SWIM Compliance Report

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Abstract

This report gives information about the service compliance assessment done for the Validation Exercise EXE-P07.05.04-VP-710 and explains why services designed within the scope of SESAR activities were neither taken into consideration nor validated on SWIM compliance

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1 Introduction

1.1 Purpose of the Document

This report is part of the SWIM Compliance Framework, produced in the context of SWIM Compliance for Validation Exercises that want to demonstrate the SWIM Compliance level. The SWIM Compliance Criteria for R5 explain the criteria against we assess for SWIM Compliance. This template provides the evidence to satisfy the Compliance Criteria. The steps in completing the template report are the following:

1. The SWIM Compliance Applicant person responsible for the Validation Exercise, with assistance from WP 8 and WP 14 experts, produces the SWIM Compliance Report i.e. using this template.
2. The report is then handed over to the SWIM Compliance Acceptance Team, who performs the assessment and completes this template report into the final SWIM Compliance Assessment Report, including a **SWIM Compliance Level**.

This report is meant to contain all evidences that show the SWIM compliance for the Technical Service Contract (TSC) for a service.

1.2 Intended Readership

- WP8 / WP 14
- WP 3
- Persons participating in the R5 Validation Exercise (e.g. Owners of the Validation Exercise)
- SWIM Compliance Acceptance Team

1.3 Acronyms and Terminology

Term	Definition
Capability	The collective **ability to deliver a specified type of effect or a specified course of action**. Within the context of the SESAR Programme a capability is therefore the ability to support the delivery of a specific operational concept to an agreed level of performance. **Source: Common working meeting between B41 EA study and B43 T5. In bold, the NATO Architecture Framework V3 definition**
Governance	Ability of decision-makers to set policies regarding stakeholders, services, and their relationships
Information Exchange	A specification of the information that is to be exchanged. An Information Exchange must have a unique identifier. Source: NATO Architecture Framework V3 definition.
Information Exchange Requirement	An Information Exchange Requirement (IER) is the description, in terms of characteristics, of the requirement to transfer information between two or more end users. The characteristics described include source, recipients, content, size, timeliness, security and trigger. IERs are defined as independent of the communications medium. An IER may express both current and future requirements. Note: an information element is the descriptor of the content in the IER. Source: (British) Ministry of Defence, Information Exchange Requirements.
Infrastructure profile	A set of features characterising the enabling infrastructure, including the QoS and security that the infrastructure provides, technical constraints,

Term	Definition
	user behaviour patterns and characteristics. Profiles relate to legacy and/or new infrastructures such as the SWIM technical infrastructure. Source: B43 T5 study
Means of compliance	Means to demonstrate that an 'Object under Assessment' conforms to a rule (such rule being as e.g., a specification, policy, standard or law)
Node	**A logical entity that performs Operational Activities specified independently of any physical implementation,** e.g. a stakeholder type providing and/or consuming operational information within a network of other stakeholders. Source: Common working meeting between B41 EA study and B43 T5. In bold, the NATO Architecture Framework V3 Definition.
Object under Assessment	Item (i.e., specifications, mechanisms, activities, individuals) upon which an assessment method is applied during an assessment. In this document, the Object under Assessment (OuA) is the Technical Service Contract for a service.
Operational Focus Area	A limited set of dependent operational and technical improvements related to an Operational Sub-Package, comprising specific interrelated OIs designed to meet specific performance expectations of the ATM Performance Partnership. Source: ATM Lexicon
Policy	Principle or rule with a view to guiding decisions and achieving one or more rational outcomes
Registry	The SWIM registry is a trusted, managed, complete and consolidated source of reference for service information and related regulations (policies, standards, certifications and taxonomies). It holds all SWIM metadata regarding: - stakeholders, - service definitions (ISRM), - service instances, and the links between them. Source: Registry ConOps
Service	The contractual provision of something (a non-physical object), by one party, for the use of one or more other parties. Services involve interactions between providers and consumers, which may be performed in a digital form (data exchanges) or through voice communication or written processes and procedures. Source: ATM Lexicon
Service definition	The specification of a service as it appears in the Service Description Document and Service Interface Definition. The Service Description Document consists of a mix of textual information and graphics (expressed in a UML notation). The Service Interface Definition consists of machine-interpretable constructs specified according to the selected technical platform, including the necessary technology bindings, e.g. complete WSDL (and XSD), IDL, AMQP, DDS, etc. Source: B4.3 Working Method on Services.

