning on both, CWP and ASM support systems. Additionally the ASM support systems update the Network Management Function (NMF) system. This leads to a visualization of this information at the predefined FMP by a pop-up in the Demand and Capacity Balancing (DCB) tool (ETFMS). The FMP now is aware that this part of the airspace can no longer be used.

The ATCO now starts to free the airspace of civil traffic.

With the mission approaching the VPA the TRAMON activates the ARES via the ATC system, automatically changing the airspace status in “active/used” in the ASM support systems. The ASM support systems then highlight the activation on their displays and trigger the activation at the ATC systems. The outlines of the ARES are now presented in a different way to make a clear distinction between pre-notification and activation. Parallel to the activation message to the ATC system the ASM support systems send an update of the airspace status to the NMF system (NM).

The responsible TRAMON marks the entry time of the first authorized training aircraft in the ARES for statistical reasons.

Some minutes after the mission has started, Snake 1 decides that the airspace is only required up to FL 300. He informs his controller about the change. The TRAMON updates the ARES using his ATC system and thereby updating the ASM support systems. The new airspace availability is displayed in the ASM support systems of the relevant units (additionally giving an acoustical signal) and subsequently is distributed automatically to the predefined ATC systems and the NMF system. This leads to a visualization of this information at the predefined FMP by a pop-up in the DCB tool. The FMP is now aware that this part of the airspace can be used again, possibly terminating a regulation. This additional capacity is reflected in NM system, making more airspace/capacity available for GAT.

At 11:00 UTC Snake 1/2 requests to recover IFR. The TRAMON coordinates the handover to the appropriate IFR ATCO (civil or military). At 11:05 UTC the formation leaves the ARES. The TRAMON deactivates the ARES via the ATC system. The input is send to the ASM support systems. This leads to an automatic change of the airspace status becoming inactive in the ASM support systems highlighting the de-activation on their displays (additionally giving an acoustical signal) and also updating the predefined ATC system. The outlines of the ARES will now disappear at the CWP. The ASM support systems in parallel also update the NMF system with the airspace status and the automatically calculated availability of the affected CDRs. The DCB tool is then triggered to visualize the airspace status information at the predefined FMP using a pop-up. The available airspace now can be considered again by possibly reducing the impact of a regulation or completely cancelling a regulation.

Blizzard Mission

During the take-off Blizzard 2 had a ground abort and will not be able to join Blizzard 1. However, Blizzard 1 decides to continue individual with his mission. Following the same procedure as above, the ARES segments are activated when Blizzard 1 approaches the VPA. With checking in on the controller frequency he informs the TRAMON about his plan. As he is a single aircraft now he only needs the C segment of the VPA performing an AHC mission instead of a BFM mission. The ATCO enters this information in the ATC system updating thereby the ASM support systems. The ASM support systems highlighting the change on their displays (additionally giving an acoustical signal) and automatically distributes it to the predefined ATC systems visualising it at the CWPs. Also the NMF system is updated, leading to a visualization of this information at the predefined FMP by a pop-up in the DCB tool. The FMP now is aware that this part of the airspace is available again possibly terminating a regulation.

NM is making more airspace/capacity available for GAT.

During the mission Blizzard 1 decides to perform a single supersonic run. He therefore requests an additional VPA segment for 10 minutes by the TRAMON.

Considering the predicted traffic situation, the responsible supervisor enters and activates the D segment in the level band FL360 – FL400 as additional airspace for the request of Blizzard 1 in the ASM support systems. This information is sent to the NMF system and the predefined ATC systems leading to an appropriate visualization of the additional VPA outlines at the CWPs. Additionally, this leads to a visualization of this information at the predefined FMP by a pop-up in the DCB tool. The FMP now is aware that this part of the airspace can no longer be used.

As stated by the pilot, the run is completed 10 minutes later and the TRAMON deactivates the D segment of the VPA via the ATC system initiating the above mentioned deactivation process. At 13:00 UTC Blizzard 1 leaves the ARES IFR and the TRAMON deactivates the C segment as mentioned above.

Thunder Mission

As two of the planned three aircrafts have technical problems the squadron leader decides to cancel the booking at 12:00 UTC. The cancellation is done using the ASM support systems. The new booking situation is displayed at the ASM support systems of the appropriate units (ACC, AMC etc.), the availability of the concerned CDRs are calculated in the ASM support systems and the set of information is automatically sent to the NMF system by the ASM support systems.

The DCB tool additionally is triggered to visualize this information at the predefined FMP using a pop-up. The FMP uses this information by possibly cancelling a regulation.

Spider Mission

At 12:30 UTC a new mission is booked for segment A. It is supposed to start at 16:00 UTC lasting until 17:00 UTC with requested FL 250 to 350, involving 2 Typhoon for a BFM-Mission out of Base Delta. After the booking process (involving ARES user, Approved Agency, ACC and AMC) is completed and the airspace is allocated, the new booking situation including the status and new availability of the concerned CDR (manually done by the AMC) is automatically sent to the NM system by the ASM support systems.

The DCB tool is triggered to visualize this information at the predefined FMP using a pop-up. The FMP thereby is aware of the new request and starts an impact assessment on the new allocation and its impact on DCB. The outcome of the impact assessment is communicated to NM and AMC.

At 15:55 UTC Spider 1/2 starts taxiing. The Tower informs the responsible TRAMON via telephone (Taxi-Call) forwarding the expected arrival time 16:15 UTC. The TRAMON then activates the TAXI Call function for the booked ARES (entering the announced time frame for arrival (20 minutes)), using the ATC system and thereby updating the ASM support systems. The ASM support systems update the NMF system. This leads to a visualization of this information at the predefined FMP by a pop-up in the Demand and Capacity Balancing (DCB) tool (ETFMS). The FMP now is aware that this part of the airspace can no longer be used.

At 16:05 UTC the ASM support systems highlight the pre-warning on their displays (additionally giving an acoustical signal) and trigger the pre-notification of the ARES at all predefined ATC systems so the status of the booked segment outlines is visualized in a way indicating the pre-warning on both, CWP and ASM support systems. The ATCO now starts to free the airspace of civil traffic.

With the mission approaching the VPA the TRAMON activates the ARES via the ATC system, automatically changing the airspace status in “active/used” in the ASM support systems. The ASM support systems then highlight the activation on their displays and trigger the activation at the predefined ATC systems. The outlines of the ARES are now presented in a different way to make a clear distinction between pre-notification and activation. Parallel to the activation message to the ATC system the ASM support systems send an update of the airspace status to the NMF system.

The responsible TRAMON marks the entry time of the first authorized training aircraft in the ARES for statistical reasons.

At 16:50 UTC Spider 1/2 requests to recover IFR. At 16:55 UTC the formation is flying IFR. The TRAMON deactivates the ARES via the ATC system. The input is send to the ASM support systems. This leads to an automatic change of the airspace status becoming inactive in the ASM support systems highlighting the de-activation on their displays (additionally giving an acoustical signal) and also updating the predefined ATC systems. The outlines of the ARES will now disappear at the CWP. The ASM support systems in parallel also update the NMF system with the airspace status and the automatically calculated availability of the affected CDR2. The DCB tool then is triggered to visualize this information at the predefined FMP using a pop-up. The available airspace now can be considered again by the ACC supervisor/ FMP.

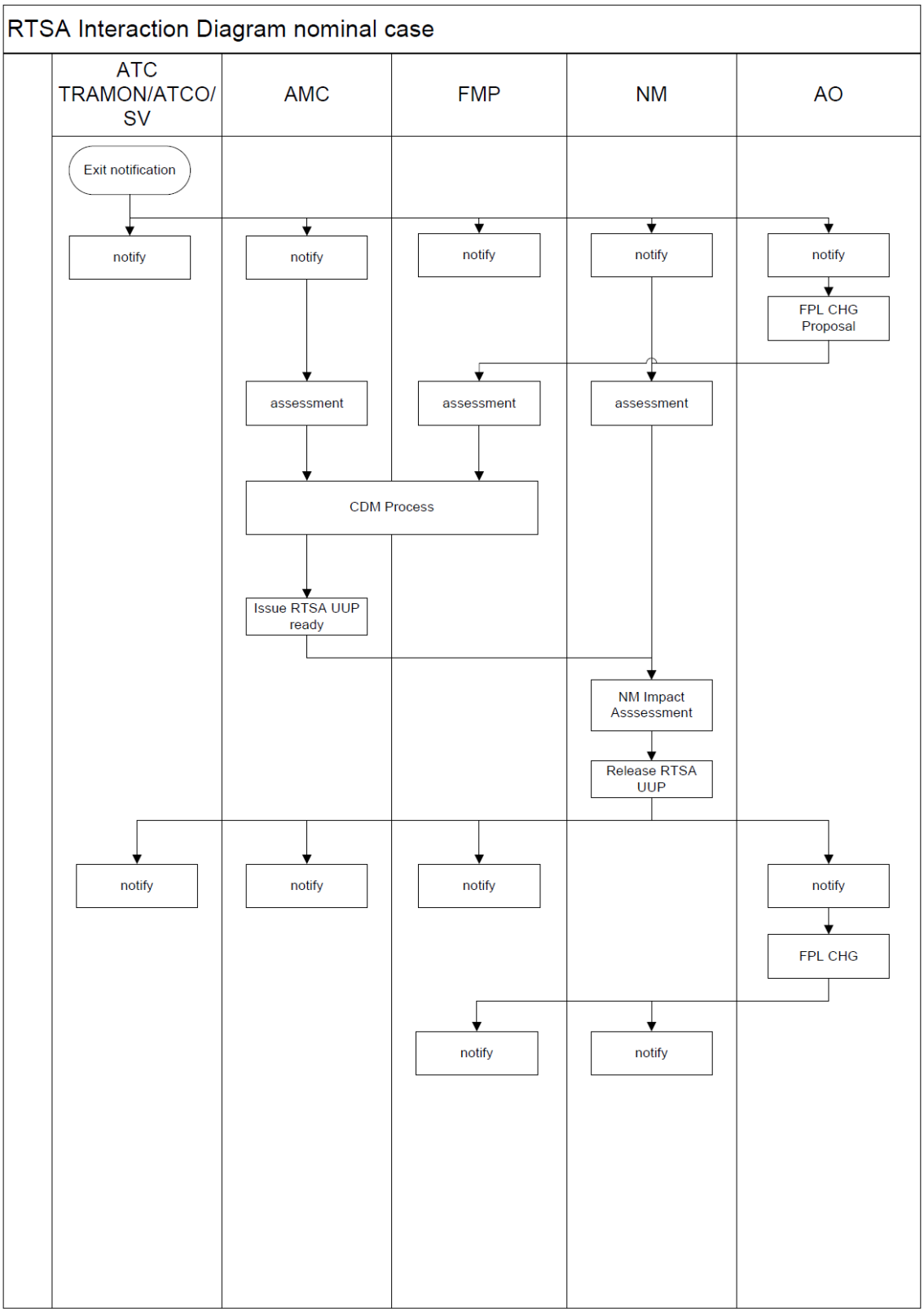

Figure 25: RTSA Interaction Diagram

5.2.4 Use Case

5.2.4.1 Use Case 6: Early ARES Release

Process Diagram

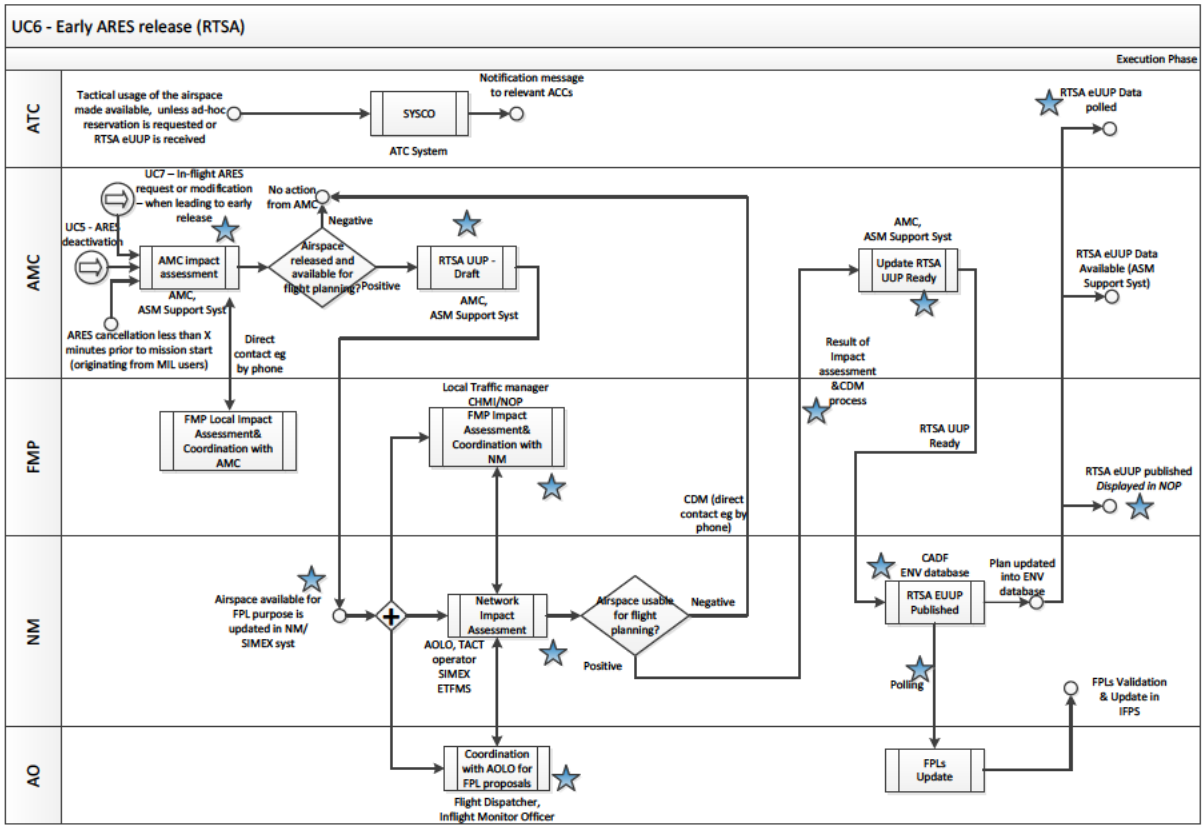

Figure 26 UC6 Early ARES Release

Scope

This Use Case describes the process of handling an early release (before de-activation time in AUP/UUP) of activated ARES. The release can be either related to all modules of the ARES or can be also limited to de-activation of single modules.

