SESAR Solution PJ.06-01 SPR-INTEROP/OSED for V3 - Part I

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00.00.03	27/04/2017	Revised Draft	Beatrice Raynaud, Pilar Calzón Robledo, Yannick Migliorini, Peter Strub	Revised material in section 3 following comments received from internal reviewers Draft material added in section 3.2.1.3 (about traffic characteristics) Draft material added in section 4 to clarify the nature and status of OSED requirements and future SPR requirements
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00.00.05	30/06/2017	Revised Draft	Beatrice Raynaud, Olivier Huart, Francesco Preti	Executive summary and introduction elements (in sections 2.4, 2.5) added Updates (in all sections) following internal and external review by PJ06 and other PJs / Solutions New operational requirements in section 4.1.3 (about separation provision) Cost mechanism elements added in Appendix A.3
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00.01.03	29/01/2018	Revised Draft	Beatrice Raynaud, Pilar Calzon Robledo, Martin Stieber	Updated text in all sections to take into account PJ.06-01 partners review comments
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00.02.01	18/05/2018	Revised Draft	Beatrice Raynaud, Olivier Huart, Pilar Calzon Robledo, Martin Stieber, Francesco Preti	Minor changes in Use Cases listed in section 3.3.2.4 Harmonised terminology in OSED and SPR-INTEROP Requirements in sections 3 and 4 and updated rationale in INAP-related Requirements Updated Cost Mechanism in Appendix A.3 (in line with CBA work progress)
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00.03.01	16/10/2019	Final for approval	Pilar Calzon Robledo, Marta García Gutiérrez, Martin Stieber, Beatrice Raynaud	Minor changes in all sections following internal/external review Updated requirement traceability in section 4 Version approved by the partners and submitted to SJU
00.03.02	05/11/2019	Final	Beatrice Raynaud	Minor changes in sections 2.4, 3.2.2.1, 4.3.1 and 4.6.1 following SJU assessment Minor changes in MEGA modelling of the Solution in section 3.3.2.3 following coordination with PJ19 for the V3 Maturity Gate

PJ06

PJ.06-01 — OPTIMIZED TRAFFIC MANAGEMENT TO ENABLE FREE ROUTING IN HIGH AND VERY HIGH COMPLEXITY ENVIRONMENTS

Abstract

This document is the final version of the SPR-INTEROP / OSED for Solution PJ.06-01 closing its V3 phase. It is part of the Solution's V3 Data Pack.

The SESAR Solution PJ.06-01 is about optimized traffic management to facilitate Free Routing in upper En-Route airspace. It is focused on the improvement of Aircraft-to-Aircraft Separation Provision to enable Free Routing operations in En-route high and very high complexity and cross-border environments.

This final version of the SPR-INTEROP / OSED describes the operational services, environment and assumptions that are applicable to the Solution. It also provides the list of requirements, at SPR-INTEROP level (i.e. quality of service, safety, human performance, interoperability requirements), and when deemed relevant operational requirements at OSED level, to be considered for the Solution implementation.

Table of Contents

The SPR/INTEROP-OSED Template includes the following parts:

- ***SPR/INTEROP-OSED Template – Part I (this volume)***
- SPR/INTEROP-OSED Template – Part II Safety Assessment Report (SAR)
- SPR/INTEROP – OSED Template – Part III Security Assessment Report (SeAR)
- SPR/INTEROP – OSED Template – Part IV Human Performance Assessment Report (HPAR)
- SPR/INTEROP – OSED Template – Part V Performance Assessment Report (PAR)

All parts, except Part III, are included in the SESAR Solution PJ.06-01 SPR-INTEROP/OSED for V3.

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1 Executive Summary

The **SESAR Solution PJ.06-01** is about optimized traffic management to enable Free Routing in En-route high and very high complexity environments. It contributes to the **OI Step AOM-0505**: "*Free Routing for Flights both in cruise and vertically evolving within high and very high complexity environments in Upper En Route airspace*".

The Free Routing concept seeks Airspace Users being able to plan flight trajectories without reference to a fixed route network or published directs, so they can optimise their associated flights in line with their individual operator business needs or military requirements. It is a transversal operational concept that affects many ATM activities at regional, sub-regional and local level.

The Solution PJ.06-01 is contributing to the improvement of air traffic management at local level. More precisely, it focuses on the improvement of Separation Provision to enable Free Routing operations in En-route airspace **in high and very high complexity and cross-border[1] environments** (with minimum structural limits to manage airspace and demand complexity).

According to the initial Grant, the SESAR Solution PJ.06-01 falls within the scope of the current PCP (EU No 716/2014) and its third ATM Functionality which targets an implementation date of 1st of January 2022. Nevertheless the applicable version of the EATMA and its associated Data Set (EATMA v12 / DS19) now shows the following revised IOC/FOC dates for PJ.06-01:   IOC 31/12/2026 – FOC 31/12/2030. Beginning of January 2027 is thus considered, in this SPR-INTEROP/OSED, as targeted implementation date of the PJ.06-01 Solution. This document is the final version of the SPR-INTEROP / OSED for Solution PJ.06-01 closing its V3 phase and is part of the Solution's V3 Data Pack. It has been updated with the results of the V3 validation exercises conducted by PJ.06-01.

This final version contains the list of safety, performance and interoperability requirements at SPR-INTEROP level to be considered for the Solution implementation. These requirements consist in:

- safety requirements derived from the Safety Assessment conducted at SPR level,
- performance requirements in terms of Quality of Service (QoS),
- human performance requirements derived from the Human Performance assessment
- requirements that would be necessary to ensure the interoperability of the Solution,
- when deemed relevant, some operational requirements identified at OSED level.

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[1] In the context of this SPR-INTEROP/OSED document, cross-border aspects could either relate to cross-FRAs, cross-ACCs/sectors or cross-FIRs aspects.

These requirements are presented in the context of the **Operational Service and Environment Definition** (OSED), which describes the environment, operating methods, assumptions, etc. that are applicable to the requirements.

The Solution PJ.06-01, and therefore the new operating methods and related operational requirements described in this SPR-INTEROP/OSED document, are contributing to the following ATM Capabilities in the context of Free Routing high and very high complexity cross-border environments:

- Free Route Airspace Design
- Separation Provision (airspace)
- Coordination and Transfer
- Trajectory Conformance Monitoring

This final version of the SPR-INTEROP/OSED for Solution PJ.06-01 provides a reference operational environment description for SESAR 2020 Free Routing operations in En-Route airspace. This environment description distinguishes between the targeted operating environment for Solution PJ.06-01 (at the 2027 timeframe) and possibly future operating environment with more advanced ATM Capabilities under investigation by other SESAR Solutions.

2 Introduction

2.1 Purpose of the document

According to the SPR-INTEROP/OSED template, part I of this document provides the Operational Service and Environment Definition (OSED), which describes the environment, operating methods, assumptions, etc. that are applicable to the Solution. Requirements specification, covering functional non-functional and interface requirements related to SESAR Solution PJ.06-01 at SPR-INTEROP level are then presented.

Parts II, IV and V provide the series of assessment performed at Solution level to justify the SPR and INTEROP requirements:

- Part II: final Safety Assessment Report

- Part IV: Human Performance Assessment Report

- Part V: Performance assessment Report

The document is completed by an appendix including a revised version of the Benefit and cost Mechanisms, showing how the SESAR Solution elements contribute (positively or negatively) to the delivery of performance benefits and the costs.

2.2 Scope

This document builds upon the intermediate SPR-INTEROP / OSED previously developed for the Solution PJ.06-01 and takes on board the results of the V3 validation exercises conducted by the Solution. It is the final version of the SPR-INTEROP / OSED for Solution PJ.06-01 closing its V3 phase and is part of the Solution's V3 Data Pack.

This final version contains the list of safety, performance and interoperability requirements at SPR-INTEROP level to be considered for the Solution implementation. These requirements consist in:

- safety requirements derived from the Safety Assessment conducted at SPR level,

- performance requirements in terms of Quality of Service (QoS), both at functional (or operational) and non-functional level,

- human performance requirements derived from the Human Performance Assessment at V3 level,

- technical and functional requirements that would be necessary to ensure the interoperability of the Solution,

- when deemed relevant, some operational requirements identified at OSED level.

These requirements are presented in the context of the Operational Service and Environment Definition (OSED), which defines the environment, assumptions, etc. that are applicable to the safety, performance and interoperability requirements.

This OSED describes the operational improvements (in the scope of the Solution) needed to enable Free Routing in En-route high complexity and cross-border environments. It also provides a reference operational environment description to other SESAR Solutions that can be impacted by Free Routing operations in En-Route airspace. Use cases depicting how the Solution PJ.06-01 works under nominal and non-nominal situations are also provided.

Finally, this intermediate version of the SPR-INTEROP/OSED contains an updated description the benefit and impact mechanisms for the Solution PJ.06-01 aligned with the SESAR2020 Performance Framework [12].

2.3 Intended readership

The intended audience of this initial OSED for Solution PJ.06-01 are:

- the key stakeholders targeted by the Solution, i.e.

  o Airspace Users who will benefit from the deployment of Free Routing operations in En-Route airspace including in high complexity environment;
  o Air Navigation Service Providers who will be directly impacted by the Solution to enable to Free Routing operations in Free Routing Airspace in En-route airspace of permanently or temporary high complexity;

- the SESAR Projects developing Solutions related to advanced ATM Capabilities planned to be deployed, or that can be impacted by the deployment, of Free Routing operations in En-Route airspace.

2.4 Background

The Free Route operational concept has been under development for many years now (before, aside and in the context of the SESAR Programme). This concept aims at enabling Airspace Users to fly as closely as possible to their preferred trajectory without being constrained by fixed airspace structures or fixed route network. According the EU Regulation No 716/2014 and its ATM Functionality #3.2: "*Free Route may be deployed both through the use of Direct Routing Airspace and through FRA.*"

The term 'Free Route' is therefore a high level title under which two distinct instantiations of implementation can occur: i.e. 'Direct Routing' and "Free Routing" operations. Direct Routing aims at offering Airspace Users an airspace volume with a network of published En-Route DCTs (Directs),

whereas 'Free routing' is the ability of an Airspace Users to plan/re-plan route according to the user-defined segments within significant blocks of Free Routing Airspace (FRA).

Note to the reader: In this document, the term 'Free Route' is used when referring to the general concept of Free Route (or in extracts from reference documents and sources) and the term 'Free Routing' is used when specifically referring to FRA operating environment as targeted by the Solution PJ.06-01.

The safety and performance requirements developed in this SPR build upon a lot of background information from other initiatives / projects / studies related to Free Route, and Free Routing operations in particular, among which:

- **The EUROCONTROL European Route Network implementation plan (ERNIP)**, and more specifically ERNIP Part 1 that contains European Airspace Design Methodology Guidelines providing general principles and technical specifications for airspace design including for Free Route Airspace Design in current and future environment (see section 6.5 of [41]).

- **The outcomes of the SJU Free Route Task Force 2013-2014**. This Task Force was set up in response to a request by the Integrated Roadmap DS11 Change Board to clarify some elements related to Free Route. The objectives were to address clarifications required for the Pilot Common Project (PCP), to set the framework for subsequent SESAR work and to deliver in time for the Data Set 12 campaign. The SJU Free Route Task Force final report (see [55] provided agreed foundation for individuals and organisations engaged in Free Route descriptive activity such as R&D work, high level policy documentation and local ANSP implementation.

- The work conducted within SESAR 1, building on the outcomes of the SJU Free Route Task and taking into account the update of P4.2 and P7.2 Step 1 DODs for the European ATM Master Plan Data Set 13, to derive operational, safety and performance requirements for two Free Route Solutions (see [61], [62]), i.e.:

  o **Solution #32**: Free Route through the use of Direct Routing.
  o **Solution #33**: Free Route through the use of Free Routing for flights both in cruise and vertically evolving above a specified Flight Level.

- The validation activities conducted within SESAR 1 to achieve a V3 maturity level of the SESAR Solutions #32 and #33 including:

  o a V2 Real Time Simulation exercise involving the FOCs, Network management and ANSPs (EXE-04.03-VP-797) aimed at validating the Free Routing concept in the European core area, including minimum Flight Level and associated acceptable complexity level within the En-Route airspace [59] [64],

- o a series of integrated and pre-operational V3 validations (EXE-04.03-VP-798) in both Direct Routing and Free Routing environments and focused on ATC tools and Ground-Ground IOP (using the Flight Object concept) [60],

- o as well as demonstration activities executed through SESAR 1 Demo projects (i.e. WE-FREE [56], FRAMAK [57] and FREE Solutions [58]) to confirm this maturity.

At the end of SESAR 1, it was concluded that additional validation activities were required to support the implementation of Free Routing Airspace (FRA) in upper airspace of high and very high complexity (The EU Regulation No 716/2014 mandates FRA above FL310 from 1st January 2022).

It is also to be noted that FRA is already operational in some ANSPs and that deployment is in progress in many other ANSPs (see section 3.2.1 for details) in accordance with the Deployment Programme 2017 [54] developed by the SESAR Deployment Manager.

2.5 Structure of the document

Part I of this SPR-INTEROP / OSED document is composed of four chapters:

- Chapter 1 is an Executive Summary of the document scope and content.

- Chapter 2 is presenting the document purpose, scope and intended readership.

- Chapter 3 is providing the Operational Service and Environment Definition (OSED) for the Solution PJ.06-01. It also provides a reference operational Free Routing environment description for other SESAR Solutions.

- Chapter 4 contains an initial list of operational requirements related to the Solution (at OSED level).

- Chapter 4.9 provides the list of references and applicable documents.

- Appendix A includes a description of the Cost and Benefit Mechanisms for the Solution.

- Appendix B includes OSED material (related to Enhanced Air Traffic Flow / Complexity Management aspects at ACC level) investigated at V2 level, but eventually not retained in the scope of the Solution PJ.06-01 at the end of V3.

2.6 Glossary of terms

Term	Definition	Source of the definition
Air Traffic Complexity Management	The ability to detect / anticipate / monitor air traffic complexity issues and solve the complexity issue.	EATMA V12 (ATM Capability Model)
Air Traffic Flow Management	The ability to detect / monitor demand capacity imbalances (present, future) in the airspace and solve the imbalance issues acting on load/demand.	EATMA V12 (ATM Capability Model)
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
Area of Responsibility	An airspace of defined dimensions within which an ATC unit provides air traffic services.	ATM Lexicon

Term	Definition	Source of the definition
Business Trajectory	The representation of an airspace user's intention with respect to a given flight. It is aimed at guaranteeing the best outcome for the flight as seen from the airspace user's perspective.	**SESAR Integrated Dictionary**
Complexity	The number of simultaneous or near- simultaneous interactions of trajectories in a given volume of airspace. Note: Given complexity definition refers to ATM context. For automation, complexity is relevant only in terms of calculation effort, not the ability to solve a given set of problems. Beyond a certain level of complexity, humans can no longer oversee all the consequences of the interactions and automation support is required if traffic is to be handled safely and efficiently. See also **Density**.	**SESAR Integrated Dictionary**
Conflict	Converging of aircraft in space and time which constitutes a predicted violation of a given set of separation minima.	**ATM Lexicon**
Coordination and Transfer	The ability to coordinate and transfer flights between sectors.	**EATMA V12** **(ATM Capability Model)**
Density	In the ATM context, density refers to the number of simultaneous or near- simultaneous trajectories present in a given airspace volume. Note: High densities require specific procedures to ensure that the required capacity to handle traffic can be provided. See also **Complexity**	**SESAR Integrated Dictionary**
Direct Routing	A published segment of a Great Circle between 2 published waypoints.	**SESAR Integrated Dictionary**
Demand and Capacity Balancing (airspace)	The ability to evaluate traffic flows and adjust airspace resources to allow airspace users to meet the needs of their operating schedules.	**EATMA V12** **(ATM Capability)**

Term	Definition	Source of the definition
Extended Flight Plan	Includes the ICAO Flight Plan and the 4D trajectory computed by the Flight Operation Centre (FOC).	**SESAR Integrated Dictionary**
Free Routing	The ability of an Airspace User to plan/re-plan route according to the user-defined segments.	**SESAR Integrated Dictionary**
Free Routing Airspace	Airspace defined laterally and vertically, allowing Free routing with a set of entry/exit features. Within this airspace, flights remain subject to air traffic control.	**SESAR Integrated Dictionary**
Free Route Airspace[2]	A specified airspace within which users may freely plan a route between a defined entry point and a defined exit point, with the possibility to route via intermediate (published or unpublished) way points, without reference to the ATS route network, subject to airspace availability. Within this airspace, flights remain subject to air traffic control.	**ERNIP Part 1 [41]**
Free Routing Airspace Design	The ability to design a portion of airspace based upon user preferences (free route airspace).	**EATMA V12 (ATM Capability)**
FRA Arrival Connecting Point (A)	A published Significant Point to which FRA operations are allowed for arriving traffic to specific aerodromes. The FRA relevance of such points shall be included in ENR 4.1/4.4 columns as (A). Indications on their use for arrivals to specific aerodromes shall be notified via the RAD.	**ERNIP Part 1 [41]**
FRA Departure Connecting Point (D)	A published Significant Point from which FRA operations are allowed for departing traffic from specific aerodromes. The FRA relevance of such points shall be included in ENR 4.1/4.4 columns as (D). Indications on their use for departures from specific aerodromes shall be notified via the RAD.	**ERNIP Part 1 [41]**

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[2] It is worthwhile noting that the term used to refer to a specified airspace where free routing operations are allowed is different depending on the source. It is called 'Free Routing Airspace' according to the SESAR Integrated Dictionary and 'Free Route Airspace' in the ERNIP Part 1 document [41]. The underlying FRA concepts are nevertheless the same.

Term	Definition	Source of the definition
FRA Horizontal Entry Point (E)	A published Significant Point on the horizontal boundary of the Free Route Airspace from which FRA operations are allowed. The FRA relevance of such points shall be included in ENR 4.1/4.4 columns as (E). If this point has specific conditions of utilization, this shall be described in the RAD.	**ERNIP Part 1 [41]**
FRA Horizontal Exit Point (X)	A published Significant Point on the horizontal boundary of the Free Route Airspace to which FRA operations are allowed. The FRA relevance of such points shall be included in ENR 4.1/4.4 columns as (X). If this point has specific conditions of utilization, this shall be described in the RAD.	**ERNIP Part 1 [41]**
FRA Intermediate Point (I)	A published Significant Point or unpublished[3] point, defined by geographical coordinates or by bearing and distance via which FRA operations are allowed. If published, the FRA relevance of such points shall be included in ENR 4.1/4.4 columns as (I). If this point has specific conditions of utilization, this shall be described in the RAD.	**ERNIP Part 1 [41]**
Horizontal Flight Efficiency	Horizontal flight efficiency (HFE) is a performance indicator part of the performance monitoring and reporting under: - SES: IR691/2010 (European Commission 2010) and IR390/2013 (European Commission 2013); and - EUROCONTROL: performance review reporting HFE is very simply defined at its highest level: the comparison between the length of a trajectory and the shortest distance between its endpoints. Further details about HFE calculation available here: https://ansperformance.eu/methodology/horizontal-flight-efficiency-pi/	**PRU portal** **https://ansperformance.eu/**

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[3] It is worthwhile noting that planning for trajectory changes in FRA using unpublished intermediate points defined by geographical coordinates is out of the Solution PJ06.01 scope.

Term	Definition	Source of the definition
Integrated Network Management and Extended ATC Planning	The scope of the INAP function is to address the overlapping period where the Network Management Function runs DCB and dynamic DCB processes at all geographical levels, ATC planning starts preparing early strategic de-confliction and conflict detection within the appropriate look ahead time horizon and within its defined local area of responsibility.	**EATMA V12** **(Node)**
Network Management Function	An integrated ATM activity with the aim of ensuring optimised Network Operations and ATM service provision meeting the Network performance targets. Note: It encapsulates: - Collaborative layered planning and execution processes, including the facilitation of business/mission trajectories. - Airspace organisation and management processes. - Demand and Capacity Balancing processes through all planning and execution phases to ensure the most efficient use of airspace resources, to anticipate and solve workload/complexity issues and to minimize the effects of ATM constraints. - The enabling of UDPP process. - The provision and maintenance of Operation Plans covering the range of activity, i.e. Network to Local. - The provision of relevant complexity resolution advice to ATC operations.	**SESAR Integrated Dictionary**
Network Operations Plan	A set of information and actions derived and reached collaboratively both relevant to, and serving as a reference for, the management of the Pan-European network in different timeframes for all ATM stakeholders, which includes, but is not limited to, targets, objectives, how to achieve them, anticipated impact. Note: The NOP has a dynamic and rolling lifecycle starting in the planning phases and is progressively updated up to and including the execution and post-operations phases.	**SESAR Integrated Dictionary**
Separation Provision	The ability to separate aircraft when airborne in line with the separation minima defined in the airspace design (incl. aircraft separation from incompatible	**EATMA V12**

Term	Definition	Source of the definition
(airspace)	airspace activity, weather hazard zones, terrain-based obstacles).	**(ATM Capability)**
Service	A contractual provision of something (a non-physical object), by one, for the use of one or more others. Note: 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.	**SESAR Integrated Dictionary**
Significant Point	A specified geographical location used in defining an ATS route or the flight path of an aircraft and for other navigational and ATS purposes. *Note. - There are three categories of significant points: ground-based navigation aid, intersection and waypoint. In the context of this definition, intersection is a significant point expressed as radials, bearings and/or distances from ground based navigation aids.*	**ICAO Annex 11 Air Traffic Services**
Structural index **(of Traffic Complexity Score)**	The structural index originates from horizontal, vertical, and speed interactions and is computed as the sum of the three indicators. • **Horizontal interactions index**. A measure of the complexity of the flow structure based on the potential interactions between aircraft on different headings. The indicator is defined as the ratio of the duration of horizontal interactions to the total duration of all interactions. • **Vertical interactions index**. A measure of the complexity arising from aircraft in vertical evolution based on the potential interactions between climbing, cruising and descending aircraft. The indicator is defined as the ratio of the duration of vertical interactions to the total duration of all interactions. • **Speed interactions indicator**. A measure of the complexity arising from the aircraft mix based on the potential interactions between aircraft of different speeds. The indicator is defined as the ratio	**Performance Review Unit**

Term	Definition	Source of the definition
	of the duration of speed interactions to the total duration of all interactions.	
Traffic Complexity Score	The Complexity Score is the product of two components: **Traffic density** and **Structural index**.	**Performance Review Unit**
Traffic density	The traffic density is expressed in **Adjusted density** which measures the (uneven) distribution of traffic throughout the airspace (i.e. taking into account the relative concentration).	**Performance Review Unit**
Trajectory Conformance Monitoring	The ability to anticipate / detect deviations from trajectory agreement during execution.	**EATMA V12 / DS19 (ATM Capability Model)**
User Driven Prioritisation Process	A CDM-based process which permits Airspace Users to reflect a prioritisation of flights which best respects the business interests of AU stakeholders.	**SESAR Integrated Dictionary**
User defined segment	A segment of great circle connecting any combination of two user-defined or published waypoints.	**SESAR Integrated Dictionary**
User Preferred Route	Defined during the planning phase by Airspace Users, the UPR describes the entire airborne phase of a flight as an expression of their Business / Mission intentions. Note: The Airspace Users are free to define UPR taking into account the network constraints already defined and shared. The User Preferred Route may include a part freely defined in Free Route Airspace, a part chosen among a set of several available published routes (direct or not) outside the Free Route Airspace, the description of the related transition phases and cruising, climbing and descending profiles. The User preferred trajectory computed from the UPR is published by the Airspace User for collaborative ATM planning purposes as Shared Business / Mission Trajectory.	**SESAR Integrated Dictionary**

Term	Definition	Source of the definition
User Preferred Trajectory	The trajectory initially provided by the Airspace User. During planning phase, it may be amended by the AU to integrate ATM constraints from DCB (e.g. airspace reservations, capacity short falls) resulting from iterative SB/MT and RB/MT agreement; alternate user preferred trajectories may be associated to the RB/MT to face pre-defined scenarios; in execution phase, it may be revised to integrate new ATM constraints from dynamic DCB (e.g. new or revised airspace reservations, capacity short falls) involving the AU to provide the user preferred trajectory solution integrating the new ATM constraints.	**SESAR Integrated Dictionary**

Table 1: Glossary of terms

2.7 List of Acronyms

Acronym	Definition
ACC	Area Control Center
ADD	Architecture Description Document
ANSP	Air Navigation Service Provider
AOM	Airspace Organisation and Management
AOR	Area of Responsibility
APW	Area Proximity Warning
ARES	Airspace Reservation
ARN	ATS Route Network
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
ATSU	ATS Unit
AU	Airspace User
CACD	Central Airspace and Capacity Database
CBA	Cost Benefit Analysis
CDM	Collaborative Decision Making
CDT	Conflict Detection Tool
CM	Conflict Management
CNS	Communication Navigation and Surveillance
CONOPS	Concept of Operations
CPDLC	Controller Pilot Data Link Communications
DAC	Dynamic Airspace Configuration
DCB	Demand and Capacity Balancing
DCT	Direct
dDCB	Dynamic DCB
DS	Data Set
DMA	Dynamic Mobile Area
E-ATMS	European Air Traffic Management System
EATMA	European ATM Architecture
EAP	Extended ATC Planner

Acronym	Definition
ERNIP	European Route Network Improvement Plan
ETFMS	Enhanced Tactical Flow Management System
FAB	Functional Airspace Block
FDPS	Flight Data Processing System
FIR	Flight Information Region
FOC	Full Operational Capability (in the context of OI Step or Enabler)
FOC	Flight Operations Centre (in the context of AU Operations)
FP	Flight Planning
FPL	Flight Plan
FRA[4]	Free Routing Airspace
G-G IOP	Ground-Ground IOP
HFE	Horizontal Flight Efficiency
HPAR	Human Performance Assessment Report
IER	Information Exchange Requirement
IFPS	Integrated initial Flight Plan Processing System
INAP	Integrated Network Management and Extended ATC Planning
INTEROP	Interoperability Requirements
IOC	Initial Operational Capability
IOP	Interoperability Protocol
ISRM	Information Services Reference Model
KPA	Key Performance Area
KPI	Key Performance Indicator
LAT	Latitude
LON	Longitude
LTM	Local Traffic Manager
MSP	Multi-Sector Planner
MSSC	Minimum Set of Security Controls
NA	Not Applicable

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[4] It is worthwhile noting that the FRA acronym has a different definition depending on the source. It stands for 'Free Routing Airspace' according to the SESAR Integrated Dictionary and stands for 'Free Route Airspace' in the ERNIP Part 1 document [41]. The underlying FRA concepts are nevertheless the same (see glossary of terms in section 2.6).

Acronym	Definition
NAF	NATO Architecture Framework
NIMS	Network Information Management System
NM	Network Manager
NMF	Network Management Function
NOP	Network Operations Plan
OI	Operational Improvement
OLDI	Eurocontrol Specification for On-Line Data Interchange
OSED	Operational Service and Environment Definition
PAR	Performance Assessment Report
PBN	Performance Based Navigation
PC	Planning Controller
PCP	Pilot Common Project
PRR	Performance Review Report (of the PRU)
PRU	Performance Review Unit (of EUROCONTROL)
QoS	Quality of Service
RAD	Route Availability Document
RB/MT	Reference Business / Mission Trajectory
RNAV	Area Navigation
RNP	Required Navigation Performance
R/T	Radio / Telephony
SAR	Safety Assessment Report
SB/MT	Shared Business / Mission Trajectory
SecAR	Security Assessment Report
SESAR	Single European Sky ATM Research Programme
SJU	SESAR Joint Undertaking (Agency of the European Commission)
SO	Safety Objective
SR	Safety Requirement
SPR	Safety and Performance Requirements
SWIM	System Wide Information Model
TC	Tactical Controller
TS	Technical Specification
TV	Traffic Volume
UDPP	User Driven Prioritisation Process
UPR	User Preferred Route
VPA	Variable Profile Area

Acronym	Definition
WOC	Wing Operations Centre

Table 2: List of acronyms

3 Operational Service and Environment Definition

This section describes the SESAR Solution PJ.06-01, further detailing the operational concept aspects under the scope of the Solution.

In the following sub-sections, the document describes the operational environment that is applicable to the Solution (and other SESAR Solutions applicable in Free Routing environment) as the context for assessing and establishing the requirements at Solution level (which requirements are captured in the Safety, Performance and Interoperability Requirements (SPR-INTEROP) section of this document for the Solution PJ.06-01).

3.1 SESAR Solution P.06-01: a summary

Operational Concept Elements in the scope of the Solution

The SESAR **Solution PJ.06-01** is defined in the applicable version of EATMA (Data Set 19) [40] as follows:

> *"Optimized traffic management to enable Free Routing in high and very high complexity environments sees airspace users being able to plan flight trajectories without reference to a fixed route network or published directs within high and very high-complexity environments so they can optimise their associated flights in line with their individual operator business needs or military requirements.*
>
> *The solution provides a description of high and very high complexity cross-border Free Routing environment in upper airspace (at the 2022 timeframe –as per PCP AF#3). The scope of the solution focuses on the improvement of Aircraft-to-Aircraft Separation Provision to enable Free Routing operations in upper airspace in high and very high complexity cross-border environments (with minimum structural limits to manage airspace and demand complexity)."*

Note: The applicable version of the EATMA and its associated Data Set (EATMA v12 / DS19) now shows revised IOC/FOC dates for PJ.06-01: IOC 31/12/2026 – FOC 31/12/2030. Beginning of January 2027 is thus considered, in this SPR-INTEROP/OSED, as targeted implementation date of the PJ.06-01 Solution. The Solution description in EATMA would need to be updated for consistency.

Regarding cross-border aspects in the context of the Solution PJ.06-01, they could either relate to cross-FRAs, cross-ACCs/sectors or cross-FIRs aspects (e.g. Free Routing in cross-border FRA, Free Routing across adjacent local FRAs at State/FIR/ACC level).

Free Routing is the ability of an Airspace User to plan/re-plan route according to the user-defined segments, i.e. segments of great circle connecting any combination of two user-defined or published waypoints. In the context of the Solution PJ.06-01, flight planning using user-defined trajectory turning points or trajectory revision using user-defined points is not envisaged considering the targeted

timeframe. This might not necessarily be the case in future operating environment with more advanced ATM Capabilities under investigation by other SESAR 2020 Solutions.

The Free Routing concept is a transversal operational concept that affects many ATM activities at regional, sub-regional and local level. The Solution PJ.06-01 is contributing to the improvement of air traffic management at local ATC level to enable Free Routing in En-route high and very high complexity cross-border environments. Although contributing to support the deployment of Free Routing operations beyond low and medium complexity environments, the Solution is not targeting unrestricted free routing operations, but aims at enabling safe and efficient operations in Free Routing Airspace (FRA) with minimum structural constraints as far as practicable while maintaining the required level of safety and capacity in the airspace. The Solution also relies on the Network Management function to cope with any Demand and Capacity imbalances created from changes in dominant traffic flows in FRA through the monitoring of the traffic complexity levels together with the level of the traffic demand.
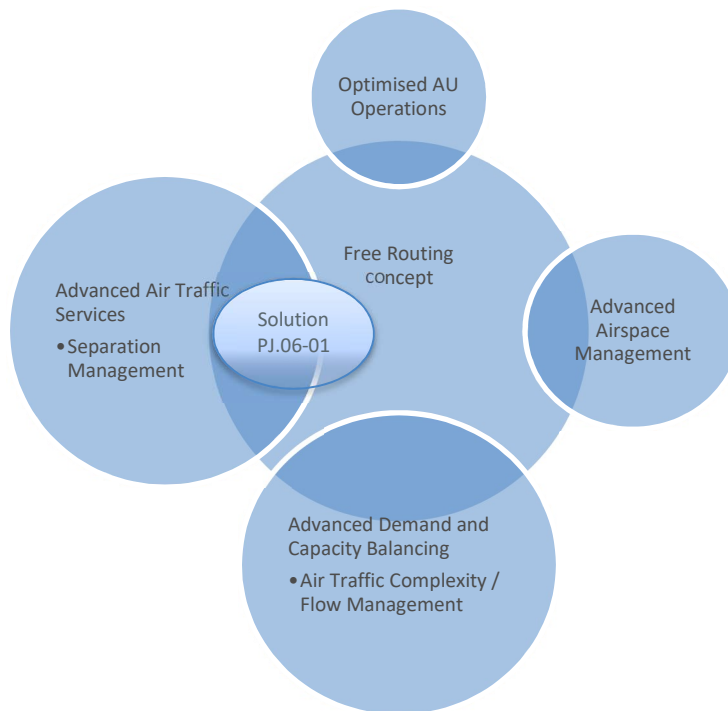
Figure 1: SESAR Solution PJ.06-01 and Free Routing concept

Full implementation of wide cross-border Free Routing Airspace in all complexity En-route environments will require further improvements that are beyond the scope of the Solution PJ.06-01. The concept options to be further progressed beyond the Solution include:

- Optimised Airspace User operations with management and update of the Shared Business Trajectory enhanced to achieve the full integration of AUs in the ATM Network processes;
- Advanced Airspace Management features like Dynamic Airspace configurations;

- Advanced Demand Capacity Balancing features like Enhanced Complexity Assessment processes and tools and enhanced management of AUs' fleet prioritisation and preferences;
- Enhanced Air Traffic Flow / Complexity Management in the frame of Integrated Network Management and Extended ATC Planning;
- Advanced ATS with 4D Trajectory Management supported by:

  - ATC-ATC trajectory and flight data exchange enabled by Flight Object sharing services and/or
  - Advanced Air/Ground Datalink Services functions like Extended Projected Profile data downlink.

