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PJ.10-W2 PROSA

DELEGATION OF ATM SERVICES PROVISION AMONG ATSUS

This SPR-INTEROP/OSED is part of a project that has received funding from the SESAR3 Joint Undertaking under grant agreement No 874464 under European Union's Horizon 2020 research and innovation programme.

Abstract

The objective of the SESAR Solution PJ.10-W2-93 is to explore the different possible cases of delegation of provision of ATM Services amongst ATSUs based on traffic / organisation needs (either static on fix-time transfer schedule (Day/Night) or dynamic e.g., when the traffic density is below/over certain level) or on contingency needs. In the scope of V3 operational thread activities, this document specifies the operational procedures for delegating ATM services provision in normal and abnormal conditions as well as several use cases. This document provides the operational requirements which are needed to implement the operational procedures.

Table of Contents

EUROPEAN PARTNERSHIP

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EUROPEAN PARTNERSHIP

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List of Tables

List of Figures

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1 Executive Summary

To fulfil the future needs of Air Traffic Management, a higher flexibility will be required compared to today, where Air Traffic Management is bound to national boundaries. In the future a more flexible use of resources is required and a high-level vision of this is depicted by the Airspace Architecture Study of the European Commission.

PJ.10-Wave2-Solution 93 investigates Operational Uses Case for delegating the provision of Air Traffic Management services. Procedures are defined for normal and abnormal conditions. The operational concept is as technology-agnostic as possible and can be implemented by legacy systems as well as by systems supporting the Virtual Centre Model. The concept is applicable to En-Route, TMA, and Terminal airspaces.

This V3 OSED describes the following operational use cases:

- Delegation of ATM services provision at night
- Delegation of ATM services provision at fixed time
- Cross-border delegation of ATM services with dynamic AoR for an elementary sector
- Cross-border optimisation using delegation with static AoR
- Delegation of ATM services provision following abnormal conditions (ATSU contingency)

The following use cases are only summarised in this document but described in detail in the OSED of PJ.32-W3, according to the grant agreements of PJ.10-W2-WP3 and PJ.32-W3 and the agreed distribution of use cases between the two solutions:

- Delegation of the ATFCM service and load-balancing between ATSUs
- Delegation between Civil and Military ATSUs

This document describes the necessary requirements for implementing the concept of delegation of ATM services among ATSUs. This includes the operational requirements as well as requirements on performance, information exchange, safety, security, and human performance. The concepts and procedures described in this document are not specific to any of the different supporting architectures that are described in the TS/IRS of this Solution. The TS/IRS of this solution describes various technical architectures which are all well suited for implementing the normal delegation and contingency use cases.

The initial maturity level of this Solution is V2. The target maturity level of PJ.10-W2-93 is V3.

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2 Introduction

2.1 Purpose of the document

This document describes the operational environment and provides an overview of the operating method and the use cases (UCs) related to SESAR Solution PJ.10-W2-Solution 93 Delegation of ATM services provision among ATSUs. Furthermore, it aims at providing the requirements specification, covering functional, non-functional and interface requirements. The SPR-INTEROP/OSED represents one of the key parts of this V3 SESAR Solution data pack.

2.2 Scope

This is the SPR-INTEROP/OSED for Solution 10-W2-Solution 93 Delegation of ATM services provision among ATSUs for V3 phase. Figure 1111Figure 11~~Figure 1~~ depicts the classification of Air Navigation Services according to the European Union Aviation Safety Agency (EASA) as described in Implementing Regulation (EU) 2020/469 [17] which is used as the baseline definition for this solution.

This Solution is dealing with the delegation of ATM services provision according to this definition of ATM services which comprises:

- Air Traffic Services
- Air Space Management
- Air Traffic Flow Management

In the current V3 version of this OSED, the focus is on Air Traffic Services. The aspect of ATFCM-related service delegation is only touched at a high level in this document but will be further researched by PJ.32-W3.

ATM services are the primary focus of this solution. Besides this, CNS and MET services are regarded as enablers for the ATM services. They are required but not in the primary focus of the solution.

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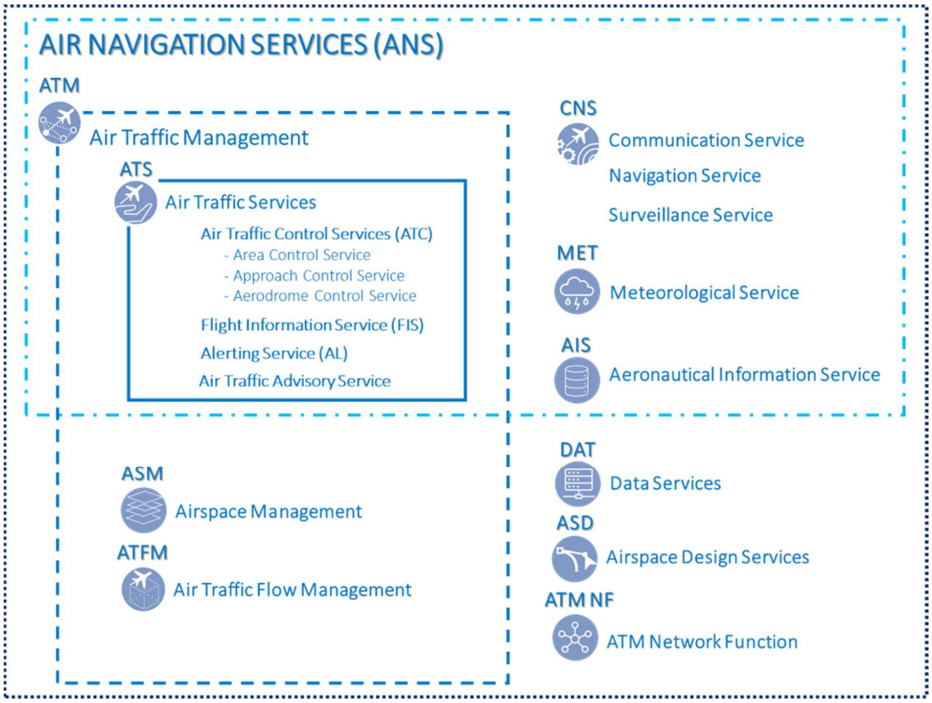

Figure 11111: EASA Classification of Air Navigation Services

This document defines the operational concept of the solution. The developed concept is validated by the following validation exercises which are performed during the V3 phase (exercise leads are depicted in brackets):

- EXE-PJ.10-W2-93-V3-VALP-001 – Delegation of ATM services provision among ATSUs (ENAIRE)
    - Real Time Simulation on the delegation of ATM services provision among ATSUs.
    - The objective was to validate the operational aspects of the delegation of ATM services provision in nominal conditions.
    - A Safety and Human Performance analysis was conducted as well as part of the activities.
    - Night delegation (scheduled), fixed time delegation (scheduled) and on-demand delegation (semi-dynamic) use cases have been validated using a Y-architecture

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- EXE-PJ.10-W2-93-V3-VALP-002 – Delegation of ATM services provision among ATSUs (Skyguide)
    - Real Time Simulation on the delegation of ATM services provision among ATSUs.
    - The objective was to validate the operational and technical aspects (including the validation of new services) of the delegation of ATM services provision in nominal and abnormal conditions.
    - A Safety and Human Performance analysis was conducted as well as part of the activities.
    - Night delegation (scheduled) and ATSU contingency (unpredicted) use cases have been validated using Y-, D- and U-architectures

- EXE-PJ.10-W2-93-V3-VALP-003 – Delegation of ATM services provision among ATSUs (ENAV)
    - Real Time Simulation on the delegation of ATM services provision among ATSUs.
    - The objective was to validate the operational and technical aspects of the delegation of ATM services provision in nominal and abnormal conditions.
    - A Safety and Human Performance analysis was conducted as well as part of the activities.
    - Night delegation (scheduled), fixed time delegation (scheduled), on-demand delegation (semi-dynamic), contingency (unpredicted) and civ/mil (semi-dynamic) use cases have been validated using a Y-architecture

- EXE-PJ.10-W2-93-V3-VALP-004 – Delegation of ATM services provision among ATSUs (COOPANS)
    - Real Time Simulation on the delegation of ATM services provision among ATSUs.
    - The objective was to validate the operational and technical aspects of the delegation of ATM services provision in nominal and abnormal conditions.
    - A Human Performance analysis was conducted as well as part of the activities.
    - On-demand delegation (semi-dynamic) and Contingency (unpredicted) use cases have been validated using a Y-architecture

- EXE-PJ.10-W2-93-V3-VALP-005 – Delegation of ATM services provision among ATSUs (PANSA)
    - Real Time Simulation on the delegation of ATM services provision among ATSUs.
    - The objective was to validate the operational aspects of the delegation of ATM services provision in nominal conditions.
    - A Human Performance analysis was conducted as well as part of the activities.
    - Night delegation (scheduled), on-demand delegation (semi-dynamic) and Contingency (unpredicted) use cases have been validated using a D-architecture

The Solution addresses the OI-step SDM-0217 ‘Delegation of ATM Services provision between ATSUs’.

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2.3 Intended readership

The intended audience for this document is the team members of PJ.10-W2-Solution 93, including other PJ.10-W2 Solutions, in particular:

- PJ.10-W2-Solution 73 IFAV
- PJ.09-W2-Solution 44 Dynamic Airspace Configuration
- PJ.32-W3 Virtual Centre
- PJ33-W3 FALCO - Flexible ATCO Endorsement and LDACS Complement

And following transverse and federating projects:

- PJ.19

2.4 Background

The Virtual Centre (VC) concept was originally explored in SESAR 1 B.04.04, which first demonstrated its feasibility from a technical point of view.

In SESAR 2020 Wave 1, PJ.16-03 solution was defined as an enabling solution to define and mature this technological concept. During the TRL2 gate, a lack of Operational definition was identified in the solution PJ.16-03, which was later covered by the solution PJ.15-09. Nevertheless, it was decided to continue PJ.16-03 as an enabling solution to reach TRL6 Gate at the end of Wave 1 and reduce the scope of PJ.15-09 to the definition of potential use cases for the delegation of airspace and contingency. PJ.10-W2-93 was then built as a follow-up to the SESAR 2020 Wave 1 projects PJ.15-09 "Delegation of airspace and contingency" and PJ.16-03 "Enabling rationalisation of infrastructure using virtual centre-based technology".

Solution PJ.10-W2-93 at V3 phase has further developed the concepts described in the V2 version of the OSED, has developed the following user expectations from different perspectives:

- A global and generic operational concept supporting the delegation of ATM service provision under different conditions (normal & contingency). The developed Use Cases are based on the work done under PJ15.09. The use cases are aligned with the V3 validation exercises and coordinated across PJ.10-W2-93 and PJ.32-W3.
- Development of new procedures involving new roles & actors for the delegation of ATM service provision between ATSUs. In particular, the role of the ATSEP has been incorporated into the procedures for delegation and contingency.
- Validation on a Real Time Simulation environment, of the developed operational concept, the related requirements and procedures while assessing their benefits, impacts and operational acceptance.
- Development of a various validation platforms, partly based on a Virtual Centre design and partly being based on legacy systems, separating ATSUs and ADSPs.
- Virtual Centre Services are based on the work performed in PJ.16-03 on Virtual Centre. These services are complemented by the operational needs identified by Solution PJ.10-W2-93 at V3.
- Develop a proper mapping between the operational objectives at V3 and the set of Technical Enablers (ENs), or required services on the Virtual centre validation platform, see more details under section 3.1.

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2.5 Structure of the document

Section 1 is the Executive Summary.

Section 2 introduces all terms that are used in the document and in the requirements.

Section 3 contains the core part of the operational concept and describes the environment, assumptions, etc. that are applicable to the SPR and INTEROP requirements.

Section 4 lists the SPR and INTEROP requirements, which are covering safety, performance, operational aspects as well as the interoperability aspects related to a specific technology to support this SESAR Solution.

Section 5 lists applicable and reference documents.

Appendix A Detailed tables of OI Steps and Enablers

Appendix B contains the Benefit and cost Mechanisms, showing how the SESAR Solution elements contribute (positively or negatively) to the delivery of performance benefits and the costs.

Appendix C describes the Handover Dialogue that was developed by EXE-PJ.10-W2-93-V2-VALP-001.

Appendix D describes the WEST checklist, a tool for a systematic handover of traffic between ATSUs.

Appendix EAppendix E~~Appendix E~~ presents operational recommendations for the Y-architecture provided by PJ.32-W3.

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2.6 Glossary of terms

Term	Definition	Source of the definition
ADSP	The ATM Data Service Provider is providing all the data necessary for an ATSU. An ADSP might be part of an ANSP, or it might be an independent entity which is certified for the service provision. An ADSP might provide all ATM data required by an ATSU or it may be specialised for a certain type of data, e.g., Voice services. An ADSP may provide data to several ATSUs. It is expected that ADSPs will be part of the functional system and thus are operated by certified ATSEPs in the future.	PJ.10-W2-93
Alliance Model	ANSPs could form alliances by creating a dedicated jointly-owned entity responsible for producing and providing the needed air traffic data for their airspace (e.g., COOPANS/iTEC like model);	Airspace Architecture Study [20]
Area of Interest	The airspace encompassing the AoR and a defined buffer zone within which airspace status and flight information are of operational interest to the system operators.	ATM Lexicon [1]
Area of Responsibility	An airspace of defined dimensions within which an ATC unit provides air traffic services.	ATM Lexicon [1]
Airspace Reservation (ARES)	Airspace Reservation is a defined volume of airspace temporarily reserved for exclusive or specific use by categories of users.	European Route Network Improvement Plan (ERNIP), Part 3 - The ASM Handbook
Airspace Restriction	Airspace Restriction is 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').	European Route Network Improvement Plan (ERNIP), Part 3 - The ASM Handbook

Air Traffic Management services	ATM services comprise the provision of services for Air Traffic Services, Airspace Management, and Air Traffic Flow Management.	PJ.10-W2-93
Collaborative Decision Making	A process focused on how to decide on a course of action articulated between two or more community members.	SESAR Concept of Operations Step 2 Edition 2014 (Ed. 01.01.00)
Consolidated Sector	Multiple elementary sectors that are combined to operate them as a single sector.	PJ.10-W2-93
D-architecture	The provision of Virtual Centre standardised services allows a CWP to subscribe to services of different ADSPs. In particular, an ATSU supported by a specific ADSP can delegate ATM services provision to another ATSU, served by another ADSP, by just allowing CWPs of this ATSU to subscribe to the other ADSP services, thus keeping the ATSU AoRs unchanged. This delegation configuration set-up is referenced as the "D" architecture. This architecture is deployed with the use of standard VC services in the first place, but it may be deployed with the use of proprietary interfaces common to the ADSPs, thus making the use of the standard VC services optional. The use of proprietary interfaces within a 'D' Architecture is then referred as "Legacy 'D' architecture" whenever there is the need to distinguish the two cases. 'D' architecture is well fitted for supporting ATSU contingency scenarios.	PJ.10-W2-93
Delegation Agreement	All the procedures regarding triggering, execution, cancelation, and termination of delegation including the procedures related to third parties constitute a binding Delegation Agreement. These Agreements are clear and acceptable for all the actors involved in the delegation. They shall also be legally binding to allow for smooth execution of the delegation but also provide a framework for resolution in case of dispute.	PJ.10-W2-93
Delegating ATSU	A delegating ATSU is an ATSU that delegates parts of its airspace or even its entire airspace to the receiving ATSU.	PJ.10-W2-93

Delegation Procedure	The operational procedure describes the actors, their activities, and their order of execution within the process of delegating the provision of ATM services amongst ATUs.	PJ.10-W2-93
Elementary sector	ATC workable 3D airspace that can be controlled by ATCO for ATS provision and that cannot be split further down into workable/controllable sector(s)	SESAR W1 PJ08 OSED
Fully-dynamic delegation	In a fully-dynamic delegation the point in time of the delegation as well as the potential partners are not known before-hand. This implies that necessary delegation agreements and system configurations can be set-up dynamically during runtime. A fully dynamic delegation is out-of-scope of this OSED and is mentioned here as a theoretical option for completeness.	
Group of sectors	A set of sectors that belong together organisationally and in terms of licensing.	PJ.10-W2-93
Key Performance Indicator	Current/past performance, expected future performance (estimated as part of forecasting and performance modelling), as well as actual progress in achieving performance objectives is quantitatively expressed by means of indicators (sometimes called Key Performance Indicators, or KPIs). To be relevant, indicators need to correctly express the intention of the associated performance objective. Since indicators support objectives, they should not be defined without having a specific performance objective in mind. Indicators are not often directly measured. They are calculated from supporting metrics according to clearly defined formulas, e.g., cost-per-flight-indicator = Sum(cost)/Sum(flights). Performance measurement is therefore done through the collection of data for the supporting metrics." 9.5.2013 EC Official Journal of Union definition: In the context EC Performance Implementing Regulation, Key Performance Indicator means specifically the performance indicators used for the purpose of performance target setting	ICAO Doc 9883
Network Management Function	An integrated ATM activity with the aim of ensuring optimised Network Operations and ATM	ATM Lexicon

	service provision meeting the Network performance targets.	
Preview Mode	The Preview Mode enables a receiving ATSU to preview the traffic of a sector for which it prepares to provide ATM services for.	PJ.10-W2-93
Rating	indicates the type of service which the licence holder is authorised to provide	Reg (EU) 2015-340
Receiving ATSU	A receiving ATSU is an ATSU that receives parts of the airspace or even the entire airspace from a delegating ATSU.	PJ.10-W2-93
Scheduled delegation	A delegation that is performed regularly according to an agreed schedule.	PJ.10-W2-93
Sector	Part of a control area and/or part of a flight information region or upper region	Reg (EU) 2015-340
Semi-dynamic delegation	Semi-dynamic delegation is characterised by a dynamic delegation decision, i.e., the point in time for a delegation is not predetermined, but can by triggered by certain conditions, such as traffic flows. The potential receiving ATSUs of a semi-dynamic delegation are all well-known before-hand and all necessary delegation contracts are in place.	PJ.10-W2-93
Service	The contractual provision of something (a non-physical object), by one, for the use of one or more others. 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	EATMA Guidance Material
U-architecture	A delegation of ATM services provision may be achieved by transferring an ATSU AoR, or a piece of AoR, to another ATSU. In this set-up, the receiving ATSU provides both the CWPs and an extension of its AoR in the system, while at the same time the AoR of the delegating ATSU is reduced accordingly. This principle is based on the capability of the systems to exchange the required information at the right time in order to provide the relevant information to the CWPs taking the delegation(s). This delegation configuration set-up is referenced as the “U” architecture.	PJ.10-W2-93

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	This architecture can be applied to any combination of Virtual Centres and/or non-Virtual Centres. Therefore, the use of the standard VC services may become relevant only when the optional VC enablers are used. 'U' architecture is well fitted for supporting ATSU contingency scenarios.	
Unpredicted delegation	A delegation triggered by an unpredictable event, usually a contingency or emergency case.	PJ.10-W2-93
Virtual Centre	A virtual centre is a single Air Traffic Service Unit (ATSU) or a grouping of collaborative ATSUs using data services provided by ATM Data Service Provider (ADSP). The concept provides, at least, geographical decoupling between ADSP(s) and ATSU(s), through service interfaces defined in Service Level Agreements. One ATSU may use data services from multiple ADSPs, just as an ADSP may serve multiple ATSUs.	PJ.16-03 solution
Y-architecture	The provision of Virtual Centre standardised services allows an ADSP to provide ATM data to several ATSUs with a common core system. Such a configuration allows straightforward delegation of ATM Services provision between those ATSUs, where CWPs from the receiving ATSU are able to receive the expected ATM data without affecting the respective ATSU AoRs. This one-ADSP-to-several-ATSUs configuration is referenced as a "Y" architecture. This architecture is deployed with the use of standard VC services in the first place, but it may be also deployed with the use of proprietary interfaces, thus making the use of the standard VC services optional. The use of proprietary interfaces within a 'Y' Architecture is then referred as "Legacy 'Y' architecture" whenever there is the need to distinguish the two cases. 'Y' architecture is also well fitted for supporting ATSU contingency scenarios.	PJ.10-W2-93

Table 11111: Glossary of terms

2.7 List of Acronyms

Acronym	Definition
A/C	Aircraft
AAS	Airspace Architecture Study
AC	Area Control
ACC	Area Control Centre
ADSP	ATM Data Service Provider
AIM	Aeronautical Information Management
AIP	Aeronautical Information Publication
AMAN	Arrival Management
ANS	Air Navigation Services
ANSP	Air Navigation Service Provider
APP	Approach
AoI	Area of Interest
AoR	Area of Responsibility
ARES	Airspace Reservation / Restriction
ASM	Airspace Management
ATC	Air Traffic Control
ATCO	Air Traffic Controller
ATFCM	Air Traffic Flow and Capacity Management
ATM	Air Traffic Management
ATS	Air Traffic Services
ATSEP	Air Traffic Safety Electronics Personnel
ATSU	Air Traffic Service Unit
AU	Airspace User
BIM	Benefit Impact Mechanism
CAA	Civil Aviation Authority

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CAF	Cyber Assessment Framework for Aviation
CAP	Cyber Security Oversight Process for Aviation
CAT	Clear Air Turbulence
CB	Cumulonimbus Cloud
CIV	Civil
CNS	Communication Navigation and Surveillance
CONOPS	Concept of Operations
CPDLC	Controller/Pilot Data Link Communications
CR	Change Request
CSF	Cyber Security Framework
CTR	Control
CWP	Controller Working Position
DAC	Dynamic Airspace Configuration
DCB	Demand Capacity Balancing
EASA	European Union Aviation Safety Agency
EAT	Expected Approach Time
EATMA	European ATM Architecture
E-ATMS	European Air Traffic Management System
EC	European Commission Executive Controller
ECAC	European Civil Aviation Conference
ER	En-Route
EU	European Union
EUROCAE	European Organization for Civil Aviation Equipment
FIR	Flight Information Region
FIS	Flight Information Service
FL	Flight level

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FMP	Flow Management Position
FO-IOP	Flight Object Interoperability
G/G	Ground/Ground
HLOR	High Level Concept of Operations Requirement
HMI	Human Machine Interface
HP	Human Performance
HPAR	Human Performance Assessment Report
HW	Hardware
ICAO	International Civil Aviation Organization
IFAV	Increased Flexibility in ATCO Validations
INTEROP	Interoperability Requirements
IRS	Interface Requirements Specification
ISM	Information Security Manual
ISO	International Organization for Standardization
KFOR	Kosovo Force
KPA	Key Performance Area
KPI	Key Performance Indicator
LoA	Letter of Agreement
LPR	Language Proficiency
MET	Meteorology
MIL	Military
MONA	Monitoring Aids
MSP	Multi Sector Planner
MTCD	Mid-term Conflict Detection
NAT	North Atlantic
NGCV	Non-geographical Controller Validations
NIST	National Institute of Standards and Technology

NM	Network Manager
NMF	Network Managing Function
NMOC	Network Manager Operations Centre
NOTAM	Notice to Airmen
NOV	NATO Operational View
NSA	National Supervisory Authority
OI	Operational Improvement
OLDI	On-Line Data Interchange
OJTI	On-the-Job Training Instructor
OPAR	Operational Performance Assessment Report
OSED	Operational Service and Environment Definition
PAR	Performance Assessment Report
PC	Planner Controller
PIRM	Programme Information Reference Model
POI	Preliminary Operational Improvement
Req	Requirement
RVSM	Reduced Vertical Separation Minima
Rx	Receive
QoS	Quality of Service
SAC	Safety Criteria
SAR	Safety Assessment Report Search and Rescue
SDM	Service Delivery Management
SecAR	Security Assessment Report
SES	Single European Sky
SESAR	Single European Sky ATM Research Programme
SIGMET	Significant Meteorological Phenomena

SMS	Safety Management System
S3JU	SESAR3 Joint Undertaking (Agency of the European Commission)
SMS	Safety Management System
SPO	Single Person Operations
SPR	Safety and Performance Requirements
SRD	Safety Requirements at Design
SRS	Safety Requirements at Service
SSR	Secondary Surveillance Radar
STCA	Short-term Conflict Alert
SW	Software
SWIM	System Wide Information Model
SYSCO	System Assisted Coordination
TA	Terminal Airspace
TC	Terminal Control
TCT	Tactical Controller Tools
TMA	Terminal Management Area
TRL	Technical Readiness Level
TS	Technical Specification
TWR	Tower
Tx	Transmit
Tx/Rx	Transmit/Receive
UC	Use Case
VALP	Validation Plan
VALR	Validation Report
VC	Virtual Centre
VCS	Voice Communication System
VFR	Visual Flight Rules

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WAN	Wide Area Network
WEST	Weather, Equipment, Situation, Traffic

Table 22222: List of acronyms

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3 Operational Service and Environment Definition

3.1 SESAR Solution PJ.10-W2-Solution 93: a summary

PJ.10-W2-Solution 93 (target maturity level is V3) is exploring operational concepts of the delegation of ATM services provision amongst ATSUs. Delegations can be done either in normal conditions to improve the efficiency of ATM or it can be done in abnormal, i.e., contingency, conditions to improve resilience and minimise the impact of a failure. The concept and procedures described in this document are not specific to any of the different technical architectures that are described in the TS/IRS [25] of this Solution.

The delegation of ATM services provision concept applies when one ATSU delegates a portion of its airspace, or the entire airspace, to another ATSU based on a particular condition. The Solution investigates Use Cases for the Delegation of ATM and Contingency in conjunction with the Virtual Centre Technology where the ATM Data Service Provider (ADSP) is geographically separated from the Virtual Centre ATSU providing ATS to a region of airspace.

Based on the new operational opportunities offered by the Virtual Centre concept, a preliminary set of Delegation and Contingency Uses Cases have been selected, with the aim to further investigate and develop dynamic airspace configuration and advanced ATFCM[1] capabilities. These will allow a completely new architecture to provide Air Traffic Services. These Use Cases will consider the operational procedures and resource management to support static and dynamic delegation of ATS and will be identified before defining the Operational Requirements for different ATSU and ADSP configurations.

This agility will lead to greater opportunities to provide Air Traffic Services, both from a technical and operational context, leading to flexible use of resources, which in turn leads to improved overall Performance.

This solution considers potential improvements in ATM by developing detailed Use Cases for the Delegation of ATM services provision between ATSUs in normal conditions and in the event of a Contingency. The delegation and contingency use cases are supported by all technical architectures described in the TS/IRS [25].

Additionally, in the context of Virtual Centre, the Virtual Centre ATSUs may use Data Services from multiple ATM Data Service Providers. This solution is broadly aligned with the standardization activities of EUROCAE in WG-122. The working group took the results of this Solution and their previous projects as an input. On the other hand, the output of WG-122 is taken into consideration by this Solution to complement the developed operational and technical concepts.

[1] ATFCM aspects of delegation of ATM services among ATSU will be researched in detail by PJ.32-W3

This solution is taking the input of the previous projects and works on maturing the operational concepts of the delegation of ATM services provision among ATSUs. This document develops generic operational procedures applicable to all operational use cases. The operational use cases identified by SESAR 2020 PJ.15-09 [22] at a very high level are detailed and investigated. Based on that conceptual foundation, architectures and services are developed as part of the technical thread of this solution and described in the TS/IRS [25]. Services are based on previous work done by the predecessor projects SESAR B.04.04 and SESAR2020 PJ.16-03 working on Virtual Centre architectures. Concepts and architectures are prototypically implemented and validated [27]. In the V3 phase of this solution, a close cooperation with PJ.32-W3 has been established to jointly validate operational use cases identified in PJ.10-W2-93 and to ensure consistency of this OSED with ATFCM-related delegation which is investigated by PJ.32-W3.

Solution definition from EATMA (Dataset 22):

'*The Delegation of Airspace concept applies when one ATSU delegates a portion of its airspace to another ATSU based on a particular condition. The Solution will investigate some Use Cases for the Delegation of ATS and Contingency in conjunction with the Virtual Centre Technology where the ATM Data Service Provider (ADSP) is geographically separated from the Virtual Centre ATSU providing ATS to a region of airspace. Based on the new operational opportunities offered by the Virtual Centre concept, a preliminary set of Delegation and Contingency Uses Cases have been selected, with the aim to further investigate and develop dynamic airspace configuration and advanced ATFCM capabilities. These will allow a completely new architecture and totally new way to provide Air Traffic Services. These Use Cases will consider the operational procedures and resource management to support static and dynamic delegation of ATS.*

Additionally, in the context of Virtual Centre, the Virtual Centre ATSUs may use Data Services from multiple ATM Data Service Providers. This agility will lead to greater opportunities to provide Air Traffic Services, both from a technical and operational context, leading to flexible use of resources, which in turn leads to improved overall Performance.'

PJ.10-W2-WP3 represents an operational Solution which addresses OI step SDM-0217. This OI step is supported by different sets of Enablers which are associated with different technical architectures (Y, D and U) which are based on the taxonomy defined by EUROCAE WG-122 [36]. These technical architectures target different maturity levels.

This document describes the three architectures only on a high level of detail. More detail is provided in the TS/IRS [25]. Three technical Solutions have been defined to explore these different architectures. Each technical Solution is supported by their own POIs linked to individual sets of Enablers:

- PJ.10-W2-93A: Y-architecture supporting delegation of ATM services provision amongst ATSUs (POI-0075)
- PJ.10-W2-93B: D-architecture supporting delegation of ATM services provision amongst ATSUs (POI-0076)
- PJ.10-W2-93C: U-architecture supporting delegation of ATM services provision amongst ATSUs (POI-0077)

The following paragraphs provide a high-level overview of the technical architectures.

"Y": Centralised option (target maturity level TRL6)

In this option, multiple ATSUs are connected to the same ADSP. ATSUs may or may not belong to the same ANSP.

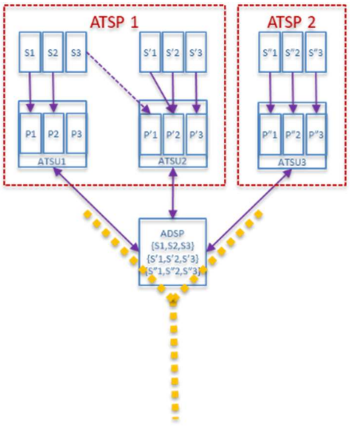

Figure 22222: Y-architecture

The three ATSUs depicted in Figure 2222Figure 22Figure 2 are connected to the same ADSP and behave as if they were part of one system

The "Y" option allows complete flexibility among all connected ATSUs but is not easily re-configured to manage new ATSUs.

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"D": ATSU-ADSP re-allocation model (target maturity level TRL4)

In this option, positions in one ATSU can connect to a different ADSP managing the sectors they need to control:

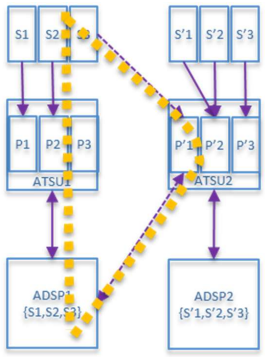

Figure 33333: D-architecture

The two ATSUs shown above in Figure 3333Figure 33~~Figure 3~~ may or may not belong to the same ANSP.

"U": the ADSP variable scope model or "U" model (target maturity level TRL4)

In this model airspace delegation is managed thanks to the ability of the ADSP to manage additional sectors not initially belonging to its AoR.

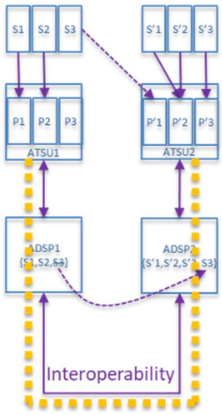

Figure 44444: U-architecture

The two ATSUs shown above in Figure 4444Figure 44~~Figure 4~~ may or may not belong to the same ANSP.

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The following Table 3333Table 33~~Table 3~~ depicts the OI step SDM-0217 which is linked to the operational Solution PJ.10-W2-WP3 which is supported by three technical Solutions PJ.10-W2-93A-C which have their own POIs and linked Enablers. The tables that present the POIs and Enablers of the technical Solutions are presented in Appendix A.

SESAR Solution ID	SESAR Solution Title	OI Steps ID	OI Steps Title	Enabler ID	Enabler Title	OI Step/Enabler Coverage
PJ.10-W2-93	Delegation of ATM services provision between ATSUs	SDM-0217	Delegation of ATM Services between ATSUs			Fully
PJ.10-W2-93	Delegation of ATM services provision between ATSUs			REG-0546	Regulatory provisions for delegation of ATM services provision among ATSUs	n/a[2]
PJ.10-W2-93	Delegation of ATM services provision between ATSUs			CR 07428 (PRO-267)	Procedure for Delegation of ATM Services provision between ATSUs	Fully

[2] The Solution didn't work on the area of regulation. This Enabler is created to indicate that for a deployment of the concept regulatory efforts are necessary. Thus, it is declared as n/a here.

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PJ.10-W2-93	Delegation of ATM services provision between ATSUs			CR 07429 (HUM-067)	Updated role/responsibilities for ATCOs in context of the delegation of ATS between ATSUs	Fully
PJ.10-W2-93	Delegation of ATM services provision between ATSUs			CR 07430 (HUM-068)	Updated role/responsibilities for ACC/Approach/TMA Supervisor in context of the delegation of ATS between ATSUs	Partial
PJ.10-W2-93	Delegation of ATM services provision between ATSUs			CR 07431 (HUM-069)	Updated role/responsibilities for ATSEPs in context of the delegation of ATS between ATSUs	Partial
PJ.10-W2-93	Delegation of ATM services provision between ATSUs			CR 07432 (HUM-070)	Updated role/responsibilities for Technical Supervisor in context of the delegation of ATS between ATSUs	Partial

Table 33333: SESAR Solution PJ.10-W2-WP3 Scope and related OI step

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Table 4 summarizes the High-Level Operational Requirements [18] applicable to the SESAR Solution in the Concept of Operations.

High Level Concept of Operations Requirement ID	High Level Concept of Operations Requirement	Reference to relevant Concept of Operations Sections e.g. Operational Scenario applicable to the SESAR Solution
S93-HLOR-01	**S93-HLOR-01** Delegation of ATM services between ATSUs shall improve the following KPIs: • ATM resilience • Cost efficiency • Capacity • Safety Through: • The transfer of air traffic services responsibility for an airspace volume between ATSUs when this brings resources optimisation and improved load balancing. It can be performed on a fix-time transfer scheduling (day/night), dynamic or semi-dynamic according to the traffic conditions; • Allowing business continuity to be ensured over an airspace when an ATSU experiences an event such as total system failure or an environmental catastrophe; While: • Maintaining a seamless ATM Services provision in the delegated airspace as well as the air navigation quality and safety. Enabled by: Appropriate systems, services and procedures, supporting seamless ATC operations and the airspace delegation. Services include – flight data processing, surveillance, correlation management, voice, coordination and transfer and configuration management.	Not covered in CONOPS

Table 44444: Link to Concept of Operations

PJ.10-W2-Solution 93 is expected to contribute benefits in to following Key Performance Areas and corresponding Key Performance Indicators (see Appendix B for details):

- Fuel efficiency (FEEF1)
- TMA capacity (CAP1)
- En-route capacity (CAP2)
- Predictability (PRD1)
- ATCO productivity (CEF2)
- Technology cost (CEF3)

3.1.1 Deviations with respect to the SESAR Solution(s) definition

There are no deviations with respect to the SESAR Solution definition.

3.2 Detailed Operational Environment

This section provides a detailed overview of the operational environment which is applicable for this Solution.

This solution investigates the delegation of ATM services among different ATSUs. The assumption is taken, that ATM services are delegated for certain sectors. The compatibility with Flight-centric ATC has not been studied.

3.2.1 Operational Characteristics

Note: The ability to delegate ATM services among ATSUs highly depends on the actual traffic complexity at the time of the delegation. Realistically, for safety reasons, a delegation can only be performed in low to medium traffic conditions. Thus, in airspaces of very high complexity, a delegation can only be done in low traffic situations.

The operating environments described in Table 5555Table 55~~Table 5~~ and Table 6666Table 66~~Table 6~~ are valid for all three technical architectures (Y, D, U) described in the TS/IRS [25].

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Operational interactions per context (NOV-2)	Operating Environment
[NOV-2] Sector Delegation Management	En-Route; ER-High Complexity; ER-Low Complexity; ER-Medium Complexity; ER-Very High Complexity; TA-High Complexity; TA-Low Complexity; TA-Medium Complexity; TA-Very High Complexity; Terminal Airspace;
Comment	

Table 55555: Operating environments of Sector Delegation Management

Operational interactions per context (NOV-2)	Operating Environment
[NOV-2] Contingency Delegation Management	En-Route; ER-High Complexity; ER-Low Complexity; ER-Medium Complexity; ER-Very High Complexity; TA-High Complexity; TA-Low Complexity; TA-Medium Complexity; TA-Very High Complexity; Terminal Airspace;
Comment	

Table 66666: Operating environments of the Contingency Delegation Management

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3.2.2 Roles and Responsibilities

The following Table 7777Table 77~~Table 7~~ depicts the nodes and their responsibilities as modelled in EATMA.

Node	Responsibilities
Data Service Provision	The Data Service Provision node is responsible for delivering remotely the data required by a Virtual Centre and through the dedicated set of virtual centre services.
En-Route/Approach ATS	Performs all the En-Route and approach ATS operations. [RELATED ACTORS/ROLES] Executive controller, planning controller, etc.
Flight Deck	Performs all the on-board AU operations including flight execution/monitoring according to agreed trajectory, compliance with ATC clearances/instructions, etc. [RELATED ACTORS/ROLES] Flight Crew
Network Operations	The objectives of the ATM Network Management Function (NMF) are to enable the optimum use of airspace and ensure that Airspace Users can operate preferred trajectories while allowing maximum access to airspaces and air navigation services. The NMF integrates and manages all the tasks related to the ATM Network, i.e., the dynamic, integrated management of air traffic and airspace including Air Traffic Services (ATS), Airspace Management (ASM) and Air Traffic Flow and Capacity Management (ATFCM) - safely, economically, and efficiently - through the provision of facilities and seamless services in collaboration with all parties and involving airborne and ground-based functions. For all ATM phases, the NMF is based on Collaborative Decision-Making processes; the actors involved are different ones depending on the phases and the activities carried out, but collaborative actions and processes will always drive the result. The Network Management Function is truly performed at all geographical levels (regional, sub-regional, local) with a level of involvement and responsibilities depending on the activities and on the ATM phases. The following roles described in this chapter participate to this function.

Table 77777: Nodes and their responsibilities as modelled in EATMA

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Table 8888Table 88~~Table 8~~ depicts the nodes involved in the Sector Delegation Management with D-architecture.

Operational interactions per context (NOV-2)		Operating Environment
[NOV-2] Architecture D - Sector Delegation Management		En-Route; ER-High Complexity; ER-Low Complexity; ER-Medium Complexity; ER-Very High Complexity; TA-High Complexity; TA-Low Complexity; TA-Medium Complexity; TA-Very High Complexity; Terminal Airspace;
Node	Node instance	Node instance description
Data Service Provision	ADSP Delegating ATSU	ADSP supporting the Delegating ATSU, and able to provide delegation facilities for a delegation with a Receiving ATSU supported by another ADSP.
Data Service Provision	ADSP Receiving ATSU	ADSP supporting the Receiving ATSU, and able to provide delegation facilities for a delegation issued by a Delegating ATSU supported by another ADSP.
En-Route/Approach ATS	Delegating ATSU	ATSU requiring a delegation of a portion of its AoR.
En-Route/Approach ATS	Receiving ATSU	ATSU required for taking a delegation of a portion of the AoR of another ATSU.

Table 88888: Nodes involved in the Sector Delegation Management with D-architecture as modelled in EATMA

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Table 9999Table 99~~Table 9~~ depicts the nodes involved in the Sector Delegation Management with U-architecture.

Operational interactions per context (NOV-2)		Operating Environment
[NOV-2] Architecture U - Sector Delegation Management		En-Route; ER-High Complexity; ER-Low Complexity; ER-Medium Complexity; ER-Very High Complexity; TA-High Complexity; TA-Low Complexity; TA-Medium Complexity; TA-Very High Complexity; Terminal Airspace;
Node	Node instance	Node instance description
Data Service Provision	ADSP Delegating ATSU	ADSP supporting the Delegating ATSU, and able to provide delegation facilities for a delegation with a Receiving ATSU supported by another ADSP.
Data Service Provision	ADSP Receiving ATSU	ADSP supporting the Receiving ATSU, and able to provide delegation facilities for a delegation issued by a Delegating ATSU supported by another ADSP.
En-Route/Approach ATS	Delegating ATSU	ATSU requiring a delegation of a portion of its AoR.
En-Route/Approach ATS	Receiving ATSU	ATSU required for taking a delegation of a portion of the AoR of another ATSU.

Table 99999: Nodes involved in the Sector Delegation Management with U-architecture as modelled in EATMA

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Table 10101010Table 1010~~Table 10~~ depicts the nodes involved in the Sector Delegation Management with Y-architecture.

Operational interactions per context (NOV-2)		Operating Environment
[NOV-2] Architecture Y - Sector Delegation Management		En-Route; ER-High Complexity; ER-Low Complexity; ER-Medium Complexity; ER-Very High Complexity; TA-High Complexity; TA-Low Complexity; TA-Medium Complexity; TA-Very High Complexity; Terminal Airspace;
Node	Node instance	Node instance description
Data Service Provision	ADSP	ADSP common to both Delegating and Receiving ATSUs and able to provide delegation facilities between the 2 ATSUs.
En-Route/Approach ATS	Delegating ATSU	ATSU requiring a delegation of a portion of its AoR.
En-Route/Approach ATS	Receiving ATSU	ATSU required for taking a delegation of a portion of the AoR of another ATSU.

Table 1010101010: Nodes involved in the Sector Delegation Management with Y-architecture as modelled in EATMA

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Table 11111111Table 1111~~Table 11~~ depicts the Nodes involved in the Contingency Delegation Management.

Operational interactions per context (NOV-2)		Operating Environment
[NOV-2] Architecture Y - Contingency Procedure		En-Route; ER-High Complexity; ER-Low Complexity; ER-Medium Complexity; ER-Very High Complexity; TA-High Complexity; TA-Low Complexity; TA-Medium Complexity; TA-Very High Complexity; Terminal Airspace;
Node	Node instance	Node instance description
En-Route/Approach ATS	Adjacent ATSU	Node that is not able to provide delegation support to a failing neighbouring ATSU, but only handover some traffic.
Data Service Provision	ADSP	ADSP common to both Aiding and Failing ATSUs and able to provide delegation facilities between the 2 ATSUs.
En-Route/Approach ATS	Aiding ATSU	Node that is able to provide delegation support to a failing neighbouring ATSU.
Flight Deck	Aircraft	Aircraft under control of a failing ATSU.
En-Route/Approach ATS	Failing ATSU	Node that is failing and requesting support from neighbouring ATSUs.
Network Operations	Network Manager	Standard and nominal NM Node.

Table 1111111~~11~~: Nodes involved in the Contingency Delegation Management as modelled in EATMA

The procedures described in this OSED need to be broken down into more detail. In EATMA these additional roles are identified as additional swim lanes in the NOV-5 diagrams which are depicted as dashed rectangles. The remainder of this section describes the roles, tasks and responsibilities which are involved in the Delegation of ATM provision and Contingency procedures in more detail. Only the responsibilities with respect to the two procedures presented in sections 3.3.2.6 and 3.3.2.7 are described here. It is not a complete description of the respective roles in general.

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The granularity of the Nodes as described above is too coarse to describe the roles and responsibilities in detail that are required for the delegation of ATM services and Contingency. Therefore, a set of more detailed roles is described in the following sections. Figure 5555Figure 55~~Figure 5~~ depicts the operational (dark blue) and technical roles (light blue) that participate in the process of delegating ATM services among ATSUs. The arrows indicate a high-level view of the interactions between the roles.

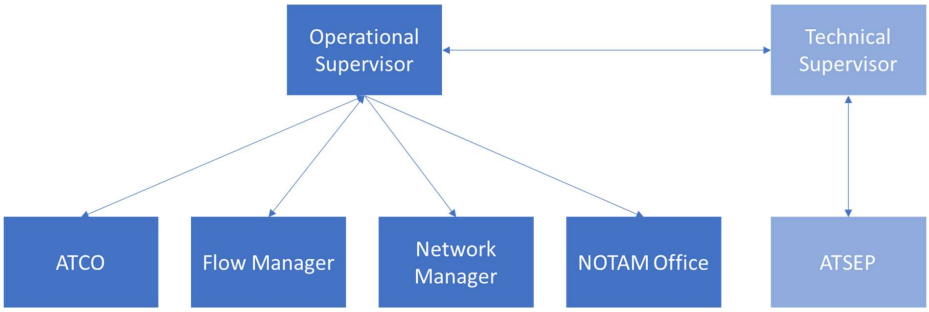

Figure 5555~~5~~: Overview of the detailed operational and technical roles and their interactions

The responsibilities identified in the following sections focus on the contexts of delegation of ATM services and Contingency. That means that the responsibilities described below do not represent an exhaustive list of general responsibilities of the roles.

3.2.2.1 Detailed operational Roles

This section describes the operational roles and their responsibilities in more detail.

3.2.2.1.1 Operational Supervisors

The operational Supervisors of the delegating and receiving ATSUs are responsible for coordinating the delegation process and ensuring that it is safe and in accordance with procedures set out in the delegation agreement (see section 3.3.2.2 for details). The operational Supervisor of an ATSU is the person who is responsible for the operations of an ATSU. They coordinate with their technical Supervisors who are coordinating the ATSEPs of the ATSU who are in charge of the functioning of all technical systems of an ATSU.

In the event of an emergency that results in the inability of an ATSU to continue to provide air traffic services to a region of airspace, it is mandatory that a specialist team of operational and technical experts and senior staff will be created to manage the event using a contingency plan. This team will have developed a set of procedures to handle different emergencies and can advise the operational and technical staff how to proceed. However, in the context of this document the roles and responsibilities described below are confined to the staff directly affected in the ATSU control rooms.

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3.2.2.1.1.1 Operational Supervisor of the delegating/failing ATSU

In the context of the delegation procedure the operational Supervisor of the delegating ATSU is responsible for the following task:

- Coordinate with technical Supervisor of the delegating ATSU.
- Coordinate with the operational Supervisor of the receiving ATSU about the delegation.
- Reconfigure the delegating ATSU's operational sector configuration post delegation.
- Assess whether it is safe to close the position(s) that controlled the delegated sector(s) after the delegation process has been completed.

In the context of the Contingency procedure, the operational Supervisor of the failing ATSU is responsible for the following tasks:

- In conjunction with other senior responsible staff, assess whether the emergency requires the initiation of contingency procedures.
- Coordinate with operational staff to manage the emergency, initiating pre-planned procedures (if they exist) for the specific type of emergency.
- Inform other affected parties (Flow Management Position, NM, adjacent ATSUs, Military, …) about the contingency procedures.
- Coordinate with one or more ATSUs to check whether they can provide air traffic services in the affected airspace.
- If contingency can be provided, supervise the delegation of ATM services provision to the aiding ATSU(s), managing the operational staff and technical resources as required.
- Coordinate with the technical Supervisor of failing ATSU about the status of the technical systems and availability of technical resources

3.2.2.1.1.2 Operational Supervisor of the receiving/aiding ATSU

In the context of the delegation procedure the operational Supervisor of the receiving ATSU is responsible for the following task:

- Coordinate with the operational Supervisor of the delegating ATSU about the delegation.
- Coordinate with and manage the human and technical resources required to support the delegation.
- Assess whether the delegation can proceed safely.
- Formally accept responsibility for the airspace after the delegation process has completed.
- Coordinate with technical Supervisor of the receiving ATSU

In the context of the Contingency procedure, the operational Supervisor of the aiding ATSU is responsible for the following tasks:

- Assess whether their ATSU can provide contingency facilities and, if so, coordinate with the supervisor in the failing ATSU about the contingency procedures to be instigated.
- Coordinate with and manage the human and technical resources required to support the contingency procedures.
- Supervise the contingency procedures as they take effect, ensuring that safety is maintained.
- Coordinate with the technical Supervisor of aiding ATSU about the status of the technical systems.

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3.2.2.1.2 Air Traffic Controllers

The Air Traffic Controllers of the delegating and the receiving ATSU are responsible for managing the traffic within their sector. The default is that a sector is managed by a pair of controllers consisting of Executive and Planner controller. Besides that, different configurations might be possible as well. In Single Person Operations (SPO) a sector is managed by a single controller, i.e., a single controller is responsible to carry out the activities of Executive and Planner controller simultaneously. In case of a Multi Sector Planner (MSP), a Planner controller is responsible for managing Planner tasks for multiple sectors. This does not change the activities described below.

3.2.2.1.2.1 Executive Air Traffic Controller of the delegating ATSU

In the context of the delegation procedure the ATCO of the delegating ATSU is responsible for the following tasks:

- Coordinate with the corresponding controller in the receiving ATSU that will take responsibility for the sector(s) to be delegated.
- Brief the corresponding controller in the receiving ATSU on the current and near-term traffic situation in the sector(s) to be delegated.

In the context of the Contingency procedure controllers in the failing ATSU are responsible for the following tasks:

- If communication with flight crews is possible after failure, inform flight crews under their control about the emergency and the procedures that will be invoked to mitigate the situation, including Clear-the-Sky or contingency measures.[3]
- If aiding ATSUs can provide contingency, handover responsibility for the airspace under control to the relevant aiding ATSU following agreed procedures.
- Coordinate with the operational Supervisor of the failing ATSU about progress of the contingency measures.

[3] If communication with flight crew is not possible, the ATCO will repeatedly try to establish contact. If contact is lost, the flight crew will fly according to their published flight plan.

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3.2.2.1.2.2 Planner Air Traffic Controller of the delegating ATSU

In the context of the delegation procedure the ATCO of the delegating ATSU is responsible for the following tasks:

- Coordinate with the corresponding controller in the receiving ATSU that will take responsibility for the sector(s) to be delegated.
- Brief the corresponding controller in the receiving ATSU on the current and near-term traffic situation in the sector(s) to be delegated.

In the context of the Contingency procedure controllers in the failing ATSU are responsible for the following tasks:

- If communication with flight crews is possible after failure, inform flight crews under their control about the emergency and the procedures that will be invoked to mitigate the situation, including Clear-the-Sky or contingency measures.[4]
- If aiding ATSUs can provide contingency, handover responsibility for the airspace under control to the relevant aiding ATSU following agreed procedures.
- Coordinate with the operational Supervisor of the failing ATSU about progress of the contingency measures.

3.2.2.1.2.3 Executive Air Traffic Controller of the receiving ATSU

In the context of the delegation procedure the ATCO of the delegating ATSU is responsible for the following tasks:

- Set up their working position so that it is ready to manage the sector(s) to be delegated.
- Coordinate with the corresponding controller in the delegating ATSU that has responsibility for the sector(s) to be delegated.
- Assimilate the traffic situation as briefed by the delegating controller.
- Accept responsibility for the sector(s) to be delegated at the end of the delegation process.

In the context of the Contingency procedure the controllers of the aiding ATSU are responsible for the following tasks:

- Prepare their CWP and VCS to support the contingency procedures.
- Coordinate with their operational Supervisor on the contingency procedures to be put into effect.
- Coordinate with their counterparts in the failing ATSU to take over the sector(s) they will be responsible for.

[4] If communication with flight crew is not possible, the ATCO will repeatedly try to establish contact. If contact is lost, the flight crew will fly according to their published flight plan.

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3.2.2.1.2.4 Planner Air Traffic Controller of the receiving ATSU

In the context of the delegation procedure the ATCO of the delegating ATSU is responsible for the following tasks:

- Set up their working position so that it is ready to manage the sector(s) to be delegated.
- Coordinate with the corresponding controller in the delegating ATSU that has responsibility for the sector(s) to be delegated.
- Assimilate the traffic situation as briefed by the delegating controller.
- Accept responsibility for the sector(s) to be delegated at the end of the delegation process.

In the context of the Contingency procedure the controllers of the aiding ATSU are responsible for the following tasks:

- Prepare their CWP and VCS to support the contingency procedures.
- Coordinate with their operational Supervisor on the contingency procedures to be put into effect.
- Coordinate with their counterparts in the failing ATSU to take over the sector(s) they will be responsible for.

3.2.2.1.3 Flow Management Position of the delegating / failing ATSU

In the context of the delegation procedure, the Flow Management Position (FMP) of the delegating ATSU is responsible for the following task:

- Coordinate with the operational Supervisor about the point in time for the delegation.

In the context of the Contingency procedure, the Flow Management Position of the failing ATSU is responsible for the following task:

- Coordinate with the Network Manager about the delegation or the closure of the affected airspace.

This section covers only the responsibilities of the Flow Management Position during the delegation procedure in normal conditions and in contingency situations. PJ.32-W3 VC describes the role of the Flow Management Position in more details in the phases preceding the delegation procedure. Details for this are provided in [33].