User Goal

The goal for the AO is to retrieve this information in real time for potential flight planning.

Summary

If an airspace requestor releases airspace prior scheduled time of de-activation the released ARES modules can be used by other airspace user for trajectory optimization (impacted trajectories). This includes the responsible ATCO, using this airspace for tactical decisions and/or making the information available to AOs to optimise their flight planning of pre- and post- departure flights, following a series of impact assessments at local and network level.

Primary actors

- AA,
- ATCO/supervisor,
- Flight Dispatcher,
- Inflight Monitor Officer,
- Flight Crew.

Supporting actors

- NMOC,
- FPS system,
- ASM support systems,
- WOC/FOC systems,
- IFPS systems,
- ATC systems.

Precondition

An ARES is active.

Post-condition

The primary actor has adapted an impacted trajectory

Success End State

The primary actor has adapted an impacted trajectory is flown and related data submitted to NMOC for flight efficiency measure.

Failure End State

The ad-hoc de-activated or cancelled ARES (VPA) is not used.

Main Flow

1. The Airspace User, ANSP (ATC system) and AO receive a notification about a cancellation or early release of an allocated ARES (VPA) via the NMOC.
2. Upon RTSA, a CDM process is triggered and involves the concerned parties.
3. As an outcome of this CDM process, AO provides FPL change proposals to NMOC.
4. The AA performs a local impact assessment and provides the result to NMOC by issuing a Special UUP (SUUP) in “Ready” state.
5. After capacity figures are recalculated (currently by FMP), Network Manager Flight Efficiency support function identifies eligible flights by using ETFMS systems.
6. A list of eligible flights is produced. It includes rerouting proposals which take into account the recalculated capacity figures of the impacted sector(s). This list is communicated to the concerned airline operators via the NOP portal. The affected flights are flagged and the AOs start the coordination process to whether accept, modify or refuse the proposed rerouting. After accepting the proposal, the flight plan is resubmitted and validated by IFPS.
7. The local FMP performs an impact assessment and provides the result to NMOC.
8. In case of both the results being positive, NMOC performs the network impact assessment based on the eligible flights provided by AO via FPL change proposal.
9. Following a positive network impact assessment, NMOC converts the SUUP and publishes the RTSA UUP.
10. The published RTSA UUP updates the IFPS system.
11. RTSA UUP is sent to AO.

12. AO sends FPL update.

Alternate Flow 1

1. The Airspace User, ANSP (ATC System) and AO receive a notification about a cancellation or early release of an allocated ARES (VPA) via the NMOC.
2. The AO provides a FPL change proposal to NMOC.
3. The AA performs a local impact assessment and provides the result to NMOC by issuing a Special UUP (SUUP) in “Ready” state.
4. The local FMP performs an impact assessment and provides a negative result to NMOC.
5. NMOC does not perform an impact assessment and ARES remains available.
6. The released airspace (the planned ARES) can be made available to AUs.
7. The released airspace is not used at all.

Alternate Flow 2

1. The Airspace User, ANSP (ATC System) and AO receive a notification about a cancellation or early release of an allocated ARES (VPA) via the NMOC.
2. The AO provides a FPL change proposal to NMOC.
3. The AA performs a local impact assessment and provides a negative result to NMOC.
4. The local FMP performs an impact assessment and provides the result to NMOC.
5. NMOC does not perform an impact assessment and ARES remains available.

Alternate Flow 3

1. The Airspace User, ANSP (ATC System) and AO receive a notification about a cancellation or early release of an allocated ARES (VPA) via the NMOC.
2. The AO provides a FPL change proposal to NMOC.
3. The AA performs a local impact assessment and provides the result to NMOC by issuing a Special UUP (SUUP) in “Ready” state.
4. The local FMP performs an impact assessment and provides a negative result to NMOC.
5. NMOC does not perform an impact assessment.
6. The ANSP (ATCO) uses the released airspace via tactical decisions (Directs).

6 Requirements[10]

6.1 Requirements for Process / Service[11]

In this section, the operational requirements have been organised as follow:

- Airspace Organisation and Management (AOM);
- Network Operating Plan (NOP);
- Negotiation level (NL);
- Execution level (EL);
- Post flight analysis (PO).

[REQ]

Identifier	REQ-07.05.02-OSED-AOM1.0001
Requirement	The ASM data base shall manage any VPA volume and combination thereof.
Title	ASM Database
Status	<Validated>
Rationale	The database shall manage any combination of basic volumes.
Category	<Operational>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Service>	AeronauticalInformationFeature	N/A
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0005	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-AOM1.0002
Requirement	New design principle shall enable definition of a VPA by outline coordinates and several basic volumes.
Title	Definition of VPA
Status	<Validated>
Rationale	The VPA design principle shall be incorporated and applied in the ASM operating methods.
Category	<Operational>
Validation Method	<Shadow Mode>
Verification Method	

[10] In this section there are several requirements in status “Deleted”. Reason for that is that during the document development and the performed safety assessment on AFUA concept some requirements have been moved into SPR, or completely deleted as the content was considered for not anymore relevant or obsolete. Also some SPR requirements have been moved in D45 OSED as they have been considered being operational. Therefore they appear in D47 SPR as “Deleted”. The status of all requirements was consolidated during a dedicated meeting.

[11] There are several requirements that do not state clearly the role of the operational actor as operationally, multiple actors can use the same or different functionalities of the named systems.

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Service>	AeronauticalInformationFeature	N/A
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0005	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-AOM1.0003
Requirement	Operational process and procedures shall allow to define and manage each basic volume of a VPA
Title	VPA management
Status	<Validated>
Rationale	Any basic volume shall be identified by a unique name.
Category	<Operational>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Service>	AeronauticalInformationFeature	N/A
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0005	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-AOM1.0004
Requirement	The ATC system shall accept any basic volume of a VPA
Title	ATC Database
Status	<Validated>
Rationale	The database shall accept the specified number of any basic volume defining the VPA.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Service>	AeronauticalInformationFeature	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0005	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-NOP1.0010
Requirement	The Military Airspace User shall publish in the NOP the planned Military events as soon as the information is mature enough to be shared with the ATM network, and any update until the day of operation.
Title	Publication of military events in the NOP
Status	<Validated>

Rationale	Important MIL events are planned well in advance and involve an AS usage that impacts the overall ATM. In the previous operating method, the information available about Military events is limited, and the way it is collected and disseminated does not guarantee the earliest sharing between all actors for an efficient planning and accommodation of all demand needs. Supported by the WOC/AOC, data related to the long term planning shall be shared as soon as they have reached a certain level of maturity, and they shall be refined when additional information is available. At an early stage, data will be limited to the following type of information: planned exercises (incl. dates, impacted FIR/UIR, volume of flights, concerned airspace portions/volumes, general time slots), volume of flights expected for each exercises (incl. distribution between VFR and IFR), special events having an impact on the network (e.g. International Conference Summit, Olympic Games, Air Shows, Competitions). Those data are loaded in the ASM Support system and these should be available also in the Network Operations Plan.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Service>	AeronauticalInformationFeature	N/A
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0016	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-NOP1.0020
Requirement	The Network Manager shall publish in the NOP the outcome of its impact assessment of Military events on the European ATM network.
Title	Publication of network impact assessment in the NOP
Status	<Validated>
Rationale	Impact assessment information includes the traffic impacted (timings, flight levels), network performance impact (KPIs), sectors impacted (incl. neighbouring areas), compatibility with sector capacities.
Category	<Operational>
Validation Method	<Real Time Simulation><Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Service>	AeronauticalInformationFeature	N/A
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0010	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-NOP1.0030
Requirement	The Airspace Manager shall share with NM for publication in the NOP the planned ARES within his area of responsibility as soon as the information is mature enough to be shared with the ATM Network (prior to D-1), and any update including the day of operation.

Title	Publication of planned ARES in the NOP
Status	<Validated>
Rationale	Timely and continuous update of ARES information in the NOP will help maintaining an up-to-date view of airspace demand and resources available in the network. In the previous operating method, the availability of Military Airspace is available one day in advance only, followed by 2 updates on D-Day.
Category	<Operational>
Validation Method	<Real Time Simulation><Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Service>	AeronauticalInformationFeature	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0010	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-NOP1.0040
Requirement	The Network Manager shall publish in the NOP the outcome of the impact assessment of new ARES - or ARES planning changes e.g. early activation/de-activation; cancellation - on the network and strategies to mitigate the impact (e.g. adjusting timings of closure or levels) or to benefit from created opportunities (available CDRs).
Title	Publication of network impact assessment in the NOP
Status	<Validated>
Rationale	Sharing the impact assessment of ARES opening/closing and the strategies would facilitate making the best possible (best expected performance) planning and decision making.
Category	<Operational>
Validation Method	<Real Time Simulation><Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Service>	AeronauticalInformationFeature	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0016	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-NOP1.0050
Requirement	The NM system shall update the NOP in real-time with the latest status of allocated ARES (activation/de-activation).
Title	Publication of ARES activation in the NOP
Status	<Validated>
Rationale	This is required to maintain an up-to-date and consistent network view.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Service>	AeronauticalInformationFeature	N/A
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0010	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-AOM1.0005
Requirement	Operational process shall accept that the status of a VPA can differ from one mission to another mission.
Title	VPA Status
Status	<Validated>
Rationale	Depending on the mission type, the ARES shall be accepted as fully segregated or permeable under certain conditions. This status (TSA, TRA, or D) shall be defined by the ARES user.
Category	<Operational>
Validation Method	<Expert Group (Judgement Analysis)>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Service>	AeronauticalInformationFeature	N/A
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0005	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-AOM1.0006
Requirement	New operating methods shall foresee a possibility to subdivide an Airspace into areas and routes
Title	AFUA-AOM006: Airspace Design
Status	<Deleted>
Rationale	Any airspace type shall be integrated in a database. The new operating methods shall enable subdivision of an Airspace into areas and routes
Category	<Operational>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-07.05.02-OSED-AOM1.0007
Requirement	Definition of an ARES / modules shall include coordinates and lower and upper level
Title	Outline of Area Design
Status	<Validated>

Rationale	Any area shall be identified by coordinates (latitude and longitude or georef) and one lower and one upper level.
Category	<Operational>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Service>	AeronauticalInformationFeature	N/A
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0005	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-AOM1.0008
Requirement	Levels of area shall always be defined in FL or feet
Title	Area FL units
Status	<Validated>
Rationale	The system shall accept only level definition in FL or feet
Category	<Operational>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Service>	AeronauticalInformationFeature	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0005	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-AOM1.0009
Requirement	The ASM system and its supporting system(s) shall provide Network Managers with the ability to select different ARES / modules for “what-if” functionality (impact assessment).
Title	Booking a VPA what-if
Status	<Validated>
Rationale	Airspace managers shall evaluate various options before presenting them to users as alternatives in the CDM process.
Category	<Operational>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0020	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-NL01.0010