Term	Definition
Service interface	The mechanism by which a service communicates. Service providers and consumers need to implement service interfaces in order to be able to collaborate. A service interface includes service operations that enable access to the functionality of the services identified, as well as the data used in the service interaction. Source: B43 T5 study.
Service instance	Service which has been implemented in accordance with its specification in the service catalogue (during the SESAR Development Phase, the service definitions are available in the ISRM) by a service provider (by itself or contracted to a third party). Source: SWIM ConOps
Service level	A value specification for one or more service attributes indicating the level to which a technical system (or resource if including non-automated services) delivers a service in a particular environment. Example: A "Service Response time" may be defined in relation to a service. A given technical system could have a corresponding Service Level, e.g. "Less than 3 seconds". Source: B43 T5 study.
Service consumer	Stakeholder which consumes service(s) provided by other stakeholder(s)
Service lifecycle	The lifecycle defines the sequence of phases followed by a service.
Service Payload definition	The data/information exchange model represented in UML contained in the Service Description Document.
Service provider	Stakeholder which provides service(s) that can be consumed by other stakeholder(s)
SWIM	System-wide information management. SWIM consists of standards, infrastructure and governance enabling the management of ATM information and its exchange between qualified parties via interoperable services. Source: SWIM ConOps.
SWIM Common Component	A SWIM infrastructure element managed by the 'SWIM authority' and implementing a shared capability, e.g. registry, PKI, etc. Source: SWIM ConOps.
SWIM Compliance Acceptance Team	The group of experts who perform the SWIM Compliance Assessment and provide the final SWIM Compliance Level.
SWIM Infrastructure	The sum of all the SWIM infrastructure elements which are needed to support SWIM services. Source: B43 T5 study.
SWIM Profile	A SWIM profile is a coherent, appropriately sized grouping of middleware functions/services for a given set of technical constraints/requirements which permit a set of stakeholders to share information
(Technical) Service Contract	A set of one or more published documents that express meta information about a service. The fundamental part of a service contract consists of the service description documents that express its technical interface. These form the Technical Service Contract (TSC) which essentially establishes an API into the functionality offered by the service. The service interface definition in the TSC is mainly given as a machine-readable format usually provided in a standard definition language such as IDL, WSDL or others. The TSC also describes such aspects as the

Term	Definition
	message exchange pattern between provider and consumer, plus the chosen SWIM profile and requirements (bindings) on the technical infrastructure. A TSC can further reference human-readable documents, such as Service Level Agreement (SLA) that describes additional quality-of-service features, behaviours and limitations.

1.4 Acronyms and Terminology

Term	Definition
AIRM	ATM Information Reference Model.
ACC	
ADQ	Aeronautical Data Quality
AFUA	
AMC	
AO	
ARES	
ASM	
ATCO	
ATFCM	
ADQ	Aeronautical Data Quality
ATM	Air Traffic Management
CLDM	Consolidated Logical Data Model
ConOps	Concept of operations
DDS	Data Distribution Service
DOD	Detailed Operational Description
EA	Enterprise Architecture
EAEA	European ATM Enterprise Architecture
EASA	European Aviation Safety Agency
EC	European Commission
EU	European Union

Term	Definition
ESB	Enterprise Service Bus
EUROCAE	European Organization for Civil Aviation Equipment
FMP	
FOC	
IBP	Industry Based Prototype
ICAO	International Civil Aviation Organisation
iCAS	
ICD	Interface Control Document
IER	Information Exchange Requirements
INTEROP	Interoperability Requirements
IRS	Interface Requirements Specification
ISO	International Organisation for Standardisation
ISRM	Information Services Reference Model
IT	Information Technology
ITIL	IT Infrastructure Library (ITIL® provides a Best Practice guidance framework for IT Service Management)
MET	Meteorology
NAF	NATO Architecture Framework
NM	
NMVP	
OFA	Operational Focus Area
OI	Operational Improvement
OPS	Operational
OSED	Operational Service and Environment Definition
OuA	Object under Assessment
PKI	Public Key Infrastructure
QoS	Quality of Service

Term	Definition
RPC	Remote Procedure Call
RTCA	Radio Technical Commission for Aeronautics
SACG	SWIM Architect Co-ordination Group
SCG	Service Coordination Group
SCL	SWIM Compliance Level
SDD	Service Description Document
SES	Single European Sky
SESAR	Single European Sky ATM Research Programme
SESAR Programme	The programme which defines the research and development activities and projects for the SJU
SID	Service Identification Document
SIR	Service Identification Report
SJU	SESAR Joint Undertaking (Agency of the European Commission)
SJU Work Programme	The programme which addresses all activities of the SESAR Joint Undertaking Agency.
SLA	Service Level Agreement
SOA	Service Oriented Approach
SOAP	Simple Object Access Protocol
SoaML	Service Oriented Architecture Modelling Language
SVA	Service Activity
SWIM	System Wide Information Management
SWIM TI	SWIM Technical Infrastructure
SYS	System Projects
TAD	Technical Architecture Description
TS	Technical Specification
TSC	Technical Service Contract
UDDI	Universal Description, Discovery and Integration
UML	Unified Modelling Language

Term	Definition
VPA	
URN	Uniform Resource Name
WP	Work Package
WSDL	Web Services Description Language
XSD	XML Schema Definition

2 SWIM Compliance Report Summary

This section summarises the main information about the compliance assessment.