3.2.2.1.4 NOTAM Office of the failing ATSU

In the context of the Contingency procedure, the NOTAM Office of the failing ATSU is responsible for the following task:

- Publish NOTAM to declare airspace of the failing ATSU a no-fly-zone.

3.2.2.1.5 Network Manager

In the context of the Contingency procedure, the Network Manager is responsible for the following task:

- Regulate traffic according to the closure of the sector(s) of the failing ATSU.

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3.2.2.2 Detailed technical Roles

3.2.2.2.1 Technical Supervisors

The technical Supervisors are responsible for coordinating all technical task within the various nodes (ATSUs and ADSPs). They are the point of contact of the operational Supervisor of their organisation as well as the point of contact for technical Supervisors of other ATSUs or ADSPs. They coordinate with their local ATSEP and often are also licensed as ATSEPs themselves.

3.2.2.2.1.1 Technical Supervisor of the delegating/failing ATSU

In the context of the delegation procedure the technical Supervisor of the delegating ATSU is responsible for the following task:

- Coordinate the technical aspects of the delegation procedure in the delegating ATSU with the ATSEPs of the delegating ATSU.
- Coordinate with the operational Supervisor of the delegating ATSU about the technical status of the systems.
- Coordinate with the technical Supervisor of the ADSPs.

In the context of the Contingency procedure, the technical Supervisor of the aiding ATSU is responsible for the following tasks:

- Coordinate with the ATSEPs of failing ATSU about the technical status of the systems.
- Coordinate with the technical Supervisor of the ADSP and/or the aiding ATSU about the status of its technical systems to manage the data flow requirements and the allocation of the necessary enablers such as radio frequencies.
- Coordinate with the operational Supervisor of the aiding ATSU and operational staff on how to manage the emergency, initiating pre-planned procedures (if they exist) for the specific type of emergency.

3.2.2.2.1.2 Technical Supervisor of the receiving/aiding ATSU

In the context of the delegation procedure the technical Supervisor of the receiving ATSU is responsible for the following task:

- Coordinate the technical aspects of the delegation procedure in the receiving ATSU with the ATSEPs of the receiving ATSU.
- Coordinate with the operational Supervisor of the receiving ATSU about the technical status of the systems.
- Coordinate with the technical Supervisor of the ADSPs.

In the context of the Contingency procedure, the technical Supervisor of the aiding ATSU is responsible for the following tasks:

- Coordinate with the ATSEPs of aiding ATSU about the technical status of the systems.
- Coordinate with the technical Supervisor of ADSP and/or the failing ATSU about the status of its technical systems to manage the data flow requirements and the allocation of the necessary enablers such radio frequencies.
- Coordinate with the operational Supervisor and operational staff on how to provide pre-planned contingency services (if they exist) for the specific type of emergency.

3.2.2.2.1.3 Technical Supervisor of the ADSP

In the context of the delegation procedure the technical Supervisor of the ADSP is responsible for the following task:

- Coordinate with technical Supervisors at delegating and receiving ATSU.
- Coordinate the ATSEPs of the ADSP.
- Coordinate with technical Supervisors of other ADSPs in case several ADSPs are involved.

In the context of the Contingency procedure, the technical Supervisor of the ADSP is responsible for the following tasks:

- Coordinate with technical Supervisors at failing and aiding ATSU.
- Coordinate the ATSEPs of the ADSP.
- Coordinate with technical Supervisors of other ADSPs in case several ADSPs are involved.

3.2.2.2.2 ATSEP

The ATSEPs at the ATSUs and the ADSPs are licensed technical staff that is authorised to maintain the technical infrastructure. They are coordinating with their local technical Supervisor.

3.2.2.2.2.1 ATSEP of the delegating/failing ATSU

In the context of the delegation procedure the ATSEP of the delegating ATSU is responsible for the following tasks:

- Manage the technical aspects of the delegation procedure in the delegating ATSU on behalf of their technical Supervisor.
- Ensure that all required services and data have successfully been transferred and all interfaces are in full operation (including no cybersecurity risk exists) all systems ‘Go’.
- Continuously and at all phases monitor the status of the ANS services and ATM data in their area of responsibility before, during and after the process of delegation.

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In the context of the contingency procedure the ATSEP of the failing ATSU is responsible for the following tasks:

- Manage the technical aspects of the delegation procedure at the failing ATSU on behalf of their operational Supervisor.
- Coordinate with the technical Supervisor to manage the emergency, initiating pre-planned procedures (if they exist) for the specific type of emergency.
- Coordinate with the technical Supervisor of the ATSU or ADSP to manage the data flow requirements and the allocation of the necessary enablers such as radio frequencies.
- Ensures that the availability, accuracy, and integrity of the data layer is ensured during all phases of the delegation.

3.2.2.2.2.2 ATSEP of the receiving/aiding ATSU

In the context of the delegation procedure the ATSEP of the receiving ATSU is responsible for the following tasks:

- Manage the technical aspects of the delegation procedure in the receiving ATSU on behalf of their technical Supervisor.
- Ensure that all required services and data have successfully been transferred and all interfaces are in full operation (including no cybersecurity risk exists) all systems 'Go'.
- Continuously and at all phases monitor the status of the ANS services and ATM data in their area of responsibility before, during and after the process of delegation.

In the context of the contingency procedure the ATSEP of the aiding ATSU is responsible for the following tasks:

- Manage the technical aspects of the delegation procedure at the aiding ATSU on behalf of their operational Supervisor.
- Coordinate with operational staff to manage the emergency, initiating pre-planned procedures (if they exist) for the specific type of emergency.
- Coordinate with the technical Supervisor of the ATSU or ADSP to manage the data flow requirements and the allocation of the necessary enablers such as radio frequencies.
- Ensures that the availability, accuracy, and integrity of the data layer is ensured during all phases of the delegation.

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3.2.2.2.2.3 ATSEP of the ADSP

In the context of the delegation procedure the ATSEP of the receiving ATSU is responsible for the following tasks:

- Coordinate with the technical Supervisor of the ADSP.
- Manage the technical aspects of the delegation procedure in the ADSP.
- Ensure that all required services and data are provided to the ATSUs, and all interfaces and systems are in full operation (including no cybersecurity risk exists).
- Continuously and at all phases monitor the status of the ANS services receiving data from and the ATM data in their area of responsibility before during all phases.
- Take the necessary actions to ensure compliance to the technical and operational parameters of operation.
- Ensure data quality, accuracy, availability, and integrity of the data sensors such as surveillance

In the context of the contingency procedure the ATSEP of the receiving ATSU is responsible for the following tasks:

- Manage the technical aspects of the contingency procedure in the ADSP towards the ATSUs.
- Ensure that all required services and data are provided to the ATSUs, and all interfaces and systems are in full operation (including no cybersecurity risk exists).
- Continuously monitor the status of the ANS services receiving data from and the ATM data in their area of responsibility before and during all phases of the contingency procedure.
- Take the necessary actions to ensure compliance to the technical and operational parameters of operation.
- Ensure data quality, accuracy, availability, and integrity of the data sensors such as surveillance

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3.2.3 CNS/ATS description:

Delegating the provision of ATM services between ATSUs requires a shared infrastructure to enable the delegation. After the provision of ATM services provision for a certain airspace between two ATSUs, the receiving ATSU have all the necessary data available that is needed to manage the aircraft in the airspace. This comprises the following data which are regarded as enablers for the delegation of ATM services among ATSUs:

- **Radar data**
  The ATCOs need to have all the flights in the airspace being visualised on their CWPs, i.e., the ADSP serving the ATSU and their CWPs needs to deliver the radar data for the airspace for which ATM service provision was delegated between ATSUs. Depending on national requirements, military track data might be treated differently. It might be filtered out or reduced with respect to the level of detail.

- **Flight plans**
  All flight plans of the aircraft inside the airspace for the ATM service provision was delegated between two ATSUs, need to be available to the ATCOs of the receiving ATSU. The ADSP serving the receiving ATSU needs to have all flight plans for the delegated airspace available and process inputs made by the ATCOs

- **Voice communication**
  The ATCOs of the receiving ATSU must be able to communicate with the aircraft in the delegated airspace by radio communication on the frequency published in the AIM.

- **Datalink**
  If the delegated airspace is supported by data link, then the ATCOs of the receiving ATSU should be able to communicate by datalink to the aircraft.

- **NM**
  The delegation of ATM services among ATSUs require the Network Manager to have an up-to-date picture of the open sectors and the responsibilities for these sectors. Therefore, interfaces to the Network Manager are required.

- **MET**
  In order to safely manage a delegated sector, the receiving ATSU requires the meteorological data for this airspace.

All data described above must be available to the receiving ATSU to be able to serve the airspace for which the provision of ATM services is delegated.

Considering a case where ATM services provision is delegated between different ATSUs of a single ANSP. In this case it can be expected that a common ADSP is shared between all ATSU (thus it is likely that there is no need to synchronise different ADSPs). In addition, usually all ATSUs of the ANSP share a common infrastructure in terms of wide area network and radio infrastructure. Therefore, it should in principle be possible to have access to necessary sector frequencies and datalink stations at the receiving ATSU. However, all these different configurations must be mapped in the necessary configuration files by ATSEPs. Training exercises involving operational and technical staff must take place regularly. In the case of a frequency change this must be configured in the technical systems so

that any transfer can be done automatically. Alternate or fallback frequencies in relation to sectorisation activities must also be configured.

In a deployment scenario involving 2 ANSPs served by different ADSPs, the data provision to the receiving ATSU must be coordinated. Technical details are provided by the Technical Specifications of this Solution [25] and PJ.32-W3 [34].

3.2.4 Applicable standards and regulations

This section provides an overview of standards and regulations that affect the delegation of ATM services provision.

3.2.4.1 State sovereignty

The Convention on International Civil Aviation (Chicago, 1944) recognizes in Articles 1 and 2 that every State has complete and exclusive sovereignty over the airspace above its territory, i.e., the airspace above its land areas and adjacent territorial waters. It will be called national airspace in this document. A state via a state ANS representative organisation (e.g., National Civil Aviation Authority) appoints one or several other ATS service providers on all or on a part of its national airspace to manage the service of navigation. The State shall require from the contracting Air Navigation Service Providers operating in that State to establish and implement a safety management system (SMS) to meet the state SMS requirements. An Air Navigation Service provider cannot delegate any part of its contracting airspace to another provider, it is a state prerogative.

3.2.4.2 Airspace delegation

A state may delegate a piece of its national airspace to another state. When delegating an airspace, a state remains accountable of taking appropriate measures to ensure compliance in respect of safety and operational efficiency. The delegating State prescribes the conditions under which the delegation is agreed, and the delegation can be reverted at any time. When delegating the functional responsibility for service provision to a foreign entity, the delegating State retains a residual liability under Article 28 of the Chicago Convention. However, that liability is limited to the obligation to ensure that the service delivery activity is properly regulated, the service provider duly certified, and that adequate and effective supervision is exercised.

3.2.4.3 ATM services delegation

An Air Navigation Service provider may agree with another provider to transfer permanently or temporarily Air Traffic Management services. In application of the principle of territorial sovereignty, only the laws and regulations of the concerning State (e.g., in which the service is provided) should be in force and applied. Such agreement requires an approval from concerning State via a state ATS representative organisation (e.g., National Air Authority) and the commitment of all stakeholders to respect concerning State SMS and/or to clarify which laws and regulations, or operational rules and procedures will be applied.

3.2.4.4 ATC Licensing

Any ATC licensing and regulatory are based on the requirements in reg. (EU) 340-2015 [21]. ATC licensing can be depicted as follows:

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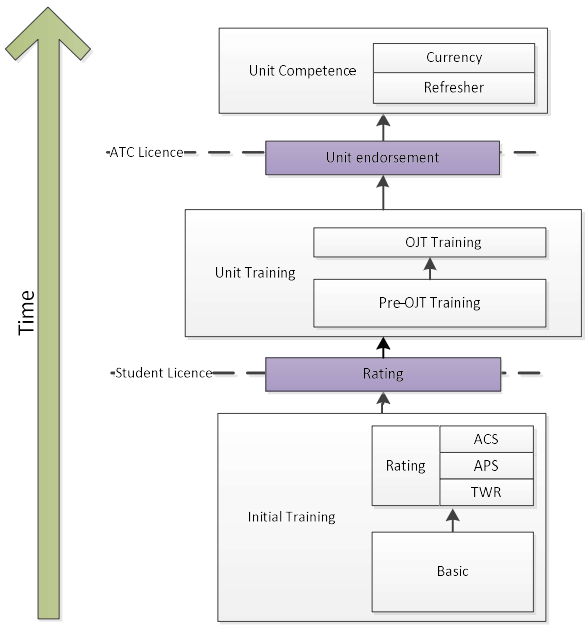

Figure 66666: ATC licensing according to [21]

ATC licences are based on the rating, which is common throughout Europe and obtained through Initial training and the unit endorsement which is specific to the volume of airspace to be controlled and therefore specific to the sector and positions managed. The latter are obtained through unit training and maintained through the unit competence scheme.

Further licence endorsements exist (OJTI, Assessor, LPR), but are not relevant to this solution.

The unit endorsements are specific to an ATS Centre.

To provide ATM Services, ATCOs should hold a valid ATC licence which indicates the successful completion of the appropriate Unit Training and demonstration of competency to provide the ATM services associated with sectors and position mentioned in the licence.

A controller may have a valid ATC licence[5] on different ATS unit and any sector combinations as long as it is described in the ATS Unit Training plan and competence scheme which are validated by the state ATS representative organisation (e.g., NSA: National Air Authority or Competent Authority).

The receiving ATSU should develop and implement an ATS Unit Training plan and a competence scheme containing the shared sectors or positions.

[5] This includes training of the ATCO on the use of the ATM system to be used.

Future ATC licensing model might be different. PJ.10-W2-IFAV [37] investigates how controller validations can be based on systems and sector types rather than expert knowledge of geographical sectors. PJ.33-W3 FALCO [38] will be working on a licensing model based on a system and tool set that can then be applied to any airspace that has the appropriate system support. This new model is not required but it might be beneficial for the delegation process.

As described in section 3.3.4.1, todays licensing regimes seem to constrain the flexible delegation of ATS services among ATSUs.

3.2.4.5 Developing an ATM services delegation

Two different types of delegation of ATM services may be possible:

- **Delegation related to performance optimisation**: agreement between two adjacent ATSU to manage ATC resources to provide better air traffic services. This could be to fulfil the traffic demand or consequently from the necessity for some controllers to fulfil the competence scheme requirements regarding currency. The LoA between the two ATSU should clearly delineate the process between delegating ATSU to receiving ATSU. All LoAs impacted by the delegating ATM services with other stakeholders should consider operations in delegating ATSU and in receiving ATSU. In normal operations, delegating ATM services are shared amongst two ATSUs through a close collaboration.
  The Switch may be performed between two ATSUs

  1. in the same physical ATC Centre[6]
  2. of the same ANSP in the same state but different locations
  3. of the same ANSP in two different states, the two states should make an agreement (different SMS) with the ANSP
  4. of different ANSP in the same state
  5. of different ANSP in two different states, the two states should make an agreement (different SMS) with the two ANSP

  Within the shared ATS services provision option 3 and 5, the two different states may establish a treaty to designate one ATS representative organisation for the shared airspace to have one SMS.

[6] This is a rather rare case, but there are sometimes two ATSUs being responsible for different AoRs although they are co-located in the same physical premises.

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- **Delegation in case of contingency**: The aiding ATSU provides ATM services for the affected airspace using its own technical infrastructure on behalf of the failing ATSU. The aiding ATSU then, will operate from a different location with its own human and procedures assets. A contingency plan is required beforehand which defines all necessary agreements between the aiding and the failing ATSU and the related ADSPs in the case of a contingency situation. The contingency plan should define the three phases of operations:
    - the first transfer process (triggering, initiating, completing)
    - ATM services provided within the receiving ATSU (normal, abnormal, and degraded mode of operations)
    - the transfer back process (triggering, initiating, completing)

  This approach is also applicable to delegation related to performance optimisation in some cases.

3.3 Detailed Operating Method

3.3.1 Previous Operating Method

The delegation of ATM services provision between two ATSUs, as described in this document is rarely done today. This section describes some examples from different ANSPs.

3.3.1.1 Delegation of Cardiff Terminal Airspace (NATS)

Bristol and Cardiff airports in the UK manage the terminal airspace up to FL165 during the day but delegate it to NATS's Swanwick Area Control centre overnight. The procedures governing the delegation process are formally set out in the UK Manual of Air Traffic Services. This document defines the precise volume of airspace for which air traffic services will be delegated and the time period of the delegation. It also sets out the ATC procedures in effect during the delegation.

Prior to the normal time of delegation (23:00) the Cardiff Supervisor phones the Supervisor in Swanwick ACC and agrees the exact time of the handover. The Swanwick Supervisor informs the affected sector(s) to prepare for the handover and the ATSEP who has to make the necessary adjustments to the systems. In the case of Cardiff this means updating the sectorisation and enabling Short Term Conflict Alert in the airspace being delegated.

Due to the very limited exchange of flight data between the ATSUs it is necessary to 'Clear the Skies' prior to executing the delegation to ensure a safe transfer meaning that, if there are any aircraft in the airspace, delegation is delayed until the airspace is empty.

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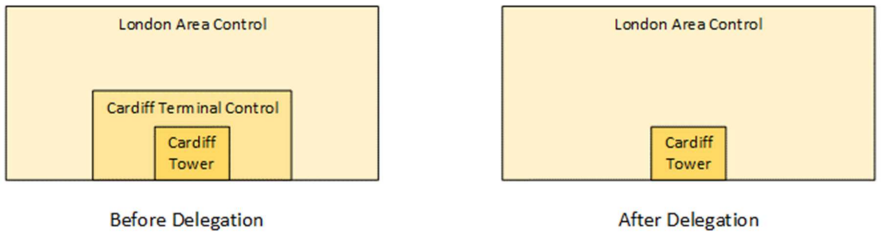

Figure 77777: Delegation of Cardiff Terminal Airspace

When the delegation process has been completed during the night, the Surveillance (Radar) is not on duty. Therefore, Cardiff Tower is manned to provide a procedural approach service only. Cardiff Tower cannot clear any aircraft above FL50 without coordination with Swanwick ACC.

During the period that air traffic services are delegated to Swanwick AC all Standing Agreements, abbreviated clearances and silent releases are suspended. Furthermore, the first AC sector receiving a departing flight from Cardiff airport is responsible for verifying that the SSR code is valid.

At 0600 the delegation process is reversed. The Swanwick AC Supervisor phones Cardiff TC and checks that they are ready to provide air traffic services. Any aircraft inbound to Cardiff airport are coordinated directly with Cardiff tower before the handover to ensure an empty airspace. The ATSEP in Swanwick AC reverses the sectorisation and disables STCA in the delegated airspace for Swanwick AC. Cardiff TC starts to receive flight data from the Swanwick flight data processor but as the feed is one-way it is not able to modify it.

However, due to the very limited exchange of flight data between the ATSUs it is necessary to 'Clear the Skies' prior to executing the delegation to ensure a safe transfer. The delegation is conducted over the phone and apart from re-sectorisation in the en-route centre there is very little system impact.

Similarly, in French airspace, Jersey airport delegates its airspace to the Brest centre at night. There is some additional complexity in this case because Jersey has an OLDI boundary with the UK which must be managed correctly to ensure correct coordination. The operations and procedures to manage these two delegations have been developed over the years and work well in very low or zero traffic conditions but are severely limited in their capabilities.

This pattern was common, with local procedures in place that had been developed independently with almost no exchange of data that would support a more complex delegation process where the traffic levels were not adversely impacted.

3.3.1.2 Changing responsibilities between Bremen and Munich FIR (DFS)

In Germany, there are some areas that are controlled by different Control Centres at different points in time. Between Bremen ACC and Munich ACC, a letter of Agreement (LoA) defines the rules for controlling the TORGAU area which can be controlled by either ACC.

The objective of the changing responsibilities of the TORGAU area is an improved airspace for Munich ATCOs when handling approaches to Leipzig airport. The TORGAU area belongs to the Bremen FIR, but can be requested by Munich ACC, in particular during the night. At night-time, Leipzig Approach must

handle a lot of freight cargo to and from Leipzig. Therefore, Munich ACC can request the TORGAU area via phone coordination to have more airspace available for the Leipzig Approach.

The TORGAU area is used as a geographically defined Release Area in which flights going from Bremen ACC to Munich ACC are already released. This means that the flights are already under control of Munich ACC before officially entering the Munich FIR. In addition, Munich ATCOs are allowed to guide flights through the TORGAU area that are not known to Bremen ACC, e.g., inbound flights to Leipzig airport.

There are no special license agreements necessary for this procedure. When holding licenses for their own sectors, ATCOs also need to have knowledge for their adjacent sectors. In principle, such arrangements can be dynamically agreed between two sectors without having a LoA.

3.3.1.3 Delegation of Roma ACC airspace to Malta ACC

In a limited portion of airspace located in the southern part of the Rome LIRR UIR/FIR the provision of ATS and FIS in accordance with the airspace classification, “G” class excluded, is performed by Malta ACC in application of Article 10 of SES Regulation 550/2004 in which it is stated that air navigation service providers may avail themselves of the services of other service providers that have been certified in the Community.

In the airspace concerned, Rome ACC cannot authorize traffic to use this zone without the previous coordination and approval of Malta ACC which do not transfer or coordinate with Roma ACC the controlled flights within the area. The operational agreement may be suspended temporarily or limited if required by Military Air Defence activity.

3.3.1.4 The delegation of Kosovo airspace

After the closure of the Kosovo warfare, agreement was signed by all concerned parties, that the airspace of Kosovo would be governed by the KFOR Commander of the NATO.

NATO has authorised Budapest ACC by the Government of Hungary to provide ATS service in the airspace over Kosovo from 4th of April 2014, from FL205 up to FL660 (important: ATS is delegated, not the airspace!) The separation minima, and other conditions are the same as in Budapest ACC, or in the majority of ACCs in Europe. Minor alterations are the followings:

- Licencing: approximately 90% of Budapest ACC staff licenced also for Kosovo airspace. Junior controllers are awarded a Kosovo extension after 2-5 years of practice in Budapest ACC. To keep licence valid a minimum 15 hours of operational duty is required within a 6-month period in Kosovo sectors (compared to 50 hours in case of Budapest sectors).
- Kosovo is normally operated as one sector, however if traffic demand requires, it can be split to 2 sectors, lower and upper with a split at FL365.
- When there is low traffic demand, the supervisor can decide that the Kosovo sector can be manned by one controller.
- Kosovo sector is managed by Budapest Flow Management Unit, the same way as Budapest sectors.

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Technically, an earlier version of the Hungarian main ATS system with a separate dataset is used, which only comprises the KFOR airspace. The radios for managing the KFOR airspace are located in Macedonia and Serbia. They are leased by Hungarocontrol for their exclusive use.

3.3.1.5 Night delegation and dynamic sector delegation in Denmark

In Denmark, one of the provincial TWR/APP unit normally closes during the night. Aarhus (EKAH) is an airport located approximately 160 km northwest of Copenhagen and normally provides service in EKAH CTR and EKAH APP area, stretching from ground up to FL 65. During the night, after the last scheduled landing, the TWR/APP unit normally closes, and open again early next morning in time to provide service for the scheduled morning traffic.

Normally, the EKAH ATCO on duty calls the Planner Controller (PC) of Copenhagen ACC who is responsible for the ACC sector just above Aarhus to inform about the closing. When this message is received, the PC informs Copenhagen information (who are handling all VFR flights in the Copenhagen FIR) and Copenhagen ACC Supervisor. The Supervisor then configures the ATM system enabling the STCA alerts to also include the EKAH TWR/APP airspace. A map on the radar screen is activated at the concerned ACC sector(s) and Copenhagen information to clarify that Aarhus are closed.

Aarhus and Copenhagen ACC are not part of the same system and have limited system information exchange between the ATSUs. Copenhagen ACC is aware of/has received information about all flights that are expected to pass their airspace from NM, meaning all traffic, except local flights in EKAH area, are known to the ACC. However, to allow for the delegation, the airspace is first cleared of all traffic, e.g., a departure in a climb to the ACC area, but still in APP area, can still be accepted.

In the morning, when EKAH re-opens, the procedure is the same. When contacted by EKAH ATCO, the PC of the sector above makes the internal coordination with Copenhagen information and ACC Supervisor, who then disables the STCA alerts in the EKAH TWR/APP area. The map on the radar screen is removed and the airspace is delegated back to EKAH ATCOs. If there is any traffic in the EKAH APP area, all related information about the flight(s) is handed over before delegating the airspace back.

As Copenhagen Airport, Kastrup (EKCH), is located very close to the Swedish national boundary, and Swedish airspace, there have since long been a need to establish a flexible concept to accommodate inbound and outbound traffic to Copenhagen. Especially some of the possible runway configurations used at Copenhagen airport influences the demand to allocate additional airspace to Copenhagen APP Area. Even if some of the approach service can be delivered from Malmoe ATCC/APP, Copenhagen APP have the ultimate responsibility to line up the aircraft for final approach.

Copenhagen ACC and Malmoe ATCC are using “siblings” of the same system – TopSky-ATC – and have the possibility to exchange flight information via OLDI (including field 15), and even to do some electronic coordination like release in a handover. However, when it comes to delegation of the service provision, this is done purely on operational level, not by changing any configuration in the system. The main reason for this is that the areas that can be delegated are predetermined, relatively small and are all located along the pre-existing boundary. The pattern for delegation is fixed to specific runway configurations, ensuring controllers on both sides knows what to expect in a specific configuration.

The delegation procedure is handled directly by the operational ATCOs on duty on both sides. The Copenhagen ATCO will initiate the delegation (as it is related to EKCH runway configuration). The ATCO calls the Malmoe APP ATCO and ask for the sectors to be delegated due to the runway configuration in Copenhagen. There is a possibility for the controllers to coordinate any traffic that might be affected

in the short term by the delegation, and then the APP ATCO in Malmoe can approve the request and delegate the airspace to Copenhagen APP. A map on the radar screens is activated in Copenhagen and Malmoe respectively to clarify to the ATCOs that the delegation is in effect. When the runway configuration change back (or to a new configuration) and Copenhagen APP no longer need the delegated sectors, those are handed back to Malmoe and the map is deactivated. This procedure is also managed solely by the operational controllers. STCA is always active in the sectors on both sides and are not disabled/configured during the process.

3.3.1.6 FINEST - cooperation programme between EANS and ANS Finland

Estonian Air Navigation Services (EANS) and Air Navigation Services Finland (ANS Finland), the main air navigation service providers in Estonia and Finland, have a long record of cooperation in the field of Air Traffic Management. The implementation of Free Route Airspace in Northern Europe brought a possibility and need to continue the cross-border cooperation. In 2018, based on common interest, a decision was taken to commence wider cross-border cooperation and FINEST programme was initiated. FINEST [35] aims to provide to airspace users consistent, cost-efficient, and competitive cross-border Air Navigation Services (ANS). Within the FINEST airspace, Estonia and Finland will be merged consisting of the Flight Information Regions (FIRs) of Helsinki and Tallinn between FL95 and FL660.

By reorganizing the ATC sectors, it is intended to improve the flow of air traffic in these two FIRs regardless of national boundaries. In these sectors, ATC service will be dynamically transferred between Tallinn and Helsinki ACCs. FMP will create operational sectors for every moment by collapsing/splitting sectors to meet the actual traffic demand and flows. ANSPs will remain the same in terms of organization, however, operational staff will be required to obtain a common certification. ATCOs from both ACCs will be able to operate in the entire FINEST area with one license and rating and using one set of procedures, giving the possibility of delegation of airspace between ACC in nominal conditions or in case of contingency.

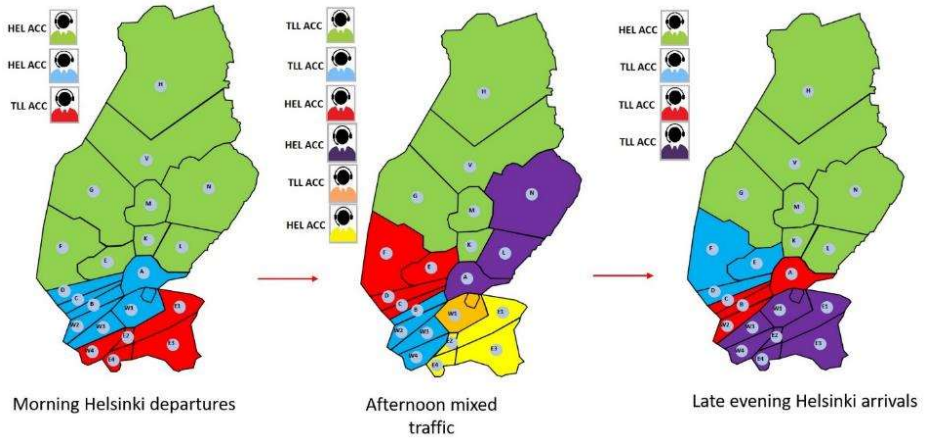

Figure 88888: FINEST - Daily ATCOs roster from both ACCs (example)

Instead of creating a completely new FINEST infrastructure, the two ANSPs have chosen to adapt existing systems to make them more cost-effective and easier to use. The system was also adjusted by

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modifying the existing and introducing new adaptation data. Although coordination will actually take place between two FIRs, the new system will provide controllers with elements of inter-sector coordination. Outside the FINEST, the two FIRs of Finland and Estonia will remain visible and external partners (adjacent ACCs, Eurocontrol NM, etc.) will interact with them as usual, although they will be treated as one FIR internally by the same Thales system.

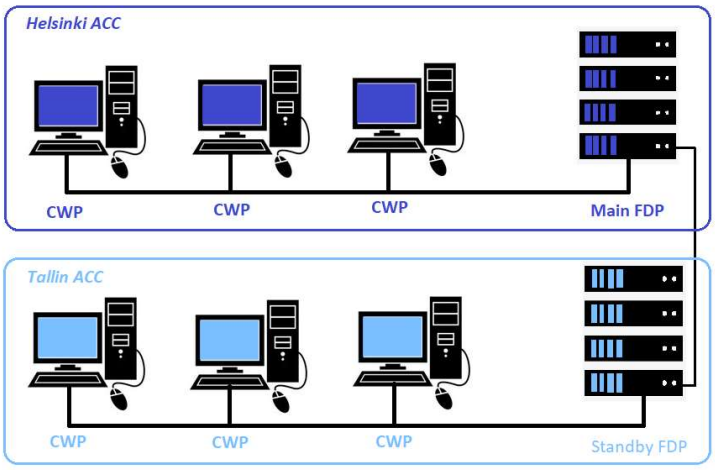

Figure 99999: FINEST - "Y" architecture solution – one main FDP/two FIRs (EFIN and EETT)

Finland's ADSP for both ATSUs will be operational and Estonia's ADSP will be used in case of contingency. The FINEST Project provides an example of Virtual Centre technology by separating the FDPS and HMIs in two different countries (decoupling the ATSU from the ADSP).

3.3.1.7 Current Contingency Operations

Today, contingency operations are organised according to the Generic Contingency Lifecycle [19] (see Figure 10101010Figure 1010~~Figure 10~~). After the outage occurs, e.g., loss of a control room, a period of degraded mode of operations is entered. This phase is usually initiated clearing the sky procedure, which means all aircrafts in the affected airspace are moved out or landed and no new aircrafts are allowed to enter the affected airspace. This has a huge impact on the whole ATM system. In today's contingency solutions usually a number of contingency positions are held available by the ANSPs. Typically, the number of these positions is much lower than the number of the operational positions. In case of a contingency situation, these positions need to be set up, because they are normally not kept up to date during normal operations, due to reasons of cost efficiency. In addition, it might be necessary to relocate ATCOS, depending on the location of the contingency facility. During the phase of degraded operations, significant ATFCM regulations are necessary to compensate the affected airspace. Depending on the procedure to establish service continuity, the ATM service might be lost for a few days or even longer.

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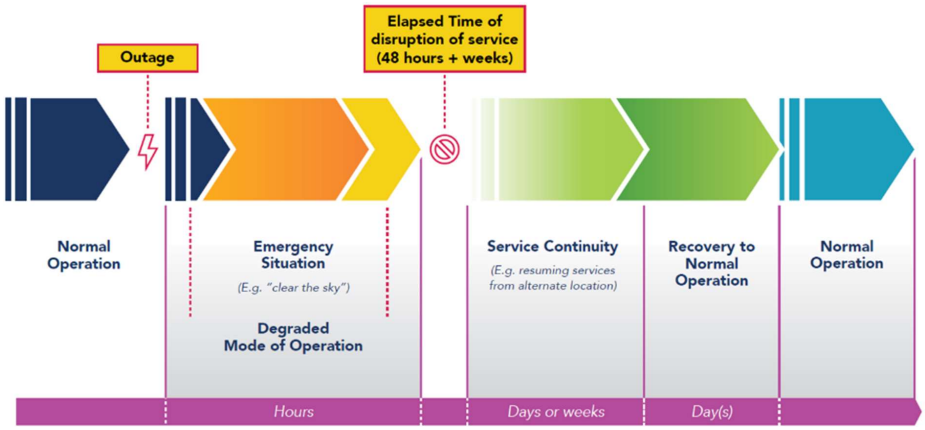

Figure 1010101010: Generic contingency lifecycle [19]

As depicted by Figure 11111111Figure 1111~~Figure 11~~ in the lower graph of Figure 10101010Figure 1010~~Figure 10~~, the capacity during the contingency phase is significantly reduced, even during the phase of service continuity. After the outage the airspace is closed, and a clear-the-sky procedure is executed. Therefore, the capacity of the affected airspace is reduced to zero. In the phase of service continuity, the airspace can be reopened again, but not with its full capacity since the number of contingency positions is usually lower than the number of operational positions. To make things even worse, it might be that the contingency positions are functionally less powerful than the operational positions, which further lowers the capacity of the airspace. Therefore, the capacity during service continuity is significantly lower than the normal capacity of the airspace. When recovering to normal operations, it might be necessary to temporarily reduce the capacity due to procedures being executed before switching back to normal operations.

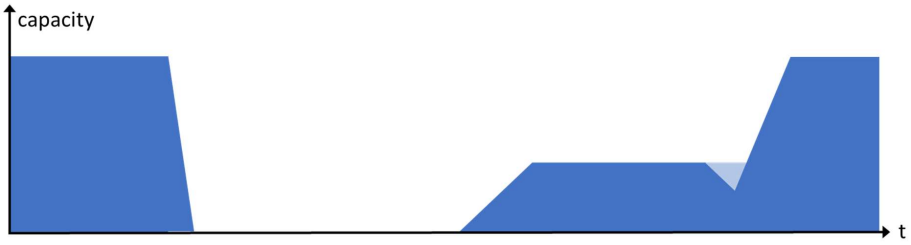

Figure 1111111111: Capacity over time of today's contingency solutions related to the generic contingency lifecycle

3.3.1.8 Limitations of the Current Operating Method

Chapter 4 and Annex A of the Eurocontrol Common Format LoA provide a set of guidelines in which the delegation of provision of air traffic services between two States may be formally specified. It identifies at a high level the following issues that should be addressed in any LoA:

- Identification of the authority responsible for the provision of ATM services in the airspace
- Scope of the delegation: ATC service, flight information service and alerting service
- Radar separation minima
- Special activities affecting the provision of air traffic services
- Procedures for the allocation of SSR codes
- Distribution of aeronautical information
- Air Traffic Controller competence requirements
- Distribution of meteorological data
- Contingency procedures

However, it does not address the delegation process and procedures itself. This is left to the involved States to agree bi-laterally. While this is not unreasonable in the current operational environment it does not provide common methods that can be adopted universally that advance the goals of interoperability and operational flexibility. PJ.10-W2-93 develops a comprehensive set of Use Cases and, subsequently, operational procedures and services that will enable ATSUs to delegate the provision of air traffic services dynamically and without impacting on traffic flows.

The existing approaches described in this section are geographically limited solutions that serve specific goals and/or are based on vendor-specific solutions, e.g. FINEST, and thus do not enable a virtualised environment as envisaged by the Airspace Architecture Study [20].

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3.3.2 New SESAR Operating Method

3.3.2.1 Elementary delegation Scenarios

The elementary delegation scenarios operationally describe the different ways how ATM services (see Figure 1111Figure 11~~Figure 1~~ in section 2.2 Scope for the EASA definition of ATM) can be delegated among two ATSUs without putting it into a broader operational context. Thus, the elementary delegation scenarios neglect for example the reasons why a delegation is initiated. This operational context is described by use cases in sections 3.3.2.8.2 and 3.3.2.8.3.

3.3.2.1.1 Delegation with static AoR

When delegation with static AoR is applied between two ATSUs, ATM services are delegated between two ATSUs, that may or may not share a common border. Figure 12121212Figure 1212~~Figure 12~~ depicts an example of this elementary delegation scenario. Two ATSUs are considered in this example: ATSU A (blue) and ATSU B (green). Each of them manages several sectors. The black line depicts the shared common border between the ATSUs at which a coordination is required between the ATSUs.

The key point of this delegation scenario is that the AoRs of the participating ATSUs are not changed and that the sector which is delegated is not consolidated with another sector of the AoR of the receiving ATSU. The boundary and all related agreements for the coordination remain unchanged between ATSU A and ATSU B.

The CWPs in the receiving ATSU are provided with data by the ATM system of the delegating ATSU. In this sense, the receiving ATCOs use a remote CWP to manage the airspace. Although, the AoR between the delegating and the receiving ATSU remains unchanged, this is considered as airspace delegation since a different ATSU is in charge of the airspace after the delegation.

In the example depicted below, ATM services are delegated for sector A3 from the blue ATSU to the green ATSU. In this case an ATCO of the green ATSU is controlling sector A3, but this sector is still part of the AoR of the blue ATSU being comprised by sectors A1-A3 and is not collapsed with any sectors of the green ATSU. Therefore, there is no change in the AoR of any of the ATSUs. In addition, a dedicated ATCO is required at ATSU B for managing sector A3.

At the technical level, the coordination points for OLDI, data link and FO-IOP remain the same since the boundary between the ATSUs remain unchanged.

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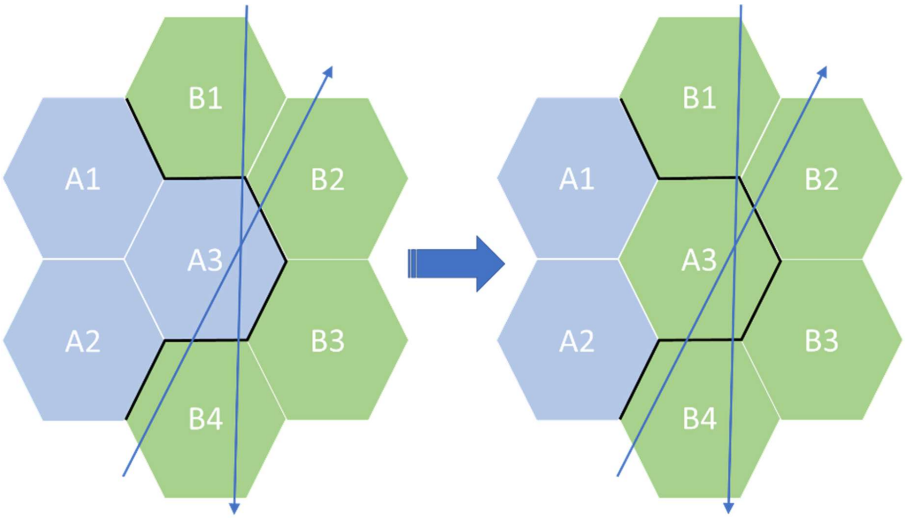

Figure 1212121212: Delegation with static AoR

The following three sections illustrate the delegation scenario of transfer of sector and breaks it further down to several options of allocating CWPs between the participating ATSUs.

3.3.2.1.1.1 Delegation with static AoR and Layout of delegating ATSU

In this case, the provision of ATM services for sector A3 is delegated from ATSU A to ATSU B and ATCO CB1 is taking responsibility for this sector (see Figure 13131313Figure 1313Figure 13). To achieve this, the CWP of ATCO CB1 in ATSU B is connected to the ATM system of ATSU A and receives all necessary data (radar data, flight plans, …) from there.

It is expected that the CWP used by ATCO CB1 in ATSU B is identical in terms of functionality and layout to the CWPs used in ATSU A. This can be achieved by

- using a dedicated position which is used for the delegation, and which is identical to the CWPs of ATSU A, or
- using the same type of CWPs in both ATSUs, or
- using a CWP which can be switched between different modes, i.e., it can act as a green or blue CWP on request, or
- using CWPs that are interoperable with the ATM system of the other ATSU.

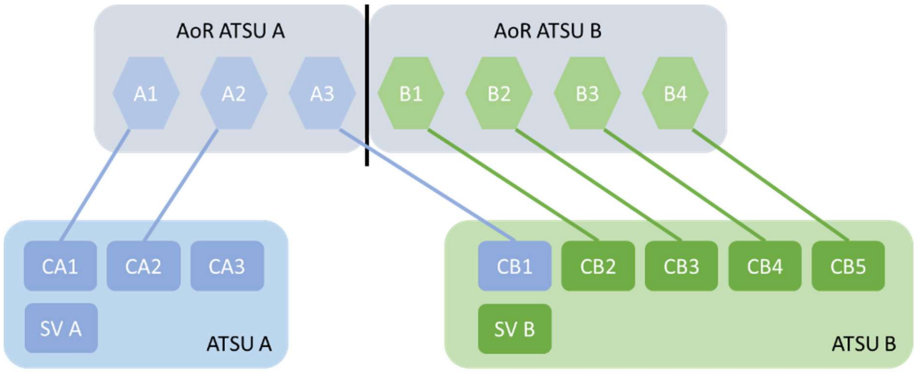

Figure 1313131313: CWP allocation of delegation with static AoR using a remote position with layout of delegating ATSU

3.3.2.1.1.2 Delegation with static AoR and Layout of receiving ATSU

This case is similar to the one presented in the previous section. The difference is that the CWP of ATCO CB1 in ATSU B is using the original CWP layout used in ATSU B. This is indicated by the green frame around CB1 (see Figure 14141414Figure 1414Figure 14).

This implies that data provided by the ATM system of ATSU A can be handled by the CWPs of ATSU B after connecting to the ATM system of ATSU A.

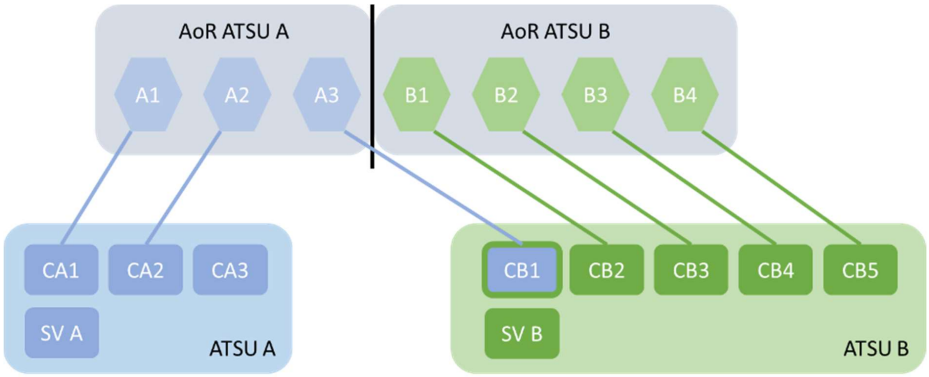

Figure 1414141414: CWP allocation of delegation with static AoR using remote position with layout of receiving ATSU

3.3.2.1.1.3 Delegation of multiple sectors/FIR with static AoR

In the sections above, provision of ATM services was delegated only for single sectors. But as shown in Figure 15151515Figure 1515Figure 15, provision of ATM services can be delegated also for multiple sectors up to a whole FIR of an ATSU. In this case the CWPs of ATSU B would be connected to the ATM system of ATSU A, which is still in operations, but all ATCOs in ATSU A will be idle after the delegation. In the receiving ATSU B, all delegated sectors can be consolidated on a single CWP or multiple CWPs of ATSU B will be used for managing the delegated airspace of ATSU A.

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This can also be done using the CWP layout of ATSU B as described in the previous section.

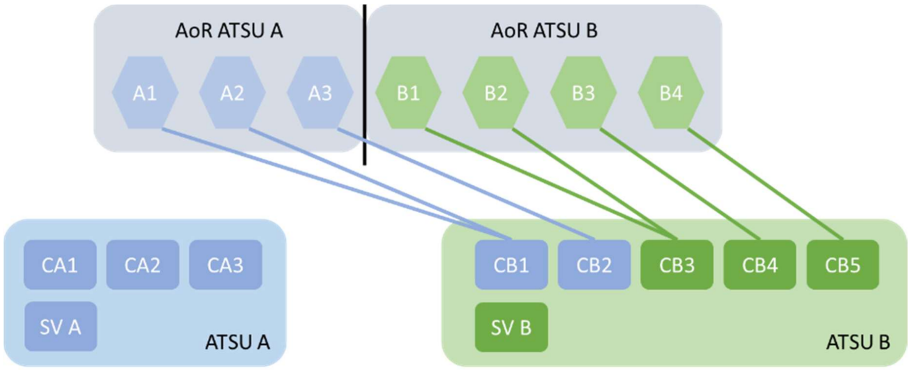

Figure 1515151515: CWP allocation of delegation of FIR with static AoR using remote position

3.3.2.1.2 Delegation of elementary Sector with dynamic AoR

Delegation of ATM services for an elementary sector with dynamic AoR can be performed only between two adjacent ATSUs that share a common border. Furthermore, this delegation scenario requires that the delegated sector is adjacent to a sector of the receiving ATSU. This would give the opportunity to consolidate the two sectors during the delegation process or to consolidate at a later point in time. Figure 16161616Figure 1616Figure 16 depicts an example with two ATSUs: ATSU A (blue) and ATSU B (green). The black line depicts the common border between the two ATSUs.

The key point of delegation of elementary sector with dynamic AoR is that the AoRs of the ATSUs are adapted according to the delegation. A new boundary is established between the ATSUs at which the coordination will take place.

After the delegation, the CWPs of the receiving ATSU that are assigned to the delegated sector, are provided with data by the ATM system of the receiving ATSU. The delegated sector is integrated into the AoR that is managed by the ATM system of the receiving ATSU.

To optimise the coordination effort for the sample flights depicted in the figure, ATM services for sector A3 are delegated from ATSU A to ATSU B. Subsequently, sector A3 is controlled by the green ATSU and the common border between the two ATSU has been re-arranged such that sector A3 becomes part of the airspace of ATSU B. In addition, the delegated sector A3 is consolidated with one of the adjacent sectors of the receiving ATSU B. In the example below A3 is consolidated with sector B1, due to the common traffic flows between these two sectors. After the consolidation, A3 and B1 would be managed by a single ATCO team. Sectors B2 and B4 are also candidates due to the common traffic flows. In principle, after the delegation ATSU B is responsible for managing sector A3 and could also split this sector into multiple parts and consolidate it with its sectors B1, B2 and B4. Sector B3 would also be possible since it is adjacent to sector A3, but it would not offer any benefit in terms of traffic optimisation in this example.

On a technical level this implies that all necessary coordination information, such as OLDI, data link and FO-IOP, now must consider the new common border between the two ATSUs.

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Principally, this delegation scenario could also be performed without consolidating the delegated sector with another sector in the receiving ATSU. In the example depicted in Figure 16161616Figure 1616~~Figure 16~~, this would mean that the delegated sector A3 would be handled by an additional ATCO team of the receiving ATSU B. This would reduce the positive economic effects of this delegation scenario.

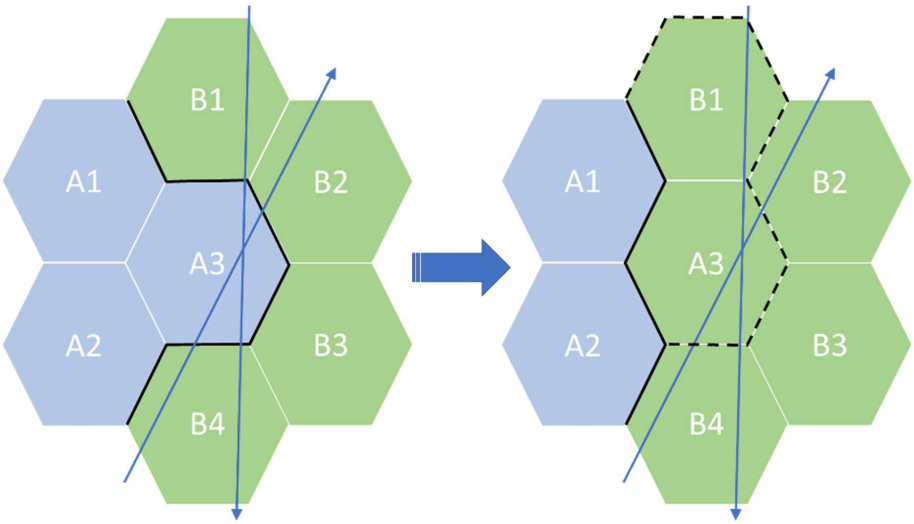

Figure 1616161616: Delegation of elementary sector with dynamic AoR and consolidation in receiving ATSU

Figure 17171717Figure 1717~~Figure 17~~ below depicts a possible allocation of the CWPs in ATSU A and ATSU B after the sector A3 has been delegated from ATSU A to ATSU B. In this example, ATSU B has not yet consolidated the received sector A3 with any of its own sectors and thus five ATCOs are required for managing the airspace under the responsibility of ATSU B. From an operational perspective, a delegation without a consolidation of the received sector at the same time, reduces the complexity of the delegation, but requires additional resources: an idle ATCO and an idle CWP. In some cases, it might be necessary to delay the consolidation of the sectors, because the traffic load is still too high to combine sectors.

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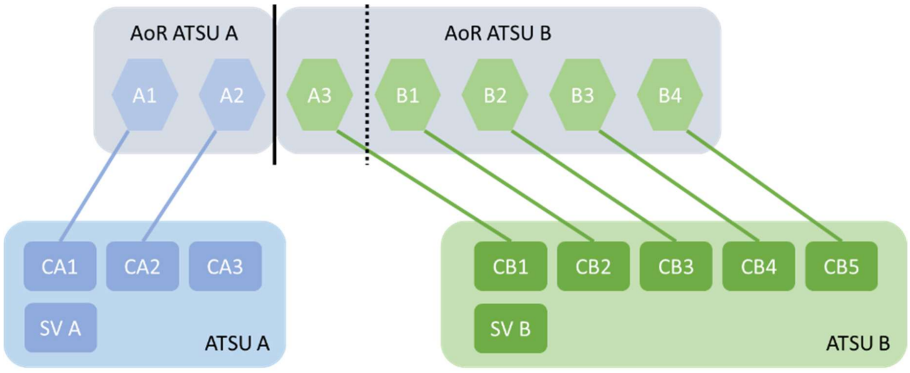

Figure 1717171717: CWP allocation of delegation of elementary sector with dynamic AoR but without consolidation in receiving ATSU

Figure 18181818Figure 1818Figure 18 depicts an example of how CWPs can be allocated in the two ATSUs A and B for the delegation scenario depicted in Figure 16161616Figure 1616Figure 16 when the received sector is consolidated in ATSU B. In the example, the ATCO CB1 of ATSU B will be responsible for managing the delegated sector A3 of ATSU A in addition to the sector B1 of ATSU B which he already manages. As a result of the delegation the boundary between the two ATSUs is adapted and sector A3 becomes part of the AoR of ATSU B. In the figure the solid black line represents the new boundary whereas the original boundary is depicted as a dotted black line.

The CWP allocation depicted Figure 18181818Figure 1818Figure 18 can also be the result of a consolidation that was performed after the delegation. Thus, it is possible to first have the CWP allocation depicted in Figure 17171717Figure 1717Figure 17 for some time and then to have the final CWP allocation after the consolidation of the delegated sector as depicted in Figure 18181818Figure 1818Figure 18. This would also result in a decreased need of ATCOs and CWPs to manage the airspace.

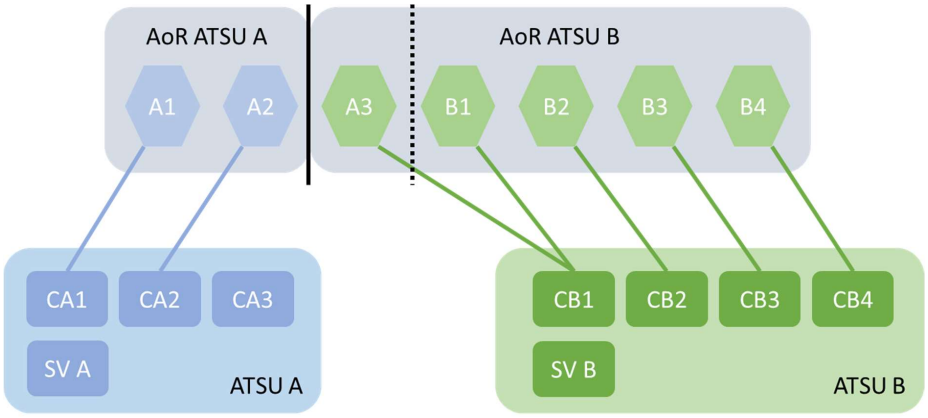

Figure 1818181818: CWP allocation of delegation of elementary sector with consolidation at receiving ATSU

3.3.2.1.3 Delegation of partial Sector with dynamic AoR

The concept of delegating a partial sector with dynamic AoR is a special case of the delegation of an elementary sector with dynamic AoR which is described in the previous section 3.3.2.1.2. It requires special functionality at the system level to enable a fine-grained reconfiguration of the common boundary between the ATSUs that is independent of elementary sectors. As in the previous delegation scenario, the delegated part of sector A3 (airspace A3.2) is consolidated with B1 to optimise the traffic flows and managed by a single ATCO team. The airspace A3.1 remains in ATSU A and might be consolidated with sectors A1 or A2 of ATSU A. A new common boundary is established between the two ATSUs.