Requirement	The ASM Support System shall manage any VPA modules and combinations thereof in booking process
Title	Booking a VPA modules
Status	<Validated>
Rationale	The requestor shall combine any basic volume supporting the demand when booking a VPA
Category	<Operational>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0010	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-NL01.0011
Requirement	Operational process shall allow the booking of only one basic volume or combinations thereof for a single mission
Title	VPA options in booking for a single mission
Status	<Validated>
Rationale	Depending on the initial design of a module, the module sufficient for a certain type of mission and shall be booked by the requestor
Category	<Operational>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0005	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-NL01.0012
Requirement	Operational process shall allow the booking of several basic volumes or combinations thereof for exclusive usage by several missions
Title	VPA options in booking for a combined mission
Status	<Validated>
Rationale	Because a VPA is composed of a high number of basic volumes, it shall be possible to perform more than one mission at the same time
Category	<Operational>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0005	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-NL01.0013
Requirement	The requestor shall be able to choose a VPA status (TSA, TRA, or D)
Title	VPA status
Status	<Validated>
Rationale	The ASM Support System shall propose a list of status (TSA, TRA, or D) when the requestor books and uses an ARES. The ASM support system shall indicate the status of ARES use.
Category	<Operational>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0005	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-NL01.0014
Requirement	The requestor shall be able to choose the upper and lower level of ARES for the mission
Title	Booking a VPA
Status	<Validated>
Rationale	The ASM Support system shall allow to choose the upper and lower levels and verify that they are within the published upper and lower levels
Category	<Operational>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0005	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-NL01.0015
Requirement	The NM system shall allow analysing the impact of any combination of VPA on network performance.
Title	Select VPA for network performance assessment
Status	<Validated>
Rationale	The system shall allow user to select any pertinent combination of modules to limit the impact on the network performance (KPA/KPI)
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0013	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0015	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-NL01.0016
Requirement	The NM shall be able to make counterproposals on combination of modules to limit the impact on the network performance
Title	NM counterproposals
Status	<Validated>
Rationale	The NM system shall calculate and propose the best option of VPA design to limit the impact on the network performance (KPA/KPI) while balancing AUs demands
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0010	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-EL01.0017
Requirement	All users shall have access to information about RTSA ARES status (Activation/Deactivation/Modification) in real time.
Title	Activation/Deactivation/Modification
Status	<Validated>
Rationale	The systems shall be connected in a network to share the information between all ATM actors potentially in real time
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Service>	ARESQuery	N/A
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0001	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0002	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0005	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0006	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0011	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0012	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0017	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0018	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-PERF.0312
Requirement	The type of the VPA (TRA, TSA, D or R) shall allow adaptation according to the mission(s).
Title	VPA type list
Status	<Validated>
Rationale	For Performance / Safety reasons, airspace users should know far in advance if an airspace is D or R.
Category	<HMI><Performance><Safety>
Validation Method	<Real Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0005	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-AMAP.1030	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-PERF.0313
Requirement	D and R types shall appear in the list of available VPA types up to ASM level 2, not after.
Title	Danger and Restricted Areas
Status	<Validated>
Rationale	For Performance / Safety reasons, airspace users should know far in advance if an airspace is D or R.
Category	<HMI><Performance><Safety>
Validation Method	<Real Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0005	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-AMAP.1030	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-PERF.0316
Requirement	The ASM Support System shall allow to choose the date and the slot (start and end time) for the ARES booking
Title	Date and slot for ARES booking
Status	<Validated>
Rationale	The day and slot of ARES booking is: - a basic parameter for a reservation - one of the most important criteria for a lesser impact on GAT traffic flows
Category	<Performance>
Validation Method	<Real Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0005	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-EL01.0018
Requirement	The ASM support system shall enable share planning status of ARES among all ATM actors, including across the border at any time
Title	Planning Status sharing
Status	<Validated>
Rationale	The NOP shall be updated with any data related to the planning. Modification to such plans will include an appropriate coordination process.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0016	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-EL01.0019
Requirement	If an activation/de-activation is not confirmed, the ATC system shall not allow the automatic activation/deactivation of the ARES on the controller working position
Title	Activation De activation confirmation
Status	<Validated>
Rationale	Status of the airspace shall be accurate and consistent between the ASM support system and the ATC system
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Service>	ARESActivation	N/A
<ALLOCATED TO>	<Service>	ARESDeActivation	N/A
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0004	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0023	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-PERF.0620
Requirement	The process for ARES de-activation shall be the same as for activation

Title	ARES De-activation
Status	<Deleted>
Rationale	The ARES will no longer be displayed on the Controller Working Position (CWP) after a prenotification has already indicated the expected change.
Category	<Performance>
Validation Method	<Real Time Simulation><Gaming Technique (Agent Based Analysis)>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-07.05.02-OSED-EL01.0020
Requirement	On the CWP, the VPA related and indicated outlines of the ARES shall differ between pre notification and real activation
Title	VPA status
Status	<Validated>
Rationale	The ATCO shall be able to differentiate between a pre notification and the real activation of an ARES by outline.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Service>	ARESQuery	N/A
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0012	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-PO01.0021
Requirement	The ASM system shall be able to analyse actual outcomes of ARES use and compare them with predicted outcomes for performance assessment.
Title	Post Ops Analysis
Status	<Validated>
Rationale	The ASM support system shall support the process of post ops analysis for the performance assessment.
Category	<Operational>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Service>	ARESQuery	N/A
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0011	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0013	<Full>

<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0015	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-AMAP.1000	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-AMAP.1010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-AMAP.1020	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-AMAP.1030	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-PERF.0630
Requirement	Planning Efficiency analysis shall consist in analysing at least: - The application of the concept - The adherence to optimum airspace dimensions - The utilisation of airspace - The efficient booking system
Title	Planning Efficiency
Status	<Validated>
Rationale	The elements defined in this requirement allow evaluation of the planning efficiency.
Category	<Performance>
Validation Method	<Expert Group (Judgement Analysis)>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0011	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0013	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0015	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0016	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-PERF.0640
Requirement	Flight Efficiency analysis shall consist of comparing the initial flight plan with the executed one.
Title	Flight Efficiency
Status	<Validated>
Rationale	Military missions, mostly flying from A to A and sometimes having extreme flight profiles are by nature not efficient, although efficiency of their transit phase to the training zone can be improved.
Category	<Performance>
Validation Method	<Real Time Simulation><Expert Group (Judgement Analysis)>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0011	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0013	<Full>

<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0015	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-PERF.0650
Requirement	Mission Effectiveness analysis shall consist of analysing at least: - Economic impact on transit - Impact of airspace location on training - Volume and shape of the airspace allocated
Title	Mission Effectiveness
Status	<Validated>
Rationale	Efficiency of the transit phase of military missions to their training zone can be improved, in terms of fuel consumption as well as time left for training. Volume and shape of airspace allocated are also important in relation with the training flight profile.
Category	<Performance>
Validation Method	<Expert Group (Judgement Analysis)>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0011	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0013	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0015	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-AMAP.1020	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-PERF.0660
Requirement	Civil and military flexibility analysis shall consist of analysing: - Training in non-restricted areas (MIL) - Release of airspace (MIL, CIV) - Accommodation of short notice needs (MIL, CIV)
Title	Flexibility
Status	<Validated>
Rationale	Flexibility is a key element for both civil and military airspace users to get benefit from AFUA.
Category	<Performance>
Validation Method	<Expert Group (Judgement Analysis)>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0011	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0013	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0014	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0015	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-PERF.0670
Requirement	Capacity analysis shall consist of comparing the initial capacity declared by the Air Navigation Service Provider (ANSP) with the real one
Title	Capacity
Status	<In Progress>
Rationale	This analysis will allow to make periodic re-assessments of the capacity model
Category	<Performance>
Validation Method	<Real Time Simulation><Expert Group (Judgement Analysis)>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0011	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0013	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0015	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-AMAP.1000	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-AMAP.1010	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-PERF.0680
Requirement	Environmental Sustainability analysis shall consist in comparing optimum trajectory, i.e. great circle TMS to TMA trajectory, with the executed one.
Title	Environment Sustainability
Status	<Validated>
Rationale	This requirement is linked to horizontal/vertical deviation fuel burn KPIs.
Category	<Performance>
Validation Method	<Real Time Simulation><Expert Group (Judgement Analysis)>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0011	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0013	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0015	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-AMAP.1020	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-PO01.0022
Requirement	The NM system shall provide access to RTSA information to ATM actors concerned.
Title	Execution level
Status	<Validated>
Rationale	RTSA information shall enable the concerned ATM actor to perform the necessary assessments with regards to their business needs

Category	<Operational>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0011	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0013	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0015	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-PO01.0023
Requirement	The NM shall provide RTSA information to the AOs.
Title	Execution level
Status	<Validated>
Rationale	With RTSA information, AOs can send proposals to update current flight planning if relevant. It shall support the issuance of a new or changed flight plan using a more optimal trajectory.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Service>	ARESQuery	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0011	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0013	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0015	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0016	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-PO01.0025
Requirement	The ATC system shall accept ATCO input on an ad-hoc ARES request in regard to pre-notification, activation, de-activation and modification.
Title	Execution level
Status	<Validated>
Rationale	ATCOs' common SA with regards to RTSA information.
Category	<Safety>
Validation Method	<Real Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0010	<Full>

<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0011	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0013	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0015	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0016	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-AMAP.1030	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-PO01.0026
Requirement	The transition to deployment and operational use shall be secure
Title	Execution level
Status	<In Progress>
Rationale	The security requirement of 16.6.2 shall be met.
Category	<Performance>
Validation Method	<Real Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0019	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-PO01.0027
Requirement	The role of the human shall be consistent with Human Performance Limitations
Title	Human Performance – Human role
Status	<Deleted>
Rationale	The Human performance requirement of 16.6.5 shall be met.
Category	<Performance>
Validation Method	<Real Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-07.05.02-OSED-PO01.0028
Requirement	The technical system shall support the human actors performing their tasks
Title	Human Performance – Technical system
Status	<Deleted>
Rationale	The Human performance requirement of 16.6.5 shall be met.
Category	<Performance>
Validation Method	<Real Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-07.05.02-OSED-PO01.0029
Requirement	The team structures and team communication shall support the human actor in performing their tasks.
Title	Human Performance – Team and communication
Status	<Deleted>
Rationale	The Human performance requirement of 16.6.5 shall be met.
Category	<Performance>
Validation Method	<Real Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-07.05.02-OSED-PO01.0030
Requirement	HMI design shall consider the Human Performance related transition factors such as training, staffing, competence and selection.
Title	Human Performance – Transition Factors
Status	<In Progress>
Rationale	The Human performance requirement of 16.6.5 shall be met.
Category	<Performance>
Validation Method	<Real Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0024	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-PO01.0031
Requirement	HMI shall be consistent with design standards.
Title	Human Performance-HMI development
Status	<Deleted>
Rationale	The Human performance requirement of 16.6.5 shall be met.
Category	<Performance>
Validation Method	<Real Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-07.05.02-OSED-PO01.0032

Requirement	Task allocation between human and machine shall be in line with automation principles.
Title	Human Performance-Automation
Status	<Deleted>
Rationale	The Human performance requirement of 16.6.5 shall be met.
Category	<Performance>
Validation Method	<Real Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-07.05.02-OSED-EL01.0021
Requirement	The ASM Support System shall send to ATC and NM System an ARES release message once the confirmation-acknowledgement process for deactivation is completed and the current time reaches the end time of the ARES.
Title	ARES release
Status	<Validated>
Rationale	Once the confirmation-acknowledgement process is completed and the current time reaches the end time of the ARES, the ASM Support System displays the ARES as inactive, i.e. the status of the ARES is changed to “Inactive” and sends a message to the ATC to update the status of the ARES on the CWP to “Inactive” and to the NM System for RTSA.
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Service>	ARESRelease	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0016	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0021	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0023	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-AOM1.0010
Requirement	AMC operating methods and system shall allow for prioritising of actor's actions according to the significance of the RTSA event and the magnitude of their potential impact.
Title	Prioritising AMC actions
Status	<Validated>
Rationale	When several processes related to RTSA run in parallel, the assessment of a small change can hamper the timeline and inhibit a more capital event.
Category	<Operational>
Validation Method	<Shadow Mode>

Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0022	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-NL01.0017
Requirement	Automated tools shall support CDM process to fit the defined time frame and allow the CDM partners to benefit from RTSA updates.
Title	Automated support to CDM process
Status	<Validated>
Rationale	In view of multiple actors and the lengthiness of coordination between them, efficient and effective CDM is only possible if supported by automated tools.
Category	<Operational>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0022	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-NL01.0018
Requirement	AOLO support system shall make an impact assessment within an acceptable timeframe and automatically send to the FOCs the lists with flights affected by the change in the airspace.
Title	Impact assessment by AOLO
Status	<Validated>
Rationale	FOCs shall receive lists with the impacted flights in time so that they could decide if making flight plan changes for any of the flights is beneficial.
Category	<Operational>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0022	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-NOP1.0060
Requirement	FMP System shall enable the FMP to mark the affected time slots and make comments.

Title	FMP - extended automated environment
Status	<Validated>
Rationale	FMP's automated environment shall be extended to support him with the preparation for impact assessment and ensure it is done within acceptable time frame.
Category	<Operational>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0022	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-NOP1.0070
Requirement	FMP's local CHMI shall allow for quicker loading of traffic scenarios.
Title	FMP - data loading
Status	<Validated>
Rationale	FMP's automated environment shall be extended to support him with the preparation for the impact assessment and ensure it is done within acceptable time frame.
Category	<Operational>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0010	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0022	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-AOM1.0011
Requirement	High Level Airspace Policy Bodies (HLAPB) shall apply commonly VPA design principles in European airspace design.
Title	Common principle of VPA creation in European airspace
Status	<Validated>
Rationale	Existence of VPA principle is necessary for improving Airspace Management Efficiency. Common VPA design principles are necessary for system interoperability throughout European airspace. REQ-07.05.02-SPR-PERF.0001 (old ID)
Category	<Performance>
Validation Method	<Expert Group (Judgement Analysis)>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0005	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-AOM1.0012
Requirement	The HLAPB at National level or Functional Airspace Block (FAB) level shall define the basic and whole modules - size and shape - of VPA as well as non-VPA ARES, taking into account as an important criteria the geographical situation (such as density of population or vicinity of military air base).
Title	VPA and non-VPA ARES definition by the HLAPB
Status	<Validated>
Rationale	VPA as well as non-VPA ARES definition need to be in accordance with the local context for efficiency reasons. The local context means either national or national and FAB decision process, depending on the location of the VPA/non-VPA ARES and its potential influence on air traffic. REQ-07.05.02-SPR-PERF.0002 (old ID)
Category	<Performance>
Validation Method	<Expert Group (Judgement Analysis)>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0005	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-AOM1.0013
Requirement	The HLAPB shall consider AMC Manageable and non AMC Manageable ARES both for VPA and for non-VPA ARES design.
Title	AMC Manageable and non AMC Manageable ARES
Status	<Validated>
Rationale	A principle of Single European Space (SES) is that airspace is a one continuum. REQ-07.05.02-SPR-PERF.0003 (old ID)
Category	<Performance>
Validation Method	<Expert Group (Judgement Analysis)>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0005	<Full>

[REQ]

Identifier	REQ-07.05.02-OSED-AOM1.0015
Requirement	The HLAPB shall subdivide the airspace in order to allow the safe cohabitation of airspace users, where the division is adapted to local context, taking free route airspace as the general rule.
Title	Areas and routes in airspace
Status	<Validated>

Rationale	Free route airspace is a prior condition for flight performance. In the locations where free route airspace would hamper flight performance and/or safety (e.g. because of traffic density) it shall not be applied. REQ-07.05.02-SPR-PERF.0005 (old ID)
Category	<Performance>
Validation Method	<Expert Group (Judgement Analysis)>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES TO>	<Operational Focus Area>	OFA05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0005	<Full>

Table 11: Requirements Trace layout

6.2 Information Exchange Requirements

The purpose of IERs is to provide a description of services identified within SESAR. This section does not provide a complete design description of each service, but rather describes the services to such a level that it is possible to make decisions on the implementation of the services in activities such as services allocation and evolution planning. It serves as a complement to a model based description and supports the configuration management process by providing well-defined baselines.