Despite these limitations, the Solution PJ.06-01 is considered as key to optimise implementation of Regulation (EU) N° 716/2014 for the deployment of Free Route at least above FL305 in the ICAO EUR region as from 1 January 2022.

Operational improvement and expected benefits

Airspace Users' expectation regarding the Free Routing concept is not necessarily to fly more fuel optimum tracks, but more generally to be provided with significant opportunities to optimise their flights in line with individual operator business needs and/or military needs.

According to the SESAR 2020 Validation targets 2019 document [25], the following ATM performance targets have hence been allocated to the Solution PJ.06-01:

- **Fuel Efficiency Focus Area** – Actual average fuel burn per flight (FEFF1): fuel saving of 27.69 kg/flight (8.14% contribution to the SESAR2020 Validation Target starting point);
- **Predictability Focus Area** – Variance of differences between actual and flight plan or RBT durations (PRD1): 0.93% reduction in variance of block-to-block flight time (1.5% contribution to the SESAR2020 Validation Target starting point).

Ability to plan flight in FRA in optimised alignment with business needs is expected to improve flight effectiveness in terms of flight time (more adequate with schedule) and/or flight distance (shorter) and /or fuel and cost (more efficient). In-flight variability is also expected to be reduced thanks to less trajectory revisions (e.g. less tactical directs requested by pilots or given by ATCO to expedite the traffic).

This positive impact on **Environment / Fuel Efficiency** has been demonstrated through the PJ.06-01 V3 validations. The validation results show that the Horizontal Flight Efficiency, both at planning level and in execution phase, was improved in cross-border FRA compared to Fixed Route environment and this efficiency was further improved with the extension of cross border FRA operations demonstrating that:

- The Airspace Users are able to plan shorter trajectories what allows to optimize the amount of fuel carried.

- The Airspace Users are able to fly shorter trajectories what allows to optimize the amount of fuel burn, as well as to reduce the CO2/NOX emissions in execution phase.

It has not been possible through the PJ.06-01 V3 validations to conclude on **Predictability** benefits in terms of in-flight variability. However, several FRA projects already implemented in Europe observed predictability benefits in terms of the difference between the planned and actual Horizontal Flight Efficiency. Such predictability benefits are also expected from the Solution PJ.06-01.

According to the SESAR 2020 Validation targets 2019 document [25], no specific Capacity or Safety performance targets are allocated to Solution PJ.06-01:

- **Airspace Capacity Focus Area** – En-Route Capacity (CAP2): 0% increase in peak hour en-route throughput (0% contribution to the SESAR2020 Validation Target starting point);
- **Safety Performance Area** – Mid-Air Collision En-Route (SAF1.1): no targets defined.

Capacity is not expected to be enhanced purely by the application of Free Routing operations in high and very high complexity cross borders environment. By offering more flight planning options, Free Routing can reduce bottlenecks introduced by airspace / ATS route network design in the ATM system with more flexibility to plan for AUs, but Air Traffic Controllers' workload could increase without appropriate automation support due to reduced predictability of conflicts and possibly increased need for ATC-ATC coordination. To counterbalance the possible negative effect of free routing on ATCO's performance, Air Traffic Control will have to be performed using appropriate ATC sector support tools (Conflict Detection Tools, Monitoring Aids, Inter-sector coordination support tool) adapted to Free Routing cross-border operations. The potentially high variability of the traffic demand could also lead to an increase of the traffic complexity at ACC/sector level, thus potentially entailing new requirements to cope with peaks of demand/complexity, particularly in case of Free Routing operations in high and very high complexity cross-border environment. To accommodate the variability of the traffic demand, more or less structurally limited FRA will be defined to allow Free Routing in high complexity cross-border environments, while maintaining capacity in the airspace.

Safety level need to be at least maintained. In that prospect, the target remains to mitigate the potential negative impact resulting from more flexible aircraft operations not structured by a fixed ATS Route Network by appropriate layered ATM services adapted to Free Routing operations.

Considering the potential negative impact of Free Routing operations on Capacity and Safety if not supported with adequate ATM capabilities, it is nevertheless essential to demonstrate that the Solution PJ.06-01 also contributes to not adversely affect these Key Performance Areas

This absence of negative impact on **Capacity** and **Safety** has been demonstrated through the PJ.06-01 V3 validations. Indeed the controllers considered feasible to manage the structurally limited cross-border free routing operations in high and very high complexity environment, using an adapted set of ATC support tools (conflict detection tools/monitoring aids/etc.). The implementation of such FRA structures maintaining complexity within manageable limits allows to offer a better trajectory planning while keeping capacity and high level of safety.

More detailed description of the Solution benefits can be found in Part V of this PJ.06-01 SPR-INTEROP / OSED document.

Key Feature and Capabilities under the scope of the Solution

The Key Feature to which the Solution PJ.06-01 is contributing is **Advanced Air Traffic Services**.

The SESAR Solution is contributing to the following ATM **Capabilities:**

- **Free Route Airspace Design** with the concept of "structurally" limited FRA
- **Separation Provision (airspace)** with En-Route ATS Units capabilities adapted to cross-border FRA environment
- **Coordination and Transfer** with En-Route ATS Units capabilities adapted to FRA environment
- **Trajectory Conformance monitoring** with En-Route ATS Units capabilities adapted to FRA environment
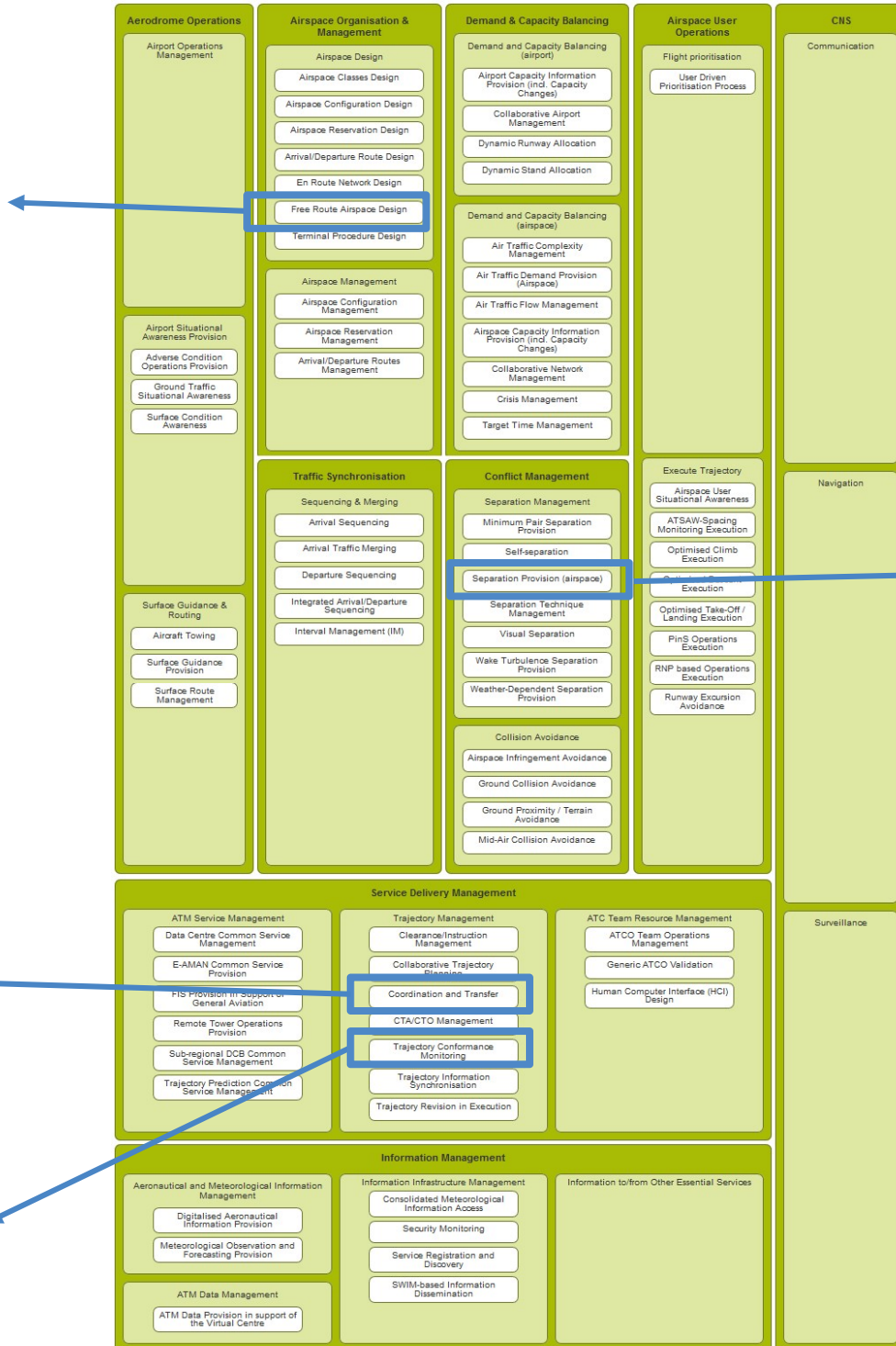
Figure 2: Link to ATM Capabilities

Regarding Information Management aspects, the Solution PJ.06-01 does not require new services supporting information exchange between ATS Units (beyond the ones available using OLDI specification). The enhanced Trajectory Management framework with *ATC to ATC flight data exchange using the Flight Object concept (FO/IOP) for separation management, coordination and transfer of flights across ATSU Area of Responsibility (AoR) boundaries is out of scope of the Solution*. Interoperability aspects are nevertheless taken into account in the scope of the Solution PJ.06-01.

Regarding Airspace Organisation & Management aspects, the Solution PJ.06-01 builds upon the framework for defined in the **European Route Network Improvement Plan (ERNIP), Part 1** [41]. Besides, the ATM Capabilities at AU/FOC/WOC and NM level contributing to Free Routing operations in En Route airspace of high and very high complexity are out of the scope of the Solution, which is focused on Air Traffic Services.

Solution dependencies

The Solution PJ.06-01 takes as input previous Free Route Solutions (brought to a V3 maturity level in SESAR 1):

- **Solution #32**: Free Route through the use of Direct Routing
- **Solution #33**: Free Route through the use of Free Routing for Flights both in cruise and vertically evolving above a specified Flight Level.

According to the applicable version of EATMA, the Solution PJ.06-01 is dependent on these two SESAR 1 Solutions. It should however be noted that *these Solutions are not a pre-requisite for Solution PJ.06-01*, *as Solution #32 does not need to be deployed prior to the Solution PJ.06-01 in high and very high complexity environments* (it is only a possible Free Route Solution in the transition phase before Free Routing implementation) *and Solution #33 (related to Free Routing in low to medium complexity environments) is not directly applicable to the same operating environment than the Solution PJ.06-01*.

The Solution PJ.06-01 also links to the following SESAR Solutions, but does not depend of these Solutions for being deployed:

- **Solution PJ.06-02**: Management of Performance-Based Free Routing in Lower Airspace
- **Solution PJ.10-02a**[5]: Improved Performance in the Provision of Separation

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[5] The Solution PJ.10-02a has eventually be split into two Solutions, i.e. PJ.10-02a2 which encompasses EPP ADS-C aspects and dedicated OIs and Enablers, and PJ.10-02a1 which deals with the rest of former Solution PJ.10-02a.

The **Solution PJ.06-02** sees the application of FRA for airspace users beyond the PCP expectations (below FL310) in high complexity en-route environments. It is therefore complementary to the Solution PJ.06-01. Besides, both Solutions require updating FDPS to support 4D trajectory direct segments in FRA beyond local AoR (enabler ER APP ATC 78). *Therefore Solutions PJ.06-01 and PJ.06-02 are compatible and interdependent* to achieve maximum performance requirements in high complexity En-Route environments regardless of Division FL of Free Routing Airspace across ACCs/FIRs.

Solution PJ.10.02a covers enhanced CD/R Tools, What-if and other tools (compliant with optional enablers ER ATC 157 and ER ATC 157b), which needs to be compatible with Free Routing operating environment. However, Solution PJ.10.02a has a broader scope than the subset of CD/R functionalities V3 validated in PJ.06-01, with e.g. the use of ADS-C EPP data or MET services to predict, with better uncertainty, the present and future aircraft positions. *Therefore, Solution PJ.10-02a (with IOC date of 2029) is not a pre-requisite for Solution PJ.06-01.*

Other technological or operational SESAR 2020 Solutions applicable to the En-Route airspace with a targeted timeframe at or beyond the one of Solution PJ.06-01 (with IOC date end of 2026) might consider the Solution PJ.06-01 as a pre-requisite for their validation of additional benefits and description of the operational environment after PCP implementation in En-Route. *However, the Solution PJ.06-01 does not need these other technological or operational SESAR Solutions*.

These other SESAR projects possibly looking forward the Solution PJ.06-01 OSED are as follows:

- **Solution PJ.01-01:** Extended Arrival Management with overlapping AMAN operations and interaction with DCB and CTA
- **Solution PJ.07-01**: AU Processes for Trajectory Definition
- **Solution PJ.07-02**: AU Fleet Prioritization and Preferences
- **Solution PJ.07-03:** Mission Trajectory Driven
- **Solution PJ.08-01**: Management of Dynamic Airspace configurations
- **Solution PJ.08-02**: Dynamic Airspace Configuration supporting moving areas
- **Solution PJ.09-01**: Network Prediction and Performance
- **Solution PJ.09-02**: Integrated Local DCB Processes
- **Solution PJ.09-03**: Collaborative Network Management Functions
- **Solution PJ.10-01a**: High Productivity Controller Team Organisation
- **Solution PJ.10-01b**: Flight centred ATC
- **Solution PJ.10-02b**: Advanced Separation Management
- **Solution PJ.11-G1**: Enhanced Short Term Conflict Alert (STCA) and Non Transgression Zone (NTZ) Ground Based Safety Nets making use of DAPs information
- **Solution PJ.15-09**: Delegation of Airspace and Contingency
- **Solution PJ.16-03**: Enabling rationalisation of infrastructure using virtual centre based technology
- **Solution PJ.18-02a**: Trajectory Based Operations
- **Solution PJ.18-02b**: Flight Object Interoperability – (FO/IOP)
- **Solution PJ.18-02c**: eFPL supporting SBT transition to RBT

- **Solutions under PJ.18-04b**: Meteorological (MET) information
- **Solutions under PJ.18-06a**: Air Traffic Control (ATC) Planned Trajectory Performance Improvement

OI Steps and Operational Enablers under the scope of the Solution

Table 3 summarizes the relevant **OI Steps** under the scope of the SESAR Solution as defined in the applicable version of EATMA.

SESAR Solution ID	SESAR Solution Title	OI Steps ID ref. (coming from EATMA)	OI Steps Title (coming from EATMA)	OI Step Coverage
PJ.06-01	Optimized traffic management to enable Free Routing in high and very high complexity environments	**AOM-0505 (FOC date end of 2030)**	Free Routing for Flights both in cruise and vertically evolving within high and very high complexity environments in Upper En Route airspace	• **Partial** (Key Feature addressed by PJ.06-01 is Advanced Air Traffic Services; AU/FOC/WOC and NM operations are part of the operational environment of the Solution, but not in scope of the Solution)

Table 3: SESAR Solution PJ.06-01 Scope and related OI steps

In the applicable version of EATMA [40] the rationale of AOM-0505 states that "... for full performance achievement high and very high complexity environments require further support for conflict detection and resolution by ATC. Demand and Capacity Balancing, including INAP function, would also bring additional performance benefits." These expectations come within the scope of the Solution PJ.06-01, apart from DCB aspects at local level (through the INAP function) which are not addressed.

Although out of scope of the PJ06-01 Solution at the end of V3, the improvement of Air Traffic Management / Complexity Management in the frame of INAP have been addressed in an intermediate version of this document. To pave the way to further research and development work, the V2 OSED material related to dynamic DCB aspects at ACC level is provided in Appendix B.

It is also indicated that "This OI Step, rather than describing a discrete technological and/or procedural change that sits within a known operating environment, covers the whole scope of Free Routing operating environment in Upper En Route airspace." Even though this document (in its OSED part) provides a common reference for the Free Routing operating environment, the new operating methods and operational requirements contained in this document are limited to the scope of the Solution PJ.06-01, which is focused on the improvement of Separation Provision to enable Free Routing operations in high and very high complexity cross-border environments.

Table 4 summarizes the list of **Enablers** indirectly linked through the OI Step AOM-0505 to the SESAR Solution according to the applicable version of EATMA [40].

SESAR Solution ID	SESAR Solution Title	Enablers ID ref. (coming from EATMA)	Enablers Title (coming from EATMA)	Enablers Coverage
PJ.06-01	Optimized traffic management to enable Free Routing in high and very high complexity environments	ER APP ATC 78	Update FDP to support 4D trajectory direct segments in free routing airspace beyond local AoR	• **Full**
		ER APP ATC 129	Upgrade FDP and provide Controller Tools to provide assistance to ATC Planning for Preventing Conflicts in En-Route Airspace	• **Full**
		ER ATC 91	ATC System Support for Advanced Conformance Monitoring in En-route Airspace	• **Full**
		NIMS-37	Basic Complexity assessment tools	• **Not addressed**

Table 4: SESAR Solution PJ.06-01 Scope and related Enablers

In the current EATMA modelling the Solution PJ06-01 only inherits from the "Required" Enablers of the OI Step, whereas the Solution also covers some "Optional" Enablers as further described hereafter. Figure 3 summarises the list of **"Required"** and **"Optional" Enablers** of the OI Step AOM-0505 under the scope of the SESAR Solution (see section 3.1.1 for details). The baseline Enablers and the PCP Enablers are also indicated.

Solution PJ.06-01

AOM-0505

Optional Enablers

Solution PJ.06-01	AOM-0505
- ER ATC 157 (Enhanced ATC System Support to the Tactical Controller for Conflict Detection and Resolution in En-Route) - ER ATC 157b (Enhanced ATC System Support the Planning Activity for Conflict Detection and Resolution in En-Route) - PRO-046b (ATC Procedures for Using Advanced System Assistance to Medium Term Conflict Detection and Resolution)	- A/C-04a (FMGS for Advanced RNP) - A/C-31b (CPDLC compliant with FANS 3/C) - ATC-STD-01 (G-G flight data exchange) - ER APP ATC 104 (Adapt Controller Tools to Use Enhanced ground based trajectory prediction) - ER APP ATC 104b Adapt Controller Tools to Use Enhanced ground based trajectory prediction) - ER APP ATC 104c (Adapt Controller Conformance Monitoring Tools to Use Enhanced ground based trajectory prediction) - ER APP ATC 104d (Adapt Controller Conformance Monitoring Tools to Use Enhanced trajectory prediction) - ER APP ATC 160 (ATC-ATC flight data exchange using FO) - ER ATC 92 (ATC tools to re-organize traffic flows to reduce complexity) - ER ATC 94 (ATC tools in support of RNP for ER) - METEO-06c (Generate and provide Meteorological information relevant at short notice) - NIMS-21a (Initial Flight Planning management enhanced to support 4D for Step 1) - NIMS-36 (Enhanced complexity assessment tools) - NIMS-46 (Integrated local DCB WP) - PRO-220a (ATC Procedures related to Detection and Resolution of Complexity, Density and Traffic Flow Problems) - REG-0012 (CS in support to PCP AF3 – Free Routes) - REG-0500 (regulatory provision for PBN implementation) - SWIM-APS-05a (necessary for G-G IOP – PCP) - SWIM-INFR-01a (necessary for G-G IOP)

Figure 3: Link to "Required" and "Optional" Enablers of related OI Step

The Solution PJ.06-01 is focused on some "Required" and "Optional" Enablers that support Air Traffic Services in structurally limited Free Routing cross-border environment, but not the more advanced ones (like e.g ATC support tools adapted to enhanced trajectory data or RNP operations). Also, the Solution PJ.06-01 does not address any Airspace User capabilities (like for Advanced RNP or full 4D operations) or Network Manager capabilities (like initial Flight Planning management to support 4D).

The OI Step Requirements are therefore only partially covered by the Solution PJ.06-01 (see section 3.1.1 for details).

Table 5 summarizes the **High Level Operational Requirements** applicable to the SESAR Solution in the SESAR 2020 Concept Of Operations [4] developed by PJ19.

Id	High Level CONOPS Requirement Description	CONOPS section
S06-01-HLOR-02	Free Route operations shall allow ATC services to be performed across boundaries, with maintained or increased capacity compared to current operations, even without reference to published directs or fixed route network, while ensuring: · smooth entry and exit to/from Free Route Airspace and adapted procedures for transition to/from conventional ATS route Network, in both vertical and horizontal plans, · full situation awareness and manageable workload for ATC thanks to advanced Controller toolset for coordination and management of trajectories interactions.	Section 3.1.7 Operational Requirements PJ 06

Table 5: Link to CONOPS

3.1.1 Deviations with respect to the SESAR Solution definition

It has been confirmed through the PJ.06-01 V3 validations that, supported by an advanced controller toolset as well as an FDPS adapted to cross border FRA, free routing operations in upper en-route airspace can be performed in a cross-border environment of high and very high complexity without any detrimental effect on safety and capacity with full situation awareness and manageable workload.

However, as detailed in Table 6 below the High Level Requirement attached to the Solution PJ.06-01 in the SESAR 2020 Concept of Operations (CONOPS 2019) [4] is partially covered by the Solution PJ.06-01.

OI Step Code	OI Step title	Deviation
AOM-0505	Free Routing for Flights both in cruise and vertically evolving within high and very high complexity environments in Upper En Route airspace	• S06-01-HLOR-02 - Smooth entry and exit to/from FRA and adapted procedures for transition to/from conventional ATS route Network, in both vertical and horizontal plans: **Partially addressed** (the Solution is focused on Air Traffic Services and management of vertical transitions were addressed in a simplified way)

Table 6: Coverage of CONOPS Requirements

Enablers associated to the Solution

According to the applicable version of EATMA, the Solution PJ.06-01 is associated to Enablers different from the ones actually in the scope of the Solution described in this document. Moreover the Solution PJ06-01 only inherits from the "**Required**" Enablers of the OI Step, whereas the Solution also covers some "**Optional**" Enablers" as further described hereafter.

Enabler ID	Enabler Title	Enabler Coverage	Link with the Solution
ER APP ATC 78	Update FDP to support 4D trajectory direct segments in free routing airspace beyond local AoR	• **Full** (Required enabler)	This enabler aims at updating Flight Data Processing (FDP) related systems to support 4D trajectory direct segments in Free Routing Airspace, and support at ATC level the planning and execution of RBT/MBT across ACC/FIR/FAB and multiple AoRs. It is essential to support ATS in cross-border Free Routing Airspace of high and very high complexity. *This enabler is a required enabler of both the OI Step AOM-0505 and the Solution PJ.06-01.*
ER APP ATC 129	Upgrade FDP and provide Controller Tools to provide assistance to ATC Planning for Preventing Conflicts in En-Route Airspace	• **Full** (Required enabler)	This enabler is the pre-SESAR baseline enabler for ATC support tools. *This enabler is a required enabler of both the OI Step AOM-0505 and the Solution PJ.06-01.*
ER ATC 91	ATC System Support for Advanced Conformance	• **Full** (Required enabler)	This enabler (which IOC date is in 2016) is a SESAR 2020 baseline enabler brought in V3 maturity in SESAR 1 in the scope of Solution #33.

Enabler ID	Enabler Title	Enabler Coverage	Link with the Solution
	Monitoring in En-route Airspace		This enabler is essential to support Free Routing operations not only in permanently low to medium complexity environments (as validated by Solution #33), but also in high and very high complexity environments as considered in the scope of the Solution PJ.06-01. *This enabler is a required enabler of both the OI Step AOM-0505 and the Solution PJ.06-01.*
ER ATC 157	Enhanced ATC System Support to the Tactical Controller for Conflict Detection and Resolution in En-Route	• **Full** (Optional enabler)	This enabler is a SESAR 2020 baseline enabler brought in V3 maturity in SESAR 1 in the context of Solution #27. These enhanced ATC functionalities (with "what-if" and "what-else" probing of ATC clearances) are nice to have to support separation provision in Free Routing environments of high and very high complexity. *This enabler is an optional enabler of the OI Step AOM-0505 and is part of the advanced Solution PJ.06-01.*
ER ATC 157b	Enhanced ATC System Support the Planning Activity for Conflict Detection and Resolution in En-route	• **Full** (Optional enabler)	This enabler is envisaged to achieve V3 maturity in SESAR 2020 in the context of the Solution PJ.10-02a and the Solution PJ.06-01 with regard to Free Routing environment. These enhanced ATC functionalities, which goes beyond the baseline support tools for ATC Planning (cf. enabler ER APP ATC 129), are nice to have to support separation provision in Free Routing environments of high and very high complexity. *This enabler is an optional enabler of the OI Step AOM-0505 and is part of the advanced Solution PJ.06-01.*
NIMS-37	Basic Complexity assessment tools	• **Out of scope** (Required enabler)	This enabler (which IOC date is in 2019) is a SESAR 2020 baseline enabler brought in V3 maturity in SESAR 1 in the context of Solution #19.

Enabler ID	Enabler Title	Enabler Coverage	Link with the Solution
			This enabler is essential to support LTM/local DCB actor in FRA of high and very high complexity. It was not considered in the Solution PJ.06-01 which focus is on the improvement of Aircraft-to-Aircraft Separation Provision. ***This required enabler of the OI Step AOM-0505 is out of scope of the Solution PJ.06-01.***
PRO-046b	ATC Procedures for Using Advanced System Assistance to Medium Term Conflict Detection and Resolution	• **Partial** (Optional enabler)	This enabler is nice to have to support the ATCOs in managing conflicts in FRA of high and very high complexity using advanced Conflict Detection Tools (cf. enablers ER APP ATC 157 and ER ATC 157b). ***This enabler is an optional enabler of the OI Step AOM-0505 and is part of the advanced Solution PJ.06-01.***

Table 7: Coverage of Related Enablers

3.2 Detailed Operational Environment

According to the initial Grant, the SESAR Solution PJ.06-01 falls within the scope of the current PCP (EU No 716/2014) and its third ATM Functionality which targets an implementation date of 1st of January 2022. Nevertheless the applicable version of the EATMA and its associated Data Set (EATMA v12 / DS19) now shows the following revised IOC/FOC dates for PJ.06-01: IOC 31/12/2026 – FOC 31/12/2030. Beginning of January 2027 is thus considered, in this SPR-INTEROP/OSED, as targeted implementation date of the PJ.06-01 Solution.

In the detailed operational environment described hereafter (including Free Routing Airspace characteristics, traffic characteristics and technical characteristics), distinction is made between the targeted operating environment for Solution PJ.06-01 and possibly future operating environment with more advanced ATM Capabilities under investigation by other SESAR 2020 Solutions.

3.2.1 Operational Characteristics

3.2.1.1 En-Route airspace of high and very high complexity

SESAR 2020 PJ.20 specifies the level of complexity of a given operating environment in En-Route airspace using an aggregated complexity score as defined in the EUROCONTROL Performance Review Unit. This aggregated traffic complexity score is used to distinguish between four categories of ACCs:

- En-Route <u>Very High Complexity</u>: traffic complexity score higher than 10
- En-Route <u>High Complexity</u>: traffic complexity score higher than 6 but lower than 10
- En-Route <u>Medium Complexity</u>: traffic complexity score higher than 2 but lower than 6
- En-Route <u>Low Complexity</u>: traffic complexity score Lower than 2

	Cluster 1 Low Complexity	Cluster 2 Medium Complexity	Cluster 3 High Complexity	Cluster 4 Very High Complexity
SESAR 1 classification methodology	< 2	[2;6)	> 6	-
SESAR 2020 classification methodology (modified SESAR 1 classification methodology)	< 2	[2;6)	[6;10)	≥ 10

Figure 6: Boundaries of Aggregated Traffic Complexity Score (source PJ20)

This aggregated traffic complexity score is a composite measure which combines a measure of traffic density (concentration of traffic in space and time) with structural complexity (structure of traffic flows in the horizontal plane and the vertical plane).

$$Complexity\ Score = \ Adjusted\ density \times Structural\ index$$

The set of complexity indicators defined by the PRU are based on the concept of "interactions" arising when there are two aircraft in the same "place" at the same time. Hence, the **Complexity Score** is a measure of the potential number of interactions between aircraft (in terms of headings, vertical profiles and speeds) defined as the total duration of all interactions (in minutes) per flight-hour controlled in a given volume of airspace.

$$Complexity\ Score = \frac{VERTICAL\_(INTER\_HRS\ ) + HORIZONTAL\_(INTER\_HRS\ ) + SPEED\_INTER\_HRS}{CPLX\_FLIGHT\_HRS} \times 60$$

Source https://ansperformance.eu/reference/dataset/traffic-complexity-score/

The figure below shows the annual complexity scores computed by the PRU for 2018 over Europe.
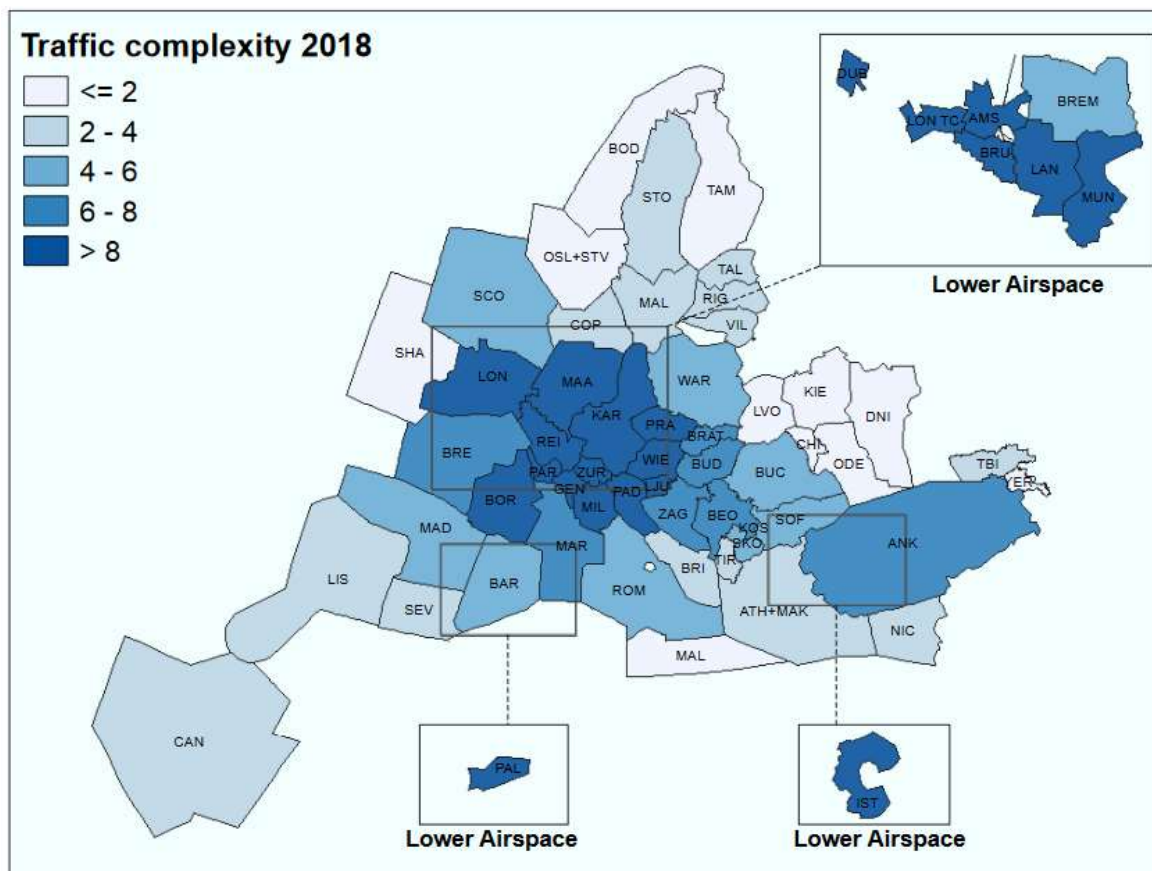
Figure 4: En-route complexity scores – Source PRR 2018 Report [53]

This complexity indicator is therefore representative of the level (and characteristics) of the traffic demand in the airspace (and the need for Enhanced Conflict Management and Automation at local level).

Other environmental factors could also affect the complexity of En-route airspace (and which needs to be taken into account when envisaging deploying Free Route operations). These include e.g. the level of interference between civil / military activity in the airspace (and need for AFUA to balance traffic / airspace demand by civil / military AUs).