As in the previous section, for all necessary coordination information, the new common boundary between the two ATSUs must be considered.

The concept of Dynamic Airspace Configuration (DAC) is developed by PJ.09-W2-44 [29].

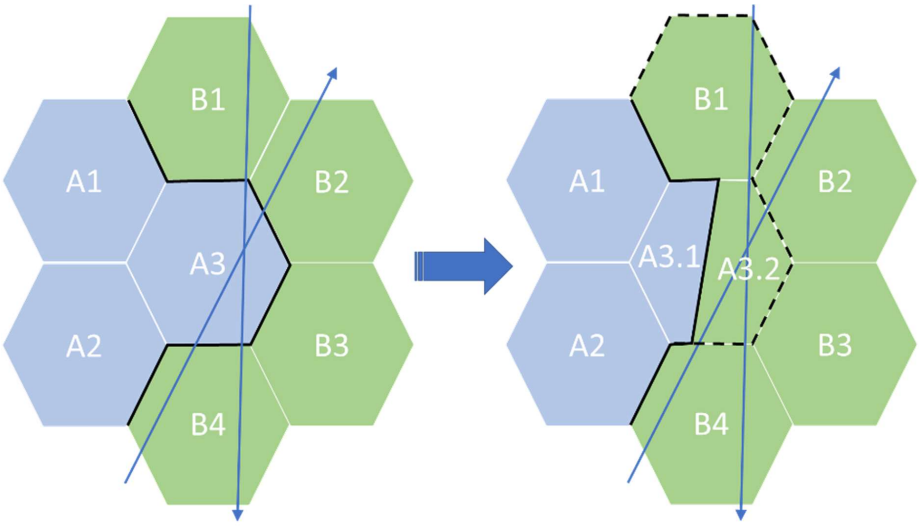

Figure 1919191919: Delegation of partial sector with dynamic AoR

Figure 20202020Figure 2020~~Figure 20~~ depicts an example of a possible CWP allocation in the two ATSUs A and B for the sample airspace shown in Figure 19191919Figure 1919~~Figure 19~~. In order efficiently use the available resources in both ATSUs, the newly created pieces of airspace A3.1 and A3.2 are consolidated with sector A2 in ATSU A and sector B1 in ATSU B respectively. In the figure the solid black line represents the new boundary whereas the original boundary is depicted as a dotted black line. The main difference compared to the delegation scenario described in the previous section 3.3.2.1.2 is that the new border between the two adjacent ATSU does not match a defined sector boundary, but it can be an arbitrary splitting of a sector. Thus, a new LoA needs to be established at the new boundary between ATSUs A and B.

In the context of delegation of a partial sector with dynamic AoR, it would be principally possible to delegate without consolidation as described for the delegation of elementary sector with dynamic AoR in the previous section 3.3.2.1.2. But since the delegation of partial sectors is used to optimise the

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traffic flows close to the border and to minimise their need for coordination, the size of the delegated partial sectors is expected to be quite small. Therefore, a management of this small piece of airspace by a separate controller does not make sense operationally. Consequently, delegation of partial sectors with dynamic AoR is always consolidated with an adjacent sector of the receiving ATSU during the delegation.

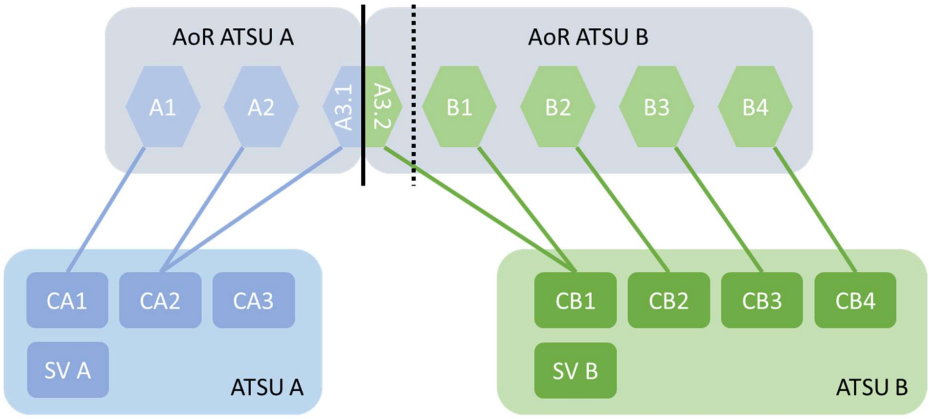

Figure 2020202020: CWP allocation of delegation of partial sector with dynamic AoR

3.3.2.2 Agreements between delegating and receiving ATSU

3.3.2.2.1 Letter of Agreement (LoA)

LoAs are formal agreements between two ATSU and define the necessary coordination procedures for managing the adjacent airspace of the partner ATSUs as well as ATFCM-related agreements with the NM. LoAs usually follow a common format [28] and define the following elements:

- Areas of responsibility and areas of cross-border provision
- Procedures that are applicable
- Revisions and deviations
- Cancellation of the LoA
- Interpretation and Settlement of Disputes
- Validity

In general, LoAs are very important for the work of an ATCO. In particular, ATCOs of a receiving ATSU need to be aware of all the conditions and regulations defined in the LoA of the delegating ATSU to be able to manage the airspace safely and efficiently which they are providing the ATM services for.

The elementary delegation scenarios concerning delegation in a cross-border context described in previous sections 3.3.2.1.2 and 3.3.2.1.3 highlight the importance of LoAs. If ATM services provision is delegated between non-adjacent partners, as described in section 3.3.2.1.1, then there is no obvious

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direct system impact, but the receiving ATCO needs to be aware of the LoA and its regulations defined for the delegated airspace.

In case of adjacent ATSUs and a delegation of cross-border elementary or partial sectors resulting in a modification of the AoRs of the participating ATSUs (as described in sections 3.3.2.1.2 and 3.3.2.1.3), then there is an additional system impact. When the boundary is changed between two adjacent systems, the system-level implementation of the LoA also needs to be updated. When dynamic airspace configuration is used, as described in section 3.3.2.1.3, the overall LoA needs to reflect this aspect.

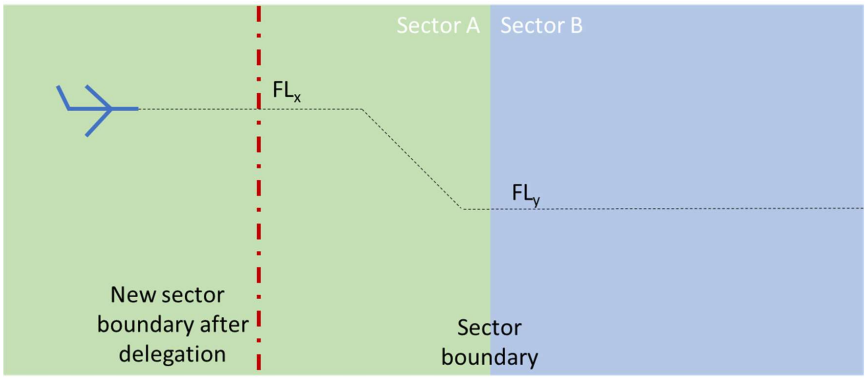

Figure 2121212121: LoA changes according to shift of AoR

When changing the AoR between two adjacent ATSUs, there might be the need to adapt operations according to the new boundaries. Consider a flight going through two adjacent sectors as depicted in Figure 21212121Figure 2121Figure 21. Usually, the a/c is descending in sector A from FL_x to FL_y and is expected by sector B to be handed over on the latter flight level. If the sector boundary is shifted as depicted by the red line as the result of a delegation, then sector B would be enlarged by a part of sector A. In that case, a/c would be still on FL_x and not on the FL_y as expected by sector B. There are two ways to handle this situation:

- sector A will descend the a/c earlier if possible and handover on FL_y
- sector B will take care of the a/c and descend it in its enlarged airspace

Both options need a coordination between the two ATSUs to agree on the options chosen by both ATSUs.

The LoA shall cover agreements covering specific aspects of the delegation, such as triggering, delegation related processes, preconditions for delegation etc., between the delegating ATSU and the receiving ATSU. Any deviations from the LoA would require specific coordination by phone between ATSUs.

3.3.2.2.2 Delegation agreements

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LoAs are agreed between cooperating ATSUs today. For the delegation of ATM services among ATSUs these LoAs are not sufficient and need to be extended to provide a full delegation agreement between two ATSUs.

A delegation agreement needs to define all the services that are delegated among two ATSUs including their technical parameters and performance boundaries during degraded modes of operation. Particularly, the procedures to be implemented if a failure happens during services are delegated (see 3.3.2.9 for a general description of possible counter measures) need to be described. Thus, delegation agreements will be very specific to the delegation use case between two ATSUs and therefore only a high-level recommendation can be given here. Details need to be agreed between the parties and defined in a delegation agreement.

Significant differences are expected when defining delegation agreements between ATSUs of the same ANSP (delegation within one country) compared to delegation agreements between two ATSUs belonging to different ANSPs (delegation between two countries). If delegation agreements are agreed between different ANSPs, the delegation agreements need to be approved by their National Supervisory Authorities.

The services described in the following subsections, need to be considered when defining a delegation agreement. Depending on the delegation use case, additional services might need to be considered.

3.3.2.2.2.1 Arrival management

In case the delegating airspace contains an arrival function via an AMAN, the use of AMAN is recommended in the receiving ATSU. AMAN is a support to sequence aircraft on arrival and meter them at the TMA entry fix. ATCO in the ACC sector should follow advisories mentioned on AMAN to ensure smooth arrival traffic and silent coordination.

Depending on the delegation use case, e.g., during night or low traffic situations, an AMAN might not be required in the receiving ATSU.

3.3.2.2.2.2 ARES management

In case the delegating airspace contains an ARES management function, the operational Supervisor of the receiving ATSU should have a direct phone line to pre-activate, activate, and deactivate the airspace. The ATCO on the sector should monitor different status of the ARES and its boundaries. This is particularly important in cases of Civ/Mil interaction (see UC #04 in described in the SPR-INTEROP/OSED of PJ.32-W3 [33]).

3.3.2.2.2.3 ATC overload management

The receiving ATSU should have a process to monitor ATC workload of the receiving airspace including its predicted traffic flows to prevent overload situations.

3.3.2.2.2.4 Tailored ATS

The delegating airspace may include tactical management of pre-defined and specific procedures (refuelling, drones, photo, military exercises, 7600, fuel shortage, medical assistance, aircraft interception etc.…). All concerned parties need to mutually approve the operational procedures and the receiving ATSU requires complete knowledge of it at different level: strategic, pre-tactic or tactical. Process should be ready to be in force in the receiving ATSU.

3.3.2.2.2.5 Flight Information Services (FIS)

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When FIS is in a different facility, the receiving ATSU should be in phone contact with the FIS and if the delegating ATSU has developed system coordination it is recommended to be available in the receiving ATSU as well.

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3.3.2.2.2.6 Emergencies

The delegation agreement between delegating and receiving ATSU should clearly define how emergencies will be managed by the operational Supervisor of the receiving ATSU. The necessary processes in the receiving ATSU that are required to respect the delegation agreement should be in place.

If a special tool support is required for handling emergencies in the delegated airspace, the delegation agreement shall describe which support is required, e.g., indicating the nearest airport that is certified to land a particular aircraft type having an emergency.

Special attention also must be on training the emergency situations in the delegated airspace at the receiving ATSU.

3.3.2.2.2.7 Considerations on failures of specific ATM/ANS or CNS/ATM systems and services

This section discusses some failures of ATC specific functions at the receiving ATSU during the delegation of ATM services among two ATSUs. These failures need to be considered in a delegation agreement.

When functional failures occur, they often occur at the ADSP where the data is produced. But a reason for a failure detected by an ATCO or ATSEP at an ATSU may also be caused by problems in the network which interconnects ADSP and ATSU. In all cases described in the following sections, the analysis and resolution of these failures include the technical Supervisors and the ATSEPs at both ADSP and ATSU and their close coordination which might be supported by tools and services.

3.3.2.2.2.7.1 RADAR Surveillance failure

A procedure in the delegation agreement should describe how Radar surveillance failures are handled in the receiving airspace. This might include the use of different surveillance sensor types.

3.3.2.2.2.7.2 Air-Ground Communication failure

A procedure in the delegation agreement should describe how to handle an Air-Ground Communication failure due to an ATC system failure in the receiving airspace. Different type of communication systems might be in operation and each one will have their own system management process.

3.3.2.2.2.7.3 ADSP failure

Failure of the data provision by the ADSP is considered as a failure having a strong impact on the ATSU. It might be caused by a failure of the ADSP itself or it might also be caused by a failure of the wide area network connection between the ADSP and the ATSU. A specific procedure should mention how to handle ADSP failure in the receiving ATSU. Since this has a very strong impact on the ATSU, it might be considered at the ATSU to define a backup ADSP for this situation. In any case the delegation agreement needs to define the contingency procedure for this situation.

3.3.2.2.2.7.4 OLDI/SYSCO failure

A specific procedure in the delegation agreement should mention how to handle OLDI or SYSCO failure in the receiving ATSU.

3.3.2.2.2.7.5 Safety net failures

The delegation agreement between delegating and receiving ATSU should clearly describe how safety net failure should be managed by the operational Supervisor of the receiving ATSU. The processes in the receiving ATSU to respect delegation agreement should be in place.

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Any safety net failure during the delegation should be declared to NSA of both the receiving ATSU and the delegating ATSU.

3.3.2.2.2.7.6 Conflict detection failure (MTCD/TCT/MONA)

A specific procedure in the delegation agreement should define how failures of conflict detection tools in the receiving ATSU will be handled. Most of the time it will result in a reduction of ATC capacity.

3.3.2.3 Delegation of ATM services and relation to third parties

Two ATSUs delegating ATM services among each other, do not exist in isolation, but there are many third parties around the delegating and the receiving ATSU which they need to coordinate with. In principle a third party shall not be impacted by a delegation of ATM services among two ATSUs. This section identifies the role of third party ATSUs before, during and after a delegation of ATM services between two ATSUs.

Figure 22222222Figure 2222~~Figure 22~~ depicts a sample airspace consisting of three sectors (S1-S3) which are managed by ATSU A (blue) and ATSU B (green). Sector S2, originally managed by ATCO A1, is delegated to ATSU B and subsequently manged by ATCO B1. A flight is entering from ATSU C, controlled by ATCO C1, into the sector S2.

Before a delegation is initiated, all coordination is done between ATCO A1 and ATCO C1. When a delegation is initiated, ATCO A1 is still in charge until the control is handed over to ATCO B1. Therefore, all coordination is still done between ATCOs A1 and C1. But ideally, ATCO B1 is aware of the coordination between A1 and C1. This can be provided by technical means or as part of the coordination between ATCOs A1 and B1 during the delegation of sector S2.

After sector S2 is delegated to ATSU B and ATCO B1 is in charge, it must be ensured that ATCO C1 who is not involved in the delegation does not need to know that sector S2 was delegated. Therefore, whenever ATCO C1 needs to coordinate with the ATCO in charge of sector S2, it shall not make a difference if the sector is delegated or not. That means that all necessary coordination and communication data (e.g., G/G telephony, OLDI lines, data link connections, …) between the delegating ATSU and third parties need to be available at receiving ATSU. The technical Supervisors are responsible for assuring the data provision during the whole process.

In non-nominal cases, manual interaction might be necessary due to missing functionality or integration of the backup systems. This is a very crucial situation which causes stress to the operational and technical staff in the ATSUs as well to the technical staff in the ADSPs.

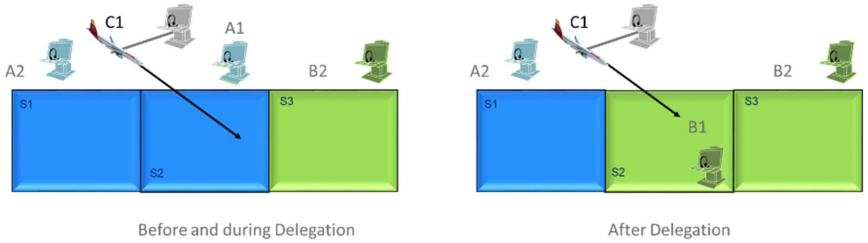

Figure 2222222222: Delegation of ATM services among ATSUs and third parties

3.3.2.4 Operational and Technical considerations in relation to third parties

There is a requirement to show that coordination to the receiving controller is provided in such a way that they understand what is happening. It needs to be clear on the delegating side which co-ordinations are being lost to the receiving to make the handover efficient and clear. Figure 16 outlines the Controller Working Position (CWP) HMI operational and technical consideration. Not shown in the figure is the technical part which includes but is not limited to technical working position for monitoring and controlling the CWPs, the local processing, and the communication systems

- The relevant flights impacted shall be displayed on the receiving sector CWP during the delegation process. This is to ensure that the 3rd ATSU impacted during the delegation process between the primary ATSUs (A and B) has visibility of all the relevant flights impacting a 3rd ATSU or that will be inherited and do not suddenly appear on the 3rd ATSU sectors.
- If the coordination is in place when delegation occurs, it will need to be copied to the receiving controller and clearly indicated that this is a coordination that the delegating sector is in place with a 3rd party, and that it is not for them to alter/action until they have control of the sector.
- Once the receiving sector has taken control, all coordination should appear as they would normally.

The slightly more complicated flight to represent would be a flight coordinated into the delegating sector that will enter the receiving sector as well, especially if it will be two different levels. The ATCO will need to be notified with a clear indication that this level is changing.

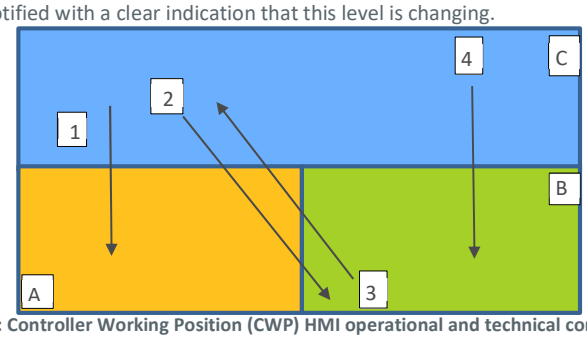

Figure 16: Controller Working Position (CWP) HMI operational and technical consideration

A is delegating to B: Route 1 has a coordination C to A that B knows nothing about so the coordination would need to be replicated on B's position, within the HMI, and clearly denoted as such so B knows not to change/agree anything until they have control. Whether this is colour coded or a separate coordination section, some CWP/HMI solution is needed.

Route 2 is more complicated: There is a coordination C to A that B needs to know about as above. Before the handover was initiated there may also have been a coordination in place of A to B depending on timings. I believe that on handover the A to B handover would be removed since the preview will be of A and B sector combined and therefore there would not be a coordination between the two. This means that the coordination C to A would appear, and it needs to be clear in the HMI that this is not the A to B coordination even though the callsign and level could superficially appear to be the same.

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For route 3, it is similar to the issues for route 2. When A is delegating to B, the B to A coordination would be removed but a new coordination from A to C may well appear depending on timings and it would need to be clear that B is not supposed to interact with this until the handover is completed. With agreement with A, B could change it, but it would need the approval of A since they are still in executive control. If this was to be allowed, then it would need to be replicated on both working positions.

The issues with routes 2 and 3 would apply if C was an external or internal ATSU.

Route 4 coordination would stay the same but as with the other coordinations there needs to be someway of separating it from the new co-ordinations that are being inherited, whether by HMI / training, or some other means.

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3.3.2.5 Prerequisites for delegation ATM services between ATSUs

This section describes a list of prerequisites that need to be fulfilled to enable a delegation of ATM services among ATSUs. This is not an exhaustive list but giving an overview of the prerequisites related to the delegation of ATM services among ATSUs.

P1 **Delegation procedure is generic**
A delegation procedure defines all the actors involved in the process, their activities, and their order of execution. To ensure that the ATCOs are familiar with the procedure and ensure a safe execution, the procedure must be identical regardless of the reason why a delegation needs to be performed.

P2 **Delegating and receiving ATSUs need to be defined**
Delegating and receiving ATSU which are involved in a delegation of ATM services are always defined. A delegating ATSU knows all its potential receiving ATSUs that it might delegate ATM services to. There may be more than one receiving ATSU. If there are more than one receiving ATSU, it may be decided dynamically at runtime to which receiving ATSU, ATM services are delegated. But ATM services are never delegated to a receiving ATSU that is not defined beforehand.

P3 **Agreements need to be in place when delegation is done between states (including third parties)**
ATM services can be delegated between ATSUs of the same ANSP or within the same country. But there is also the possibility to delegate ATM services among ATSU of different states and/or ANSPs. In the latter case, agreements need to be in place that define the legal frame for the delegation between the partners.

P4 **Delegation agreements describing all conditions, constraints, and procedures between delegating ATSUs, receiving ATSUs and concerned third parties need to be in place**
For all delegations of ATM services between ATSUs, delegation agreements need to be in place which define all necessary procedures, constraints and conditions that are required for a safe delegation of ATM services among two ATSUs. This point is always valid, regardless if ATM services are delegated among ATSUs of the same ANSP or if the delegation is done between two countries. Delegation agreements are always required.

P5 **Trigger of a delegation: scheduled vs. semi-dynamic**
As described in prerequisites P2 to P4, the partners, constraints and procedures need to be defined beforehand. Triggers of delegations can be subdivided into two categories: a delegation may be performed regularly according to a defined schedule, or the delegation is on-demand and the point when a delegation is performed is determined dynamically. Since the delegation partners are selected from a predefined set, the delegation is categorised as semi-dynamic.

P6 **ATCOs of the receiving ATSU need to be licensed appropriately**
In order to be able to provide ATM services for a delegated piece of airspace, the ATCOs of the receiving ATSU need to hold the appropriate licences for the airspace they are intended to take the responsibility for. If the receiving ATSU cannot provide appropriately licensed ATCOs, ATM services cannot be provided for a delegating ATSU.

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P7 ATSEPs of ATSUs and ADSPs need to be licensed appropriately
In order to assure the availability of the technical systems and the integrity of the provided ATM data, all ATSEPs working in the delegating and receiving ATSU and in associated ADSPs need to be trained, competent and properly authorised according to regulation EU 373/3017.

P8 All adaptation data of the involved systems needs to be prepared offline and be available in the system during runtime
In the same way the participating delegating and receiving ATSUs need to be defined beforehand, all adaptation data of the systems which is required to delegate ATM services among ATSUs during runtime needs to be prepared offline and be available during runtime. The adaptation data prepared offline contains all the information to support the intended delegations of ATM services among the ATSUs defined before. This information contains all the required information of the airspace being subject to delegation including sector borders, coordination points, coordination levels, airways, etc.

P9 Adaptation data is not manipulated during runtime
The adaptation data is prepared offline, tested, and approved before being imported into the ATM system. The adaptation data is not changed during runtime, but elements, such as sectors, might be activated or deactivated according to delegations of ATM services among ATSUs.

P10 Third party ATSU involvement
Third party ATSUs not being involved in a delegation of ATM services among two ATSU are not affected by the delegation.

P11 En-Route and TMA airspace
The delegation procedure described in the following section is applicable to En-Route and to TMA airspace. In principle the delegation procedure can be applied to any type of airspace. The activities that need to be performed by the actors will be the same, but there might be differences in terms of required information for safely managing an airspace. For example, in TMA airspaces arrival management might be required and if the airspace is delegated, this information need to be available to the receiving ATCOs as well.

P12 Traffic situation must allow delegation
The delegation of ATM services depends on the traffic situation in the sector that shall be delegated since the execution of the delegation procedure requires attention by the involved ATCOs in the delegating and receiving ATSU. This requires that during the handover, the ATCOs are not distracted to perform the handover safely. Therefore, the delegation procedure is putting a checkpoint during the delegation request (see section 3.3.2.6.2) if the delegation request can be accepted.

P13 Complexity of airspace must be suitable for delegation
As described in P11, the delegation procedure is applicable for En-Route and TMA airspaces. But the complexity of airspace might limit the possibility of delegation of ATM services for this airspace among ATSUs.

P14 Safety margin
If an ATSU receives sectors from another ATSU, it needs to keep sufficient spare capacity to be able to react on unforeseen traffic flow changes during the delegation.

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P15 NM informed about delegation
In order to have a complete picture about the open sectors and the ATSUs being responsible for them, the Network Manager needs to be informed about each delegation of ATM services between two ATSUs.

P16 ATSUs are equipped according to mandates
It is expected that the ATSUs involved in the delegation of ATM services among them are equipped according to the mandates that are valid for the affected airspace. Ideally, delegating and receiving ATSU are equal in terms of equipment and functionality.

P17 Recording capabilities
To enable the investigation of incidents, the delegating and the receiving ATSU need to record all system interactions as well as voice communication.

P18 Surveillance-based ATC
The concept described in this OSED is applicable for Surveillance-based ATC.

P19 All services provided must be cybersecure through the implementation of related systems and procedures
ATSEPs in the delegating and receiving ATSU and in the ADSPs will be trained and competent to tactically address technical or cybersecurity failures without, ideally, the effect of a cyberattack reaching the CWP

3.3.2.6 Delegation Procedure

The delegation procedure involves two geographically separated ATSUs, which are depicted as swim lanes in Figure 23232323Figure 2323~~Figure 23~~. The following procedure describes the delegation of ATM services provision for one individual sector[7]. If ATM services provision for several sectors needs to be delegated, this procedure can be carried out multiple times in parallel by different ATCO teams.

The procedure generically describes the delegation of ATM services provision between two ATSU. If, for some operational used cases, such as night delegation, the provision of ATM services is delegated back and subsequently reversed after a period of time, then the delegation procedure would be executed twice. When closing ATSU A at night, they would delegate the ATM services provision for their sectors to ATSU B. When reopening ATSU A again in the morning, then the same delegation procedure would be used but in the opposite direction.

The delegation procedure is described from the perspective of two ATSUs that share a common ADSP. The procedure is also applicable to an environment in which multiple ADSPs are involved that synchronise among themselves and therefore appear as a single logical ADSP. But the modelling of inter-ADSP interfaces is not part of Solution 93.

When multiple ADSPs are used that are not synchronised, some changes may appear to certain phases of the delegation procedure. These changes are described in section 3.3.2.6.9 on page 103102~~101~~.

[7] In principle, parts of sectors could be delegated as described in section 3.3.2.1.3. This requires that the system is able to dynamically define new sector boundaries during runtime as researched by [29].

3.3.2.6.1 Overall Delegation Procedure

In the following sections a procedure is described for the transfer of responsibility for the provision of ATM services in a volume of airspace between two ATSUs: the delegating ATSU and the receiving ATSU. The procedure is intended to be as generic as possible and to imitate as far as possible the common, everyday procedure used by a sector team when handing over responsibility for a sector(s) at the end of their shift to an incoming sector team. Therefore, the delegation procedure is applicable to all kinds of delegations, e.g., regular delegation at night-time, ATFCM-based delegation providing capacity-on-demand or even contingency cases. The procedure is a sequence of tasks performed by the delegating and receiving ATSU operational staff and, where necessary, technical staff.

Notes and assumptions:

1. The sequence is not meant to be too prescriptive in the order of the tasks but there is necessarily some order and coordination between the actors required.
2. Actions described as being performed by one actor, may be performed by other actors if the capability exists and the need arises, e.g., an ATCO may perform a task identified as being performed by an operational Supervisor. This may depend on local implementation choices.
3. The procedure assumes that the sector team consists of a Planner and Executive controller, but single ATCO operations are not precluded.
4. In the procedures the Executive ATCO is always described as the leading ATCO, e.g., informing the operational Supervisor about a certain condition. These tasks could also be performed by the Planner ATCO. To reflect that in the models would overcomplicate them.
5. The delegation procedure describes the necessary steps to delegate one sector from a delegating ATCO team to a receiving ATCO team. Depending on the use case, a set of sectors might be delegated, e.g., in night delegation all sectors of an ATSU would be transferred to another ATSU. This means that several ATCO teams are performing the delegation procedure in parallel. Necessary details will be provided in the use cases as required.
6. The receiving ATCO team could be either idle or they might already be in control of a sector. In the latter case, the delegated sector needs to share a common boundary with the sector already under control by the receiving ATCO team.
7. In some parts of the delegation procedure an ADSP is used to illustrate necessary interactions with the ATM system. However, that does not preclude any legacy architecture solutions that do not implement the Virtual Centre concept.
8. The operational Supervisor is the responsible person taking the decisions in the ops room to delegate or not and to take the necessary preparatory steps. Depending on the local implementation the operational Supervisor also has the technical means to perform these steps, or he needs to request these steps from a technical Supervisor or ATSEP.

The overall delegation procedure is initiated by the delegating ATSU sending a delegation request to the receiving ATSU (see Figure 23232323Figure 2323~~Figure 23~~). If the receiving ATSU accepts the delegation request, several preparatory steps must be performed before it is able to take over traffic and control the sector(s) to be delegated. During the 'Enter Preview Mode' phase the CWPs taking

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over the sector are switched into a 'display-only' Preview Mode[8] where traffic in the sector(s) being delegated is displayed but the receiving ATCOs are inhibited from communicating with the aircraft and from entering tactical commands into the system before responsibility for the sector has been handed over. During the 'Delegation Preparation' phase the receiving ATCO team prepares their CWPs. If a problem occurs, the delegation procedure can be aborted. Otherwise, the receiving ATCO team initiates the 'Handover Traffic' phase during which the delegating ATCO team explains the traffic situation and the plan to manage it in the short term to the receiving ATCO team. After this phase is finished, the 'Enter Operational Mode' phase is executed in which the receiving ATCO team switches their CWPs to operational mode and the delegating ATCO team may switch to shadow mode for safety reasons for a certain period of time. Finally, the 'Exit Preview Mode of delegating ATSU' phase ends the Preview Mode of the CWPs of the delegating ATCO team and the CWPs are switched to idle.

Important: a delegation can be aborted at any time before the receiving ATSU has taken control of the delegated airspace. To keep the diagrams readable, the abort is only described at a particular phase of the delegation procedure.

Each of the phases is described in more detail in the following sections.

[8] The term 'Preview Mode' was chosen on purpose even if its name is not perfect during all the phases of the procedure since the term 'Shadow Mode' is connotated already with different meanings.

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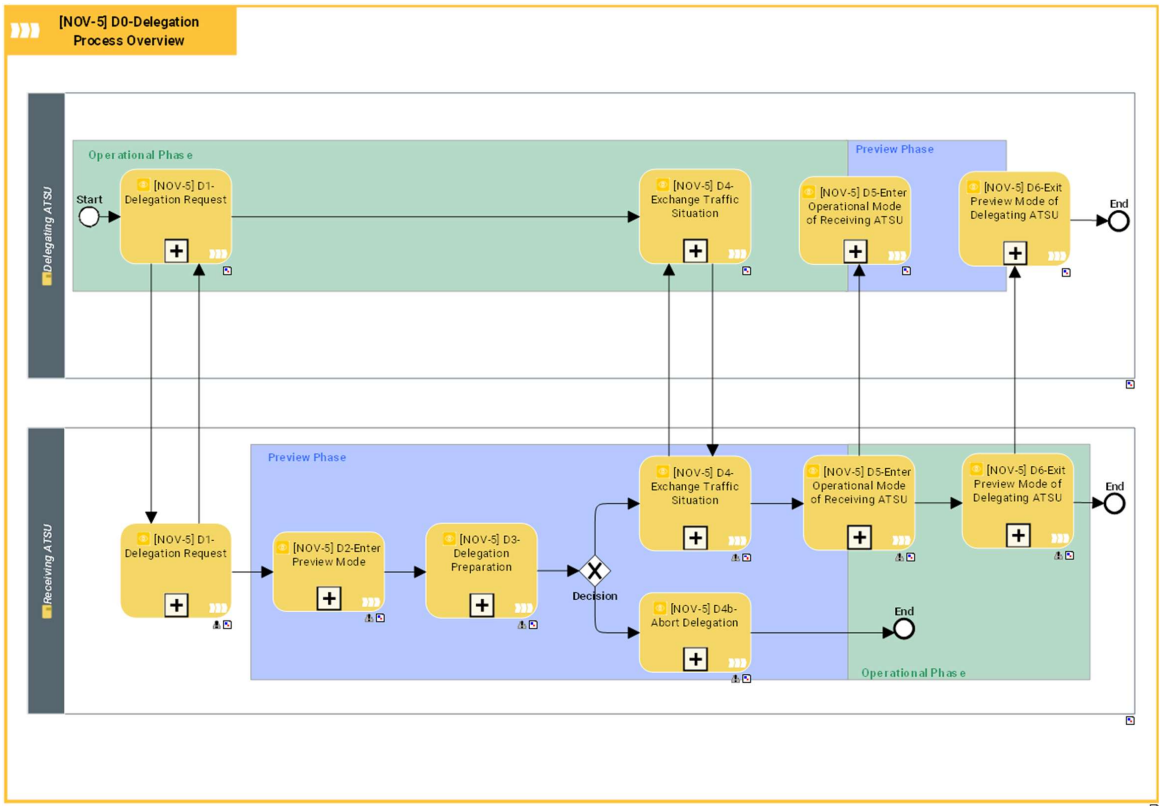

Figure 2323232323: Overview of the delegation procedure

The delegation procedure has some potential parallel activity which is not explicitly shown in Figure 7. If a use case requires the delegation of multiple sectors from one ATSU to another, e.g., during a night delegation (cf. section 3.3.2.3.1), there will be a parallel exchange between multiple ATCO teams in the two ATSU, once the operational Supervisors have agreed upon the start of the delegation. Since several ATCO teams coordinate in parallel with their counterparts, each coordination might take a different time to complete. Therefore, the delegation of all individual sector does not necessarily end at the same time and thus the handover of control can be asynchronous for each individual sector.

When delegating ATM services provision between two ATSUs, two fundamental cases can be distinguished:

- The receiving ATCO team is not in charge of a piece of airspace, and
- The receiving ATCO team is already operationally in control of a piece of airspace.

Delegation of ATM services provision to an idle ATCO team

The ATM services provision for a sector is delegated to an ATCO team that is in a different ATSU than the ATCO team being in responsibility of the sector. At the initiation of the delegation, the receiving ATCO team is idle, i.e., they have no sector under control. This is depicted in Figure 24242424Figure 2424~~Figure 24~~, where $ATCO_1@ATSU_a$ is initially having responsibility of Sector A and is delegating the provision of ATM services to $ATCO_2@ATSU_b$ who is initially not in control of any sector. After the provision of ATM services has been successfully delegated to $ATCO_2@ATSU_b$, they are responsible for the sector and $ATCO_1@ATSU_a$ becomes idle.

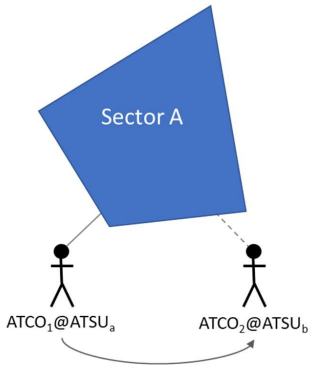

Figure 2424242424: Delegation of ATM services provision to an idle ATCO team

During this delegation process, the ATM services of both ATSUs undergo certain state changes. Figure 25252525Figure 2525~~Figure 25~~ depicts the chronological sequence of the different system states in the receiving and the delegating ATSU. The delegating ATSU remains in control until the 'Enter Ops Mode' phase is reached at the receiving ATSU. Before reaching this phase the ATCO team at the receiving ATSU is preparing their CWP for taking over the delegated sector.

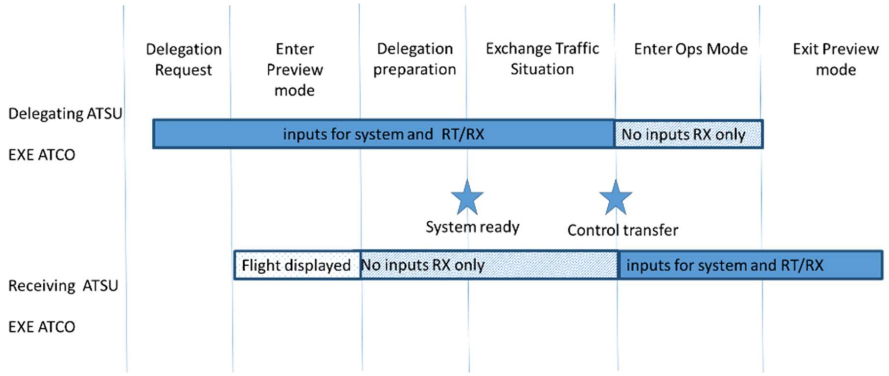

Figure 2525252525: Delegation of ATM services provision to an idle ATCO team

Delegation of ATM services provision to an ATCO team already controlling airspace

The second principal case is the delegation of the provision of ATM services to an ATCO team in a geographically separated ATSU which is already in control of a sector. This requires a consolidation of the sector being controlled and the sector being received from another ATCO team. A high-level overview is depicted in Figure 26262626Figure 2626Figure 26, where $ATCO_1@ATSU_a$ is initially having responsibility of Sector A and is delegating the provision of ATM services to $ATCO_2@ATSU_b$ who is already responsible for controlling Sector B. After the provision of ATM services has been successfully delegated to $ATCO_2@ATSU_b$, they are responsible for sector A and $ATCO_1@ATSU_a$ becomes idle. Sector A and B need to be consolidated, i.e., merged and managed as a single sector, as part of the delegation process.

The reverse operation is the splitting of the sectors A and B and delegating sector A back to $ATCO_1@ATSU_a$.

In general, the delegation increases the workload of the receiving ATCO team. Thus, a delegation can only be consolidation can only be performed if the workload of the ATCO permits.

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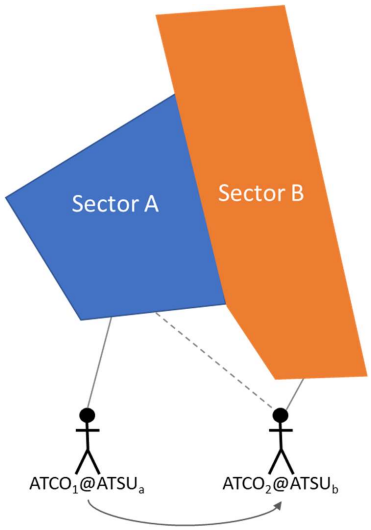

Figure 2626262626: Delegation of ATM services provision to an ATCO team already controlling airspace

If the receiving ATCO team is already controlling airspace, they need to prepare the delegation of a sector in parallel to the control of their sector. This is depicted in Figure 27272727Figure 2727Figure 27 where the yellow bar is indicating the parallel management of the original sector of the receiving ATCO team. Therefore, a delegation to an ATCO team that is already in control of airspace is only possible if the workload of the receiving ATCO team permits.

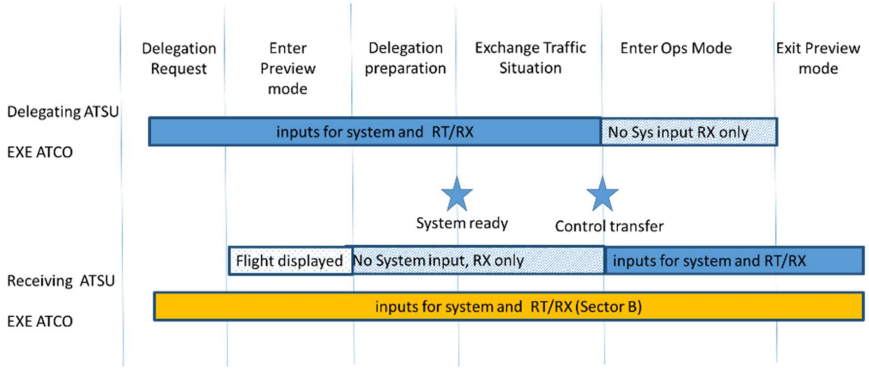

Figure 2727272727: Delegation of ATM services provision to an ATCO team already controlling airspace

The examples above focus only on the delegation of one sector between two ATSUs. Besides the delegated sector the delegating ATSU can still be in control of more sectors. Or the delegating ATCO is still managing some airspace because they only delegated a part of their airspace, e.g., by splitting the sector and delegating one part of it.

3.3.2.6.2 Delegation Request

This is the initial phase of a delegation of ATM services provision between two ATSUs as depicted in Figure 28282828Figure 2828~~Figure 28~~. This phase is triggered by different events related to various use cases, e.g., delegation during night-time (see section 3.3.2.8.2.1 on page 128127~~126~~). Independent of the triggering mechanism the delegation procedure is always the same. It is expected that the operational Supervisor of the delegating ATSU has evaluated if the traffic situation is suitable for the execution of the delegation procedure before the delegation is requested to the receiving ATSU (see use cases described in SPR/INTEROP OSED of PJ.32-W3 [33]).

This phase is initiated by the operational Supervisor of the delegating ATSU checking with their technical Supervisor if the envisaged delegation of ATM services is supported by the system from a technical perspective in terms of required services and data. If required, the technical Supervisor is requesting a detailed technical analysis from their ATSEPs. The ATSEP is then checking the technical status of the system and provides technical advice to the technical Supervisor. If there are any technical constraints preventing a delegation of ATM services, the operational Supervisor will terminate the procedure at this stage. If the system is technically able to support the delegation of ATM services, the operational Supervisor of the delegating ATSU is sending a delegation request for one or more sectors to the operational Supervisor of the receiving ATSU.

Currently, this would be via a telephone call but could be via a service request in the future. This phase consists of the following main steps:

- When receiving a delegation request, the operational Supervisor of the receiving ATSU determines from an operational perspective whether a safe delegation can proceed by evaluating the current traffic, staffing and other conditions against a checklist tailored to the local airspace.
- If the envisaged delegation is possible from a technical point of view, the operational Supervisor of the receiving ATSU cross-checks with their technical Supervisor if the envisaged delegation is technically possible or not. The technical Supervisor of the receiving ATSU may coordinate with the ATSEPs of the receiving ATSU if required.
- The ATSEPs of the receiving ATSU check the technical status of their system and provide technical advice to the technical Supervisor of the receiving ATSU.
- Depending on the outcome of the operational and technical evaluation of the delegation request, the operational Supervisor of the receiving ATSU is indicating to the operational Supervisor of the delegating ATSU that the delegation can either proceed, be delayed, or denied.
- Depending on the answer, the operational Supervisor of the delegating ATSU may either cancel or delay the delegation in case of a negative answer, or on positive answer the delegation is expected to be confirmed to the operational Supervisor of the receiving ATSU.
- On the delegating ATSU side, the operational Supervisor needs to inform the Executive and the Planner ATCOs that a delegation is going to take place. They are already on duty and are then preparing themselves for the delegation, e.g., by having checklists at hand for the handover of the traffic and are standing-by to be contacted by the receiving ATCO team after they have finished their initial preparation.

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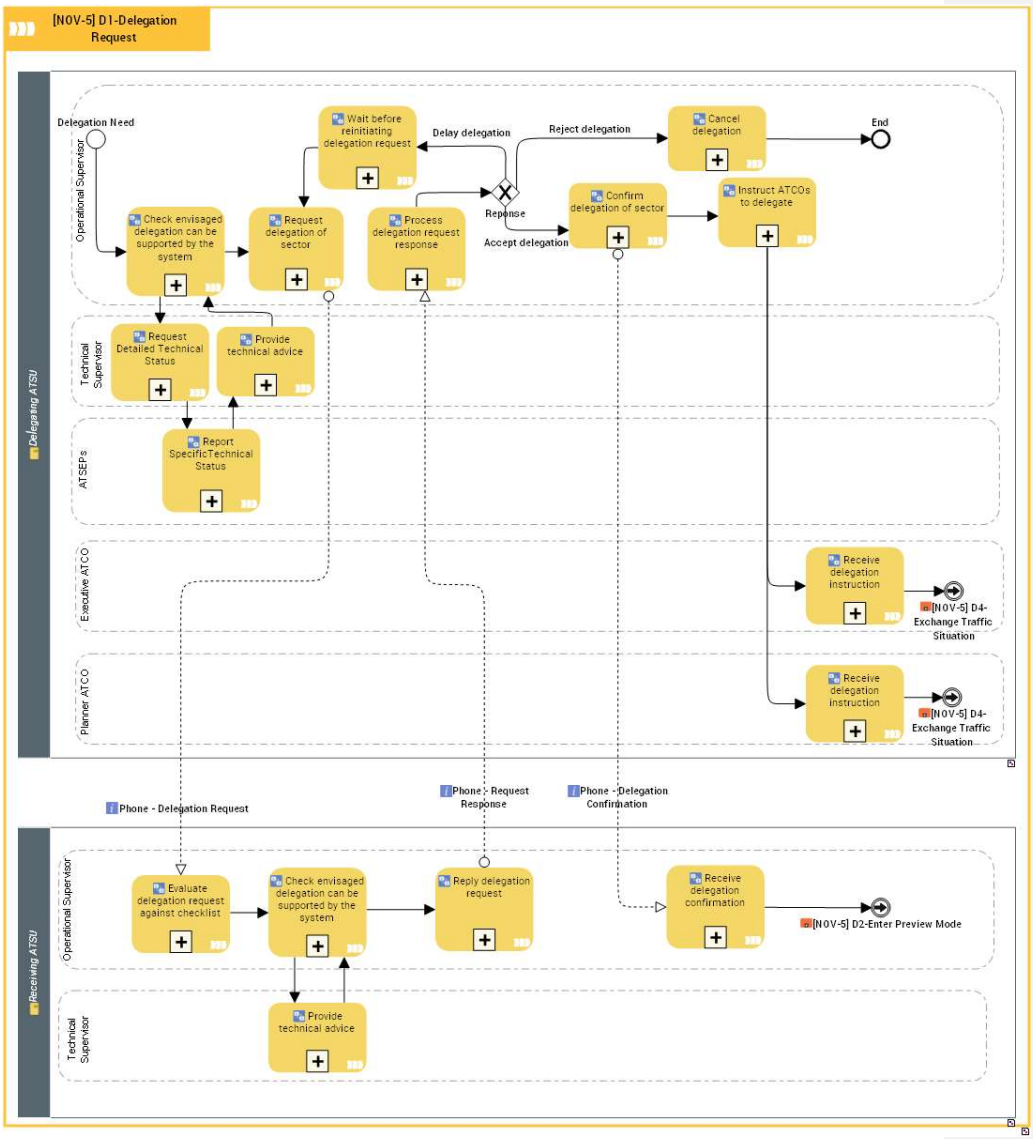

Figure 2828282828: Initiating a delegation request

3.3.2.6.3 Enter Preview Mode

In the context of delegation of ATM service provision and contingency, the principal purpose of Preview Mode is to display to the receiving ATSU's controllers the traffic that they will inherit because of the delegation. The traffic displayed will include those flights under the control of the delegating

sector and traffic of interest to that sector, particularly traffic that will shortly be under the control of that sector. The display of the traffic, in conjunction with a handover briefing from the delegating controllers, enable the receiving controllers to understand the traffic situation and take responsibility for the delegated traffic in a safe and efficient manner.

A secondary purpose of Preview Mode is to inhibit the entry of clearances and other instructions. This may be achieved

- by operational procedures agreed between ATSUs or
- by intervention by the system to prevent such inputs or
- by a combination of the two options.

Which method is chosen must be agreed by the participating ATSUs and included in the Delegation Agreement to avoid any possibility of misunderstanding.

The 'Enter Preview Mode' phase is the start of the preparations on the receiving ATSU side. Figure 29292929Figure 2929~~Figure 29~~ depicts the process flow of this phase of the delegation procedure. The operational Supervisor of the receiving ATSU decides the operational sector configuration to be used to accommodate the delegated sector(s). Depending on whether a delegation is done regularly, e.g., a daily night delegation, or less frequently, there might be some tasks necessary to be done. The technical Supervisor checks if the operational sector configuration is ready for activation. If the operational sector configuration is not yet ready, the ATSEP performs the necessary steps to prepare the system and checks if the system works properly with the newly activated operational sector configuration. This includes an interaction with the ADSP providing data to the receiving ATSU.

When the operational sector configuration has been decided, the operational Supervisor triggers the switch of the receiving ATSU Executive and Planner CWPs that will receive the delegated sector(s) into Preview Mode via a service request to the involved ADSP. In principle, the activation of the preview mode may be triggered by the operational Supervisor of the receiving ATSU or one of the receiving ATCOs, depending on the local implementation choice. In Preview Mode, the CWP displays the traffic but system inputs that affect the flight data are inhibited. The new mode of the CWPs is distributed back from the ADSP to the CWPs that subsequently change from idle mode to Preview Mode. The operational Supervisor informs the ATCO team (Executive and Planner) to prepare for the upcoming delegation.

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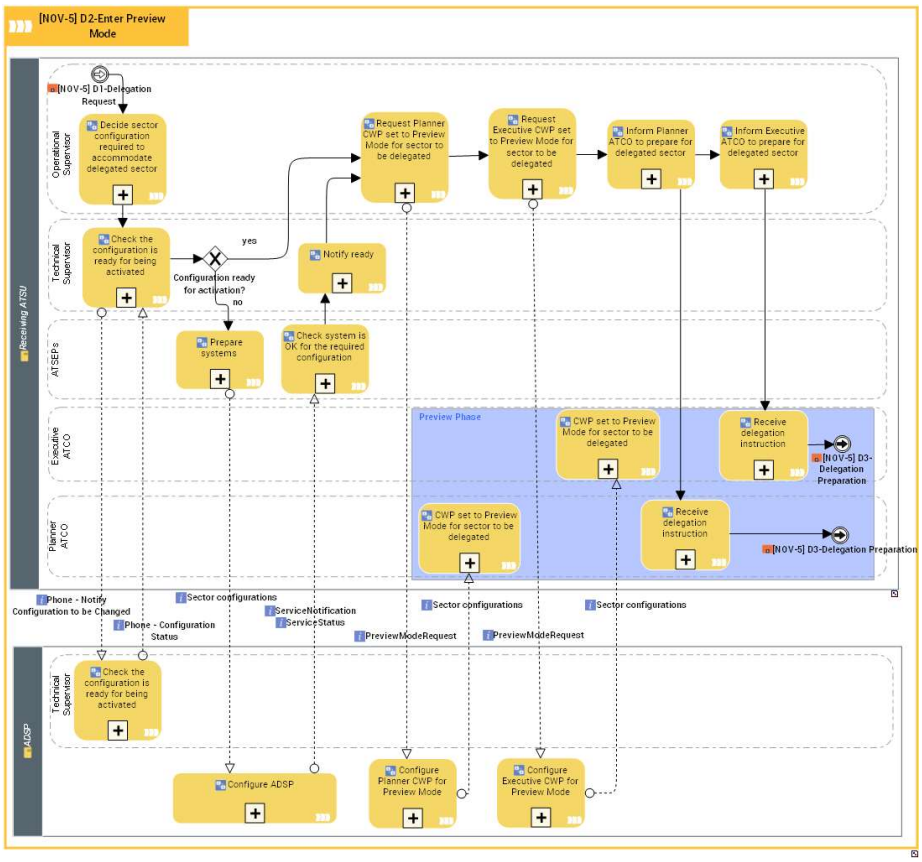

Figure 2929292929: Enter Preview Mode

3.3.2.6.4 Delegation Preparation

During this phase the receiving Executive and Planner ATCOs prepare their working positions for the upcoming delegation (see Figure 30303030Figure 3030Figure 30). This includes selecting the appropriate maps, filters and tools required to manage traffic in the sector(s). In addition, the Voice Communication System (VCS) must be configured so that the A/G frequencies are set for Rx only and G/G connections are established. By integrating the ATM system and the VCS, it would be possible to automatically switch sector frequencies to Rx as soon as the preview mode for a sector is activated. This would particularly provide benefit to ATCOs when operating sectors that are not well known to them.

At the end of the phase, the receiving Executive and Planner ATCOs check that their CWPs are ready for the handover of traffic. Only if both positions are correctly prepared the delegation procedure can proceed. If a problem is encountered, the delegation procedure may need to be aborted if it cannot be resolved quickly. If the problem can be fixed in a reasonable time, then the procedure is only delayed and will continue with the 'Exchange Traffic Situation' phase after the problem is solved.