Exercise EXE-07.05.04-VP-710 is the last one in a chain of SESAR step1 validation activities that validates AFUA concept element the Real Time Status of Airspace (RTSA) update. The exercise was performed in a shadow mode at the EUROCONTROL NM premises in Brussels, using the NM Validation Platform and interfacing with prototype systems of key ATM stakeholders involved in the validation activities.

VP-710 implicates the key ATM actors namely: Network Manager, Airspace managers (including AMCs), FMPs, ACC supervisors, Military Supervisors, ATCOs, Military Airspace Users (WOC), AOs (FOC)

EXE-P07.05.04-VP-710 was split on two different phases:

- the first one, was already held in October 8-9 2014, assessing the RTSA update process between ATC (iCAS IBP) and ASM support systems (STANLY_ACOS ASM-ATC and ASM-ASM components);
- the second phase was scheduled for week n.24 of 2015 involving NM (NMVP), ASM support tools (LARA, STANLY_ACOS ASM-NMVP component) and flight/mission planning tools (LIDO, OPTARION) in the ATFCM process,.

The ASM-ATC component of STANLY_ACOS (DFS) as well as the iCAS IBP (Indra) will not be part of this report, as they validated during the first phase of the exercise held in October 2014.

VP-710 validates the RTSA update process, in conjunction with newly introduced airspace reservation/restriction (ARES) variable profile area (VPA) design principle. The exercise aims at demonstrating the feasibility of updating the real time airspace status automatically into the NM systems, delivering a closed cycle of CDM process between ASM support systems, NM systems, ATC systems and FOC/WOC systems. The focus is given to the expected benefits from the exchange of real time airspace availability information between national / regional ASM Support Systems, the national ATC system, the regional ATFCM system and the FOC/WOC systems.

The stakeholders involved in the AFUA concept development and validation activities agreed to validate concept elements by means of already developed prototype systems in order to demonstrate the system interoperability and feasibility of SWIM technical profile TP (B2B) as well as the applicability of data exchange standards (AIXM 5.1) .

VP710 was recognised by SCG (Service Consultation Group) as the best candidate exercise where the validation of AFUA services may take place along with the validation of the operational concept elements utilising capability of NM, ATC, ASM and FOC/WOC prototype systems

AFUA services were defined and designed by WP 8 experts in line with service design methodology following all consecutive steps in FT 09 and further transferred to SVA 008 for further validation and alignment with SWIM criteria. SVA-008 was focused on 5 AFUA services out of 11 identified in SID document and designed properly following SOA design principles and the ISRM foundation.

There were five services-candidates chosen for validation on SWIM compliance bearing in mind that these services were recorded in ISRM version 1.2:

- **ARES Activation**
- **ARES De Activation**
- **ARES Pre Activation**
- **ARES Release**
- **ARES Query**

It should be noted that at the stage of service identification design and allocation the validation activities were compromised by lack of involvement of the system projects in particular within the scope of SESAR AFUA service identification and allocation. Therefore in SCG forum the proposal was raised to make best use of already developed prototype systems in order to synchronise logical services designed in FT-09/SVA-008 with physical services implemented in the prototype systems.

It is not a coincidence that listed above services are similar to services defined in COMMISSION IMPLEMENTING REGULATION (EU) No 716/2014 of 27 June 2014 on the establishment of the Pilot Common Project supporting the implementation of the European Air Traffic Management Master Plan PCP regulation.
In the Implementing Rules paragraph 5.1. **Operational and technical scope** it is stated that operational stakeholders shall implement services which support the exchange of the following aeronautical information using the yellow SWIM TI Profile:

- **Notification of the activation of an Airspace Reservation/Restriction (ARES)**
- **Notification of the de-activation of an Airspace Reservation/Restriction (ARES)**
- **Pre-notification of the activation of an Airspace Reservation/Restriction (ARES)**
- **Notification of the release of an Airspace Reservation/Restriction (ARES)**
- **Query Airspace Reservation/Restriction (ARES) information**

With publication of PCP IR the importance of the validation of the services has become crucial.

After several consultations in the expert group meetings it was recognised that the prototype systems such as ASM support systems LARA and Stanley ACOS as well as FOC Lufthansa system, WOC Airbus defence and space system and NM systems involved in the exercise were developed outside the scope of SESAR activities. Therefore physical services allocated to the system functionalities were designed in conformity with industrial standards stakeholders operational and system requirements.

It was recognised by stakeholders and respective WP8 experts that the services designed within FT-09/SVA-008 activities have the same or similar functionalities versus services used by the systems in the validation activities but they cannot be compliant with SWIM criteria and addressed further on in the SWIM compliance report. **Different service design methodology and semantic aspects make these services non SWIM compliant whereas these services satisfy operational needs for information exchange within SWIM profile utilising XML data exchange standard.** Nevertheless no SWIM compliance was performed on these services since the SWIM compliance matrix was not available at the time of the development of the exercise.