Once services have been identified, the services design process starts where the details of the services are defined. The results of the services design is documented in the Information Services Reference Model (ISRM) and in a Service Design Document for each service.

Here, the ATM services that support the information interactions of the OFA 05.03.01 (Airspace Management and AFUA) are described.

The IERs cover

1. Strategic ASM (ASM level 1) activities between the *HLAPB* and *CDM Group for European Network Airspace Organisation and Management* and the *European Network Manager* and the *Airspace Manager*. It covers the long term planning exchanges and the airspace data.
2. Pre-tactical ASM (ASM level2) between *Wing Operations Centre*, *Airspace Manager*, *European Network Manager*
3. Tactical ASM (ASM level3) between *Airspace Manager* and *ACC/approach Supervisor*. It covers the exchanges concerning the activation of ARES.
4. Post Ops ASM (ASM key indicators) between *HLAPB* and the *ATC* and *Network Manager*.

Taking into account the Service Oriented Architecture (SOA) architectural principles, the high level business processes covering the IERs are decomposed into several autonomous services instead of doing a one-to-one mapping between business processes and SOA services. One of the reasons is to make the services more reusable, more stateless and more agnostic. For example, the Query Airspace Reservation function has been taken out of this business process so that this service can be used by any actor in the ATFM community outside any actual reservation request.

From service designer's point of view, 5 services were defined as possible candidates to be recorded in ISRM as others were not mature enough. Therefore, only these 5 logical services are recorded in ISRM and considered as part of the ATM architecture and listed below:

- ARESPreActivation Service: negotiation of the pre-activation of a planned ARES;
- ARESActivation Service: notification of the activation of a pre-activated ARES;
- ARESDeActivation Service: negotiation of the de-activation of a planned ARES;
- ARESRelease Service: notification of the release of a de-activated ARES.
- ARESQuery: provides information on an ARES.

The service definition process in AFUA was following several activities, also known as FT09, defining set of services candidates for validation activities:

- Query Airspace Reservation Service
- Submit Airspace Reservation Service
- Negotiate Airspace Reservation Service
- Query Regional AUP
- Submit local AUP
- Negotiate local AUP
- AUP simulation service
- Activate Airspace Reservation service
- Deactivate Airspace Reservation service
- Query Airspace Activations service

These 10 services are not recorded in the ISRM 1.4 and then are just mentioned in the “Rationale” column of the corresponding IER requirements to keep track of the current work performed by B4.3.

[IER]

Identifier	Name	Issuer	Intended Addressees	Information Element	Involved Operational Activities	Interaction Rules and Policy	Status	Rationale	Satisfied DOD Requirement Identifier	Service Identifier
IER-07.05.02-OSED-LTPL.0101	Submit long term plan	HL APB	CDM Group for European Network Airspace Organisation and Management	Long term plan (3-5 years -> 6 months in advance): text document + AIS + AIP (eg for the Olympic games) 1) Geographical location (area of activities) 2) Condition of utilisation 3) Timing Nbre of aircrafts participating +conversation_id	Co-ordinate Long Term Plan		Validated	Support of NOP update of LTP for collaborative planning process	REQ-07.02-DOD-0001.0010<Full> REQ-07.02-DOD-0001.0019<Full>	AeronauticalInformationFeature
IER-07.05.02-OSED-LTPL.0102	Propose Changes to LTP	CDM Group for European Network Airspace Organisation and Management	HL APB	Long term plan (3-5 years -> 6 months in advance): text document + AIS + AIP (eg for the Olympic games) 1) Geographical location (area of activities) 2) Condition of utilisation 3) Timing Nbre of aircrafts participating +conversation_id	Co-ordinate Long Term Plan		Validated	Support of NOP update of LTP for collaborative planning process	REQ-07.02-DOD-0001.0010<Full> REQ-07.02-DOD-0001.0019<Full>	AeronauticalInformationFeature
IER-07.05.02-OSED-LTPL.0103	Final long term plan	HL APB	CDM Group for European Network Airspace Organisation and Management	Final	Co-ordinate Long Term Plan		Validated	Support of NOP update of LTP for collaborative planning process	REQ-07.02-DOD-0001.0010<Full> REQ-07.02-DOD-0001.0019<Full>	AeronauticalInformationFeature
IER-07.05.02-OSED-LTPL.0104	Accept long term plan	CDM Group for European Network Airspace Organisation and Management	HL APB	LT plan used as reference for detailed planning of individual flights	Co-ordinate Long Term Plan		Validated	Support of NOP update of LTP for collaborative planning process	REQ-07.02-DOD-0001.0010<Full> REQ-07.02-DOD-0001.0019<Full>	AeronauticalInformationFeature

Identifier	Name	Issuer	Intended Addressees	Information Element	Involved Operational Activities	Interaction Rules and Policy	Status	Rationale	Satisfied DOD Requirement Identifier	Service Identifier
IER-07.05.02-OSED-LTPL.0105	Publish long term plan	HL APB	CDM Group for European Network Airspace Organisation and Management	LT plan to be shared with NM to enhance SA to improve capacity planning	Co-ordinate Long Term Plan		Validated	Support of NOP update of LTP for collaborative planning process	REQ-07.02-DOD-0001.0010<Full> REQ-07.02-DOD-0001.0019<Full>	AeronauticalInformationFeature
IER-07.05.02-OSED-DgAS.0001	Update airspace structure	HL APB	European Network Manager	Newly designed airspace (eg VPA) to be input in EAD for AIP publication	Update Airspace Structure		Validated	Support of Airspace Design process and sharing of information	REQ-07.02-DOD-0001.0005<Full> REQ-07.02-DOD-0001.0010<Full> REQ-07.02-DOD-0001.0011<Full> REQ-07.02-DOD-0001.0019<Full>	AeronauticalInformationFeature
IER-07.05.02-OSED-PuAS.0001	Provide static airspace data	European Network Manager	Airspace Manager	AIP data in Format AIXM 5.1: Configurations, Aerodromes, points, routes, airspaces...	Publish Airspace static data		Validated	Support sharing of AIP data	REQ-07.02-DOD-0001.0010<Full> REQ-07.02-DOD-0001.0019<Full>	AeronauticalInformationFeature
IER-07.05.02-OSED-ARES.0001	Submit ARES request	Wing Operations Centre	Airspace Manager	ARES request data structure to provide the ARES, date, slot, priority, VPA(s), Upper/Lower levels (Volume of Flights (number Flight for certain period of time), Penetration Status, Mission Callsign, Number and A/C type, AirportDEPature/AirportDESTination, mission type, link with other mission (if existing)	Reserve Airspace		Validated	Support and enable ASM process between WOC and ASM actors	REQ-07.02-DOD-0001.0005<Full> REQ-07.02-DOD-0001.0010<Full> REQ-07.02-DOD-0001.0017<Full> REQ-07.02-DOD-0001.0018<Full> REQ-07.02-DOD-0001.0019<Full>	

Identifier	Name	Issuer	Intended Addressees	Information Element	Involved Operational Activities	Interaction Rules and Policy	Status	Rationale	Satisfied DOD Requirement Identifier	Service Identifier
IER-07.05.02-OSED-ARES.0002	Propose modifications	Wing Operations Centre	Airspace Manager	Status identifier (eg. Counter Proposal), key of the initial ARES; ARES data structure providing the counter proposal	Reserve Airspace		Validated	Support and enable ASM process between WOC and ASM actors	REQ-07.02-DOD-0001.0005<Full> REQ-07.02-DOD-0001.0010<Full> REQ-07.02-DOD-0001.0011<Full> REQ-07.02-DOD-0001.0019<Full>	
IER-07.05.02-OSED-ARES.0003	Accept ARES (modifications)	Wing Operations Centre	Airspace Manager	Status identifier (eg. Accept), ARES key.	Reserve Airspace		Validated	Support and enable ASM process between WOC and ASM actors	REQ-07.02-DOD-0001.0005<Full> REQ-07.02-DOD-0001.0010<Full> REQ-07.02-DOD-0001.0011<Full> REQ-07.02-DOD-0001.0019<Full>	
IER-07.05.02-OSED-ARES.0004	Reject ARES (modifications)	Wing Operations Centre	Airspace Manager	Status identifier (eg. Reject), ARES key; Reject Reason (Proposed data is not justified from any source, at this stage for discussion)	Reserve Airspace		Validated	Support and enable ASM process between WOC and ASM actors	REQ-07.02-DOD-0001.0017<Full> REQ-07.02-DOD-0001.0018<Full> REQ-07.02-DOD-0001.0019<Full>	
IER-07.05.02-OSED-ARES.0005	Modify ARES Request	Airspace Manager	Wing Operations Centre	ARES request data structure to provide the ARES, date, slot, priority, VPA(s), Upper/Lower levels (Volume of Flights (number Flight for certain period of time), Penetration Status, Mission Callsign, Number and A/C type, AirportDEPature/AirportDESti nation, mission type, link with other mission (if existing)	Reserve Airspace		Validated	Support and enable ASM process between WOC and ASM actors	REQ-07.02-DOD-0001.0005<Full> REQ-07.02-DOD-0001.0010<Full> REQ-07.02-DOD-0001.0011<Full> REQ-07.02-DOD-0001.0019<Full>	

Identifier	Name	Issuer	Intended Addressees	Information Element	Involved Operational Activities	Interaction Rules and Policy	Status	Rationale	Satisfied DOD Requirement Identifier	Service Identifier
IER-07.05.02-OSED-ARES.0006	Delete ARES Request	Wing Operations Centre	Airspace Manager	Status identifier (eg. Delete), ARES key.	Reserve Airspace		Validated	Support and enable ASM process between WOC and ASM actors	REQ-07.02-DOD-0001.0005<Full> REQ-07.02-DOD-0001.0019<Full>	
IER-07.05.02-OSED-ARES.0007	Approve ARES Request	Airspace Manager	Wing Operations Centre	Status identifier (eg. Approve), ARES key.	Reserve Airspace		Validated	Support and enable ASM process between WOC and ASM actors	REQ-07.02-DOD-0001.0005<Full> REQ-07.02-DOD-0001.0019<Full>	
IER-07.05.02-OSED-ARES.0008	ARES not approved	Airspace Manager	Wing Operations Centre	Type is either New Request, indicating why a new request is needed; or Modify Current Request, indicating what is not correct or acceptable in current request.	Reserve Airspace		Validated	Support and enable ASM process between WOC and ASM actors	REQ-07.02-DOD-0001.0010<Full> REQ-07.02-DOD-0001.0011<Full> REQ-07.02-DOD-0001.0012<Full> REQ-07.02-DOD-0001.0017<Full> REQ-07.02-DOD-0001.0018<Full> REQ-07.02-DOD-0001.0019<Full>	

Identifier	Name	Issuer	Intended Addressees	Information Element	Involved Operational Activities	Interaction Rules and Policy	Status	Rationale	Satisfied DOD Requirement Identifier	Service Identifier
IER-07.05.02-OSED-nAUP.0001	Propose AUP	Airspace Manager	European Network Manager	Status: draft or Ready AUP and UUP in AIXM 5.1 format. The AUP contains the decision of an AMC on the temporary allocation of the airspace within its jurisdiction for a specific time period. The validity period of the Baseline AUP is always: from 6:00 day D till 6:00 D+1 The (unique) key of an AUP chain (AUPChain type) is the (day, AMC id) pair. CDR update or ARES allocation crossing the AIRAC switch (i.e. midnight of the last day of the running AIRAC), must be split in two: i) A CDR update/ARES allocation ending at midnight ii) and a CDR update/ARES allocation beginning at midnight c) The "pre-midnight" part must comply with the running AIRAC data definition; the "postmidnight" part must comply with the next AIRAC data definition	Co-ordinate AUP		Validated	Support and enable airspace use planning process between ASM actors and NM	REQ-07.02-DOD-0001.0005<Full> REQ-07.02-DOD-0001.0010<Full> REQ-07.02-DOD-0001.0011<Full>	
IER-07.05.02-OSED-nAUP.0002	Update AUP	Airspace Manager	European Network Manager	Same information element as for the Create AUP	Coordinate AUP		Validated	Support and enable airspace use planning process between ASM actors and NM	REQ-07.02-DOD-0001.0005<Full> REQ-07.02-DOD-0001.0010<Full> REQ-07.02-DOD-0001.0011<Full>	