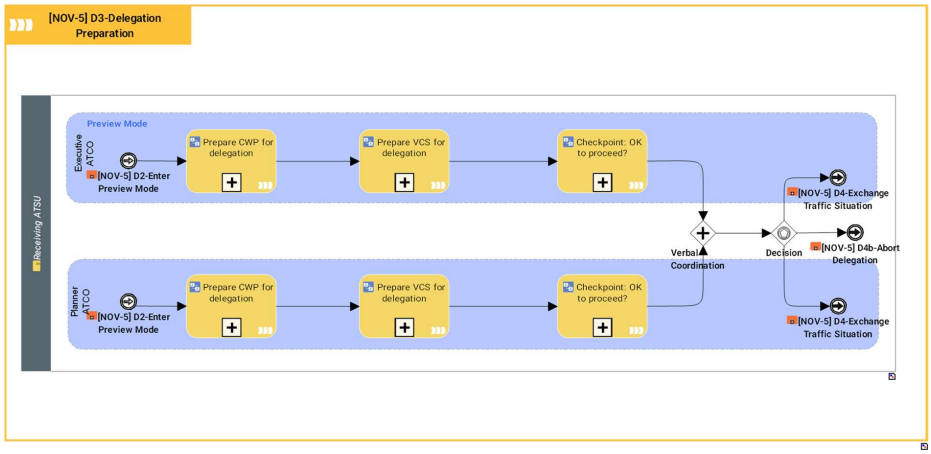

Figure 3030303030: Delegation preparation

3.3.2.6.5 Abort Delegation

In the event of a problem on the receiving side which cannot be resolved quickly, e.g., unavailability of radio communication or failure of the CWP, the delegation procedure needs to be aborted. Furthermore, there might occur operational situations, such as a sudden emergency call of an aircraft, that require to abort a delegation requested by the delegating ATSU although the delegation request was positively replied by the receiving ATSU before.

Important: a delegation can be aborted at any time before the receiving ATSU has taken control of the delegated airspace. To keep the diagrams readable, the abort is only described at this particular phase of the delegation procedure.

The process flow of this phase is depicted in Figure 31313131Figure 3131~~Figure 31~~. In this case, either the receiving Executive or Planner ATCO informs their operational Supervisor of the receiving ATSU that a problem has occurred during the preparation of the CWPs. Besides this, a problem may also be detected by the operational Supervisor themselves through the supervision tools available at the operational Supervisor position. The operational Supervisor of the receiving ATSU then consults experts to decide if the problem can be fixed quickly and the delegation can be continued or if the delegation needs to be aborted. This involves the technical Supervisor of the receiving ATSU and their ATSEPs for a detailed technical analysis of the problem.

At the technical level, the ATSEPs of the receiving ATSU are responsible to analyse the system and to solve problems if possible. They provide technical advice to the technical Supervisor of the receiving ATSU. In the latter case the operational Supervisor of the receiving ATSU forwards this information about the abort to the operational Supervisor of the delegating ATSU who subsequently informs the ATCO team of the delegating ATSU about the abort of the delegation procedure.

In addition to the delegating ATSU the Network Manager needs to be informed about the abort delegation. There might be a regular delegation between two ATSUs, such as a night delegation, that needs to be aborted. To have a full picture of the ATM network in Europe, the NM needs to be informed

if a delegation is aborted. In addition to the Network Manager, additional third parties might need to be informed, such as Military, airports, adjacent ATSUs, etc.

On the receiving ATSU side, the operational Supervisor requests the switch of the CWPs from the Preview Mode back to the previous mode for the affected sector. This request is processed by the ADSP and redistributed to the CWPs.

The procedure ends here. The consequences of aborting the delegation procedure are depending on the use case and will be elaborated in more detail in section 3.3.2.8 when describing the different use cases.

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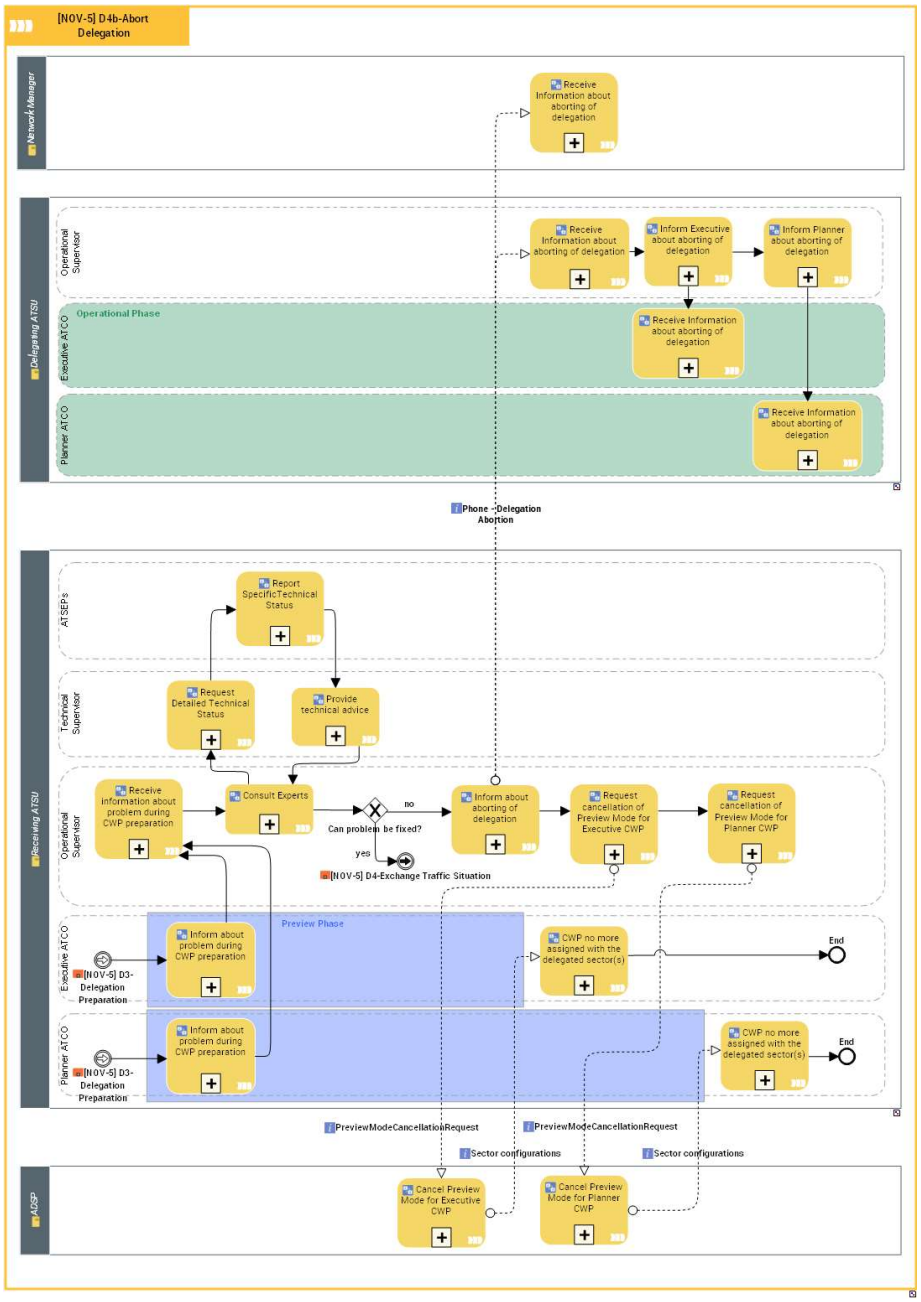

Figure 3131313131: Abort delegation

3.3.2.6.6 Exchange Traffic Situation

If the preparation of the receiving ATSU was completed successfully, everything is in place to initiate the handover of traffic from the delegating ATSU to the receiving ATSU to switch the responsibility for providing ATM services in the delegated sector. During this phase the receiving and the delegating ATCO team are in direct contact to exchange information about the current traffic situation as depicted in Figure 32323232Figure 3232~~Figure 32~~.

The exchange of traffic can start as soon as the receiving ATCO team has finished their preparation and they have called the delegating ATCO team. By watching the traffic situation in preview mode and listening to the sector frequency, the receiving ATCO team tries to determine if the current traffic situation is suitable to start the handover. Nonetheless, the delegating ATCO team may have the need to slightly delay the exchange the traffic, if there are urgent situations that need to be handled beforehand.

The communication is established by the receiving Executive and Planner after they have successfully prepared their positions and collectively decided to continue the delegation procedure. They contact their counterpart on the delegating ATSU side. The receiving controllers have the traffic displayed on their CWPs and, after contact is established, they request the tactical information for the flights relevant to the sector (Executive) and the plans for the short-term traffic entering/leaving the sector (Planner) respectively. When both the receiving Executive and Planner controllers are confident that they understand the traffic scenario and are ready to take over the sector, the next phase is entered.

This is a very critical phase of the delegation procedure because after the exchange the delegating and the receiving ATCO team need to be fully synchronised. It is essential, that the receiving ATCO team has the full picture of the traffic in the sector to be delegated. All operational intentions and potential conflicts need to be explained by the delegating ATCO team. A systematic approach needs to be applied for this exchange to make sure no flights are forgotten, e.g., explaining the flight from north to south or starting with the most critical ones and finishing with the most uncritical flights. In addition to this, all flights shall be read-back and acknowledged by the receiving ATCO team.

To have a standardised handover a tool like the WEST checklist shall be used (see Appendix D), which covers weather, equipment, situation, and traffic information.

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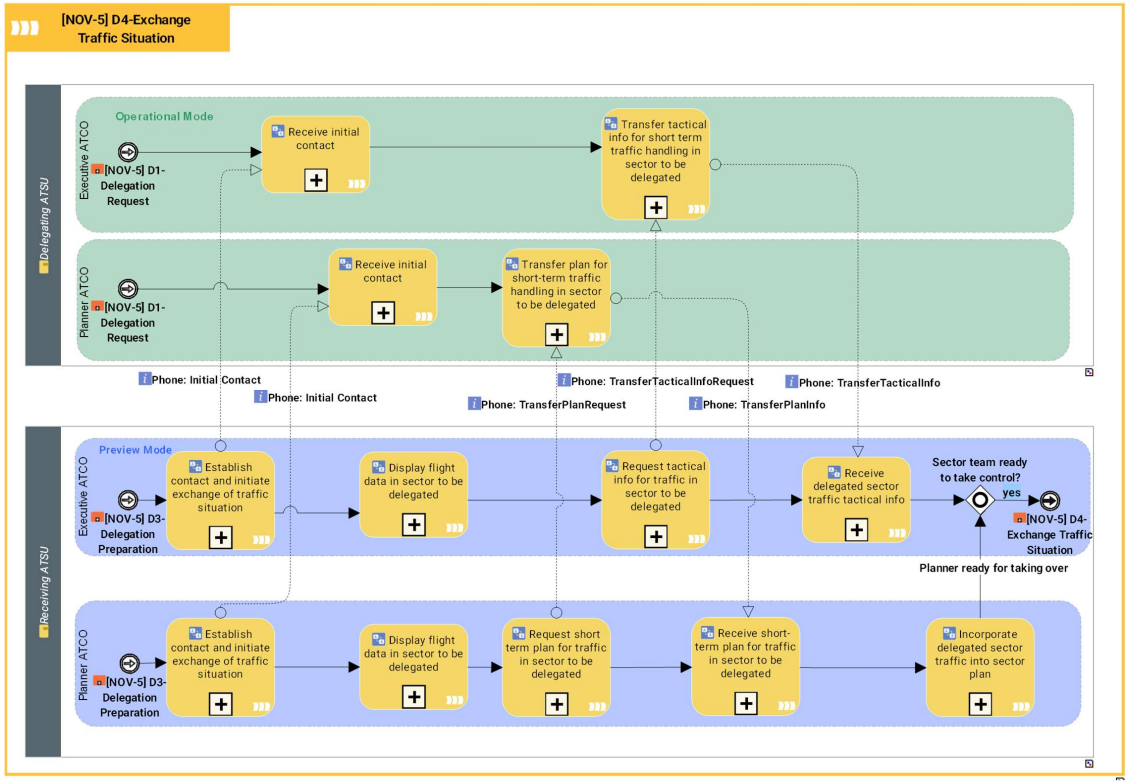

Figure 3232323232: Exchange Traffic Situation

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3.3.2.6.7 Enter Operational Mode

After the traffic situation has been exchanged, the CWPs of the receiving ATCO team need to be switched from Preview Mode to operational mode and the CWPs of the delegating ATCO team need to be switched to Preview Mode. In principle, this switch may be triggered by the operational Supervisor of the receiving ATSU or one of the receiving ATCOs, depending on the local implementation choice. In Figure 33333333Figure 3333~~Figure 33~~ and in the further description of this phase, the operational Supervisor triggers the switch.

Initially, the receiving Executive ATCO switches the frequency of the sector to Tx/Rx on their VCS and informs their counterpart at the delegating ATSU that control has successfully been taken over. Consequently, the delegating Executive relinquishes the responsibility for the sector and switches the sector frequency on their VCS from Tx/Rx to Rx only to follow the radio communication during Preview Mode. By integrating the ATM system and the VCS, the sector frequencies of the delegated sector could be automatically switched from Rx to Tx/Rx in the receiving ATSU and from Tx/Rx to Rx in the delegating ATSU as soon as they switch from preview mode to operational mode and vice versa.

The receiving Executive ATCO informs the operational Supervisor of the receiving ATSU that the previous phase was successfully completed, and that the receiving ATCO team has taken over control of the sector. The operational Supervisor of the receiving ATSU requests the CWP to be set to operational mode. This request is processed by the ADSP. Since a new set of CWPs will be responsible for a given sector, the operational sector configuration needs to be changed and distributed to all the involved CWPs. By processing this change, system inputs that affect flight data are enabled at the CWPs of the receiving ATSU while the delegating CWPs enter Preview Mode. For reasons of safety, the delegating CWPs may remain in preview mode for a while, allowing the delegating ATCOs, that still have the current traffic picture in their minds, to reverse the delegation at short notice if necessary.

Finally, the Network Manager needs to be informed about the delegation between the delegating and receiving ATSU to have the full picture of the European network. In addition to the Network Manager, additional third parties might need to be informed, such as Military, airports, adjacent ATSUs, etc.

As the previous phase, the switch from preview mode to operational mode at the receiving ATSU is a very critical phase of the delegation procedure with respect to safety. It is essential that throughout the procedure exactly one ATSU is responsible for a particular sector. This needs to be made sure by clear communication between the delegating and the receiving ATCO team. The receiving team needs to make clear unambiguously when they are ready to take over the airspace. A suitable phraseology might be helpful.

Figure 33333333Figure 3333~~Figure 33~~ identifies the receiving ATSU as the actor who is initiating the switch from preview mode to operational mode. But this is only one possible option. A concrete implementation of the delegation procedure may also have the delegating ATSU in the leading role for the switch from preview mode to operational mode. A safety assessment of a concrete implementation is required to identify which actor should be in the lead for a particular implementation case. Generally, it is considered safer that the receiving ATSU is explicitly pulling the responsibility for the delegated airspace, instead of being pushed into the responsibility by the delegating ATSU due to the geographical separation of the ATSUs. Again, clear, and unambiguous communication between the delegating and receiving ATCO teams is paramount to ensure a safe delegation.

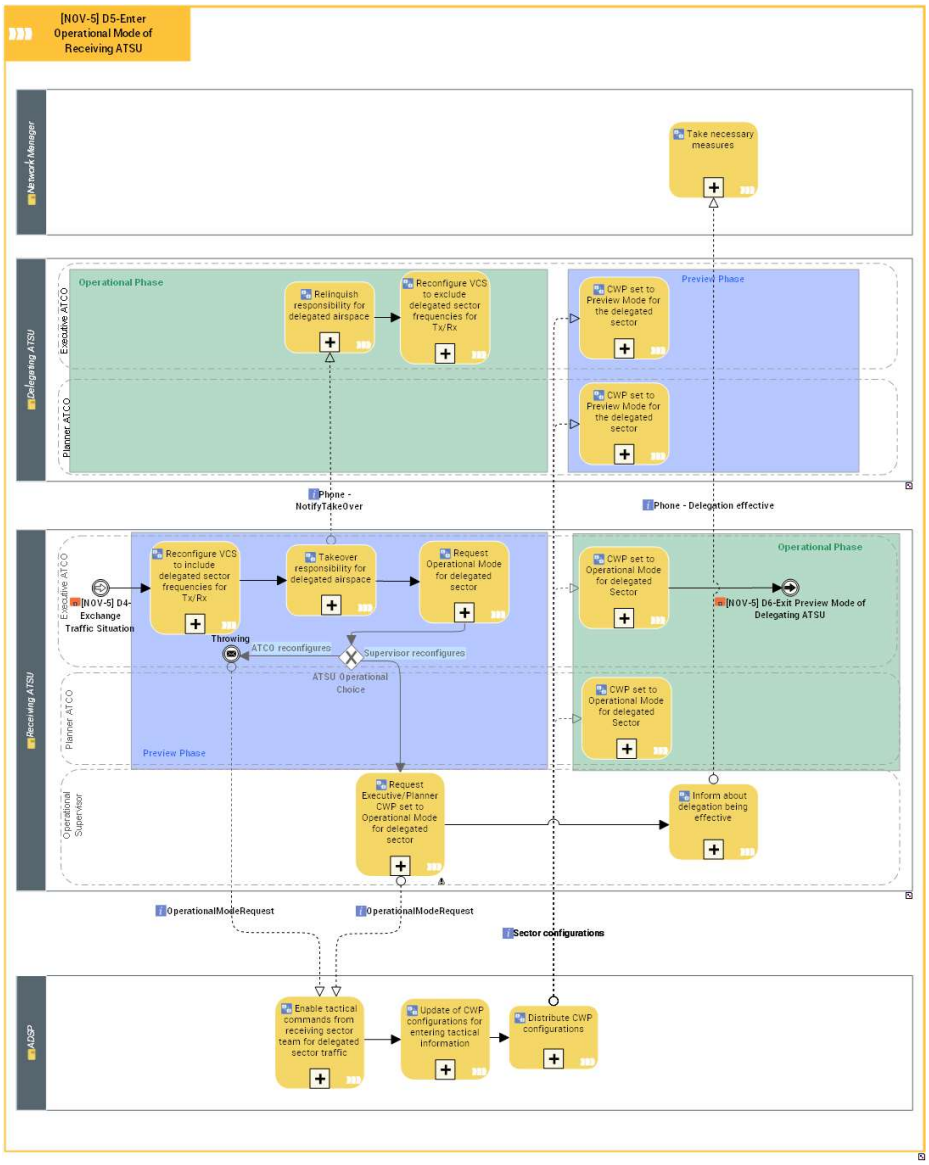

Figure 3333333333: Enter operational mode

Despite all safety measures being taken, several potential problems might occur that require immediate counter measures. Three potential problems and their solutions are described in the following sections.

3.3.2.6.7.1 No ATCO team in control of a sector

This situation must be avoided by all means. It originates from an ambiguous communication between the delegating and receiving ATCO team. This situation shall be prevented by the design of the procedure.

All steps done locally, e.g., switching the sector frequency to Rx at the receiving ATSU when starting preview mode shall be cross-checked by the receiving Executive and Planner. By technically synchronising the ATM system and the Voice Communication System, sector frequencies might be automatically set to Rx when preview mode is activated for a particular sector.

Coordination between ATCOs of the delegating and receiving ATSU shall be read-back and/or confirmed/acknowledged. A checklist, such as the handover dialogue used in validation exercise EXE-PJ.10-W2-93-V2-VALP-001 (see Appendix C) can help to avoid miscommunication.

By setting the sector frequency to Rx at the receiving ATSU at the start of the preview mode and switching the sector frequency from Tx/Rx to Rx at the delegating ATSU when switching from operational mode to preview mode, aircrafts should always be on frequency in both ATSU. The absence of an answer of the ATSU supposed to be in charge to an aircraft call is an indication of such a potential problem for the ATSU which assumes not to be in charge. An immediate phone coordination between the delegating and the receiving ATSU is advised to clarify the potential problem.

A radio check of the receiving ATSU when switching to operational mode is an additional measure to make sure the receiving ATSU is really in control and in contact with the aircraft in the delegated sector.

If the problem could not be resolved, the delegation must be aborted and the delegating ATSU will remain in responsibility of the sector.

3.3.2.6.7.2 Two teams in control

As in the previous case, this problem originates from a miscommunication between the delegating and the receiving ATSU. Principally, all the counter measures described above also suit to prevent the problem of two active ATCO teams.

It can easily be detected by an ATCO team through an unexpected radio transmission of the other ATCO team which is not supposed to be in control of the sector. When the preview mode is supported by the system (see section 3.3.2.6.3 for implementation options of the preview mode), only one team shall be able to make system inputs. If the system is not preventing an ATCO to make inputs while being in preview mode, unexpected clearances (including data link clearances) might be an indication that there is a second ATCO assuming to be in control and making inputs to the system.

When delegating and receiving ATSU are provided with data by the same ADSP and are sharing a common system, this situation can be detected easier, because both ATSUs receive the identical data. When delegating and receiving ATSU are provided with data by different ADSPs, it depends on the degree of synchronisation between the ADSPs if the clearances entered by the other ATCO team can be easily detected or not.

If there is an integration of the ATM system and the VCS, the sector frequencies could automatically be set to Tx/Rx or Rx respectively, which prevents the simultaneous transmission of radio calls. In any case, the VCS shall signal a simultaneous transmission which indicates the ATCO teams of the

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delegating and the receiving ATSU a potential problem. As an immediate counter measure, the two ATCO teams shall have a direct coordination via phone to clarify and solve the situation.

If the problem could not be resolved, the delegation must be aborted and the delegating ATSU will remain in responsibility of the sector.

3.3.2.6.7.3 Corruption of data

Corrupted data can make it impossible for the receiving ATSU to safely control the delegated sector. In principle, the problem of corrupted data can occur at any time. If it happens during the execution of the delegation procedure, the procedure needs to be aborted (see section 3.3.2.6.5).

If it happens just after the switch of the receiving ATSU from preview mode to operational mode, then this situation can be mitigated by handing over the responsibility back to the delegating ATSU which is in preview mode for a certain period of time after giving control to the receiving ATSU. The delegation procedure is particularly designed to deal with this situation and to have an additional safety layer around the point of switching the responsibilities between the delegating and the receiving ATSU.

When a corruption of data happens at a later stage after the delegating ATSU stopped the preview mode at its side and went off-duty, an immediate switch back to the delegating ATSU is impossible. The principal options to handle this kind of problems are described in section 3.3.2.9.

3.3.2.6.8 Exit Preview Mode of Delegating ATSU

The period during which the Preview Mode is maintained in the delegating ATSU for safety reasons is not uniquely specified. A number of local factors will be involved including terms agreed in a delegation agreement or it may be individually decided by the receiving ATCO team Figure 34343434Figure 3434~~Figure 34~~ depicts the process flow of this phase.

The receiving Executive ATCO informs the operational Supervisor of the receiving ATSU about ending the Preview Mode of the delegating ATSU. The final decision is made by the operational Supervisor of the receiving ATSU. The request to end the Preview Mode of the delegating ATSU is processed by the ADSP and distributed to all involved ATSUs. Upon receipt of the updated operational configuration of the CWP, the CWPs of the delegating ATCO team are switched to Idle Mode.

The procedure ends here.

In principle, the end of the Preview Mode can also be triggered by the delegating ATSU. This is not depicted in Figure 34343434Figure 3434~~Figure 34~~ in order not to overcomplicate the diagram.

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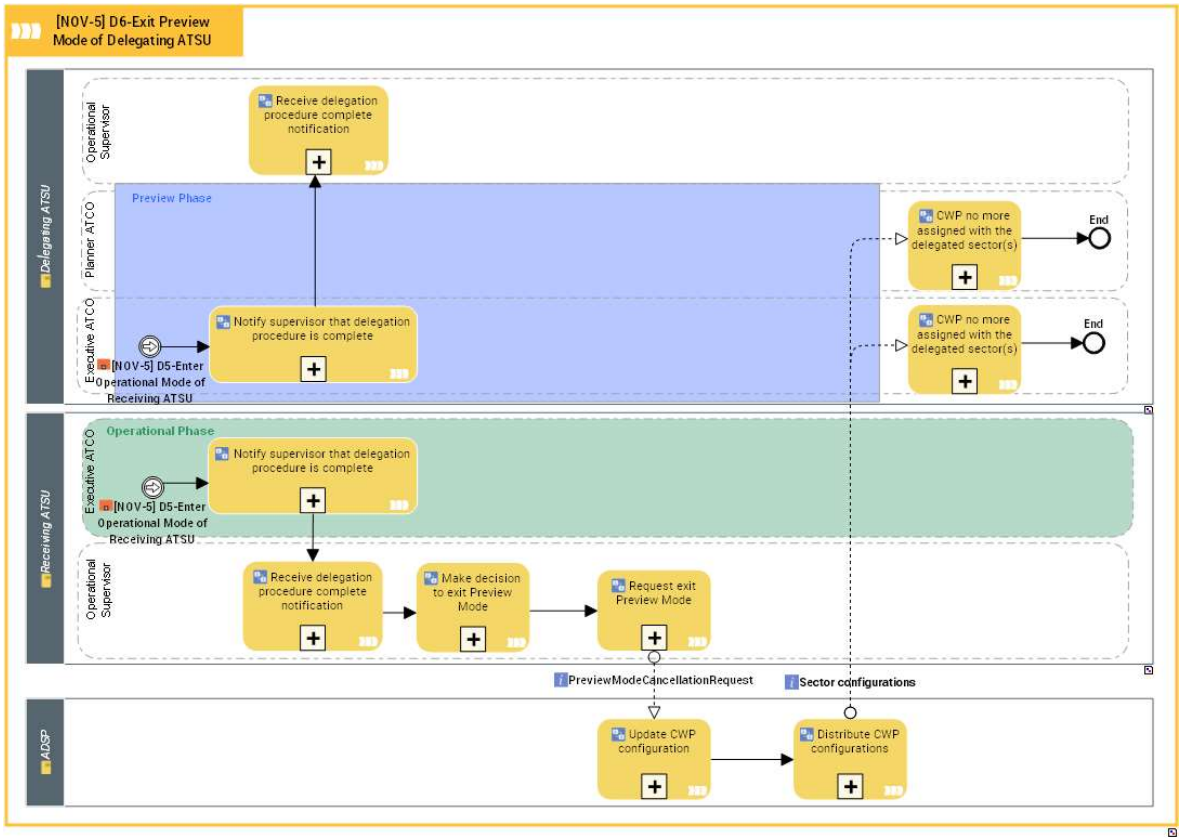

Figure 3434343434: Exit Preview Mode of delegating ATSU

3.3.2.6.9 Impact of delegation of ATM services on airspace users

Ideally, the delegation of ATM services among two ATSUs is transparent to airspace users to a great extent. But the extent of the impact depends on a concrete delegation case and cannot be defined generally. Furthermore, this section only identifies relevant topics that have to be researched further by follow-up projects. The topics described here are not exhaustive. It is expected that there are more topics that need further investigation.

3.3.2.6.9.1 Flight rules

Between two ATSUs of different countries there might exist differences in flight rules, e.g., the need to give position reports by the pilot or the procedures to handle communication failures. In the context of delegation of ATM services these differences are problematic because it either requires the ATCOs of the receiving ATSU to work according to flight rules of the delegating ATSU, or the pilot will encounter a change in flight rules in an airspace where they do not expect it. This requires extra training for the ATCO to ensure they have the appropriate knowledge about the applicable flight rules in the delegated airspace. Switching between normal sectors and delegated sectors is likely to have a negative impact on the ability of the ATCO to manage the traffic safely. Furthermore, differences in flight rules would prevent the consolidation of a delegated sector with an adjacent sector of the receiving ATSU because this scenario would require the ATCO to work according to different flight rules when crossing the border of the two consolidated sectors.

If the receiving ATCO manages a delegated airspace according to the flight rules of the receiving ATSU, no additional training would be necessary. But a pilot could be confused when a delegation takes place while an aircraft is in a delegated sector and the receiving ATCO works according to flight rules of the receiving ATSU. Aircrafts entering a delegated sector after the delegation could also be confused because they expect flight rules of the delegating ATSU.

Considering these difficulties that occur when delegating and receiving ATSU have significant differences in flight rules, it is obvious that a harmonisation of the flight rules is a prerequisite for a delegation between two ATSU of different countries. These necessary changes would also include the regulators of the involved ATSUs.

3.3.2.6.9.2 Information of changing responsibility

An important topic that needs to be further investigated is if the pilots that are in a sector during its delegation need to be informed about the delegation or not. Today, pilots are not informed about a shift change that is taking place locally in the control room. This may lead to situations where pilots hear to two different ATCO voices while being in the sector where the shift change takes place.

When ATM services are delegated between two ATSUs, the situation is different, because the ATSUs have their own call signs that are used for radio communication. For a pilot being in the sector while it is delegated might get confused hearing different ATCOs who identify themselves by different call signs. This problem might be less important for pilots that regularly fly through the sector because they get used to regular delegations of the airspace. But for pilots that rarely fly through a delegated sector, e.g., long-haul flights, have a higher chance of being confused by different call signs for the ATSU in control of the sector. This holds also true when a flight enters a sector after it was delegated, and the pilot is expecting a different ATSU being in control. This confusion could impact the mental picture of the pilot and thus might have safety-relevant impacts.

A solution could be that the receiving ATCO still uses the call sign of the delegating ATSU. But this would add extra workload on the ATCO in case of delegation. In addition, this is difficult to handle

when a delegated sector should be consolidated with an adjacent sector of the receiving ATSU, because this would require that the ATCO is using different unit call signs depending on which part of the consolidated sector they are referring to.

3.3.2.6.10 Delegation Procedure in a multiple ADSP environment

This section describes changes in the phases related to changing the status of a CWP within an ATSU: entering and leaving Preview Mode and Operational Mode. The affected phases in an environment with several ADSPs are described in the following subsections. The remaining phases as described under section 3.3.2.2 will be unchanged by this different environmental condition.

3.3.2.6.10.1 Enter Preview Mode in a multiple ADSP environment

The Enter Preview Mode phase in an environment comprising multiple ADSPs is depicted in Figure 35353535Figure 3535~~Figure 35~~. Since the involved ADSPs are not synchronised among themselves, the operational Supervisors of the delegating and the receiving ATSU need to independently decide the required operational sector configuration for the delegation. The necessary changes need to be implemented in each ADSP separately. They need to be clearly coordinated between the operational Supervisors while agreeing on the coordination and particular focus must be put on the implementation of the changes to make sure the ADSPs do not have diverging operational sector configurations afterwards.

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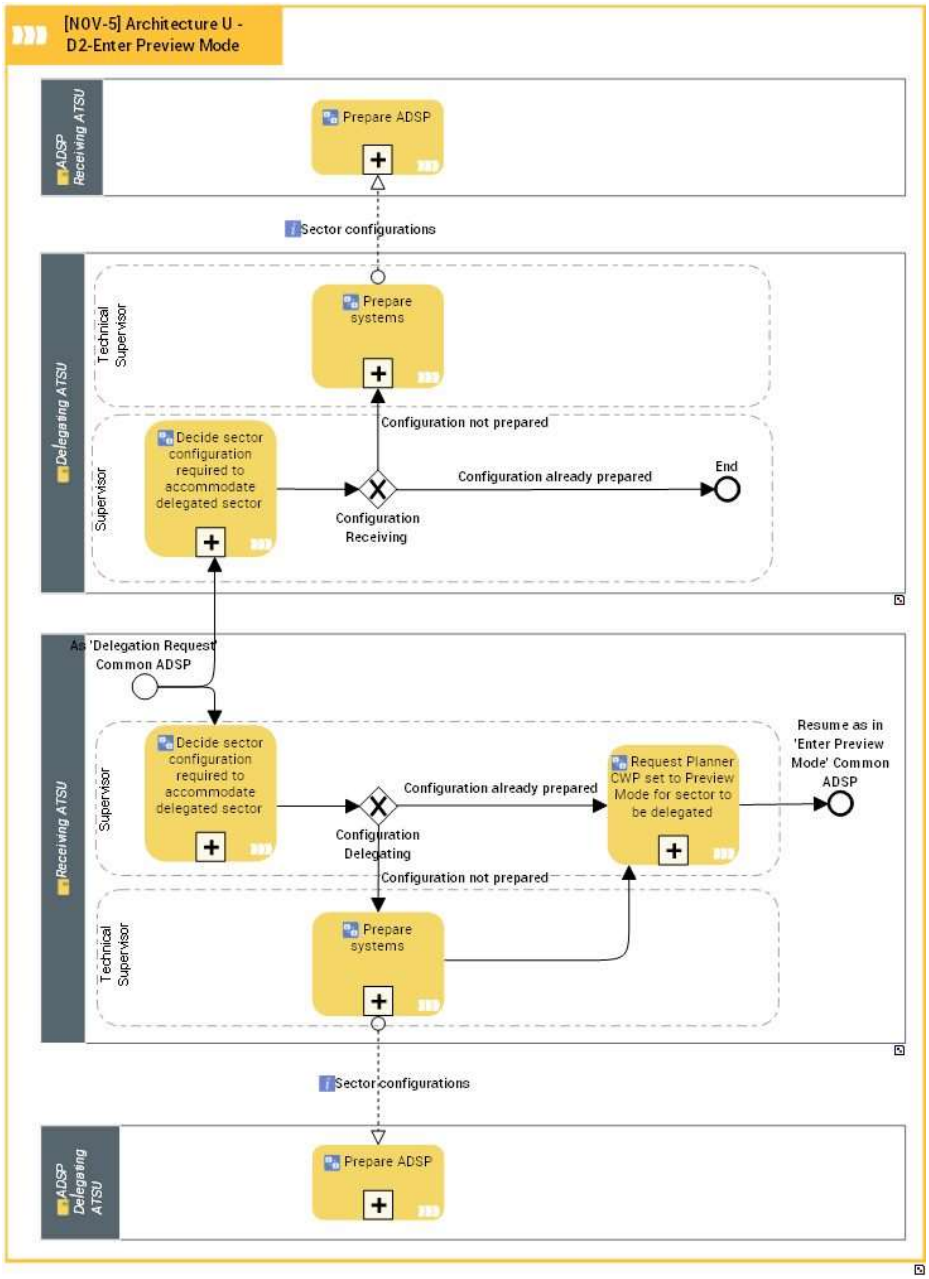

Figure 3535353535: Enter Preview Mode in a multiple ADSP environment

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3.3.2.6.10.2 Enter Operational Mode in a multiple ADSP environment

Figure 36363636Figure 3636~~Figure 36~~ depicts the Enter Operational Mode phase in a multiple ADSP environment. To properly switch into Operational Mode at the receiving ATSU and into Preview Mode at the delegation ATSU, both operational Supervisors need to coordinate by phone in order agree on the switch. After the agreement, the switch needs to be implemented on both sides to be in the correct state in both ATSUs and to ensure that only one sector team is in charge at a time. This might be supported by a service interface provided to the operational Supervisor/ATCO, but it would require an additional inter-ADSP service interface to synchronise the necessary data across multiple ADSPs.

It is critical that the operational Supervisor of the receiving ATSU is initiating the synchronisation with the operational Supervisor of the delegating ATS, since only the receiving ATCO team can determine whether the handover of the traffic is completed, and the responsibility of the sector can be transferred. During the synchronisation via phone, the two Supervisors need to make sure that the switch between Preview Mode and Operational Mode and vice versa is done almost simultaneously in both ATSUs to ensure that only one ATSU is in charge of a sector at any time.

In this configuration each ADSP is only managing the operational configurations of the CWPs of its associated ATSUs.

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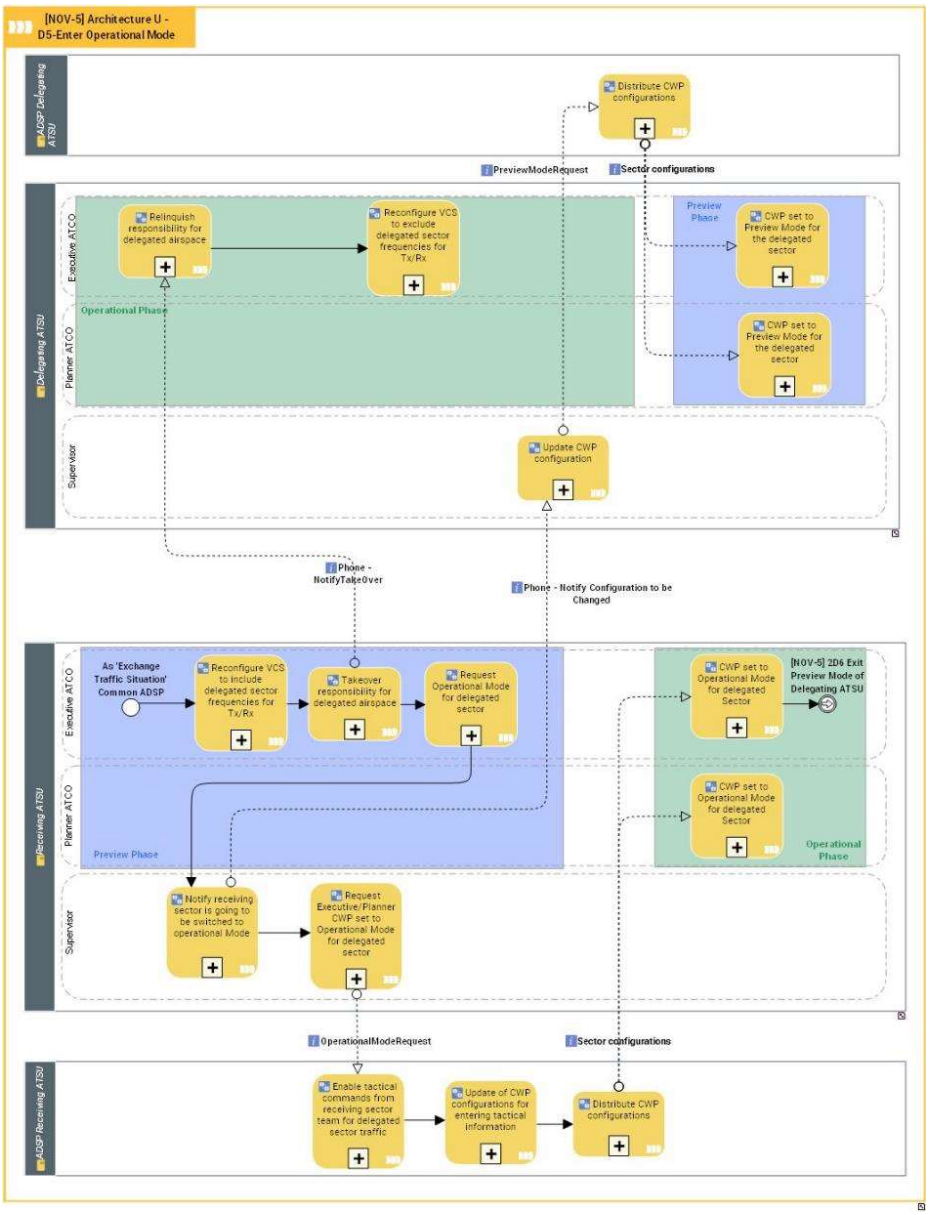

Figure 3636363636: Enter operational Mode in a multiple ADSP environment

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3.3.2.6.10.3 Exit Preview Mode of Delegating ATSU in a multiple ADSP environment

The following Figure 37373737Figure 3737~~Figure 37~~ depicts the Exit Preview Mode of Delegation ATSU phase in an environment with multiple ADSPs that are not synchronised. As described in the previous section, a phone coordination between the operational Supervisors of the receiving and the delegating ATSU is required. The operational Supervisor of the receiving ATSU is informing the operational Supervisor of the delegating ATSU that the Preview Mode can be exited on the delegating side. The operational Supervisor of the delegating ATSU is then requesting the exit of the Preview Mode at its ADSP. Consequently, the operational configuration of the delegating CWPs is changed online and distributed.

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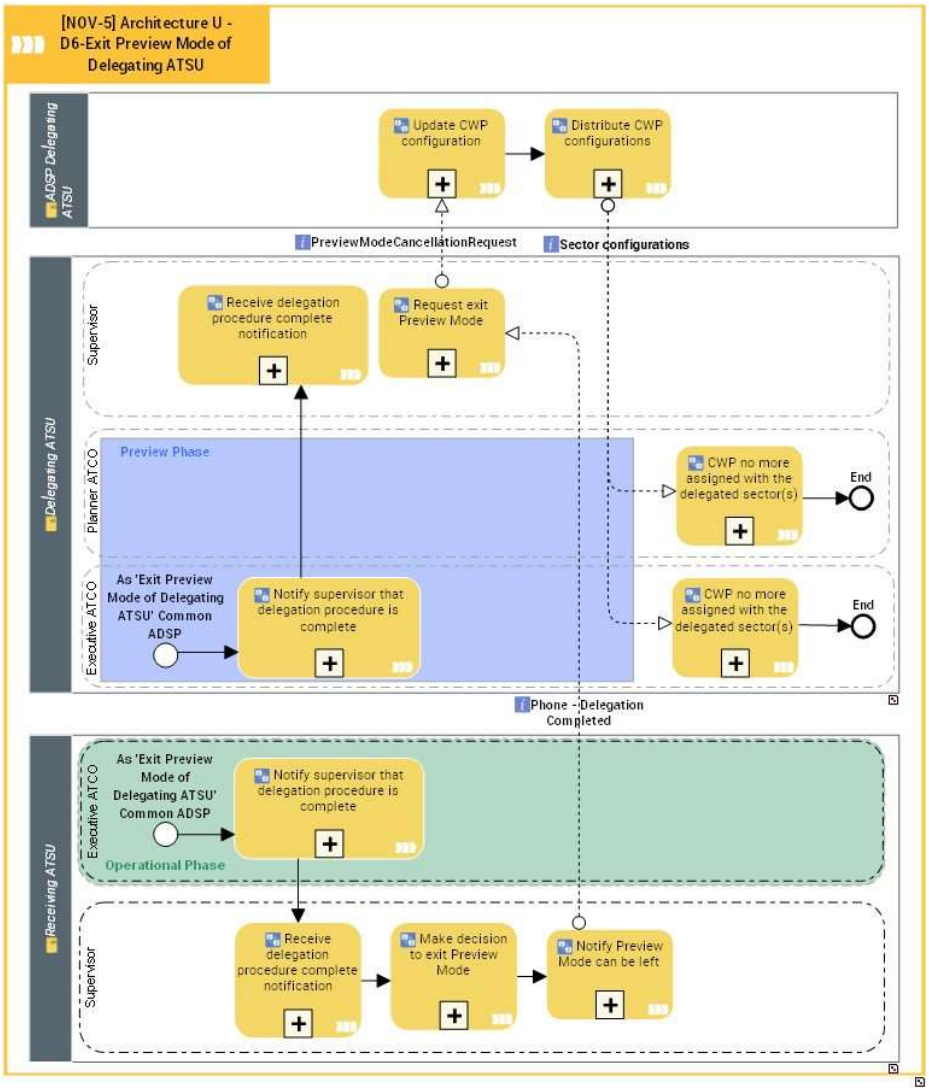

Figure 3737373737: Exit Preview Mode of Delegating ATSU in a multiple ADSP environment

3.3.2.6.11 Interconnections and Information Exchanges of the Delegation Procedure

Figure 38383838Figure 3838Figure 38 shows the high-level overview of the top-level actors (Nodes) and the information exchanges among them being part of the delegation procedure in a Y-architecture (see section 3.1) in which a common ADSP is shared among the ATSUs.

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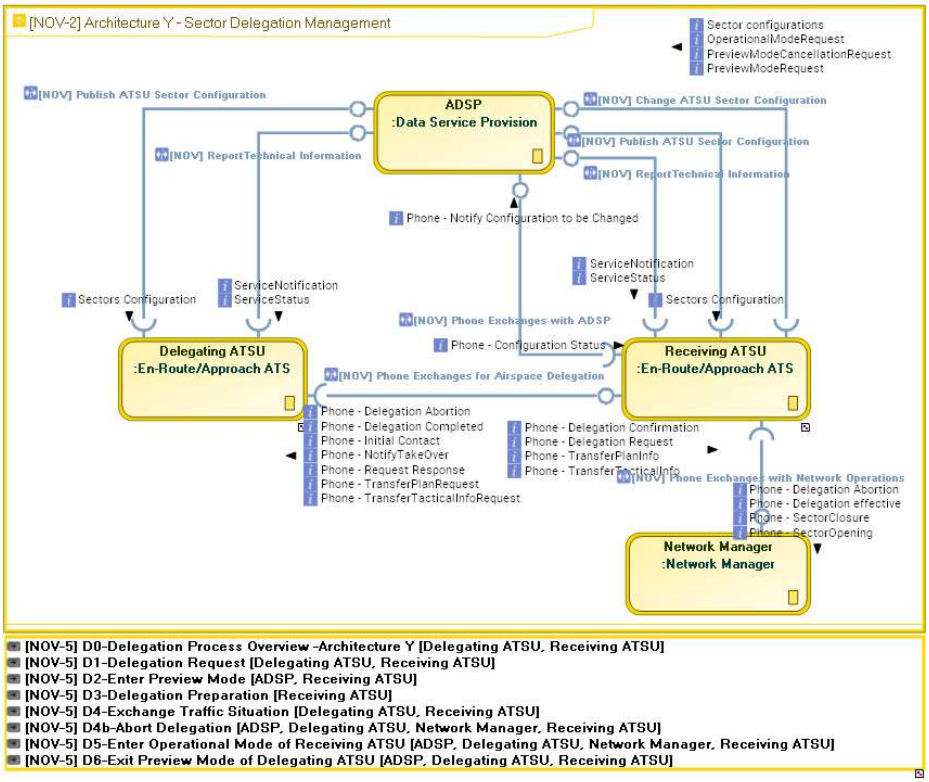

Figure 3838383838: NOV-2 of Sector Delegation Management with Y-architecture

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3.3.2.7 Contingency Procedure

The contingency procedure is aligned with the Contingency Lifecycle [19] defined by Eurocontrol (see Figure 39393939Figure 3939~~Figure 39~~). The Contingency Lifecyle starts with an unexpected severe event that causes the failure of an ATSU. In this OSED only ATSU failures are considered. In the Eurocontrol documentation [19] it is assumed that the ATSU comprises the control room and the equipment room. In a Virtual Centre environment where there is a geographical separation between ATSU and ADSP and these entities are connected over a Wide Area Network (WAN), there are more sources of errors than in a non-distributed environment.

In principle, the Contingency Lifecycle consists of three major phases:

1. **Degraded Mode / Emergency**
   This phase is characterised by the immediate countermeasures against the failure. In most cases, the affected airspace is cleared, and regulations are put in place. In a non-Virtual Centre environment as they exist today, ATCOs would be relocated to contingency premises, which would need some time for travelling if the contingency premises are not nearby.

2. **Service Continuity**
   During the Service Continuity phase the air traffic is managed from the contingency premises. These premises often have a reduced capacity compared with the failing ATSU. Therefore, regulations are expected to be in place during this phase, meaning that the air traffic is significantly impacted.

3. **Operational Recovery**
   When the failing ATSU has been restored again, Air Traffic Management will be shifted back to the original ATSU. For this, ATCOs are required in both premises: the original ATSU and the Contingency ATSU. Then ATM services provision will be delegated between these two units according to the delegation procedure described in section 3.3.2.6 on page 828180~~80~~. After the Operational Recovery, the original ATSU is back at normal operations.

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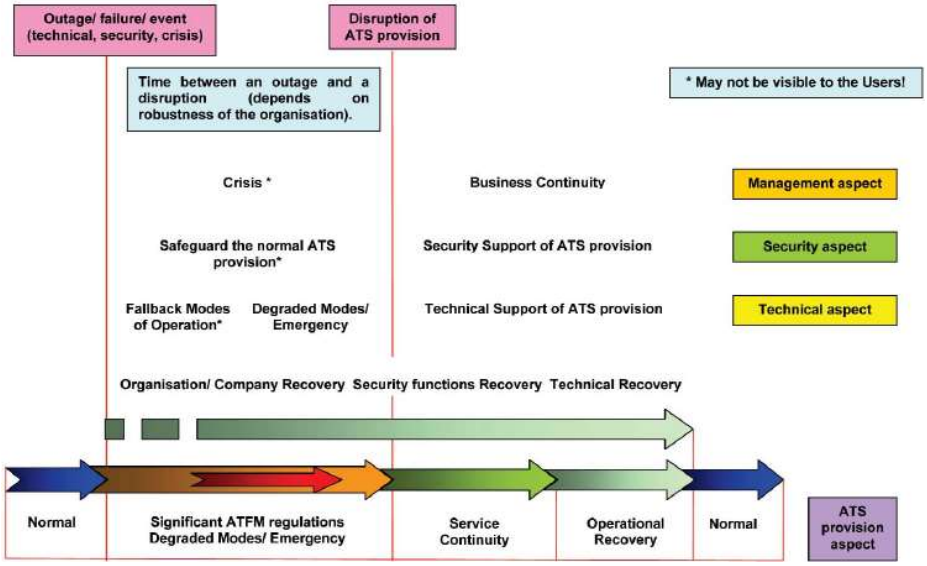

Figure 3939393939: Expanded Contingency Lifecycle [19]

3.3.2.7.1 Overall Contingency Procedure

The contingency procedure depicted in Figure 40404040Figure 4040~~Figure 40~~ is aligned with the Contingency Lifecycle (see Figure 39393939Figure 3939~~Figure 39~~ in previous section) and its three main phases: degraded mode, service continuity and operational recovery. The Contingency Lifecyle starts with an unexpected severe event that causes the failure of an ATSU and which initiates the phase of degraded modes.

Contingency cases can be quite diverse: in some cases, an immediate clear-the-sky maybe essential, e.g., if the ATSU needs to be evacuated, while in other cases there might be the possibility to delegate to aiding ATSUs, e.g., if the ATSU is technically impacted but still able to ensure safe operations with reduced capacity.

For the definition of the contingency procedure the following assumption has been taken:

1. The procedure currently covers the case of a contingency case at an ATSU. Therefore, it is expected that the ADSP is not affected by the ATSU failure and thus is still able to provide data to other ATSUs that are not impacted.

When a failure occurs at the ATSU, it is the responsibility of the operational Supervisor to decide if it is a contingency case or not. If yes, all impacted actors of the ATSU need to be informed. After this, the operational Supervisor needs to check if immediate action is required, e.g., the control room needs to be evacuated immediately. In such a case the only option would be to clear-the-sky. In this case, external partners of the failing ATSU, such as predefined aiding ATSU, need to be informed to start their preparation for providing ATM services for airspace of the failing ATSU and be able to provide service continuity.

If there is more time available to react on the failure, there will the opportunity to initiate a contingency delegation, i.e., the delegation procedure (see section 3.3.2.2) will be used to delegate the provision of ATM services for an affected sector. This might not be possible for all sectors of an ATSU, but it would at least offer the opportunity to keep parts of the airspace of the failing ATSU open while the other parts of the airspace might need to be cleared. In any case a service continuity preparation would take place in aiding units to ensure sufficient airspace capacity for the duration of the contingency.

The contingency procedure is just distinguishing between either the possibility to apply the delegation procedure as described in section 3.3.2.2, expecting cooperation by the receiving / aiding ATSUs, or to apply the clear-the-sky procedure. These are two extremes and there might be procedures in between, which allow delegation but do not require full cooperation. But this aspect is not investigated further.