After consultations with Industrial Stakeholders and SJU management in Release 5 engineering review meeting it was decided to prepare a VP 710 SWIM compliance report and explain why services designed within the scope of SESAR activities were neither taken into consideration nor validated on SWIM compliance **Therefore, information addressed in this report will deviate from the required order for writing the details on SWIM compliance and can be regarded as a lessons learned document.**

3 Details of the Compliance Assessment

The compliance assessment is focused rather on gaps than SWIM compliance criteria's

The Real Time Status of Airspace (RTSA) update process within the scope of AFUA for Step1 and the interface to exchange such information among prototype systems is well described in TS document. It describes the services (B2B) in AIXM **Error! Reference source not found.**format in order to send, receive and process RTSA data between several systems as ASM support tools, NM, FOCs and WOCs. RTSA data will be available and displayed on the Controller Working Position (CWP). Furthermore this data will be made available to identified partners (FOC, WOC, AMC FMP) for whom the update of planning data may be relevant and consequently used to support the decision making process between FOC/WOC, AMC and NM.

3.1 Description of the services

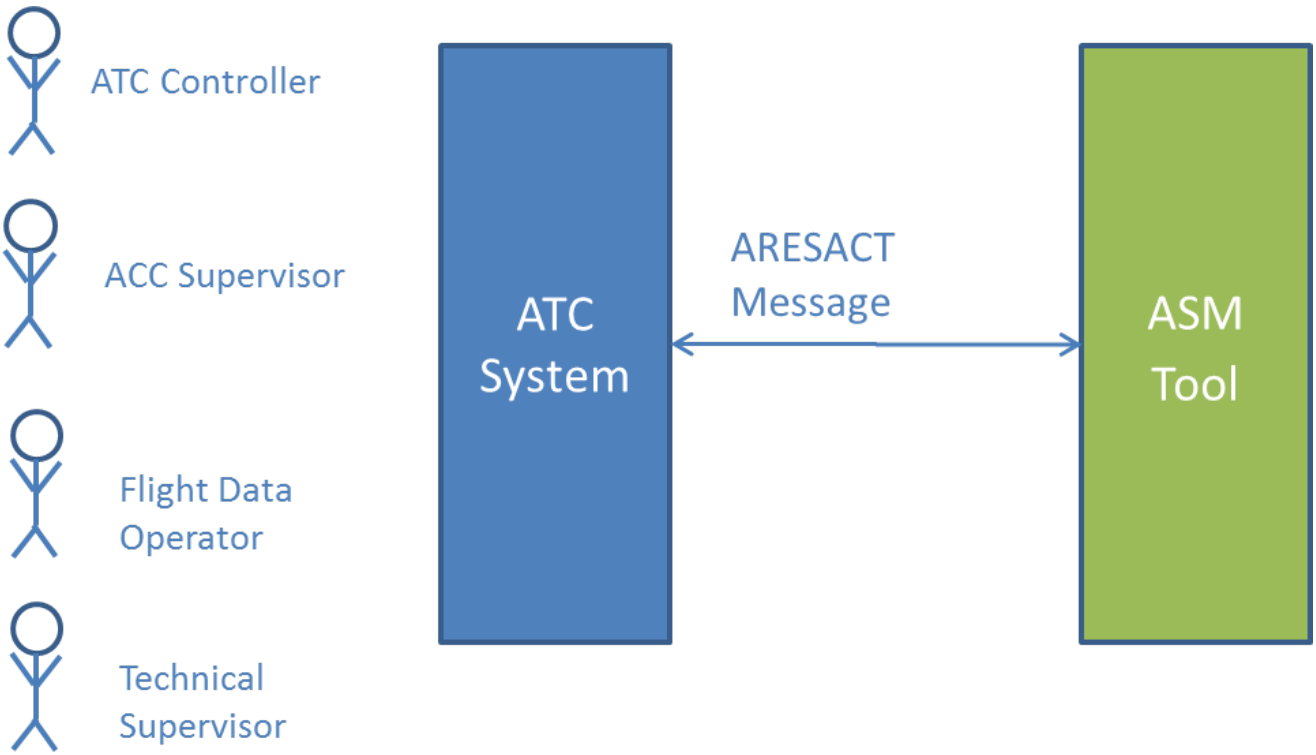
3.1.1. ATC - RTSA

ASM Tool and ATC System are interconnected in order to exchange ARES information between both systems. The information is sent by using ARESACT messages.

ASM Tool feeds the ATC System with consolidated information regarding ARES. The ASM Tool will communicate the existing bookings to the ATC System. Then, the ATC System will display on all CWPs that list of bookings. If there are modifications on those bookings or new ad-hoc activations, the ASM Tool will communicate the changes to the ATC System and those changes will be displayed on all CWPs accordingly.