3.2.1.2 Free Routing Airspace characteristics

General characteristics

Despite the fact that individual implementations of Free Routing Airspace exist today, greatest benefits can only be realised after harmonisation. It is therefore required to have the same basic rules concerning publication, design principles and constraints, structural elements and hence flight planning requirements. Within these basic rules and structures each ANSP or FAB has some leeway with regards to its own implementation.

The general assumptions regarding airspace characteristics eligible for Free Routing operations are summarised in the table below (refer to **European Route Network Improvement Plan (ERNIP), Part 1** [41] for further details). Beyond these airspace design characteristics, other strategic rules/constraints related to the conditions of use of the airspace (like RAD restrictions for ATFCM purposes) will also have to be defined.

.Characteristic	Free Routing Airspace Characteristics
Airspace Classification	Free Routing Airspace in En-Route operating environment will, in principle be classified as Class C airspace, with certain agreed exemptions. [41]
Flight Level Orientation	The Flight Level Orientation Scheme (FLOS) applicable within Free Routing Airspace will be promulgated through the relevant national AIS publications. (This does not constitute a change to the current system of 2 FLOS in Europe). [41]
Airspace Organisation	FRA forms an integral part of the overall European ATM network, interfacing vertically or laterally with adjoining fixed route environment. [41] There is no specific recommendation on the minimum FL. Nevertheless, with goal being a harmonized airspace structure across the European network, the following recommendations are made [41]: •The lower vertical limit shall be coordinated at European network level to ensure interconnectivity with adjoining airspace and this could vary in different areas or at different times within a particular FRA •The minimum level should be the lowest feasible, taking into account the complexity of the airspace and the demand. In complex airspace, the full implementation of FRA could potentially have a detrimental effect on capacity. In such airspace, States / FABs / ANSPs may decide to implement FRA on a structurally limited basis, for example by restricting the available FRA Horizontal entry/exit points for certain traffic flows, which could increase predictability and reduce the number of potential conflicts. [41] Airspace reservations will remain, and as all airspace users will have equal

.Characteristic	Free Routing Airspace Characteristics
	access to FRA, harmonized application of the FUA Concept and Civil/Military Coordination are taken into account in order to ensure harmonised procedures and service provision for the benefit of all the airspace users. [41]
	The most adequate way to publish constraints for AUs in FRA is via the use of restrictions on airspace volumes or flows. The restrictions have to be kept at a minimum level and be published to AUs. The RAD has to be constructed and presented to AUs in a harmonized way. At NM level, all the functionalities exist to manage these constraints (RAD Appendix 4, Appendix 7 Pan-Europe Annex, AUP/UUP).
Publication and maintenance of Significant Points and ATS Route Network	There is no over-arching requirement for a European contingency fixed ATS route network in FRA [41]. The conclusion has been made just to maintain published Significant Points (for flight definition and for other navigational and ATS purposes). It will be up to each ANSP to decide if the fixed route network has to be maintained or not, as the ATS route network is no longer required.
	FRA significant points will be published in national AIPs with a clear reference to the Free Route Airspace and to indicate the FRA relevance of the point. Publication of FRA relevance on 5LNC and navigation aids - en-route falls under [...] ENR 4.1[..] and ENR 4.4 [41].
	Airspace users may be allowed to use any intermediate unpublished points for flight planning defined by geographical coordinates or by bearing and distance. Such possibility shall be clearly promulgated in national AIS publications [41].
	Although possible in principle (and in some existing FRA implementation in low to medium complexity airspace), the assumption is made in the context of Solution PJ.06-01 that user-defined Significant Points can only be usable for speed/level changes in FRA (and not for trajectory turning points). This might not necessarily be the case in future operating environment with more advanced ATM Capabilities under investigation by other SESAR 2020 Solutions.
Sectorisation	The present sectorisation scheme may need to be restructured to accommodate traffic flows within FRA and according to the underlying fixed ATS route network. Instead of having regularized flows of traffic along the ATS route network crossing at recognized points, the traffic will potentially be spread across the whole of a sector [41].
	Sector design will need to respond to this change and may need to be more flexible as traffic demand varies. [...] Sector design criteria should, at least, take into account [41]:

.Characteristic	Free Routing Airspace Characteristics
	• The principle traffic flows and orientation • Minimizing short transits through sectors • Minimizing sector and ACC re-entry • Positions of airspace reservations • coherency with adjoining fixed ATS route network sectors and connecting ATS routes to SIDs/STARs; • Civil / military coordination aspects. Sectors will have to be aligned as far as possible so that the number of flights with short transit times is reduced to a minimum. If this is not feasible such traffic should be exempted from Network Manager traffic counts. [41]. More flexibility in defining a larger number of elementary sectors/airspace volumes and sector configurations might need to be explored. Operationally designed, cross-border sectors may be needed where FRA is implemented in adjacent areas. [41] Local FMPs will have to take a more proactive role in the selection of optimum sector configurations. Active sector configurations will have to be dynamically communicated Network Manager Operations Centre (NMOC). [41]
Letters of Agreement and Coordination Procedures	Letters of Agreement shall be adapted to reflect the specificities of FRA in regard to transfer points, flexible changes in sectorisation, links with the fixed ATS route network, high fluctuations in traffic flows, possibility to leave/enter the airspace at random points, etc. [41] Appropriate mentioning of ATS delegation in areas involving FRA shall be fully considered. [41] The automatic exchange of flight data between ACCs/UACs will need to consider the possibility of transfer at random points. [41] Transfer procedures and restrictions currently stipulated in the existing Letters of Agreement may no longer be applicable in Free Route Airspace. Appropriate procedures shall be defined to reflect these new provisions. [41] Where relevant to enable efficient Flight Planning operations by Airspace Users in FRA, constraints imposed by letters of agreement between ATC Units will be defined as FRA structural constraints in the RAD.

Characteristic	Free Routing Airspace Characteristics
ATS delegation	In areas where operational boundaries do not coincide with FIR/UIR boundaries, and delegation of ATS is effective the operational boundaries of FRA shall be published in the national AIS publications of both States. The Letters of Agreement between the concerned ATS units shall be amended accordingly to reflect any changes to the applicable procedures in the airspace where ATS is delegated. [41]

Table 8: Free Routing Airspace characteristics

Cross-border Free Routing Airspace

In the applicable version of EATMA, AOM-0505 has the following comments:

"*This OI Step, rather than describing a discrete technological and/or procedural change that sits within a known operating environment, covers the whole scope of Free Routing operating environment in Upper En Route airspace.*

The EN list provided below is showing the key elements stemming from operational requirements for large scale extension of Free Routing in En-route high and very high complexity cross-border environments."

The Solutions contributing to the OI Step should therefore aim at paving the way towards the large scale implementation of Free Routing operations across ACC/FIR borders including in high and very high complexity environments.

What's a cross-border FRA?

EUROCONTROL's definition proposal for Cross-Border FRA [44] is:

- "*A specified Free Route Airspace where common procedures are applied regardless of national and/or operational boundaries.*
- *Such Free Route Airspace comprises part and/or the whole areas of responsibility of at least two adjacent ATS units (e.g. ACCs, UACs, etc.) not belonging to the same State.*
- *Any published NAVAID/Significant Point on the common boundary can be considered as a FRA Intermediate Point; when and if required and is not mandatory for flight planning purposes.*"

Then, it can be summarised that **cross-border FRA implies common procedures, in at least two adjacent ATS units not belonging to the same State, where published points on the common border are not mandatory for flight planning**.
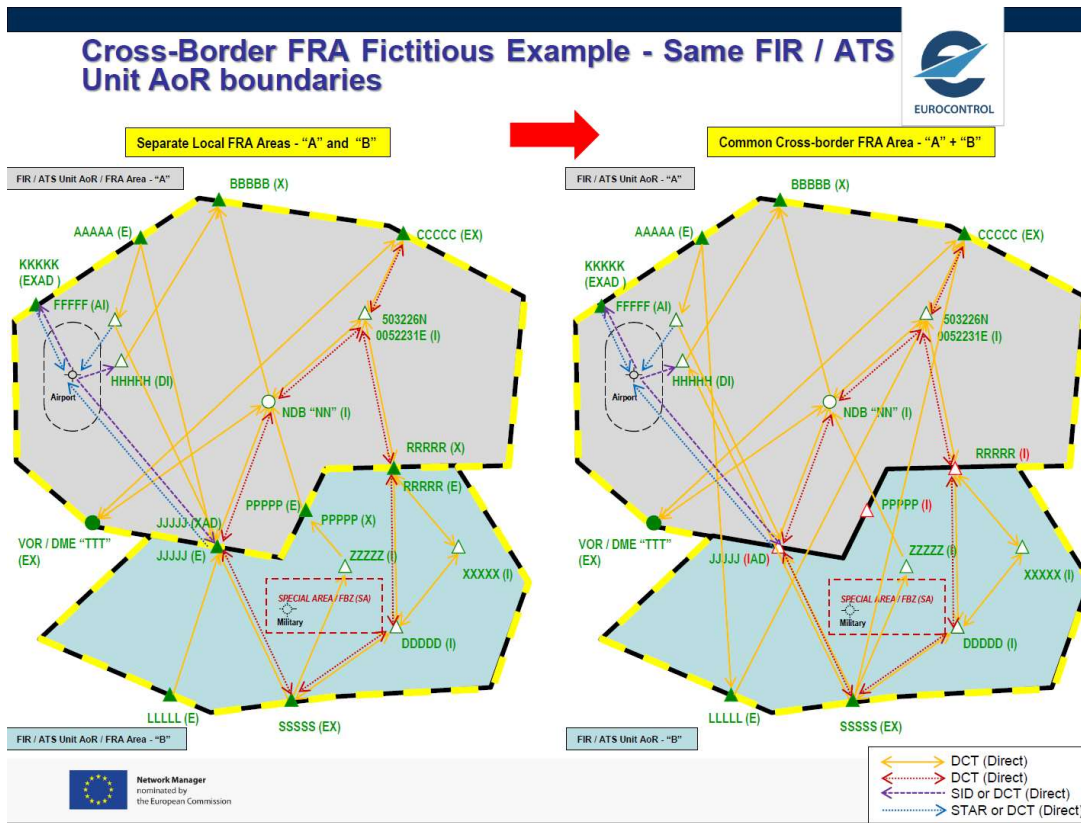
Figure 5: Example of Cross-border FRA – Source EUROCONTROL Free Route Workshop [44]

In the context of the Solution PJ.06-01, considering the targeted timeframe (end of 2026), the European airspace environment is expected to consist of a mix of common cross-border FRAs where AUs have the ability to plan for Directs across the FIR/ATS Unit AoRs (as shown in the right figure) and adjacent local FRAs at State/FIR/ACC level (as shown in the left figure) with supplementary cross-ACC En-route Directs available for flight planning (see section about "structurally limited" FRA).

What's the change introduced by a cross-border FRA?

In a cross-border FRA, published points at State/FIR borders can remain and be eligible for flight planning purposes, but not mandatory as in a fixed ATS route network environment. Then this FRA concept in high and very high complexity environment introduces needs on ATS compared to ARN environment in terms of working methods for safe and efficient coordination and transfer of flights at the border of two different States.

The Figures below show the Free Route implementation evolution, including cross border activities (with borders in magenta), from current situation (2017) till end of 2022.

2017 (source ERNIP Monitoring report – AIRAC 1707 [42])	
2022 (source EUROCONTROL FRA website)	
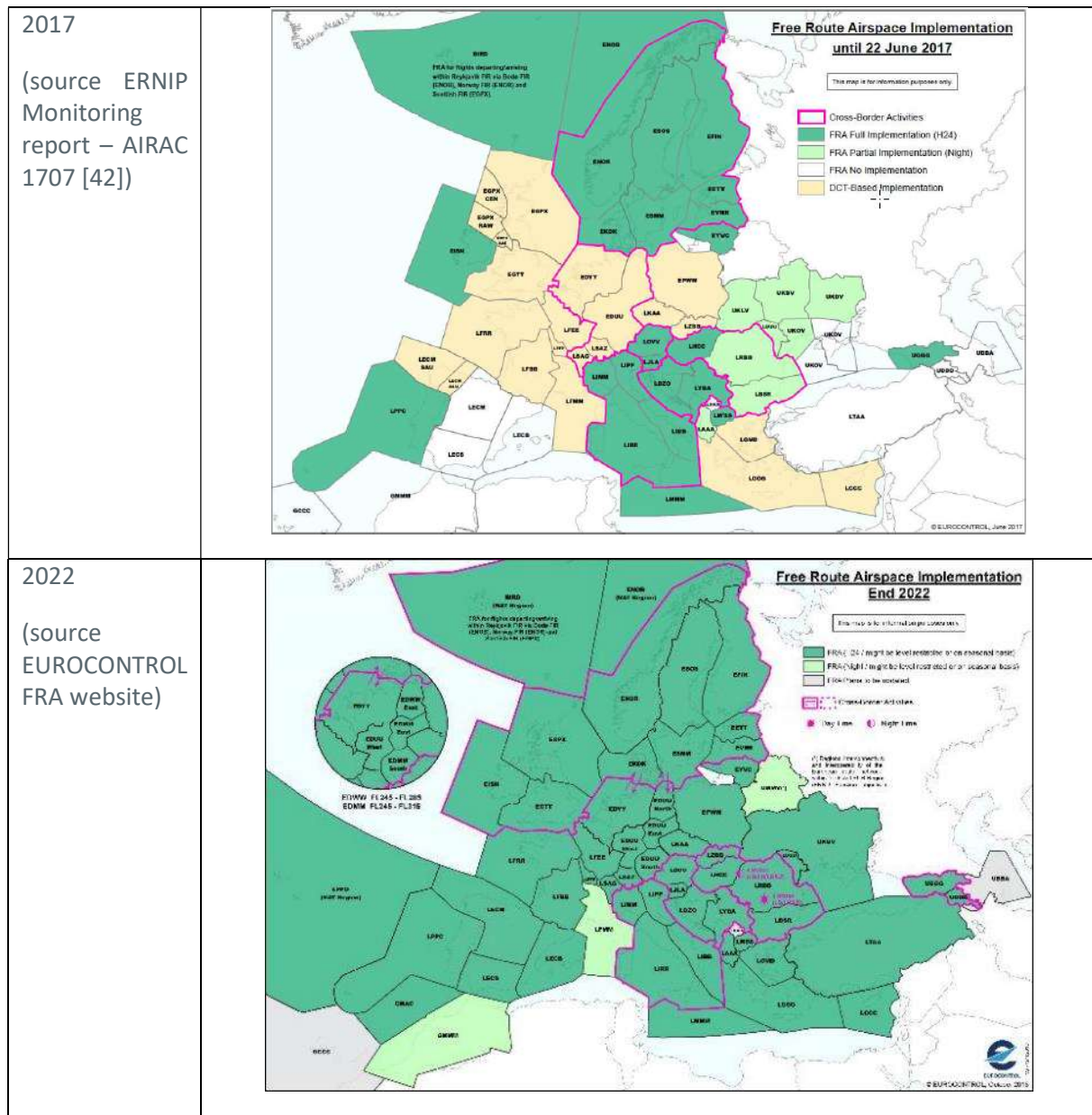
Figure 6: Free Route Airspace Evolutions – Source EUROCONTROL FRA Website

See https://www.eurocontrol.int/concept/free-route-airspace (implementation charts) for details.

These on-going or planned implementations of Free Route (with a mix of Direct Routing and Free Routing environments) will be beneficial for AUs compared to the ARN environment. However, there is much variability in these implementations with FRA at different lower flight level limits, FRA H24 or only in night, FRA with ATS routes available or removed, FRA with cross-ACC En-Route Direct options or not, airspaces with En-Route DCTs only, etc.

Cross-border FRA implementation has started and is already applicable or will be soon in many parts of Europe, namely SAXFRA (Austria/Slovenia), SEENFRA (Romania/Hungary/Bulgaria), SEAFRA (Belgrade/Zagreb ACCs), MALTA/ITALY, NEFRA (Estonia/Latvia/Finland/Sweden/Denmark/Norway), SECSI FRA (Austria/Slovenia/Croatia/Serbia-Montenegro/Bosnia-Herzegovina).

Cross-border operations ease harmonization and extend FRA in larger areas, however high complexity aspects and harmonization of working methods need to be carefully considered to ensure safe and efficient operations ECAC wide.

"Structurally" limited Free Routing Airspace

In order to allow cross-border operations in Free Routing environment traffic will not necessarily enter or leave the sector/ACC at mandatory coordination points, and conflicts could appear anywhere within the sector as a result of removing predefined crossing points existing in the ATS Route Network. The trajectories will also vary from day to day, and not follow a specific pattern, which might increase the complexity at sector/ACC level particularly in case of Free Routing operations across ATSU AoRs.

To maintain the airspace complexity to an acceptable level for ATCOs taking into account the geographical and temporal variability of the traffic demand in Free Routing environment, more or less "structurally" limited FRA might be defined in high and very high complexity environments.

In the context of the Solution PJ.06-01, a "structurally" limited FRA may contain one or a combination of the following features.

Items	"Structurally "limited FRA in high and very high complexity environments
Geographical scale	Limited geographical scale of FRA defined at State / ACC level (or even down to a group of sectors) with Entry/exit points in the FIR / ATSU (or group of sectors) area of responsibility with cross-ACC En-Route Direct options available / OR / Cross-border FRA of limited size (as an alternative to a maximum DCT limit in the airspace)
User defined segments (and points)	Possibility for an Airspace User to plan/re-plan route inside FRA using user-defined segments between two user-defined (defined by geographical coordinates or by bearing and distance) or published way points (in ENR 4.1 or ENR 4.4) with some limitations, i.e. • Possibility to plan/re-plan route via published FRA Significant Points (assumed to be sufficient enough to offer efficient route options along all major flows and around airspace reservations) • Possibility to plan/re-plan route via user-defined points for altitude / speed change only, but not for trajectory turning points at user-defined points

Items	"Structurally "limited FRA in high and very high complexity environments
	• Possibility to plan/re-plan route inside FRA with flight plan filing limitations (described in the RAD) for ATFCM purposes (see traffic flow restrictions hereafter) • Possibility to plan route across ACC/FIR border inside a common cross-border FRA or along allowed cross-border En-Route DCTs between adjacent local FRAs Publication of additional intermediate points to support tactical rerouting by ATCOs in execution phase.
Traffic flow restrictions	En-route Directs (between published points) with flight plan filing limitations (described in RAD Appendix 4 or Pan-Europe Annex), e.g. • Some Direct Routing segments not allowed (i.e. En-Route DCTs with availability "No" in RAD) between specific FRA Significant Points (e.g. to prevent/limit traffic filing along FRA boundaries) • Any Direct Routing segments combination not allowed for specific pairs of FRA Significant Points (to strategically manage traffic complexity in FRA through traffic flow restrictions) • Forbidden En-route Directs (from a given FRA Significant Point) through a given airspace volume (e.g. ATC sectors restrictions to avoid undesired traffic flow crossings in FRA) • Limited number of cross-border En-Route Direct options allowed (i.e. En-Route DCTs with availability "Yes" in RAD) between two adjacent FRAs, possibly with temporal or vertical availability limits Published FRA Significant Points with specific conditions of use (described in RAD Appendix 5 or Pan-Europe Annex), e.g. • FRA Entry/Exit points with traffic flow restrictions (to manage the traffic complexity at the FRA lateral boundaries) • Mandatory FRA Intermediate points to be used only for avoidance of airspace reservations (during flight planning phase) • Mandatory FRA Intermediate points for specific traffic flows inside FRA (e.g. "flights entering via A and exiting via B shall proceed via C") • FRA Arrival / Departure Connecting points with indications on their use for departures / arrivals from / to specific aerodromes (e.g. compulsory connecting routes for flights transitioning from/to FRA)

Table 9: Structural limited Free Routing Airspace

General principles for the definition of ad-hoc structural limits of FRA include the following:

    o   Avoid trajectories or crossing points too close to the border of sectors, in particular close and conflicting with known descending or climbing flows,

    o   Avoid flights exit/re-entry in the sectors,

    o   Avoid convergence of cruise trajectories,

    o   Avoid flights trajectories crossing the corner of a sector for a few nautical miles only.

    o   Ensuring the connectivity with lower non-FRA airspace and segregate arrival and departure flows.

    o   Ensuring optimized lateral connectivity with neighbouring centres.

    o   Ensuring enough intermediate waypoints for tactical re-routing.

Although efficient approach to manage air traffic flows and airspace capacity in high and very high complexity environments, such structural limitations defined at the FRA design level should be relaxed as far as possible to allow maximising the operational benefits of Free Routing for AUs.

The Solution PJ.06-01 aims at developing ATC improvements to enable Free Routing operations in high and very high complexity cross-border environments with minimum structural constraints while maintaining the required level of safety and capacity in the airspace.

Future operating environment (beyond the scope of PJ.06-01)

With more advanced ATM capabilities (beyond the scope of Solution PJ.06-01), it might be possible in the future to better accommodate unconstrained and efficient Free Routing operations even in high and very high complexity cross-border environments.

3.2.1.3 Traffic characteristics

General characteristics

The general assumptions regarding traffic characteristics eligible for Free Routing operations in En-Route airspace at the considered timeframe (end of 2026) are summarised in the table below:

Traffic Characteristics	Free Routing Airspace in En-Route airspace
Traffic Level for En-Route ACC	Flights operating in FRA at least at and above FL310 in the ICAO EUR region regardless of traffic levels.
Traffic Mix	Mix of business / mission flights (essentially IFR flights) Accommodation of a variety of different a/c capabilities is likely to be required in FRA at the targeted timeframe (end of 2026)
Traffic Patterns	Overflights, climbing and descending flights above a certain vertical limit, which limit might not necessarily be the same all over the European airspace

Possible convergence phenomenon of traffic flows leading to a number of interactions, hotspots and conflicts at sector/ACC levels that might require appropriate ATFCM restrictions to maintain the traffic complexity acceptable by ATCOs

Higher variability in traffic demand and complexity in FRA due to more flight planning options (compared to a fixed ATS Route Network environment) that could lead to a high to very high complexity in a sector generally considered as low to medium complexity and vice-versa

Traffic demand in En-Route Airspace

According to the EUROCONTROL STATFOR long-term traffic forecast [51], the Regulation and Growth (most-likely) forecast of the annual number of IFR flights is for 13.8 million IFR flight movements (±2.2 million) in Europe in 2030, 32% more than in 2017 for Europe as a whole.

	IFR Movements (000s)												Total Growth 2040/2017
	2010	2011	2012	2013	2014	2015	2016	2017	2025	2030	2035	2040	
Global Growth	9,617	9,921	9,707	9,601	9,768	9,920	10,193	10,604	14,044	16,018	17,809	19,462	1.8
Regulation & Growth	.	.	.	.	.	.	.	.	12,443	13,847	15,174	16,200	1.5
Happy Localism	.	.	.	.	.	.	.	.	12,410	13,449	14,231	14,917	1.4
Fragmenting World	.	.	.	.	.	.	.	.	10,877	11,375	11,669	11,911	1.1

	Average Annual Growth												AAGR 2040/2017
	2010	2011	2012	2013	2014	2015	2016	2017	2025	2030	2035	2040	
Global Growth	0.9%	3.2%	-2.2%	-1.1%	1.7%	1.6%	2.7%	4.0%	3.6%	2.7%	2.1%	1.8%	2.7%
Regulation & Growth	.	.	.	.	.	.	.	.	2.0%	2.2%	1.8%	1.3%	1.9%
Happy Localism	.	.	.	.	.	.	.	.	2.0%	1.6%	1.1%	0.9%	1.5%
Fragmenting World	.	.	.	.	.	.	.	.	0.3%	0.9%	0.5%	0.4%	0.5%

Table 10: IFR movements Long Term Forecast - Source EUROCONTROL fifth Challenges of Growth study [51]

The part of this traffic demand related to FRA operations will depend on the lateral and vertical limits of the airspace allowing for Free Routing, as well as the percentage of the traffic willing to plan/re-plan using user-defined segments in FRA where an ARN is maintained, particularly during the transition phase before full implementation of the Free Routing concept.

It should also be noted that the increased flight planning freedom provided to AUs through FRA operations may lead to greater uncertainty in strategic and pre-tactical traffic forecast accuracy. On the other hand, it is expected that the adherence to flight plan as filed will improve in execution phase. The benefits in terms of in-flight variability are subject to validation.

3.2.2 Roles and Responsibilities

> *In the roles and responsibilities described hereafter (including those of AU, NM and ATS nodes), distinction is made between the targeted operating environment for Solution PJ.06-01 (including assumptions related to flight planning rules and ASM / ATFCM operations in the context of the Solution) and possibly future roles and responsibilities under progress by other SESAR 2020 Solutions.*

3.2.2.1 Airspace Users Roles and Responsibilities

At Airspace User level, the **Airspace User Operations, Airspace User Ops Support and Flight Deck nodes** are directly impacted by Free Routing operations, but their related Actors/Roles **are not expected to change in the context of the Solution PJ.06-01**.

Node	AUs Roles and Responsibilities in Targeted Operating Environment
Airspace User Operations	• Airspace User Operations represent all the activities undertaken by those organisations and individuals who have access to and operate in the airspace which is managed for ATM purposes in accordance with ICAO and national procedures. [40] • Both civil and military Airspace Users, through their Operations Centres (if any in place), will be connected to the airspace planning process. An improved dynamicity and transparency of this process will allow AUs to optimise their fleet planning or mission planning and permit improved flight planning for individual flights. • To support AUs to optimise their business trajectory in the network, AUs will have more flexibility to select the flights to which specific measures will be applied, including automated processes where AUs provide information on the optimisation of departure sequences (for priority flights) in order to swap slots with other flights inside or outside the airline group. [40] • The safe and transparent integration of Civil RPAS in non-segregated airspace, in a multi-aircraft and manned flight environment, guaranteeing the interoperability with the ATM system, brings many operational and technical considerations and potential issues that still need to be progressed. Considering the targeted timeframe (end of 2026), civil RPAS operations in Free Routing Airspace is not envisaged in the context of the Solution PJ.06-01.
Airspace User Ops Support[6]	• Performs all the necessary activities to support AU ops, including the strategic and tactical planning of AU operations, participation to related CDM processes and UDPP, update of AOP with AU information, ground handling. [40]

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[6] A civil Airspace User can be supported or not by a Flight Operations Centre (FOC).

Node	AUs Roles and Responsibilities in Targeted Operating Environment
	• When developing and planning Business / Mission Trajectories in Free Routing environment, the Airspace User Ops Support actors are assumed to comply with the applicable rules in the airspace.
Flight Deck	• Performs all the on-board AU operations including flight execution/monitoring according to agreed trajectory, compliance with ATC clearances/instructions, etc. [40]
	• No change is envisaged in flight crew's operating methods for flight execution and trajectory revision in FRA, including with regard to the use of user-defined (LAT, LON) points. The conditions for using non-published fixed waypoints (ex. LAT,LON points) in a safe and efficient way by the flight crew are still to be accurately identified, since the risk is that automatic naming of such fixes are not intuitive enough in particular when some of the LAT,LON points are spaced by few tenths of NMs. If not supported by appropriate automation, the trajectory revision process using non published (LAT, LON) points might raise controller/pilot workload and communication issues[7]. Besides, specific mitigations might need to be defined in case of CPDLC failure (on board and on the ground). Therefore, considering the targeted timeframe (end of 2026), this concept option is not envisaged in the context of the Solution PJ.06-01. This might not necessarily be the case in future operating environment with more advanced ATM Capabilities under investigation by other SESAR 2020 Solutions.

Table 11: AUs Roles and Responsibilities in Targeted Operating Environment

Assumptions related to AUs roles and responsibilities (in the scope of PJ.06-01)

The following assumptions are made regarding the Airspace Users operations in Free Routing environment in the context of the Solution PJ.06-01.

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[7] Without advanced CPDLC capabilities and the capability to load the LAT,LON clearances (received via CPDLC) into the FMS, flight crew would have to insert non-published waypoints (LAT/LON) manually into the FMS which is time consuming and source of mistakes.

Assumption ID	Assumption Title
ASS-06.01-OSED-AU.0001	Airspace Users will have procedures and means in place to get information about the airspace volume availability in Free Routing Airspace (e.g. ARES)
ASS-06.01-OSED-AU.0002	Airspace Users will have procedures and means in place to get information about the Free Routing Airspace time availability (e.g. Night FRA, FRA closure due to non-nominal situations)
ASS-06.01-OSED-AU.0003	Airspace Users will have procedures and means in place to get information about the flight planning rules in the Free Routing Airspace. They include: • Usable points for flight planning (i.e. published significant points in the airspace, and limited usage of user-defined significant points for speed/level changes only) • Entry/exit conditions (both horizontal and vertical) • Allowed segment lengths (minimum/maximum), if any defined at State level • Applicable ATFCM restrictions when available (e.g. volume-based constraints, FL capping, arrival/departing flows, etc.) • Cross-border operations between different ACCs/FIRs/States when enabled
ASS-06.01-OSED-AU.0004	Airspace Users will plan trajectories in Free Routing Airspace respecting its availability and the applicable flight planning rules
ASS-06.01-OSED-AU.0005	In Free Routing Airspace, Airspace Users will, in the flight planning phase, avoid active ARES unless otherwise specified in the national Aeronautical Information (e.g. ARES for which tactical re-routing is provided in the execution phase)
ASS-06.01-OSED-AU.0006	In Free Routing Airspace, Airspace Users will be allowed to use any available Intermediate point to avoid active ARES in the flight planning phase
ASS-06.01-OSED-AU.0007	In Free Routing Airspace, in case of rejection of a flight plan by IFPS, Airspace Users will manage the final best flight profile optimisation taking into account the information provided by the Network Manager (e.g. reasons for rejection of the flight plan by IFPS, proposal for re-routing to comply with applicable ATFCM)
ASS-06.01-OSED-AU.0008	After any change to the Free Routing Airspace properties, Airspace Users will evaluate the impact of the change sufficiently fast to be able to re-plan the trajectory in the flight planning phase, if deemed beneficial in terms of flight cost efficiency/fuel efficiency.

Assumption ID	Assumption Title
ASS-06.01-OSED-AU.0009	Airspace Users will plan trajectories in Free Routing Airspace respecting the applicable ATFCM restrictions (e.g. volume-based constraints, FL capping) when available.
ASS-06.01-OSED-AU.0010	In Free Routing Airspace, the Airspace Users will update the flight plan information with the required flight plan adjustment at the STAM measure implementation time
ASS-06.01-OSED-AU.0011	During the execution phase, Airspace Users will fly their planned trajectory unless otherwise required to comply with ATC instructions and clearances or to ensure the safety of the flight

Table 12: Assumptions relating to Airspace Users in Targeted Operating Environment

Possible future AU roles and responsibilities (out of scope of PJ.06-01)

In the future, with new Airspace Users capabilities (at flight planning and execution level), it might be possible to accommodate more efficient Free Routing operations including in high and very high complexity environments.

The development of AU/FOC related processes for the management and update of the Shared Business Trajectory to achieve the full integration of FOCs in the ATM Network processes will increase FOCs role with regard to the Trajectory Management in future ATM including in Free Routing environment.

Advanced CPDLC capabilities (and aircraft FMS auto-load capability) to handle LAT,LON clearances in a safe and efficient manner might support unrestricted Free Routing along user-defined (unpublished) points even in high and very high complexity environments.

With new technical capability and procedural means to allow IFR RPAS to comply with ATC instructions, as well as suitable airborne collision avoidance for RPAS, it might be possible to allow for RPAS operations in FRA in upper En-route airspace, and even in lower airspace, of high complexity.