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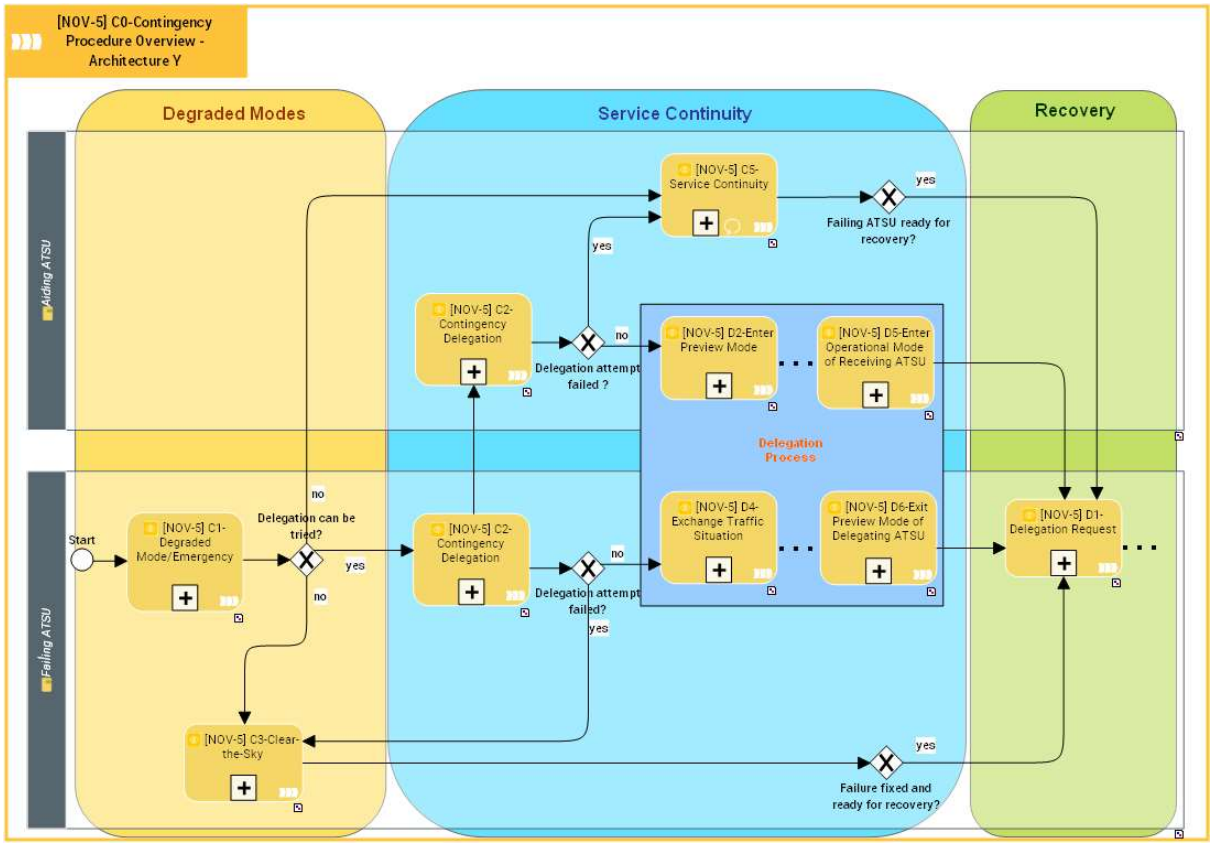

Figure 4040404040: Overview of the contingency procedure

3.3.2.7.2 Degraded Mode / Emergency

This phase describes the process flow that is performed when an unexpected and severe failure causes the outage of an ATSU (see Figure 41414141Figure 4141~~Figure 41~~).

The first thing to do for the operational Supervisor is to decide whether there is a Contingency situation or not. The reasons for ATSU Contingency cases may be quite diverse. They might range from operational issues over technical issue to disaster situations such as fires in control rooms or equipment rooms. Operational issues may be detected by the operational Supervisor, or they may be reported by ATCOs. In case of technical issues, they are usually detected by an ATSEP who then coordinates with the technical Supervisor. If the technical issue is so severe that it has an operational impact, the technical Supervisor informs the operational Supervisor.

The operational Supervisor is responsible to declare a Contingency situation at the ATSU. To come to this decision, all relevant experts are asked for advice, such as ATSEPs. If there is a contingency situation, the operational Supervisor needs to inform the ATCOs currently working in the ATSU about the Contingency situation so they are aware of the situation and wait about further instructions about how the Contingency situation will be handled (see following section)

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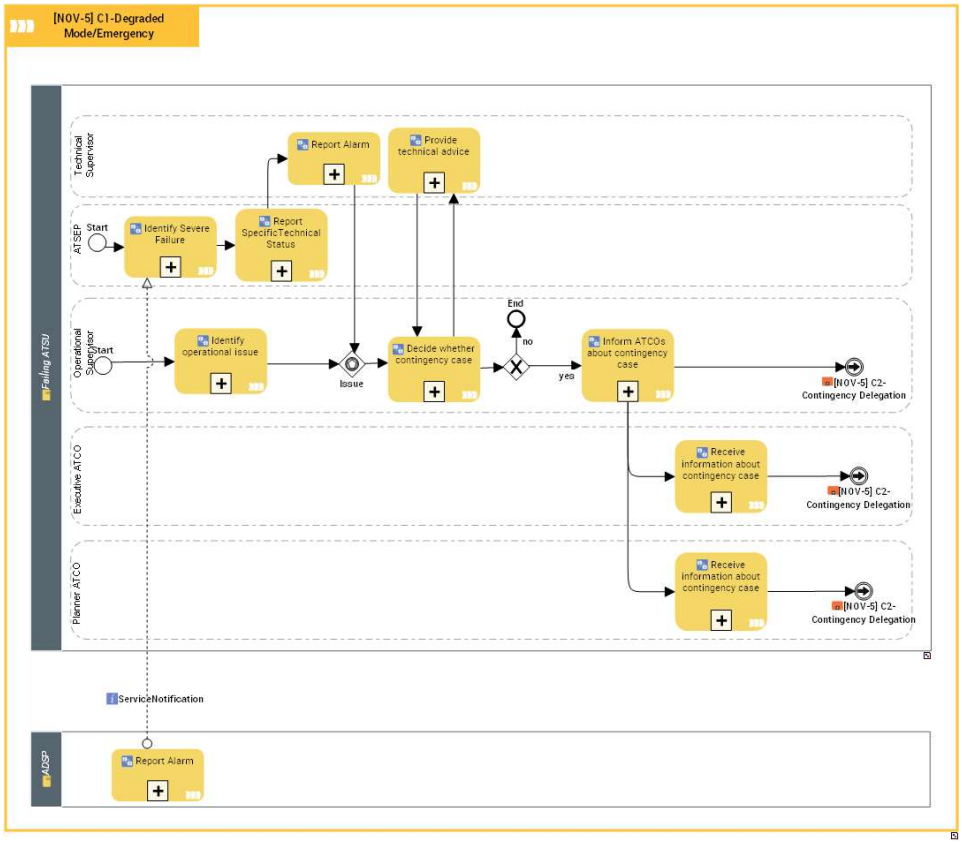

Figure 4141414141: Degraded Mode / Emergency

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3.3.2.7.3 Contingency Delegation

In a non-Virtual Centre environment, there is almost only the option to clear-the-sky, evacuate the building and relocate ATCOs to the Contingency premises. The technical flexibility expected from the Virtual Centre concept should provide improvements in operations, especially offering means for Contingency that were not existing before. But there might also be situations where clear-the-sky is required in a Virtual Centre environment, if an immediate evacuation prohibits the orderly execution of the delegation procedure or if there are no aiding ATSUs available immediately.

Since the event causing the Contingency and its severity are unpredictable, it is very difficult to anticipate how much time an ATSU has available to deal with this exceptional situation. There might be a fire in the building allowing the ATCOs to have very little coordination with adjacent ATSUs. In case of a flood and a rising water level, there might be more time to react, but there are also situations like earthquakes that would immediately neutralise the ATSU without having the chance to deal with the situation. The process flow depicted in Figure 42424242Figure 4242~~Figure 42~~ needs to be interpreted keeping in mind this time dimension of the Contingency cases.

The added value is to have the possibility to have Contingency Delegation of some sectors if time permits. If possible, the operational Supervisor of the failing ATSU can try to contact an aiding ATSU (in the respect of pre-determined procedures) and ask for immediate support for the airspace of the failing ATSU by Contingency Delegation. This would allow for a clean handover of the airspace to an aiding unit using the delegation procedure described in section 3.3.2.6. When receiving a contingency request, the operational Supervisor of the aiding ATSU will check whether the aiding ATSU is able to immediately provide Contingency Delegation services for the affected airspace.

If the aiding ATSU is immediately able to provide Contingency Delegation services, the ATM services provision will be delegated according to the delegation procedure starting with the Preview Mode phase described in section 3.3.2.6.3. This is a decision that will be made per sector of the failing ATSU. It is very likely that the aiding ATSU is not able to provide Contingency for all sectors of the failing ATSU, but only for a few of them. On the other hand, there might be more than one aiding ATSU being able to provide Contingency service.

If the aiding ATSU is not immediately able to provide Contingency Delegation services, then the failing ATSU needs to clear-the-sky to ensure safe operations as depicted in Figure 43434343Figure 4343~~Figure 43~~ and the aiding ATSU is obliged to support as soon as possible. Therefore, the aiding ATSU is initiating Service Continuity to take over airspace as soon as possible (see section3.3.2.7.5).

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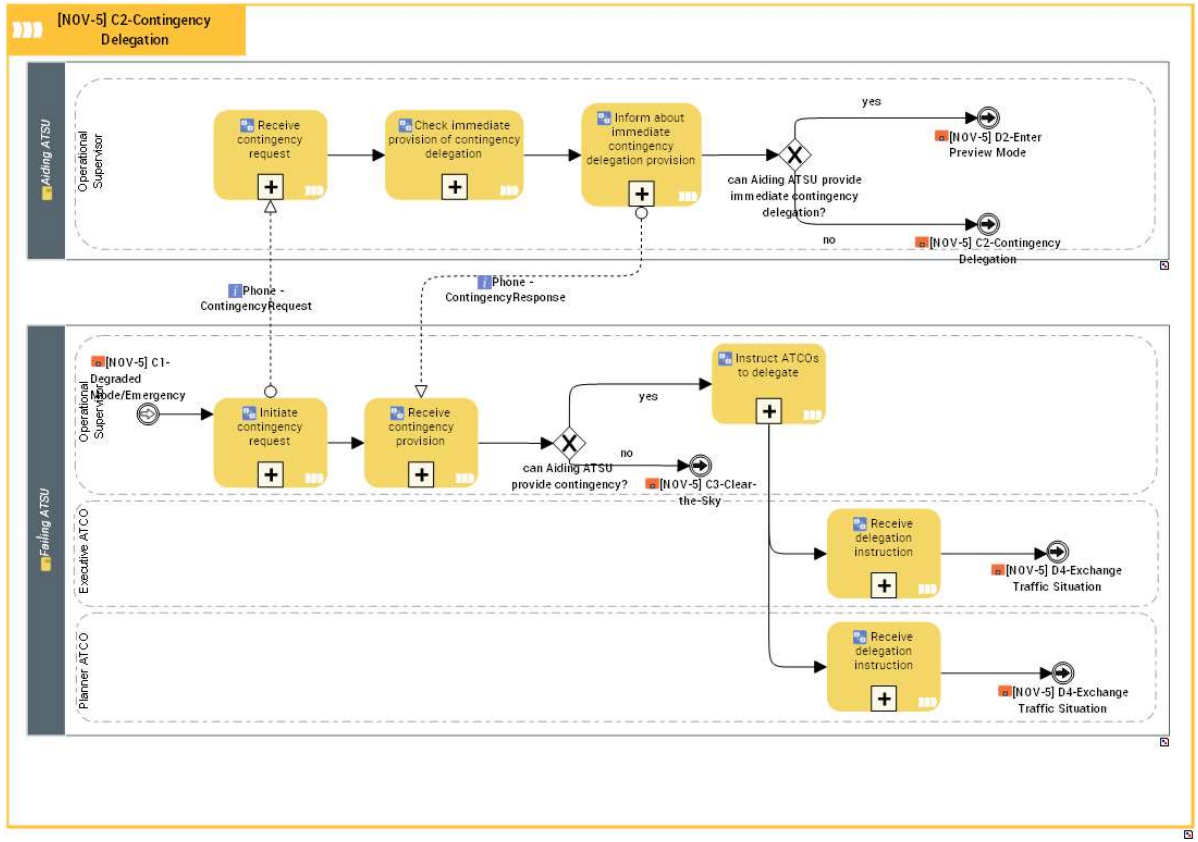

Figure 4242424242: Contingency delegation

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3.3.2.7.4 Clear-the-Sky

If no immediate Contingency Delegation can be provided by aiding units or if the Contingency event does not allow to coordinate with aiding ATSUs, the operational Supervisor of the failing ATSU instructs the ATCO teams of the failing unit to clear-the-sky. This process flow is depicted in Figure 43434343Figure 4343~~Figure 43~~.

Initially, the operational Supervisor of the failing ATSU notifies the Network Manager about the initiation of the clear-the-sky procedure at the ATSU. Besides the Network Manager, all adjacent ATSUs and the ADSP[9] are also informed by the operational Supervisor of the failing ATSU as well as additional third parties, such as military and airports. Furthermore, the operational Supervisor of the failing ATSU instruct their NOTAM office to publish a prepared NOTAM for a No-Fly zone declaration. In addition, the ATCOs of the failing ATSU are instructed by the operational Supervisor to clear-the-sky.

In general, during a contingency situation, the work-sharing between Executive and Planner would not be as strict as outlined in Figure 43434343Figure 4343~~Figure 43~~, but both would try to handover aircraft to other units simultaneously. To not overcomplicate the diagram, the activities were not duplicated.

To clear-the-sky, the ATCO team needs to handover as quickly as possible the aircraft in their sector to other units. This may be an upper or lower unit in case of a vertically split airspace or an adjacent unit from the flight path of the aircraft. An important prerequisite is that the ATSU taking over has the aircraft in its radar coverage. If an aircraft cannot be handed over to another unit, the aircraft will be instructed to fly according to its flight plan and to try to contact the next sector on the appropriate frequency as soon as possible. If an aircraft can be handed over successfully, the flight needs to be updated, therefore involving an interaction with the ADSP.

In addition, the ATCO team needs to make sure that no further aircraft enter the airspace. Therefore, all departures need to stay on the ground and aircraft entering from adjacent sectors need to be redirected.

When Clear-the-Sky is initiated, it may take between 15 to 60 minutes until there are no more aircraft in the airspace, depending on the size of the affected airspace. In cases of severe failures on the ATSU side, aircrafts maybe required to strictly follow their flight plan until they get contact to the next unit.

After the ATCO team has successfully cleared the sky, they inform their operational Supervisor that their sector is cleared. The operational Supervisor takes the decision and closes the sector. This involves the ADSP where measures are taken to configure the system and distribute a new operational sector configuration. After the sector closure the operational Supervisor informs the Flow Management Position, who forwards this information to the Network Manager who will put ATFCM restrictions in place.

[9] The coordination with the ADSP might be taken over by the technical Supervisor.

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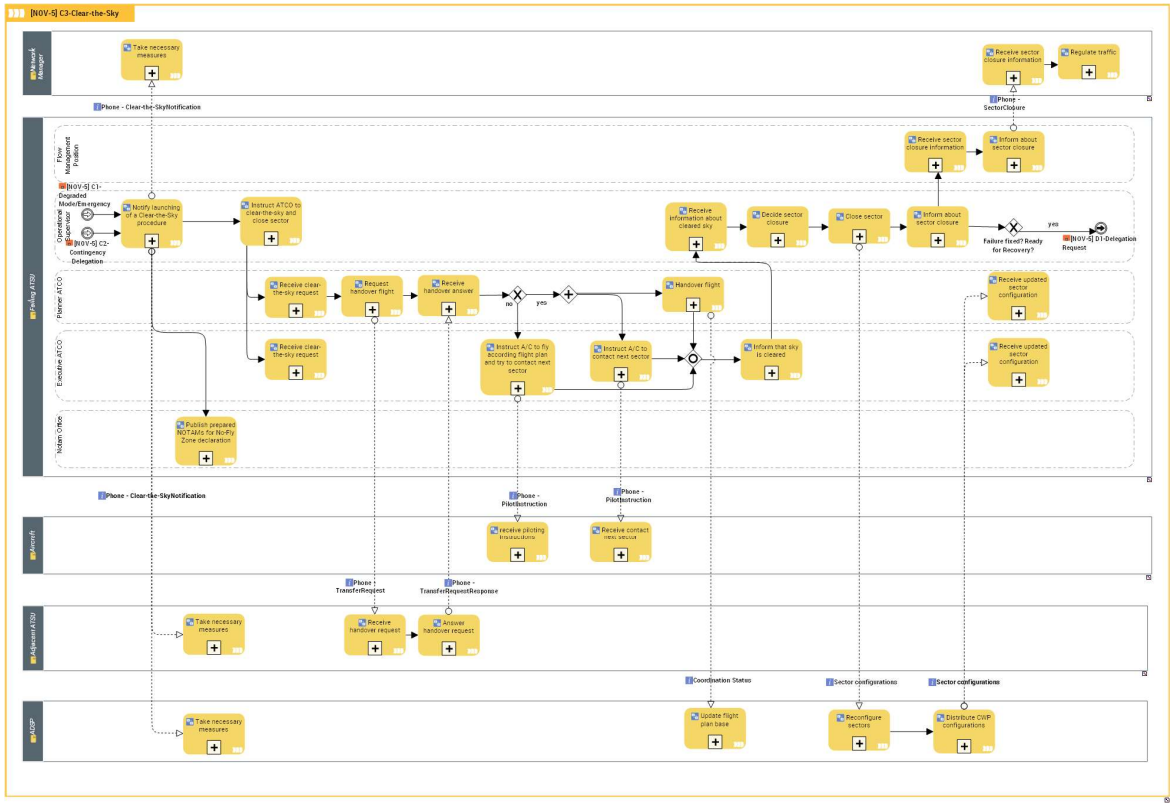

Figure 4343434343: Clear-the-Sky

3.3.2.7.5 Service Continuity

If an aiding ATSU could not activate contingency delegation procedures, it is obliged to provide contingency services as soon as possible for the airspace of the failing ATSU as part of the Service Continuity. Therefore, the shift plan will be adapted to bring in additional ATCOs for providing Contingency services for the airspace of the failing ATSU. Consequently, a new sector opening plan needs to be defined. It is worth mentioning that these preparatory activities might need from a few hours up to 48 hours, because the ATCOs need to be contacted and then they need to commute to the aiding ATSUs premises.

After the aiding ATSU has prepared to provide Contingency services for the airspace of the failing ATSU, sectors that have been closed before are reopened again step-by-step. Over time more and more sectors can be reopened which have been cleared and closed before. This has the potential to provide more capacity in a Contingency situation compared to today's solutions. In addition, it is very likely that the Contingency services can be provided much quicker. Either directly by delegating ATM services provision to another ATSU or by a quick reopening of the sectors supported by the flexibility provided by a Virtual Centre environment.

3.3.2.7.6 Operational Recovery

The Operational Recovery phase starts when the failing ATSU is restored and is ready to take over responsibility again. It is expected that for redelegating the ATM services provision to the original ATSU the delegation procedure described in section 3.3.2.6 is used. Therefore, no special process flow is foreseen for this phase.

This phase also includes technical recovery, i.e., all necessary technical systems and services must be set up in the aiding ATSU, before being able to take back the airspace.

3.3.2.7.7 Interconnections and Information Exchanges of the Contingency Procedure

Figure 44444444Figure 4444~~Figure 44~~ shows the high-level overview of the top-level actors (Nodes) and the information exchanges among them being part of the contingency procedure in a Y-architecture (see section 3.1) in which a common ADSP is shared among the ATSUs.

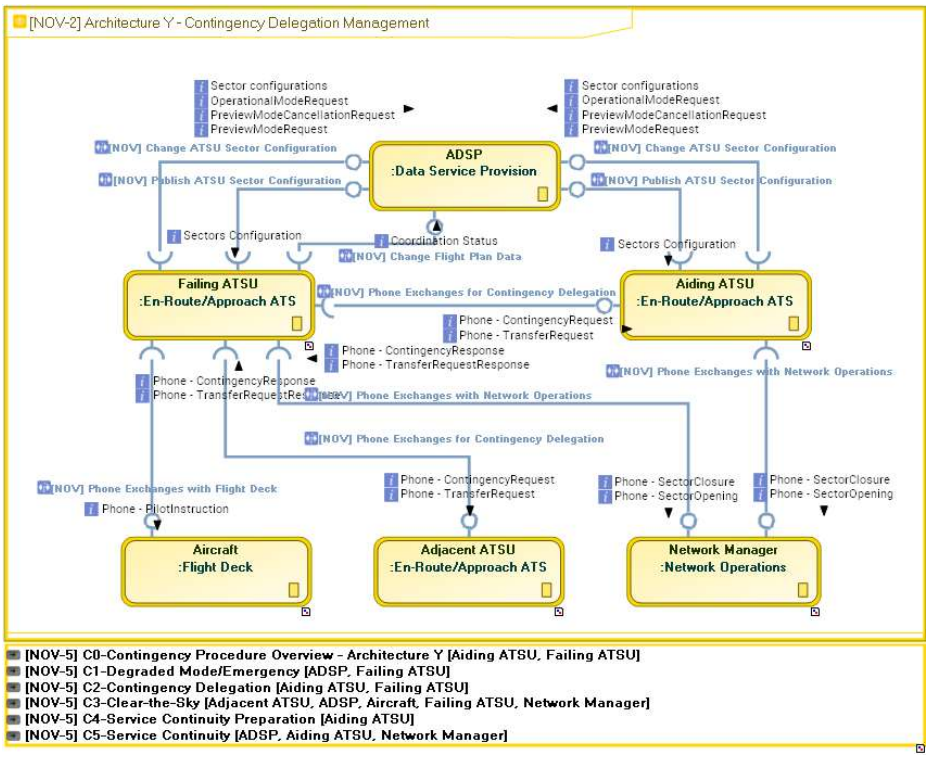

Figure 4444444444: NOV-2 of Contingency Delegation Management with Y-architecture

3.3.2.8 Operational delegation use cases

This section describes a number of operational use cases utilising the delegation procedure outlined in section 3.3.2.6 and the contingency procedure described in section 3.3.2.7. The described procedures are generic and thus applicable to different operational use cases. This is important for their safe and efficient application.

The following section 3.3.2.8.1 identifies the elementary delegation scenarios first which are the very basic building blocks for the operational use cases in normal conditions (see section 3.3.2.8.2) and the use case in unexpected conditions (see section 3.3.2.8.3).

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3.3.2.8.1 Classification of operational Use Cases

In general, the use case can be described according to the attribute scheme depicted in Figure 45454545Figure 4545~~Figure 45~~. The attributes are subdivided into two groups:

- Characteristics classifying use cases, and
- Effects that are expected because of a use case (impacts on KPI).

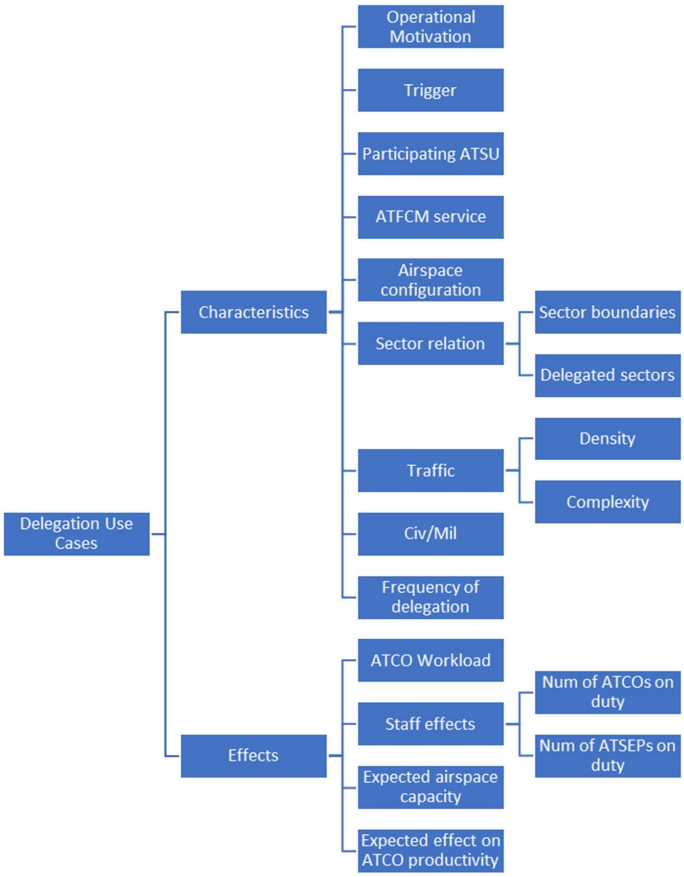

Figure 4545454545: Classification scheme for delegation and contingency use cases

All possible attribute values are described in Table 12121212Table 1212~~Table 12~~. The intention of this attributes is to give a high-level overview of each use case. Section 3.3.2.8.4 shows a summarising table that provides a brief comparison of all use cases based on the use case attributes.

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Attribute	Values	Description
Operational Motivation	Efficient use of resources Capacity improvement Contingency	The motivation from an operational perspective why a use case is implemented.
Trigger	Scheduled Semi-dynamic (pre-determined): pre-defined delegation taking place under certain conditions[10] Dynamic: fully dynamic delegation (e.g., ATCO efficiency and network capacity)[11] Unpredicted: in case of contingency	Defines how the delegation procedure is triggered. Ranging from a scheduled delegation to a fully dynamic delegation including unpredictable emergency situations.
Participating ATSU	Same ACC Same ANSP but different locations Same ANSP, but in different States Different ANSPs and different states	The delegating ATSUs and the receiving ATSU can belong to the same or to different ANSPs. [12]
ATFCM service	Delegated Not delegated	Describes whether the ATFCM service itself is delegated or not.

[10] In a semi-dynamic delegation, a delegating ATSU has one or more potential receiving ATSUs with which all necessary agreements exist that are prerequisite for a delegation. But the point in time can't be predetermined since it is related to certain conditions, e.g. availability of staff or a traffic demand. See also prerequisite P5 described in section 3.3.2.5.

[11] A fully dynamic delegation is out-of-scope of this OSED and is mentioned here as a theoretical option for completeness.

[12] Alliance model (as defined in [20]) could also be considered as the same system is used by Alliance members.

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Attribute	Values	Description
Airspace configuration	Static Pre-defined Dynamic	How is the airspace configuration affected by a delegation? It can remain static, i.e., there is no change in the AoR. Or the AoR can be affected according to a pre-defined configuration up to a point of a fully dynamic reconfiguration during the delegation.
Sector boundaries	Adjacent Non-adjacent	Describes the relation of delegated sector and refers to applicable elementary delegation scenarios as describe in section 3.3.2.1.
Delegated sectors	(multiple) full sector(s) (multiple) partial sector(s) Group of sectors (considered as homogenous for operational purpose) Entire FIR	Describes the sectors that are delegated
Traffic Density	Low Medium High	Traffic density at which the use case can be performed successfully
Traffic Complexity	Low Medium High	Traffic complexity at which the use case can be performed successfully
Civ/Mil	Civ/Mil included Civ/Mil not included	Describes if delegation or coordination between civil and military ATSUs is part of the use case.
Frequency of delegation	Frequently Infrequently Rarely	Frequency determining how often the use cases is executed.
ATCO Workload	Low Medium High	Workload of the ATCOs when the use case is triggered.

Attribute	Values	Description
Num of ATCOs on duty	More Equal Less	Number of ATCOs on duty compared to today
Num of ATSEPs on duty	More Equal Less	Number of ATSEPs on duty compared to today
Expected airspace capacity	Higher Unchanged Lower	The airspace that is expected to be achieved when the use case is executed compared to current capabilities.
Expected effect on ATCO productivity	Higher Unchanged Lower	Effect on the ATCO productivity that is expected to be imposed by the use case.

Table 1212121212: Attributes of operational use cases

Not all possible use cases are analysed by this document which would be valid combinations of the classification scheme. The delegation use cases related to normal conditions which are analysed in more detail are described in section 3.3.2.8.2, while section 3.3.2.8.3 describes a use case for unexpected conditions. Sections 3.3.2.8.2.1 - 3.3.2.8.2.5 give a high-level view of use cases already identified in SESAR 2020 Wave 1 PJ.15-09 [22].

The delegation procedure (see section 3.3.2.2) and the contingency procedure (see section 3.3.2.7) are described using NOV-5 diagrams which define the procedures as such. Since the procedures are generic, they are applicable to all the use cases that are described in the following sections.

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3.3.2.8.2 Operational Use Cases in normal Conditions

Table 13131313Table 1313~~Table 13~~ depicts the mapping between the use cases described in following sections and the elementary delegation scenarios described in section 3.3.2.1.

	Delegation of ATM services provision at Night	Delegation of ATM services provision at fixed time	Cross-border delegation of ATM services provision for an elementary sector with dynamic AoR	Cross-border optimisation using delegation with static AoR	Delegation of ATM services Provision following abnormal conditions (ATSU Contingency)
Delegation of elementary sector with dynamic AoR	X	X	X		X
Delegation of partial sector with dynamic AoR			X		
Delegation with static AoR	X	X		X	X

Table 1313131313: Mapping of operational use cases and elementary operational use cases

3.3.2.8.2.1 Delegation of ATM Services Provision at Night

This section describes the use case 'Delegation of ATM Services Provision at Night'. Table 14141414Table 1414~~Table 14~~ summarises the attributes of the use case.

Attribute	Value	Description
Operational Motivation	Efficient use of resources	The operational motivation of this use case is the reduction of resources that are required to manage the airspace during night-time.
Trigger	Scheduled	Regularly triggered according to a schedule defined in a delegation agreement (subject to passing certain criteria).
Participating ATSU	Same ANSP Different ANSP	The use case can be executed within one ANSP as well as across ANSPs.
ATFCM service	Delegated Not delegated	The ATFCM service may be delegated or not during night delegation. The impact of this analysed by PJ.32-W3 [33].
Airspace configuration	Static Pre-defined	Both options can be implemented for the night delegation use case (see section 3.3.2.1 for more details).
Sector boundaries	Adjacent Non-adjacent	Both options can be implemented for the this use case (see section 3.3.2.1 for more details).
Delegated sectors	Entire FIR	In principle, smaller parts of the airspace may be delegated as well, but the most economic effects would have the delegation of the entire FIR. In that case the ATSU could be completely off duty during the delegation and staff cost could be reduced. If delegating only sectors or groups of sectors, the benefit will be much smaller.
Traffic Density	Low	Traffic level during night hours is expected to be low.
Traffic Complexity	Low	The traffic complexity during night hours is expected to be low due to mainly overflights with few level changes and low number of take-offs and landings.
Civ/Mil	Civ/Mil included Civ/Mil not included	Both options are possible. The impact of this analysed by PJ.32-W3 [33].
Frequency of delegation	Frequently	Supposed to be performed every night.

ATCO Workload	Low	ATCO workload is expected to be low due to low traffic volume and low traffic complexity.
Num of ATCOs on duty	Less or unchanged	Fewer ATCOs may be required compared to today if sectors could be consolidated across the ATSUs. Fewer operational support staff including operational Supervisors and Flight Data Operators are required by consolidating ATSUs at night.
Num of ATSEPs on duty	Less	Only fewer ATSEPs in ATSU on duty.
Expected airspace capacity	Unchanged	The delegation of ATM services from one ATSU to another should not impact capacity or service levels.
Expected effect on ATCO productivity	Unchanged or Higher	ATCO productivity is expected to slightly increase if fewer ATCOs are required. Otherwise, it will not be affected.

Table 1414141414: Attributes of Delegation of ATM Services Provision at Night

Scope

During evening hours, traffic usually decreases, and the traffic complexity is reduced due to less aircraft flying in the airspace. Many airports cease their operations since take-offs and landings are often prohibited due to noise constraints. This means that besides some airports having significant cargo operations, the traffic is largely overflights with much less altitude changes and therefore simpler traffic patterns. Therefore, less staff is needed during night hours to safely manage the remaining traffic.

Today, staff would be reduced in all the ATSUs, but since they are fully equipped with all the backend systems locally to provide the necessary data for the ATCOs, it is expected that there is more personnel required compared to a Virtual Centre environment where the backend systems are centralised and provided to multiple ATSUs.

The concept of delegation of ATM services provision at night is to concentrate the ATM operations during low traffic hours at night in a few ATSUs and to shut down the other ATSUs that are not needed during this time. Thus, the number of active ATSUs on duty during night hours will be significantly reduced. When the traffic starts to rise again in the morning, this process is reversed, and the provision of ATM services will be delegated back to the original ATSU. The business driver behind this concept is to reduce the cost of operations by using as few resources as possible to manage the traffic during low traffic hours.

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Actors

Primary Actors

- operational Supervisors in delegating and receiving ATSUs
- Executive and Planner ATCOs in delegating and receiving ATSU

Supporting Actors

- ATSEPs in delegating and receiving ATSU
- ADSP providing data to the ATSUs

Preconditions

The following preconditions apply:

- The necessary conditions and rules will be laid down in a delegation agreement (see section 3.3.2.2 for details on agreements between ATSUs) between all participating ATSUs.
- The systems of the ATSUs are prepared are technically prepared for the delegation and have the required airspace configurations available
- The delegation of ATM services provision is done according to the procedure described in section3.3.2.6.
- Since the traffic is low at night-time, sectors will be consolidated as far as possible. Therefore, CWPs for receiving sectors from other ATSUs are available.

Postconditions

The airspace is delegated successfully between the delegating and the receiving ATSUs during the night-time as defined in the delegation agreement and back in the morning.

Success end state

The ATM services have been delegated successfully between the ATSUSs and less resources are needed during the night compared to the case where both ATSUs operate during the night without delegation.

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Failure end state

The ATM service could not be delegated between delegating and receiving ATSU due to the following reasons:

- Rejection of the delegation request by the receiving ATSU due to an inability to take the sectors
- Abort of the delegation procedure due to a problem during the preparation phase at the receiving ATSU

Notes

Depending on the size of the ATSU, it is very likely that multiple sectors will be delegated within this use case. After the starting time of the delegation is agreed between the operational Supervisors of the delegating and the receiving ATSU, the involved ATCO teams will individually coordinate the delegation of ATM services provision with their counterparts for their sectors. Depending on the traffic situation, handover of some sectors may take longer than other sectors. It is expected that the handover process is finished individually for each sector being involved in the delegation process.

If a delegation needs to be aborted for a sector, the delegating ATSU needs to be kept open for a longer period of time and cannot be closed as planned. If the problem can be fixed, the delegation will take place at a later stage. If the problem cannot be fixed and the sector cannot be consolidated with another sector in the receiving ATSU, the delegating ATSU needs to either keep the sector throughout the night or the sector needs to be closed. In the latter case, regulations need to be put in place, but the delegating ATSU will be able to close.

When delegating ATM services provision between ATSUs at night-time, the delegation can take place in different sequences. Figure 46464646Figure 4646~~Figure 46~~ depicts a hypothetical airspace of ATSUs: ATSU A (blue) and ATSU B (green). Both ATSUs have three sectors (A1-A3 and B1-B3). In this example, all the airspace of ATSU A (sectors A1-A3) will be delegated to ATSU B. To be able to receive sectors from ATSU A, ATSU B needs to locally consolidate their sectors to have empty CWPs available. In principle, the delegation between two ATSUs can be done in two different ways:

1. Sectors are consolidated locally in ATSU A and then the consolidated sector is delegated as a whole from ATSU A to ATSU B (see main flow below).
2. Sectors can by delegated individually one at a time from ATSU A to ATSU B (see alternative flow 1 below).
3. mix of options 1 and 2 (see alternative flow 2 below).

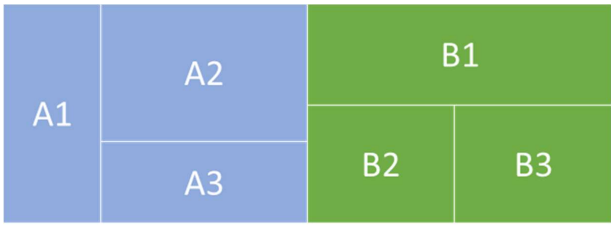

Figure 4646464646: Delegation of ATM Services Provision between 2 ATSUs at night-time

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Trigger

This use case is classified as scheduled and thus triggered by the time that that is defined in the delegation agreement between the delegating and the receiving ATSU. It is expected that the delegation agreement either defines a time slot within the delegation will take place or a point in time which serves as a reference point. A delegation can take place either before or after this time depending on the coordination of the ATSUs and the traffic situation.

Main Flow: delegation after local consolidation

The flow is defined by the delegation procedure described in section3.3.2.6. Thus, only the high-level steps are listed here, which is compliant with the overview of the delegation procedure depicted in Figure 23232323Figure 2323~~Figure 23~~ in section 3.3.2.6.1:

1. Handling of delegation request between delegating and receiving ATSU
2. Entering preview mode at receiving ATSU
3. Preparing for delegation at receiving ATSU
4. Exchanging traffic situation between delegating and receiving ATSU
5. Entering operational mode at receiving ATSU
6. Switching to preview mode at delegating ATSU
7. Exiting preview mode at the delegating ATSU

The switch to the preview mode at the delegating ATSU is an optional step. The receiving ATSU can also switch to operational mode without the delegating ATSU switching to preview mode. In the latter case the steps 6 and 7 are obsolete.

Table 15151515Table 1515~~Table 15~~ describes the flow of a delegation of ATM services between two ATSUs, where each ATSU consolidates their sectors first locally, before the delegation is initiated.

Sectors ATSU A	Action ATSU A	Sectors ATSU B	Actions ATSU B
A1, A2, A3		B1, B2, B3	
	A1 + A2 ➔ A12		B2 + B3 ➔ B23
A12, A3		B1, B23	
	A12 + A3 ➔ A123		B1 + B23 ➔ B123
A123		B123	
	Delegate A123		Receive A123
None		A123, B123	

Table 151515151~~5~~: Delegation of ATM Services provision at night-time by delegating consolidated sectors

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Alternative Flow 1: consolidation after delegation

Table 16161616Table 1616~~Table 16~~ describes the flow when ATM services are delegated sector-by-sector from ATSU A to ATSU B. The first column describes the delegation/consolidation action that is performed and the second and third column depict the number of ATCO teams needed in ATSU A and ATSU B. Initially the whole airspace is allocated to the original ATSUs and thus 3 ATCO teams are required per ATSU.

Then ATSU B is incrementally consolidating its sectors locally until all sectors are operated by a single ATCO team to have empty CWPs and ATCO teams to receive sectors from ATSU A. At that point sectors are not consolidated yet in ATSU A because the traffic situation hasn't allowed to do so. Therefore, the sectors of ATSU A are delegated individually to ATSU B as soon as the traffic situation allows. The delegated sectors are then consolidated at ATSU A. Sector A1 is delegated to an empty position at ATSU B. The remaining sectors A2 and A3 will then be consolidated when being delegated with sector A1 handled by ATSU B.

Sectors ATSU A	Action ATSU A	Sectors ATSU B	Actions ATSU B
A1, A2, A3		B1, B2, B3	
			B2 + B3 ➔ B23
A1, A2, A3		B1, B23	
	Delegate A1		Receive A1
A2, A3		A1, B1, B23	
			B1 + B23 ➔ B123
A2, A3		A1, B123	
	Delegate A2		Receive A2
A3		A1, A2, B123	
			A1 + A2 ➔ A12
A3		A12, B123	
	Delegate A3		Receive A3
None		A12, A3, B123	
			A12 + A3 ➔ A123
None		A123, B123	

Table 1616161616: Delegation of ATM Services provision at night-time while delegating sector-by-sector

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Alternative Flow 2: mixed delegation options

Combinations of the two flows are also possible (see Table 17171717Table 1717~~Table 17~~). This provides more flexibility to adapt to the actual traffic situation and do consolidation and delegation when it fits best instead of sticking to a strict pattern (combination of the two flows described above). In the table below, ATSUs A and B first consolidate two sectors locally (A1+A2 and B2+B3). This enables ATSU B to receive sectors from ATSU A, because ATSU B is having an idle ATCO team and CWPs. In the example below sector A12 is delegated to ATSU B, but it could also be sector A3. It is not mandatory that consolidated sectors are delegated first.

Sectors ATSU A	Action ATSU A	Sectors ATSU B	Actions ATSU B
A1, A2, A3		B1, B2, B3	
	A1 + A2 ➔ A12		B2 + B3 ➔ B23
A12, A3		B1, B23	
	Delegate A12		Receive A12
A3		A12, B1, B23	
			B1 + B23 ➔ B123
A3		A12, B123	
	Delegate A3		Receive A3
None		A12, A3, B123	
			A12 + A3 ➔ A123
None		A123, B123	

Table 1717171717: Delegation of ATM Services provision at night-time by using mixed delegation options

Failure Flows

Any time a failure occurs, the delegation can be aborted according to the procedure (see section 3.3.2.6.5). If a failure occurs after a delegation was done successfully, the ATSU has the options described in section 3.3.2.9.

3.3.2.8.2.2 Delegation of ATM Services Provision at fixed Time

This use case was originally identified by PJ.15-09 as UC #2 (Delegation of provision of ATS services at Fixed Time) [22]. During the analysis of the use case, it appeared that there are no substantial differences in terms of procedure compared to the use case described in the previous section.

The main difference seems to be that in the previous use case (Delegation of ATM Services Provision at Night in previous section 3.3.2.8.2.1), the assumption is that all the ATM services are delegated for all the airspace of an ATSU. In this use case, only some sectors may be delegated to another ATSU.

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Table 18181818Table 1818~~Table 18~~ depicts the attributes of this use case. The main differences compared to the previous use case are in the expected traffic and that not the whole airspace is delegated to another ATSU.

Attribute	Value	Description
Operational Motivation	Efficient use of resources Capacity improvement	The operational motivation this use case is the efficient use of the available resources and linked to that an improvement in capacity compared to the case without delegation.
Trigger	Scheduled	Regularly triggered according to a schedule defined in a delegation agreement (subject to passing certain criteria).
Participating ATSU	Same ANSP Different ANSP	The use case can be executed within one ANSP as well as across ANSPs. The impact of this analysed by PJ.32-W3 [33].
ATFCM service	Delegated Not delegated	The ATFCM service may be delegated or not in this use case. The impact of this analysed by PJ.32-W3 [33].
Airspace configuration	Static Pre-defined	Both options can be implemented for this use case (see section 3.3.2.1 for more details).
Sector boundaries	Adjacent Non-adjacent	Both options can be implemented for this use case (see section 3.3.2.1 for more details).
Delegated sectors	(multiple) full sector(s) (multiple) partial sector(s) Group of sectors	Multiple options are possible for this use case. The delegation of the entire FIR is only realistic for the night delegation use case (see section 3.3.2.8.2.1)
Traffic Density	Low to medium	Traffic level during a delegation is expected to be low to medium.
Traffic Complexity	Low to medium	The traffic complexity during a delegation is expected to be low to medium.
Civ/Mil	Civ/Mil included Civ/Mil not included	Both options are possible.

Frequency of delegation	Frequently	Supposed to be performed on a regular basis.
ATCO Workload	Low to medium	ATCO workload is expected to be low to medium at the time of a delegation.
Num of ATCOs on duty	Less or unchanged	Fewer ATCOs may be required compared to today if sectors could be consolidated across the ATSUs. Fewer operational support staff including operational Supervisors and Flight Data Operators are required only if the whole airspace of an ATSU is delegated.
Num of ATSEPs on duty	Less or unchanged	Only fewer ATSEPs in ATSU on duty but only if the whole airspace of an ATSU is delegated.
Expected airspace capacity	Unchanged or higher	The delegation of ATM services from one ATSU to another should not impact capacity or service levels.
Expected effect on ATCO productivity	Unchanged or higher	ATCO productivity is expected to slightly increase if fewer ATCOs are required. Otherwise, it will not be affected.

Table 1818181818: Attributes of Delegation of ATM Services Provision at fixed Time

3.3.2.8.2.3 Delegation of the ATFCM service and load balancing between ATSUs

This use case was originally identified by PJ.15-09 as UC #3 (Delegation of the provision of ATS services based on Flow Control (ATFCM) predictions) [22]. The concept and the use cases will be described in the V2 OSED of SESAR2020 Wave 3 PJ.32 [33] which particularly focuses on ATFCM aspects.

3.3.2.8.2.4 Delegation between Civil and Military ATSUs

This use case was originally identified by PJ.15-09 as UC #4 (Delegation of provision of ATM services – Civil-military operation) [22]. The concept and the use cases will be described in the V2 OSED of SESAR2020 Wave 3 PJ.32 [33].

3.3.2.8.2.5 Cross-border delegation of ATM services for an elementary sector with dynamic AoR

This use case was originally identified by PJ.15-09 as UC #5 (Delegation of provision of ATS services – Cross Border) [22]. This section further breaks down this high-level use case identified by PJ.15-09. An alternative cross-border use case is described in the following section 3.3.2.8.2.6.

This use case focuses on delegation of ATM services between adjacent ATSUs and therefore refers to the elementary delegation scenario described in sections 3.3.2.1.2 and 3.3.2.1.3. The aim of this use case is the optimisation of traffic flows along the common border of the adjacent units for operational reasons (e.g., decreasing traffic, ATCOs engagement plan, economy of scale) as well as the optimisation of available ATCO resources.

This section describes the use case 'Delegation of ATM Services Provision at Night'. Table 19191919Table 1919~~Table 19~~ summarises the attributes of this use case.

Attribute	Value	Description
Operational Motivation	Efficient use of resources Optimisation of traffic flows	The operational motivation of this use case is to manage the traffic near the common border of the participating ATSUs in an efficient way, by delegating airspace in relation to the traffic flows.
Trigger	Scheduled Semi-dynamic	Regularly triggered according to a schedule defined in a delegation agreement (subject to passing certain criteria) or depending on traffic flows or ATCO availability.
Participating ATSU	Same ANSP Different ANSP	The use case can be executed within one ANSP as well as across ANSPs.
ATFCM service	Delegated Not delegated	The ATFCM service may be delegated or not during night delegation. The impact of this analysed by PJ.32-W3 [33].
Airspace configuration	Pre-defined	The AoR is modified according to a pre-defined configuration.
Sector boundaries	Adjacent	This use case is only applicable for adjacent sectors.
Delegated sectors	(multiple) full sector(s) (multiple) partial sector(s)	The use case is applicable only for the sectors that are along the common boundary of the delegating and the receiving ATSU.
Traffic Density	Low to medium	Traffic level needs to allow the delegation. The decision if a delegation request will be accepted or not is taken by the operational Supervisor of the receiving ATSU.

Traffic Complexity	Low to medium	The traffic complexity needs to allow the delegation. The decision if a delegation request will be accepted or not is taken by the operational Supervisor of the receiving ATSU.
Civ/Mil	Civ/Mil included Civ/Mil not included	Both options are possible. The impact of this analysed by PJ.32-W3 [33].
Frequency of delegation	Frequently	Expected to be performed regularly.
ATCO Workload	Low to medium	ATCO workload is expected to be low to medium in relation to the traffic volume and the traffic complexity.
Num of ATCOs on duty	Less or unchanged	Fewer ATCOs may be required compared to today if sectors could be consolidated across the ATSUs.
Num of ATSEPs on duty	Unchanged	No change in the number of ATSEPs on duty is expected.
Expected airspace capacity	Unchanged	The delegation of ATM services from one ATSU to another should not impact capacity or service levels.
Expected effect on ATCO productivity	Unchanged or Higher	ATCO productivity is expected to slightly increase by a decreasing need of coordination. Otherwise, it will not be affected.

Table 1919191919: Attributes of cross-border delegation of ATM Services for an elementary sector with dynamic AoR

Scope

Two adjacent ATSUs may use cross-border delegation of ATM services with dynamic AoR to optimise their resources and the handling of the traffic flows that are close to the common border between these two ATSUs. Depending on the time of day, it might be more efficient to change the original operational sector configuration of the AoRs of the adjacent ATSUs. This might be caused by inbound/outbound rushes to a particular airport that is close to the border, or it may also be due to an agreement between the ATSUs to regularly change the AoRs to optimise their local staff rosters.

Figure 47474747Figure 4747Figure 47 depicts two adjacent ATSUs A and B with AoRs sharing a common boundary. ATM services for sector A3 are delegated from ATSU A (blue) to ATSU B (green). After the delegation, ATCO CA3 of ATSU A is idle and the ATCO CB1 of ATSU B is in control of sector A3. For reasons of efficiency, ATCO CB1 consolidates sector A3 and B1.

Figure 47474747Figure 4747Figure 47 depicts the cross-border delegation of ATM Services for an elementary sector with dynamic AoR as introduced in section 3.3.2.1.2. But this use case is also applicable for cross-border delegation of ATM Services for partial services with dynamic AoR as described in section 3.3.2.1.3.

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Principally, consolidation may also be done after the delegation of ATM services for sector A3, but this would require a spare CWP and a spare ATCO in ATSU B to take over sector A3 until the traffic situation permits its consolidation with another sector of ATSU B.

During the delegation of the ATM services for sector A3, the operational sector configurations in ADSP A and ADSP B are modified as well: the AoR of ATSU A is reduced by sector A3 while the AoR of ATSU B is increased by sector A3.

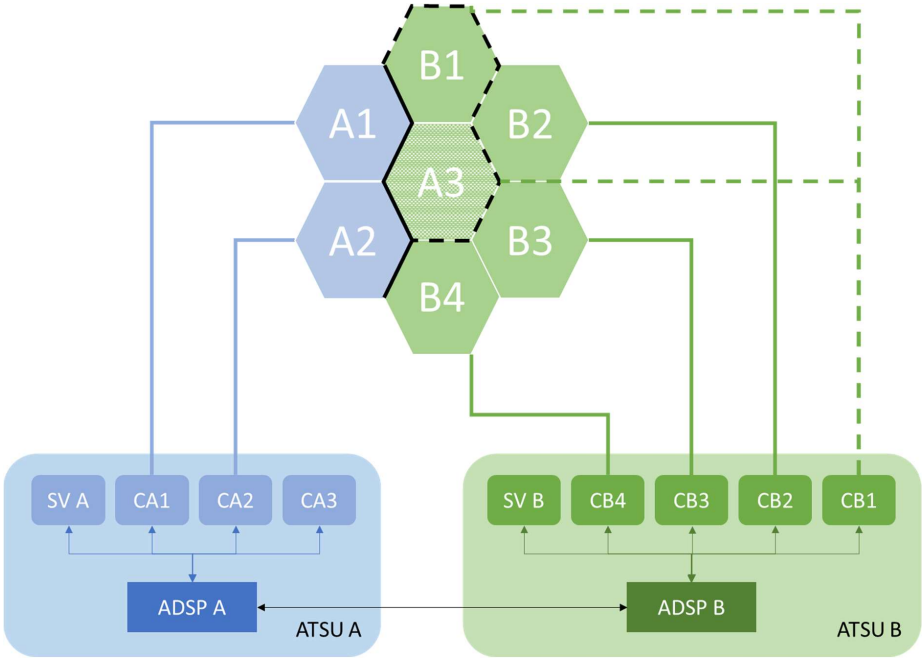

Figure 4747474747: Cross-border delegation of ATM services for an elementary sector with dynamic AoR

Actors

Primary Actors

- Operational Supervisors in delegating and receiving ATSUs
- Executive and Planner ATCOs in delegating and receiving ATSU

Supporting Actors

- ATSEPs in delegating and receiving ATSU
- ADSP providing data to the ATSUs

Preconditions

The following preconditions apply:

- The necessary conditions and rules will be laid down in a delegation agreement (see section 3.3.2.2 for details on agreements between ATSUs) between all participating ATSUs.
- The systems of the ATSUs are prepared are technically prepared for the delegation and have the required operational sector configurations available
- The delegation of ATM services provision is done according to the procedure described in section 3.3.2.6.
- No specific time of day is assumed, but traffic density and complexity must allow delegation and consolidation according to the predefined triggering scenarios of the delegated sector.

Postconditions

The airspace is delegated successfully between the delegating and the receiving ATSUs for the foreseen duration and delegated back afterwards.

Success end state

The ATM services have been delegated successfully between the ATSUSs and traffic flows can be handled more efficiently (less coordination and/or less resources are needed) during the time of delegation.

Failure end state

The ATM service could not be delegated between delegating and receiving ATSU due to the following reasons:

- Rejection of the delegation request by the receiving ATSU due to an inability to take the sector
- Abort of the delegation procedure due to a problem during the preparation phase at the receiving ATSU

Notes

None

Trigger

This use case intends to optimise traffic flows near the common border of two adjacent ATSUs. Depending on the concrete implementation of this use case, this use case may be either triggered by concrete traffic flows or there may be an agreement in place which defines times for delegating ATM services between the participating ATSUs

Main Flow: cross-border delegation with dynamic AoR and immediate consolidation

The flow is defined by the delegation procedure described in section 3.3.2.6. Thus, only the high-level steps are listed here, which are compliant with the overview of the delegation procedure depicted in Figure 23232323Figure 2323~~Figure 23~~ in section 3.3.2.6.1:

1. Handling of delegation request between delegating and receiving ATSU
2. Entering preview mode at receiving ATSU
3. Preparing for delegation at receiving ATSU
4. Exchanging traffic situation between delegating and receiving ATSU
5. Entering operational mode at receiving ATSU
6. Switching to preview mode at delegating ATSU
7. Exiting preview mode at the delegating ATSU

The switch to the preview mode at the delegating ATSU is an optional step. The receiving ATSU can also switch to operational mode without the delegating ATSU switching to preview mode. In the latter case the steps 6 and 7 are obsolete.

Table 20202020Table 2020~~Table 20~~ describes the flow of a delegating of ATM services for a cross-border sector between two adjacent ATSUs with dynamic AoR. This flow is applicable for the cross-border delegation of elementary sectors with dynamic AoR as well as the cross-border delegation of partial sectors with dynamic AoR. The immediate delegation is a prerequisite for the delegation of the partial sector because it cannot be managed individually, but always needs to be consolidated with an existing sector.