The interfaces are:

- From a technical point of view: ASM Tool with ARESACT Message
- From a user's point of view: ACC supervisor, ATCO, FDO, Technical Supervisor



ATC-ASM Tool interfaces

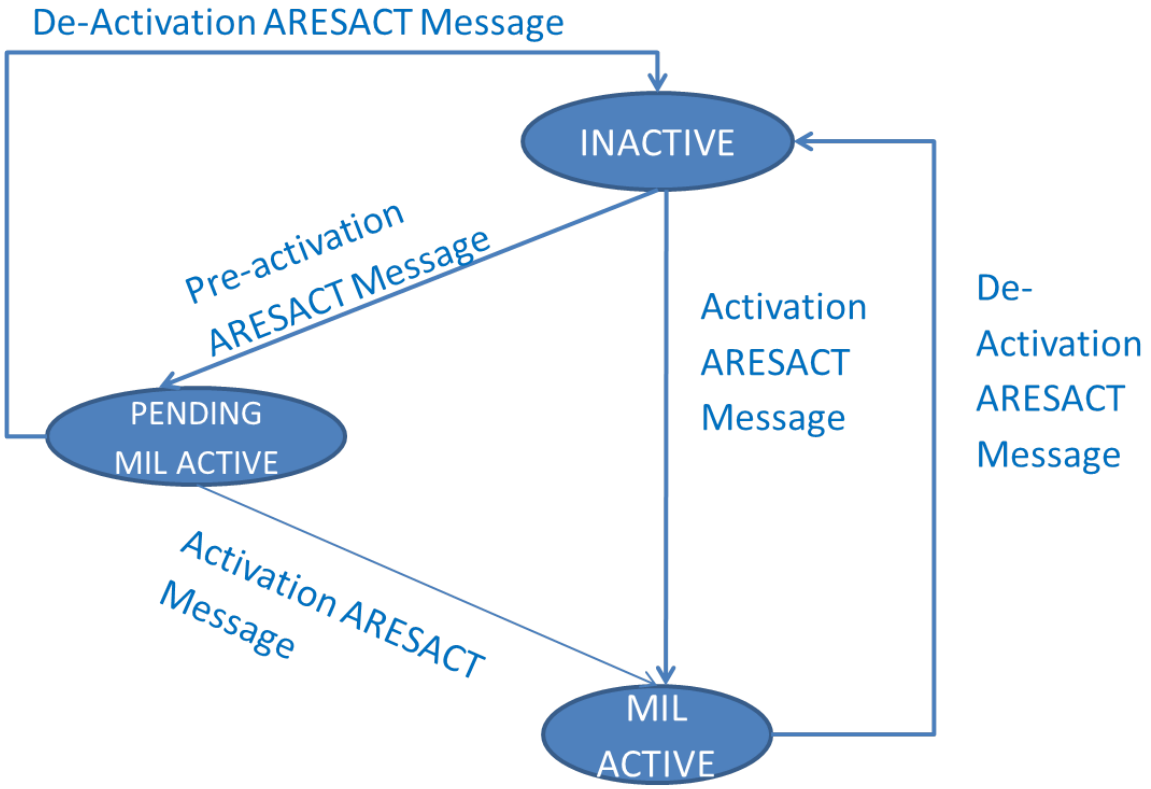
It has to be noted that the ATC System will display ARES information if the message is received from the ASM Tool, acting the ASM Tool as a master and the ATC System as a slave. All the actions made by the ATC Controller will be considered as proposals.

The interface uses FMTP and ADEX-P format to exchange data in a bidirectional communication

3.1.1.1 ARES Status

The following figure will illustrate the ARES status related the to the ARESACT messages, taking into account the field “LACTSTAT” of the message. This field indicates the status of the booking.

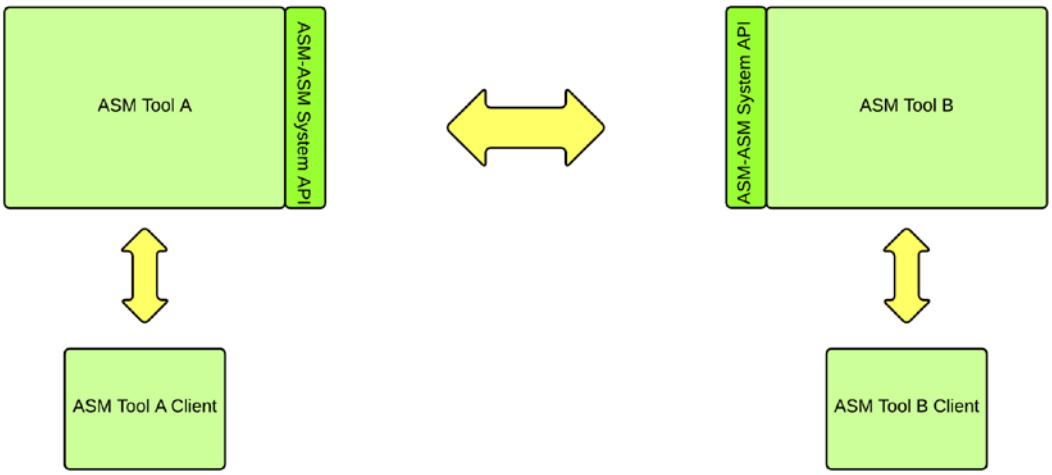
The initial status of an ARES shall always be “Inactive” until a pre-activation ARESACT message is received or an activation or ad-hoc activation is received.