3.2.2.2 Network Management Roles and Responsibilities

The Network Vision for 2020/21 (refer to NM High Level Network Operational Framework [52] for details) is to achieve predictability, punctuality, safety and service continuity. This will be achieved by the following:

- **Free Route Airspace - fully deployed in the upper En-Route airspace**
- Efficient access to airports - high density segregated departure and arrival routes requiring PBN capabilities[8]
- Advanced flexible use of airspace - unused airspace will be made available to either civil or military users
- Network operations (e.g. Target Time Over - TTO) are integrated with local/FAB ops (e.g. AMAN/DMAN) through cooperative traffic management
- Network Safety is addressed with a focus on human aspects
- SWIM enables the sharing of dynamic ATM information to support the European ATM Network
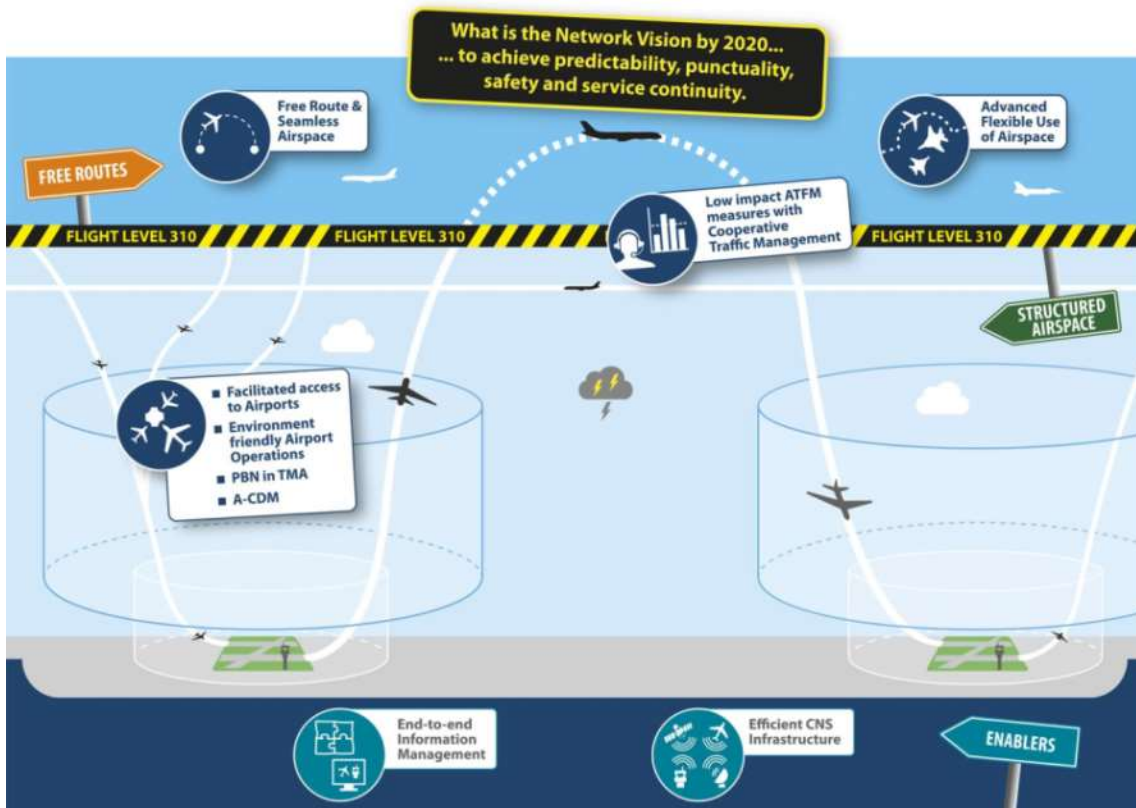
Figure 7: Network Vision by 2020/21 – Source NM High Level Network Operational Framework [52]

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[8] It is worthwhile noting that this requirement does not affect Free Routing operations as there is no mandate for deployment of advanced PBN in En-Route airspace.

Node	NMF Roles and Responsibilities in Targeted Operating Environment
Network Operations	• The objectives of the ATM Network Management Function (NMF) is 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. [40]
Network Management (NM)	• The Network Management (NM) node instance includes all Network Management (NM) activities that are exercised at the regional level. [40] **The Network Manager role and responsibilities are not expected to change in the context of the Solution PJ.06-01.** • As part of its general role and responsibilities, the Network Manager will support the combined operation of Flexible Airspace Management and Free Routing taking into account operational performance requirements addressing both flight efficiency and capacity. • Network Manager will also participate to the evolution of ATFCM from airspace to a trajectory based system, through a Network collaborative management process and towards a Cooperative Traffic Management environment, in order to support efficient Network management in Free Routing environment.

Table 13: NM Roles and Responsibilities in Targeted Operating Environment

Airspace Management (at NM level)

The Airspace Management node is responsible for the airspace organisation and management and the airspace allocation activities. [40]

Short notice reserved/restricted airspace requirement changes will be continuously shared between ASM/ATFCM/ATS partners in a rolling airspace update process, facilitating immediate responses from service providers and airspace users. Real time coordination supported with what-if functionality will support the selection of appropriate responses. Airspace availability will be shared in real time to optimise utilisation of airspace. Traffic synchronisation actions may follow as a result.

The combined operation of Flexible Airspace Management and Free Route will enable airspace users to fly as closely as possible to their preferred trajectory without being constrained by fixed airspace structures or the fixed route network. It will further allow operations that require segregation, for example military training, to take place safely and flexibly, and with minimum impact on other airspace users. This improvement of airspace utilisation will be obtained through flexibility in airspace organisation and design plus flexibility and dynamicity in airspace management. This will be facilitated by the widespread implementation of Variable Profile Areas (VPAs) and possibly Dynamic Mobile Areas (DMAs), ensuring full flexibility and dynamicity to accommodate military requests while minimising the impact on traffic flows.

The combination of ATC sectors and flexible ARES in a FRA environment will constitute the basic elements of so called Dynamic Airspace Configurations[9] that aim to accommodate specific civil and military demand requirements through synchronised agreements. Airspace configurations are dynamically adapted to the traffic demand and military exercises in order to respond to any AUs performance needs, for example by enabling AUs to benefit from capacity opportunities as soon as they become available.

Operational performance requirements addressing both flight efficiency and capacity will be taken as an input. Meeting the diversity of user requirements requires effective and dynamic management of the pre-designed airspace configurations through a highly flexible and integrated Collaborative Decision Making (CDM) process at Network, sub-regional, national and local level. The effective and dynamic management will be addressed through an integrated dynamic airspace configurations process, supported by appropriate ATS/ASM/ATFCM procedures. Between ATM actors real time airspace status data will be exchanged and provide the basis for ASM/ATFCM planning, updating and fine-tuning.

Air Traffic Flow and Capacity Management (at NM level)

The Traffic Flow and Capacity Management (ATFCM) node is responsible for the demand and capacity balancing activities. [40]

ATFCM through a Network collaborative management

ATFCM through a Network collaborative management process will improve the European ATM network performance by improving capacity and flight efficiency through the exchange, modification and management of trajectory information.

In the airspace and airport planning process, stakeholders will aim at meeting the Airspace Users (AUs) business needs by providing capacity on a proactive and dynamic basis, delivering where and when it is needed while at the same time ensuring flight efficiency based on expected demand.

Through the Network Operations Plan (NOP) a focus will be maintained on planning and the implementation of improvement delivery of required en-route and airport capacity. This will be a rolling process, through continuous assessment of performance and the identification of improvement and/or mitigation actions. Potential bottlenecks will be identified early on and with sufficient accuracy to enable efficient resource allocation where available. The coordination of measures required to solve the remaining demand/capacity imbalances can be initiated to ensure minimum impact. While

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[9] Although useful to support more efficient use of airspace and facilitate free routing operations and considering the targeted timeframe (of end of 2026), advanced DAC (like dynamic sectors or DMAs) are out of the scope of the Solution PJ.06-01.

planned major ATM transition projects are coordinated well in advance across the network to ensure synchronised deployments.

While a more dynamic, transparent and efficient airspace planning process involving AUs and local ATSUs will be established; the Network Manager Operations Centre (NMOC) will collaboratively address the overall network stability and efficiency plus take the necessary actions to optimise overall network performance.

The timely sharing of dynamic operational data by ANSPs will improve predictability of sector capacities and contribute to improved capacity and flight efficiency coordination processes in the network and improve the effective application of measures.

High level network operational performance targets will be cascaded down geographically (regionally, sub-regionally and locally) and/or periodically orientated (yearly, monthly, weekly, daily) to a workable operational level.

The Network and its operational stakeholders will have to ensure:

- the timely development of operational plans and their coordination at Network level
- performance analysis resulting in improved capacity (e.g. at weekends, sector configurations, airport capacity values, traffic peaks, route restrictions, areas of responsibility);
- Recommend measures and improve transparency to better manage critical events (e.g. low visibility at airports, temporary airspace closures etc.)

Towards ATFCM in a Cooperative Traffic Management environment

Flow management will move towards a Cooperative Traffic Management environment, optimising the delivery of traffic into sectors and the need for ATFCM.

The Network capacity monitoring process will take into account new indicators and threshold values related to complexity and workload. This will require en-route and airport capacities to be updated in real time.

The Network planning processes will be continuous, sharing the latest updated data to all users (requiring interoperability between ASM, ATFCM and ATS). Network actors will link their own processes (continuous or snapshot) to the network processes supported by a SWIM compliant infrastructure. Flight information exchanged during the pre-tactical and tactical phases by ATC systems and the NMOC will support the predictability of network events and their impact, reduce uncertainty and thereby improve operational performance.

In the planning phase, to efficiently use resources, an optimal plan of sectors and airspace restrictions/reservations will be updated on a timely basis to balance with demand and achieve the most optimum airspace configuration.

Clear organisational processes will be established to deal with unplanned major events and/or significant reduced operations (applicable to local and Pan-European disruptions, but also to global

disruption or out of area disruption having an impact on the Pan-European Network). Depending on the nature of the situation the normal ATFM toolbox and rules can be extended, including adapted prioritisation rules, buffers and new what-if applications etc.

The tactical ATFM phase will be improved by the accuracy of the traffic demand management by including OAT information, comparing ICAO FPL flight planning information with the flight intention information, incorporating the AUs trajectories, shared resolution of detected inconsistencies and by increasing instances of airports passing departure and arrival planning information until commencement of flight.

Trajectory-based ATFCM in Free Routing Airspace of high and very high complexity

Against the general background of the enhanced ATFCM environment described above, in high complexity airspace the full implementation of FRA could potentially have a detrimental effect on capacity. In such airspace, States, FABs or ANSPs may decide to implement FRA on a structurally limited basis (see Table 9 for further details). This would increase predictability and reduce the number of potential conflicts.

With the implementation of FRA there are a number of issues relating to the application of ATFCM when changing from airspace to a trajectory based system:

- Traffic Demand Forecast: the increased flight planning freedom provided to AUs through FRA operations, may lead to greater uncertainty in Traffic Forecast accuracy and an impact on Demand Capacity Balancing (DCB) efficiency.
- Flight proposals: mitigation against higher Traffic Forecast volatility improved sharing of flight intentions -> improved access for AUs to the CDM dialogue in the DCB processes
- Hotspot identification: Points and Flows (segment of route) cannot be used as reference location in FRA
- Some DCB Measures: Primarily based on a fixed-route structure cannot be used in FRA for rerouting measures

The above issues may be mitigated in a high and very high complexity environments where their impact may be significantly reduced by the implementation of "structurally limited" FRA as described above. In 2021 RAD and EU restrictions will continue to be the major method to manage constraints, in such a structured environment.

Beyond 2021 the evolution of ATFCM from the application of restriction on fixes will have to be based on flows in FRA. Reference locations will have to change to become more sophisticated to influence FRA traffic and will include airspace borders and possibly gates. The publication of these restrictions to users will need to be reviewed and probably be on an electronic basis. Considering the targeted timeframe (of end of 2026), such ATFCM evolutions are not envisaged in the context of the Solution PJ.06-01.

Assumptions related to NM roles and responsibilities (in the scope of PJ.06-01)

The following assumptions are made regarding the Network Manager operations in Free Routing environment in the context of the Solution PJ.06-01.

Assumption ID	Assumption Title
ASS-06.01-OSED-NM.0001	In addition to normal SBT validation rules, the Network Manager will invalidate (suspend or reject) planned route inside a FRA if it: • Fails to comply with flight planning rules (e.g. published entry/exit requirements, min/max segment length, usable points) • Fails to comply with airspace time and volume availability (e.g. active ARES, volume-based ATFCM constraints)
ASS-06.01-OSED-NM.0002	In Free Routing Airspace, in case of rejection of a flight plan by IFPS, NM will provide the reason of the rejection
ASS-06.01-OSED-NM.0003	In Free Routing Airspace, the reason of IFPS rejection of flight plan will be understandable, machine readable and manageable by the Airspace Users (e.g. volume to be avoided)
ASS-06.01-OSED-NM.0004	In Free Routing Airspace, in case of rejection of a flight plan by IFPS, NM may provide a proposal of re-routing to the Airspace Users in a timely manner
ASS-06.01-OSED-NM.0005	NOP will contain the latest updated information on all planned and actual available airspace in Free Routing Airspace
ASS-06.01-OSED-NM.0006	NOP information will contain the actual sector volumes together with hotspot identification in Free Routing Airspace
ASS-06.01-OSED-NM.0007	NOP information will contain the exclusion zones inside Free Routing Airspace together with their specification
ASS-06.01-OSED-NM.0008	NOP information will contain the latest updated information on all DCB measures – planned and actual ones in Free Routing Airspace
ASS-06.01-OSED-NM.0009	A rerouting option may be proposed to Airspace Users by the Network Manager in case of a Flight Plan being affected by a regulation in Free Routing Airspace
ASS-06.01-OSED-NM.0010	In Free Routing Airspace, the Network Manager will update the flight plan according to the required departure time modification on behalf of the concerned Airspace User implementation time where time shift based ATFCM measures are concerned

Table 14: Assumptions relating to Network Manager in Targeted Operating Environment

Refer to 'Free Route Airspace (FRA) Application in NMOC – Guidelines' [43] for further details about NMOC FRA processing systems.

Possible future NM roles and responsibilities (out of the scope of PJ.06-01)

In the future, with more advanced Network Management capabilities, it might be possible to accommodate more efficient Free Routing operations including in high and very high complexity environments.

With the management of dynamic airspace configuration in future environment, a seamless and coordinated approach to airspace configuration, from planning to execution phases, will allow the Network to continuously adapt to demand pattern changes notably in Free Routing environment.

The development of Collaborative Trajectory Management with increased integration of FOCs in the ATM Network processes and enhanced management of AUs' fleet prioritisation and preferences will allow to better accommodate individual AUs' business needs and priorities without compromising optimum ATM system outcome and the performances of all stakeholders, including in capacity-constrained situations.

Improved prediction of DCB constraints and complexity issues will improve the accuracy and credibility of the diagnosis and awareness of hotspots at Network level. Such developments will have to accommodate the possible variability of the traffic demand in Free Routing environment.

3.2.2.3 Integrated Network Management and Extended ATC Planning (at ATSU level)

The scope of the INAP function is to address the overlapping period where the Network Management Function runs DCB and dynamic DCB[10] processes at all geographical levels, ATC planning starts preparing early strategic de-confliction and conflict detection within the appropriate look ahead time horizon and within its defined local area of responsibility. [40]

At the INAP level, the roles and responsibilities of the Local Traffic Manager (LTM) and of the Extended ATC Planner (EAP) are not expected to change in the context of the Solution PJ.06-01.

Node	INAP Roles and Responsibilities in Targeted Operating Environment
Integrated Network Management and	• Local Air Traffic Service Units (ATSUs) plans will show more dynamicity through modular and flexible sectorisation and by taking into account basic complexity indicators based on specific forms of demand, network flight efficiency needs and ATC capabilities, all in addition to the current capacity processes.

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[10] Dynamic DCB corresponds to the management of demand and capacity imbalances (through dynamic DCB measure, dynamic airspace management or crisis event management) during execution phase.

Node	INAP Roles and Responsibilities in Targeted Operating Environment
Extended ATC Planning	• In addition, adjacent ACCs will agree and apply cooperative over-the-horizon traffic management and coordination procedures with greater emphasis on resolving issues before they materialise. This will be achieved through traffic demand adaptations that reduce the dependency on downstream reactive controller workload. By identifying hotspots (overloads/conflicts) based on complexity and occupancy values, local measures will be cooperatively decided on to prevent a negative impact on downstream controller workload (e.g. Short Term ATFCM Measures - STAM). These measures could be traditional measures but also more fine-tuned and targeted to optimise complexity/workload. The application of a measure will take into consideration the expected network effect, including the interface with airports. • Trajectory modifications for flight efficiency purposes will be beneficial to AUs and without negative impact to downstream operations. • In order to be fully efficient, the local DCB actors should be able to appreciate difficulties that the traffic situation could generate from a controller point of view that is why the EAP function should be done by staff holding an ATCO rating in the concerned ATSU's airspace. This EAP position can either be collapsed with LTM, or regarding the expected traffic, be insured by a specific EAP specialist (when needed). The EAP is indeed not systematically an additional staff; it is a role which covers a set of services/ functions and which can be assumed by different already existing actors (like MSP or LTM). Performing this function requires actors to have local expertise and the way it will be implemented (procedures, detailed activities, actors involved ...) will vary dependent upon local drivers.

Table 15: INAP Roles and Responsibilities in Targeted Operating Environment

Assumptions related to INAP roles and responsibilities (in the scope of PJ.06-01)

The following assumptions are made regarding the INAP actor(s) in Free Routing environment in the context of the Solution PJ.06-01.

Assumption ID	Assumption Title
ASS-06.01-OSED-INAP.0001	The INAP function may be an option for less structurally limited Free Routing Airspace
ASS-06.01-OSED-INAP.0002	Where considered relevant to be implemented by local ANSPs, the INAP actor(s) will support complex hotspot management in Free Routing Airspace

Assumption ID	Assumption Title
ASS-06.01-OSED-INAP.0003	Where considered relevant to be implemented by local ANSPs, the INAP actor(s) will support strategic deconfliction of flights in Free Routing Airspace
ASS-06.01-OSED-INAP.0004	Where considered relevant to be implemented by local ANSPs, the INAP actor(s) will apply dDCB measures and STAM during short-term planning to execution phase in Free Routing Airspace
ASS-06.01-OSED-INAP.0005	Where considered relevant to be implemented by local ANSPs, the INAP actor(s) will implement de-complexification measures (at local level) whenever early resolution brings operational benefits compared to baseline dDCB solutions

Table 16: Assumptions relating to INAP in Targeted Operating Environment

Possible future roles and responsibilities (out of the scope of PJ.06-01)

In the future, with more advanced INAP functions, it might be possible to accommodate more efficient Free Routing operations particularly in high and very high complexity environments.

Integrated Local DCB Processes are notably foreseen as valuable concept options to improve Air Traffic Flow Management and Complexity Management at local Network level in Free Routing Airspace.

3.2.2.4 En-route ATC Sector Roles and Responsibilities

Below is a summary of the relevant ATS Operations Node (as described in the applicable version of EATMA – see Table 17).

Node	Responsibilities
En-Route/Approach ATS	Performs all the en-route and approach ATS operations. [RELATED ACTORS/ROLES] Executive controller, planning controller, etc.

Operational interactions per context (NOV-2)	Operating Environment	
[NOV-2] Separation Assurance in cross-border FRA	High Complexity; Very High Complexity;	
Node	Node instance	Node instance description
En-Route/Approach ATS	Downstream En-Route ATS Unit	Adjacent En-route ATS Unit downstream to En-route ATS Unit in FRA

En-Route/Approach ATS	En-Route ATS Unit	En-route ATS Unit of cross-border Free Routing Airspace
En-Route/Approach ATS	Neighbour En-Route ATS Unit	Neighbour En-route ATS Unit
En-Route/Approach ATS	Upstream En-Route ATS Unit	Adjacent En-route ATS Unit upstream to En-route ATS Unit in FRA

Table 17: En-Route/Approach ATS Node and Responsibilities

According to EATMA definition of the ATS Operations node, "*Air traffic service (ATS) include variously, flight information service, alerting service, air traffic advisory service, air traffic control service (area control service, approach control service or aerodrome control service). Air Traffic control service is provided for the purpose of preventing collisions between aircraft, and on the manoeuvring area between aircraft and obstructions. Furthermore it's provided for expediting and maintaining an orderly flow of air traffic. (based on ICAO Doc 4444)*". [40]

En-Route ATC Sector roles and responsibilities (in the scope of PJ.06-01)

At ATC sector level, the Planning Controller and Executive Controller roles and responsibilities (as described in the applicable version of EATMA – see Table 18) are not expected to change at the targeted timeframe of the Solution PJ.06-01.

Disclaimer: In the applicable version of EATMA [40], there is sometimes a mix between ATC Roles (e.g. ATC Sector Planning Control and Tactical Control) and Actors (e.g. Air Traffic Controllers at ATC sector levels). To better accommodate various ATC sector team organisation and task sharing (between the Planning and Executive Controllers) notably in case of ACC configuration with advanced ATC support tools (like electronic coordination), it might be worthwhile to update the EATMA modelling of ATC Sector Roles and Responsibilities. However, such update goes beyond the scope of PJ06-01 Solution (as not directly linked to Free Routing operations). It is recommended that PJ.19-02 amends, as necessary, the description of the ATC Sector roles in coordination with all relevant Solutions and taken into account the changes proposed hereafter.

Actors/Roles[11]	Responsibilities
ATC Sector Planning Controller[12]	The ATC Sector Planning Controller is mainly responsible for planning and coordination of the traffic entering, exiting or existing within the ATC Sector.
	Furthermore, it provides tactical flight control assistance to the ATC Sector Executive role.
	Responsibilities
	The responsibilities of ATC Sector Planning are to: - Co-ordinate entry and exit conditions[13]. · Resolve boundary problems by re-coordination · Provide early conflict detection and resolution (depending on the Conflict Detection and Resolution tools horizon) if this early resolution brings operational benefit (either on the ground side or the airborne side) · Check flight-plans/iRBT/iRMTs for possible conflicts and complexity issues within its area of responsibility. · Plan conflict-free flight path through its area of responsibility. · Coordinate with the ATC Sector Executive role about planned conflict solution strategies based on system derived solution proposals

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[11] To be agnostic on task sharing arrangements within the ATC sector teams, it is proposed to replace 'ATC Sector Planning Controller' and 'ATC Sector Executive Controller' respectively by 'ATC Sector Planning role' and 'ATC Sector Tactical role'. Both roles have to be linked to En-Route and Approach ACC Capability Configurations. This is not the case of the 'ATC Sector Planning Controller' role, which is only linked to Approach ACC Capability Configuration in the current version current of EATMA.

[12] It also exist an 'ATC Planning Role' linked only to En-Route ACC Capability Configuration, which description is very similar to the 'ATC Sector Planning Controller' role with some additions for the provision of early conflict detection and resolution (though the use of Controlled Time Over constraints) if this early resolution brings operational benefit (either on the ground side or the airborne side). This 'ATC Planning Role' goes beyond the scope of the expected ATC Controllers responsibility in the scope of the Solution PJ.06-01.

[13] More generally, the ATC Sector Planning responsibility is to 'Analyse flights entry/exit conditions into the sector, depending on Air Traffic situation and in compliance with letters of agreement, internal procedures or coordination exceptions (in compliance with Air Regulations)', and when something has to be changed to 'Co-ordinate entry and exist conditions'.

Actors/Roles[11]	Responsibilities
	· Implement solution strategies by communicating trajectory changes to the aircraft through the concerned ATC Sector Executive role via Data Link[14]. - In coordination with the ATC Supervisory or Local Traffic Management roles determine the need for additional Executive Controller(s)[15] in the case where forecast overload situations are developing. · Input tactical trajectory changes into the Flight Data Processing System when delegated by the Executive Controller. · Co-ordinate with adjacent control areas/sectors for the delegation of airspace or aircraft
ATC Sector Executive Controller	The ATC Executive Controller has responsibility for traffic management within the sector/AoR and for the tactical tasks.
	He is responsible for the safe and expeditious flow of all flights operating within its area of responsibility. Its principal tasks are, compliance with the ICAO Rules of the Air, other relevant ICAO (e.g. Doc. 4444) and European/National provisions to separate known flights operating within its area of responsibility and to issue instructions to pilots for conflict resolution and segregated airspace circumnavigation. Additionally, he monitors the trajectories (4D and 3D) of aircraft, according to the clearance they have received. The responsibilities of the ATC Sector Executive role are focused on the traffic situation, as displayed at the Controller Working Position (CWP), and are very much related to task sharing arrangements within the sector team.
	Responsibilities
	ATC Executive main responsibilities are: - Identify conflict risks between aircraft - Provide separation between controlled flights - Provide sequencing between controlled flights - Provide flight information to all known flights

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[14] More precisely, communicating trajectory changes to aircraft could be done through the ATC Sector Executive role via Data-Link or R/T.

[15] More generally, the need is for additional Air Traffic Controllers in case of ATC sector(s) split, i.e. need for Executive Controller(s), and possibly Planning Controller(s) unless the overload situations develop in a Multi-Sector Planning configuration.

Actors/Roles[11]	Responsibilities
	- Provide information on observed but unknown flights that may constitute traffic for known aircraft - Monitor flights regarding adherence to flight plan/RBT - Monitor the air situation picture[16] · Communicate with pilots by means of R/T or data link · Monitor information on airspace status, e.g. activation/ deactivation of segregated/reserved airspace · Input data into the flight data processing system regarding tactical route modification, modification of flight level etc · Monitor the weather situation · Relay to pilots SIGMETS that may affect the route of a flight · Re-route flights to avoid bad weather areas Monitor aircraft equipment status according to information provided by the system - Co-ordinate with Planning Controller or EAP (inter-sector co-ordination) and adjacent centre/sector Executive Controllers[17] - Co-ordinate with Planning Controller or EAP (inter-sector co-ordination) and adjacent centre/sector Executive Controllers · Coordinate with the Planning Controller about planned conflict solution strategies based on system derived solution proposals · Coordinate the implementation of system derived conflict solutions with the Planning Controller · Coordinate with the ACC Supervisor role or LTM role in order to determine actions to be taken in case non forecast overload situations are developing (inclusive sector split) · Handle flight-information [18]

[16] More precisely, the ATC Sector Planning responsibility is to 'Monitor the air traffic situation' (as other aspects of the air picture like airspace status, weather, etc. are mentioned separately under other responsibilities).

[17] More precisely, the ATC Sector Executive responsibility is to 'Perform tactical coordination (short term) with concerned adjacent sectors' and if required 'Negotiate transfers under radar separation in entry or exit of sector'.

[18] Among others the ATC Executive Control responsibility is to 'Take into account as much as possible pilots requests to optimize the flights trajectories, even if flight safety will remain the absolute priority' and also to give appropriate consideration to planned/desired flight profile to 'Facilitate adherence of RBT/RMT (and associated constraints)'.

Actors/Roles[11]	Responsibilities
	· Apply appropriate separation to all controlled flights departing his area of jurisdiction · Transfer control of aircraft to the appropriate Executive Controller when clear of traffic within his area of jurisdiction - Assign specified headings, speeds and levels suitable for the planned approach · Inform pilots about the intended approach procedures and determine (if not done by arrival management systems) the approach sequence · Issue approach and, if necessary, holding instructions · Issue approach clearance · He provides Alerting Service (ALRS) to all known flights according to the following three different phases (INCERFA,ALERFA,DETRESFA) Changes in Responsibilities · Monitor flights regarding adherence to flight plan (i.e. agreed UP 4D trajectory) · Communicate with Flight Crews by means of R/T or data link · Co-ordinate with Planning Controller or EAP (inter-sector co-ordination) and adjacent centre/sector Executive Controllers

Table 18: ATC Sector Planning Controller and Executive Controller Roles and Responsibilities

Air Traffic Control and Network operations

In relation to business trajectory development, the flight plan data set will be extended (EFPL) with the aim to facilitate the implementation of the planned trajectory in the operational phase – meaning that the aircraft FPL adherence is facilitated by ATC. In specific areas special attention by ATC will be given to flights subject to downstream constraints, to ensure that targeted measures established in the planning phase, are respected. Trajectory modifications will be implemented in the execution phase for separation purposes and in the event of a particular contingency.

ATC will support Network operations optimisation by facilitating the coordinated targeted measures (4D time, route, level) through adherence to the agreed business/mission trajectory and will anticipate opportunities for airspace users when and where possible, based on cooperative traffic management procedures in coordination with relevant ACCs, FOCs/WOCs and with the NMOC.

ATC will ensure efficient flows of traffic by facilitating trajectories optimised during the planning phase while maintaining the required level of safety.

Enhanced ATC support tools

To perform their operational activities in a safe and efficient manner in Free Routing Airspace of high or very high complexity, ATCOs will need to be assisted by enhanced ATC support tools that allow managing coordination of flights outside named Co-Ordination Points (COP), providing aircraft-to-aircraft separation and managing conflict with airspace reservations taking into account airspace status and flight information within the Area of Interest (AoI) of the sector.

(cf. New ATC Sector Planning and Tactical operating methods in the scope of the Solution PJ.06-01 in section 3.3.2)

Possible future ATC roles and responsibilities (out of the scope of PJ.06-01)

In the future, with more advanced ATM capabilities beyond the scope of Solution PJ.06-01, it might be possible to better accommodate unconstrained Free Routing operations.

Within flight-centred ATC, a controller is responsible for a certain number of aircraft throughout their flight segment within a given airspace, independent of current sector boundaries. The nowadays known sector boundaries are going to be to dissolve. Such environment might facilitate Free Routing operations in En-route airspace in the future.

3.2.3 Technical Characteristics

3.2.3.1 AU Operations Support Capabilities

The fundamental technical characteristics of the Airspace Users Operation Support systems in the context of the Solution PJ.06-01 are summarised in Table 19.

Node	AU Ops Support Systems in Targeted Operating Environment
FOC	• Flight planning systems capable to plan in FRA areas (including using Extended FPL in the context of the Solution PJ.06-01, and possibly an evolution of ICAO/FF ICE standard in future operating environment)
WOC	• Flight planning systems capable to plan in FRA areas

Table 19: AU Ops Support Systems in Targeted Operating Environment

3.2.3.2 Network Manager Capabilities

The technical characteristics of the Network Manager Operating Center (NMOC) systems in the context of the Solution PJ.06-01 are summarised in Table 20.

Node	NMOC Systems in Targeted Operating Environment
ASM	• Enhanced B2B, SWIM, Rolling EAUP/EUUP, New ASM interface replacing CIAM and NOP Portal in n-CONECT, Enhanced CACD, Enhanced simulation capability for a more effective Network Impact Assessment (NIA)
ATFCM	• Integrated initial Flight Plan Processing System (IFPS) capable to process flight plans in FRA areas (see [43] for further details) • Enhanced B2B, SWIM, n-CONECT, enhanced ETFMS – TT capability, Enhanced CACD

Table 20: Network Manager Systems in Targeted Operating Environment

3.2.3.3 En-Route ACC Capabilities

The result of some past studies reported that in FRA the controller workload per flight is basically increased. Thus, and more particularly in high and very high complexity environments, all the involved actors in Free Routing operations will have to cope with a trade-off between flight efficiency and capacity. En-Route ACCs need specific ATC tools and capabilities in targeted Operating Environment in order to mitigate the possible loss of capacity induced by FRA, taking into account that no change in separation minima is needed in relation to Free Routing operations in En-Route airspace.

According to the Commission Implementing Regulation (EU No 716/2014) for free route (section 3.1.2): "*ATC systems shall implement the following:*

— Flight data processing system, including HMI, to manage trajectory/flight planning without reference to the fixed ATS network
— Flight planning systems to support FRA and cross-border operations
— ASM/ATFCM to manage FRA
— for FRA, Medium Term Conflict Detection (MTCD) including Conflict Detection Tools (CDT), Conflict Resolution Assistant (CORA), Conformance Monitoring, and APW for dynamic airspace volumes/sectors; Trajectory prediction and de-confliction shall support an automated MTCD tool adapted to operate in FRA airspace and, when required, on DCT

— Flight Data Processing System (FDPS) shall support FRA, DCT and A-FUA

— The controller working position shall support the operating environments, as appropriate"

Definition of Operational Areas

Regarding flight data processing in ATC systems in FRA, and particularly in support to large scale FRA across ACC/FIR borders, it is relevant to define a number of areas that govern the distribution of flight plans and the responsibilities of the flights under control:

- The Area of Responsibility (AoR). The AoR is the volume of airspace (geographical area and altitude limits) for which the FDPS is responsible, i.e. in which the flights are under air traffic control of one of the ATSUs supported by the FDPS.
- The Area of Interest (AoI). The AoI is a volumetric extension (geographical area and altitude limits) of the AoR of an ATSU. The AoI has no real link or impact on coordination and transfer but allows identifying an ATSU interested in receiving information for a flight which is planned to enter in its AoI even if that flight does not intent to go through its AoR (controller's situation awareness purposes). There are as many AoI as there are ATSUs. An AoI is conditioned by the need of tactical control, i.e. capability of controllers to integrate mentally the traffic, and/or by application of specific rules based on traffic flows.
- Free Routing Airspace (FRA) Area. The FRA is the volume of airspace in which the free routing operations are allowed. The FRA Area is the sum of the FDPS AoRs.

The figure below illustrates the different geographical scopes. It is only an example to illustrate the possible larger scope of the AoI compared to the AoR at FDPS level. It should be noted that the AoI is not a fixed volume around the AoR, but rather an extended volume beyond the AoR which boundaries are defined to fit the operational needs at ATSU's level.
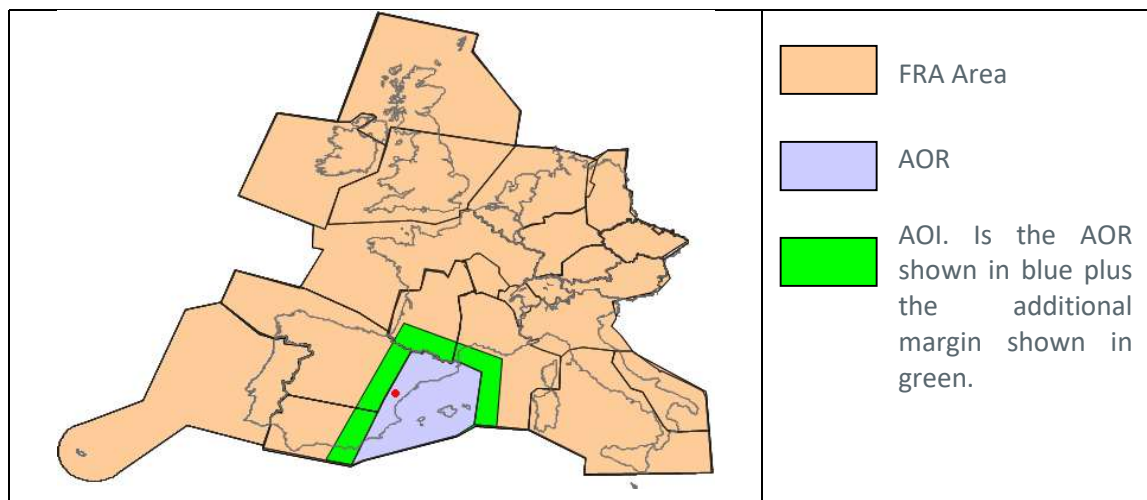
Figure 8: Illustration of FRA and related AOR / AOI - Source SESAR, 04.07.02 D37 Free Route OSED

On the Controller Working Position (CWP), different flight presentation rules could be applied to each sector (adaptation), i.e. a flight could be displayed for an adapted time/distance before AoR (or AoI) entry; or after AoR (or AoI) exit. So, from the ATCO's perspective, there is a "virtual area of interest" parameterized if needed.