Sectors ATSU A	Action ATSU A	Sectors ATSU B	Actions ATSU B
A1, A2, A3		B1, B2, B3, B4	
	Delegate A3		Receive A3 and consolidate with B1: B1 + A3 ➔ B1A3
A1, A2		B1A3, B2, B3, B4	

Table 2020202020: Cross-border delegation of ATM services for a sector with dynamic AoR and immediate consolidation

Alternative Flow: cross-border delegation with dynamic AoR and later consolidation

Table 21212121Table 2121~~Table 21~~ describes the flow for cross-border delegation of a sector between adjacent ATSUs with dynamic AoR and later consolidation of the delegated sector. This flow is only applicable for the delegation of an elementary sector, but not for partial sectors since they always need to be consolidated with another sector and cannot be managed individually.

The difference to the main flow described is that the consolidation of the delegated sector A3 is not done immediately as a part of the delegation, but that this consolidation is delayed to a later point in time. This means that the receiving ATSU B requires an idle CWP and an idle ATCO to take over sector A3. The consolidation with another sector of the receiving ATSU, sector B1 in this example, is done as soon as the traffic situation allows.

Sectors ATSU A	Action ATSU A	Sectors ATSU B	Actions ATSU B
A1, A2, A3		B1, B2, B3, B4	
	Delegate A3		Receive A3
A1, A2		B1, B2, B3, B4, A3	
			B1 + A3 ➔ B1A3
A1, A2		B1A3, B2, B3, B4	

Table 2121212121: Cross-border delegation of ATM services for a sector with later consolidation

Failure Flows

Any time a failure occurs, the delegation can be aborted according to the procedure (see section 3.3.2.6.5). If a failure occurs after a delegation was done successfully, the ATSU has the options described in section 3.3.2.9.

3.3.2.8.2.6 Cross-border optimisation using delegation with static AoR

This use case was originally identified by PJ.15-09 as UC #5 (Delegation of provision of ATS services – Cross Border) [22]. This section further breaks down this high-level use case identified by PJ.15-09. An alternative cross-border use case is described in the previous section 3.3.2.8.2.5.

Table 22222222Table 2222Table 22 depicts the attributes of this use case. The main differences compared to the previous use case are in the expected traffic and that not the whole airspace is delegated to another ATSU.

Attribute	Value	Description
Operational Motivation	Efficient use of resources	The operational motivation of this use case is to manage the traffic near the common border of the participating ATSUs in an efficient way, by delegating airspace in relation to the availability of ATCO resources.
Trigger	Scheduled	Regularly triggered according to a schedule defined in a delegation agreement (subject to passing certain criteria) or depending on traffic flows or ATCO availability.

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Participating ATSU	Same ANSP Different ANSP	The use case can be executed within one ANSP as well as across ANSPs.
ATFCM service	Delegated Not delegated	The ATFCM service may be delegated or not during night delegation. The impact of this analysed by PJ.32-W3 [33].
Airspace configuration	Static	The AoRs of the participating ATSUs remain unchanged.
Sector boundaries	Adjacent	This use case is only applicable for adjacent sectors.
Delegated sectors	(multiple) full sector(s)	The use case is applicable only for the sectors that are along the common boundary of the delegating and the receiving ATSU.
Traffic Density	Low to medium	Traffic level needs to allow the delegation. The decision if a delegation request will be accepted or not is taken by the operational Supervisor of the receiving ATSU.
Traffic Complexity	Low to medium	The traffic complexity needs to allow the delegation. The decision if a delegation request will be accepted or not is taken by the operational Supervisor of the receiving ATSU.
Civ/Mil	Civ/Mil included Civ/Mil not included	Both options are possible. The impact of this analysed by PJ.32-W3 [33].
Frequency of delegation	Frequently	Expected to be performed regularly.
ATCO Workload	Low to medium	ATCO workload is expected to be low to medium in relation to the traffic volume and the traffic complexity.
Num of ATCOs on duty	Unchanged	The ATCOs resources are used more efficiently, but no reduction is expected.
Num of ATSEPs on duty	Less or unchanged	No change in the number of ATSEPs on duty is expected.
Expected airspace capacity	Unchanged or higher	The delegation of ATM services from one ATSU to another should not impact capacity or service levels.
Expected effect on ATCO productivity	Unchanged	No change in the ATCO productivity is expected.

Table 2222222222: Attributes of cross-border optimisation using delegation with static AoR

Scope

Two adjacent ATSUs may use cross-border delegation with static AoR to optimise their resources for handling the traffic flows that are close to the common border between these two ATSUs. The main difference compared to the previous cross-border use case described in section 3.3.2.8.2.5 is that in this use case the AoR of the participating ATSUs remain unchanged. But an ATCO of the receiving ATSU takes over a sector of the delegating ATSU by connecting their CWP to the ATM system of the delegating ATSU (see section 3.3.2.1.1). Consequently, the delegated sector cannot be consolidated with an adjacent sector of the receiving ATSU, but only with an adjacent sector of the delegating ATSU.

ATSUs may optimise their staff rostering by mutually taking control of sectors at their common border. For the ATCOs of the receiving ATSU it is expected to be easier to manage an adjacent sector, because the traffic flows are already well known.

Figure 48484848Figure 4848~~Figure 48~~ depicts two adjacent ATSUs A and B with AoRs sharing a common boundary. Sector A3 is transferred from ATSU A (blue) to ATSU B (green). After the transfer, ATCO CA3 of ATSU A is idle and the ATCO CB5 of ATSU B is in control of sector A3. To manage the sector A3, the CWP of ATCO CB5 is connected to ADSP A and served with the necessary data to manage the sector. The AoRs of the ATSUs remain unchanged. This is the main difference compared to the use case in the previous section.

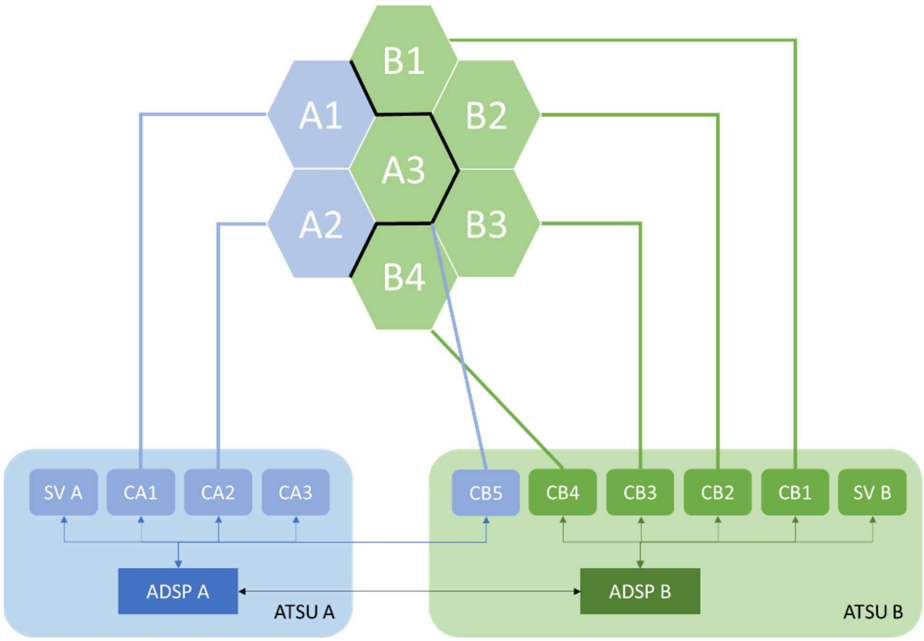

Figure 4848484848: Cross-border optimisation using delegation with static AoR

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Actors

Primary Actors

- Supervisors in delegating and receiving ATSUs
- Executive and Planner ATCOs in delegating and receiving ATSU

Supporting Actors

- ATSEPs in delegating and receiving ATSU
- ADSP providing data to the ATSUs

Preconditions

The following preconditions apply:

- The necessary conditions and rules will be laid down in a delegation agreement (see section 3.3.2.2 for details on agreements between ATSUs) between all participating ATSUs.
- The systems of the ATSUs are prepared are technically prepared for the delegation and have the required operational sector configurations available
- CWPs of the receiving ATSU are interoperable with the ADSP of the delegating ATSU
- The delegation of ATM services provision is done according to the procedure described in section 3.3.2.6.
- No specific time of day is assumed, but traffic density and complexity must allow delegation according to the predefined triggering scenarios of the delegated sector.

Postconditions

The sector is transferred successfully between the delegating and the receiving ATSUs for the foreseen duration and transferred back afterwards.

Success end state

The sector has been transferred successfully between the ATSUSs and ATCO resources are used more efficiently during the time of delegation.

Failure end state

The sector could not be transferred between delegating and receiving ATSU due to the following reasons:

- Rejection of the delegation request by the receiving ATSU due to an inability to take the sector
- Abort of the delegation procedure due to a problem during the preparation phase at the receiving ATSU

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Notes

None

Trigger

This use case intends to optimise the staff rostering of the participating ATSUs. Therefore, an agreement is expected to be in place which defines times for delegating ATM services between the participating ATSUs

Main Flow: cross-border optimisation using delegation with static AoR

The flow is defined by the delegation procedure described in section 3.3.2.6. Thus, only the high-level steps are listed here, which are compliant with the overview of the delegation procedure depicted in Figure 23232323Figure 2323~~Figure 23~~ in section 3.3.2.6.1:

1. Handling of delegation request between delegating and receiving ATSU
2. Entering preview mode at receiving ATSU
3. Preparing for delegation at receiving ATSU
4. Exchanging traffic situation between delegating and receiving ATSU
5. Entering operational mode at receiving ATSU
6. Switching to preview mode at delegating ATSU
7. Exiting preview mode at the delegating ATSU

The switch to the preview mode at the delegating ATSU is an optional step. The receiving ATSU can also switch to operational mode without the delegating ATSU switching to preview mode. In the latter case the steps 6 and 7 are obsolete.

Table 23232323Table 2323~~Table 23~~ describes the main flow of cross-border optimisation using delegation with static AoR between two adjacent ATSUs.

Sectors ATSU A	Action ATSU A	Sectors ATSU B	Actions ATSU B
A1, A2, A3		B1, B2, B3, B4	
	Delegate A3		Receive A3
A1, A2		A3, B1, B2, B3, B4	

Table 2323232323~~23~~: Main Flow of cross-border optimisation using delegation with static AoR

Failure Flows

Any time a failure occurs, the delegation can be aborted according to the procedure (see section 3.3.2.6.5). If a failure occurs after a delegation was done successfully, the ATSU has the options described in section3.3.2.9.

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3.3.2.8.3 Operational Use Case in unexpected Conditions

3.3.2.8.3.1 Delegation of ATM services Provision following abnormal conditions (ATSU Contingency)

The ATSU Contingency use case is related to a severe failure taking place at the ATSU premises at a random point in time. This severe event results in the impossibility of the ATSU to further control its associated airspace. Such severe events might be:

- Fire in the control room
- Terrorist threat and a related evacuation of the ATSU
- Destruction of the ATSU due to a natural catastrophe, e.g., flood or earthquake
- …

In these cases, ATM services provision needs to be delegated to another ATSU or several ATSUs to provide ATM services to the airspace users. The delegation of ATM services is done according to the delegation procedure described in section 3.3.2.6. The overall Contingency procedure itself is described in section 3.3.2.7. It contains the immediate delegation of ATM services provision as well as the Clear-the-Sky if no aiding ATSU can take over the ATM services provision immediately.

It is very difficult to precisely define a use case for Contingency due to the high degree of uncertainty of the Contingency cases. Only very dedicated cases can be assessed that have been defined in detail. For this, assumptions have to be taken for the following topics to define an assessable Contingency use case:

- How many sectors are affected by the failing of the ATSU?
- For how many sectors can the provision of ATM services be delegated to an aiding unit?
- For how many sectors is the clear-the-sky procedure executed?
- After which time can sectors be reopened by an aiding ATSU?
- After which time is the Contingency case ended (from some days for terrorist threat up to more than a year in case of an earthquake)?
- …

When an ATSU is failing, there are three principal possibilities to react on this situation for each individual sector of the failing ATSU exist:

1. A sector of the failing ATSU can be immediately delegated to an aiding ATSU and taken over by spare resources of an aiding ATSU.
2. A sector of the failing ATSU can be immediately delegated to an aiding ATSU and the delegated sector is consolidated with a sector already in control on the aiding ATSU.
3. A sector of the failing ATSU cannot be delegated to an aiding ATSU and therefore the clear-the-sky procedure needs to be performed.

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Assuming a failing ATSU is managing multiple sectors, for each sector of the failing ATSU one of the above reactions can take place. Maybe some sectors may be immediately delegated to spare resources of an aiding ATSU. This option might be rather rare, because it is very likely that not many spare resources will be available that are able to take over a sector of a failing ATSU.

The second case, delegating a sector of the failing ATSU and consolidating it with another sector of an aiding ATSU is more likely, but it highly depends on the traffic situation at the time of the emergency. If the traffic is low, ATCOs in the aiding ATSU will have the opportunity to take over control of a sector of the failing ATSU. But if the ATCO workload is too high, this will be impossible. Another constraint is that the second option is only possible if the sectors are adjacent to the aiding ATSU.

The last option will always be to clear-the-sky, but this will have the highest impact on the airspace capacity and will very likely produce the highest delays. If the clear-the-sky procedure is executed for a sector, preparatory steps need to be taken in aiding ATSU(s) to prepare to take over and reopen sectors from the failed ATSU at a later point in time.

This high uncertainty in the Contingency use case is also reflected in Table 24242424Table 2424~~Table 24~~ which describes the attributes of ATSU Contingency characterising the use case.

Attribute	Value	Description
Operational Motivation	Improvement in service continuity	Delegation of ATM services can be used to provide service continuity for airspace of a failing ATSU more quickly than it is possible today.
Trigger	Dynamic	ANSPs prepare Contingency Plans, but the event occurs rarely and at a random time.
Participating ATSU	Same ANSP Different ANSP	The use case can be executed within one ANSP as well as across ANSPs.
ATFCM service	Delegated	If the ATSU failed a delegation of the ATFCM service seems to be required. The impact of this analysed by PJ.32-W3 [33].
Airspace configuration	Static Pre-defined	Both options can be used in a contingency case (see section 3.3.2.1 for more details).
Sector boundaries	Adjacent Non-adjacent	Both options can be used in a contingency case (see section 3.3.2.1 for more details).
Delegated sectors	Entire FIR	In a contingency case the entire FIR needs to be delegated. If this is not possible, sectors need to be closed which has a high impact on the capacity and the delay.

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Traffic Density	Low to high	Since a Contingency Case can occur at any time, no assumption about the traffic density can be made when the event occurs.
Traffic Complexity	Low to high	Since a Contingency Case can occur at any time, no assumption about the traffic complexity can be made when the event occurs.
Civ/Mil	Civ/Mil included Civ/Mil not included	Both options are possible are valid. The impact of this analysed by PJ.32-W3 [33].
Frequency of delegation	Rare	Contingency cases usually are very rare. Their occurrence cannot be predicted.
ATCO Workload	Low to high	ATCO workload is depending on the traffic level and therefore not predictable.
Num of ATCOs on duty	n/a	No assumption can be made
Num of ATSEPs on duty	n/a	No assumption can be made
Expected airspace capacity	Higher	Due to improved capabilities in provision of ATM services, it is expected that less airspace needs to be closed during a Contingency case. In addition, aiding ATSU might take over control of an airspace compared to today.
Expected effect on ATCO productivity	n/a	No assumption can be made

Table 2424242424: Attributes of ATSU Contingency

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3.3.2.8.4 Summary of Use Cases

The following Table 25252525Table 2525~~Table 25~~ summarises the attributes of the use cases described in sections 3.3.2.8.2 and 3.3.2.8.3.

Attribute	Delegation of ATM Services Provision at Night	Delegation of ATM Services Provision at fixed Time	Cross-border delegation of ATM services provision for an elementary sector with dynamic	Cross-border optimisation using delegation with static AoR	Delegation of ATM services Provision following abnormal conditions (ATSU Contingency)
Operational Motivation	Efficient use of resources	Efficient use of resources Capacity improvement	Efficient use of resources Optimisation of traffic flows	Efficient use of resources	Improvement in service continuity
Trigger	Scheduled	Scheduled	Scheduled Semi-dynamic	Scheduled	Dynamic
Participating ATSU	Same ANSP Different ANSP	Same ANSP Different ANSP	Same ANSP Different ANSP	Same ANSP Different ANSP	Same ANSP Different ANSP
ATFCM service	Delegated Not delegated	Delegated Not delegated	Delegated Not delegated	Delegated Not delegated	Delegated
Airspace configuration	Static Pre-defined	Static Pre-defined	Pre-defined	Static	Static Pre-defined
Sector boundaries	Adjacent	Adjacent	Adjacent	Adjacent	Adjacent

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	Non-adjacent	Non-adjacent			Non-adjacent
Delegated sectors	Entire FIR	(multiple) full sector(s) (multiple) partial sector(s) Group of sectors	(multiple) full sector(s) (multiple) partial sector(s)	(multiple) full sector(s)	Entire FIR
Traffic Density	Low	Low to medium	Low to medium	Low to medium	Low to high
Traffic Complexity	Low	Low to medium	Low to medium	Low to medium	Low to high
Civ/Mil	Civ/Mil included Civ/Mil not included	Civ/Mil included Civ/Mil not included	Civ/Mil included Civ/Mil not included	Civ/Mil included Civ/Mil not included	Civ/Mil included Civ/Mil not included
Frequency of delegation	Frequently	Frequently	Frequently	Frequently	Rare
ATCO Workload	Low	Low to medium	Low to medium	Low to medium	Low to high
Num of ATCOs on duty	Less or unchanged	Less or unchanged	Less or unchanged	Unchanged	n/a
Num of ATSEPs on duty	Less	Less or unchanged	Unchanged	Less or unchanged	n/a

Expected airspace capacity	Unchanged	Unchanged or higher	Unchanged	Unchanged or higher	Higher
Expected effect on ATCO productivity	Unchanged or higher	Unchanged or higher	Unchanged or Higher	Unchanged	n/a

Table 2525252525: Summary of the use case attributes

3.3.2.9 Handling of problems after a successful Delegation

The abort of the delegation procedure due to occurring problems during the execution of the delegation procedure itself is described in section 3.3.2.6.5. Principally, the delegation procedure can be aborted at any time during its execution. But problems may also occur after a delegation was performed successfully. Since the potential problems that may occur after a successful delegation can be manyfold, it is difficult to give concrete counter measures for every possible incident. Figure 49494949Figure 4949~~Figure 49~~ clusters possible types of problems and depicts general procedures to solve them.

Generally, potential problems can be subdivided into two categories:

- Performance-related problems
  After airspace was successfully delegated, the receiving ATSU is unable to handle the requested amount of traffic, e.g., caused by weather conditions, or unexpected shortages in staffing.

- Failures
  After airspace was successfully delegated, a functional failure occurs at the receiving ATSU impacting its ability to provide service. These failures can either be non-severe, i.e., the quality of service or the capacity of the ATSU is impacted, but the ATSU remains operational, while in case of a severe failure, the receiving ATSU will have a contingency case.

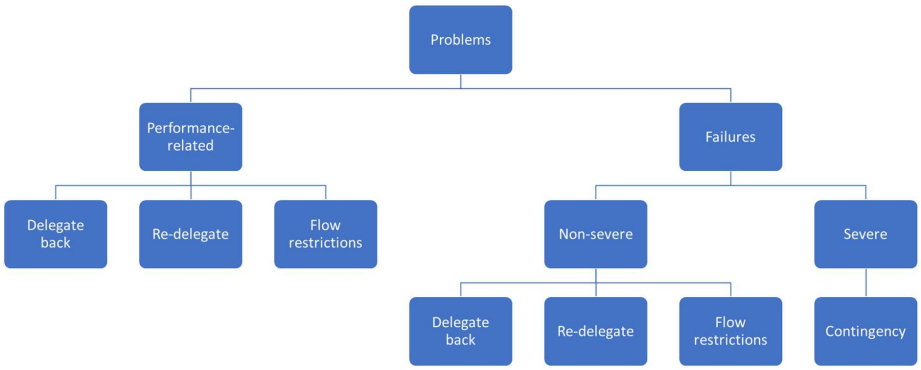

Figure 4949494949: Overview of problems after a successful delegation and their mitigations

To mitigate performance-related and problems and failures, the receiving ATSU can apply the following counter measures:

- Delegate back to delegating ATSU
- Delegate airspace to another ATSU
- Apply flow restrictions

- Apply contingency measures

Details of the various counter measures are described in the following subsections.

3.3.2.9.1 Delegate back to delegating ATSU

Delegating back the received airspace to the delegating ATSU might be the first option although it is very likely that this cannot be done, because it can be expected that the delegating ATSU is not having the necessary resources to take back the airspace. In any case, it is very likely that there are no resources available at the delegating ATSU. Otherwise, the delegating ATSU would not have delegated the airspace.

Depending on the operational use case for the delegation (see section 3.3.2.8), the delegating ATSU will be closed and therefore is unable to take back the airspace (see the operational use case 'Delegation of ATM Services Provision at Night' in section 3.3.2.8.2.1). Only during a small period after the delegation, the delegating ATSU might have staff in the unit available to take back the delegated airspace. But it would create issues for the staff planning and rostering of the delegating ATSU. It would be obliged to bring in new ATCOs for the night-time, that have not been scheduled for this time. At the end it might require applying flow restrictions and close the airspace or parts of it.

3.3.2.9.2 Delegate sectors to another ATSU

The critical point for the receiving ATSU is the reduction of the workload and to free resources to able to manage the amount of traffic. If airspace cannot be delegated back to the delegating ATSU, another option is to delegate airspace to another ATSU. This requires that the receiving ATSU has a delegation agreement in place with another ATSU.

To achieve this, two options are available:

- The receiving ATSU delegates a part of its own airspace to another ATSU
- The receiving ATSU re-delegates the airspace received from the delegating ATSU to another ATSU

The two options are described in more detail in the following sections.

3.3.2.9.2.1 The receiving ATSU delegates a part of its own airspace to another ATSU

Figure 50505050Figure 5050~~Figure 50~~ depicts an example of this option. Originally ATSU A (blue) is delegating its airspace to ATSU B (green). This might be a delegation of the whole airspace in case of a night delegation (cf. section 3.3.2.8.2.1) or it might be a partial delegation of the airspace of ATSU A, e.g., for reasons of cross-border delegation (c.f. section 3.3.2.8.2.5 and 3.3.2.8.2.6).

When ATSU B is coming into performance problems, it will delegate a part of its own airspace to ATSU C (orange) to free resources and to lower its workload. In this case, a re-delegation to the ATSU A is not an option for ATSU B. To be able to delegate its own airspace to ATSU C, ATSU B and C need to have a delegation agreement (see section 3.3.2.2.2) in place.

As soon as ATSU B has recovered from the performance problems, ATSU C may delegate back the airspace to ATSU B.

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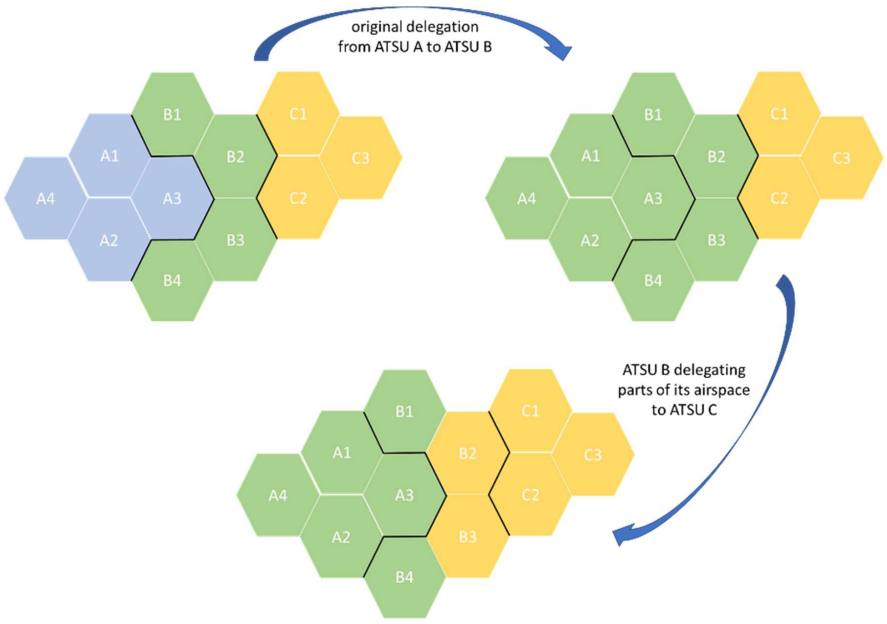

Figure 5050505050: The receiving ATSU delegates a part of its own airspace to another ATSU

3.3.2.9.2.2 The receiving ATSU re-delegates the airspace received from the delegating ATSU to another ATSU

Figure 51515151Figure 5151~~Figure 51~~ depicts an example of the option in which the receiving ATSU B (green) is re-delegating the airspace received from ATSU A (blue) to ATSU C (orange). This scenario could be an option, if ATSU A also has a delegation agreement with ATSU C and might also delegate its airspace to ATSU C. In this case it would be an option to re-delegate the airspace (or parts of it) received from ATSU A to ATSU C. This requires appropriate delegation agreements between

- ATSU A and ATSU B
- ATSU A and ATSU C
- ATSU B and ATSU C (about airspace of A)

To enable this, the delegation agreement between ATSU B and ATSU C needs to be valid also for airspace delegated by ATSU A to ATSU B. In particular, the two delegation agreements need to be consistent with respect to the regulations concerning the airspace of ATSU A. There must not be a difference if the airspace of ATSU A is directly delegated to ATSU C or if it is re-delegated from ATSU B to ATSU C.

If the airspace of ATSU A or parts of it are re-delegated by ATSU B to ATSU C, ATSU A needs to be informed about that.

A delegation back of the airspace of ATSU A from ATSU C could be either done to ATSU A or to ATSU B. It will depend on which one of this two ATSUs will be available.

Figure 5151515151: The receiving ATSU re-delegates the airspace received from the delegating ATSU to another ATSU

3.3.2.9.3 Apply flow restrictions

If no relief can be achieved by delegating airspace, the last option of the receiving ATSU is to apply flow restrictions. This will reduce the workload of the ATSU by reducing the traffic entering the airspace of the receiving ATSU.

This mitigation option is always possible, but it would impact the capacity of airspace and thus consequently affects the airspace user.

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3.3.2.9.4 Apply contingency measures

There is the possibility that the receiving ATSU is facing some failures and severe problems. It is very difficult to give general answers to all possible failures, since the diversity of potential problems is huge. Here, general counter measures for two classes of failures are described:

1) Non-severe failures: In this case, the capacity of the ATSU is impacted, but the ATSU is still operable. As a reaction, the ATSU can either

   a) Delegate back the received airspace to the delegating ATSU

   b) Try to delegate part of its airspace to another ATSU

   c) Apply flow measures and close sectors

2) Severe failures: When the failures are severe and the ATSU not operable anymore, it is facing a contingency situation and will apply a contingency procedure as described in section 3.3.2.7.

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3.3.3 Differences between new and previous Operating Methods

As described in section 3.3.1 the delegation of ATM services provision amongst ATSUs is quite limited today. The procedures described in sections 3.3.2.6 and 3.3.2.7 provide a basis for a more flexible delegation in the future.

Table 26262626Table 2626~~Table 26~~ lists the aggregated activities of the delegation procedure (see Figure 23232323Figure 2323~~Figure 23~~ on page 858483~~83~~). Since there were no baseline activities modelled yet, all activities were newly introduced by this Solution.

Activities (in EATMA) that are impacted by the SESAR Solution	Current Operating Method	New Operating Method
Delegation Request	Not existing today	Supervisors are negotiating about the possibility of delegating the ATM provision for a certain airspace between two ATSUs.
Enter Preview Mode	Not existing today	The receiving ATSU is receiving all the necessary data for the sectors to be delegated so that the receiving ATCOs are in a position to have a traffic picture.
Delegation Preparation	Not existing today	ATCOs of the receiving ATSU prepare their CWPs for the delegation.
Exchange Traffic Situation	Not existing today	Receiving ATCOs are given an overview of the traffic situation by the delegating ATCOs.
Abort Delegation	Not existing today	In case of problems a delegation that was initiated can be aborted at any time.
Enter Operational Mode	Not existing today	The receiving ATSU takes responsibility of the delegated sectors and delegating ATSU switches to preview mode for the delegated sectors.
Exit Preview Mode of delegating ATSU	Not existing today	Delegating ATSU is stopping the preview mode and the delegation is ended.

Table 2626262626~~26~~: Differences between new and previous Operating Method related to the delegation procedure

Table 27272727Table 2727~~Table 27~~ lists the aggregated activities of the contingency procedure (see Figure 40404040Figure 4040~~Figure 40~~ on page 114113~~112~~). Some activities do not differ from today's operations, but they are not yet described with the EATMA model.

Activities (in EATMA) that are impacted by the SESAR Solution	Current Operating Method	New Operating Method
Degraded Mode / Emergency	Not described yet in EATMA	There is no change compared to today's operations, but the activity was not described yet in the EATMA model. It is about the operational Supervisor determining that a contingency case has occurred and starting to put counter measures in place.
Clear-the-Sky	Not described yet in EATMA	There is no change compared to today's operations, but the activity was not described yet in the EATMA model. It is about clearing the affected airspace by handing over aircraft to adjacent units.
Contingency Delegation	Not existing today	This is comparable to a delegation request in the delegation procedure. The objective is to find an aiding unit that is immediately able to take over affected airspace.
Service Continuity Preparation	Not existing today	The aiding unit is preparing to take over airspace from the failing unit later.
Service Continuity	Not existing today	Aiding unit has taken over the airspace from the failing unit.
Sector Opening	Not described yet in EATMA	There is no change compared to today's operations, but the activity was not described yet in the EATMA model. It describes the activities to open a sector that was closed before.

Table 2727272727~~27~~:Differences between new and previous Operating Method related to the contingency procedure

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3.3.4 Transition and Deployment Factors

This section provides a high-level overlook of potential transition factors and deployment-related topics that need to be considered if the delegation of ATM services provision amongst ATSUs will be put into operations. This is not a holistic transition plan, but a first reflection of this topic based on conceptual analysis and exercise results from the V3 validation exercises. It is distinguished between general topics and topics that are relevant only in deployment scenarios involving multiple states / ANSPs.

3.3.4.1 General Transition and Deployment Factors

The following transition factors have been identified so far:

- **Tailoring of delegation procedure**
  The concept and the delegation procedure described in this document are presented in a generic manner. For a concrete implementation of the concept, it cannot be used as is but must be tailored to the actual needs of the participating ATSUs. The constraints and complexity of the airspace needs to be considered, the operational use case need to be considered, additional tool support might need to be developed, legal constraints need to be taken into account, etc. Based on a detailed analysis of all relevant factors of the concerning ATSUs a tailored delegation procedure can be developed which suits the individual delegation case.

- **Definition of a delegation agreement**
  As outlined in section 3.3.2.2.2, a delegation agreement is the formal core element which needs to be prepared and signed between the concerned parties. This includes the description of the tailored and agreed delegation procedure and of all other relevant parameters and constraints as described in section 3.3.2.2.2. Delegation agreements will be approved by the concerned regulator(s).

- **Licensing**
  Today, as described in section 3.2.4.4, licenses are related to ATSUs and bound to geographical regions associated with the ATSU. This is probably the main obstacle preventing the delegation of ATM services provision to be put into operations. With today's licensing regime, an ATCO needs to obtain a license for additional sectors of another ATSU. In addition to that, the ATCO needs to maintain the unit endorsement by working sufficient hours on the sectors to ensure competence. Training ATCOs for additional sectors requires resources, time, and financing. In rare cases of delegation, the maintenance of the unit endorsement is threatened.
  Alternative approaches for future licensing regimes have initially been investigated by PJ.10-06 in Wave 1 [30] and is continued by PJ.10-W2-73 IFAV [37] and PJ.33-W3 FALCO [38].

- **Tool Support**
  Appropriate tool support for all actors involved (operational and technical) is required for a delegation of ATM services provision between ATSUs. This was already identified by PJ.10-06 when investigating alternative licensing approaches. Support tools are considered of great importance, e.g., for conflict detection and resolution, flight conformance monitoring, geographical information, technical supervision, etc. This view was backed up by the feedback provided by V3 validation exercises [26] where ATCOs considered tool support very important since in this exercise most of the ATCOs were handling unknown airspace.

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- **Training**
  For being able to delegate the provision of ATM services amongst ATSU, new procedures need to be established and supported by appropriate tools. This implies that all actors being involved (operational and technical personnel) need to be trained appropriately. This is subject to time and finance.
  In addition, rehearsal scenarios can be defined including special situations. This is an appropriate mean to improve the operational readiness of the ATCOs.

- **HW/SW Licensing**
  The concepts described in this document imply a different use of the technical architecture that is in place today. Without going into further detail, it needs to be mentioned that this might affect software and hardware licenses that are used today. They may need to be changed to comply with future architectures. This is subject to finance and needs to be analysed in more detail on the technical level.

- **Managing of social and economic aspects of delegation**
  The delegation of ATM services amongst ATSUs will have social as well economic effects that need to be analysed and considered. Job profiles might change and there might be changes in responsibilities of roles as well as organisations.

3.3.4.2 Transition and Deployment Factors specific to multi-national Scenarios

- **Shared radio and telephony infrastructure**
  Today, the radio communication infrastructures are usually exclusively operated within the geographical borders of the states: each ANSP operates its own radio communication infrastructure exclusively. For deploying the delegation of ATM services between different states, the radio communication infrastructure needs to be used in a joint manner between delegating and receiving ATSU. That means that if a sector is delegated from one ANSP to another, the receiving ANSP needs to have access to the radios of the delegated airspace. For reasons of cost efficiency, it is not an option to deploy additional radios for the delegation cases, as their number would multiply if there were multiple potential ANSPs to delegate to. Therefore, a radio communication infrastructure is required that is shared by the partners being involved in the delegation.
  With respect to telephony, it is necessary that a third party is always connected with the responsible ATCO of a sector at any time. If ATM services are delegated, incoming phone calls must be redirected appropriately.

- **Data Link**
  Data Link is a very complex topic. In principle, there is a mandate for Data Link, but the rate of equipage and usage is very different across Europe. Thus, there are several options that need to be considered:
  1. ATM services might be delegated between ATSUs that have the same level of equipage
  2. ATM services are delegated from an ATSU with DL equipage to another ATSU without DL equipage
  3. ATM services are delegated from an ATSU without DL equipage to another one with DL equipage.
  These constellations need to be investigated further. So far, it can be concluded that the logon procedure of the aircraft is affected.

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- **Accounting and charging**
  If ATM services are delegated between different ANSPs, it must be defined how accounting and charging will be coordinated among them. It is expected that this highly depends on the operational use case that the ANSPs intend to implement. If ANSPs implement a mutual night delegation on a weekly basis there might not be the need to define agreements for accounting and charging because it might be a give-and-take situation for both ANSPs. But it might be different with other use cases, or if the night delegation is not mutual, but it is always the same ANSP delegating ATM services. In those cases, a compensation for the receiving ANSP would be required. This can be done either on the exact number of managed flight or based on a general compensation.

3.3.5 Conclusions and outlook to future research

In the V3 phase of this Solution, five different validations exercises [26] have been performed and thus provided a solid basis for validating the concept.

The V3 validation exercises confirmed the results that were also produced by the V2 validation exercise performed in the previous phase of this Solution. The V3 validation exercises validated

- a much wider scope of operational use cases covering normal and abnormal conditions,
- different airspaces,
- scenarios with different traffic complexity and traffic density,
- different technical delegation concepts (static vs. dynamic AoR),
- and multiple technical architectures.

In all validation exercises, the delegation procedure was considered as precisely defined for all the actors involved in the delegation process. The procedure was confirmed to be operationally acceptable and feasible by the involved operational experts from different ANSPs. The execution of the delegation procedure was judged safe from an operational perspective by the operational experts involved. From a Human Performance perspective the procedure did not add significant additional workload and the situational awareness of the ATCOs involved in the validation exercises was not impacted.

All validation exercises demonstrated that there is a threshold concerning the traffic density and the traffic complexity with regards to the feasibility of ATM services delegation between ATSUs. The procedure is safe and feasible when the traffic density and the traffic complexity are low or medium. This proves the prerequisite P12 described section 3.3.2.5 to be important. The delegation of ATM services creates an extra workload for the ATCO and requires special attention to manage it safely. This can only be fulfilled when ATCOs are not too busy with the management of their sectors. Thus, the traffic density and complexity need to be at a manageable level which allows to take the extra workload caused by the delegation on board.

As already addressed by the V2 exercise, the V3 exercises confirmed the need of the ATCOs to be familiar with the delegated airspace. This is an important prerequisite for a safe delegation. In the validation exercises the ATCOs were (partly) familiar with the airspace, but there were also ATCOs for whom the airspace in the exercises was unknown. This was due to the difficulty to find ATCO resources for the exercises. Additional tool support might be one approach to bypass this issue. Potential

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solutions for this may be identified by PJ.33-W3 FALCO [38] which works on generic controller validations and investigate suitable tools for controller support. For future research and validation exercises it is considered important to further improve the system support for the ATCOs with respect to the delegation procedure. This involves additional tool support, such as MTCD, Safety Nets, Mona, etc., in order to improve Safety and situational awareness. Ideally, the CWPs used in validation exercises do not differ from the ones used operationally by the ATCOs. Improved visualisation and support of the Preview mode during the delegation procedure is also considered as helpful.

In cross-border use cases where several ANSPs using different CWPs are involved, it was considered reasonable to harmonise the different HMI across the partners. If the functionality and the representation of the HMI is as similar as possible across the delegating and the receiving ATSU, this will ease the handover of the traffic and increase the safety because all ATCOs involved know what their counterpart has on the screen and how it is represented. This should be considered In future validations.

The validation exercises of PJ.10-W2-93 PROSA focussed on the operational and technical aspects of the delegation. Legal, regulatory, military (data sharing) and certification aspects have not been addressed but are important topics for a later deployment of the concept. Thus, it is recommended to further validate these aspects to fully discover benefits and drawbacks with the concept. Safety and HP was not perceived as a limiting factor from the participating operators, but to gain further assurance, several different environments and traffic scenarios should be considered, and then also considering the legal, regulatory, military and certification aspects.

With respect to the different technical architectures as defined by Solutions PJ.10-W2-93A, PJ.10-W2-93B and PJ.10-W2-93C the maturity is varying. Additional work is required to further mature these technical architectures and validate them in operational delegation use cases.

For a future deployment of the concept, the transition and deployment factors identified in section 3.3.4 need to be further analysed. This might unveil additional factors that need to be analysed and considered for a future deployment.

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4 Safety, Performance and Interoperability Requirements (SPR-INTEROP)

This section lists the requirements which are managed in SE-DMF. The following documents also define requirements based on the V3 validation exercises [23]:

- Safety Assessment Report [28]
- HP Log [29]

There is a significant number of requirements which are related to a later deployment of the concept and thus are difficult to validate in validation exercises. Examples for this are, among others, all arrangements that need to be defined in delegation agreements between two ATSUs or requirements related to training and licensing. Nevertheless, many of these requirements have been marked as validated, because the validation exercises provided documents defining exactly the use cases and necessary steps the partners had to perform. All concerned requirements have an extra explanation in their rationale section to highlight this point.

4.1 General Requirements for Delegation

All the requirements of this section are overall expectations for setting-up a delegation. As such, they do not refer to a specific phase of the delegation as detailed in this OSED and are not traced to specific EATMA elements.

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0001
Title	Conditions for delegation of ATS provisions
Requirement	ATSUs involved in the delegation shall agree on conditions triggering the process of ATC provision delegation.
Status	<validated>
Rationale	The triggering conditions shall be very precise. They shall be negotiated in detail including all possible options and pre-prepared scenarios for the delegation. These procedures are part of the delegation agreement. Once agreed the process will be in place for their change and amendment. Having a full agreement and understanding of the events triggering the ATC provision delegation is essential for planning of resources, forecasting and planning of actions related to the delegation.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D0-Delegation Process Overview

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0002
Title	Delegation of ATS provision procedures
Requirement	The two ATSUs subject to delegation (delegating and receiving) shall agree upon and establish a delegation agreement for the triggering, execution, and termination of the delegation.
Status	<validated>
Rationale	Once conditions are agreed ATSU involved in delegation shall detail the required procedures for the triggering but also for the execution and the termination of delegation. These procedures shall be clear and acceptable for all the actors involved in the delegation. They shall also be legally binding in order to allow for smooth execution of the delegation but also provide a framework for resolution in case of dispute. All these procedures constitute the Delegation Agreement. Delegation agreements are contractual documents that are agreed between participating partners when the concept is deployed. During the validation exercises no formal contracts have been defined, but validation exercises defined documents which described the use cases and the procedure including the necessary steps that the partners had to perform. Thus, this requirement is defined as validated.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D0-Delegation Process Overview

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0003
Title	Delegation of ATS provision procedures and other adjacent ATSU(s)
Requirement	Special procedures, as defined by delegation agreements, regulating the initiation, execution and termination of the delegation shall be in place with the ATSU(s) adjacent to sectors subject delegation.
Status	<validated>
Rationale	The ATSU(s) adjacent to the delegated sectors are impacted by the delegation at technical and operational level. At technical levels, procedures for checking the ground/ground communication are necessary. On operational level, LOA need to be adapted and to take into account the effects of the delegation and a delegation agreement shall be in place. These procedures shall be clear and acceptable for all the actors involved in the delegation. They shall also be legally binding in order to allow smooth execution of the delegation, but also to provide a framework for resolution in case of dispute. Delegation agreements are contractual documents that are agreed between participating partners when the concept is deployed. During the validation exercises no formal contracts have been defined, but validation exercises defined documents which described the use cases and the procedure including the necessary steps that the partners had to perform. Thus, this requirement is defined as validated.
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
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<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D0-Delegation Process Overview

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0006
Title	Tool Support
Requirement	The delegation of ATS provision shall be supported by the CWP (ATS and Voice).
Status	<validated>
Rationale	CWPs used for the delegation of the ATS provision on delegating and receiving side are designed to enable smooth and save delegation process and transfer of responsibility between delegating and receiving ATC sectors.
Category	<Safety> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D0-Delegation Process Overview

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0007
Title	Receiving ATCO team
Requirement	The ATCO team shall be physically present at the designated CWP at the receiving ATSU.
Status	<validated>
Rationale	The ATCO team is physically present at the CWP defined for delegation by procedure in order to accept the responsibility for the service provision.
Category	<Operational>

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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D0-Delegation Process Overview

4.1.1 Airspace Pre-Requisites

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0004
Title	Delegation of ATS provision
Requirement	A delegating ATSU shall have all technical, organisational, and regulatory prerequisites as defined by the Delegation Agreement in order to be able to delegate provision of ATS for a pre-defined airspace to a receiving ATSU.
Status	<validated>
Rationale	The airspace which is subject to reception of provision of ATS is precisely defined in the delegation scenarios and procedures and in the supporting technical systems. There cannot be ambiguity about the exact volume of airspace being subject delegation since this definition directly affects safety, regulatory (licensing of ATCOs) and technical (system design and adaptation) aspects of the delegation. Delegation agreements are contractual documents that are agreed between participating partners when the concept is deployed. During the validation exercises no formal contracts have been defined, but validation exercises defined documents which described the use cases and the procedure including the necessary steps that the partners had to perform. Thus, this requirement is defined as validated.
Category	<Operational>

EUROPEAN PARTNERSHIP

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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D0-Delegation Process Overview

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0005
Title	Reception of ATS provision
Requirement	A receiving ATSU shall be appropriately equipped and staffed in order to provide ATS in the pre-defined airspace of the delegating ATSU.
Status	<validated>
Rationale	The airspace which is subject to reception of provision of ATS is precisely defined in the delegation scenarios and procedures and in the supporting technical systems and its full definition is a part of the Delegation Agreement. There cannot be ambiguity about the exact volume of airspace being subject to delegation since this definition directly affects safety, regulatory (licensing of ATCOs) and technical (system design and adaptation) aspects of the delegation.
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
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<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D0-Delegation Process Overview

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0008
Title	Adjacent sector
Requirement	If the receiving ATCO team is already in control of a sector, the delegated sector shall be adjacent to the sector already in control by receiving ATCO team.
Status	<validated>
Rationale	This requirement is based on the assumption that ATCO are not used to manage non-contiguous airspaces. In this case, delegated sectors need to be adjacent since the ATCO is not used to manage non-contiguous airspaces.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D0-Delegation Process Overview

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0009
Title	Consolidation of sectors
Requirement	If the receiving ATCO team is already in control of a sector, the delegated sector shall be consolidated with the sector already in control by receiving ATCO team.
Status	<validated>
Rationale	The consolidation is, in respect to the technical and HMI elements, where the already controlled and delegated sector should behave as one sector after the delegation.
Category	<Operational>

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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D0-Delegation Process Overview

4.1.2 Licensing and Training Pre-Requisites

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0036
Title	Training plan and competence scheme
Requirement	The ANSP shall implement a unit training plan and a unit competence scheme taking into account airspaces associated with a delegation agreement.
Status	<validated>
Rationale	To ensure that their ATCOs have the appropriate licences and endorsements, the ANSP needs to put a training plan and a competence for its unit in place. Actual licensing process was not part of the validation exercises, but this requirement was validated at expert level.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D0-Delegation Process Overview

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0037
Title	Recurrent Training Needs
Requirement	Recurrent Training shall be provided to ATCOs in order to guarantee an optimal maintenance of competence for airspaces associated with a delegation agreement.
Status	<validated>
Rationale	HP requirement is related to the necessity of reinforcing and broadening the knowledge that is necessary for performing effectively an ATCO role in case of delegation. Actual licensing process was not part of the validation exercises, but this requirement was validated at expert level.
Category	<Operational> , <Human Performance> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D0-Delegation Process Overview

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0012
Title	Licensing of receiving ATCOs
Requirement	The ATCOs of the receiving ATSU shall have the appropriate endorsement(s) to operate the sector or operational sector configurations to be delegated.
Status	<validated>
Rationale	Delegation is supported by the appropriate licencing and endorsement procedures including satisfaction of defined training and proficiency requirements. Familiarisation, training and licensing of the ATCOs of the receiving ATSU for the delegated airspace are essential. Actual licensing process was not part of the validation exercises, but this requirement was validated at expert level.
Category	<Operational> , <Human Performance> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D1-Delegation Request

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0068
Title	Training of ATSEPs
Requirement	The ATSEPs of the delegating and receiving ATSU and the ATSEPs of the ADSP shall be regularly trained to operate their technical systems.
Status	<validated>
Rationale	Delegation is supported by the appropriate licencing and endorsement procedures including satisfaction of defined training and proficiency requirements. Actual licensing process was not part of the validation exercises, but this requirement was validated at expert level.
Category	<Human Performance> , <Safety> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0069
Title	Competence of ATSEPs
Requirement	The ATSEPs of the delegating and receiving ATSU and the ATSEPs of the ADSP shall be competent to operate their technical systems.
Status	<validated>
Rationale	Delegation is supported by the appropriate licencing and endorsement procedures including satisfaction of defined training and proficiency requirements. Actual licensing process was not part of the validation exercises, but this requirement was validated at expert level.
Category	<Operational> , <Human Performance> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0070
Title	Licensing of ATSEPs
Requirement	The ATSEPs of the delegating and receiving ATSU and the ATSEPs of the ADSP shall be licensed for the technical systems they are operating.
Status	<validated>
Rationale	Delegation is supported by the appropriate licencing and endorsement procedures including satisfaction of defined training and proficiency requirements. Actual licensing process was not part of the validation exercises, but this requirement was validated at expert level.
Category	<Operational> , <Human Performance> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

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4.1.3 Delegation Agreements

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0071
Title	Delegated services
Requirement	A delegation agreement shall define all ATM services that are delegated between delegating and receiving ATSU.
Status	<validated>
Rationale	Some services, such as an AMAN or an ARES function, are very specific for an airspace. It will depend on the use case whether such a service needs to be delegated or not. Support for an AMAN function might not be required during a night delegation, because the airports may either be closed, or the traffic demand may easily be handled without an AMAN. Whereas an ARES function might not be delegated itself but may require access to it by the receiving operational Supervisor via phone. Delegation agreements are contractual documents that are agreed between participating partners when the concept is deployed. During the validation exercises no formal contracts have been defined, but validation exercises defined documents which described the use cases and the procedure including the necessary steps that the partners had to perform. Thus, this requirement is defined as validated.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0072
Title	Degraded mode of delegated services
Requirement	A delegation agreement shall define the constraints and performance boundaries when delegated ATM services are operated in degraded mode.
Status	<validated>
Rationale	Degraded mode of operations is adding extra stress on all actors involved. Clear defining expectations and opportunities for degraded mode of operations provide guiding principle for them. Delegation agreements are contractual documents that are agreed between participating partners when the concept is deployed. During the validation exercises no formal contracts have been defined, but validation exercises defined documents which described the use cases and the procedure including the necessary steps that the partners had to perform. Thus, this requirement is defined as validated.
Category	<Safety> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0073
Title	Handling of failures during delegation
Requirement	A delegation agreement shall clearly define how failures of delegated ATM services need to be handled after their successful delegation.
Status	<validated>
Rationale	Failures can happen at any time a receiving ATSU has taken the responsibility of a delegated airspace. For these situations, the necessary counter measures need to be clearly defined in the delegation agreement. Delegation agreements are contractual documents that are agreed between participating partners when the concept is deployed. During the validation exercises no formal contracts have been defined, but validation exercises defined documents which described the use cases and the procedure including the necessary steps that the partners had to perform. Thus, this requirement is defined as validated.
Category	<Safety> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0074
Title	Processes for handling of failures during delegation
Requirement	The receiving ATSU shall implement processes and procedures to manage failures of delegated ATM services after their successful delegation.
Status	<validated>
Rationale	Failures can happen at any time a receiving ATSU has taken the responsibility of a delegated airspace. The receiving ATSU has to implement necessary processes and procedures to perform the necessary counter measures as described in the delegation agreement. Delegation agreements are contractual documents that are agreed between participating partners when the concept is deployed. During the validation exercises no formal contracts have been defined, but validation exercises defined documents which described the use cases and the procedure including the necessary steps that the partners had to perform. Thus, this requirement is defined as validated.
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0075
Title	Approval of delegation agreements by NSA
Requirement	The National Supervisory Authority shall approve a delegation agreement involving an ATSU under their responsibility.
Status	<validated>
Rationale	The National Supervisory Authority (Regulator) needs to review and approve the delegation agreements of the delegating and receiving ATSUs under their responsibility to ensure a safe implementation of the delegation procedure. Delegation agreements are contractual documents that are agreed between participating partners when the concept is deployed. During the validation exercises no formal contracts have been defined, but validation exercises defined documents which described the use cases and the procedure including the necessary steps that the partners had to perform. Thus, this requirement is defined as validated.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0076
Title	Monitoring of traffic in delegated sectors
Requirement	The receiving ATSU shall be able to monitor the traffic load in the delegated sector(s).
Status	<validated>
Rationale	Safe operations are paramount in ATM. When managing a delegated airspace, particular care needs to be taken in order to avoid overload situations since ATCOs are likely to be less familiar with the airspace.
Category	<Safety> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0077
Title	Mutual agreement of procedures
Requirement	The delegating ATSU and the receiving ATSU as well as other concerned parties shall mutually agree upon operational procedures of the delegated airspace.
Status	<validated>
Rationale	All parties involved in managing a delegated airspace or that might be affected by a delegation, need to mutually agree upon the operational procedures in order to make sure that all parties have the same understanding. Delegation agreements are contractual documents that are agreed between participating partners when the concept is deployed. During the validation exercises no formal contracts have been defined, but validation exercises defined documents which described the use cases and the procedure including the necessary steps that the partners had to perform. Thus, this requirement is defined as validated.
Category	<Safety> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0078
Title	Receiving ATSU in contact with FIS
Requirement	The receiving ATSU shall have access to the relevant Flight Information Service.
Status	<in progress>
Rationale	Coordination with the Flight Information Service which is responsible for the delegated airspace is required to ensure the safety of this airspace. The Flight Information Service may be either locally at the receiving ATSU or it may be located somewhere remotely. Coordination with FIS can be either by phone or by using an implemented service.
Category	<Safety> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0079
Title	Handling of emergencies
Requirement	The delegation agreement shall clearly define the handling of emergencies by the operational Supervisor of the receiving ATSU while a delegation is in place.
Status	<validated>
Rationale	Management of emergencies is a very critical topic with respect to safety of the airspace. In case of delegation, the procedure for managing emergencies in the delegated airspace by the receiving ATSU need to be well known. Particular care needs to be taken, when airspace is delegated between different countries, because the handling of emergencies also involves local authorities of the delegating state, such as police, ambulance service, and fire brigades.
Category	<Safety> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0080
Title	Tool support for handling emergencies
Requirement	A delegation agreement shall clearly define which tool support is required for handling emergencies at the receiving ATSU.
Status	<in progress>
Rationale	Depending on the complexity of the airspace, it might be required that the receiving ATSU has tool support for handling emergencies of a delegated airspace, since the receiving ATCOs can be considered less familiar with the airspace compared to the ATCOs of the delegating ATSU. For example, the ATCO might require the nearest suitable airport for an emergency landing.
Category	<Safety> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0081
Title	Handling of failing ATC functions during delegation
Requirement	A delegation agreement shall clearly define for each ATM function how failures will be handled by the receiving ATSU during a delegation.
Status	<validated>
Rationale	Failures of ATC functions can be quite diverse. It ranges from surveillance failures, over failures of the ground/ground or air/ground communication, failures of the safety net or MTCD functionality up to a failure of a complete ADSP. Delegation agreements are contractual documents that are agreed between participating partners when the concept is deployed. During the validation exercises no formal contracts have been defined, but validation exercises defined documents which described the use cases and the procedure including the necessary steps that the partners had to perform. Thus, this requirement is defined as validated.
Category	<Safety> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