ARES State Transition Diagram

3.1.2 ASM - RTSA

The ASM-ASM System Interface shall allow the equivalent model of communication between two arbitrary ASM Systems as follows:



The ASM-ASM System Interface

The ASM-ASM interface is composed of services in six main areas:

- Authentication services
- Static data services
- Reservation services
- Mission services
- Proposal services
- Activation services

Information that is exchanged over services must be compliant with common industry standards. This ensures a consistent approach across all system development, and does not introduce any unnecessary level of bespoke development or any intrinsic dependencies on a proliferation of niche technologies.

The standard interchange format for airspace data is AIXM (version 5.1 at the time of writing). The services described in this section explicitly reference this standard as the basic interchange format.

3.1.2.1 Authentication Services

Services shall be provided to allow an external ASM system to retrieve the user data from within the service. This exchange is intended to be symmetric between two ASM systems, with each knowing the other's users and providing credentials for each external to login.

These services enable each ASM tool to initially authenticate each other, establishing a connection. They enable the exchange of user information allowing each ASM system to know of the authenticated users of the other. Finally they allow a user of the other ASM system to authenticate and continue to use the other services.

3.1.2.2 Static Data Services

Services shall be provided to enable the retrieval of static data from within the ASM system.

Once each ASM tool has established a connection this service enables access to the static data managed by each ASM tool.

3.1.2.3 Reservation Services

Services shall be provided to enable the creation, modification and retrieval of reservations within the ASM system by external users. Details of conflicts between different reservations shall also be made accessible through the service.

The creation and modification of reservations shall be supported through the provision of 'actions' by the service. The actions shall describe the allowed modifications that a user may take on a specific reservation. Actions are subject to change based on the state of a reservation and the current time.

These services enable an ASM tool to request and subscribe to the reservation data and reservation conflict data from another tool. It also enables an authenticated user to request their action data and create or update a reservation.

3.1.2.4 Mission Services

Services shall be provided to enable the retrieval of missions held within the ASM system by external users. Privileges related to which external users may view the mission data should be configured between the two ASM systems.

These services enable an exchange of limited mission data between two authenticated ASM tools

3.1.2.5 Proposal Services

Services shall be provided to enable the retrieval of proposals held within the ASM system by external users.

A proposal refers to a specific reservation and effectively re-defines a subset of the reservation data. A proposal can then be accepted or rejected as per the actions accessible through the service. A reservation may, before being given full approval to go ahead, be the subject of a proposed change. These services enable the retrieval and subscription to the proposal data from an ASM tool. They also enable an authenticated and privileged user to create a proposal on a reservation or handle a reservation by either accepting or rejecting it.