Identifier	Name	Issuer	Intended Addressees	Information Element	Involved Operational Activities	Interaction Rules and Policy	Status	Rationale	Satisfied DOD Requirement Identifier	Service Identifier
IER-07.05.02-OSED-nAUP.0003	Set Ready AUP	Airspace Manager	European Network Manager	AUP id; Status = Ready	Coordinate AUP		Validated	Support and enable airspace use planning process between ASM actors and NM	REQ-07.02-DOD-0001.0005<Full> REQ-07.02-DOD-0001.0010<Full> REQ-07.02-DOD-0001.0011<Full>	
IER-07.05.02-OSED-nAUP.0004	Delete AUP	Airspace Manager	European Network Manager	AUP id	Coordinate AUP		Validated	Support and enable airspace use planning process between ASM actors and NM	REQ-07.02-DOD-0001.0005<Full> REQ-07.02-DOD-0001.0010<Full> REQ-07.02-DOD-0001.0011<Full> REQ-07.02-DOD-0001.0019<Full>	
IER-07.05.02-OSED-nAUP.0005	Validate AUP = Provide AUP errors list	European Network Manager	Airspace Manager	No transaction takes place: the AUP is neither created nor updated. The validation service is meant for the customer to validate an AUP at any time, e.g. to work on an AUP prior to persisting it within the NM system.	Coordinate AUP		Validated	Support and enable airspace use planning process between ASM actors and NM	REQ-07.02-DOD-0001.0005<Full> REQ-07.02-DOD-0001.0010<Full> REQ-07.02-DOD-0001.0011<Full> REQ-07.02-DOD-0001.0019<Full>	
IER-07.05.02-OSED-nAUP.0006	Propose changes to AUP	European Network Manager	Airspace Manager	Same information element as for the Create AUP	Coordinate AUP		Validated	Support and enable airspace use planning process between ASM actors and NM	REQ-07.02-DOD-0001.0005<Full> REQ-07.02-DOD-0001.0010<Full> REQ-07.02-DOD-0001.0011<Full> REQ-07.02-DOD-0001.0019<Full>	
IER-07.05.02-OSED-nAUP.0007	Set Release AUP	European Network Manager	Airspace Manager	AUP id; Status = Released. AUPs become immutable (cannot be updated anymore) once in RELEASED state	Coordinate AUP		Validated	Support and enable airspace use planning process between ASM actors and NM	REQ-07.02-DOD-0001.0005<Full> REQ-07.02-DOD-0001.0010<Full> REQ-07.02-DOD-0001.0011<Full> REQ-07.02-DOD-0001.0019<Full>	

Identifier	Name	Issuer	Intended Addressees	Information Element	Involved Operational Activities	Interaction Rules and Policy	Status	Rationale	Satisfied DOD Requirement Identifier	Service Identifier
IER-07.05.02-OSED-nAUP.0008	request AUP expansion	Airspace Manager	European Network Manager	Same information element as for the Create AUP	Coordinate AUP		Validated	Support and enable airspace use planning process between ASM actors and NM	REQ-07.02-DOD-0001.0005<Full> REQ-07.02-DOD-0001.0010<Full> REQ-07.02-DOD-0001.0011<Full>	
IER-07.05.02-OSED-nAUP.0009	Provide AUP expansion	European Network Manager	Airspace Manager	The expansion algorithm or simply "expansion" computes a list of CDR opening/closures based on: a) A provided list of ARES allocations, and b) The pre-defined ARES allocations in CACD, and c) The pre-defined relationships between ARES and CDRs (is-nearby, is-not-affected, etc) in CACD d) A period for which the calculation on the affected routes will be done (4) The output list of CDR openings/closures is labelled implicit to distinguish it from CDR openings and closures managed by the customer. (5) This request does not imply any update transaction within the NM system. AUP and UUP in AIXM 5.1 format.	Coordinate AUP		Validated	Support and enable airspace use planning process between ASM actors and NM	REQ-07.02-DOD-0001.0005<Full> REQ-07.02-DOD-0001.0010<Full> REQ-07.02-DOD-0001.0011<Full> REQ-07.02-DOD-0001.0019<Full>	
IER-07.05.02-OSED-EAUP.0001	Provide eAUP	European Network Manager	Airspace Manager; ACC/Approach Supervisor; Airspace User	The consolidated regional released Airspace Use Plan or Updated Use plan - eAUP in AIXM 5.1 format	Disseminate eAUP		Validated	Support sharing of airspace use planning information	REQ-07.02-DOD-0001.0005<Full> REQ-07.02-DOD-0001.0010<Full> REQ-07.02-DOD-0001.0011<Full>	

Identifier	Name	Issuer	Intended Addressees	Information Element	Involved Operational Activities	Interaction Rules and Policy	Status	Rationale	Satisfied DOD Requirement Identifier	Service Identifier
IER-07.05.02-OSED-AcAS.0001	Notification of pre-activation	Airspace Manager	ACC/Approach Supervisor	Reference location - ARES (specified in the AUP). ATC can confirm or reject the allocation.	Activate Airspace		Validated	Support ASM processes between ATCO and ASM actors	REQ-07.02-DOD-0001.0001<Full> REQ-07.02-DOD-0001.0002<Full> REQ-07.02-DOD-0001.0005<Full> REQ-07.02-DOD-0001.0006<Full> REQ-07.02-DOD-0001.0010<Full> REQ-07.02-DOD-0001.0011<Full> REQ-07.02-DOD-0001.0017<Full> REQ-07.02-DOD-0001.0018<Full> REQ-07.02-DOD-0001.0019<Full>	ARESPre Activation
IER-07.05.02-OSED-AcAS.0002	Real time Activation of an Airspace	Airspace Manager	ACC/Approach Supervisor	Messages in OLDI (via SWIM)	Activate Airspace		Validated	Support ASM processes between ATCO and ASM actors	REQ-07.02-DOD-0001.0001<Full> REQ-07.02-DOD-0001.0002<Full> REQ-07.02-DOD-0001.0005<Full> REQ-07.02-DOD-0001.0006<Full> REQ-07.02-DOD-0001.0010<Full> REQ-07.02-DOD-0001.0011<Full> REQ-07.02-DOD-0001.0012<Full> REQ-07.02-DOD-0001.0017<Full> REQ-07.02-DOD-0001.0018<Full> REQ-07.02-DOD-0001.0019<Full>	ARESActi vation

Identifier	Name	Issuer	Intended Addressees	Information Element	Involved Operational Activities	Interaction Rules and Policy	Status	Rationale	Satisfied DOD Requirement Identifier	Service Identifier
IER-07.05.02-OSED-AcAS.0003	Activation Refusal	ACC/Approach Supervisor	Airspace Manager	Messages in OLDI (via SWIM)	Activate Airspace		Validated	Support ASM processes between ATCO and ASM actors	REQ-07.02-DOD-0001.0001<Full> REQ-07.02-DOD-0001.0002<Full> REQ-07.02-DOD-0001.0005<Full> REQ-07.02-DOD-0001.0006<Full> REQ-07.02-DOD-0001.0010<Full> REQ-07.02-DOD-0001.0011<Full> REQ-07.02-DOD-0001.0012<Full> REQ-07.02-DOD-0001.0017<Full> REQ-07.02-DOD-0001.0018<Full> REQ-07.02-DOD-0001.0019<Full>	ARESDeActivation
IER-07.05.02-OSED-AcAS.0004	Real time De-activation of an Airspace	Airspace Manager	ACC/Approach Supervisor	Messages in OLDI (via SWIM)	Activate Airspace		Validated	Support ASM processes between ATCO and ASM actors	REQ-07.02-DOD-0001.0001<Full> REQ-07.02-DOD-0001.0002<Full> REQ-07.02-DOD-0001.0005<Full> REQ-07.02-DOD-0001.0006<Full> REQ-07.02-DOD-0001.0010<Full> REQ-07.02-DOD-0001.0011<Full> REQ-07.02-DOD-0001.0012<Full> REQ-07.02-DOD-0001.0017<Full> REQ-07.02-DOD-0001.0018<Full> REQ-07.02-DOD-0001.0019<Full>	ARESDeActivation

Identifier	Name	Issuer	Intended Addressees	Information Element	Involved Operational Activities	Interaction Rules and Policy	Status	Rationale	Satisfied DOD Requirement Identifier	Service Identifier
IER-07.05.02-OSED-AcAS.0005	Release of an Airspace	Airspace Manager	ACC/Approach Supervisor	Messages in OLDI (via SWIM)	Activate Airspace		Validated	Support ASM processes between ATCO and ASM actors	REQ-07.02-DOD-0001.0001<Full> REQ-07.02-DOD-0001.0002<Full> REQ-07.02-DOD-0001.0005<Full> REQ-07.02-DOD-0001.0006<Full> REQ-07.02-DOD-0001.0010<Full> REQ-07.02-DOD-0001.0011<Full> REQ-07.02-DOD-0001.0012<Full> REQ-07.02-DOD-0001.0017<Full> REQ-07.02-DOD-0001.0018<Full> REQ-07.02-DOD-0001.0019<Full>	ARESRelease
IER-07.05.02-OSED-PKPI.0001	Publish KPI	HLAPB	NM, Aus, ATC	See description in OSED	Publish KPI		In Progress	Support performace assessment and analysis processes	REQ-07.02-DOD-0001.0011<Full> REQ-07.02-DOD-0001.0013<Full> REQ-07.02-DOD-0001.0014<Full> REQ-07.02-DOD-0001.0015<Full> REQ-07.02-DOD-0001.0019<Full> REQ-07.02-DOD-0001.0020<Full>	ARESQuery

Table 12: Information Exchange Requirements [IER] 07.05.04 FAM

7 References

7.1 Applicable Documents

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

[1] IS SESAR Template Toolbox Latest version
[2] IS SESAR Requirements and V&V Guidelines Latest version
[3] IS SESAR Template Toolbox Users Manual Latest version

7.2 Reference Documents

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

[4] European Route Network Improvement Plan PART 3 Airspace Management Handbook Guidelines for Airspace Management, ed. 27 November 2015
[5] COMMISSION REGULATION (EC) No 2150/2005 of 23 December 2005 laying down common rules for the flexible use of airspace", http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32005R2150
[6] SESAR 08.03.10-D64 ISRM Service Portfolio Ed. 00.07.01, 03/02/2016
[7] EUROCONTROL Specifications for the Application of the Flexible Use of Airspace – Ed. 1.1 http://www.eurocontrol.int/sites/default/files/publication/files/20090110-fua-spec-v1.1.pdf

[8] SESARJU Validation Strategy and Integrated Validation Plan for SESAR Step 1 for Network Operations (WP7) Ed 01.00.02
[9] P07.02-D28 Step 1 Release 4 Network Operations Detailed Operational Description (DOD) Ed 00.03.00, 08/07/2015
[10]European ATM Service Identification for OFA 05.03.01 Airspace Management and AFUA Release 2
[11]P07.05.04-D52 Step 1 Flexible Airspace Management Validation Report (VALR), edition 00.00.04 (draft)
[12]Advanced Flexible Use of Airspace Interoperability Requirements for Step 1, D46, edition 00.03.05
[13]WOC operational and performance requirements for Step 1, Step 2 and Step 3 as available including the traceability of the AU comments V2, D11.1.2-3m, Ed. 00.01.02
[14]WPB.01 Integrated Roadmap DS14 version
[15]DOD 04.02-D98-En Route Detailed Operational Description Step1_update, ed. 00.07.00
[16]D37 Free Route Operational Service and Environment Definition (OSED) for Step 1 - Iteration 2, ed. 00.02.00

Appendix A Justifications

NA

Appendix B New Information Elements

NA

Appendix C ASM support system descriptions

This appendix is addressing a description of the Airspace Management support systems that have been used in the validation exercises of SESAR 07.05.04 FAM project in Step 1. They represent only examples of such tools and are by no way prescriptive or intending to excluding other pertinent tools with functionalities as adequate as these are.

1. The STANLY / ACOS System

STANLY_ACOS [Airspace Coordination System] is a web based application for the management of temporary active airspaces supporting their management in the strategic, tactical, operational and post-ops ASM phases. It is capable of managing several airspace types like TRA, MVPA, Danger and Restricted Areas, AAR, AEW Orbits as well as special used or prohibited airspaces based on NOTAM.

ACOS provides a module for creation of the airspace use plan including the calculation of conditional route opening times in relation to the activation times of linked airspaces.

Silent coordination is provided between military and civil airspace managers and users, being capable of replacing the telephone coordination in the operational phase. The real time coordination can be monitored by each participant of the network, being an enabler for the CDM process.

Target of the STANLY_ACOS founding was to introduce the Flexible Used Airspace management Concept, based on EU Regulations. The scheduling and reporting of restricted areas can be performed at any location at minimum hardware needs.

ACOS is a web-based client-server architecture with standard PC clients and connection via web browser Firefox, Chrome or Safari and an Internet access.

External client access to the server is archived by using RSA token, thus guarantees a secure connection. The ACOS System complies with European interoperability Regulation for ASM systems [EC declaration].

The ACOS 1 Version is used operationally since 2005, for 2012 an update to ACOS 2 is scheduled. It will utilize state-of the art technology, using flexible window modes for individual adoption to user's demand. ACOS will be 100% compatible to the AIXM 5.1 data exchange format, flexible bookings and reporting of missions and reservations are the key function to implement the FUA principle.