There are different cases when or where traffic need to be presented to the ATCO. These cases can be summarised in following categories:

- **Traffic entering the sector**. These flights need to be presented quite early before entry. The time/distance for presentation could need to be set by parameters (adaptation). This is valid for both horizontal and vertical entries.
- **Traffic leaving the sector.** These flights do not need to be presented for a long time/distance after leaving the sector. The time/distance for presentation could need to be set by parameters (adaptation). This is valid for both horizontal and vertical exits.

- **Traffic flying close to the sector.** In some cases it might be of interest to present flights flying inside the AoI but not the AoR of a sector. Presentation of these flights could need to be set by parameters (adaptation). Note: Presentation in this context means that concerned flights can be distinguished from other flights without manual intervention from the ATCO.

Applicable separation minima

Separation minima between aircraft are expected to continue to be based on guidance, regulations, and factors used in today's environment (ICAO Doc 4444 Procedures for Air Traffic Management, especially Chapter 5). The following criteria will be considered:

- Vertical separation minimum (VSM) will be 2,000 feet at or above FL310, except as provided for in within designated airspace (RVSM), subject to a regional air navigation agreement:
  - o 1,000 feet at or above FL310, and below FL410.
  - o 2,000 feet at or above FL410.

- Horizontal separation: En Route Radar separation minimum of 5 NM.

The radar separation standard may not be constant throughout the En-route sectors. Different separation minima might be required, e.g.:

- A non-RVSM flight that is authorized to fly within an RVSM airspace remains subject to the separation minimum (of 2,000ft) that is applicable above the RVSM limit in a non-RVSM airspace;
- At the edges of multi-radar coverage or in the case of a reduction in radar service where the radar separation minimum may be increased up to 10 NM;
- The TMA sectors that interface the lower En-route sectors may be operating a lower radar separation minimum (procedures ensure that the separation is established prior to transfer of control in this case).

Also the separation minima between aircraft and a reserved area may not be homogeneous throughout the En-route airspace. Therefore the choice of separation standard is made on a case-by-case basis depending on both the pair of elements to assess and the airspace where the separation is assessed, and it may not be homogeneous throughout the whole controlled sector, so it will be able to be configured in all the ATC conflict detection and resolution support tools.

En-Route ATC support tools

Free-Routing operations will impact traffic patterns and possibly complexity at sector/ACC level, so it requires appropriate support system and tools to maintain sector capacity without a detrimental effect on safety, the following control support tools will be considered.

Technical Systems / Functional Blocks	En-Route ACC Systems in Targeted Operating Environment
Local Traffic Complexity Management (LTCM) [19]	Where implemented, the Local Traffic Complexity Management (LTCM) system will support the LTM/local DCB actors in managing traffic complexity in Free Routing Airspace (e.g. monitoring of Traffic Volume (TV) complexity, predicted Intruders on all potential TV, flight data related to a given TV, time range, hotspot or any complexity indicator, display of predicted air situation, etc.)
Flight Plan - Lifecycle Mgt - Data Distribution (FPLD)	Flight Data Processor (FDP) will use 4D trajectories to support free routing beyond each FIR AoI, including corresponding AoR, or each Functional Airspace Block (FAB), defined into the Free Routing Area (FRA). Flight Planning Management (embedded into FDP) will process advanced flight information (Extended Flight Plan[20]) including flight preferences and priorities and additional elements that are defined in the context of ICAO/FF-ICE standard evolutions.

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[19] Although essential to improve Free Routing operations from the ANSP perspective, improvements related Local Traffic Complexity Management (NIMS-37) are out of scope of the Solution PJ.06-01.

[20] Although essential to improve Free Routing operations from the Airspace User perspective, Initial Flight Planning management enhanced to support 4D (Enabler NIMS-21a) is out of scope of the Solution PJ.06-01 which is focused on Air Traffic Services.

Technical Systems / Functional Blocks	En-Route ACC Systems in Targeted Operating Environment
Coordination & Transfer (C&T)	System supported electronic coordination will be of prime importance in Free Routing Airspace as coordination actions will be made more difficult by high variability of trajectories and the lack of mandatory coordination points. Advanced coordination/conflict detection tools using Ground-Ground Interoperability mechanism (e.g. OLDI or G-G IOP) should support ATC in managing seamless free routing operations. The automatic exchange of flight data between ACCs/UACs will need to consider the possibility of transfer at random points. This would be facilitated by exchange of FPL field 15 (via OLDI) or through the optional use of G-G IOP[21]. However, G-G IOP capabilities are not considered as necessarily part of the targeted operating environment of the Solution PJ.06-01.
Conflict Management (CONF)	To be able to handle traffic in a safe and efficient manner in FRA of high or very high complexity, ATCOs are going to need a tool set to detect and solve conflicts. These tools could be embedded into Control Working Position (CWP) for a better and faster usage by ATCOs. At least, the following tools will be considered: • 4D graphical trajectory presentation. Horizontal trajectory and vertical profile will be displayed onto the CWP (together or in different panels). The presentation of estimated time over "interest" point is necessary (e.g. AoR cross borders, AoI cross borders, fix points if DCTs are defined into the planning route, route LAT/LON points defined by user (if allowed in the airspace), etc.). • Conflict Detection Tools (CDT). Because of possible long range segments, the conflicts detection algorithms will have to consider long segments as portions of Great Circles. • CDT for Planning Control: ATCOs need support to negotiate conflict-free coordination conditions, including mid-term detection of conflicts for traffic entering / leaving or within their ATC sectors of interest. So this is an important tool for the Planner Controller, but it can also be used by the Tactical Controller.

[21] Although relevant to improve Free Routing operations in cross-border environment, ATC-to ATC Flight Data Exchange using the Flight Object (ER APP ATC 160) is out of scope of the Solution PJ.06-01. Indeed, the use of G-G IOP is not the only option in order to improve ATC to ATC flight data exchange in a cross-border Free Routing environment. An alternative is to increase the number of used OLDI messages in order to create an extended Area of Interest for ATC tools.

Technical Systems / Functional Blocks	En-Route ACC Systems in Targeted Operating Environment
	CDT for Tactical Control. ATCOs also need to know every conflict detected as consequence of tactical actions (i.e. headings, directs or route modifications, CFL, etc.), performed over assumed flights, against the rest of the flight inside an adapted time interval (time configured by user). This is a necessary tool for Tactical controllers. **Minimal Predicted Separation tool.** To visualize the minimal horizontal distance between two aircraft on their planned trajectories. **What-if and/or What-else tools.** Every time an ATCO issues a clearance or gives a tactical instruction to a flight, a potential conflict could be raised (or several), so What-if tools is necessary to detect possible conflicts induced by ATC and What-else is a useful support tool to determine conflict-free clearances or instructions. In the same way, all actions over the flight plan route could raise conflicts (also called "risks") against other flights in a long time range, so What-if what-else tools are important for ATCOs to plan possible changes over the flights. Both tools can be used by TC and/or PC. It may also happen that some current CD/R tools for the PC in a Fixed Routes environment are limited to detect conflicting entry/exit sequences, leaving the TC with the crossing conflicts. In Free Route operations across ACC/FIR borders where conflicts may occur arbitrarily close to the sector boundaries, the CD/R Tools for the PC will have to take into account all kind of conflicts and not only sequencing issues.
Monitoring Aids (MONA)	The MONA help controllers to reduce the workload associated with traffic monitoring tasks by providing warnings if aircraft deviate from a clearance or plan and reminders of instructions to be issued and providing conformance monitoring triggering trajectory re-calculation essential for the CDT.
Safety Nets (SNET)	Ground-based safety nets will be of prime importance in Free Routing Airspace as the last ATC barriers against collision / airspace infringement hazards. **Short-Term Conflict Alert (STCA)** is a ground-based safety net intended to assist the controller in preventing collision between aircraft by generating, in a timely manner, an alert of a potential or actual infringement of separation minima. The purpose of STCA is to detect and alert "operationally relevant conflict" involving at least one "eligible aircraft" with "sufficient warning time" for the controller to intervene and the aircraft to execute an appropriate

Technical Systems / Functional Blocks	En-Route ACC Systems in Targeted Operating Environment
	manoeuvre. STCA parameters setting might require being adapted in order to better fit this purpose in Free Route environment.
	• Area Proximity Warning (APW) is a ground-based safety net intended to warn the controller about unauthorized penetration of an airspace volume by generating, in a timely manner, an alert of a potential or actual infringement of the required spacing to that airspace volume, which require attention/action. APW is intended to function in the short term, if applicable providing warning times of up to 2 minutes, and to contribute in a significant way to the prevention of accidents arising from unauthorized penetration of an airspace volume, e.g. active ARES.

Table 21: En-Route ACC Systems in Targeted Operating Environment

Interoperability principles for Flight Data Processing

An initial description of interoperability principles for ATC system and control support tools in Free Routing in cross-border environment is provided in the table below. These principles will be refined in a future version of the SPR-INTEROP / OSED document.

#	Interoperability principles for Flight Data Processing
#1	Common view of the trajectory within overlapping AoIs
#2	Requesting of frequency between sectors
#3	Requesting traffic skipping sectors
#4	To receive coordination proposals from other ACCs (e.g. Direct to, different FL, different time, different lateral trajectory)
#5	Pointing out traffics to support coordination tasks. (e.g. PNT OLDI message)
#6	To show to an ATCO a coordination with other ATCO when a change of the trajectory is performed (not only FL change). System needs shared trajectories to support decision regarding to shared flights
#7	To be able to share specific FLs (NFL, XFL and RFL) with neighbour ATSU
#8	To include a new point in the planned trajectory, get its ETO to share with any sector / ATSU affected.

#	Interoperability principles for Flight Data Processing
#9	Calculation of conflict detection in common AoI between different ACCs. TCT and MTCD should be fed also with traffic still flying in the neighbour ATSU
#10	Inter ATSU coordination with tools and associated working methods/procedures, including long range coordination across several ATSU (mostly in case of trajectory revision).
#11	ETOs in all sector intersections. (it is also mentioned in the 4D graphical trajectory presentation)
#12	To draw and to share new trajectories (i.e. Graphic Route Modifications tools, elastic vector, and other CWP graphic tools)
#13	To raise a warning when the same trajectory, built in different ATSUs, differ significantly

Table 22: Interoperability principles for FDPS in Targeted Operating Environment

3.2.3.4 Aircraft Capabilities

A variety of different aircraft capabilities is likely to be encountered in Europe at the time horizon of the Free Routing Solutions deployment (with a mix of baseline and more advanced capabilities available on-board aircraft).

The baseline aircraft CNS capabilities considered in the context of the Solution PJ.06-01 are summarised in the table below.

Functionalities	Aircraft Systems in Targeted Operating Environment
COMMUNICATION	• Technical capability, both in pre-departure and during execution, to receive by ACARS[22] messages via data-link from FOC, and easily load in airborne Navigation functions, 3D trajectories based either on published routes (SIDs, Airways, STARs) or user-defined routes in FRA (using published significant points)

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[22] A large majority of mainlines (A/C & FOC) are and should be ACARS capable.

Functionalities	Aircraft Systems in Targeted Operating Environment
	• Progressive capabilities for Air / ground data link exchange of CPDLC messages allowing to easily load[23] in Navigation systems clearance / closed loop instruction for "Proceed DIR TO", "Proceed New route", etc.
NAVIGATION	• Basic navigation capabilities to <u>manually</u> modify, delete, add route segments of waypoints in the FMS (Flight Management System), including a LAT/LON point (➔ procedurally <u>limited to integer LAT/LON in continental airspace)</u>.
SURVEILLANCE	• ACAS Resolution Advisory transmitted to the ground station via e.g. Mode S Transponder and ADS-B-Out as per standards DO-260A (current), then DO-260B (future).

Table 23: Aircraft Systems in Targeted Operating Environment

3.2.4 Applicable standards and regulations

As required by Regulation 716/2014 on the establishment of the PCP supporting the implementation of the European Air Traffic Management Master Plan and its ATM Functionality #3.2 Free Route, ATC systems adapted to operate in FRA shall support Free Routing and cross-border operations across Europe.

Besides, as required by Regulation 1032/2006 - Exchange of Flight Data Between ATC Units (and its amendment Regulation 30/2009 - Requirements for Automatic Systems for the Exchange of Flight Data Supporting Data Link Services), the OLDI protocol for co-ordination and transfer of current flight data between adjacent air traffic control units shall be in use by all ATC units providing service to general air traffic.

In this context, the list of ATC systems standards applicable to the Solution PJ.06-01are as follows:

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[23] It's to be noted that for part of the A/C, this loading capability for revisions to e.g. tactically conflict solving would use the unique Secondary Flight Plan of the FMS, in conflict with many others, more strategic uses (pending the airline policy). Depending on the operational impact for AUs, and also due to the fact that many aircraft DO NOT have a Secondary Flight Plan, it might be necessary to perform additional developments in the FMS if CPDLC requests such as "Proceed New Route" was necessary in the medium-long term. Besides, Secondary Flight Plan is not the only option as trajectories might be loaded into the FMS as "temporary data" in order to be checked by the pilot on the navigation display, before validation.

- EUROCONTROL Specification for On-Line Data Interchange (OLDI), EUROCONTROL-SPEC-106, Edition 4.3 – in particular its Annex G: Evolution of the OLDI message exchanges and their application in FRA environment
- EUROCONTROL Specification for Medium-Term Conflict Detection, EUROCONTROL-SPEC-139, Edition 2.0 (STD-061)
- EUROCONTROL Specification for Monitoring Aids (MONA), EUROCONTROL-SPEC-142 (STD-062)
- EUROCONTROL Specification for Trajectory Prediction, EUROCONTROL-SPEC-143 (STD-063)
- EUROCONTROL Guidelines for Area Proximity Warning (APW), EUROCONTROL-GUID-161 (STD-064)
- EUROCONTROL Guidelines for Short Term Conflict Alert (STCA), EUROCONTROL-GUID-159

No need for new standards and/or regulations or update of the existing ones has been identified.

3.3 Detailed Operating Method

The previous and new operating methods described hereafter are limited to the scope of the Solution PJ.06-01, which is focused on the improvement of Air Traffic Services to enable Free Routing operations in En-route high and very high complexity cross-border environments.

3.3.1 Previous Operating Method

In this section related to previous Air Traffic Control operating methods in En-route High and Very High Complexity environments, the considered baseline is ATS Route Network environment with possibly direct routing.

3.3.1.1 ATC Sector Planning Operating Method

Below is an overview of the En-Route ATS Units activities related to separation and trajectory management in the ATC planning phase.

Operating Method Item	ATC Sector Planning Operating Method
Operator	Node : ATS Unit (ENR/APP)
	Performed by Actor/Role : ATC Sector Planning Controller
Automatic actions	Distribution of flight plan information
	Display of entry conditions from upstream sector
	Display of exit conditions to downstream sector
Procedures	• Assess entry conditions and desired/planned profile through AoR
	• Determine planning problems at offered entry conditions

Operating Method Item	ATC Sector Planning Operating Method
	• Refer to tactical controller to assess problems when action by TC is required/appropriate • Revise entry conditions if needed in coordination with upstream sector • Determine safe potential exit conditions • Assess trajectory profile through the AoR for tactical suitability • Make coordination offer to downstream sector when required
Triggering events	Traffic enters planning control AoI Coordinated offered entry conditions Potential problem detected (e.g. conflict)
Inputs	Flight plan data Entry conditions
Outputs	Revised entry conditions Exit Conditions Problems
Additional features	Baseline coordination and conflict detection support tools

3.3.1.2 ATC Sector Tactical Operating Method

Below is an overview of the En-Route ATS Units activities related to separation and trajectory management in the ATC tactical phase.

Operating Method Item	ATC Sector Tactical Operating Method
Operator	Node : ATS Unit (ENR/APP) Performed by Actor/Role : ATC Sector Executive Controller
Automatic actions	Display of flight plan information

Operating Method Item	ATC Sector Tactical Operating Method
	Display of flight trajectories
	Conflict detection based on tactical trajectory
	Conformance monitoring based on calculated ground system trajectory
Procedures	• Assess planned/desired profile for problems
	• Establish necessary separation
	• Assess planned profile constraints or co-ordinations
	• Issue clearances
	• Monitor clearance implementation
	• Check conformance to planned constraints
Triggering events	Traffic enters Area of Responsibility
	Pilot requests trajectory modification
Inputs	Flight plan data
	Trajectory data
Outputs	Clearances
Additional features	Baseline CDT and MONA tools

3.3.2 New SESAR Operating Method

In this section related to new operating methods, the focus is the ATC aspects expected to change in the scope of the Solution PJ.06-01 to enable En-route Free Routing operations in high and very high complexity cross-border environments.

3.3.2.1 New ATC Sector Planning Operating Method

Below is an overview of the main changes (highlighted in bold) required in the En-Route ATS En-Route Units activities in the ATC planning phase to enable Free Routing operations in high and very high complexity cross-border environments.

Operating Method Item	ATC Sector Planning Operating Method
Operator	Node: ATS Unit (ENR/APP) Performed by Actor/Role : ATC Sector Planning Role
Automatic actions	Distribution of flight plan / Trajectory information **Display of entry conditions from upstream sector** **Display of 2D/3D/4D trajectories within AOI** **Display of exit conditions to downstream sector** **Conflict Detection and Resolution advisory**
Procedures	- Assess entry conditions **not necessarily supported by published Coordination Points** and desired/planned profile through AoR/**AoI** **Assess detected planning problems at offered entry conditions (and possibly suggested resolution action)** **Assess detected trajectory profile problems through the AoR (and possibly suggested resolution action)** **Coordinate with tactical controller for situation awareness sharing or tactical resolution assessment** - Revise entry conditions if needed in coordination with upstream sector **not necessarily at defined Coordination Points** - Determine safe potential exit conditions **not necessarily supported by published Coordination Points** - Make coordination offer to downstream sector when required
Triggering events	Traffic enters planning control AoI **Coordinated offered entry conditions** **Automated Detection of problems and possible resolution proposals**

Operating Method Item	ATC Sector Planning Operating Method
Inputs	Flight plan data **with user-defined segments in FRA**
	Surveillance data
	Entry/Exit conditions **not necessarily supported by published Coordination Points on ACC/sector boundaries**
Outputs	Revised entry conditions **not necessarily supported by published Coordination Points**
	Revised Exit Conditions **not necessarily supported by published Coordination Points**
Additional features	Advanced **trajectory-based** Conflict Detection (and possibly Resolution) **within AoR/AoI**
	Advanced ATC Coordination tools **not necessarily supported by published Coordination Points** and associated HMI features

Coordination and Transfer

In Free Routing high and very high complexity cross-border environments, the use of advanced coordination and visualization support tools is considered mandatory.

The Cross-Border context imposes to consider a larger Area of Interest (extension according to local needs) and an adaptation of ATC support tools, in particular for supporting coordination actions made more difficult due to the high variability of trajectories and the lack of mandatory coordination points on ACC/sector boundaries.

Advanced coordination associated to advanced HMI functions are highly recommended (e.g. :

- Support to unambiguous flight identification
- Graphic trajectory Edition/ Modifications tools, elastic vector, and other CWP graphic tools
- trajectory revision proposal display shared with adjacent sectors, taking into account all types of trajectory revision actions (Vertical, Lateral, Speed, time), in isolation or mixed, to improve coordination action efficiency (better anticipation, no identification mistake, improved visualization of proposals)
- Trajectory revision negotiation support (accept, reject, counter-proposal)
- Display of the latest agreed RBT/RMT in order to support the minimum deviation rule/principle

According to local operational environment/needs, some specific rules should be defined in case of regular conflicts to be solved over/close to the sector boundaries (conflict resolution responsibility and transfer conditions).

Conflict Detection and Resolution

In Free Routing Airspace in high and very high complexity cross-border environments, the use of Conflict Detection support tools is considered essential to support Planning Separation Assurance (What-if probing tools and What-else tools are also considered nice to have) for the detection of problems at Entry/Exit and along planned flight trajectory within AoR/AoI.

Free Routing in cross border environment imposes to consider a larger Area of Interest and an adaptation of ATC support tools (i.e. visualization, conflict detection, resolution options assessment, screen-to-screen electronic coordination support). Appropriate support tools for ATC planning are essential to facilitate ATCOs situation awareness maintenance, conflicts detection (including agreed transfer condition infringement) and coordination actions in Free Routing environment. Indeed, these ATCO duties are basically made more difficult due to the high variability of trajectories, random crossing points and the lack of mandatory coordination points on ACC/sector boundaries (directs to/from waypoints located far away from ATSU/sector AoR must be integrated).

Even if ATC sector shape should be adapted at best according to traffic flows, some specific rules should be defined in order to clearly allocate medium term conflict resolution responsibility in case of converging flows managed by two contiguous ATC sectors or frequent conflict situations over/close to the sector boundaries.

The implementation of automated ATC support tools allows a better anticipation of traffic situation (medium term) and provide ATCOs with more time to analyse problems and select the best solutions, taking into account ATM aspects (e.g. safety, flights subject to constraints) but also flight efficiency aspects (minimum RBT deviation principle).

Task sharing and coordination within ATC sector team as well as coordination with adjacent sectors are facilitated by advanced HMI functions (e.g. common TC/PC conflict list and display of conflict resolution allocation TC/PC, trajectory revision proposal display shared with adjacent sectors).

Traffic Expedition

Trajectory revisions during the execution phase to expedite traffic (in the frame of Air Traffic Control service) will still be part of ATC planning role tasks, but will be much fewer. Indeed, the RBT defined in planning phase, in particular the portion in Free Routing Airspace, represents the best compromise between known ATM constraints, aircraft performance and flight/company business needs. Therefore this RBT must be facilitated as far as possible. However, in some specific situations, like the cancellation of an ATM constraint (e.g. early deactivation of an ARES) expedite traffic on ATCO initiative will still be possible.

3.3.2.2 New ATC Sector Tactical Operating Method

Below is an overview of the main changes (highlighted in bold) required in the En-Route ATS Units activities in the ATC tactical phase to enable Free Routing operations in high and very high complexity cross-border environments.

Operating Method Item	ATC Sector Tactical Operating Method
Operator	Node: ATS Unit (ENR/APP) Performed by Actor/Role : ATC Sector Executive role
Automatic actions	Display of flight plan information Display of 4D flight trajectories Conflict detection based on tactical trajectory Conformance monitoring based on calculated ground system trajectory
Procedures	• Assess planned/desired profile for problems **within AoR/AoI** • Establish necessary separation • Assess planned profile constraints or co-ordinations • Issue clearances • Monitor clearance implementation • Check conformance to planned constraints
Triggering events	Traffic enters Area of Responsibility Pilot requests trajectory modification
Inputs	Flight plan data Trajectory data
Outputs	Clearances
Additional features	Advanced **trajectory-based** Conflict Detection (and possibly Resolution) **within AoR/AoI** Advanced Monitoring Aids

Operating Method Item	ATC Sector Tactical Operating Method
	Advanced inter-sector Coordination tools and associated HMI features

Conflict Detection and Resolution

In Free Routing high and very high complexity cross-border environments, the use of Tactical Conflict Detection tools, monitoring aids and electronic coordination tools is essential to support tactical Separation Assurance for the detection of problems at along planned flight trajectory within AoR/AoI.

Free Routing in cross-border environment imposes to consider a larger Area of Interest and an adaptation of ATC support tools (i.e. visualization, conflict detection, resolution options assessment, conformance monitoring, electronic coordination support). Appropriate support tools for tactical control is essential to facilitate ATCOs situation awareness maintenance, tactical conflicts detection and tactical coordination actions in Free Routing environment. Indeed, these ATCO duties are basically made more difficult due to the high variability of trajectories, random crossing points and the lack of mandatory coordination points on ACC/sector boundaries (directs to/from waypoints located far away from ATSU/sector AoR must be integrated).

What-if probing tools are considered valuable support tools for ATCOs to assess tactical conflict resolution options.

The implementation of automated ATC support tools allows a better anticipation of traffic situation and provide ATCOs with more accurate conflict data (e.g. conflict geometry display, minimum separation distances, extrapolation of aircraft positions at separation minima infringement), more time to analyse problems and select the best solutions, taking into account Safety, ATM constraints and flight efficiency aspects. These advanced tools support the selection of solutions ensuring a minimum deviation from agreed RBT. Task sharing and coordination within ATC sector team as well as coordination with adjacent sectors are facilitated by advanced HMI functions (e.g. common TC/PC conflict list and display of conflict resolution allocation TC/PC, trajectory revision proposal display shared with adjacent sectors).

Even if sector shape should be adapted at best according to traffic flows, some specific rules should be defined in order to clearly allocate conflict resolution responsibility in case of converging flows managed by two contiguous ATC sectors or frequent conflict situations over/close to the sector boundaries.

Tactical Coordination and Transfer

The Cross-Border context imposes to consider a larger Area of Interest and an adaptation of ATC support tools, in particular for supporting coordination actions made more difficult due to the high variability of trajectories and the lack of mandatory coordination points.

Advanced coordination associated to advanced HMI functions are highly recommended (e.g. :

- Support for control release negotiation
- Change of Frequency requests
- Support to unambiguous flight identification
- Graphic trajectory Edition/ Modifications tools, elastic vector, and other CWP graphic tools
- trajectory revision proposal display shared with adjacent sectors, taking into account all types of trajectory revision actions (Vertical, Lateral, Speed, time), in isolation or mixed, to improve coordination action efficiency (better anticipation, no identification mistake, improved visualization of proposals)
- Trajectory revision negotiation support (accept, reject, counter-proposal)
- Display of the latest agreed RBT/RMT in order to support the minimum deviation rule/principle

According to local operational environment/needs, some specific rules should be defined in case of regular conflicts to be solved over/close to the sector boundaries (conflict resolution responsibility and transfer conditions).

Traffic Expedition

Tactical actions to expedite traffic (in the frame of Air Traffic Control service) will still be part of ATC tactical role tasks, but will much rarer. Indeed, the RBT defined in planning phase, in particular the portion in Free Routing Airspace, represents the best compromise between known ATM constraints, aircraft performance and flight/airline business needs. Therefore this RBT must be facilitated as far as possible. However, in some specific situations, like the cancellation of an ATM constraint (e.g. early deactivation of an ARES) or changing weather conditions, expedite traffic on ATCO initiative or flight crew request will still be possible.

3.3.2.3 Use Cases for [NOV-2] Separation Assurance in cross-border FRA

Regarding Information Management aspects, the Solution PJ.06-01 does not require new services supporting information exchange between ATS Units (beyond the ones available using OLDI specification).

The enhanced Trajectory Management framework with ATC to ATC flight data exchange using the Flight Object concept (FO/IOP) for separation management, coordination and transfer of flights across ATSU Area of Responsibility (AoR) boundaries is out of scope of the Solution. Interoperability aspects are nevertheless taken into account in the scope of the Solution PJ.06-01.

This Node view summarizes the Information exchanges described in the Use Cases:

- Provide Planning Separation Assurance inside and across ATSUs in cross-border FRA
- Provide Tactical Separation Assurance inside and across ATSUs in cross-border FRA
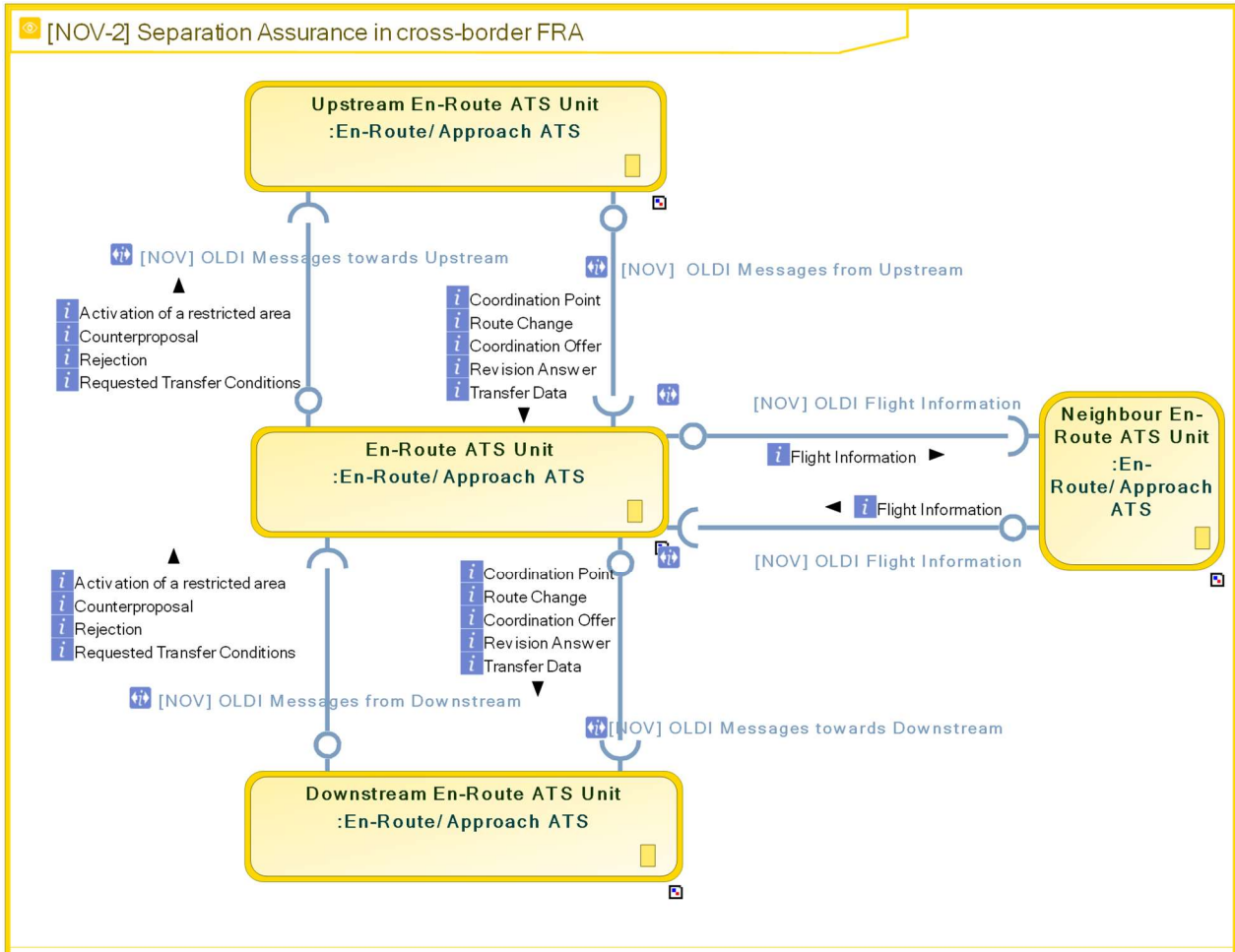
[NOV-2] Separation Assurance in cross-border FRA

[NOV-5] Provide Planning Separation Assurance inside and across ATSUs in cross-border FRA [Downstream En-Route ATS Unit, En-Route ATS Unit, Neighbour En-Route ATS Unit, Upstream En-Route ATS Unit]

[NOV-5] Provide Tactical Separation Assurance inside and across ATSUs in cross-border FRA [Downstream En-Route ATS Unit, En-Route ATS Unit, Neighbour En-Route ATS Unit, Upstream En-Route ATS Unit]

Click on http://webprisme.cfmu.eurocontrol.int/oneportal_working_validation/data/diagrams/FF89352F5D16FB02 for zooming.

Use case	[NOV-5] Provide Planning Separation Assurance inside and across ATSUs in cross-border FRA
Use case	[NOV-5] Provide Tactical Separation Assurance inside and across ATSUs in cross-border FRA

3.3.2.3.1 [NOV-5] Provide Planning Separation Assurance inside and across ATSUs in cross-border FRA

Separation assurance at planning level is a continuous process triggered on a cyclic basis in order to detect and solve potential interactions between (pairs of) aircraft and between aircraft and restricted airspace that are within his/her area of interest, at every step of the coordination process (e.g. receipt of an offer, selection of a suitable sector exit level etc.).

Conflict resolution in planning terms may involve the identification of alternative co-ordination conditions (level, route, profile etc.) at either the entry and/or exit boundaries of the ATSU AoR.

In Free Routing Airspace, because the coordination of flights is not necessarily supported by published Coordination Points, the Planning Controller has to use specific procedures and tools to coordinate with the adjacent Planning Controller the modification of the entry/exit parameters.