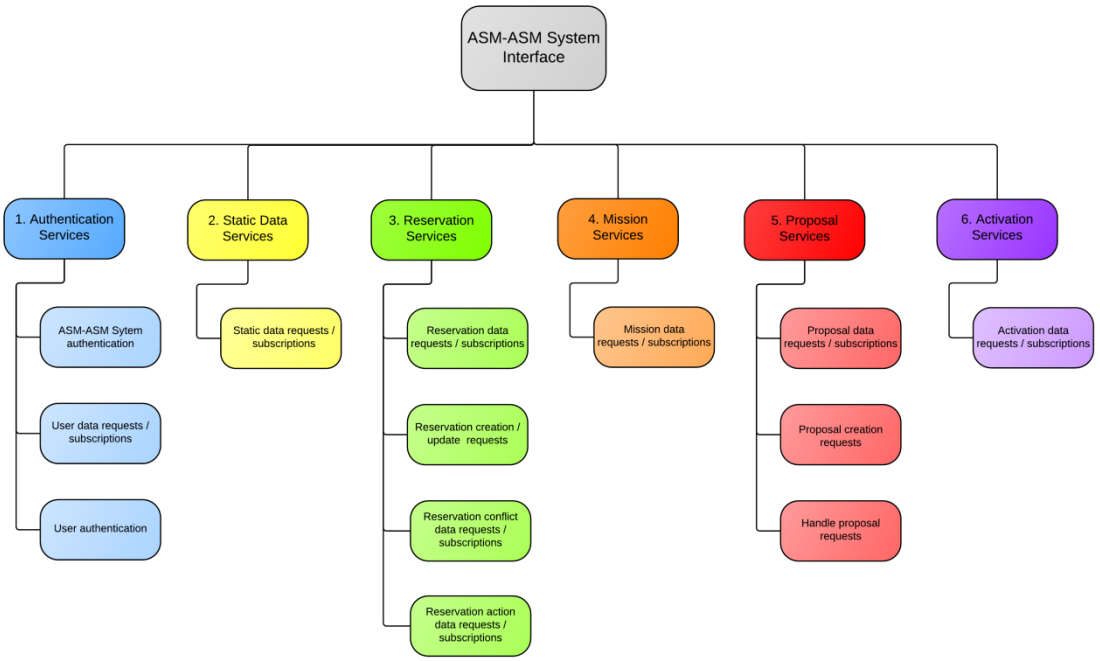
3.1.2.6 Activation Services

Services shall be provided to enable the retrieval of activation data held within the ASM system by external users.

Activation refers to the specific state of airspace at the current time and until a specified end time. The end time of activation is subject to change, it may be shortened or extended.

The functional elements and associated responsibilities of each component/service are described in the diagram below.

These services enable an authenticated ASM tool to request and subscribe for real time updates to the current activation state of all of the airspace managed by the tool.



3.1.3 NM - RTSA

The capability to receive, process, store and send RTSA data allows the system to automatically manage and exchange data in AIXM format via an automated B2B connection in order to support the CDM process and consistency between local / regional ASM and NM systems, and to balance demand and capacity in real time.

The NM system shall ensure the validity and the consistency of the RTSA data received and sent. Given the implicit risk related to sharing RTSA data among different users, safety aspect is a critical requirement for NM AFUA implementation.

The capability to differentiate RTSA data from AUP/UUP messages allows the system to process and store them separately in order to be able to perform network impact assessments, what-if and post-ops analyses, and to update ENV ATFCM/FLIGHT client systems accordingly to allow AOs to file FPLs based on real time information.

Cooperative Airspace Management covers the following ARES collaboration services

- ARESPreActivationService: negotiation of the pre-activation of a planned ARES;
- ARESActivationService: notification of the activation of a pre-activated ARES;
- ARESDeActivationService: negotiation of the de-activation of a planned ARES;
- ARESReleasingService: notification of the release of a de-activated ARES.