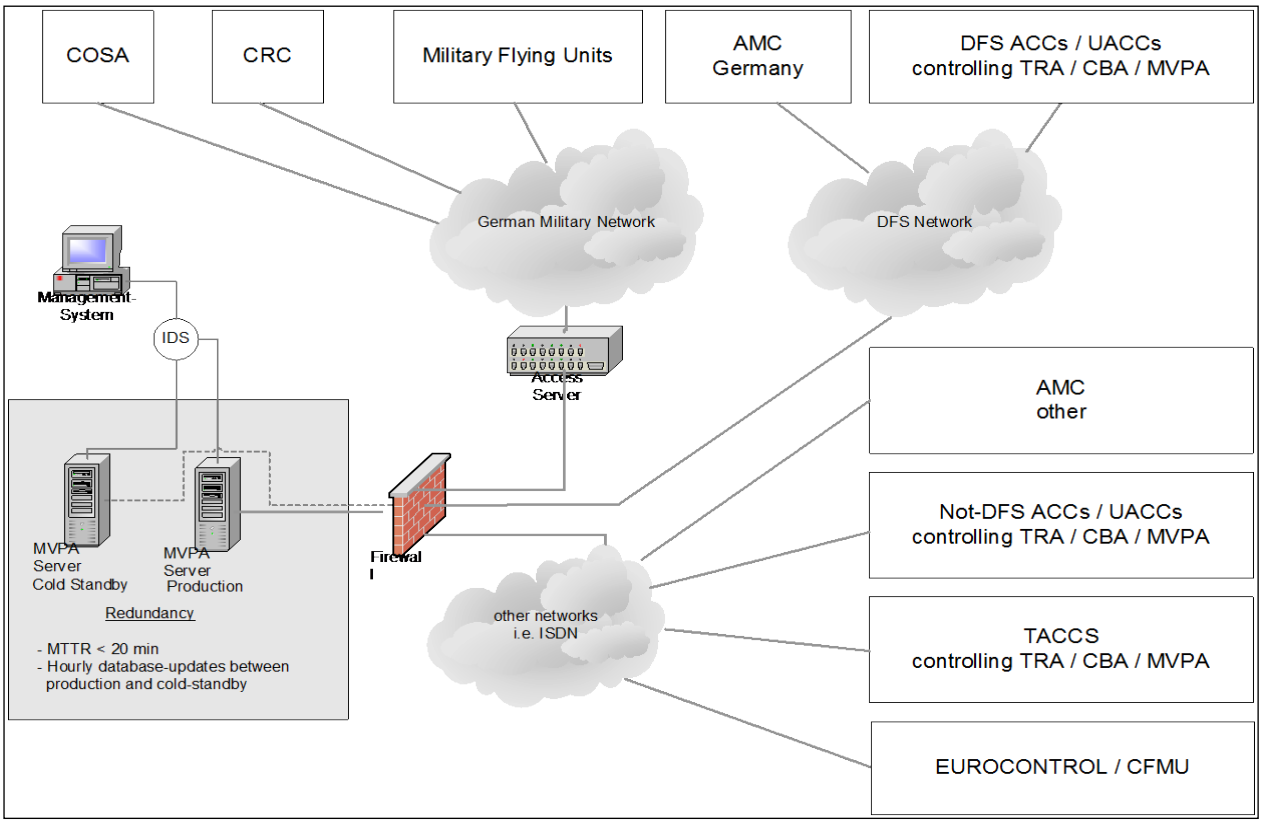

Figure 27: ACOS Network and connectivity

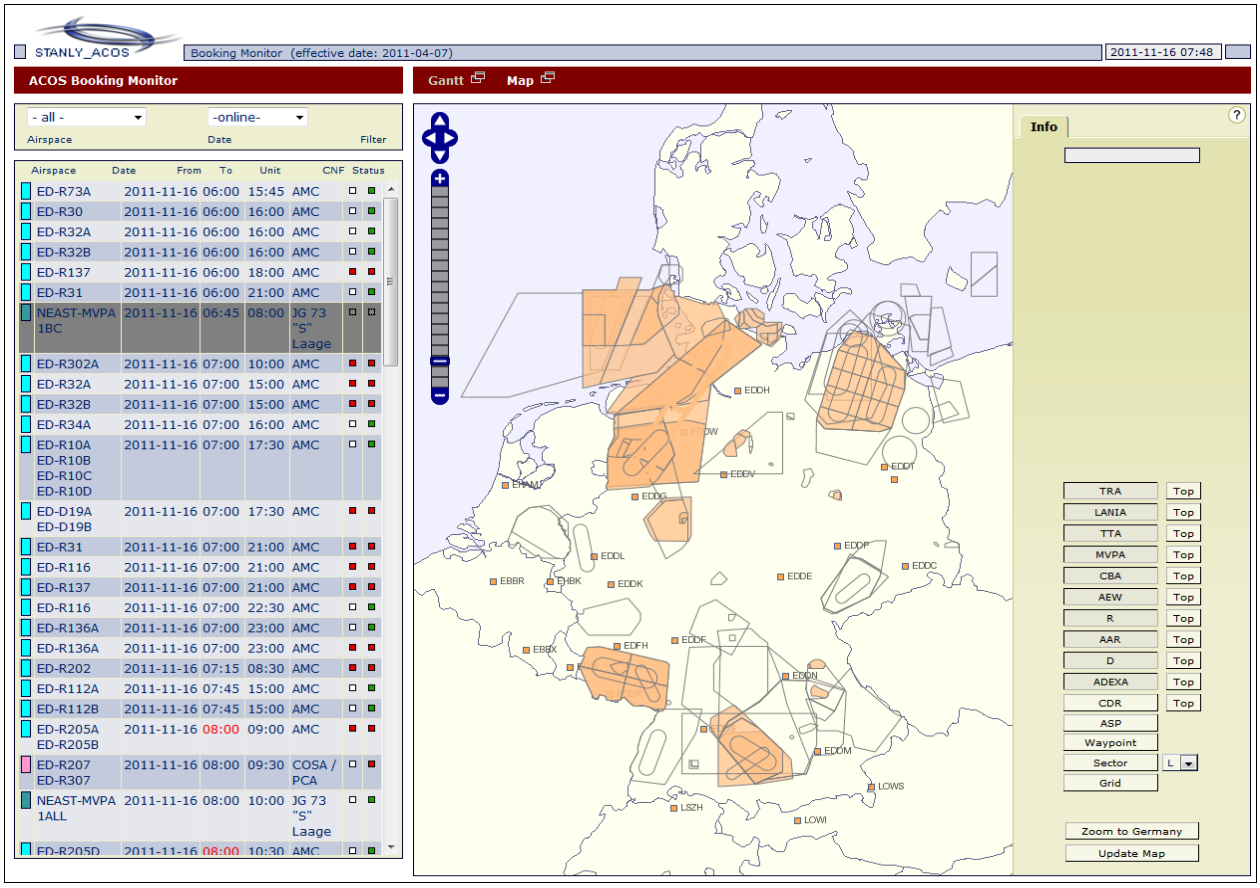

Figure 28: Screenshot STANLY_ACOS 1.3

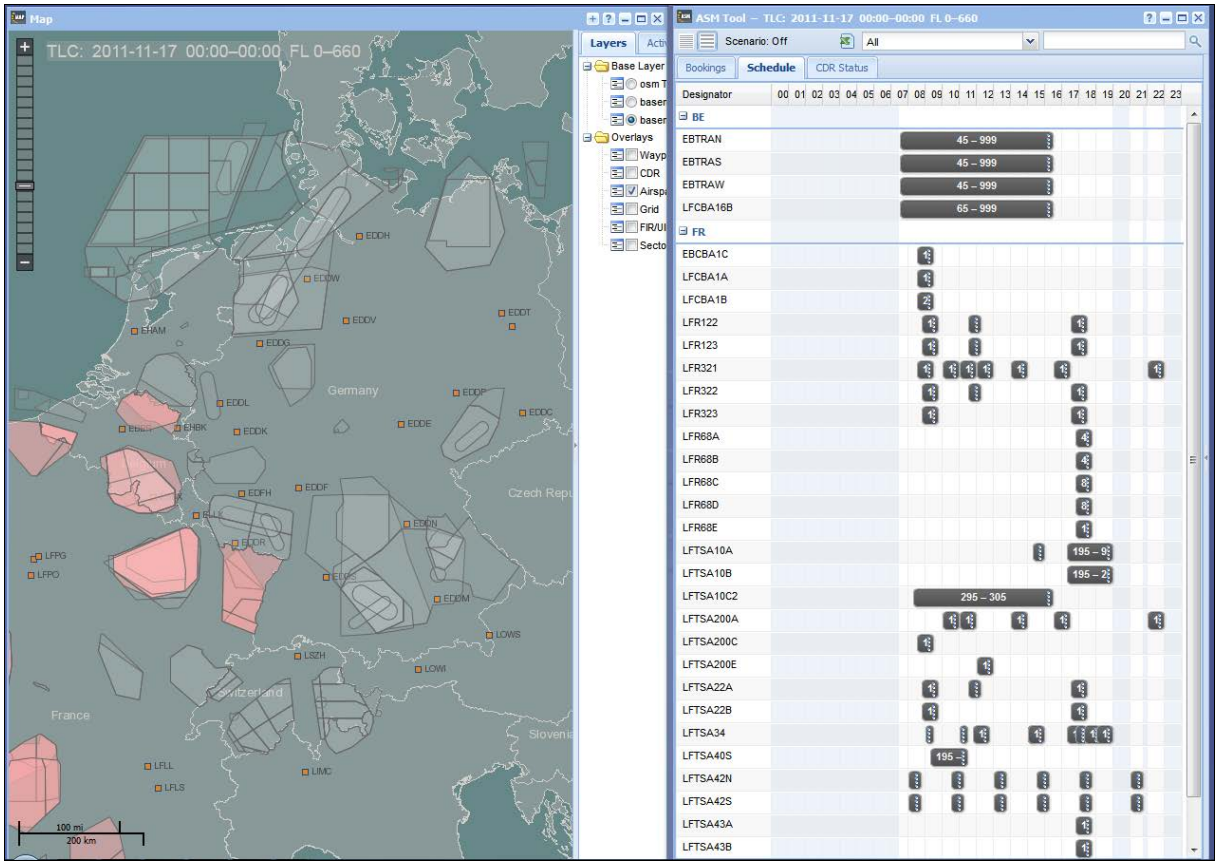

Figure 29: Screenshot STANLY_ACOS 2.0 (beta)

2. The LARA System

LARA is organised in clusters, which are normally defined by national boundaries, but can be adapted to any organisation like a FAB. Each cluster hosts a central server and connected clients. Clusters can be interconnected to allow cross border airspace allocation and collaboration.

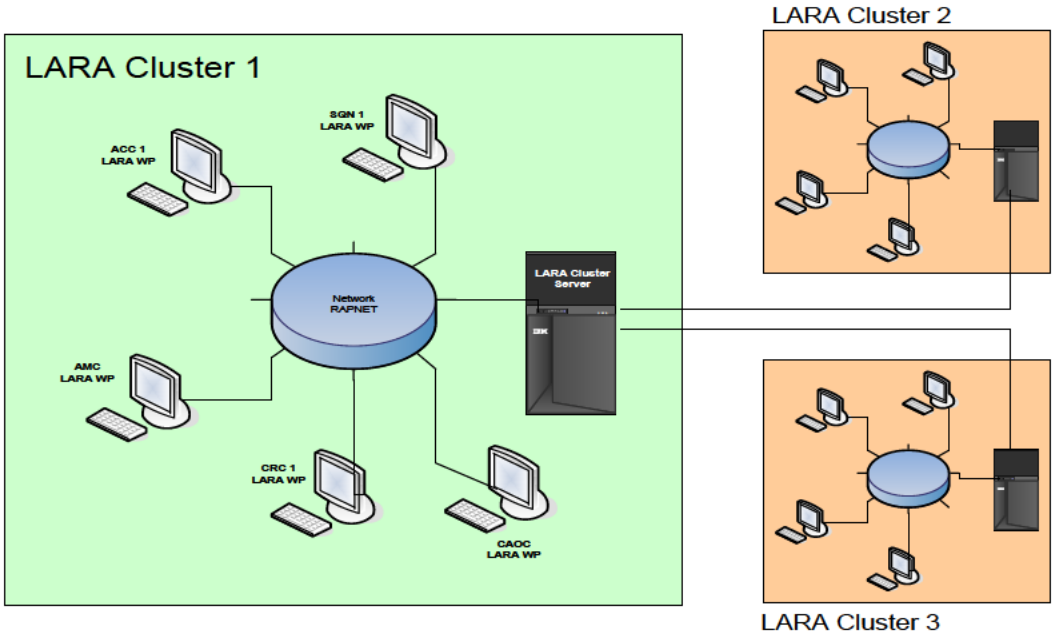

Figure 30: LARA System Overview

Airspace planning function

LARA provides a user friendly interface to create and manage reservation requests for airspaces. As all data is shared across the network, every requestor benefits from an overview on all previously entered bookings in LARA and therefore is enabled to base his further inputs on this information - allowing already a de-confliction of requests at this early stage.

Once a suitable airspace and associated time slot has been identified, the user calls the Airspace Reservation Editor by clicking on his desired airspace and time frame. This editor allows to fine tune the request by selecting the requested levels, the type of usage and additional details on the planned mission.

LARA offers the possibility to join multiple adjacent or overlapping airspaces together and create a single reservation for an airspace block. In support to this, LARA provides a complete overview of the airspace structure in a graphical display and in textual form from dropdown menus available for each airspace.

LARA indicates if a booking interferes with other airspaces, detecting and highlighting all conflicts between bookings while taking into consideration interdependent airspaces and CDRs.

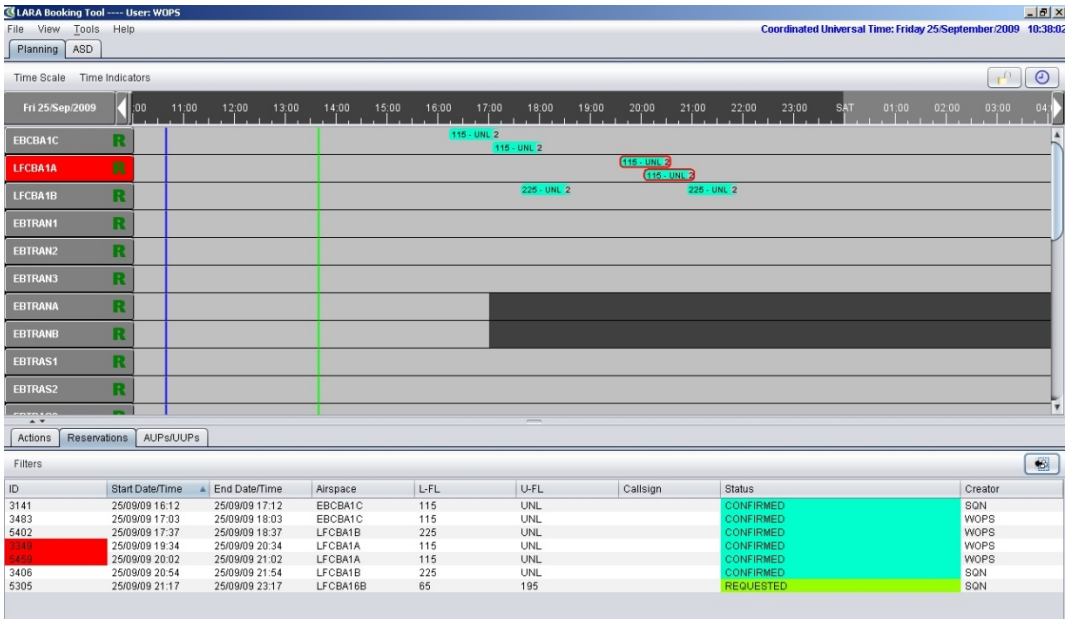

Figure 31: Airspace planning user interface

LARA is organised in “clusters”. One cluster corresponds to a LARA System deployed within organisational (FAB) or national borders. A cluster system consists of a Central Server and connected LARA Working Positions. A LARA Cluster can be connected to other clusters allowing a seamless exchange of data. This allows airspace users to request airspace beyond national borders and provides an efficient way to manage commonly used cross-border areas.