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4.1.4 Requirements for ATSEPs

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0044
Title	Monitor systems of the ATSU
Requirement	ATSEP of the ATSU shall be able to monitor the status of all relevant systems running at the ATSU, including network connection to the ADSP at all times.
Status	<validated>
Rationale	The ATSEP of the ATSU in charge of all the systems deployed needs sufficient information about the health status of these systems. The monitored systems include all the CWPs running at the ATSU, independently of if they are allocated to the ATSU itself or provided to another ATSU for a delegation.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Role>	ATSEP (PJ.10-93)
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D1-Delegation Request [NOV-5] D2-Enter Preview Mode [NOV-5] D4b-Abort Delegation

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0045
Title	Monitor remote state of ADSP
Requirement	ATSEP of the ATSU shall be able to monitor the remote state of all relevant ADSPs at all times.
Status	<validated>
Rationale	The systems of the ATSU are provided with data by one or more ADSPs. Without the data of the ADSP(s), the ATSU is not able to work properly. In order to have an overview of the health status of the ADSP(s), the ATSEP of the ATSU needs the ability to monitor the remote states of the relevant ADSP(s). In case of any problems, the ATSEP at the ATSU might take appropriate counter measures.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Role>	ATSEP (PJ.10-93)
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D1-Delegation Request [NOV-5] D2-Enter Preview Mode [NOV-5] D4b-Abort Delegation

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0046
Title	Control systems of ATSU
Requirement	ATSEP of the ATSU shall be able to control systems running at the ATSU, including network connection to ADSP at all times.
Status	<validated>
Rationale	The ATSEP of the ATSU in control of all the systems deployed needs the ability to issue control actions in order to ensure the functioning of the systems.
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Role>	ATSEP (PJ.10-93)
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D2-Enter Preview Mode

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0047
Title	Monitor systems of the ADSP
Requirement	ATSEP of the ADSP shall be able to monitor the status of all relevant systems running at the ADSP, including network connection to the ATSU(s) at all times.
Status	<validated>
Rationale	The ATSEP of the ADSP in charge of all the systems deployed needs sufficient information about the health status of these systems.
Category	<Operational>

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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Role>	ATSEP (PJ.10-93)

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0048
Title	Monitor remote state of the ATSU
Requirement	ATSEP of the ADSP shall be able to monitor the remote state of all relevant ATSU(s) at all times.
Status	<validated>
Rationale	An ADSP provides data to one or more ATSUs. In order to ensure their functioning, the ATSEP of the ADSP needs to have a high level overview of the ATSUs that they are responsible for. In case of any problems, the ATSEP at the ADSP might take appropriate counter measures.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Role>	ATSEP (PJ.10-93)

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0049
Title	Control systems of the ADSP
Requirement	ATSEP of the ADSP shall be able to control systems running at the ADSP at all times.
Status	<validated>
Rationale	The ATSEP of the ADSP in control of all the systems needs the ability to issue control actions in order to ensure the functioning of the systems of the ADSP.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Role>	ATSEP (PJ.10-93)

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0050
Title	Inter ADSP monitoring
Requirement	ATSEP of the ADSP shall be able to monitor the remote state of all relevant ADSPs at all times.
Status	<in progress>
Rationale	The ATSEP of the ADSP needs to monitor the availability of other relevant ADSP(s), e.g. in U or Triangle Architecture, when the systems they are in charge are configured for receiving data from some other ADSPs.
Category	<Operational>

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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Role>	ATSEP (PJ.10-93)

4.1.5 Relation between delegating and receiving ATSU

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-SYS.0001
Title	Receiving ATCO aware of delegating flights
Requirement	The ATCOs in the receiving ATSU shall be aware of the flights in concern of the sector for which ATM services are delegated.
Status	<validated>
Rationale	The receiving ATCO needs to know all relevant information to enable them to take control of a sector. Relevant information includes: - callsigns - clearances - coordinations - etc.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D2-Enter Preview Mode

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-SYS.0002
Title	Correlation of flights
Requirement	All flights in AoI of the sector for which ATM services are to be delegated shall be correlated at the receiving ATSU during the preview mode phase.
Status	<validated>
Rationale	The correlation of flights is necessary for the ATCO in order to safely plan the operations in their sector. By correlation, the limited information contained in radar tracks are enriched with the information from the flight plans.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D2-Enter Preview Mode

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-SYS.0003
Title	Coordination status in receiving ATSU
Requirement	The status of all coordinations for the sector to be delegated that were made by an ATCO in the delegating ATSU shall be available in the receiving ATSU during the preview mode phase.
Status	<validated>
Rationale	When an ATCO in the delegating ATSU is coordinating with a third party ATSU which is not involved in the delegation, this coordination information needs to be present to the ATCO in the receiving ATSU in order to have a full picture of the sector which is delegated. As recommendation, this coordination information should be displayed differently at the CWP of the receiving ATCO.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D2-Enter Preview Mode

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-SYS.0005
Title	Continuous update during preview mode
Requirement	All information concerning the sector to be delegated shall be continuously updated at the receiving ATSU during preview mode.
Status	<validated>
Rationale	For safety reasons, the receiving ATCO needs to be up to date with the current situation in the sector that will be delegated at any time. Therefore, the preview mode does not provide a snapshot of the situation, but a continuous update is required.
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D2-Enter Preview Mode

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-SYS.0006
Title	Identical tool support for delegated sector
Requirement	The receiving ATSU shall have access to their current tools to support the delegated airspace.
Status	<validated>
Rationale	The receiving ATCO should have the same functionality for the delegated airspace as they have for their own airspace during all phases of the delegation procedure. However, due to technical constraints the operational performance of the tools and functions for the delegated airspace might be fairly different compared to the normal operations. Any deltas will be covered by additional training. Note: this might not be required when using delegation with static AoR (remote positions).
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D2-Enter Preview Mode

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4.2 Operational Requirements

4.2.1 Operations in Normal Conditions

4.2.1.1 The Delegation Request

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0085
Title	Evaluation of traffic situation before delegation request
Requirement	The operational Supervisor of the delegating ATSU shall be responsible to ensure the traffic situation is in line with conditions defined in the delegation agreement before initiating a delegation request.
Status	<validated>
Rationale	To ensure the delegation of ATM services is always performed in a safe manner, the operational Supervisor of the delegating ATSU must check if the traffic situation is suitable for delegating airspace to the delegating ATSU. If the situation is not suitable for delegation, no delegation request will be initiated.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Role>	ACC/Approach/TMA Supervisor (PJ.10-93)

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0086
Title	Checklist for evaluating traffic situation at delegating ATSU
Requirement	The operational Supervisor of the delegating ATSU shall evaluate the traffic situation according to a checklist tailored to the affected airspace which is part of the delegation agreement and related procedures before initiating a delegation request.
Status	<validated>
Rationale	To ensure the delegation of ATM services is always performed in a safe manner, the operational Supervisor of the delegating ATSU and their team must check if the traffic situation is suitable for delegating airspace to the delegating ATSU. If the situation is not suitable for delegation, no delegation request will be initiated.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Role>	ACC/Approach/TMA Supervisor (PJ.10-93)
<ALLOCATED_TO>	<ActivityView>	[NOV-5] C2-Contingency Delegation [NOV-5] D1-Delegation Request

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0051
Title	Initiation of delegation request
Requirement	The operational Supervisor of the delegating ATSU shall be able to initiate a delegation request.
Status	<validated>
Rationale	The operational Supervisor of the delegating ATSU or authorized actor needs to be able to initiate the request in line with defined and agreed procedures for triggering and performing the delegation.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Role>	ACC/Approach/TMA Supervisor (PJ.10-93)
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D1-Delegation Request

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0052
Title	System support for delegation request processing
Requirement	The processing of a delegation request should be supported by the system.
Status	<validated>
Rationale	Processing of a delegation request, a task performed by human actors (Supervisor), needs system support for its execution. The system has to be designed in order to provide this support in line with the delegation procedures.
Category	<Operational>

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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D1-Delegation Request

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0053
Title	Evaluation of delegation request
Requirement	When a delegation request is received, the operational Supervisor of the receiving ATSU and their team shall be supported by the system in deciding if the requested delegation can be supported by the receiving ATSU.
Status	<validated>
Rationale	In order to assess the delegation request and the feasibility of accepting it according to the existing procedures, the human actor (Supervisor) needs support from the system adequately designed for this purpose. This includes for example information about the predicted traffic and available staff during the expected duration of the delegation.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Role>	ACC/Approach/TMA Supervisor (PJ.10-93)
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D1-Delegation Request

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0087
Title	Checklist for evaluating traffic situation at receiving ATSU
Requirement	The operational Supervisor of the receiving ATSU and their team shall evaluate the traffic situation according to a checklist tailored to the affected airspace and part of the delegation agreement and related procedures when a delegation request is received.
Status	<validated>
Rationale	To ensure the delegation of ATM services is always performed in a safe manner, the operational Supervisor of the receiving ATSU must check if the traffic situation is suitable for delegating airspace to the receiving ATSU. In addition, the staffing of the receiving ATSU must be sufficient for a delegation and other conditions might need to be checked as well. As a result the operational Supervisor of the receiving ATSU decides whether to accept, reject or delay the requested delegation.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Role>	ACC/Approach/TMA Supervisor (PJ.10-93)

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0010
Title	Reply to delegation request
Requirement	The operational Supervisor of the receiving ATSU shall be able to accept, defer or reject the delegation proposal.
Status	<validated>
Rationale	The operational Supervisor is the actor responsible for the decision on ATC service delegation defined by procedure.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Role>	ACC/Approach/TMA Supervisor (PJ.10-93)
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D1-Delegation Request

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0054
Title	Delegation request via phone
Requirement	The delegating and the operational Supervisor of the receiving ATSU shall be able to coordinate via phone about the delegation.
Status	<validated>
Rationale	When system support for the delegation request is missing or the function is not available due to a failure, a coordination via phone should be used to compensate the situation by the operational Supervisors of the delegating and the receiving ATSU.
Category	<Operational>

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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Role>	ACC/Approach/TMA Supervisor (PJ.10-93)
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D1-Delegation Request

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0011
Title	Acceptance of delegation request
Requirement	When the delegation request is accepted by the operational Supervisor of the receiving ATSU, the delegating ATCO team(s) and the receiving ATCO team(s) shall be able to communicate before commencing the delegation procedure.
Status	<validated>
Rationale	Types of information exchange between the delegating and receiving sector teams and mode of communication is defined by procedure; communication means to enable execution are available.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D1-Delegation Request

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0013
Title	Brief and instruct ATCO team
Requirement	If the delegation request is accepted by the operational Supervisor of the receiving ATSU, the operational Supervisor of the delegating ATSU shall brief and instruct the delegating ATCO team(s) to prepare for delegation.
Status	<validated>
Rationale	The internal procedures for the execution of the delegation and taking over the responsibility are described in the ATSU/Centre Working Manual with task description for the operational Supervisors, and nature and elements of the briefings for the receiving sectors ATCO teams.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Role>	ACC/Approach/TMA Supervisor (PJ.10-93)
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D1-Delegation Request

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0033
Title	Inform the adjacent ATSU(s)
Requirement	The operational Supervisor of the delegating ATSU shall inform operational Supervisor(s) of adjacent ATSU(s) when the delegation procedure is triggered.
Status	<validated>
Rationale	The adjacent ATSU(s) need to be aware and to prepare for the delegation. ATCOs on the concerned sectors have to be informed about the delegation.
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Role>	ACC/Approach/TMA Supervisor (PJ.10-93)
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D1-Delegation Request

4.2.1.2 The Preview Mode

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0055
Title	Sector config for Preview
Requirement	The operational Supervisor of the receiving ATSU shall be supported by the system in changing the operational sector configuration for enabling preview mode for the sector to be delegated.
Status	<validated>
Rationale	Depending upon each ATSU approach, the trigger needs to be accessible in different system locations for different persons (Supervisor, ATCO, ATSEP).
Category	<Operational>

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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D2-Enter Preview Mode

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0014
Title	Preview traffic
Requirement	The receiving ATCO team(s) shall be able to preview traffic of the sector to be delegated on their CWP.
Status	<validated>
Rationale	The ATCO team(s) need to familiarise with the traffic situation and gain sufficient situational awareness for the delegating sector before taking over the ATC service provision responsibility.
Category	<Safety> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D2-Enter Preview Mode

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0015
Title	Preview Phase Inputs
Requirement	An ATCO team in preview phase of a delegation shall not make system inputs in the delegated sector.
Status	<validated>
Rationale	Input and active interaction with the system is not allowed in the preview phase.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D2-Enter Preview Mode

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0065
Title	Implementation of Preview Mode
Requirement	The Preview Mode shall be implemented either by procedure or by system support.
Status	<validated>
Rationale	The Preview Mode is a means to prepare a safe handover of the traffic. Its implementation depends on the local possibilities and can be supported by the system or based on a procedural implementation.
Category	<Operational>

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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0066
Title	Procedural Implementation of Preview Mode
Requirement	All necessary regulations shall be defined in the delegation agreement between delegating and receiving ATSU when the preview mode is implemented by procedure.
Status	<validated>
Rationale	When implemented by procedure, the necessary steps and responsible actors have to be defined in a delegation agreement in order to avoid misunderstanding during its execution.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0067
Title	System Support of Preview Mode
Requirement	The ATCO team of the receiving ATSU shall be provided with same relevant operational data about the sector to be delegated as in operational mode.
Status	<validated>
Rationale	When the preview mode is supported by the system, the CWPs of the receiving ATSU provide the receiving ATCO team with the relevant operational data of the sector being subject to delegation.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D2-Enter Preview Mode

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0088
Title	Activation of preview mode
Requirement	The receiving ATSU shall activate the preview mode for the sectors to be delegated.
Status	<validated>
Rationale	For a safe execution of the delegation procedure, the activation of the preview mode (by system or procedure) is essential.
Category	<Operational> , <Safety>

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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D2-Enter Preview Mode

4.2.1.3 The Delegation Preparation

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0016
Title	CWP Prep receiving ATCO team(s)
Requirement	The ATCO team(s) of the receiving ATSU shall prepare their CWPs during Delegation Preparation phase.
Status	<validated>
Rationale	The CWP is prepared and adapted to the needs of the receiving ATCO team(s), including specific HMI and ergonomic features related to safe takeover of the service provision responsibility.
Category	<Human Performance> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D3-Delegation Preparation

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0017
Title	VCS Prep receiving ATCO team(s)
Requirement	The ATCO team(s) of the receiving ATSU shall prepare their VCS and key-in the frequency of the delegated sector to Rx during Delegation Preparation phase.
Status	<validated>
Rationale	The working frequency is available and operational at the receiving CWP.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D3-Delegation Preparation

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0089
Title	Automatic activation of Rx frequency during preview mode
Requirement	The frequency of the delegated sector should be activated automatically to Rx at the Executive CWP of the receiving ATSU when the receiving ATSU activates the preview mode for this sector.
Status	<in progress>
Rationale	Automatically activating a sector frequency relieves the Executive ATCO of the receiving ATSU and prevents that the frequency remains inactive by mistake. But it requires an integration of the ATS system and the VCS.
Category	<Safety> , <Operational> , <Human Performance>

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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0034
Title	CWP Prep receiving ATCO team(s)
Requirement	The ATCO team(s) of the receiving ATSU shall prepare their CWPs and check ground/ground communications with the parties concerned by the delegation (corresponding adjacent sectors to the sector subject of delegation) during Delegation Preparation phase.
Status	<validated>
Rationale	The CWP is prepared and adapted to the needs of the receiving ATCO team(s), including specific HMI and ergonomic features related to safe takeover of the service provision responsibility, and all necessary ground–ground communication lines are checked.
Category	<Operational> , <Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D3-Delegation Preparation

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0018
Title	Coordination to proceed
Requirement	The receiving ATCO team shall coordinate about proceeding to the next phase of the Delegation Procedure at the end of the Delegation Preparation phase.
Status	<validated>
Rationale	During the preparation phase the members of the sector team may perform tasks which are individual and independent; in order to move to the next phase they should check and agree that all the necessary actions have been completed.
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D3-Delegation Preparation

4.2.1.4 Abort Delegation

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0019
Title	Abort delegation
Requirement	The operational Supervisor of the receiving ATSU shall be able to abort the delegation at any time before the delegating sector(s) is switched to operational mode at the receiving ATSU.
Status	<validated>
Rationale	As responsible for the delegation process, the operational Supervisor of the receiving ATSU is empowered and provided with the required means to abort the delegation up till defined point in the process where the delegation is considered completed according to the Delegation Agreement.
Category	<Safety> , <Operational>

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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Role>	ACC/Approach/TMA Supervisor (PJ.10-93)
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D4b-Abort Delegation

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0056
Title	System support for delegation abort
Requirement	The operational Supervisor of receiving ATSU shall be supported by the system to abort the ongoing delegation.
Status	<validated>
Rationale	In order to ensure system consistency in case of an aborted delegation, the system needs to be designed to safely revert back to the state before the delegation was.
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D4b-Abort Delegation

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0057
Title	System input to abort delegation
Requirement	The operational Supervisor and/or the ATSEP shall be able to make the system input to abort a delegation.
Status	<validated>
Rationale	In order to abort the delegation, the human actor (Supervisor or ATSEP) needs support from the system and must be able to make the required system inputs.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Role>	ATSEP (PJ.10-93) ACC/Approach/TMA Supervisor (PJ.10-93)

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0020
Title	End of Preview Mode
Requirement	The Preview mode of a sector to be delegated shall be ended at the receiving ATSU when a delegation is aborted.
Status	<validated>
Rationale	At the moment of the abortion of the delegation all the system functions and procedural actions related to the preparation of the delegation are suspended, and normal operations continue.
Category	<Operational>

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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D4b-Abort Delegation

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0021
Title	State after abortion
Requirement	The CWPs of the receiving ATCO team and of the delegating ATCO team shall be in the same state and operational sector configuration as before the delegation was initiated when a delegation is aborted.
Status	<validated>
Rationale	When a delegation is aborted, the ATCOs need to continue their work in a safe and consistent environment as per standard condition without delegation.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D4b-Abort Delegation

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0090
Title	Informing NM about abort of delegation
Requirement	The Network Manager shall be informed about an aborted delegation.
Status	<in progress>
Rationale	The Network Manager needs to have an up-to-date picture of the European ATM network. Therefore, NM needs be informed about aborted delegations.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D4b-Abort Delegation

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0091
Title	Informing third parties about abort of delegation
Requirement	All relevant third parties shall be informed about an aborted delegation.
Status	<validated>
Rationale	All relevant third parties need to be aware of an aborted delegation. The relevant third parties depend on the concerned airspace. They include e.g., adjacent ATSUs, military partners, airports, etc.
Category	<Safety> , <Operational>

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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

4.2.1.5 The Exchange of Traffic Situation

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0022
Title	Exchange traffic
Requirement	The receiving ATCO team(s) shall contact the delegating ATCO team(s) and exchange the traffic situation of the sector to be delegated when starting the Exchange Traffic Situation phase.
Status	<validated>
Rationale	The delegating ATCO team(s) provides all necessary information complementary to the system information already available (e.g. immediate action suggestions, important notes on current weather conditions, non-nominal situations, etc).
Category	<Safety> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D4-Exchange Traffic Situation

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0023
Title	Display traffic
Requirement	The receiving ATCO team(s) shall be in Preview Mode where the traffic of the sector to be delegated is displayed at their CWPs during the Exchange Traffic Situation phase.
Status	<validated>
Rationale	This is to provide full traffic situation picture with all the auxiliary information provided by the system and gain required situational awareness to take over the ATC service provision responsibility for the delegated sector(s).
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D4-Exchange Traffic Situation

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0092
Title	Systematic handover
Requirement	The delegating ATCO team shall use the WEST checklist for a systematic approach of the traffic handover to the receiving ATCO team.
Status	<validated>
Rationale	It is safety critical that all aircraft are explained to the receiving ATCO team. By systematically pointing out aircraft to the receiving ATCO team, it is made sure that no flight is overseen. Depending on the geometry of the sector, flight may be pointed out from north to south or west to east. The WEST checklist was not used throughout all exercises, because weather and equipment were not simulated in the validation exercises. But a systematic approach was taken for all exercises. Thus, this requirement is defined as validated.
Category	<Safety> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D4-Exchange Traffic Situation

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0093
Title	Identification of relevant flights for hand over
Requirement	The delegating ATCO team shall be able to identify the flights that need to be handed over.
Status	<validated>
Rationale	To ensure safety during the delegation process, it is essential the delegating ATCO team is able to identify all relevant flights for handover to the receiving ATSU. This ensures the completeness of the handover.
Category	<Safety> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D4-Exchange Traffic Situation

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0112
Title	Tool support for handover
Requirement	The delegating and receiving ATCOs shall be supported by appropriate automation and HMI functions to fully exchange relevant information and safely handover the responsibility.
Status	<in progress>
Rationale	ATSUs involved in the delegation should identify a minimum list of equipment, tools and functions for a safe delegation of airspace. The impact of the unavailability of any of the identified items should be included in the delegation agreement between the two ATSUs (e.g., unavailability of certain tools will not allow a delegation).
Category	<Safety> , <Operational>

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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0094
Title	Acknowledgement of pointed out flights
Requirement	The receiving ATCO team shall read-back and acknowledge all flights being pointed out by the delegating ATCO team.
Status	<validated>
Rationale	To avoid misunderstandings between the delegating and the receiving ATCO team, the receiving ATCO team reads back and acknowledges all flights that are pointed out to them.
Category	<Safety> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D4-Exchange Traffic Situation

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0095
Title	Situational awareness by receiving ATCO team
Requirement	The receiving ATCO team shall have the complete traffic situational awareness for the delegated sector following the traffic exchange with the delegating ATCO team.
Status	<validated>
Rationale	It is safety critical that the receiving ATCO team is fully synchronised with the delegating ATCO team before taking over responsibility of the airspace. This includes potential conflicts and operational intentions after exchanging with the delegating ATCO team.
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D4-Exchange Traffic Situation

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0024
Title	Coordinate before Operational Mode
Requirement	The ATCO team(s) of the receiving ATSU shall coordinate internally to agree on entering the Enter Operational Mode phase after exchanging traffic with the ATCO team of the delegating ATSU.
Status	<validated>
Rationale	The exchange of information between the delegating and receiving sector(s) may take place separately between the team members (PC with PC and EC with EC). Before the final decision to move to the operational mode and before taking responsibility for ATC service provision in the sector(s) subject delegation, the receiving ATCO team must have a final agreement on the decision.
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D4-Exchange Traffic Situation

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4.2.1.6 The Operational Mode

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0025
Title	Operational Supervisor of the Receiving ATSU or ATCO request switch to Operational Mode
Requirement	The receiving ATSU shall request to switch the CWPs at the receiving ATCO team from Preview Mode to Operational mode.
Status	<validated>
Rationale	Receiving ATCO(s) team move to the operational mode (takes over the responsibility for ATC service provision in the sector(s) subject delegation) only upon their full consent. Due to local implementation choices, the switch from the Preview Mode to the Operational Mode can be performed by different human actors, supported by the system in the execution of this task.
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Role>	ACC/Approach/TMA Supervisor (PJ.10-93)
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D5-Enter Operational Mode of Receiving ATSU

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0058
Title	Switch to Operational Mode
Requirement	The receiving ATSU shall switch the CWPs of the receiving ATCO team to Operational mode via system input.
Status	<validated>
Rationale	In order to switch from preview mode to operational mode in the receiving ATSU, the human actor (operational Supervisor or ATCO) must be able to make the required inputs into the system adequately designed for this purpose.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Role>	ATSEP (PJ.10-93) ACC/Approach/TMA Supervisor (PJ.10-93)
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D5-Enter Operational Mode of Receiving ATSU

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0096
Title	Clear communication of switch of responsibility
Requirement	The delegating and receiving ATCO teams shall coordinate and acknowledge the point when the preview mode is switched to operational mode at the receiving ATSU.
Status	<validated>
Rationale	To ensure the safety of the airspace a clear communication about the switch of responsibilities is required in order to avoid misunderstandings by all means.
Category	<Safety> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0097
Title	Awareness of Operational Mode at receiving ATSU
Requirement	The ATCO of the receiving ATSU shall be able to identify which sector is in operational mode.
Status	<validated>
Rationale	To ensure the safety of the operations at all times, the ATCO requires a clear understanding of the sector configuration and in particular of which sector is operational and which sector is in preview mode.
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0100
Title	Radio check before switching to operational mode
Requirement	The receiving Executive should have a radio check of the frequency of the delegated sector before switching to operational mode.
Status	<validated>
Rationale	A radio check of the receiving Executive ensures that all aircraft in the delegated sector are on frequency.
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0026
Title	Receiving ATCO team in control
Requirement	The receiving ATCO team(s) shall be in control of the delegated sector after switching to Operational Mode.
Status	<validated>
Rationale	The receiving ATCO team(s) resume full responsibility for ATC service provision.
Category	<Operational>

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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D5-Enter Operational Mode of Receiving ATSU

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0027
Title	Delegating ATCO team in Preview Mode
Requirement	The delegating ATCO team(s) shall be in Preview Mode for the delegated sector after switching to Operational Mode in the receiving ATSU.
Status	<validated>
Rationale	For a time period defined by the delegation agreement, the delegating ATCO team(s) continues operating in preview mode in order to be available for providing additional information to, and supporting, the receiving ATCO team(s).
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D5-Enter Operational Mode of Receiving ATSU

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0101
Title	Activation of Rx frequency at delegating ATSU
Requirement	The delegating ATCO team shall switch the frequency of the delegated sector from Tx/Rx to Rx when switching from operational mode to preview mode in the delegating ATSU.
Status	<validated>
Rationale	After the receiving ATCO team has taken over responsibility of the delegated sector, the delegating ATCO team remains in preview mode and listens to the sector frequency for a time defined in the delegation agreement. This is a safety measure to quickly take back control when problems occur at the receiving ATSU.
Category	<Safety> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0102
Title	Automatic activation of Rx frequency while switching to preview mode at delegating ATSU
Requirement	The frequency of the delegated sector should be switched automatically from Tx/Rx to Rx at the Executive CWP of the delegating ATSU when switching from operational mode to preview mode in the delegating ATSU.
Status	<in progress>
Rationale	Automatically switching a sector frequency to Rx relieves the Executive ATCO of the delegating ATSU and prevents that the frequency remains in Tx/Rx by mistake. But it requires an integration of the ATS system and the VCS.
Category	<Operational> , <Human Performance> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0028
Title	Receiving ATCO team reconfigure Voice
Requirement	The receiving Executive ATCO shall reconfigure their Voice panel in order to switch the sector frequency to Tx/Rx after switching to Operational Mode.
Status	<validated>
Rationale	Operational mode means full responsibility for the provision of the service, including the responsibility for the voice and datalink communication with all the A/C in the area of responsibility (controlled by) of the delegated sector.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D5-Enter Operational Mode of Receiving ATSU

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0103
Title	Automatic activation of Tx/Rx frequency during operational mode
Requirement	The frequency of the delegated sector should be switched automatically from Rx to Tx/Rx at the Executive CWP of the receiving ATSU when switching from preview mode to operational mode for this sector in the receiving ATSU.
Status	<in progress>
Rationale	Automatically switching a sector frequency to Tx/Rx relieves the Executive ATCO of the receiving ATSU and prevents that the frequency remains on Rx by mistake. But it requires an integration of the ATS system and the VCS.
Category	<Operational> , <Safety> , <Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0035
Title	Inform the adjacent ATSU(s) on the outcome of the delegation procedure
Requirement	The operational Supervisor of the receiving ATSU shall inform the operational Supervisor(s) of the ATSU(s) adjacent to the sector(s) subject delegation on the outcome of the operation when delegation procedures is completed or aborted.
Status	<validated>
Rationale	The adjacent ATSU(s) need to be aware of the outcome of the procedure and inform ATCOs at the concerned sectors.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D5-Enter Operational Mode of Receiving ATSU

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0104
Title	One ATCO team in control of sector
Requirement	One ATCO shall be in control of the delegated sector during all phases of the delegation procedure.
Status	<validated>
Rationale	To ensure the safety of the airspace only one ATCO team must be in control of a sector and a sector must never be without an ATCO team being responsible.
Category	<Operational> , <Safety>

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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0105
Title	Informing NM about successful delegation
Requirement	The operational Supervisor of the receiving ATSU shall inform the Network Manager about the successful completion of the delegation.
Status	<validated>
Rationale	The Network Manager needs to have an up-to-date picture of the European ATM network. Therefore, NM needs be informed about successful delegations.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Role>	ACC/Approach/TMA Supervisor (PJ.10-93)
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D5-Enter Operational Mode of Receiving ATSU

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0106
Title	Informing third parties about successful delegation
Requirement	The operational Supervisor of the receiving ATSU shall inform all relevant third parties about the successful completion of the delegation.
Status	<validated>
Rationale	All relevant third parties need to be aware of an aborted delegation. The relevant third parties depend on the concerned airspace. They include e.g., adjacent ATSUs, military partners, airports, etc.
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Role>	ACC/Approach/TMA Supervisor (PJ.10-93)

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0107
Title	Termination of Preview Mode at delegating ATSU
Requirement	The delegating ATSU shall terminate the preview mode for the delegated sector after a time defined in the delegation agreement.
Status	<validated>
Rationale	As a safety measure, the original ATCO team remains in preview mode after switching control to the receiving ATCO team.
Category	<Safety> , <Operational>

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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D6-Exit Preview Mode of Delegating ATSU

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0108
Title	Disabling of frequency after termination of preview mode
Requirement	The Executive ATCO of the delegating ATSU shall disable the frequency of the delegated sector when the preview mode is terminated.
Status	<validated>
Rationale	When the Executive ATCO of the delegating ATSU is no longer in responsibility of the sector, the frequency of the sector is disabled.
Category	<Operational> , <Safety>

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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0109
Title	Automatic disabling of frequency after termination of preview mode
Requirement	The frequency of the delegated sector should automatically be disabled when the preview mode is terminated at the delegating ATSU.
Status	<in progress>
Rationale	Automatic disabling of a sector frequency relieves the Executive ATCO of the delegating ATSU and prevents that the frequency remains active by mistake. But it requires an integration of the ATS system and the VCS.
Category	<Safety> , <Human Performance> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0110
Title	Visualisation of Termination of Preview Mode at receiving ATSU
Requirement	The ATCO of the receiving ATSU shall be able to identify the termination of the preview mode at the delegating ATSU when the preview mode is supported by the system.
Status	<validated>
Rationale	The ATCOs taking part in a delegation need to know at all times in which phase of the delegation procedure they are and if they are in control or not.
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

4.2.2 Operations in Unexpected Situations

This section identifies the requirements which are directly related to the concept of delegation of ATM services among ATSUs in case of contingency. This section does not define a holistic set of requirements for general contingency situations.

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0059
Title	Contingency plans defined
Requirement	All procedures concerning involved parties in contingency delegation mode shall have a well-defined contingency plan including legal operational procedures and definition of responsibility for the service provision.
Status	<validated>
Rationale	Since a contingency case is a very critical incident, ATSUs prepare contingency plans in order to predefine necessary steps in case of emergency. The contingency plan is part of the overall Delegation Agreement. Delegation of ATM services is a possible way to deal with a contingency situation. In this case, the prerequisites defined for ATM services delegation as described in section 3.3.2.4, also hold true. But, some aspects may depend on the concrete case and may vary. Contingency plans are contractual documents that are agreed between participating partners when the concept is deployed. During the validation exercises no formal contracts have been defined, but validation exercises defined documents which described the use cases and the procedure including the necessary steps that the partners had to perform. Thus, this requirement is defined as validated.
Category	<Safety> , <Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] C0-Contingency Procedure Overview - Architecture Y

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0060
Title	Supervisor decides contingency case
Requirement	The operational Supervisor of the failing ATSU shall be responsible to decide if the ATSU has a contingency case.
Status	<validated>
Rationale	The declaration of a status that requires activation of contingency procedures is usually procedurally well-defined and it is responsibility of the operational Supervisor or other authorised human actor. Note that in exceptional cases the events dictating emergency actions and activation of contingency procedures might not be fully covered by procedures. In this cases, the decision is made by the operational Supervisor or other authorised human actor based on personal judgment.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Role>	ACC/Approach/TMA Supervisor (PJ.10-93)
<ALLOCATED_TO>	<ActivityView>	[NOV-5] C1-Degraded Mode/Emergency

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0061
Title	Supervisor decides contingency delegation
Requirement	The operational Supervisor of the failing ATSU shall be responsible to decide if a contingency delegation is initiated.
Status	<validated>
Rationale	Based on existing procedures the operational Supervisor or other authorised human actor decides whether the contingency procedure based on delegation of provision of ATC service is applicable.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Role>	ACC/Approach/TMA Supervisor (PJ.10-93)
<ALLOCATED_TO>	<ActivityView>	[NOV-5] C1-Degraded Mode/Emergency

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0062
Title	Request contingency delegation
Requirement	The operational Supervisor of the failing ATSU shall request contingency delegation at an aiding ATSU.
Status	<validated>
Rationale	In line with defined procedures the operational Supervisor of the failing ATSU have to communicate the delegation request to the aiding ATSU. Adequate system support has to be provided for this task.
Category	<Safety>

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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Role>	ACC/Approach/TMA Supervisor (PJ.10-93)
<ALLOCATED_TO>	<ActivityView>	[NOV-5] C2-Contingency Delegation

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0063
Title	Decide about contingency delegation
Requirement	The operational Supervisor of the aiding ATSU shall decide if contingency delegation can be provided.
Status	<validated>
Rationale	The operational Supervisor of the aiding ATSU makes the decision on the acceptance or rejection of the contingency based delegation request based on defined procedures.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Role>	ACC/Approach/TMA Supervisor (PJ.10-93)
<ALLOCATED_TO>	<ActivityView>	[NOV-5] C2-Contingency Delegation

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0064
Title	Contingency delegation according to delegation procedure
Requirement	The contingency delegation shall be performed according to the regular delegation procedure in normal conditions if the contingency delegation request is accepted by the operational Supervisor of the aiding ATSU.
Status	<validated>
Rationale	Since the delegation procedure is used for ATM services delegation in the contingency case, all requirements defined in section 4.2.1 apply.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D0-Delegation Process Overview

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4.3 Performance Requirements

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0029
Title	Preview Mode performance
Requirement	The delegation agreement between delegating and receiving ATSU shall define a time parameter for the availability of the CWP(s) in preview mode from the moment of the initiation of the switch procedure.
Status	<validated>
Rationale	Performance requirement related to the practicability of the delegating process. The delegation agreement between the delegating and the receiving ATSU shall define by procedure a period in which the CWP(s) should be available in preview mode. This period is driven by the system efficiency and should be as short as possible. On the other side the duration of this period can objectively vary, being subject to different local implementation, traffic complexity and technical /automation support for the delegation process. Thus, no general value can be specified for this parameter. No precise values have been defined by the validation exercise, but the performance was judged as sufficient across all exercise by the participating ATCOs. Thus this requirements is defined as validated.
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D2-Enter Preview Mode

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0031
Title	Operational Mode performance
Requirement	The CWP of the receiving ATSU shall be available in operational mode within N seconds from the initiation of the handover of control as defined in the delegation agreement between delegating and receiving ATSU.
Status	<validated>
Rationale	Performance requirement related to the practicability and safety of the delegation process regarding the most critical moment from safety point of view. The delegation agreement between delegating and receiving ATSU defines this parameter. The duration of this period can objectively vary, being subject to different local implementation, traffic complexity and technical /automation support for the delegation process. No precise values have been defined by the validation exercise, but the performance was judged as sufficient across all exercise by the participating ATCOs. Thus this requirements is defined as validated.
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<ActivityView>	[NOV-5] D5-Enter Operational Mode of Receiving ATSU

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REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-0111
Title	Performance of switch of responsibility
Requirement	The maximum overall time for execution of the delegation procedure shall be defined in the delegation agreement.
Status	<validated>
Rationale	Performance requirement related to the practicability and safety of the delegation process. To not have an impact on the safe management of the air traffic, the delegation of ATM service provision must be done within a time defined in the delegation agreement between the two ATSUs. The duration of this period can objectively vary, being subject to different local implementation, traffic complexity and technical /automation support for the delegation process. No precise values have been defined by the validation exercise, but the performance was judged as sufficient across all exercise by the participating ATCOs. Thus this requirements is defined as validated.
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

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4.4 Information Exchange Requirements

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-IER.0001
Title	Sector Configuration Update
Requirement	An ADSP shall be able to manage the requests for updating the operational sector configuration of the ATSU for preparing a specific delegation sector configuration.
Status	<validated>
Rationale	In general, the operational sector configurations are prepared off-line according to predefined agreements, but it may happen that ad-hoc configurations have to be prepared in real time operations.
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	[NOV] Change ATSU Sector Configuration

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-IER.0002
Title	Preview Mode Request
Requirement	An ADSP shall be able to manage the requests for initializing a Sector(s) in preview mode for a given CWP(s) when specific preview/operational modes are supported by the CWPs.
Status	<validated>
Rationale	In principle, changes in an operational sector configuration are expected from the Operational Configuration Management service through the provision of the whole ATSU configuration. For changing a mode on a single CWP, it would be shorter to use a dedicated operation.
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	[NOV] Change ATSU Sector Configuration

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-IER.0003
Title	Sector Configuration Publication
Requirement	An ADSP shall distribute new operational sector configurations to all relevant ATSU(s).
Status	<validated>
Rationale	Sector configurations are managed by the ADSP and need to be distributed to the various system stakeholders.
Category	<IER>

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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	[NOV] Publish ATSU Sector Configuration

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-IER.0004
Title	Preview Mode Cancellation Request
Requirement	An ADSP shall be able to manage the requests for cancellation of the sector(s) preview mode that has been previously activated.
Status	<validated>
Rationale	In principle, changes in an operational sector configuration are expected by the Operational Configuration Management service through the provision of the whole ATSU configuration. For changing a mode on a single CWP, it would be shorter to use a dedicated operation. The requirement is only relevant for ATSUs implementing specific preview/operational modes.
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	[NOV] Change ATSU Sector Configuration

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-IER.0005
Title	Operational Mode Request
Requirement	An ADSP shall be able to manage the requests for switching of a Sector(s) to operational mode for given a CWP(s) when specific preview/operational modes are supported by the CWPs.
Status	<validated>
Rationale	In principle, changes in a sector configuration are expected from the Operational Configuration Management service through the provision of the whole ATSU configuration. For changing a mode on a single CWP, it would be shorter to use a dedicated operation.
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	[NOV] Change ATSU Sector Configuration

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-IER.0006
Title	Change of Coordination Status
Requirement	An ADSP shall be able to manage the requests for notifying unexpected changes of authority on a flight.
Status	<in progress>
Rationale	During the clear-the-sky procedure, flights may be transferred to unplanned sectors and the ADSP needs to be updated for maintaining up-to-date information.
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	[NOV] Change Flight Plan Data

4.5 Safety Requirements

This section contains both the Safety Requirements at Service Level (SRS) and Safety Requirements at Design Level (SRD) defined in the framework of PJ.10-W2-93 V3 SAR following the SESAR 2020 Safety Reference Methodology. All safety requirements are tagged with the <Safety> category. Additionally, in this document, other functional safety requirements are tagged with both <Operational> and <Safety> categories.

Note: The Safety requirements are currently work in progress and there might be a considerable change in the future version.

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-SAF.0014
Title	Capability to manage unexpected events
Requirement	An ATSU shall have the capability to manage unexpected events and problems that occur during and after a delegation.
Status	<validated>
Rationale	To ensure safety of operations at all times, unexpected events and problems need to be treated by the affected ATSU. This might include coordination with other parties.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-SAF.0001
Title	Safe operational procedure
Requirement	The execution of delegation shall be managed by operational procedures that maintain an acceptable level of safety and ATCO workload.
Status	<validated>
Rationale	In normal condition of operations, safety level is not compromised by delegation of ATM services among ATSUs.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-SAF.0002
Title	Abort Delegation Procedure
Requirement	The operational Supervisor of the Receiving ATSU shall decide about the abort of a delegation in due time.
Status	<validated>
Rationale	A delay in the decision might have a safety implication through the excessive ATC workload building up at the Receiving ATSU. If a problem is encountered and cannot be resolved quickly, the operational Supervisor in the receiving ATSU has to understand immediately if the problem can be fixed quickly or if the delegation needs to be aborted.
Category	<Safety>

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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Role>	ACC/Approach/TMA Supervisor (PJ.10-93)

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-SAF.0003
Title	Safety assurance of the delegation procedures
Requirement	The delegation procedures shall be fully safety assessed and approved by the safety authorities of the parties involved in delegation.
Status	<validated >
Rationale	All procedures related to delegation shell undergo safety assessment including the check and full compliance with Safety standards and Requirement at ATS Service level (functionality & performance) associated to failure condition derived in order to mitigate the operational hazards defined in the SAR. There was no full safety assessment of the delegation procedure, but the documents prepared by the validation exercises were carefully prepared before the exercises. In addition, the safety analysis did not reveal any major safety issues related to the procedure. Thus, this requirement is defined as validated. Nevertheless, a deployment of the concept and the procedure in real operations would require a full safety assessment.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-SAF.0004
Title	Safety level in case of contingency
Requirement	The existing safety level shall not be impacted negatively in case of contingency delegation.
Status	<validated >
Rationale	In case of contingency, safety level is not compromised by delegation of ATM services among ATSUs. Proper operational procedure will allow acceptable safety levels to be maintained.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-SAF.0006
Title	Spare capacity coordination
Requirement	The delegation process shall not be performed at the moment the receiving ATSU is considered at full capacity.
Status	<validated >
Rationale	When receiving airspace from another ATSU, the receiving ATSU has the potential risk to come into an overload situation if any unforeseen issues occur during the ATSU is responsible for the delegated airspace. To prevent this, the delegation cannot be performed at the moment the sector is at full capacity.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-SAF.0007
Title	Integrity / Reliability SRS loss of service: a/c management for receiving ATSU
Requirement	The frequency of occurrence of “Loss of Service preventing controller from managing one or many aircraft for the receiving ATSU” shall not be more than 1,2 1e-6 [sector operating hours].
Status	<in progress>
Rationale	Safety Requirement at ATS Service level (integrity/reliability) associated to failure condition derived in order to mitigate the operational hazards defined in the SAR.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-SAF.0008
Title	Integrity / Reliability SRS loss of service: a/c management for both delegating and receiving ATSU
Requirement	The frequency of occurrence of “Loss of Service preventing controller from managing one or many aircraft for both delegating and receiving ATSU” shall not be more than 1,2 1e-6 [sector operating hours].
Status	<in progress>
Rationale	Safety Requirement at ATS Service level (integrity/reliability) associated to failure condition derived in order to mitigate the operational hazards defined in the SAR.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-SAF.0009
Title	Integrity / Reliability SRS loss of service: workstation for receiving ATSU
Requirement	The frequency of occurrence of “Service Loss (one/two workstation/s) for the receiving ATSU” shall be no greater than 2,4 1e-6 [sector operating hours].
Status	<in progress>
Rationale	Safety Requirement at ATS Service level (integrity/reliability) associated to failure condition derived in order to mitigate the operational hazards defined in the SAR.
Category	<Safety>

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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-SAF.0010
Title	Integrity / Reliability SRS loss of service: workstation for both delegating and receiving ATSU
Requirement	The frequency of occurrence of “Service Loss (one/two workstation/s) for both delegating and receiving ATSU” shall be no greater than 2,4 1e-6 [sector operating hours].
Status	<in progress>
Rationale	Safety Requirement at ATS Service level (integrity/reliability) associated to failure condition derived in order to mitigate the operational hazards defined in the SAR.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-SAF.0011
Title	Integrity / Reliability SRS loss of service: Corruption for receiving ATSU
Requirement	The frequency of occurrence of Loss of Service resulting in “Detected corruption for the receiving ATSU” preventing the controller to have access to all functionality required to safely manage traffic shall be no greater than 6,0 1e-7 [sector operating hours].
Status	<in progress>
Rationale	Safety Requirement at ATS Service level (integrity/reliability) associated to failure condition derived in order to mitigate the operational hazards defined in the SAR.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-SAF.0012
Title	Integrity / Reliability SRS loss of service: Corruption for both delegating and receiving ATSU
Requirement	The frequency of occurrence of Loss of Service resulting in "Detected corruption for both delegating and receiving ATSU" preventing the controller to have access to all functionality required to safely manage traffic shall be no greater than 6,0 1e-7 [sector operating hours].
Status	<in progress>
Rationale	Safety Requirement at ATS Service level (integrity/reliability) associated to failure condition derived in order to mitigate the operational hazards defined in the SAR.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-SAF.0013
Title	Integrity / Reliability SRS loss of service: Undetected Corruption for receiving ATSU
Requirement	The frequency of occurrence of Loss of Service resulting in “Undetected corruption for the receiving ATSU” preventing the controller to have access to all functionality required to safely manage traffic shall be no greater than 1,2 1e-7 [sector operating hours].
Status	<in progress>
Rationale	Safety Requirement at ATS Service level (integrity/reliability) associated to failure condition derived in order to mitigate the operational hazards defined in the SAR.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

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[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-SAF.0013
Title	Integrity / Reliability SRS loss of service: Undetected Corruption for both delegating and receiving ATSU
Requirement	The frequency of occurrence of Loss of Service resulting in "Undetected corruption for both delegating and receiving ATSU" preventing the controller to have access to all functionality required to safely manage traffic shall be no greater than 1,2 1e-7 [sector operating hours].
Status	<in progress>
Rationale	Safety Requirement at ATS Service level (integrity/reliability) associated to failure condition derived in order to mitigate the operational hazards defined in the SAR.
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01

4.6 Security Requirements

This section summarises the security requirements as they have been derived from the application of the SecRAM 2.0 Methodology. Each requirement is associated to one supporting asset and derived from the control or the controls applied to that supporting asset to reduce the risk on the associated primary asset.

It shall be noted that, being part of an ATM infrastructure, all the relevant regulation applies to the development of the systems and operations. The NIS directive is the high-level regulatory framework which shall be applied. This implies the adherence to a Security Management System for all the involved stakeholders (ATM system developers, ANSP, etc, …). At this objectives, one reference (or both) ISO27001 [39] and NIST CSF (Cyber Security Framework) [40] could be applied, noting that the SecRAM controls directly derive from the ISO 27001 framework. Other standards could be applied if equivalent and traceable with the previous one (e.g.: the UK regulation by CAA based on the CAF - CAP 1753) [41].

It is worth reporting that EASA is currently working on a standard (called Part-IS) [42], which is being introduced into European law and may become a regulation for European aviation organisations. In addition, ICAO is developing (in the long-term) some global information security performance requirements with an Information Security Manual (ISM). Again, these requirements can be traced to

the industry standards mentioned but the intent is to have an aviation specific set of requirements that could be applied globally (i.e. across 193 states). ISM came about to address greater digital interoperability between aviation organisations globally.

Because of the previous statement, there should be considered as an assumption a set of security requirements derived from the mentioned standards (e.g. restricted access and authorisation on administrative systems, including access to the virtualization management if used)

[REQ]

Identifier	REQ-PJ10-W2-93-OSED-SEC.001
Title	Security Awareness in Voice ADSP
Requirement	Security Awareness and Education about Security Risk shall be provided to personnel of a Voice ADSP
Status	
Rationale	Derived from SecRAM 2.0 methodology Security risk Assessment
Category	<Operational><Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<		

[REQ]

Identifier	REQ-PJ10-W2-93-OSED-SEC.002
Title	Security Awareness in ATC ADSP
Requirement	Security Awareness and Education about Security Risk shall be provided to personnel of an ATC ADSP
Status	
Rationale	Derived from SecRAM 2.0 methodology Security risk Assessment
Category	<Operational><Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<		

[REQ]

Identifier	REQ-PJ10-W2-93-OSED-SEC.003
Title	Security Awareness in VC ATSU
Requirement	Security Awareness and Education about Security Risk shall be provided to personnel of a VC ATSU
Status	
Rationale	Derived from SecRAM 2.0 methodology Security risk Assessment
Category	<Operational><Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<		

Identifier	REQ-PJ10-W2-93-OSED-SEC.004
Title	Security in supplier relationship
Requirement	The organisations need to ensure an information security policy to secure the use of their assets if accessible by suppliers and agree with them on the existing security requirements
Status	
Rationale	Derived from ISO_IEC_27001 A.15 control
Category	<Operational><Security>

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[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<		

4.7 Human Performance Requirements

In order to have an overall view on the list of Human Performance requirements, need to consider other requirements in the section above tagged as <Human Performance> as Category.