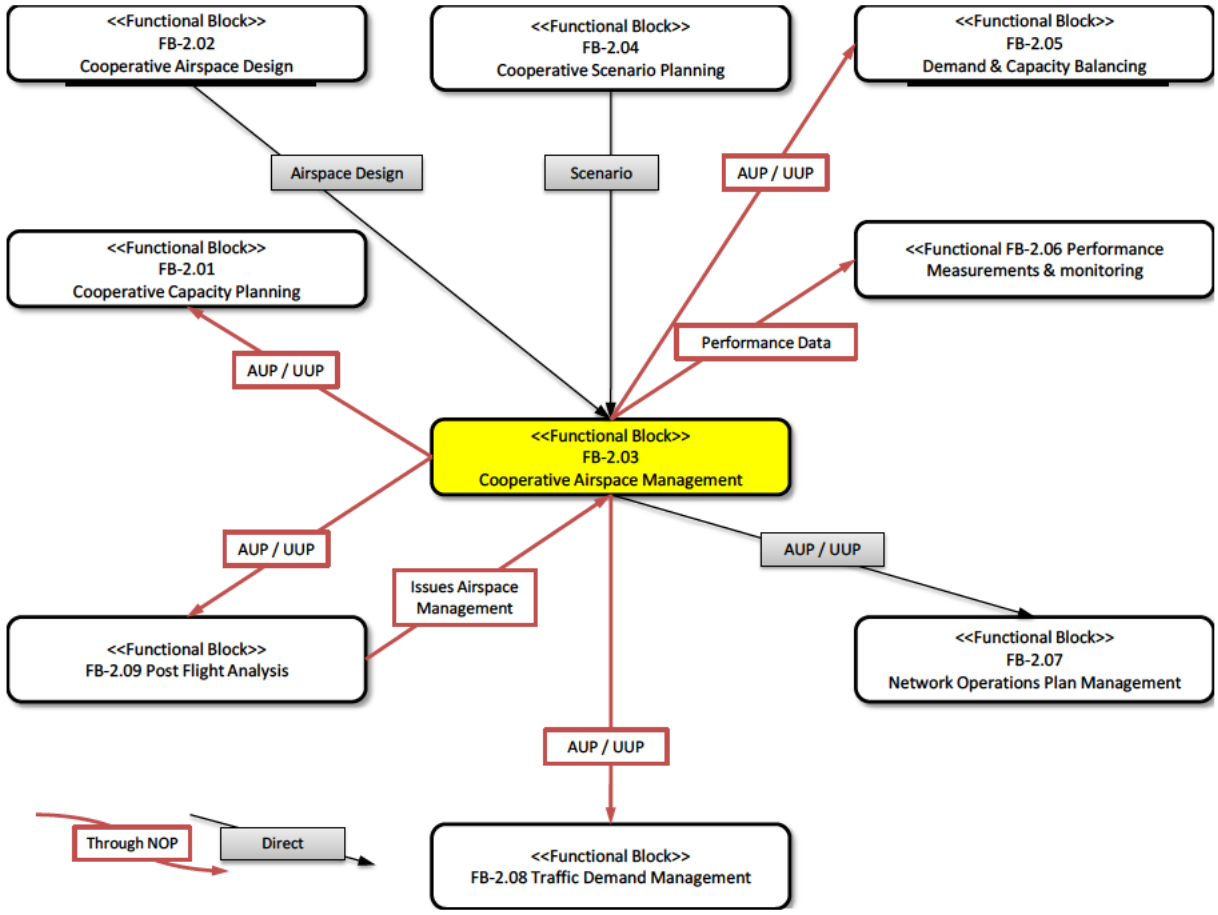


Figure 1: Functional relationships

Network Impact Assessment is performed to better use airspace opportunities (alteration of airspace restrictions, increase route availability) providing additional route options to aircraft operators by means of the following key tasks:

- Identification of the flights which are candidates to take advantage of eventual airspace opportunities;
- Coordination with the responsible FMP in case the new situation has capacity impact resulting in monitoring and evaluating capacity updates in ETFMS;
- Assessment of the impact of the request at network level (e.g. on-loading sector, sector reconfiguration, complexity, work load, etc.);

3.1.4 FOC - RTSA

The developed prototype – the "AFUA (FOC) prototype" – is based on a release of Lufthansa Systems' flight planning and flight monitoring solution "Lido/Flight" that is used operationally by most of its customers, the version V5.8.3. The prototype has been developed on a dedicated instance of the Lido/Flight system, namely the "SESAR R&D environment" (version V5.8.3.2, see also the Prototype Availability Note **Error! Reference source not found.**). Such an instance has been setup as any operational Lido/Flight system used by any airline. That means that all navigational data, meteorological data, constraints, restrictions, NOTAMs etc. are the same (in quantity and quality) as per any other operationally used Lido/Flight system.

The developed prototype delivers solutions to support the Validation Exercise. It makes available new functions to allow the management of trajectories according to airspace status changes, as communicated by relevant RTSA information. Specifically, FOC system's related developments are intended to:

- Accessing RTSA messages via a B2B service from NM.
- Monitoring of the releasing of real time airspace availability information by NM.
- Facilitating the FOC-side assessment of the impact that RTSA information might have on the planning/updating of trajectories in operational terms and with regard to the direct operating costs associated to the flights concerned.
- Facilitating the coordination and communication with concerned ATM stakeholders outside the airspace user's organization.

Dedicated interfaces have been included in the prototype to interact with the concerned ATM stakeholders for accessing RTSA information.

- CramRequest (Retrieval and Processing of EAUP/EUUP)
- SuupRequest (Retrieval and Processing of RTSA)

3.1.5 Out of Scope Justifications

3.1.6 Assessment Result - Information Compliance Level

From the information above it is evident that the prototype systems have been designed on the ground of industrial standards and requirements stemming from operational concept. A bottom up approach was accepted by SJU management as a logical way to introduce early deliverables developed by industry within the timeframe of SESAR 1 activities.

For validation purpose, AFUA concept utilises available capability of the prototype systems developed by industrial stakeholders in SESAR 1. Such approach facilitates validation activities and consequently, refinement of the operational concept elements.

The feasibility of AFUA concept is justified by implementation of operational improvement steps and validation of the technical and SWIM enablers.

Set of logical services designed within the AFUA scope and recorded in ISRM version 1.2 creates a framework for further service evolution and SWIM compliance. AIRM and ISRM foundations ensure semantic interoperability and alignment with basic SWIM compliance criteria.

Physical services introduced in the system prototypes are not SWIM compliant because of different design methodology and late delivery of SWIM compliance criteria.

It is proven by validation results that services introduced in the prototype systems in functions ensured the exchange of information between physical nodes thus justifying the feasibility of operational requirements.

Therefore, as an overall conclusion, even though industrial standards used in system prototypes for data exchange service design and allocation etc. are not SWIM compliant they properly serve the validation purpose justifying applicability and feasibility of the operational requirements of the SESAR operational concept.

Lessons learned from SESAR 1 should explicitly demonstrate how the effort spent within the scope of R&D activities should be considered by industrial stakeholders while developing system prototypes hence creating a harmonised and SWIM compliant framework for the future European ATM system.

Post-conditions for SWIM Compliance

N/A

4 Feedback from SWIM Compliance Acceptance Team

N/A

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