Each airspace request will be subject to coordination and approval processes in line with national procedures and regulations. A wide variety of rules and configuration options are available in LARA to tailor the Approval Process to reflect national procedures and regulations.

Every unit involved in the approval process is provided with an overview of reservations requiring their attention. Bookings will move up on the approval chain according to predefined rules and regulations until reaching the appropriate AMC.

Each user on the approval chain has the option to approve or reject a reservation request; alternatively a counter proposal can be sent to the requestor, which can consist of a new timeslot, a change of levels, a different airspace or any combination of these. The approval chain can be dynamic, i.e. following different approval paths depending on configurable parameters, timelines and rules.

LARA provides different means to establish communication between different actors to enable fast and system wide coordination. Additional comments and remarks can be entered for every reservation, which can be used and complemented throughout the approval chain. An online collaboration facility is available to allow direct and immediate communication between two or more users – similar to commonly known chat facilities. Email addresses, phone numbers and addresses can be retrieved for each user within the application.

The opening or closing of certain airspaces will require the publication of a NOTAM in order to inform the aviation community. LARA will automatically trigger and present the user with a draft for the NOTAM to be issued for such airspaces. This draft can be adapted as required and used for filing a NOTAM Request at the appropriate NOTAM Office.

In order to assess and optimize the airspace allocation for a given time period LARA provides a number of tools to AMCs and network managers. The current planning can be made available on a

mirrored Gantt chart, which allows the optimization of airspace utilization by rearranging existing reservations. This second Gantt chart has not any immediate effect on the current plan and, thus, allows to carefully streamline the current plan. Once this process is finalized the proposal can be sent out to the affected users[12]. The Planning Prediction Tools (PPT) supports airspace and network managers in assessing opportunities for allocation improvements. The PPT allows the user to fast forward the plan and to visualize the effect on the airspace structure. It highlights the activation of areas and the resulting availability of CDR segments through time and assists the user in spotting opportunities for improvements.

The Housekeeping Function

Managing Environmental Data

LARA requires a database containing up-to-date environmental data for operation. Each cluster identifies a Housekeeper, who is responsible to ensure the validity and completeness of the data. The Housekeeper is a separate role/user which is provided with the Housekeeping Tool to perform his task.

The Housekeeping Tool allows the user to import environmental data from a CFMU database[13]. The imported data can be reviewed, adapted and validated. New airspaces can be created and various configurations for each entity defined and set.

Aeronautical data is updated each AIRAC Cycle and the relevant data sets are made available to LARA. In the future this update functionality is planned to allow an automated retrieval mechanism to get this new Information online and in real-time. The Housekeeper will still have all options to manually check and adjust the data to fine tune the data import.

The Administrator Function

Managing Users, Privileges and the Approval Chain

The LARA administrator is in charge of managing users and roles and to establish and maintain the approval chain. Every role is granted certain privileges to book airspaces, approve certain reservations and to access specific tools. The administrator assigns these privileges and manages new and existing users, including their usernames and passwords.

The administrator has access to the Administrator Tool to perform his task. This tool allows to setup and maintain the approval chain in a user friendly way through simple mouse operations - by dragging and dropping roles and approval groups. The approval chain allows additional rules and procedures to be incorporated to reflect a wide variety of national procedures.

[12] In V1 this will be achieved by sending a copy of the mirror Gantt chart to affected users in order to highlight the changes and explain the reasoning. For the future it is foreseen to have an additional facility available to automatically send out sets of counterproposals for users to accept or reject

[13] Currently LARA uses the Central Airspace and Capacity Database (CACD) of CFMU. In the future the European AIS Database (EAD) and the Airspace Data Repository (ADR) will be the primary source for environmental data.

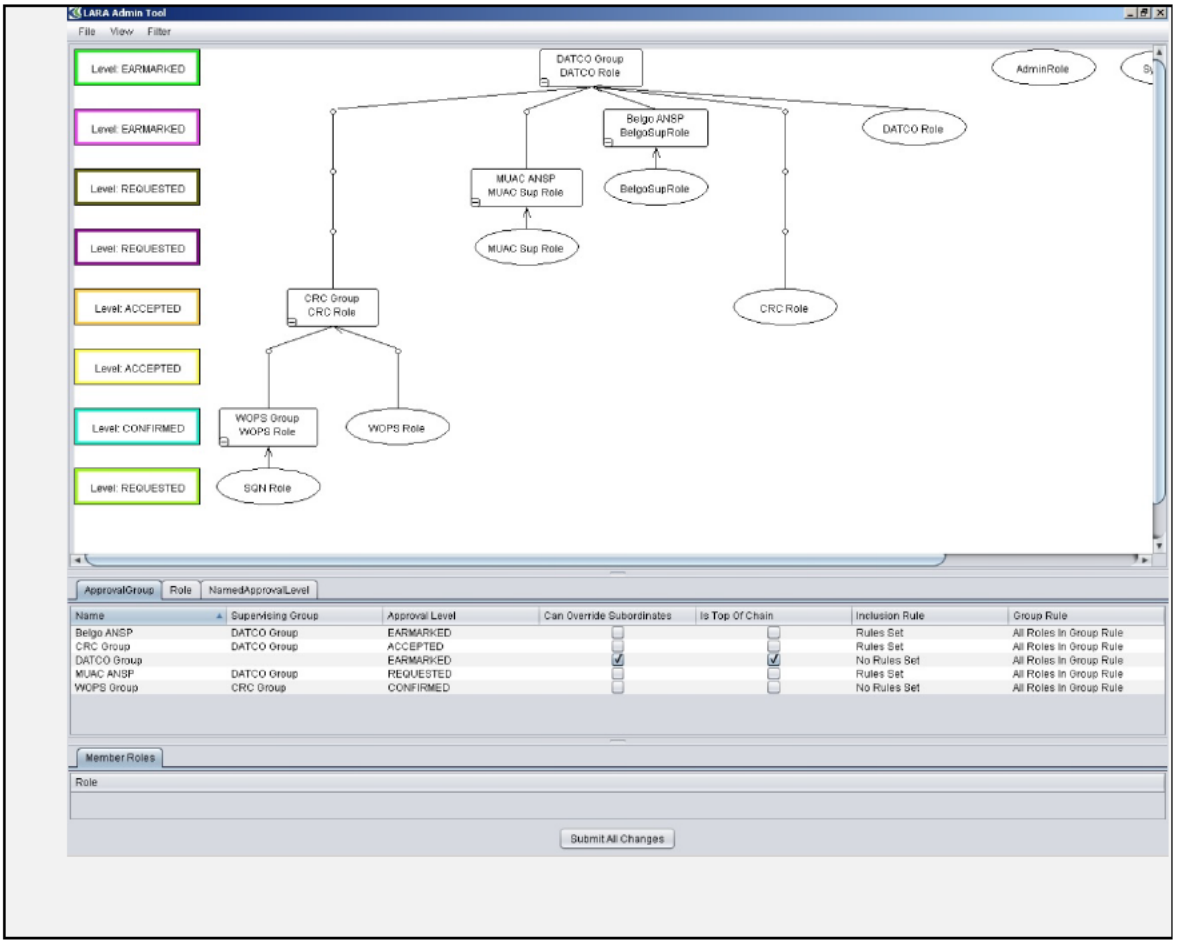

Figure 32: Example for approval chain

Airspace Status

LARA transcends the planning phase and reaches seamlessly into the tactical phase of real-time airspace allocation. It supports activation and de-activation of airspaces and allows short-term changes to existing reservations. New requests can be introduced on short notice. Due to its network based information sharing all relevant users are informed about every change occurring. Interfaces to ATM systems allow presenting the status information directly on the controller working position. LARA provides the user with an additional overview named Airspace Situation Display (ASD), which is easily accessible via the main user interface. The ASD will provide the user with all information regarding the current status of airspaces. Once a reservation is approaching activation, its status is changed to “Pending” and is coloured orange on the ASD. The time-before-activation specified for the initiation of the pending phase is a software configurable item. This “Pending”-State will inform all users about the scheduled activation of an airspace and allows them to prepare appropriately.

Once the pending state is reached, the supervisor in charge of the activated airspace (typically the military supervisor) will be triggered by the system to confirm the planned activation of the airspace. After his confirmation the civil supervisor(s) will be prompted to acknowledge the activation to ensure their awareness. Once the airspace is activated it will be coloured green on the display of the agency responsible for service provision within the activated airspace - and in red for all others. The ASD provides a vertical view for each selected airspace to indicate the vertical limits of the activation and if two or more independent level blocks have been reserved for different missions. Deactivation of the airspace is supported by similar process.

LARA can export the information on airspace status to external systems. This can be used by Air Traffic Management (ATM) Systems to indicate airspace status on the Controller Working Position (CWP) to increase situational awareness.

The Operator and Supervisor roles

The **Operator** will have the possibility to view all data maintained in the LARA System. Additionally he will have certain defined rights for booking airspaces and approve airspace bookings according to his role and approval group.

The **Supervisor** will have all rights defined for the Operator. Additionally he will be entitled to activate and deactivate airspaces and to change airspace reservations at any time. For every agency there will be exactly one user appointed as supervisor.

Each user of LARA is connected to a certain role within a defined agency. An operator can contact another operator by retrieving and using the stored contact data.

ASM Data collection

All data managed and exchanged in LARA is maintained in an RDBMS server, which allows further processing and extraction. This stored information can be used to investigate and trace occurrences as all actions performed on the system can be traced back to each user. It can as well be used to establish and maintain statistics on the allocation and use of airspaces by different users and provide a means for performance measurement.

If LARA is used in combination with an air situation display or any other modern Flight Data Processing System, the statistical data can be further enhanced by mapping actual flight profiles onto the airspace reservations to obtain a precise overview of actual use of airspaces, transit times and derived mission effectiveness.

Purpose of the system

Overview

LARA will be used as a tool to exchange information between civil and military units where current systems do not support it, specifically for the enhancement of the exchange of data relating to civil and military airspace use. LARA is a civil/military Airspace Management Tool with the aim of addressing the:

- management of booking requests issued by the military airspace users including a clear definition of roles and responsibilities,
- alignment of airspace requests with the civil/military national/regional traffic planning,
- provision to Air Traffic Service Providers of airspace planning and status and additional ATC requests for “CDRs” or airspace,
- provision of a coordinated civil/military traffic/airspace planning to the CFMU,
- pushing the real-time airspace status information to various external systems, using existing and planned interfaces.

LARA provides automation support for the following high-level operational functions:

- Airspace Management Coordination Function (AMCF),
- Military Airspace Planner Function (MAPF),
- Civil Airspace Planner Function (CAPF),
- Airspace User Function (USEF),
- Controlling Unit Function (CUF).

Service function description

LARA provides the following services:

Visualisation

Visualisation of areas/CDRs – for information only (AVD)

a. Visualisation of airspace status (ASD)
b. Visualisation of impact assessment of areas activation versus CDR activation – for information only
c. Visualisation of airspace planning – airspace planning display (APD - GANTT chart)

The safety-related functions (as identified by the FHA) are 1b and 1d. The airspace status display must be consistent with the airspace planning display, the current status of the airspace reservations (activation, de-activation) and it must be consistent with the information in the database(s).

The airspace planning display provides the interface to manipulate the reservations (enter and update them).

The airspace status will be displayed on the ASD (airspace status display) and shall reflect the reservation status in the GANTT chart (APD). LARA shall assure the integrity of data; the consistency between the GANTT chart and ASD data.

Activation and de-activation will be displayed on the ASD and APD (GANTT chart).

The main interface between people and processes in LARA system is the “Visualisation”. The visualisation was assessed as part of the operational functions where the visualisation functionality is used.

Event planning

The FMP opens the event planner and introduces the main events influencing GAT flows (such as major system changes, anticipated traffic peaks due to sport events,) and expected periods of capacity issues. Events can be linked to airspace reservations and the linkages shown on the graphical user interface. The event planner reflects the input and this is shown to all linked stakeholders. This function is not safety-related as the result of this function is for information purposes only.

Areas/CDRs reservation

Civil and Military stakeholders using LARA insert their airspace and CDR demand and the input will be shown in the GANTT chart at all LARA stations. For NOTAM-ed airspace, LARA will trigger a NOTAM template to be filled in and sent to the NOTAM office. The system will also trigger a consistency check.

Conflict Resolution

Identified conflicts of demand are negotiated via the chat box or telephone. There is no automatic conflict resolution functionality provided in LARA. Only a warning will be displayed. The information on the conflict is presented by LARA for information purposes only.