[REQ]

Identifier	REQ-PJ.10-W2.93-SPRINTEROP-HPF.0001
Title	Supervisor Support
Requirement	Supervisor shall be able to provide support to the ATCOs during the delegation process.
Status	<validated >
Rationale	During the delegation, all actors involved are always informed beforehand an opening/closure of a sector is performed. Due to potential technical issues, the ATCOs might not always have an overall vision of all sectors involved.
Category	<Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.10-W2-93
<SATISFIES>	<High Level Operational Requirement>	S93-HLOR-01
<ALLOCATED_TO>	<Role>	ACC/Approach/TMA Supervisor (PJ.10-93)

5 References and Applicable Documents

5.1 Applicable Documents

Content Integration

[1] SESAR ATM Lexicon

Content Development

[2] PJ19 CI D2.5 SESAR Concept of Operations (CONOPS 2019), May 2019

System and Service Development

[3] B.04.03 D102 SESAR Working Method on Services

[4] B.04.05 Common Service Foundation Method

Performance Management

[5] PJ19.04 D4.7 Performance Framework 2019, November 2019

[6] S2020 Common Assumptions, September 2019, edition 00.01.00

[7] PJ19-W2: Validation Targets - SESAR2020 Wave 2 & Wave 3, D4.01, May 2021, edition 00.01.00

Validation

[8] European Operational Concept Validation Methodology, E-OCVM Version 3.0, Volume I, February 2010

[9] European Operational Concept Validation Methodology, E-OCVM Version 3.0, Volume II Annexes, February 2010

[10] D2.6 - PJ19: Validation Strategy VALS (2019), October 2019, edition 00.01.00

[11] SESAR 2020 Requirements and Validation Guidelines, May 2021, edition 00.02.02

System Engineering

[12] PJ22 Updated V&VP, V&VI and Demonstration Platform Development Methodology (final release), June 2019, edition 00.01.00

Safety

[13] PJ19 CI D4.0.060 SESAR Safety Reference Material, Edition 00.04.01, December 2018

[14] PJ19 CI D4.0.050 Guidance to Apply SESAR Safety Reference Material, Edition 00.03.01, December 2018

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Human Performance

[15]PJ19 CI D4.0.070 SESAR Human Performance Assessment Process V1 to V3 – including VLD, Edition 00.03.02, August 2020

Environment Assessment

[16]PJ.19.4.2: SESAR Environment Assessment Process, December 2019, edition 04.00.00

5.2 Reference Documents

[17]COMMISSION IMPLEMENTING REGULATION (EU) 2020/469, 14th February 2020

[18]High Level Operational Requirements for Wave 2 Solutions, V 00.01.02, March 2021

[19]Eurocontrol: Guidelines for Contingency Planning of Air Navigation Services (including Service Continuity), Edition 2.0, 2009

[20]SESAR Joint Undertaking: A proposal for the future architecture of the European, 2019

[21]Commision Regulation (EU) 2016/340, 20 February 2015

[22]SESAR Solution PJ.15-09 SPR-INTEROP/OSED for V1 - Part I

[23]SESAR B.04.04 Operational and Service Modelling Report, 24.08.2016

[24]SESAR 2020 TS IRS - PJ.16-03 Solution, Edition 02.00.00, 06.12.2019

[25]PJ.10-W2-Solution 93 TS/IRS V3, Final Version

[26]PJ.10-W2-Solution 93 Validation Report (VALR) for V3 – Part I

[27]PJ.10-W2-Solution 93 Validation Plan (VALP) for V3 - Part I

[28]EUROCONTROL Common Format LoA (Edition 4.0, 15.03.2012)

[29]SESAR Solution PJ.09-W2-44 SPR-INTEROP/OSED – Part I V2

[30]SESAR Solution PJ.10-06 SPR-INTEROP/OSED for V1 - Part I, edition 00.01.06, 29.05.2019

[31]SESAR Solution PJ.10-W2-93 SPR-INTEROP/OSED for V3 - Part II - Safety Assessment Report

[32]SESAR 2020 Solution PJ.10-W2-WP3- Solution 93 SPR-INTEROP/OSED for V3 - Part IV - Human Performance Assessment Report, HP Log

[33]SESAR Solution PJ.32-W3-WP02 Intermediate SPR-INTEROP/OSED for V2 - Part I, D2.1.021

[34]SESAR Solution PJ.32-W3-WP03 TS/IRS V2, Final Version

[35]FINEST - The first Virtual Centre providing dynamic cross-border En-Route Services in Europe, World ATM Congress, FABEC Ops Theatre (worldatmcongress.org)

[36]EUROCAE: Virtual Centre – Strategy for Standardisation – Phase 1, November 2021

[37]SESAR Solution PJ.10-W2-73 IFAV SPR-INTEROP/OSED for V2 - Part I, edition 00.01.00, 30.09.2022

[38]SESAR Solution PJ.33-W3-01a IFAV SPR-INTEROP/OSED for V2 - Part I

[39]International Organisation for Standardisation: ISO/IEC 27001:2022 Information security, cybersecurity and privacy protection — Information security management systems — Requirements

[40]NIST: Framework for Improving Critical Infrastructure Cybersecurity, Version 1.1, April 2018

[41]Civil Aviation Authority: CAA Cyber security oversight process for aviation, CAP1753, June 2021

[42]COMMISSION DELEGATED REGULATION (EU) 2022/1645, 14 July 2022

Appendix A Detailed tables of OI Steps and Enablers

A.1 Summary and mapping of Enablers to Technical Solutions

Enabler	Service	POI-075	POI-076	POI-077	Initial Maturity	Target Maturity
SVC-008	Provision and Consumption of FlightDataDistribution Service in the context of Virtual Centres.	Optional	Optional	n/a	TRL6	TRL6
SVC-009	Provision and Consumption of FlightDataManagement Service in the context of Virtual Centres	Optional	Optional	n/a	TRL6	TRL6
SVC-010	Provision and Consumption of CoordinationAndTransferManagement Service in the context of Virtual Centres	Optional	Optional	n/a	TRL6	TRL6
SVC-013	Provision and Consumption of Airspace Status Distribution Service	Optional	Optional	n/a	TRL6	TRL6
SVC-014	Provision and Consumption of Arrival Sequence Distribution Service	Optional	Optional	n/a	TRL4	TRL4
SVC-015	Provision and Consumption of Arrival Sequence Management Service	Optional	Optional	n/a	TRL4	TRL4
SVC-016	Provision and Consumption of Correlation Distribution Service	Optional	Optional	n/a	TRL6	TRL6
SVC-017	Provision and Consumption of Correlation Management Service	Optional	Optional	n/a	TRL6	TRL6
SVC-018	Provision and Consumption of Medium Term Conflict Detection Distribution Service	Optional	Optional	n/a	TRL4	TRL4

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SVC-019	Provision and Consumption of Medium Term Conflict Management Service	Optional	Optional	n/a	TRL4	TRL4
SVC-020	Provision and Consumption of Monitoring Aids Distribution Service	Optional	Optional	n/a	TRL4	TRL6
SVC-021	Provision and Consumption of Operational Configuration Distribution Service	Optional	Optional	n/a	TRL4	TRL6
SVC-049	Operational Configuration Distribution of Working Position Preview Mode, and Neighbouring ATSU Sector configuration for ATM Service Delegation	Optional	Optional	n/a	new	TRL6
SVC-022	Provision and Consumption of Operational Configuration Management Service	Optional	Optional	n/a	TRL4	TRL6
SVC-050	Operational Configuration Management of Working Position Preview Mode, and Neighbouring ATSU Sectors for ATM Service Delegation	Optional	Optional	n/a	new	TRL6
SVC-023	Provision and Consumption of Safety Net (SNET) Alert Distribution Service	Optional	Optional	n/a	TRL4	TRL4
SVC-024	Provision and Consumption of SSR Code Distribution Service	Optional	Optional	n/a	TRL4	TRL4
SVC-025	Provision and Consumption of SSR Code Management Service	Optional	Optional	n/a	TRL4	TRL4
SVC-026	Provision and Consumption of Support Functions Distribution Service	Optional	Optional	n/a	TRL4	TRL4
SVC-027	Provision and Consumption of Support Functions Management Service	Optional	Optional	n/a	TRL4	TRL4
SVC-028	Provision and Consumption of Surveillance Data Distribution Service	Optional	Optional	n/a	TRL4	TRL4

SVC-029	Provision and Consumption of Technical Supervision Distribution Service	Optional	Optional	n/a	TRL4	TRL6
SVC-031	Provision and Consumption of Time-based Separation Distribution Service	Optional	Optional	n/a	TRL4	TRL4
SVC-032	Provision and Consumption of Time-based Separation Management Service	Optional	Optional	n/a	TRL4	TRL4
SVC-033	Provision and Consumption of Voice Comm Information Distribution Service	Optional	Optional	n/a	TRL6	TRL6
SVC-034	Provision and Consumption of Voice Comm Management Service	Optional	Optional	n/a	TRL6	TRL6
ER APP 184	ATM Data Service Provider for ATC services in a Virtual Centre context	Required	Required	n/a	TRL6	TRL6
ER APP 185	ATM Data Service Provider for Voice services in a Virtual Centre context	Required	Required	n/a	TRL6	TRL6
ER APP 186	Virtual Centre ATSU	Required	Required	n/a	TRL6	TRL6
ER APP 193	Management in the VC ATSU of a CWP preview mode during delegation of ATS Provision between ATUs	Required	Required	Optional	new	TRL6
ER APP 194	Management in the ADSP of a CWP preview mode during delegation of ATS Provision between ATUs	Required	Required	Optional	new	TRL6
ER APP 195	Management in the VC ATSU of Delegation of ATS Provision between ATUs with Static AoRs for Y-Architecture	Required	n/a	n/a	new	TRL6
ER APP 196	Management in the VC ATSU of Delegation of ATS provision between ATUs with Dynamic AoRs for U-Architecture	n/a	n/a	Required	new	TRL4
ER APP 197	Management in the ADSP of Delegation of ATS provision between ATUs with Dynamic AoRs for U-Architecture	n/a	n/a	Required	new	TRL4

ER APP ATC 215	Management in the VC ATSU of Delegation of ATS Provision between ATUs with Static AoRs in a D-Architecture	n/a	Required	n/a	new	TRL4
ER APP ATC 216	Management in the ADSP of Delegation of ATS provision between ATUs with Static AoRs in a Y-Architecture	Required	n/a	n/a	new	TRL6
ER APP ATC 217	Management in the ADSP of Delegation of ATS provision between ATUs with Static AoRs in a D-Architecture	n/a	Required	n/a	new	TRL4
ER APP ATC 218	Management in the VC ATSU of Delegation of ATS provision between ATUs with Dynamic AoRs in a Y-Architecture	Optional	n/a	n/a	new	TRL6
ER APP ATC 209	Management in the ADSP of Delegation of ATS provision between ATUs with Dynamic AoRs in a Y-Architecture	Optional	n/a	n/a	new	TRL6

Table 2828282828: Mapping of Enablers and Technical Solutions

A.2 OI Steps and Enablers related to the Y-architecture

SESAR Solution ID	SESAR Solution Title	OI Steps ID	OI Steps Title	Enabler ID	Enabler Title	OI Step/Enabler Coverage
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture	POI-0075	Support of deployment of Virtual Centre concept with "Y" architecture			Fully
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			SVC-008	Provision and Consumption of FlightDataDistribution Service in the context of Virtual Centres.	• Optional • Used
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			SVC-009	Provision and Consumption of FlightDataManagement Service in the context of Virtual Centres	• Optional • Used
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			SVC-010	Provision and Consumption of CoordinationAndTransferManagement Service in the context of Virtual Centres	• Optional • Used

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PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			SVC-013	Provision and Consumption of Airspace Status Distribution Service	• Optional • Used
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			SVC-014	Provision and Consumption of Arrival Sequence Distribution Service	• Optional • Used
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			SVC-015	Provision and Consumption of Arrival Sequence Management Service	• Optional • Used
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			SVC-016	Provision and Consumption of Correlation Distribution Service	• Optional • Used
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			SVC-017	Provision and Consumption of Correlation Management Service	• Optional • Used
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			SVC-018	Provision and Consumption of Medium Term Conflict Detection Distribution Service	• Optional • Used

PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			SVC-019	Provision and Consumption of Medium Term Conflict Management Service	• Optional • Used
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			SVC-020	Provision and Consumption of Monitoring Aids Distribution Service	• Optional • Used
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			SVC-021	Provision and Consumption of Operational Configuration Distribution Service	• Optional • Used
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			SVC-049	Operational Configuration Distribution of Working Position Preview Mode, and Neighbouring ATSU Sector configuration for ATM Service Delegation	• Optional • Developed
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			SVC-022	Provision and Consumption of Operational Configuration Management Service	• Optional • Used
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			SVC-050	Operational Configuration Management of Working Position Preview Mode, and Neighbouring ATSU Sectors for ATM Service Delegation	• Optional • Developed

PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			SVC-023	Provision and Consumption of Safety Net (SNET) Alert Distribution Service	• Optional • Used
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			SVC-024	Provision and Consumption of SSR Code Distribution Service	• Optional • Used
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			SVC-025	Provision and Consumption of SSR Code Management Service	• Optional • Used
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			SVC-026	Provision and Consumption of Support Functions Distribution Service	• Optional • Used
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			SVC-027	Provision and Consumption of Support Functions Management Service	• Optional • Used
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			SVC-028	Provision and Consumption of Surveillance Data Distribution Service	• Optional • Used

PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			SVC-029	Provision and Consumption of Technical Supervision Distribution Service	• Optional • Used
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			SVC-031	Provision and Consumption of Time-based Separation Distribution Service	• Optional • Used
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			SVC-032	Provision and Consumption of Time-based Separation Management Service	• Optional • Used
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			SVC-033	Provision and Consumption of Voice Comm Information Distribution Service	• Optional • Used
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			SVC-034	Provision and Consumption of Voice Comm Management Service	• Optional • Used
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			ER APP ATC 184	ATM Data Service Provider for ATC services in a Virtual Centre context	• Required • Used

PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			ER APP ATC 185	ATM Data Service Provider for Voice services in a Virtual Centre context	• Required • Used
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			ER APP ATC 186	Virtual Centre ATSU	• Required • Used
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			ER APP ATC 193	Management in the VC ATSU of a CWP preview mode during delegation of ATS Provision between ATUs	• Required • Developed
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			ER APP ATC 194	Management in the ADSP of a CWP preview mode during delegation of ATS Provision between ATUs	• Required • Developed
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			ER APP ATC 195	Management in the VC ATSU of Delegation of ATS Provision between ATUs with Static AoRs	• Required • Developed
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			ER APP ATC 216	Management in the ADSP of Delegation of ATS provision between ATUs with Static AoRs in a Y-Architecture	• Required • Developed

PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			ER APP ATC 218	Management in the VC ATSU of Delegation of ATS provision between ATUs with Dynamic AoRs in a Y-Architecture	• Optional • Used
PJ.10-W2-93a	Delegation of ATM services provision with a "Y" architecture			ER APP ATC 209	Management in the ADSP of Delegation of ATS provision between ATUs with Dynamic AoRs in a Y-Architecture	• Optional • Used
PJ.10-W2-93a	SVC-008 – SVC-010, SVC-013 - SVC-029, SVC-031 – SVC-034, SVC-049, SVC-050			STD-097	EUROCAE ER for Taxonomy of Services between ATSU & ADSP(s), and between ADSP &ADSP	• Optional • Used

Table 2929292929: OI Steps and Enablers related to the Y-architecture

A.3 OI Steps and Enablers related to the D-architecture

SESAR Solution ID	SESAR Solution Title	OI Steps ID	OI Steps Title	Enabler ID	Enabler Title	OI Step / Enabler Coverage
PJ.10-W2-93b	Delegation of ATM services provision with a "D" architecture	POI-076	Support of use of Virtual Centre concept for delegation with "D" architecture			Fully
PJ.10-W2-93b	Delegation of ATM services provision with a "D" architecture			SVC-008	Provision and Consumption of FlightDataDistribution Service in the context of Virtual Centres.	• Optional • Used
PJ.10-W2-93b	Delegation of ATM services provision with a "D" architecture			SVC-009	Provision and Consumption of FlightDataManagement Service in the context of Virtual Centres	• Optional • Used
PJ.10-W2-93b	Delegation of ATM services provision with a "D" architecture			SVC-010	Provision and Consumption of CoordinationAndTransferManagement Service in the context of Virtual Centres	• Optional • Used
PJ.10-W2-93b	Delegation of ATM services provision with a "D" architecture			SVC-013	Provision and Consumption of Airspace Status Distribution Service	• Optional • Used

PJ.10-W2-93b	Delegation of ATM services provision with a “D” architecture			SVC-014	Provision and Consumption of Arrival Sequence Distribution Service	• Optional • Used
PJ.10-W2-93b	Delegation of ATM services provision with a “D” architecture			SVC-015	Provision and Consumption of Arrival Sequence Management Service	• Optional • Used
PJ.10-W2-93b	Delegation of ATM services provision with a “D” architecture			SVC-016	Provision and Consumption of Correlation Distribution Service	• Optional • Used
PJ.10-W2-93b	Delegation of ATM services provision with a “D” architecture			SVC-017	Provision and Consumption of Correlation Management Service	• Optional • Used
PJ.10-W2-93b	Delegation of ATM services provision with a “D” architecture			SVC-018	Provision and Consumption of Medium Term Conflict Detection Distribution Service	• Optional • Used
PJ.10-W2-93b	Delegation of ATM services provision with a “D” architecture			SVC-019	Provision and Consumption of Medium Term Conflict Management Service	• Optional • Used
PJ.10-W2-93b	Delegation of ATM services provision with a “D” architecture			SVC-020	Provision and Consumption of Monitoring Aids Distribution Service	• Optional • Used
PJ.10-W2-93b	Delegation of ATM services provision with a “D” architecture			SVC-021	Provision and Consumption of Operational Configuration Distribution Service	• Optional • Used

PJ.10-W2-93b	Delegation of ATM services provision with a "D" architecture			SVC-049	Operational Configuration Distribution of Working Position Preview Mode, and Neighbouring ATSU Sector configuration for ATM Service Delegation	• Optional • Used
PJ.10-W2-93b	Delegation of ATM services provision with a "D" architecture			SVC-022	Provision and Consumption of Operational Configuration Management Service	• Optional • Used
PJ.10-W2-93b	Delegation of ATM services provision with a "D" architecture			SVC-050	Operational Configuration Management of Working Position Preview Mode, and Neighbouring ATSU Sectors for ATM Service Delegation	• Optional • Used
PJ.10-W2-93b	Delegation of ATM services provision with a "D" architecture			SVC-023	Provision and Consumption of Safety Net (SNET) Alert Distribution Service	• Optional • Used
PJ.10-W2-93b	Delegation of ATM services provision with a "D" architecture			SVC-024	Provision and Consumption of SSR Code Distribution Service	• Optional • Used
PJ.10-W2-93b	Delegation of ATM services provision with a "D" architecture			SVC-025	Provision and Consumption of SSR Code Management Service	• Optional • Used
PJ.10-W2-93b	Delegation of ATM services provision with a "D" architecture			SVC-026	Provision and Consumption of Support Functions Distribution Service	• Optional • Used

PJ.10-W2-93b	Delegation of ATM services provision with a "D" architecture			SVC-027	Provision and Consumption of Support Functions Management Service	• Optional • Used
PJ.10-W2-93b	Delegation of ATM services provision with a "D" architecture			SVC-028	Provision and Consumption of Surveillance Data Distribution Service	• Optional • Used
PJ.10-W2-93b	Delegation of ATM services provision with a "D" architecture			SVC-029	Provision and Consumption of Technical Supervision Distribution Service	• Optional • Used
PJ.10-W2-93b	Delegation of ATM services provision with a "D" architecture			SVC-031	Provision and Consumption of Time-based Separation Distribution Service	• Optional • Used
PJ.10-W2-93b	Delegation of ATM services provision with a "D" architecture			SVC-032	Provision and Consumption of Time-based Separation Management Service	• Optional • Used
PJ.10-W2-93b	Delegation of ATM services provision with a "D" architecture			SVC-033	Provision and Consumption of Voice Comm Information Distribution Service	• Optional • Used
PJ.10-W2-93b	Delegation of ATM services provision with a "D" architecture			SVC-034	Provision and Consumption of Voice Comm Management Service	• Optional • Used
PJ.10-W2-93b	Delegation of ATM services provision with a "D" architecture			ER APP ATC 184	ATM Data Service Provider for ATC services in a Virtual Centre context	• Required • Used

PJ.10-W2-93b	Delegation of ATM services provision with a "D" architecture			ER APP ATC 185	ATM Data Service Provider for Voice services in a Virtual Centre context	• Required • Used
PJ.10-W2-93b	Delegation of ATM services provision with a "D" architecture			ER APP ATC 186	Virtual Centre ATSU	• Required • Used
PJ.10-W2-93b	Delegation of ATM services provision with a "D" architecture			ER APP ATC 193	Management in the VC ATSU of a CWP preview mode during delegation of ATS Provision between ATUs	• Required • Used
PJ.10-W2-93b	Delegation of ATM services provision with a "D" architecture			ER APP ATC 194	Management in the ADSP of a CWP preview mode during delegation of ATS Provision between ATUs	• Required • Used
PJ.10-W2-93b	Delegation of ATM services provision with a "D" architecture			ER APP ATC 215	Management in the VC ATSU of Delegation of ATS Provision between ATUs with Static AoRs in a D-Architecture	• Required • Developed
PJ.10-W2-93b	Delegation of ATM services provision with a "D" architecture			ER APP ATC 217	Management in the ADSP of Delegation of ATS Provision between ATUs with Static AoRs in a D-Architecture	• Required • Developed
PJ.10-W2-93b	SVC-008 – SVC-010, SVC-013 - SVC-029, SVC-031 – SVC-034, SVC-049, SVC-050			STD-097	EUROCAE ER for Taxonomy of Services between ATSU & ADSP(s), and between ADSP &ADSP	• Required • Developed

Table 3030303030: OI Steps and Enablers related to the D-architecture

A.4 OI Steps and Enablers related to the U-architecture

SESAR Solution ID	SESAR Solution Title	OI Steps ID	OI Steps Title	Enabler ID	Enabler Title	OI Step / Enabler Coverage
PJ.10-W2-93c	Delegation of ATM services provision with a "U" architecture	POI-077	Support Infrastructure for delegation with "U" architecture			Fully
PJ.10-W2-93c	Delegation of ATM services provision with a "U" architecture			ER APP ATC 193	Management in the VC ATSU of a CWP preview mode during delegation of ATS Provision between ATUs	• Optional • Used
PJ.10-W2-93c	Delegation of ATM services provision with a "U" architecture			ER APP ATC 194)	Management in the ADSP of a CWP preview mode during delegation of ATS Provision between ATUs	• Optional • Used
PJ.10-W2-93c	Delegation of ATM services provision with a "U" architecture			ER APP ATC 196	Management in the VC ATSU of Delegation of ATS provision between ATUs with Dynamic AoRs	• Required • Developed
CR 06009 (PJ.10-W2-93c	Delegation of ATM services provision with a "U" architecture			ER APP ATC 197	Management in the ADSP of Delegation of ATS provision between ATUs with Dynamic AoRs	• Required • Developed

Table 3131313131: OI Steps and Enablers related to the U-architecture

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Appendix B Cost and Benefit Mechanisms

B.1 Stakeholder identification and Expectations

Stakeholder	Involvement	Why it matters to stakeholder
ANSPs	Direct To implement the Virtual Centre solutions	Expect to improve cost efficiency through an optimum use of available human resources. Expect technology costs reduction Improve Safety (e.g., in contingency UC#)
Industry	Direct To provide trial platforms	Opportunity to develop new markets based on large scale shared ADSPs Positioning in European Markets thanks to a long-term vision Develop new & sustainable technologies in ATM
Eurocontrol	Direct Service definition to support the exercise and contribution to technical and operational solutions for the set-up of the exercise.	Major contributor to the standardisation of ATM services
SJU	Indirect Programme coordinator	Ensure the concept definition and technical validation activities comply with the general SJU approach. Help deliver AAS-European Airspace Architecture Study
European Commission	Indirect Participation through SJU	Expect to increase economic power and position of Europe in the air-traffic sector. Expect to increase capacity and efficiency. Support for the implementation of the SES.

Table 3232323232: Stakeholder's expectations

B.2 Benefits mechanisms

The benefit impact mechanisms provided below refer to the overall scope of the solution. Within the scope of the solution validation activities at V2 level, the Cost-Efficiency benefit impact mechanism has been validated for the Delegation of ATM services provision at night use case. The rest of benefit impact mechanisms will be validated during the V3 validation activities.

The figure below depicts a general overview of the features that are part of SDM-0217, and the corresponding Key Performances Areas for which a primary benefit has been identified. In addition, an individual Benefit Impact Mechanism is presented for each one of the features identified.

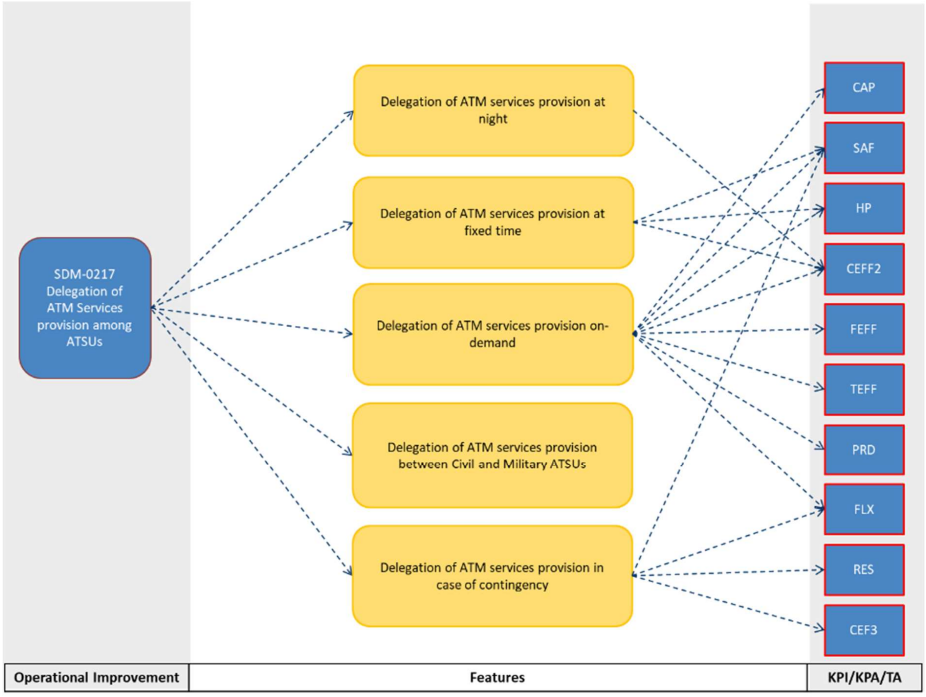

Figure 5252525252: Benefit Impact Mechanisms SDM-0217 overview

B.2.1 Delegation of ATM services provision at night

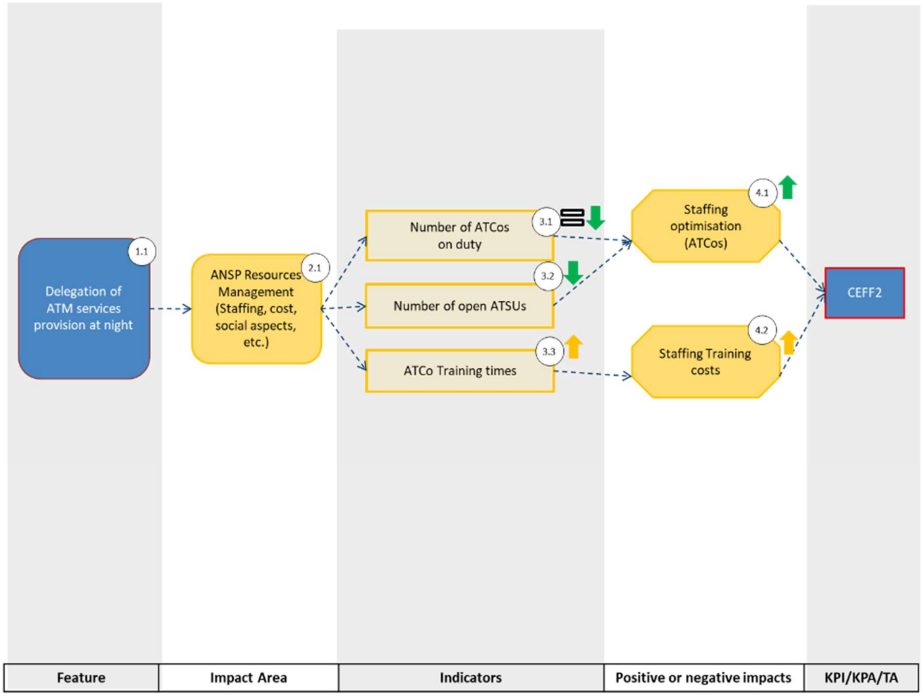

Figure 5353535353: Benefit Impact Mechanisms SDM-0217 (Delegation of ATM services provision at night)

Features:

1.1. Delegation of ATM services provision at night: delegation of the provision of Air Traffic Management (ATM) services amongst cross border or non-cross border ATSUs (entire ATSU or part of the ATSU) during the night shift period.

Benefit Mechanisms:

Impact Areas

2.1. The delegation of the provision of Air Traffic Services amongst ATSUs, for both cross border and non-cross border cases, will have an impact on the ANSP capability in terms of Resources Management at both staffing and facilities level (cost optimization).

Indicators

3.1. When traffic demand is low, full transfer of responsibility of one of more sectors from one ATSU to another ATSU will improve the Cost-Efficiency as the number of ATCOs on duty might decrease.

3.2. The Delegation of Air Traffic Services amongst ATSUs might imply ATCOs to be trained to control in different sectors of different ATSUs, increasing therefore the training times and costs to fulfil the

competence scheme requirements, considering the current competence and licensing model. In a future environment, ATCOs should be trained for a set of tools, and therefore they should be able to manage more sectors.

3.3. When traffic demand is low, full transfer of responsibility of one or more sectors from one ATSU to another ATSU will improve the Cost-Efficiency as the number of open ATSUs may decrease.

Positive or Negative Impacts

4.1. The staffing management may be improved due to a reduction in the number of ATCOs on duty or a reduction in the number of open ATSUs.

4.2. The ATCOs training costs will potentially increase since ATCOs shall have competences in those sectors that are candidates for fixed delegations.

B.2.2 Delegation of ATM services provision at fixed time

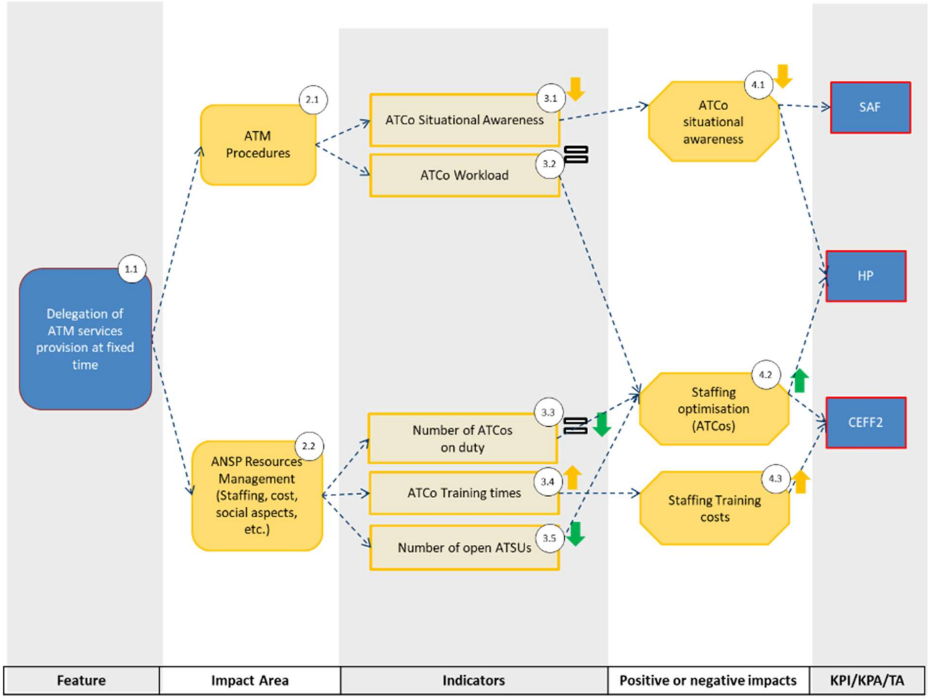

Figure 5454545454: Benefit Impact Mechanisms SDM-0217 (Delegation of ATM services provision at fixed time)

Features:

1.1. Delegation of ATM services provision at fixed time: delegation of the provision of Air Traffic Management (ATM) services amongst cross border or non-cross border ATSUs (parts of the ATSU) during predefined and pre-agreed time periods.

Benefit Mechanisms:

Impact Areas

2.1. The delegation of the provision of Air Traffic Services amongst ATSUs, for both cross border and non-cross border cases, will have an impact on the ATM procedures (airspace management procedures, ATC procedures, etc.) put in place in the different ATSUs. Given the fact that ATCOs of the delegated ATSU may not have full competences to manage sectors with traffic at capacity levels, it might be needed to have simplified ATC procedures and increased levels of automation with ATCO supporting tools (e.g., for Conflict Detection and Resolution).

2.2. The delegation of the provision of Air Traffic Services amongst ATSUs, for both cross border and non-cross border cases, will have an impact on the ANSP capability in terms of Resources Management at both staffing and facilities level (cost optimization).

Indicators

3.1. The delegation of the provision of Air Traffic Services amongst ATSUs may imply a loss of Situational Awareness for the ATCO assuming new responsibilities when absorbing new sectors. This situation may imply risks to be mitigated, impacting Safety negatively.

3.2. The simplification and standardisation of the ATC procedures when delegating the provision of Air Traffic Services amongst different ATSUs should not imply any kind of negative impact on ATCO workload nor in Capacity. Therefore, a trade-off between more common and simpler procedures and Capacity should be considered

3.3. When traffic demand is low, full transfer of responsibility of one of more sectors from one ATSU to another ATSU will improve the Cost-Efficiency as the number of ATCOs on duty might decrease.

3.4. The Delegation of Air Traffic Services amongst ATSUs might imply ATCOs to be trained to control in different sectors of different ATSUs, increasing therefore the training times and costs to fulfil the competence scheme requirements, considering the current competence and licensing model. In a future environment, ATCOs should be trained for a set of tools, and therefore they should be able to manage more sectors.

3.5. When traffic demand is low, full transfer of responsibility of one or more sectors from one ATSU to another ATSU will improve the Cost-Efficiency as the number of open ATSUs may decrease.

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Positive or Negative Impacts

4.1. The level of ATCO's situational awareness may decrease when absorbing new sectors under their control due to the delegation procedures.

4.2. The staffing management may be improved due to a reduction in the number of ATCOs on duty or a reduction in the number of open ATSUs.

4.3. The ATCOs training costs will potentially increase since ATCOs shall have competences in those sectors that are candidates for fixed delegations.

B.2.3 Delegation of ATM services provision on-demand

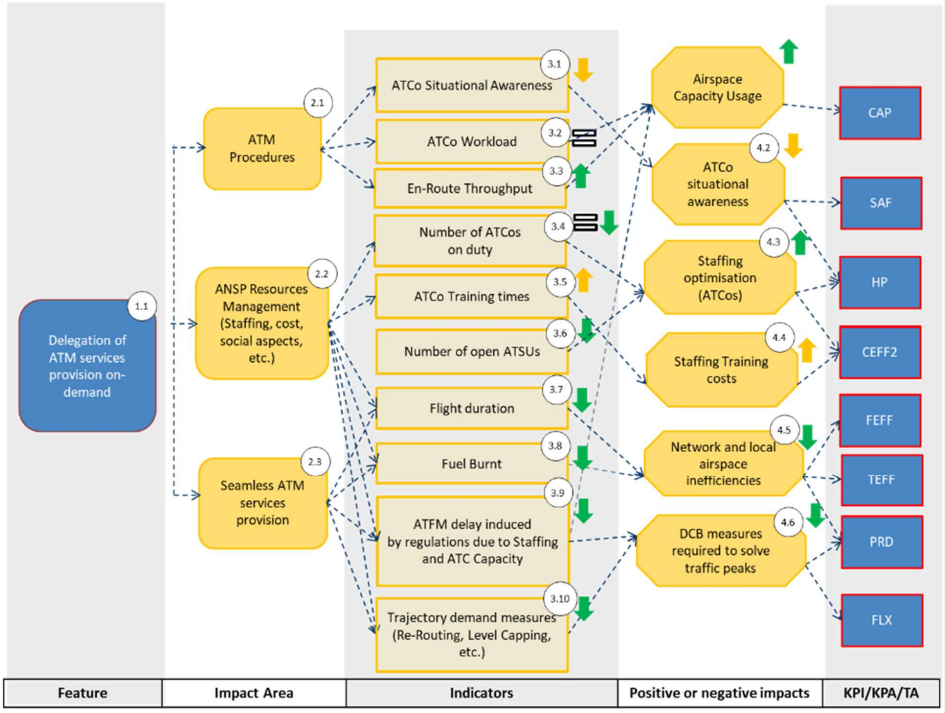

Figure 555555555: Benefit Impact Mechanisms SDM-0217 (Delegation of ATM services provision on-demand)

Features:

1.1. Delegation of ATM services provision on-demand: delegation of the provision of Air traffic services with the purpose of balancing the air traffic load amongst ATSUs for cross border or non-cross border sectors.

Benefit Mechanisms:

Impact Areas

2.1. The delegation of the provision of Air Traffic Services amongst ATSUs, for both cross border and non-cross border cases, will have an impact on the ATM procedures (airspace management procedures, ATC procedures, etc.) put in place in the different ATSUs. Given the fact that ATCOs of the delegated ATSU may not have full competences to manage sectors with traffic at capacity levels, it might be needed to have simplified ATC procedures and increased levels of automation with ATCO supporting tools (e.g., for Conflict Detection and Resolution).

2.2. The delegation of the provision of Air Traffic Services amongst ATSUs, for both cross border and non-cross border cases, will also have an impact on the ANSP capability in terms of Resources Management at both staffing and facilities level (cost optimization). More manoeuvring margin on resources management by the ANSP will lead to a better use of the spare capacity (less demand measures required).

2.3. The delegation of the provision of Air Traffic Services amongst ATSUs, for both cross border and non-cross border cases, will impact the seamless air traffic service provision as the load balancing between ATSUs and avoidance of airspace or ATM services provision disruptions will allow AUs to fly more efficient trajectories.

Indicators

3.1. The delegation of the provision of Air Traffic Services amongst ATSUs may imply a loss of Situational Awareness for the ATCO assuming new responsibilities when absorbing new sectors. This situation may imply risks to be mitigated, impacting Safety negatively.

3.2. The simplification and standardisation of the ATC procedures when delegating the provision of Air Traffic Services amongst different ATSUs should not imply any kind of negative impact on ATCO workload nor in Capacity. Therefore, a trade-off between more common and simpler procedures and Capacity should be considered

3.3. In those cases of lack of capacity in a sector or more sectors of an ATSU due to resource limitations, full transfer of responsibility of any of these sectors to a less overloaded ATSU will improve the use of spare capacity and therefore the throughput will increase. The potential higher availability of ATCOs in peak periods could lead to a better use of spare capacity.

3.4. When traffic demand is low, full transfer of responsibility of one of more sectors from one ATSU to another ATSU will improve the Cost-Efficiency as the number of ATCOs on duty might decrease.

3.5. The Delegation of Air Traffic Services amongst ATSUs might imply ATCOs to be trained to control in different sectors of different ATSUs, increasing therefore the training times and costs to fulfil the competence scheme requirements, considering the current competence and licensing model. In a future environment, ATCOs should be trained for a set of tools, and therefore they should be able to manage more sectors.

3.6. When traffic demand is low, full transfer of responsibility of one or more sectors from one ATSU to another ATSU will improve the Cost-Efficiency as the number of open ATSUs may decrease.

3.7. The delegation of the provision of Air Traffic Services amongst ATSUs in periods of low demand or due to load balancing purposes will allow AUs to fly more efficient trajectories, as the number of airspace disruptions and flight constraints originated by ATFCM measures might decrease. This will lead to improved flight durations.

3.8. The delegation of the provision of Air Traffic Services amongst ATSUs in periods of low demand or due to load balancing purposes will allow AUs to fly more efficient trajectories, as the number of airspace disruptions and flight constraints originated by ATFCM measures might decrease. This could lead to a reduction of the fuel burnt.

3.9. The ATFCM delays will be reduced on those cases where regulations are potential mitigations to solve capacity problems due to resource limitations meaning that airspace configurations with more sectors can be opened. The transfer of responsibility of one or more overloaded sectors to a different ATSU with spare capacity will avoid the application of regulations and therefore the imposition of delays. This will lead to a reduction of the number of DCB measures imposed and to a better use of the spare capacity.

3.10. The application of demand measures will be reduced on those cases where trajectory measures are potential mitigations to solve capacity problems due to resource limitations, meaning that airspace configurations with more sectors can be opened. This will lead to a reduction of the number of DCB measures imposed.

Positive or Negative Impacts

4.1. The use of the spare capacity will be improved due to the increase of En-Route throughput and maintenance of ATCO workload at acceptable levels.

4.2. The level of ATCO's situational awareness may decrease when absorbing new sectors under their control due to the delegation procedures.

4.3. The staffing management may be improved due to a reduction in the number of ATCOs on duty or a reduction in the number of open ATSUs.

4.4. The ATCOs training costs will potentially increase since ATCOs shall have competences in those sectors that are candidates for fixed or dynamic delegation.

4.5. Local and Network airspace inefficiencies will be reduced by means of improved flight durations and less consumption of fuel by AUs (more efficient trajectories).

4.6. The number of DCB measures to solve traffic peaks may decrease if there is a delay in the number of regulations and demand measures when delegating airspace due to traffic load balancing purposes.

B.2.4 Delegation of ATM services provision between Civil and Military ATSUs

This BIM is under work and will be integrated into the final version of the OSED.

B.2.5 Delegation of ATM services provision among ATSUs in case of Contingency

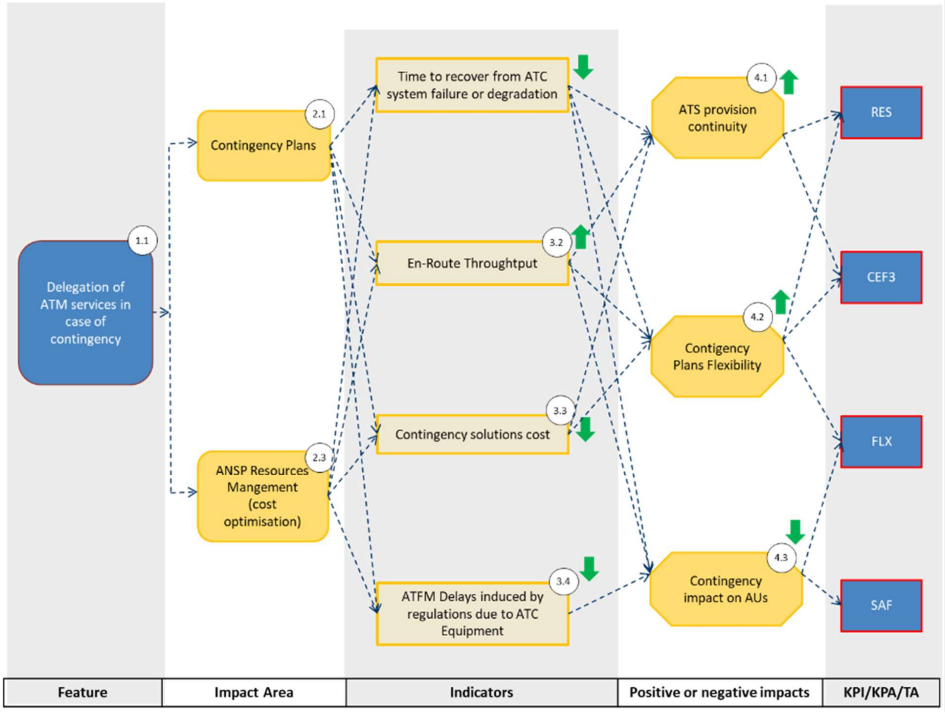

Figure 5656565656: Benefit Impact Mechanisms SDM-0217 (Delegation of ATM services provision among ATSUs in case of contingency)

Features:

1.1. Delegation of ATM services in case of contingency (same ANSP): Delegation of the provision of Air Traffic Management (ATM) services amongst ATSUs (entire ATSU or part of the ATSU) within the same ANSP due to contingency situations (failure or degradation of ATC systems).

1.2. Delegation of ATM services provision in case of contingency (different ANSP): Delegation of the provision of Air Traffic Management (ATM) services amongst ATSUs (entire ATSU or part of the ATSU) of different ANSPs due to contingency situations (failure or degradation of ATC systems).

Benefit Mechanisms:

Impact Areas

2.1. The delegation of ATM services provision amongst ATSUs (both from the same or different ANSP) will impact the ANSP Contingency Plans, since more contingency solutions will be enabled by the delegation of ATM services provision.

2.2. The delegation of ATM services provision amongst ATSUs (both from the same or different ANSP) will impact the ANSP Resources Management capabilities, and in particular, will have an impact on ANSP cost optimisation. The contingency solutions enabled by the delegation of ATM services provision will reduce the need of having contingency centres, and thus, the ANSP resources could be optimised.

Indicators

3.1. The delegation of the provision of ATM services in case of contingency will reduce the time needed to recover from an ATC system failure or degradation, since the movement of Air Traffic Controllers from the ATSU in contingency to the Contingency Centres will not be needed. Instead, in case of contingency, the ATM services provision will be delegated to another ATSU where controllers will be already prepared to take control of the contingency situation.

3.2. En-Route Throughput will be increased as the duration and loss of airspace capacity will be reduced enabled by the delegation of ATM services provision.

3.3. The delegation of the provision of ATM services in case of contingency will also reduce the cost of contingency solutions, since the number contingency facilities could be reduced.

3.4. The ATFM Delays induced by regulations due to ATC Equipment will be reduced as the impact of a failure or degradation in the ATC System will be also reduced (quicker recovery times), and thus the need to impose regulations.

Impact Areas

4.1. The ATM services provision continuity will be improved as quicker recovery times from failure or degradation modes in the ATC system are expected.

4.2. The Contingency Plans are expected to be more flexible, since more contingency solutions will be available for the ANSPs.

4.3. The impact of contingency situations on AUs is expected to be reduced, as regulations due to ATC Equipment are also expected to decrease.

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Appendix C Handover Dialogue developed by EXE-PJ.10-W2-93-V2-VALP-001

A key objective of validation exercise EXE-PJ.10-W2-93-V2-VALP-001 was the validation of the delegation procedure as described in section 3.3.2.2. During the dry runs of exercise EXE-PJ.10-W2-93-V2-VALP-001, it was discovered that the procedure as described in section 3.3.2.2 using NOV-5 diagram, was not helpful for the ATCOs being involved in the dry runs. On reason was that they were not familiar with the description format, but more importantly the description format of the NOV-5 diagram is too cumbersome to use it during a validation exercise.

Therefore, a tabular handover dialogue (see Table 33333333Table 3333~~Table 33~~) was developed to guide ATCOs through the delegation process. The handover dialogue was designed to reflect the specifics of the EXE-PJ.10-W2-93-V2-VALP-001 setup. Compared to real operations and as described in section 3.3.2.2 no dedicated Supervisors and Supervisor positions were implemented in the validation exercise. Thus, during the validation exercise, the planner controllers took responsibility of the activities that are usually done by Supervisors: planners requested a delegation, and they also took care of the handling of the preview and operational mode. In addition, there was no delay between the delegation request and the start of the delegation, since ATCOs were already sitting in front of their CWPs and there were no preparatory activities necessary. Therefore, all interaction was done in form of a dialogue between delegating and receiving planners once the delegation was requested and confirmed.

To help planners to keep the overview and make sure that both sides, delegating and receiving planners, have the same understanding about the status of the delegation procedure. To assure this, an explicit confirmation by the receiving planner was introduced for the individual steps requested by the delegating planner.

The handover dialogue proved to be very helpful for the ATCOs involved in the validation exercise to guide them through the process of delegation. The handover dialogue was taken as the baseline for the validation exercise during the V3 phase and be adapted to exercise specific needs if needed.

Delegating Planner Actions	Receiving Planner Actions
Call receiving Planner	
Request Delegation ➔	Check possibility
	← Confirm Delegation
Request Preview for sectors <sector names> ➔	
	Select sectors to preview ← Confirm preview
Advise frequencies xxx.yyy for Rx ➔	
	Select frequencies to Rx ← Confirm frequencies xxx.yyy switched to Rx

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Report Weather, Equipment, Situation ➔	
	← Confirm Weather, Equipment, Situation
Handover a/c ➔	
	← Confirm a/c
All a/c handed over? Ready to take control? ➔	
	Check radio contact with a/c in the received sector
	Confirm readiness Select <Take control> Switch frequencies for delegated sector to Tx/Rx
	← Control taken
Ask to cancel preview ➔	
	← Confirm cancel preview is acceptable
Cancel preview Confirm Preview is cancelled ➔	

Table 3333333333: Handover Dialogue developed by EXE-PJ.10-W2-93-V2-VALP-001

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Appendix D WEST Checklist

The WEST checklist, provided by NATS, aims to provide a common understanding between the delegating and receiving ATCO during the exchange traffic situation phase of the delegation procedure (see section 3.3.2.6.6 for details of this phase).

The WEST checklist includes the following aspects:

1. Weather
2. Equipment
3. Situation
4. Traffic

A handover produces a workload of its own. Thus, careful consideration to the timing of a handover must be given. The following information will be exchanged during the various steps of the WEST checklist:

Topic	Information exchanged
Weather	All weather-related items e.g., Significant Weather - Fog, Snow, Hail, etc. / CB activity / Turbulence / CAT / Upper Winds / Pressure Settings / SIGMET Warnings / NAT Track Structure / Significant deviation between forecast and actual winds
Equipment	Serviceability Status - Scheduled / Unscheduled Maintenance / Operational Status of any of the following: Radar Source (FID) / R / T Frequency / Flight Data / OLDI links etc. /SIS / Telephone Communication Links and Panels / CWP Workstations / Clearance Window / Tools / Bay sorts / Ranges on SM and LAD / enabled checkboxes
Situation	Monitor Values - Flow measures for adjacent sectors and units / Weather delays / Holding – EATs / Military Activity / Danger Area Activity / Royal Flights / Airshows / Para Dropping / Photo Flights / Other Unusual Aerial activity / Sector Staffing Numbers
Traffic	ALL Aircraft On, Expected On or Pertinent to position / sector / Any Non-RVSM traffic / Interactions and Deviation Alerts / All aircraft with outstanding tasks / Aircraft on headings or speeds / SSCs / Skipped flights / Joiners / Leavers / CFPs / Blockers / manually recognised Flights / Potential Infringer / Doubt over a pilot competence / questionable routing / intention.

Table 3434343434: WEST checklist for handover

NATS Human Factors spent a lot of time working on this. The rationale for putting Traffic last is that traffic is the most important part. Once a human does this part they tend to forget to pass on other pertinent information. So, putting Traffic last means that the other areas do not get neglected

Appendix E Operational recommendations for the Y-architecture

The recommendations presented here are provided by the technical thread of PJ.32-W3 to the OSED of PJ.10-W2-93. Recommendations are made only for Y-architecture because this architecture is the most general one and enables rationalization of infrastructure in addition to the delegation ATS provision among ATSUs. In contrast to this, D- and U-architecture are only relevant for ATS services delegation. If there is no delegation of ATS services planned between ATSUs, D- and U- architectures will not provide benefits.

The separation of activities between the technical thread of PJ.32-W3 and PJ.10-W2-93 made it clear that delegation-related activities in the OSED and TS/IRS are out of scope of PJ.32-W3, which focuses on the implementation of Virtual Centre services and concept in nominal situation.

Since D- and U- architectures are only of benefit in a delegation context, they are already fully covered by the operational requirements of this OSED. The recommendations presented here for the Y-architecture are covering situations where no delegation of ATS services is done and thus describe general recommendations for this architecture in the Virtual Centre context as a complement.

E.1 Introduction

The purpose of this appendix is to explore the operational opportunities in using a Y-architecture to implement a Virtual Centre. The analysis addresses both the delegation use cases and the general air traffic control activities that need to be performed by the VC ATSU.

This appendix is provided by PJ.32-W3 as a contribution.

E.2 Checklist

This chapter is a checklist of the points of attention that the VC ATSU shall consider when setting up a Y-architecture for its Virtual Centre.

E.2.1 Coordination and Transfer

Identifier	Y-checklist OPS1
Point of attention	ATSUs setting up a common 'Y' VC Architecture shall review the opportunity to improve procedures to transfer flights between them to remove some constraints.
Rationale	Sharing a unique instance of ADSP system improve situational awareness accuracy by the ATSUs and procedures to transfer flights between them should remove some constraints.

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Identifier	Y-checklist OPS2
Point of attention	ATSUs setting up a common 'Y' VC Architecture shall review the planning and tactical actions on flights that may have impacts on ATSU procedures.
Rationale	The fact that ATSUs are supported by a same instance of ADSP system introduces functional links between their ATCO activities and may impact OPS procedures.

E.2.2 Operational supervision

Identifier	Y-checklist OPS3
Point of attention	ATSUs setting up a common 'Y' VC Architecture shall review the operational configuration role attribution within the ATSUs.
Rationale	ATSUs supported by a same instance of ADSP system introduces functional links between their OPSUPs activities and may impact their roles.

E.2.3 FMP

Identifier	Y-checklist OPS4
Point of attention	ATSUs setting up a common 'Y' VC Architecture shall review the FMP role attribution within the ATSUs.
Rationale	ATSUs supported by a same instance of ADSP system introduces functional links between their FMPs activities and may impact their procedures.

E.2.4 Control Work Position HMI

Identifier	Y-checklist OPS5
Point of attention	ATSUs setting up a common 'Y' VC Architecture shall review how the ADSP should support ATCOs on their radar coverage adaptation and on flight data distribution.
Rationale	In a 'Y' VC Architecture, the surveillance scope is built from all surveillance data covering the ATSUs it supports. The ATCOs may not want to be disturbed by tracks outside their AOR. Same for Flight data not relevant for their control activities.

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Identifier	Y-checklist OPS6
Point of attention	ATSUs setting up a common 'Y' VC Architecture shall review on how to facilitate ATCO work on unfamiliar airspace
Rationale	In a 'Y' VC Architecture, the airspace is the combined airspace of ATSUs it supports

E.3 Recommendations

This chapter brings together a set of recommendations that the VC ATSU could turn into requirements if deemed relevant to its objectives and working methods.

E.3.1 Managing the operational room

Identifier	Y-recommendation OPS1
Recommendation	ATSUs setting up a common 'Y' VC Architecture, after coordination (phone or otherwise) with ATSU1 OPSUP, the ATSU2 OPSUP should have the possibility to assign a sector of ATSU1 airspace to an ATSU2 position according to applicable eligibilities.
Remark	Check if it is linked to delegation

Identifier	Y-recommendation OPS2
Recommendation	ATSUs setting up a common 'Y' VC Architecture, after coordination (phone or otherwise) with ATSU1 OPSUP, the ATSU2 OPSUP should have the possibility to group a sector of ATSU1 airspace onto a position already controlling a sector of ATSU2 airspace.
Remark	Check if it is linked to delegation

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E.3.2 Coordination & Transfer

Identifier	Y-recommendation OPS3
Point of attention	The ADSP in a 'Y' VC architecture shall implement as transfer between 2 sectors of each ATSU, the protocol that has been agreed inside an ATSU (which includes the possibility to recall the flight)
Rationale	Sharing a unique instance of ADSP system, leads supported ATSUs to coordinate and transfer as if they were in a same ATSU. This may impact OPS procedures

E.3.3 Datalink

Identifier	Y-recommendation OPS4
Point of attention	For 'Y' architecture, and if the ATSUs supported by an ADSP system share common Datalink facilities, the LOGON, CONTACT and CONNECTION procedures (involving ATCOs) for CPDLC communications shall be implemented only when entering the overall ATSUs AoR and when exiting it.
Rationale	For 'Y' architecture, and if the ATSUs supported by an ADSP system share common Datalink facilities, the ADSP system shall apply the LOGON, CONTACT and CONNECTION procedures only when entering the overall ATSUs AoR and when exiting it.

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