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[NOV-5] Provide Planning Separation Assurance inside and across ATSUs in cross-border FRA

The upstream and downstream sectors might be either part of the same or of a different ATSU. This model represents the planning activities from the perspective of the adjacent sectors within other ATSU's.

Upstream En-Route ATS Unit

Flight in downstream AoI

Make coordination offer to downstream sector

End

Rejection
Revision Answer
Counterproposal

En-Route ATS Unit

Coordination Point
Route Change
Coordination Offer

Traffic in planning control AoI

Is traffic in neighbour AoI ?

No
Yes

Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA

Determine planning problems at offered entry conditions in cross-border FRA

Yes
No

Problems?

Is resolution by tactical controller appropriate?
No
Yes

Refer to tactical who assesses problems

Ok for the tactical?
Yes
No

In MSP configuration, the planning controller may have to coordinate with several tactical controllers

Revise entry conditions if needed in coordination with upstream sector

Ok?
No
Yes

Reject flight

End

Distribute accepted FPL

Flight Information

Agree entry coordination in cross-border FRA

Determine safe potential exit conditions in cross-border FRA

Assess trajectory profile through the AoR for tactical controller suitability

Make coordination offer to downstream sector

Answer from following sector planning controller?

End

Sector profile suitable
Revise or reject

Entry conditions need amending

Exit conditions not suitable

Activation of a restricted area

Flight Information

Activation of a restricted area

Downstream En-Route ATS Unit

Change of area status

Automatically update status of ARES

End

Coordination Point
Route Change
Coordination Offer

Traffic in planning control AoI

Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA

Problem exists and tactical controller cannot solve it

Revision Answer
Counterproposal
Rejection

Revise entry conditions if needed in coordination with upstream sector

Not Ok

Reject flight

End

Neighbour En-Route ATS Unit

Traffic in planning control AoI

Is traffic in adjacent AoI ?
Yes
No

Distribute accepted FPL

Flight Information
Flight Information

Determine planning problems at offered entry conditions in cross-border FRA

No problem

Determine safe potential exit conditions in cross-border FRA

End

Diagram Id: FF8933F15D169EE0

Activity	Description
Agree entry coordination in cross-border FRA	Inform previous sector and tactical controller that the coordination is accepted (can be supported by advanced HMI functions). In Free Routing Airspace, because the coordination of flights is not necessarily supported by published Coordination Points, the Planning Controller has to use specific procedures and tools to coordinate with the adjacent Planning Controller the entry parameters.
Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA	The planning controller monitors the characteristics of the flight and its expected trajectory profile not necessarily supported by published Coordination Points and desired/planned profile through his/her AoR/AoI, gaining ATCOs situational awareness an overview of potential issues and/or optimisation opportunities (e.g. ARES early deactivation) within his/her AoR/AoI. In Free Routing Airspace, an adaptation of ATC support tools should be considered due to high variability of trajectories and the lack of mandatory coordination points on ACC/sector boundaries. Note: The Planning controller AoR/AoI may comprise several tactical AoRs/AoIs.
Assess trajectory profile through the AoR for tactical controller suitability	The planning controller looks along the flight path in his/her AoR to assess whether the anticipated exit conditions or any in-AoR constraints present an unacceptably high level of difficulty for the tactical controller to achieve (e.g. due to conflicting flights within the sector). If needed, planning controller possibly suggests resolution action to tactical controller based on the modification of the entry/exit parameters.
Automatically update status of ARES	This Activity is out of the Solution scope. It only plays the role of the "source" for the "Activation of a restricted area" data exchange between two ATSUs.
Determine planning problems at offered entry conditions in cross-border FRA	Looking along the flight path within his/her possibly large area of AoR/AoI, the planning controller assesses the entry conditions of the flight (desired/planned profile) and, taking into account any separation/complexity issues, determines: - The possibility to remove any unnecessary pre-tactical and/or procedural constraint which was so far applicable for the flight; - The potential need to apply additional constraints or to modify the entry parameters for suggested conflict resolution action by tactical controller. In Free Routing Airspace, it is highly recommended to use the advanced coordination support tools associated to advanced HMI functions (e.g use of Support to unambiguous flight identification, Graphic trajectory Edition/ Modifications tools).
Determine safe potential exit conditions in cross-border FRA	The planning controller monitors the characteristics of the flight and its expected trajectory profile not necessarily supported by published Coordination Points and desired/planned profile through his/her

Activity	Description
	AoR/AoI, gaining ATCOs situational awareness an overview of potential issues and optimization opportunities within his/her AoR/AoI and potentially anticipating new exit conditions if necessary. In Free Routing Airspace, an adaptation of ATC support tools should be considered due to high variability of trajectories and the lack of mandatory coordination points on ACC/sector boundaries (e.g use of the latest agreed trajectory in order to support the minimum deviation rule/principle).
Distribute accepted FPL	This Activity is out of the Solution scope. It only plays the role of the "source" for the "Flight Information" data exchange between two ATSUs.
Make coordination offer to downstream sector	Having identified appropriate exit conditions, coordination offer is made to downstream sector when required.
Refer to tactical who assesses problems	The planning controller highlights issue to the tactical controller. The tactical controller makes a decision whether he/she accepts the responsibility for monitoring and/or resolving the problem or whether a revised sector entry coordination is required.
Reject flight	If the flight cannot be reasonably accepted into the sector the coordination is to be rejected.
Revise entry conditions if needed in coordination with upstream sector	Entry coordination is amended as required in agreement with offering sector.

Issuer	Info Flow	Addressee	Info Element	Info Entity
Downstream En-Route ATS Unit	Automatically update status of ARES o--> Determine planning problems at offered entry conditions in cross-border FRA	En-Route ATS Unit	Activation of a restricted area	
Downstream En-Route ATS Unit	Automatically update status of ARES o--> Determine safe potential exit conditions in cross-border FRA	En-Route ATS Unit	Activation of a restricted area	

Issuer	Info Flow	Addressee	Info Element	Info Entity
En-Route ATS Unit	Distribute accepted FPL o--> Determine planning problems at offered entry conditions in cross-border FRA (by neighbour ATSU)	Neighbour En-Route ATS Unit	Flight Information	Flight
En-Route ATS Unit	Distribute accepted FPL o--> Determine safe potential exit conditions in cross-border FRA (by neighbour ATSU)	Neighbour En-Route ATS Unit	Flight Information	Flight
Neighbour En-Route ATS Unit	Distribute accepted FPL (by neighbour ATSU) o--> Determine planning problems at offered entry conditions in cross-border FRA	En-Route ATS Unit	Flight Information	Flight
Neighbour En-Route ATS Unit	Distribute accepted FPL (by neighbour ATSU) o--> Determine safe potential exit conditions in cross-border FRA	En-Route ATS Unit	Flight Information	Flight
Upstream En-Route ATS Unit	Make coordination offer to downstream sector (by upstream ATSU) o--> Revise entry conditions if needed in coordination with upstream sector	En-Route ATS Unit	Revision Answer	

Issuer	Info Flow	Addressee	Info Element	Info Entity
En-Route ATS Unit	Revise entry conditions if needed in coordination with upstream sector o--> Make coordination offer to downstream sector (by upstream ATSU)	Upstream En-Route ATS Unit	Counterproposal	
En-Route ATS Unit	Reject flight o--> Make coordination offer to downstream sector (by upstream ATSU)	Upstream En-Route ATS Unit	Rejection	
En-Route ATS Unit	Make coordination offer to downstream sector o--> Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA (by downstream ATSU)	Downstream En-Route ATS Unit	Coordination Offer	
En-Route ATS Unit	Make coordination offer to downstream sector o--> Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA (by downstream ATSU)	Downstream En-Route ATS Unit	Route Change	RouteChange

Issuer	Info Flow	Addressee	Info Element	Info Entity
En-Route ATS Unit	Make coordination offer to downstream sector o--> Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA (by downstream ATSU)	Downstream En-Route ATS Unit	Coordination Point	TransferOfControlPoint
Upstream En-Route ATS Unit	Make coordination offer to downstream sector (by upstream ATSU) o--> Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA	En-Route ATS Unit	Coordination Offer	
Upstream En-Route ATS Unit	Make coordination offer to downstream sector (by upstream ATSU) o--> Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA	En-Route ATS Unit	Route Change	RouteChange
Upstream En-Route ATS Unit	Make coordination offer to downstream sector (by upstream ATSU) o--> Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA	En-Route ATS Unit	Coordination Point	TransferOfControlPoint

Issuer	Info Flow	Addressee	Info Element	Info Entity
En-Route ATS Unit	Make coordination offer to downstream sector o--> Revise entry conditions if needed in coordination with upstream sector (by downstream ATSU)	Downstream En-Route ATS Unit	Revision Answer	
Downstream En-Route ATS Unit	Revise entry conditions if needed in coordination with upstream sector (by downstream ATSU) o--> Make coordination offer to downstream sector	En-Route ATS Unit	Counterproposal	
Downstream En-Route ATS Unit	Reject flight (by downstream ATSU) o--> Make coordination offer to downstream sector	En-Route ATS Unit	Rejection	

3.3.2.3.2 [NOV-5] Provide Tactical Separation Assurance inside and across ATSUs in cross-border FRA

This process describes how the controller (mostly the Tactical, and sometimes the Planning) detects and solves potential trajectory profile problems between (pairs of) aircraft and between aircraft and restricted airspace that are within his/her AoR or even within others' AoR when new collaborative control operating procedures apply. The goal is to address any remaining potential interactions that have been highlighted by the Planning Controller and achieve the overall trajectory profile targets set by him/her.

Conflict resolution in tactical terms may involve the identification of different solutions, e.g. by modifying the trajectory laterally, vertically or in terms of speed adjustments.
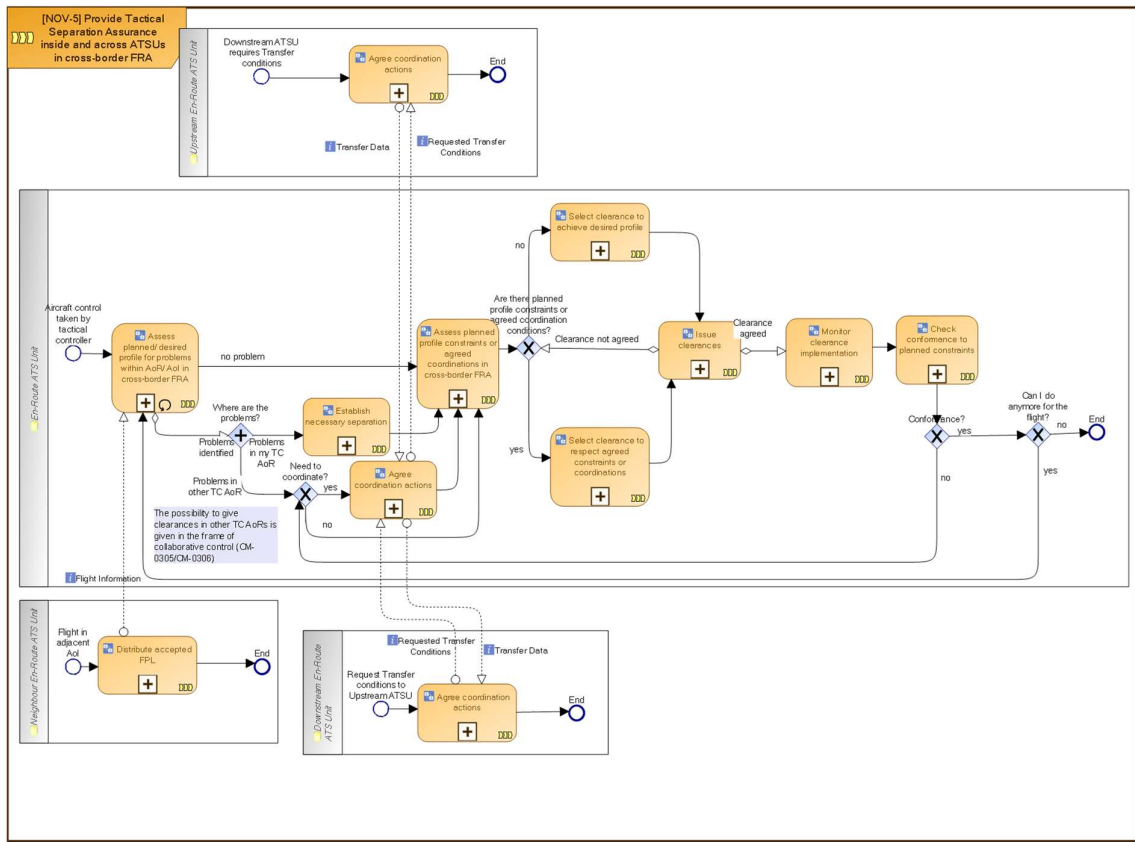
Diagram Id: FF8934925D16D3DA

Activity	Description
Agree coordination actions	Except with the new collaborative control procedures where the traditional requirement to coordinate traffic at all sector boundaries is removed, the Tactical Controller will coordinate the appropriate actions when he/she: - Identifies a planned/profile trajectory profile problem that concerns other tactical AoR/AoI. - Realises that conformance to planned constraints is not achievable anymore after the issue of the clearance. This coordination is improved thanks to new interoperability capabilities enabling increased support tools efficiency and the Tactical Controller could delegate this task to the Planning Controller. Note: In MSP configuration, more flexible/optimised solutions can be set up due to extended situation awareness (both tactical sectors are known traffic to the planner).
Agree coordination actions (by downstream ATSU)	Except with the new collaborative control procedures where the traditional requirement to coordinate traffic at all sector boundaries is removed, the Tactical Controller will coordinate the appropriate actions when he/she:

Activity	Description
	- Identifies a planned/profile trajectory profile problem that concerns other tactical AoR/AoI. - Realises that conformance to planned constraints is not achievable anymore after the issue of the clearance. This coordination is improved thanks to new interoperability capabilities enabling increased support tools efficiency and the Tactical Controller could delegate this task to the Planning Controller. Note: In MSP configuration, more flexible/optimised solutions can be set up due to extended situation awareness (both tactical sectors are known traffic to the planner).
Agree coordination actions (by upstream ATSU)	Except with the new collaborative control procedures where the traditional requirement to coordinate traffic at all sector boundaries is removed, the Tactical Controller will coordinate the appropriate actions when he/she: - Identifies a planned/profile trajectory profile problem that concerns other tactical AoR/AoI. - Realises that conformance to planned constraints is not achievable anymore after the issue of the clearance. This coordination is improved thanks to new interoperability capabilities enabling increased support tools efficiency and the Tactical Controller could delegate this task to the Planning Controller. Note: In MSP configuration, more flexible/optimised solutions can be set up due to extended situation awareness (both tactical sectors are known traffic to the planner).
Assess planned profile constraints or agreed coordinations in cross-border FRA	Assess whether there are any planned constraints or agreed coordination actions with neighbouring sectors to consider in order to select the clearance accordingly. In Free Routing Airspace, tactical coordination actions have to be facilitated by electronic coordination tools offering display and negotiation functions to ATCOS (e.g. FL request, direct request,) including counter-proposals capabilities.
Assess planned/desired profile for problems within AoR/AoI in cross-border FRA	The ATCO controller monitors the characteristics of the flight and its expected trajectory profile not necessarily supported by published Coordination Points and desired/planned profile through his/her AoR/AoI, gaining ATCOs situational awareness an overview of potential issues and/or optimisation opportunities (e.g. ARES early deactivation) within his/her AoR/AoI. The ATCO determines whether there are any problems between the aircraft's trajectory profile and other flights' trajectory profiles through his/her AoR/AoI or even through others' AoR/AoI (if collaborative control procedures apply) to achieve overall profile targets set by the Planning Controller. This monitoring activity is run in a cyclic basis to identify and classify potential interactions between flights under tactical control, including interactions already highlighted by the planning controller as pending conflicts.

Activity	Description
	Conflicts between aircraft and between aircraft and restricted airspace are detected by comparing the set of predicted trajectories modelling the behaviour of the aircraft in order to identify potential losses of minimum separation. In Free Routing Airspace, the ATCOs have to be supported by conflict detection tools (mid-term and short term) within the whole area of interest of the sector. These CDTs provide ATCOs with conflict data display (e.g. time remaining before separation minima infringement start, expected minimum separation distance, etc.), a graphical display of conflict geometry coordination functions between TC and PC and additional support.
Check conformance to planned constraints	Both tactical and planning controllers, assisted by a conformance monitoring tool, monitor the progress of the aircraft and check that conformance to planned constraints is achieved. If they are no longer achievable, they will need to be revised.
Distribute accepted FPL	This Activity is out of the Solution scope. It only plays the role of the "source" for the "Flight Information" data exchange between two ATSUs.
Establish necessary separation	Determine what actions need to be taken to maintain necessary separation based on the revision of the current trajectories, possibly supported by what-if/what-else facilities, and implements this solution (voice or datalink)
Issue clearances	The agreed conditions are implemented by issuing one or more clearances.
Monitor clearance implementation	Both tactical and planning controllers, assisted by a conformance monitoring tool, monitor the progress of the aircraft with respect to the given clearance to ensure that the problem is solved.
Select clearance to achieve desired profile	If there are not planned constraints or agreed coordination actions to respect, the Tactical Controller will select the clearance to achieve the desired trajectory profile.
Select clearance to respect agreed constraints or coordinations	If there are planned constraints or agreed coordination actions, the Tactical Controller will select the clearance to respect them.

Issuer	Info Flow	Addressee	Info Element	Info Entity
Neighbour En-Route ATS Unit	Distribute accepted FPL o--> Assess planned/desired profile for problems within AoR/AoI in cross-border FRA	En-Route ATS Unit	Flight Information	Flight

Issuer	Info Flow	Addressee	Info Element	Info Entity
En-Route ATS Unit	Agree coordination actions o--> Agree coordination actions (by downstream ATSU)	Downstream En-Route ATS Unit	Transfer Data	
Downstream En-Route ATS Unit	Agree coordination actions (by downstream ATSU) o--> Agree coordination actions	En-Route ATS Unit	Requested Transfer Conditions	
Upstream En-Route ATS Unit	Agree coordination actions (by upstream ATSU) o--> Agree coordination actions	En-Route ATS Unit	Transfer Data	
En-Route ATS Unit	Agree coordination actions o--> Agree coordination actions (by upstream ATSU)	Upstream En-Route ATS Unit	Requested Transfer Conditions	

3.3.3 Differences between new and previous Operating Methods

To enable safe and efficient Free Routing operations in En-route airspace of high or very high complexity, the Solution PJ.06-01 relies on two main changes at local ATM level:

- Structurally limited FRA defined to allow AUs to plan flight without reference to a fixed ATS route network in cross-border environments;
- Air Traffic Control in En-Route airspace using ATC sector support tools (Conflict Detection Tools, Monitoring Aids, Inter-sector coordination support tool) adapted to Free Routing cross-border operations.

Considering the nature of the change brought by the Solution PJ.06-01, which impacts the activities of the local ATM actors in a new operating environment, additional R&D activities are required (beyond the ones already conducted in SESAR 1) to demonstrate the V3 maturity of the Solution and its added value in support to the implementation of FRA in high and very high complexity environments.

Table 24 explains, succinctly, the main differences between the new and the previous operating methods highlighting what are the key aspects that will change in relation with the ATM Capabilities impacted by the Solution PJ.06-01.

ATM Capabilities (in EATMA) that are impacted by the SESAR Solution	Current Operating Method	New Operating Method
Free Route Airspace Design	Fixed ATS route network with ATS Route Network environment with possibly published En-Route DCTs	Design of Free Routing Airspace in upper En-Route airspace (at least at and above FL310) and across FIR/ATS Unit AoRs Traffic Complexity Management through "structurally" limited FRA (at long and medium-term flight planning phase)
Separation Provision (airspace)	Provision of planning and tactical separation in En-Route airspace (with ARN or Direct Routings) using baseline ATC tools	Provision of planning and tactical separation in Free Routing high and very high complexity cross-border environments using: • Enhanced CDT (possibly within AOI) to assist ATCOs' to determine planning problems and safe entry/exit conditions • Enhanced FDPS (without COP) to support conflict detection in FRA
Coordination and transfer	Standard coordination and transfer of flights in En-Route airspace (with ARN or Direct Routings)	Coordination of flights between sectors/ATSUs in Free Routing high and very high complexity cross-border environments using: • Enhanced FDPS (without COP) to support coordination of flights in FRA • Enhanced Coordination support Tools to agree on safe entry/exit conditions (outside COP)
Trajectory Conformance Monitoring	Trajectory conformance monitoring in En-Route airspace (with ARN or Direct Routings) using baseline ATC tools	Advanced Conformance Monitoring for conformity with the flight clearance in Free Routing cross-border environments

Table 24: Difference between new and previous Operating Method

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

4.1 General

This section contains the requirements relevant for the Solution PJ.06-01 at SPR-INTEROP level (at the end of the V3 Phase). These requirements have been defined using the SESAR Requirements and V&V guidelines [26].

4.1.1 Requirement layout

The REQ definition and Trace tables contain:

- The status of the requirements at the end of the V3 validation and assessment activities.
- The rationale field providing an explanation about the requirement formulation to justify the requirement and its allocation (e.g. SESAR 1 or SESAR 2020 results, Expert group workshop results, etc.) or reference to a source document (e.g. Validation Report, Safety Assessment Report, Human Performance Plan, Performance Assessment Report, etc.).
- The links to the EATMA elements from the program layer (e.g. SESAR solution and Sub-Operating Environments) and from the operational layer (e.g. Activities, Roles and Information elements).

The Requirement layout is illustrated below:

[REQ]

Identifier	REQ-XXb.YY-SPRINTEROP-UU01.0123
Title	
Requirement	
Status	<validated><in progress><deleted>
Rationale	This requirement has been validated in EXE…… This requirements has been deleted because validation Exercise XXXX confirmed that the expected role could not perform the expected activity without a significant reduction of the situational awareness
Category	<Operational>, <Safety>, <Security>, <Performance>, <Human Performance>, <IER>, <Interoperability>,<HMI>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO >	<SESAR Solution>	SESAR Solution Identifier
<SATISFIES>	<Information Exchange>	Information Exchange Identifier
<ALLOCATED_TO>	<Information Flow>	Information Flow Identifier
<ALLOCATED_TO>	<Activity>	Activity Identifier
<ALLOCATED_TO>	<Functional Block>	Functional Block
<ALLOCATED_TO>	<Role>	Role Identifier
<ALLOCATED_TO>	<Sub-Operating Environment>	Sub-Operating Environment Identifier

Table 25: REQuirement capture layout

Disclaimer: Although the SESAR Requirements and V&V guidelines [26] expect INTEROP requirements to be linked to Functional Blocks, this is not done in this SPR-INTEROP document in line with the EATMA Guidance Material [1] which recommends that this linkage be removed (as Functional Blocks belong the system layer rather than the operational layer of the EATMA Meta-Model).

4.1.2 Requirement identifier

Operational Requirements (at OSED level)

The OSED Requirements identifier follows the following schema:

REQ-06.01-SPRINTEROP-AAxy.ijkl

where 'AA' is set to:

- 'FM' for operational requirements related to Air Traffic Flow and Capacity Management (in general)
- 'SP' for operational requirements related to Separation Provision (in general)
- 'PC' for operational requirements related to Planning Separation Assurance
- 'TC' for operational requirements related to Tactical Separation Assurance

and 'xy' is set to:

- '00' for operational requirements at airspace level
- '01' for operational requirements at actor/role level

Safety and Performance Requirements (at SPR level)

The SPR Requirements identifier follows the following schema:

REQ-06.01-SPRINTEROP-AAxy.ijkl

where 'AA' is set to:

- 'SO' for Safety Requirements derived from Safety Objectives at SPR level in the SAR, and

  - o 'xy' set to '01' for functional requirements from the success model of the SAR
  - o 'xy' set to '02' for the integrity requirements from the failure model of the SAR
  - o 'xy' set to '03' for functional requirements from the failure model of the SAR

- 'QS' for Performance Requirements expressed in terms of Quality of Service, and

  - o 'xy' set to '01' for functional (or operational) requirements
  - o 'xy' set to '02' for non-functional requirements

- 'HP' for Human Performance Requirements derived from HP Arguments in the HPAR.

  - o 'xy' set to '01' for all HP requirements

Interoperability Requirements (at INTEROP level)

The INTEROP Requirements identifier follows the following schema:

REQ-06.01-SPRINTEROP-AAxy.ijkl

where 'AA' is set to:

- 'IO' for Interoperability Requirements (at operational or system level).

  - o 'xy' set to '01' for all INTEROP requirements

4.1.3 Requirement categories

This final version of the SPR-INTEROP/OSED document integrates safety, performance and interoperability requirements identified at SPR level, as well as operational performance requirements identified at OSED level.

Hereafter is a summary of the requirement categories contained in this document, and the level at which these requirements have been identified (refer to section 4.2 for further details on the requirement development approach).

SPR-INTEROP/OSED Requirement Category							
	Operational	Safety	Security	Performance	Human Performance	IER	Interoperability	HMI
Operational Requirement at OSED level	✓							
Performance Framework Requirement at SPR level				✓ (Performance Targets)	✓ (HP Arguments)			

	SPR-INTEROP/OSED Requirement Category							
	Operational	Safety	Security	Performance	Human Performance	IER	Interoperability	HMI
Functional Safety requirements at SPR level	✓	✓ (Operations related)						
Non-functional Functional Safety requirements at SPR level		✓ (Integrity & Reliability)						
Functional Performance Requirement at SPR level	✓			✓ (ATM Performance related)	✓ (HP related)			
Non-functional Performance Requirement at SPR level				✓				
Information Requirement at INTEROP level							✓ (ATSU related)	

Table 26: REQuirement categories

4.2 Requirement development

4.2.1 Safety Requirements

In this final version of the SPR-INTEROP/OSED document, the safety requirements include the safety requirements (SR) derived from the Safety Objectives (SO) identified in the final Safety Assessment conducted at SPR level.

These Safety requirements consist of:

- Functional and Performance safety requirements at operational level (SR_FP_OPS) derived from the Safety Objectives of the success model of the SAR. These safety objectives have been defined at OSED level through two safety workshops, held with free route and operational experts. The safety requirements derived at SPR design level resulted from the analyses of the solution under normal operational conditions (success model) and under abnormal conditions of the operational environment (failure model). The success case and failure case analysis at SPR design level were carried out during two safety workshop sessions held with safety and operational experts.

- Non-functional (integrity and reliability) safety requirements derived from the Safety Objectives of the failure model of the SAR. These safety objectives resulted from the hazard assessment performed at OSED level in a dedicated safety workshop. They were incorporated as quantitative Integrity and Reliability Safety Requirements at SPR level (with no further

allocation on the components of the SPR design model because such allocation could depend on local implementation). They are expressed as maximum frequency of occurrence for each hazard.

Refer to Part II: Safety Assessment Report (SAR) of this document for further details.

All safety requirements are traced with the < Safety> category and allocated to one or more **Activity** and **Role** of the EATMA operational model layer. The functional safety requirements are also traced with the <Operational> category when already identified at OSED level.

4.2.2 Security Requirements

In this final version of the SPR-INTEROP/OSED document, no Security requirements are identified for Solution PJ.06-01 (as no technical system and data exchanges specific to the solution are required).

Refer to Part V: Performance Assessment Report (PAR) of this document for further details.

4.2.3 Performance Requirements (QoS)

In this final version of the SPR-INTEROP/OSED document, the Performance requirements are expressed in terms of Quality of Service (QoS) both at functional (or operational) and non-functional level.

Note 1: Following a request for clarification to SJU on what should be understood by Quality of Service requirement, the answer provided was as follows: "*Performance Requirements shall indeed be expressed in terms of QoS. There are two kinds of QoS requirements, those associated to quantitative values that can be measured (with reference to metrics aligned to the SESAR Performance Framework) and those that are related to non-functional requirements (and do not have associated PIs).*"

The Performance Requirements consists of:

- Functional performance requirements related to ATM performance metrics and validation targets for the Solution (e.g. in terms of flight efficiency, predictability, airspace capacity and safety performance), as well as operational performance requirements identified at OSED/SPR level.

  Note 2: Following a request for clarification to SJU about requirements related to ATM performance targets, the answer provided was that "*it is not expected to create performance requirements reflecting the validation targets as such. The Validation targets are already reflected in the validation plan (section 3.4) and should guide the definition of validation objectives and success criteria (results to be then consolidated at the VALR (PAR) and CBA).*" The ATM Performance requirements identified in the intermediate version of this document have nevertheless been kept in this final SPR version for coherency with the PJ.06-01 Validation Plan [67].

- Non-functional requirements which capture acceptability criteria of the user on the system quality requirements. These requirements have been worded in their description to include: the user (i.e. the stakeholder when applicable to more than one role in En-Route ACC or the specific role), the specific system functionality and the quality of the system for the user

acceptance (e.g. response time, performance, efficiency or any other criteria that can be used to judge the operation of the system).

All performance requirements are traced with the <Performance> category and allocated to at least to one or more **Role** and **Activity** of the EATMA operational model layer (except for ATM Performance requirements).

4.2.4 Human Performance Requirements

In this final version of the SPR-INTEROP/OSED document, the HP requirements include the requirements derived from the HP arguments resulting from the Human Performance Assessment activities performed at V3 level.

These Human Performance requirements are statements that specify required characteristics of a solution from an HF point of view.

Refer to Part IV: Human Performance Assessment Report (SAR) of this document for further details.

All human performance requirements are traced with the <Human Performance> category and allocated to one or more **Activity** and **Role** of the EATMA operational model layer. They are also traced with the <Operational> category when already identified at OSED level.

4.2.5 Interoperability Requirements

In this final version of the SPR-INTEROP/OSED document, the interoperability requirements include the functional requirements that would be necessary to ensure the interoperability of the Solution would any specific technology be imposed by a design constraint.

All interoperability requirements are traced with the <Interoperability> category and allocated to one or more **Information Exchange** or **Information Flow** of the EATMA operational model layer.

4.3 Performance Requirements derived from SESAR 2020 Performance Framework

4.3.1 ATM Quality of Service Requirements

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS01.0002
Title	Flight efficiency benefits by ATS
Requirement	Civil ATS En-Route Service Provider shall able to benefit fuel efficiency
Status	<validated>
Rationale	This requirement is derived from the expected benefits in FRA for Environment/Fuel Efficiency Focus Area. This requirement takes as reference: • Solution #33: REQ-04.07.02-SPR-FR00.1001 • Transition VALS: OBJ-PJ0601-VALST3.001 Success criteria 7 & 8 • Target value from PJ19.04 - D4-8 Validation Targets (2019) In SESAR 1 EXE-07.05.03-VP-465, it was demonstrated that airlines were able to create and file UPR FPLs that met their optimisation requirements. The UPR concept was deemed acceptable by airlines, due to gains in flight cost optimisation and flexibility. FOC assessment in SESAR 1 EXE-04.03-VP-797 has demonstrated that: • Depending on the detailed Free Route environment, average fuel savings of up to 2.53% were achieved In SESAR 1 FREE SOLUTIONS Large Scale Demonstration: • overall Fuel Burn saved (for 1,002 flight trials) was 34,574Kg • Overall Time saved (for 1,002 flight trials) was 847 min • Overall distance flown saved (for 1,002 flight trials) was 4,482 NM

	In SESAR 2020 EXE-06.01-V3-VALP-001 and EXE-06.01-V3-VALP-002, it was demonstrated that the horizontal flight efficiency (in terms of local % of actual wasted route compared to the great distance circle (KEA indicator) is improved by the PJ.06-01 solution: • the local % of actual wasted route was reduced by about 20% in cross-border FRA scenarios in En-Route – Very High Complexity environment; • the local % of actual wasted route was reduced by about 27% in cross-border FRA scenarios in En-Route – High Complexity environment. With reference to SESAR 2020 PJ06.01 Performance Assessment Report: The outcomes of the PJ06.01 performance assessment , based on the V3 validation exercises results, give confidence that the PJ.06-01 Solution positively contributes to the Environment / Fuel Efficiency KPA through the implementation of structurally cross-border FRA in En-Route High and Very High Complexity operating environments.
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route High Complexity En-Route

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS01.0003
Title	Predictability benefits by ATS
Requirement	Civil ATS En-Route Service Provider shall be able to benefit predictability

Status	<validated>
Rationale	This requirement is derived from the expected benefits in FRA for Predictability KPA This requirement takes as reference: • Transition VALS: OBJ-PJ0601-VALST3.001 Success criteria 9 • Target value from PJ19.04 - D4-8 Validation Targets (2019) There are no previous results for this KPA as in SESAR 1 EXE-07.05.03-VP-797 it is reported: "the recorded data did not allow to measure the variance between the planned trajectories and the real flights duration with sufficient reliability, therefore the expected positive effect on predictability foreseen in FRA environment could not be validated." In SESAR 2020 Validation Exercises, the SESAR KPIs for Predictability KPA, as well as the KEP and KEA indicators, have been used to assess predictability benefits of Solution PJ.06-01 in En-Route High & Very High complexity environments. It was demonstrated that in FRA scenarios: • in EXE-06.01-V3-VALP-001, the local variance of actual vs. planned flight times was slightly increased, and the local % of actual vs. planned wasted route was decreased; • in EXE-06.01-V3-VALP-002, the local variance of actual vs. planned flight times was reduced, and local % of actual vs. planned wasted route was increased, , but with low confidence in the results. With reference to SESAR 2020 PJ06.01 Performance Assessment Report: the PJ.06-01 performance assessment conducted at V3 level did not provide evidence that the S2020 Validation Targets allocated to the Solution (in terms of a reduction of local variances) are achievable. Besides, the impact on the variability variances at ECAC level is considered unknown. Predictability benefits are nevertheless expected from the Solution in terms of local % of actual vs. planned wasted routes (i.e. difference [KEP-KEA]), which benefits will dependent on the cross-border FRA airspace design at local level.

Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route High Complexity En-Route

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS01.0009
Title	Airspace capacity in ATS
Requirement	Civil ATS En-Route Service Provider shall not negatively impact Airspace Capacity
Status	<validated>
Rationale	This requirement takes as reference PJ06-01 D2.1.030 Appendix A, where BIM has impacts on maintained levels on Local Capacity Thresholds and ATCO workload linked to Capacity (Airspace) KPA. This requirement takes as reference: • Solution #33: REQ-04.07.02-SPR-FR00.1004 • Transition VALS: OBJ-PJ0601-VALST3.001 Success criteria 12 In Skyguide simulation leg of SESAR 1 EXE-04.03-VP-797 dealing with FRA scenarios with different minimum Flight Levels for FRA (FL305+ and FL365+), it was demonstrated that ATCOs situation awareness & workload, traffic complexity, number of conflicts and STCA alerts showed that FRA concept could lead to a reduction of ATC sectors capacity. In SESAR 2020 EXE-06.01-V3-VALP-001 and EXE-06.01-V3-VALP-002, it was demonstrated that airspace capacity is at least

	maintained with the implementation of Solution PJ.06-01 (no reduction of capacity compared to reference scenarios). It was also demonstrated that ATCOs situation awareness & workload remains acceptable in cross-border FRA in High/Very High complexity environment with advanced ATC support tools. With reference to SESAR 2020 PJ06.01 Performance Assessment Report: The outcomes of the V3 validation activities give confidence that the PJ.06-01 Solution contributes to not adversely affect the Airspace Capacity Focus Area (i.e. 0% increase in peak hour throughput), with the implementation of structurally cross-border FRA in En-Route High and Very High Complexity operating.
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route Very High Complexity En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS01.0039
Title	Human Performance in ATS
Requirement	Civil ATS En-Route Service Provider shall not negatively impact on Human Performance of ATS actors
Status	<validated>

Rationale	This requirement takes as reference PJ06-01 D2.1.030 Appendix A, where BIM has impacts on maintained levels of ATCO workload and situational awareness linked to Human Performance KPA. With reference to SESAR 2020 PJ06.01 PAR and HPAR, the outcomes of the V3 validation activities give confidence that the PJ.06-01 Solution contributes to not adversely affect the Human Performance KPA, with the implementation of structurally cross-border FRA and appropriate ATC support tools, in En-Route High and Very High Complexity operating environments.
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route High Complexity En-Route Very High Complexity En-Route

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS01.0040
Title	Civil ATS En-Route Service Provider shall not negatively impact on Safety
Requirement	Civil ATS En-Route Service Provider shall not negatively impact on Safety
Status	<validated>

Rationale	This requirement takes as reference PJ06-01 D2.1.030 Appendix A, where BIM has impacts on maintained levels of ATCO Workload and situational awareness, linked to Safety KPA.
	With reference on SESAR 2020 PJ06.01 PAR and SAR, the outcomes of the V3 validation activities give confidence that the PJ.06-01 Solution contributes to not adversely affect the Safety KPA, with the implementation of structurally cross-border FRA in En-Route High and Very High Complexity operating environments.
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Role>	ATC Sector Executive Role ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route High Complexity En-Route Very High Complexity En-Route

4.3.2 Human Performance Requirements derived from HP Arguments

[REQ]

Identifier	REQ-06.01-SPRINTEROP-HP01.0034
Title	Clarity and completeness of role and responsibilities of human actors
Requirement	Civil ATS En-Route Service Provider shall define clear and complete role and responsibilities of human actors
Status	<validated>

Rationale	Requirement takes reference in PJ06-01 D2.1.430 HP Plan, where impacts on the following arguments have been identified: • Arg. 1.1.1- Roles & responsibilities cover all affected human actors • Arg. 1.1.2- Descriptions of roles & responsibilities cover all tasks to be performed by the human actors • Arg. 1.1.3- Roles and responsibilities are clear and consistent. PJ06.01 HPAR Evidences: Arg. 1.1.1 [Closed] HC/VHC Overall, Cross-Border FRA solutions in high/very high complexity environment did not generate any need to change the existing roles and responsibilities distribution in the Team. Arg. 1.1.2 [Closed] HC/VHC The roles and responsibilities covered all tasks and were clear to ATCOs. Arg 1.1.3 [Closed] The roles and responsibilities between the team members were considered clear. Controllers preferred to perform an early release or if not possible coordinate between planning controllers the resolution of a conflict near the border. Controllers raised issues regarding the legal responsibility in case of accident and some related real incidents due to different solving strategies between the upstream and downstream controllers. Cross-Border FRA solutions in very high complexity (VHC) environment did not generate any need to change the existing Roles and Responsibility distribution in the Team. However, some uncertainties between sectors regarding the responsibilities of solving traffic conflicts occurring close to the boundary between Geneva and Zurich ACCs (after flights exit from one ACC to another one) were observed during the simulation sessions during SOL1 and SOL2 runs, which were also mentioned during the debriefing.

	Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-042) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-HP01.0035
Title	Adequacy of operating methods (procedures) in supporting human performance
Requirement	Civil ATS En-Route Service Provider shall have adequate operating methods (procedures) supporting human performance
Status	<validated>
Rationale	Requirement takes reference in PJ06-01 D2.1.430 HP Plan, where impact on the following argument has been identified: Arg. 1.2.5- Feasibility of new procedures for managing traffic complexity PJ06.01 HPAR Evidences: Arg. 1.2.5 [Closed] The working methods and procedures were considered acceptable both in high and very high complexity environments. Globally, ATCOs considered that they were able to develop and apply appropriate working methods for all scenarios. In the high complexity environment RTS during the final debriefing controllers mentioned they would benefit from a more clear definition of handover procedures during transitions

	between sectors. This was related to the limited training ATCOs had on the platform. The FRA structure took vertical and lateral transitions into account, but vertical transitions were addressed in a simplified way. This point is clearly identified as requiring a specific and detailed local study before any cross-border FRA implementation. Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-047) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-HP01.0036
Title	Capability of human actors to achieve their tasks
Requirement	Civil ATS En-Route Service Provider shall provide the capability to human actors to achieve their tasks in a timely manner, with limited error rate and acceptable workload level
Status	<validated>
Rationale	Requirement takes reference in PJ06-01 D2.1.430 HP Plan, where impact on the following arguments has been identified: • Arg. 1.3.2- Feasibility of controllers' duty tasks in a timely manner • Arg. 1.3.3- How high-complexity/high density free route operations impact on controllers' workload

	• Arg. 1.3.4- Level of trust in the new procedures for managing traffic complexity
	• Arg. 1.3.5- How high-complexity/high density free route operations impact on controllers' situational awareness
	PJ06.01 HPAR Evidences:
	Arg. 1.3.2 [Closed]
	In High Complexity Environment the NASA-TLX cognitive workload results indicate that: temporal demand is higher for all roles when a Military Area is active. The temporal demand is lower for PC with Advanced Tools in FRA.
	Both PC an EC workload remains acceptable in solution under validation in high complexity environment.
	In very high complexity environment ATCOs considered having succeeded in accomplishing their tasks during all runs, no significant variation can be observed between the reference and solutions scenarios.
	Conflict detection and resolution have been considered acceptable by ATCOs during all runs.
	They reported that even if working principles and procedures are not strongly modified in cross-border FRA environment of very high complexity, given the higher variability of trajectories and the more random distribution of crossing points in the airspace (and consequently conflicts to be solved), the good accomplishment of conflict detection and resolution tasks by ATCOs is more dependent on good ATC support tools support.
	Arg. 1.3.3 [Closed]
	HC
	In Free Route environment workload was increased especially to solve conflicts, but the increase is within manageable limits if supported with the appropriate tools.
	During the debriefings controllers indicated that the workload distribution between planner and executive controllers is more distributed in FR environment than nowadays. The workload values obtained through the different runs are quite divergent. In some cases, the workload in Solution scenario decrease above 40% compared to Reference scenario. On the other hand, there

are trials where the workload in Solution scenario increase around 6%-17% compared to the Reference scenario.

According to the workload measurements with eyetracker the scenarios with higher workload are the Military and the 2022 scenarios. The use of basic tools require higher workload than the use of advanced tools.

VHC

ATCOs considered having succeeded in accomplishing their tasks during all runs, no significant variation can be observed between the reference and solutions scenarios.

Arg. 1.3.4 [Closed]

HC

ATCOs considered that the system allowed them to develop and apply the working methods but some features still need to be improved. The advanced tools supported the ATCO tasks, even better than in the reference scenario.

VHC

They indicated that procedures were appropriate but can be improved with an adaptation to FRA environment (e.g. no more reference to mandatory Entry/Exit points and a clear definition of conflict resolution responsibilities between contiguous centres, avoiding coordination actions and contributing to Safety level keeping).

Coordination with adjacent units was acceptable to the ATCOs in all three weeks and in all the runs and scenarios.

Screen-to-screen electronic coordination tools (ATCOs<>ATCOs) between Geneva and Zurich sectors (similar to the ones available between sectors from the same ACC), have been intensively used and strongly appreciated by ATCOs.

Arg. 1.3.5 [Closed]

HC

ATCOs (both EC and PC) average Situation Awareness was rated in the medium values of the scale. During the debriefings ATCOs mentioned that they felt that their situational awareness within the ATC sector team was enough to adequately perform their tasks.

	The situational awareness of the planning controller decreases when using basic tools and when the military area is activated.
	Controllers indicated that in FR environment situational awareness has decreased a bit with regards to structured routes, due to the spread of possible conflict locations along the sectors. Nevertheless, some controllers pointed out that some sectors with a "STAR" route structure defined improved their situational awareness.
	VHC
	TC and PC workload remained acceptable during all runs, there was no observed degradation in solution scenarios compared to reference scenarios.
	Maintaining situation awareness was reported as more mentally demanding due to the increased variability of the trajectories, but thanks to the adapted ATC support tools, situation awareness has not been degraded in solution scenarios compared to reference scenarios.
	Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-041 & OBJ-06.01-V3-VALP-045) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-HP01.0037
Title	Adequacy of human machine interface

Requirement	Civil ATS En-Route Service Provider shall have adequate human machine interface in supporting the human in carrying out their tasks
Status	<validated>
Rationale	Requirement takes reference in PJ06-01 D2.1.430 HP Plan, where impact on the following arguments has been identified: • Arg. 2.3.1- Provided information is fit for purpose and satisfies information requirements of the humans • Arg. 2.3.6- Usability of the user interface (input devices, visual displays/output devices, alarms& alerts) • Arg. 2.3.8- User interface design supports a sufficient level of individual situational awareness. PJ06.01 EVIDENCES: Arg. 2.3.1 [Closed] HC ATCOs (both EC and PC) average Situation Awareness was rated in the medium values of the scale. During the debriefings ATCOs mentioned that they felt that their situational awareness within the ATC sector team was enough to adequately perform their tasks. Trust in automation of the executive and planning controllers is increased when using advanced tools. Controllers considered the conflict detection tools (TCT/TTM) as the most useful in the FRA environment. The main concern of ATCOs was on how they could get more familiar the range of the tool, sometimes they considered the range as long, but other times as short. As possible implementation improvements they indicated an improvement on the detection precision/accurateness, and the possibility to withdraw an alert after analysis. Controllers indicated that due to the different time horizon MTCD and TCT should not be integrated in one panel, or if integrated it should be easy to distinguish between both. VHC Globally, the system was deemed by ATCOs as usable, especially in week 3 (corresponding to the optimized performance of the

	platform), which gave the highest ratings whatever the scenarios.
	Arg. 2.3.6 [Closed]
	HC/VHC
	The overall system usability and information provided are enough but there is room for improvement.
	Arg. 2.3.8 [Closed]
	HC
	ATCOs (both EC and PC) average Situation Awareness was rated in the medium values of the scale. During the debriefings ATCOs mentioned that they felt that their situational awareness within the ATC sector team was enough to adequately perform their work.
	ATCOs recommended that the graphical route of a flight is displayed briefly and automatically when the flight is assumed thus improving situational awareness.
	VHC
	Situational awareness was enough for TC and not degraded with 2022 amount of traffic in the solutions scenarios.
	Maintaining situation awareness was reported as more mentally demanding due to the increased variability of the trajectories, but thanks to the adapted ATC support tools, situation awareness has not been degraded in solution scenarios compared to reference scenarios.
	Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-043) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity

| | | En-Route |
| | | En-Route High Complexity |

[REQ]

Identifier	REQ-06.01-SPRINTEROP-HP01.0038
Title	Adequacy of team communication
Requirement	Civil ATS En-Route Service Provider shall ensure adequate team communication with regard to communication modalities, technical enablers and impact on situation awareness/workload
Status	<validated>
Rationale	Requirement takes reference in PJ06-01 D2.1.430 HP Plan, where impact on the following arguments has been identified: Arg. 3.3.1- Intra-team and inter-team communications support the information requirements of team members. Arg. 3.3.2- Phraseology supports for intra-team and inter-team communication Arg. 3.3.4- Communications load Arg. 3.3.5- How high-complexity/high density free route operations impact on controllers situational awareness PJ06.01 EVIDENCES: Arg. 3.3.1 [Closed] HC ATCOs considered that communication within the team was good in all the scenarios. Communication within the sector team is better in Free Route with advance tools than in all the other scenarios including the reference scenario. Coordination with adjacent sectors is considered as good in all the scenarios. Coordination information in the coordination panel disappeared in the moment it was accepted.

	VHC
	Cross Border FRA solutions in very high complexity environment did not generate any negative impact on internal Team communication. Internal team communication was efficient and unambiguous
	Arg. 3.3.2 [Closed]
	HC
	Communication within the sector team is better in Free Route with advance tools than in all the other scenarios including the reference scenario.
	During the military scenario there were some communication problems.
	External communication has also been intensively supported by the use of electronic coordination, which has been reported really good and efficient.
	VHC
	Cross Border FRA solutions in very high complexity environment did not generate any negative impact on internal Team communication. Internal team communication was efficient and unambiguous.
	No specific comment or mention on the phraseology adequacy.
	Arg. 3.3.4 [Closed]
	HC
	No evidence that communication load was increased. The communication was considered efficient in all the scenarios.
	VHC
	Cross Border FRA solutions in very high complexity environment did not generate any negative impact on internal Team communication. Internal team communication was efficient and unambiguous.
	Screen-to-screen electronic coordination tools (ATCOs<>ATCOs) between Geneva and Zurich sectors (similar to the ones available between sectors from the same ACC), have been intensively used and strongly appreciated by ATCOs.
	CPDLC functions were available and have been quite intensively used but mainly for change of frequencies. ATCOs having

	reported that due to the reduction of the number of available points along the trajectories and in the free route airspace structure, conflict resolution is much more based on heading clearances instead of direct clearances. This generate additional clearances and workload, compared to direct clearances to intermediate waypoints.
	Arg. 3.3.5 [Closed]
	HC
	ATCOs (both EC and PC) average Situation Awareness was rated in the medium values of the scale. During the debriefings ATCOs mentioned that they felt that their situational awareness within the ATC sector team was enough to adequately perform their work.
	ATCOs recommendation was to display the flight route momentarily when the flight is assumed.
	VHC
	Situation awareness has not been degraded in solution scenarios compared to reference scenarios and there was no reported specific issue related to sharing and coherency of situation awareness between Executive and Planner controller during de-briefing sessions.
	Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-043, OBJ-06.01-V3-VALP-044, OBJ-06.01-V3-VALP-045 & OBJ-06.01-V3-VALP-046) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route High Complexity En-Route

4.4 Free Route Airspace Design

4.4.1 Functional Safety Requirements (from success case)

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0082
Title	Flight planning rules defined and published in national AIS publication
Requirement	National AIS publication and RAD shall describe flight planning rules applicable inside the free routing airspace without reference to published route network or fixed coordination point.
Status	<validated>
Rationale	AUs have to be aware of the flight planning rules inside Free Routing Airspace to plan their trajectories accordingly. Flight planning rules includes: entry/exit conditions from/to adjacent airspace, transition conditions from/to lower/upper space, period of availability of the airspace, min/max length of the user-defined segments (if any), possibility (or not) to plan user defined points). This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-FP-001] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_018]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route Very High Complexity

	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0115
Title	Capacity adaptation in case of ATC technical failure
Requirement	ANSP shall adapt capacity of the sectors in case of ATC technical failure (loss of surveillance, air/ground communication, FDPS…)
Status	<validated>
Rationale	This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-FP-033] This requirement is linked with the ATM Performance Management capability which has no activities defined. This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_039]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route High Complexity En-Route Very High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0117
Title	Flight planning restrictions

Requirement	National AIS publication and RAD shall define sufficient flight planning restrictions enabling the provision of safe and efficient Air Traffic Control service by the ATCo in tactical phase.
Status	<validated>
Rationale	Flight panning restrictions (i.e. trade off between structural limitation of the FRA and available tool, particularly for optional tools)
	This requirement takes as reference the safety objective of SESAR solution PJ.06-01 from Final Safety Assessment Report [SO-FP-011]
	This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_019]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route High Complexity En-Route

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0118
Title	Flight planning rules defined and published
Requirement	En-Route ATS Provider shall ensure consistency between flight planning rules applicable inside the free routing airspace and limitation of the system database to ensure that system will know all the waypoints of interest.

Status	<validated>
Rationale	This requirement takes as reference the safety objective of SESAR solution PJ.06-01 from Final Safety Assessment Report [SO-FP-034] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_021]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route Very High Complexity En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0131
Title	Flight planning rules to avoid flight planning through active ARES
Requirement	National AIS publication and RAD shall describe flight planning rules applicable inside the free routing airspace to avoid flight planning through active ARES.
Status	<validated>

Rationale	This requirement takes as reference the safety objective of SESAR solution PJ.06-01 from Final Safety Assessment Report [SO-FP-013] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_020]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0042
Title	Acceptable entry and exit conditions of a sector/ACC
Requirement	LoA shall describe the acceptable entry and exit conditions of a sector/ATSU, in free routing environment, without reference to published route network or fixed coordination point.
Status	<validated>
Rationale	This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-FP-002] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_016]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)

Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route Very High Complexity En-Route High Complexity

4.4.2 Functional Safety Requirements (from failure case)

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO03.0133
Title	Structurally limited FRA airspace design on mandatory waypoints
Requirement	Structurally limited FRA airspace design shall reduce the need for sector skipping.
Status	<validated>
Rationale	e.g. include 'non plannable' areas or mandatory waypoints near sector corners. This requirement takes as reference the safety objective of SESAR solution PJ.06-01 from Final Safety Assessment Report [SO-IR-002] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_046]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route Very High Complexity En-Route High Complexity

4.4.3 Operational Performance Requirements

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS01.0007
Title	Lower level limit of FRA
Requirement	Air Navigation Service Provider shall not negatively impact Airspace Capacity with Free Route Airspace (cross-border or not) implemented at least at and above FL310
Status	<validated>
Rationale	This requirement is linked with the ATM capability: • Free Route Airspace Design for the establishment of the FRA lower limit either at ACC, State or cross-border FRA level. This requirement takes as reference: • Solution #33: REQ-04.07.02-SPR-FRAM.1002 • Transition VALS: OBJ-PJ0601-VALST3.001 Success criteria 12 According to PCP (EU No 716/2014): "Free Route shall be provided and operated in the airspace for which the Member States are responsible at and above flight level 310 in the ICAO EUR region." Common lowest level according to PCP does not restrain the possibility of lower local level wherever possible. In SESAR 1 EXE-04.03-VP-797, validation results showed that: • In the simulated area, FRA concept was considered not acceptable at at above FL305, due to the expected level of traffic and the number of interactions and conflicts to be managed between flights in vertical evolution and flights in cruise, which is

	expected to be very high and really difficult to manage in this level band. • In the simulated area, if the required concept adaptations are implemented, FRA concept was considered acceptable at and above FL365. The number of interactions and conflicts to be managed between flights in vertical evolution and flights in cruise is expected to be lower and manageable The SESAR 1 validation results related to Solution #33 do not directly apply to Solution PJ06-01, they are provided as illustrative results from previous research. Requirement is validated with reference on SESAR 2020 PJ06.01 VALR (OBJ-06.01-V3-VALP-011 and OBJ-06.01-V3-VALP-031) results and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019) With reference on PJ06.01 VALR Results: "The capacity is thus considered that is not reduced in the Structurally Limited Free Route environment using the appropriate ATC support tools and adapted procedures"
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route High Complexity En-Route Very High Complexity En-Route

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS01.0011
Title	Airspace Capacity of adjacent/subjacent airspaces to FRA

Requirement	Air Navigation Service Provider shall not negatively impact Airspace Capacity of any adjacent/subjacent non-FRA volume, with Free Route Airspace implemented at least at and above FL310.
Status	<in progress>
Rationale	This requirement is linked with the ATM capability: • Free Route Airspace Design This requirement takes as reference: • Solution #33: REQ-04.07.02-SPR-FRAM.1001 which was <in progress> at the end of SESAR 1. • Transition VALS: OBJ-PJ0601-VALST3.001 Success criteria 12 Requirement is kept in progress as it was not traced by EXEs and not possible to be anticipated and for so assessed in the Expert Group (PJ06.01 workshop, 11-12 September 2019).
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route High Complexity En-Route

4.4.4 Human Performance Requirements

[REQ]

Identifier	REQ-06.01-SPRINTEROP-HP01.0039
Title	LoA transfer conditions
Requirement	The Letter of Agreement (LoA) shall clearly state the information on the transfer conditions.

Status	<validated>
Rationale	The adaptation of LoAs and internal procedures to XFRA environment would contribute to safety level and workload reduction (e.g. some cases of uncertainties about resolution of conflicts generated additional coordination actions. PJ06.01 EVIDENCES: Arg. 1.2.5 [Closed] The working methods and procedures were considered acceptable both in high and very high complexity environments. Globally, ATCOs considered that they were able to develop and apply appropriate working methods for all scenarios. In the high complexity environment RTS during the final debriefing controllers mentioned they would benefit from a more clear definition of handover procedures during transitions between sectors. This was related to the limited training ATCOs had on the platform. The FRA structure took vertical and lateral transitions into account, but vertical transitions were addressed in a simplified way. This point is clearly identified as requiring a specific and detailed local study before any cross-border FRA implementation. Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

4.5 Air Traffic Flow / Complexity Management

4.5.1 SPR Requirements

4.5.1.1 Functional Safety Requirements (from failure case)

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO03.0132
Title	Supervisors involvement in FRA operation
Requirement	Supervisors involvement shall be increased for FRA operation.
Status	<validated>
Rationale	Supervisor involvement e.g. by increasing time to inform ATCOs of ARES activation. This requirement takes as reference the safety objective of SESAR solution PJ.06-01 from Final Safety Assessment Report [SO-IR-001] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_042]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route High Complexity En-Route En-Route Very High Complexity

4.5.1.2 Operational Performance Requirements

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS01.0010
Title	Airspace capacity in ATS under high variability of traffic complexity
Requirement	Civil ATS En-Route Service Provider shall be able to manage environments with high variability in traffic complexity at sector/ACC level, without negatively impacting Airspace Capacity
Status	<validated>
Rationale	This requirement is linked with the ATM capability: • Air Traffic Complexity Management This requirement takes as reference: • Solution #33: REQ-04.07.02-SPR-FR00.1006 which was <in progress> at the end of SESAR 1 • Transition VALS: OBJ-PJ0601-VALST3.001 Success criteria 12 In Skyguide simulation leg of SESAR 1 EXE-04.03-VP-497, ATCOs situation awareness & workload, traffic complexity, number of conflicts and STCA alerts showed that FRA concept tested during this exercise could lead to a reduction of ATC sectors capacity. Requirement is validated with reference on SESAR 2020 PJ06.01 VALR for OBJ-06.01-V3-VALP-031 results and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019). According to PJ06.01 VALR for this OBJ: "The FRA structure Design has a crucial importance in order to maintain the complexity within manageable limits".
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Role>	ATC Sector Executive Role ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity

| | | En-Route High Complexity |
| | | En-Route |

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM00.0010
Title	Capacity thresholds and TV monitoring values
Requirement	Civil ATS En-Route Service Provider shall adapt sector capacities and TV monitoring values to Free Routing operations taking into account airspace and demand complexity.
Status	<in progress>
Rationale	In Free Routing Airspace, the traffic will potentially be spread over a wider area of the sector, instead of structured flows of traffic along the route network. Sector design will need to consider this change and may need to be more flexible as traffic demand varies. More flexibility in defining a larger number of elementary sectors/traffic volumes and sector configurations might need to be explored. The associated sector capacities and TV monitoring values will then need to be defined.
Category	<Operational> , <Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

4.5.1.3 Non-functional Safety Requirements

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO02.0110
Title	Occurrence of flight descending below FRA lower limit before the exit/arrival point

Requirement	The frequency of occurrence of an aircraft descending below the FRA lower limit before reaching the exit/arrival point, shall not be greater than 1.00E-03 per flight hour while in high/very high complexity Free Routing Operations.
Status	<validated>
Rationale	This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-IR-028]

This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_IR_OPS_028]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019) |
| Category | <Safety> |

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity

En-Route

En-Route High Complexity |

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO02.0111
Title	Occurrence of aircraft flying segment longer than the maximum authorized length
Requirement	The frequency of occurrence of an aircraft flying a segment longer than the maximum authorized length in the FRA, shall not be greater than 1.00E-03 per flight hour while in high/very high complexity Free Routing Operations.
Status	<validated>

Rationale	This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-IR-029] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_IR_OPS_029]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO02.0112
Title	Ocurrence of aircraft flying several segments shorter than the minimum authorized
Requirement	The frequency of occurrence of an aircraft flying several segments shorter than the minimum authorized length in the FRA, shall not be greater than 1.00E-03 per flight hour while in high/very high complexity Free Routing Operations.
Status	<validated>

Rationale	This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-IR-030] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_IR_OPS_030]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO02.0113
Title	Occurrence of flight trajectory with unpublished points whereas not allowed
Requirement	The frequency of occurrence of an aircraft flying a trajectory with user defined points (LAT/LON) whereas it is not allowed, shall not be greater than 1.00E-03 per flight hour while in high/very high complexity Free Routing Operations.
Status	<validated>

Rationale	This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-IR-031] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_IR_OPS_031]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route High Complexity En-Route Very High Complexity

4.5.1.4 Non-Functional Performance Requirements

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS02.0018
Title	Operability of flight planning trajectories through Airspace Reservations with tactical re-routing
Requirement	Civil ATS En-Route Service Provider shall be able to operate flight planning trajectories through Airspace Reservations with tactical re-routing
Status	<validated>

| Rationale | This requirement is linked with the ATM capability:

• Air Traffic Flow Management

This requirement takes as reference:

• Solution #33: REQ-04.07.02-SPR-FRFP.1003

Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-041, OBJ-06.01-V3-VALP-042, OBJ-06.01-V3-VALP-043 and OBJ-06.01-V3-VALP-044) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)

In PJ06.01 VALR recommendations: "Procedures to be followed, in case of ARES activation, must be clear. FR waypoints available to avoid the area must be reviewed" |
|---|---|
| Category | <Performance> |

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Role>	ATC Sector Executive Role

ATC Sector Planning Role |
| <ALLOCATED_TO> | <Sub-Operating Environment> | En-Route Very High Complexity

En-Route

En-Route High Complexity |

4.5.2 INTEROP Requirements

NA

4.6 Separation Provision (airspace) / Trajectory Conformance Monitoring

4.6.1 OSED Requirements

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SP01.0001
Title	Efficient information display for separation provision at or close to sector/ACC boundaries
Requirement	Civil ATS En-Route Service Provider shall provide relevant cross border information from Adjacent ATS units for display on CWPs, to identify potential conflicts at or close to sector boundaries.
Status	<validated>
Rationale	This requirement is linked with the ATM capability: • Separation provision (airspace) This requirement takes as reference: • Solution #33: REQ-04.07.02-SPR-FRPC.1002 In SESAR 1 EXE-07.05.03-VP-465, although there were some coordination issues, 74% of ATCOs said that they received sufficient information from the previous sector regarding the UPR FPL. In DSNA simulation leg of SESAR 1 EXE-04.03-VP-798, in Low to Medium FRA, the level of ATCO's situation awareness seemed acceptable after a transition time, but with more involved cognitive resources (i.e. workload and fatigue). The SESAR 1 validation results related to Solution #33 do not directly apply to Solution PJ06-01, they are provided as illustrative results from previous research. Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-043) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Determine planning problems at offered entry conditions in cross-border FRA Assess trajectory profile through the AoR for tactical controller suitability Assess planned profile constraints or agreed coordinations in cross-border FRA Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA Check conformance to planned constraints Assess planned/desired profile for problems within AoR/AoI in cross-border FRA Determine safe potential exit conditions in cross-border FRA
<ALLOCATED_TO>	<Role>	ATC Sector Executive Role ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SP01.1000
Title	Separation assurance actions initiated by upstream (transferring) ATSU/sector
Requirement	The upstream (transferring) sector shall be responsible for the initiation of actions ensuring prescribed separation for flight entering the Area of Responsibility of the downstream (accepting) ACC/sector, if a separation infringement is detected close to the downstream/upstream ACC/sector boundary.
Status	<validated>

Rationale	The removal of published routes leads to a change in the number and location of conflict points. Moreover, in Free Routing cross-border environment conflicts may happen along sector/ACC boundaries due to the free trajectories. This may cause extensive coordination and uncertainty as to who is responsible for separation. There is an operational need to clearly define responsibility for separation provision for conflicts at/close to a boundary between two ATC sectors. This can be defined in the local ATC procedures of an ATSU or in the Letter of Agreement (LOA) between the ATSUs concerned. Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-042) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019).
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Determine planning problems at offered entry conditions in cross-border FRA Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA Determine safe potential exit conditions in cross-border FRA Assess planned profile constraints or agreed coordinations in cross-border FRA Assess trajectory profile through the AoR for tactical controller suitability Assess planned/desired profile for problems within AoR/AoI in cross-border FRA Agree entry coordination in cross-border FRA Check conformance to planned constraints Select clearance to achieve desired profile Select clearance to respect agreed constraints or coordinations

		Establish necessary separation
		Issue clearances
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity
		En-Route
		En-Route High Complexity

4.6.2 SPR Requirements

4.6.2.1 Functional Safety Requirements (from success case)

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0043
Title	Remove of a flight from the ordered list of sectors
Requirement	The ATCOs (ATC Sector Planning and Executive Roles) shall be able to remove a flight of her/his sector from the ordered list of sectors that are expected to assume a given flight.
Status	<validated>
Rationale	This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-FP-003] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_023]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Determine safe potential exit conditions in cross-border FRA Check conformance to planned constraints

		Determine planning problems at offered entry conditions in cross-border FRA
		Refer to tactical who assesses problems
<ALLOCATED_TO>	<Role>	ATC Sector Executive Role
		ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route
		En-Route High Complexity
		En-Route Very High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0044
Title	Induced conflicts reduction
Requirement	In order to avoid more ATC induced conflicts, ATC Sector Planning Role shall be informed of ATC Sector Executive Role actions AND VICEVERSA.
Status	<validated>
Rationale	This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-FP-004] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_024]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Determine planning problems at offered entry conditions in cross-border FRA Assess trajectory profile through the AoR for tactical controller suitability

		Determine safe potential exit conditions in cross-border FRA
		Assess planned/desired profile for problems within AoR/AoI in cross-border FRA
		Assess planned profile constraints or agreed coordinations in cross-border FRA
		Check conformance to planned constraints
		Select clearance to respect agreed constraints or coordinations
		Issue clearances
		Establish necessary separation
		Select clearance to achieve desired profile
		Refer to tactical who assesses problems
<ALLOCATED_TO>	<Role>	ATC Sector Planning Role ATC Sector Executive Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route High Complexity En-Route

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0045
Title	Planned trajectory display beyond the sector/ACC boundary
Requirement	The ATCOs shall be able to display the planned trajectory of a selected flight beyond the sector/ACC boundary.
Status	<validated>
Rationale	In Free Routing Airspace, a tool allowing the display of the planned 2D trajectory of at least one selected flight is essential for ATCOs to build her/his mental image of the situation. In case of Free Routing across ACC/FIR borders, the displayed trajectory would need to be possible beyond the ATSU AoR. This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-FP-005] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report

	[SR_FP_OPS_025]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Assess trajectory profile through the AoR for tactical controller suitability Assess planned profile constraints or agreed coordinations in cross-border FRA Refer to tactical who assesses problems Assess planned/desired profile for problems within AoR/AoI in cross-border FRA Select clearance to respect agreed constraints or coordinations Select clearance to achieve desired profile Check conformance to planned constraints
<ALLOCATED_TO>	<Role>	ATC Sector Planning Role ATC Sector Executive Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0046
Title	Minimal predicted separation support tool
Requirement	The ATCOs (ATC Sector Planning and Executive Roles) shall be provided with support tool to determine the minimal predicted separation between two selected flights on their planned trajectories within the area of interest of the sector
Status	<validated>

Rationale	This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-FP-006] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_026]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Determine safe potential exit conditions in cross-border FRA Determine planning problems at offered entry conditions in cross-border FRA Assess planned profile constraints or agreed coordinations in cross-border FRA Assess planned/desired profile for problems within AoR/AoI in cross-border FRA Check conformance to planned constraints Refer to tactical who assesses problems
<ALLOCATED_TO>	<Role>	ATC Sector Executive Role ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route Very High Complexity En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0047
Title	Mid-term encounters detection within the ATC sector area of interest

Requirement	The ATCOs shall be able to detect mid-term encounters between two flights along their planned trajectories within the ATC sector area of interest.
Status	<validated>
Rationale	In Free Routing Airspace, the ATCOs need a support to assess the global air situation including flights that follow an unfamiliar route scheme. Also conflicts may occur at the boundary between two sectors and the ATCOs need a support to detect such conflicts in advance. A mid-term detection of encounters at the ATC planning phase permits to predict potential loss of separation between two planned trajectories of interest for the sector (20 minutes time horizon as an order of magnitude). This functionality is considered as necessary in airspace of medium complexity or in airspace with high variability in traffic complexity. This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-FP-007] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_027]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Determine planning problems at offered entry conditions in cross-border FRA Determine safe potential exit conditions in cross-border FRA Check conformance to planned constraints Establish necessary separation

		Assess planned/desired profile for problems within AoR/AoI in cross-border FRA
		Assess planned profile constraints or agreed coordinations in cross-border FRA
		Refer to tactical who assesses problems
<ALLOCATED_TO>	<Role>	ATC Sector Planning Role
		ATC Sector Executive Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route
		En-Route Very High Complexity
		En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0048
Title	Support tools for information sharing in ATC
Requirement	The ATC Sector Planning Role shall be provided with tools to support information sharing between ATC Sector Planning and Executive Role.
Status	<validated>
Rationale	This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-FP-008] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_028]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Assess planned/desired profile for problems within AoR/AoI in cross-border FRA

		Assess planned profile constraints or agreed coordinations in cross-border FRA
		Establish necessary separation
		Determine planning problems at offered entry conditions in cross-border FRA
		Determine safe potential exit conditions in cross-border FRA
		Check conformance to planned constraints
		Refer to tactical who assesses problems
<ALLOCATED_TO>	<Role>	ATC Sector Planning Role
		ATC Sector Executive Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route
		En-Route Very High Complexity
		En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0050
Title	Ability to assess alternative trajectories (planning what-if)
Requirement	The ATCOs shall be able to assess alternative trajectories in support of the negotiation of coordination conditions with adjacent ATC sectors (planning what-if).
Status	<validated>
Rationale	With no airspace reference, the coordination of flights in Free Routing Airspace would take advantage of a support to unambiguously exchange about a given aircraft.