The user is responsible for validating each request. The airspace managers resolve conflicts using the planning information displayed and the GANTT chart. The requestor has online information about the progress of his airspace reservation request.

Areas/CDRs pre-activation/activation/de-activation

This functionality is safety-related - LARA supports the coordination of the activation and deactivation of Areas/CDRs and displays the status.

Ad-hoc airspace

Ad–hoc airspace will not be defined in LARA. The information with regard to ad-hoc airspace will be imported into LARA as other static information. In LARA, the defined ad-hoc area will be introduced like any other area in order to be displayed and flagged until publication. Ad-hoc airspace will be dealt with according to the currently implemented standard procedure and includes validation by the local housekeeper.

External System Interface

External system airspace data interface function (provision of airspace data (airspace identifier, FL, time); system-system interface).

The following external system interface functions exist:

- Interface to ATC system for display of activation/de-activation of airspace
- Import of static data
- CHMI (CIAM): Airspace reservations are sent out (which are used to build the airspace use plan) and updated. The final publication (AUP and UUP) will be imported into LARA to update the CDR availability in LARA. When activation of airspace takes place, the supervisor always visualises the affected CDR (since in the database there is a permanent link with the related airspace). Therefore, a corruption of the data will be identified.
- For NOTAM-ed airspace, a trigger will prompt the creation of a NOTAM

LARA provides the users with the option to display the airspace data on the ATC systems. LARA will assure data consistency between LARA GANTT and the export facility.

3. The iADS System

iADS is an airspace management ‘what if’ tool designed to enhance collaborative decision making between civil and military Local Network Management agencies. iADS graphically displays airspace demand, and by factoring in relevant constraints such as staffing levels, sector configurations, sector monitor values and relevant met data, airspace capacity. iADs provides an easily interpretable visual display which allows Local Network Management agencies to understand fully the impact of airspace allocation decisions and provides the ability to fine tune airspace allocation in order to make best use of available airspace.

Providing mutual awareness of airspace demand and the factors affecting the demand, as well as a graphical ‘what if’ function to simulate changes to requested bookings and aircraft routings, improves

coordination and allows airspace capacity to be optimized for the benefit of both civil and military airspace users at local level, as well as contributing to network level optimization.

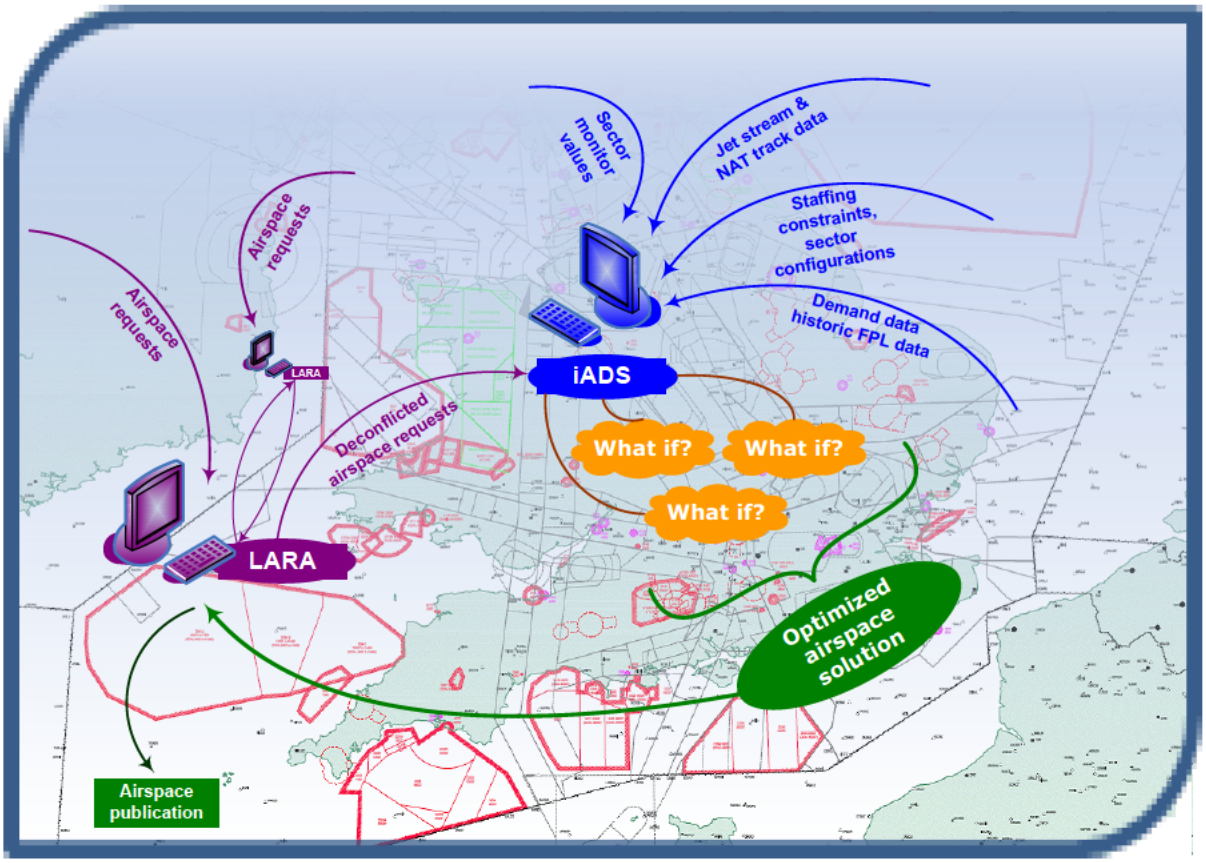

Figure 33: iADS setup

iADS is provided by a Microsoft (MS) Windows based server hosting an SQL server database and the iADS application. The service is web based and is provided via an IP based network to Windows based clients, utilising MS Internet Explorer and MS Silverlight. System data entry into the prototype is currently via manual file transfer. Manual data entry is via client interaction.

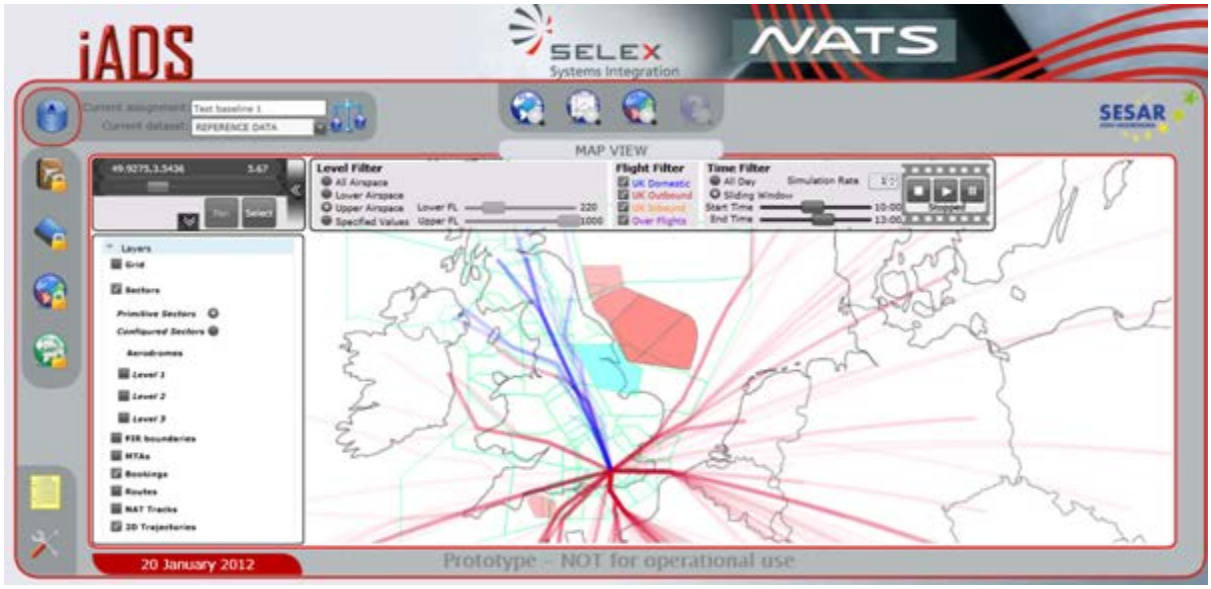

Figure 34: iADS screen shot – Map View

Phase 1 iADS is the start of a stepped development that supports present day processes and procedures within ASM and ATFCM collaborative decision making. Phase 1 focuses on decision making within the D-7 to D-3 timescale; Phase 2 focuses on the introduction of automated, parameter controlled decision making, and airspace optimization in the period D-3 to D-1; Phase 3 brings these enhancements into the day of operations.

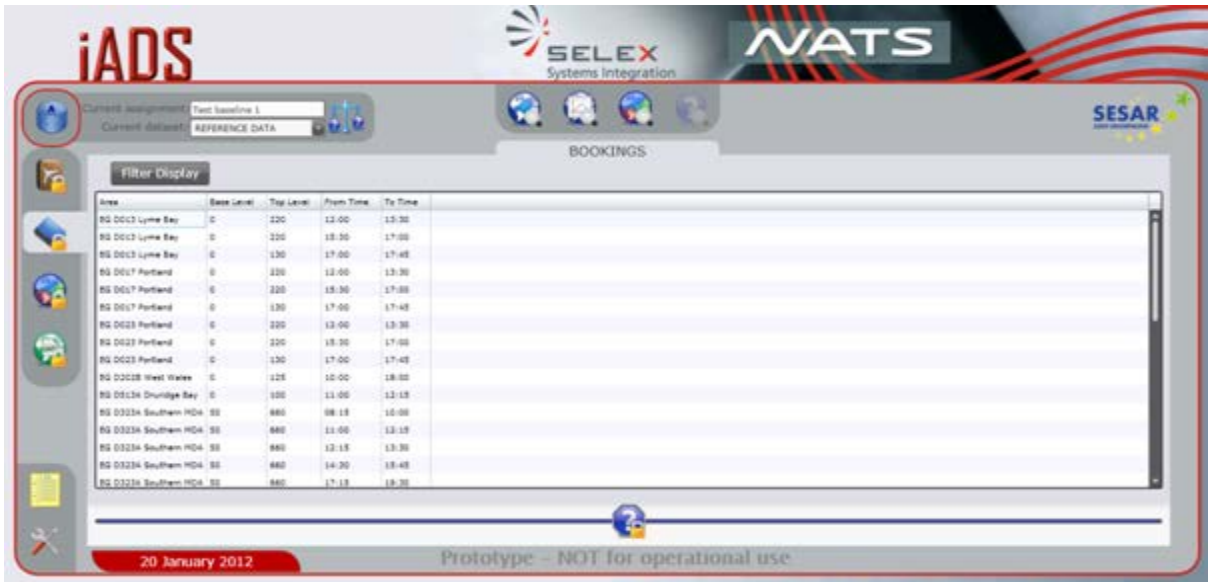

Figure 35: iADS screen shot – Airspace Requests – Tabular

iADS displays military airspace booking requests, civil traffic flows, and colour coded sector loadings to highlight demand and capacity imbalances. iADS allows Local Network Management agencies to 'what if' airspace allocation scenarios by level capping or moving (both geographical and by time) airspace requests, rerouting civil traffic and bandboxing or splitting ATC sectors.

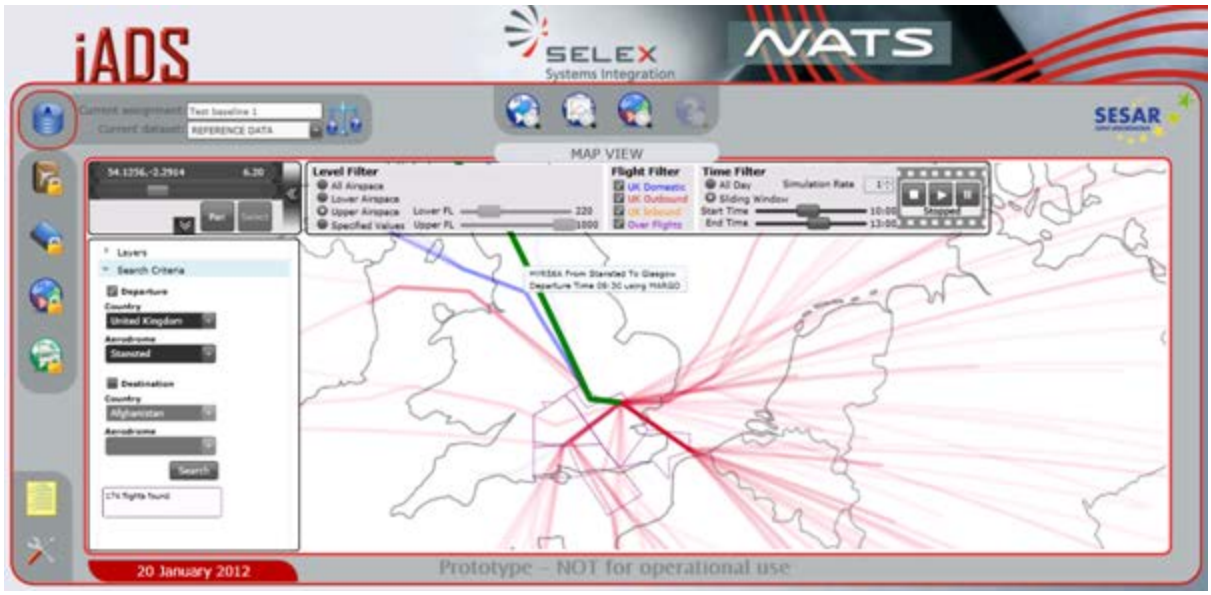

Figure 36: iADS screen shot – GAT flight detail – Map View

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