In FRA across ACC/FIR borders where interoperability aspects are taken into account, conflict detection could be handled at sector level before coordination of flight, thus this functionality is nice-to-have rather than an essential function.

This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-FP-010]

This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_030]. Requirement is considered validated through |

	the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Assess trajectory profile through the AoR for tactical controller suitability Determine planning problems at offered entry conditions in cross-border FRA Assess planned/desired profile for problems within AoR/AoI in cross-border FRA Select clearance to respect agreed constraints or coordinations Select clearance to achieve desired profile Assess planned profile constraints or agreed coordinations in cross-border FRA Establish necessary separation Determine safe potential exit conditions in cross-border FRA Check conformance to planned constraints Refer to tactical who assesses problems
<ALLOCATED_TO>	<Role>	ATC Sector Planning Role ATC Sector Executive Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0051
Title	Ability to detect tactical encounters

Requirement	The ATCOs shall be able to detect tactical encounters between two or more flights not necessarily on a fixed ATS route segment.
Status	<validated>
Rationale	In Free Routing high complexity cross-border environment, the Executive Controller needs a support to assess the global air situation including flights that follow an unfamiliar route scheme.
	A short-term detection of encounters at the ATC tactical phase permits to predict potential loss of separation between two or more trajectories within the ATSU/sector AoR/AoI. The tactical conflict detection tool must take into account situations when one or more flight is cleared direct to a point located far away from ATC sector AoR/AoI. This encompasses the analysis of trajectories slowly converging.
	This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-FP-011]
	This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_031]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Assess planned profile constraints or agreed coordinations in cross-border FRA
		Assess trajectory profile through the AoR for tactical controller suitability
		Select clearance to respect agreed constraints or coordinations
		Determine planning problems at offered entry conditions in cross-border FRA

		Assess planned/desired profile for problems within AoR/AoI in cross-border FRA
		Establish necessary separation
		Select clearance to achieve desired profile
		Check conformance to planned constraints
		Determine safe potential exit conditions in cross-border FRA
		Refer to tactical who assesses problems
<ALLOCATED_TO>	<Role>	ATC Sector Executive Role
		ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route High Complexity
		En-Route Very High Complexity
		En-Route

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0052
Title	Support for potential crossing detection between planned trajectory and active stack
Requirement	The ATCOs (ATC Sector Planning and Executive Roles) shall be provided with a tool detecting the potential crossing between the planned trajectory of the aircraft and active stack En Route in the sector
Status	<validated>
Rationale	This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-FP-0012] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_032]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Assess trajectory profile through the AoR for tactical controller suitability Determine safe potential exit conditions in cross-border FRA Determine planning problems at offered entry conditions in cross-border FRA Assess planned/desired profile for problems within AoR/AoI in cross-border FRA Establish necessary separation Select clearance to achieve desired profile Assess planned profile constraints or agreed coordinations in cross-border FRA Select clearance to respect agreed constraints or coordinations Check conformance to planned constraints Refer to tactical who assesses problems
<ALLOCATED_TO>	<Role>	ATC Sector Planning Role ATC Sector Executive Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0053
Title	Timely information or ARES activation status
Requirement	The ATCOs (ATC Sector Planning and Executive Roles) shall be informed in due time of ARES activation status (active/not active/released) within the area of interest of the sector.
Status	<validated>

Rationale	This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-FP-0013] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_033]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Check conformance to planned constraints Determine planning problems at offered entry conditions in cross-border FRA Determine safe potential exit conditions in cross-border FRA Assess planned profile constraints or agreed coordinations in cross-border FRA Issue clearances Assess trajectory profile through the AoR for tactical controller suitability Assess planned/desired profile for problems within AoR/AoI in cross-border FRA Select clearance to achieve desired profile Establish necessary separation Select clearance to respect agreed constraints or coordinations Monitor clearance implementation Refer to tactical who assesses problems
<ALLOCATED_TO>	<Role>	ATC Sector Executive Role ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route High Complexity

		En-Route Very High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0054
Title	Ability to detect predicted infringement of active ARES
Requirement	The ATCOs shall be able to detect predicted infringement of active ARES by flights along their planned trajectories within the ATC sector area of interest.
Status	<validated>
Rationale	With no route scheme, the ATCOs need a support to identify the flight that might infringe an active ARES. This is particularly true in environment with AFUA where dimension of the active ARES can vary from one day to the other. This support has to be provided at least within the Area of Responsibility (such a tool is considered as baseline). Support within the whole Area of Interest of the sector will limit the need for coordination, particularly for ARES in the border of the sector AoR. This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-FP-0014] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_034]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Determine safe potential exit conditions in cross-border FRA

		Assess planned profile constraints or agreed coordinations in cross-border FRA
		Check conformance to planned constraints
		Establish necessary separation
		Assess planned/desired profile for problems within AoR/AoI in cross-border FRA
		Determine planning problems at offered entry conditions in cross-border FRA
		Select clearance to achieve desired profile
		Select clearance to respect agreed constraints or coordinations
		Issue clearances
		Refer to tactical who assesses problems
<ALLOCATED_TO>	<Role>	ATC Sector Executive Role
		ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route High Complexity
		En-Route
		En-Route Very High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0055
Title	Awareness of FRA lower limit for sector before FRA
Requirement	ATCOs of sector before FRA shall be trained/familiarized on FRA lower limit to give appropriate clearance to make it possible for the aircraft to reach FRA lower level limit before the first point of their user-defined trajectory.
Status	<validated>
Rationale	This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-FP-015] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_007]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)

Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Assess trajectory profile through the AoR for tactical controller suitability Assess planned/desired profile for problems within AoR/AoI in cross-border FRA Assess planned profile constraints or agreed coordinations in cross-border FRA Determine safe potential exit conditions in cross-border FRA Select clearance to achieve desired profile Check conformance to planned constraints Determine planning problems at offered entry conditions in cross-border FRA Establish necessary separation Issue clearances Refer to tactical who assesses problems Select clearance to respect agreed constraints or coordinations
<ALLOCATED_TO>	<Role>	ATC Sector Executive Role ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0056
Title	Ability to assess tactical trajectory revision options
Requirement	The ATCOs shall be able to assess tactical trajectory revision options including alternative trajectories across ACC/sector boundaries (tactical what-if).

Status	<validated>
Rationale	In Free Routing environment, characterized by unusual traffic patterns and clearances not necessarily based on points located within ATSU AoR/AoI, the ATCOs need to be provided with a what-if tool allowing the assessment of trajectories revision options when required. The tactical What-if probing tool needs to assist the ATCOs in assessing the effect of a trajectory revision even if based on a point belonging to the initial flight plan, but not necessarily known by the concerned ATC sector. This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-FP-016] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_035]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Operational> , <Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Assess planned/desired profile for problems within AoR/AoI in cross-border FRA Determine planning problems at offered entry conditions in cross-border FRA Establish necessary separation Issue clearances Select clearance to achieve desired profile Determine safe potential exit conditions in cross-border FRA Assess planned profile constraints or agreed coordinations in cross-border FRA Assess trajectory profile through the AoR for tactical controller suitability

		Check conformance to planned constraints
		Select clearance to respect agreed constraints or coordinations
		Monitor clearance implementation
		Refer to tactical who assesses problems
<ALLOCATED_TO>	<Role>	ATC Sector Executive Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0079
Title	Monitor trajectory adherence support
Requirement	The ATCOs shall be provided with support to monitor trajectory adherence.
Status	<validated>
Rationale	This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-FP-029] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_036]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Monitor clearance implementation
<ALLOCATED_TO>	<Role>	ATC Sector Planning Role ATC Sector Executive Role

<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity
		En-Route High Complexity
		En-Route

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0121
Title	Training on planned conflict detection tool
Requirement	ATCOs shall be trained/familiarized on the planned conflict detection tool and its features, its particular parameter settings, time horizon and limitations.
Status	<validated>
Rationale	Conflict detection tool features refer to tool displaying all possible planned conflict or only "proven" ones.
	This requirement takes as reference the safety objective of SESAR solution PJ.06-01 from Final Safety Assessment Report [SO-FP-007]
	This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_003]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Assess trajectory profile through the AoR for tactical controller suitability
		Determine planning problems at offered entry conditions in cross-border FRA
		Assess planned/desired profile for problems within AoR/AoI in cross-border FRA

		Determine safe potential exit conditions in cross-border FRA
		Issue clearances
		Assess planned profile constraints or agreed coordinations in cross-border FRA
		Establish necessary separation
		Check conformance to planned constraints
		Select clearance to achieve desired profile
		Select clearance to respect agreed constraints or coordinations
		Refer to tactical who assesses problems
<ALLOCATED_TO>	<Role>	ATC Sector Planning Role
		ATC Sector Executive Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity
		En-Route High Complexity
		En-Route

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0123
Title	Training on the detection of tactical encounters
Requirement	Tactical Controller shall be trained/familiarized on the detection of tactical encounters between two or more flights not necessarily on a fixed ATS route network, with or without tactical detection tool (depending on tools locally available).
Status	<validated>
Rationale	This requirement takes as reference the safety objective of SESAR solution PJ.06-01 from Final Safety Assessment Report [SO-FP-011] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_005]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Check conformance to planned constraints Determine safe potential exit conditions in cross-border FRA Establish necessary separation Issue clearances Refer to tactical who assesses problems Select clearance to achieve desired profile Select clearance to respect agreed constraints or coordinations
<ALLOCATED_TO>	<Role>	ATC Sector Executive Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0124
Title	Training to the detection of potential crossing
Requirement	ATCOs shall be trained/familiarized to the detection of potential crossing between active En Route stack and the planned trajectory of flights not necessarily on a fixed ATS route segment.
Status	<validated>

Rationale	This requirement takes as reference the safety objective of SESAR solution PJ.06-01 from Final Safety Assessment Report [SO-FP-012] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_006]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Assess trajectory profile through the AoR for tactical controller suitability Assess planned/desired profile for problems within AoR/AoI in cross-border FRA Assess planned profile constraints or agreed coordinations in cross-border FRA Determine planning problems at offered entry conditions in cross-border FRA Determine safe potential exit conditions in cross-border FRA Establish necessary separation Check conformance to planned constraints Issue clearances Select clearance to achieve desired profile Select clearance to respect agreed constraints or coordinations Refer to tactical who assesses problems
<ALLOCATED_TO>	<Role>	ATC Sector Executive Role ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route High Complexity En-Route Very High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0125
Title	Training on update of contingency procedure
Requirement	ATCOs shall be trained/familiarized to updated contingency procedure in Free Routing environment.
Status	<validated>
Rationale	Contingency procedures (e.g. procedure in case of loss of surveillance, air/ground communication, FDPS, conflict detection tool...) This requirement takes as reference the safety objective of SESAR solution PJ.06-01 from Final Safety Assessment Report [SO-FP-033] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_008]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Determine planning problems at offered entry conditions in cross-border FRA Assess trajectory profile through the AoR for tactical controller suitability Determine safe potential exit conditions in cross-border FRA Check conformance to planned constraints Select clearance to respect agreed constraints or coordinations Select clearance to achieve desired profile Establish necessary separation

		Issue clearances
		Assess planned profile constraints or agreed coordinations in cross-border FRA
		Assess planned/desired profile for problems within AoR/AoI in cross-border FRA
		Refer to tactical who assesses problems
		Monitor clearance implementation
<ALLOCATED_TO>	<Role>	ATC Sector Planning Role
		ATC Sector Executive Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity
		En-Route High Complexity
		En-Route

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0128
Title	ATC operating procedures to deviate flights around active ARES
Requirement	ATC operating procedures to deviate flights around active ARES shall be adapted to free route environment.
Status	<validated>
Rationale	Operating procedure example: time to start deviating. This requirement takes as reference the safety objective of SESAR solution PJ.06-01 from Final Safety Assessment Report [SO-FP-013], [SO-FP-014] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_014]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Determine planning problems at offered entry conditions in cross-border FRA Assess trajectory profile through the AoR for tactical controller suitability Assess planned/desired profile for problems within AoR/AoI in cross-border FRA Determine safe potential exit conditions in cross-border FRA Issue clearances Check conformance to planned constraints Assess planned profile constraints or agreed coordinations in cross-border FRA Establish necessary separation Select clearance to achieve desired profile Select clearance to respect agreed constraints or coordinations Refer to tactical who assesses problems
<ALLOCATED_TO>	<Role>	ATC Sector Executive Role ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0129
Title	ATC contingency procedure adapted to Free Routing operations
Requirement	ATC contingency procedure shall be adapted to Free Routing operations.
Status	<validated>

	Contingency procedure (e.g. procedure in case of loss of surveillance, air/ground communication, FDPS, conflict detection tool…)
Rationale	This requirement takes as reference the safety objective of SESAR solution PJ.06-01 from Final Safety Assessment Report [SO-FP-033]
	This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_015]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Determine planning problems at offered entry conditions in cross-border FRA
		Determine safe potential exit conditions in cross-border FRA
		Issue clearances
		Assess planned profile constraints or agreed coordinations in cross-border FRA
		Select clearance to achieve desired profile
		Assess trajectory profile through the AoR for tactical controller suitability
		Establish necessary separation
		Assess planned/desired profile for problems within AoR/AoI in cross-border FRA
		Check conformance to planned constraints
		Select clearance to respect agreed constraints or coordinations
		Monitor clearance implementation
<ALLOCATED_TO>	<Role>	ATC Sector Planning Role
		ATC Sector Executive Role

<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity
		En-Route
		En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0130
Title	ATC operating procedures for information shared in ATC Roles
Requirement	ATC operating procedures shall include procedures for information of ATC Sector Planning Role about ATC Sector Executive Role actions.
Status	<validated>
Rationale	This requirement takes as reference the safety objective of SESAR solution PJ.06-01 from Final Safety Assessment Report [SO-FP-004] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_017]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Determine safe potential exit conditions in cross-border FRA Determine planning problems at offered entry conditions in cross-border FRA Assess planned profile constraints or agreed coordinations in cross-border FRA Assess trajectory profile through the AoR for tactical controller suitability Select clearance to achieve desired profile Issue clearances

		Check conformance to planned constraints
		Assess planned/desired profile for problems within AoR/AoI in cross-border FRA
		Establish necessary separation
		Select clearance to respect agreed constraints or coordinations
		Monitor clearance implementation
		Refer to tactical who assesses problems
<ALLOCATED_TO>	<Role>	ATC Sector Executive Role
		ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route High Complexity
		En-Route Very High Complexity
		En-Route

4.6.2.2 Functional Safety Requirements (from failure case)

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO03.0114
Title	Training to ATCOs on the importance of always updating the system with changes.
Requirement	ATCOs shall be trained/familiarized on the importance of always updating the system with changes.
Status	<validated>
Rationale	This requirement takes as reference the safety objective of SESAR solution PJ.06-01 from Final Safety Assessment Report [SO-IR-001], [SO-IR-003], [SO-IR-005] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_040]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Determine planning problems at offered entry conditions in cross-border FRA Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA Assess trajectory profile through the AoR for tactical controller suitability Establish necessary separation Issue clearances Assess planned profile constraints or agreed coordinations in cross-border FRA Assess planned/desired profile for problems within AoR/AoI in cross-border FRA Determine safe potential exit conditions in cross-border FRA Select clearance to achieve desired profile Monitor clearance implementation Refer to tactical who assesses problems Select clearance to respect agreed constraints or coordinations
<ALLOCATED_TO>	<Role>	ATC Sector Planning Role ATC Sector Executive Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route Very High Complexity En-Route High Complexity

4.6.2.3 Non-functional Safety Requirements

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO02.0109
Title	Occurrence of flight below FRA lower level limit filed
Requirement	The frequency of occurrence of an aircraft flying below the FRA lower limit when reaching the point after which user defined trajectory is filed, shall not be greater than 1.00E-03 per flight hour while in high/very high complexity Free Routing Operations.

Status	<validated>
Rationale	This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-IR-027] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_IR_OPS_027]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Determine planning problems at offered entry conditions in cross-border FRA Check conformance to planned constraints Assess planned/desired profile for problems within AoR/AoI in cross-border FRA Assess trajectory profile through the AoR for tactical controller suitability Assess planned profile constraints or agreed coordinations in cross-border FRA Issue clearances Determine safe potential exit conditions in cross-border FRA Establish necessary separation Select clearance to achieve desired profile Select clearance to respect agreed constraints or coordinations Refer to tactical who assesses problems
<ALLOCATED_TO>	<Role>	ATC Sector Executive Role ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route

		En-Route High Complexity

4.6.2.4 Non-Functional Performance Requirements

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS02.0020
Title	Efficient information presentation on CWP at or close to ACC/sector boundaries
Requirement	Civil ATS En-Route Service Provider shall have efficient information presentation in CWP to manage potential conflicts at or close to ACC/sector boundaries
Status	<validated>
Rationale	This requirement is linked with the ATM capability: • Separation provision (airspace) This requirement takes as reference: • Solution #33: REQ-04.07.02-SPR-FRPC.1002 In SESAR 1 EXE-07.05.03-VP-465, although there were some coordination issues, 74% of ATCOs said that they received sufficient information from the previous sector regarding the UPR FPL. In DSNA simulation leg of SESAR 1 EXE-04.03-VP-798, in Low to Medium FRA, the level of ATCO's situation awareness seemed acceptable after a transition time, but with more involved cognitive resources (i.e. workload and fatigue). The SESAR 1 validation results related to Solution #33 do not directly apply to Solution PJ06-01, they are provided as illustrative results from previous research. Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-043) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Assess planned/desired profile for problems within AoR/AoI in cross-border FRA Assess planned profile constraints or agreed coordinations in cross-border FRA Select clearance to respect agreed constraints or coordinations Determine safe potential exit conditions in cross-border FRA Check conformance to planned constraints Select clearance to achieve desired profile Assess trajectory profile through the AoR for tactical controller suitability Establish necessary separation Issue clearances Determine planning problems at offered entry conditions in cross-border FRA Monitor clearance implementation Refer to tactical who assesses problems
<ALLOCATED_TO>	<Role>	ATC Sector Executive Role ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route Very High Complexity En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS02.0021
Title	Reliable CD/R aid in user defined segments
Requirement	Civil ATS En-Route Service Provider shall have reliable CD/R aid where user-defined segments (long or not) are portions of Great Circles
Status	<validated>

Rationale	This requirement is linked with the ATM capability: • Separation provision (airspace) This requirement takes as reference: • Solution #33: REQ-04.07.02-SPR-FRPC.1003 In SESAR 1 EXE-07.05.03-VP-465, 86% of ATCOs reported no change in workload when controlling en-route flights flown with UPR FPLs, and 83% of ATCOs reported no change in workload when controlling departing/arriving flights flown with UPR FPLs. In DSNA simulation leg of SESAR 1 EXE-04.03-VP-798, all controllers reported that a good MTCD was mandatory in FRA whatever the level of traffic density or complexity. The SESAR 1 validation results related to Solution #33 do not directly apply to Solution PJ06-01, they are provided as illustrative results from previous research. Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-043) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Refer to tactical who assesses problems Determine safe potential exit conditions in cross-border FRA Assess planned profile constraints or agreed coordinations in cross-border FRA Select clearance to respect agreed constraints or coordinations Assess trajectory profile through the AoR for tactical controller suitability Issue clearances Establish necessary separation Assess planned/desired profile for problems within AoR/AoI in cross-border FRA

		Determine planning problems at offered entry conditions in cross-border FRA Select clearance to achieve desired profile
<ALLOCATED_TO>	<Role>	ATC Sector Executive Role ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route High Complexity En-Route Very High Complexity En-Route

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS02.0022
Title	Permanent and continuous supportability of Mid-Term Conflict Detection
Requirement	ATC Sector Planning Role shall be supported by the Conflict Detection Tool, within a permanent and continuous way on mid-term detection of flight encounters.
Status	<validated>

Rationale	This requirement is linked with the ATM capability: • Separation provision (airspace) This requirement takes as reference: • Solution #33: REQ-04.07.02-SPR-FRPC.1005 In SESAR 1 EXE-07.05.03-VP-465, 86% of ATCOs reported no change in workload when controlling en-route flights flown with UPR FPLs, and 83% of ATCOs reported no change in workload when controlling departing/arriving flights flown with UPR FPLs. In DSNA simulation leg of SESAR 1 EXE-04.03-VP-798, all controllers reported that a good MTCD was mandatory in FRA whatever the level of traffic density or complexity. The SESAR 1 validation results related to Solution #33 do not directly apply to Solution PJ06-01, they are provided as illustrative results from previous research. Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-041 and OBJ-06.01-V3-VALP-043) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Determine planning problems at offered entry conditions in cross-border FRA Assess trajectory profile through the AoR for tactical controller suitability Refer to tactical who assesses problems Determine safe potential exit conditions in cross-border FRA
<ALLOCATED_TO>	<Role>	ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route High Complexity En-Route

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS02.0023
Title	Response Time support of Mid-Term Conflict Detection tool
Requirement	ATC Sector Planning Role shall be supported, by the Conflict Detection Tool on mid-term detection of flight encounters, with adequate response time as soon as the flights are distributed and not necessarily assumed.
Status	<validated>
Rationale	This requirement is linked with the ATM capability: • Separation provision (airspace) This requirement takes as reference: • Solution #33: REQ-04.07.02-SPR-FRPC.1006 In SESAR 1 EXE-07.05.03-VP-465, 86% of ATCOs reported no change in workload when controlling en-route flights flown with UPR FPLs, and 83% of ATCOs reported no change in workload when controlling departing/arriving flights flown with UPR FPLs. In DSNA simulation leg of SESAR 1 EXE-04.03-VP-798, all controllers reported that a good MTCD was mandatory in FRA whatever the level of traffic density or complexity. It was also concluded that any CD/R tool shall display encounters within the sector and near its boundaries, i.e. in the area of interest of the sector as participants promoted the "good neighbour" behaviour in FRA. The SESAR 1 validation results related to Solution #33 do not directly apply to Solution PJ06-01, they are provided as illustrative results from previous research. Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-041 and OBJ-06.01-V3-VALP-043) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Assess trajectory profile through the AoR for tactical controller suitability Determine safe potential exit conditions in cross-border FRA Refer to tactical who assesses problems Determine planning problems at offered entry conditions in cross-border FRA
<ALLOCATED_TO>	<Role>	ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS02.0024
Title	Understandable supportability of Mid-Term Conflict Detection tool
Requirement	ATC Sector Planning Role shall be supported with understandable analysis of the conflict geometry for the mid-term encounters detected by the Conflict Detection Tool.
Status	<validated>
Rationale	This requirement is linked with the ATM capability: • Separation provision (airspace) This requirement takes as reference: • Solution #33: REQ-04.07.02-SPR-FRPC.1007 In SESAR 1 EXE-07.05.03-VP-465, 86% of ATCOs reported no change in workload when controlling en-route flights flown with UPR FPLs, and 83% of ATCOs reported no change in workload when controlling departing/arriving flights flown with UPR FPLs. In DSNA simulation leg of SESAR 1 EXE-04.03-VP-798, all controllers reported that a good MTCD was mandatory in FRA whatever the level of traffic density or complexity. Validation results also showed that any CD/R tool shall display encounters

	within the sector and near its boundaries, i.e. in the area of interest of the sector as participants promoted the "good neighbour" behaviour in FRA.
	The SESAR 1 validation results related to Solution #33 do not directly apply to Solution PJ06-01, they are provided as illustrative results from previous research.
	Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-041 and OBJ-06.01-V3-VALP-043) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Assess trajectory profile through the AoR for tactical controller suitability Determine safe potential exit conditions in cross-border FRA Determine planning problems at offered entry conditions in cross-border FRA Refer to tactical who assesses problems
<ALLOCATED_TO>	<Role>	ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route Very High Complexity En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS02.0026
Title	Accessibility to planned 2D trajectory on CWP HMI
Requirement	Civil ATS En-Route Service Provider shall have direct access to the planned 2D trajectory display for a selected flight on the CWP

Status	<validated>
Rationale	This requirement is linked with the ATM capabilities: • Separation provision (airspace) • Coordination and Transfer This requirement takes as reference: • Solution #33: REQ-04.07.02-SPR-FRPC.1009 In SESAR 1 EXE-07.05.03-VP-465, 86% of ATCOs reported no change in workload when controlling en-route flights flown with UPR FPLs, and 83% of ATCOs reported no change in workload when controlling departing/arriving flights flown with UPR FPLs. In DSNA simulation leg of SESAR 1 EXE-04.03-VP-798, validation results showed that the ATCOs (Planning Controller and Tactical Controller) shall be provided with the display of the planned 2D trajectory of a selected aircraft. The SESAR 1 validation results related to Solution #33 do not directly apply to Solution PJ06-01, they are provided as illustrative results from previous research. Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-041 and OBJ-06.01-V3-VALP-043) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Assess planned profile constraints or agreed coordinations in cross-border FRA Assess trajectory profile through the AoR for tactical controller suitability Check conformance to planned constraints Refer to tactical who assesses problems Select clearance to respect agreed constraints or coordinations

		Determine planning problems at offered entry conditions in cross-border FRA
		Select clearance to achieve desired profile
		Assess planned/desired profile for problems within AoR/AoI in cross-border FRA
		Determine safe potential exit conditions in cross-border FRA
		Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA
		Monitor clearance implementation
		Revise entry conditions if needed in coordination with upstream sector
<ALLOCATED_TO>	<Role>	ATC Sector Planning Role
		ATC Sector Executive Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity
		En-Route
		En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS02.0027
Title	Prompt supportability display of a selected flight
Requirement	Civil ATS En-Route Service Provider shall be supported by instantaneous display of planned 2D trajectory of a selected flight
Status	<validated>
Rationale	This requirement is linked with the ATM capabilities: • Separation provision (airspace) • Coordination and Transfer This requirement takes as reference: • Solution #33: REQ-04.07.02-SPR-FRPC.1010 In SESAR 1 EXE-07.05.03-VP-465, 86% of ATCOs reported no change in workload when controlling en-route flights flown with UPR FPLs, and 83% of ATCOs reported no change in workload when controlling departing/arriving flights flown with UPR FPLs.

	In DSNA simulation leg of SESAR 1 EXE-04.03-VP-798, validation results showed that the ATCOs (Planning Controller and Tactical Controller) shall be provided with the display of the planned 2D trajectory of a selected aircraft. The SESAR 1 validation results related to Solution #33 do not directly apply to Solution PJ06-01, they are provided as illustrative results from previous research. Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-041 and OBJ-06.01-V3-VALP-043) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Determine safe potential exit conditions in cross-border FRA Assess planned profile constraints or agreed coordinations in cross-border FRA Assess trajectory profile through the AoR for tactical controller suitability Establish necessary separation Select clearance to achieve desired profile Check conformance to planned constraints Assess planned/desired profile for problems within AoR/AoI in cross-border FRA Select clearance to respect agreed constraints or coordinations Determine planning problems at offered entry conditions in cross-border FRA Monitor clearance implementation Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA Revise entry conditions if needed in coordination with upstream sector Agree entry coordination in cross-border FRA

<ALLOCATED_TO>	<Role>	ATC Sector Executive Role
		ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity
		En-Route
		En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS02.0028
Title	Encounter eligibility by Tactical Conflict Detection Tool
Requirement	ATC Sector Executive Role shall be able to perform detection of tactical encounters involving at least one eligible flight within Conflict Detection Tool.
Status	<validated>
Rationale	This requirement is linked with the ATM capabilities: • Separation provision (airspace) This requirement takes as reference: • Solution #33: REQ-04.07.02-SPR-FRTC.1003 In SESAR 1 EXE-07.05.03-VP-465, 86% of ATCOs reported no change in workload when controlling en-route flights flown with UPR FPLs, and 83% of ATCOs reported no change in workload when controlling departing/arriving flights flown with UPR FPLs. In DSNA simulation leg of SESAR 1 EXE-04.03-VP-798, validation results showed that even if the TCT tool brings a huge added value, it should not be considered as mandatory in Low to medium FRA environment as these complexities was manageable without it. The SESAR 1 validation results related to Solution #33 do not directly apply to Solution PJ06-01, they are provided as illustrative results from previous research. Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-041 and OBJ-06.01-V3-VALP-043) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)

Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Assess planned profile constraints or agreed coordinations in cross-border FRA Establish necessary separation Check conformance to planned constraints Assess planned/desired profile for problems within AoR/AoI in cross-border FRA
<ALLOCATED_TO>	<Role>	ATC Sector Executive Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS02.0030
Title	Availability of alternative trajectory display on CWP beyond FDPS AoR
Requirement	Civil ATS En-Route Service Provider shall have available display of alternative trajectory in case of Direct to a next waypoint even outside sector/ATSU area of responsibility
Status	<validated>
Rationale	This requirement is linked with the ATM capabilities: • Separation provision (airspace) • Coordination and Transfer This requirement takes as reference: • Solution #33: REQ-04.07.02-SPR-FRTC.1005 In SESAR 1 EXE-07.05.03-VP-465, 86% of ATCOs reported no change in workload when controlling en-route flights flown with

	UPR FPLs, and 83% of ATCOs reported no change in workload when controlling departing/arriving flights flown with UPR FPLs.
	In DSNA simulation leg of SESAR 1 EXE-04.03-VP-798, in Low to Medium FRA, the level of ATCO's situation awareness seemed acceptable after a transition time, but with more involved cognitive resources (i.e. workload and fatigue).
	The SESAR 1 validation results related to Solution #33 do not directly apply to Solution PJ06-01, they are provided as illustrative results from previous research.
	Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-041 and OBJ-06.01-V3-VALP-043) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)
	According to PJ06.01 VALR for OBJ-06.01-V3-VALP-041 in EXE-06.01-V3-VALP-001: "The trajectory editor, enabling the visualisation of planned and alternative trajectories, including cross-border trajectories with next or previous waypoint outside sector/ATSU area of responsibility, has been considered really efficient by ATCOs participants and has been intensively used"
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Assess planned/desired profile for problems within AoR/AoI in cross-border FRA Determine planning problems at offered entry conditions in cross-border FRA Establish necessary separation Assess planned profile constraints or agreed coordinations in cross-border FRA Determine safe potential exit conditions in cross-border FRA Assess trajectory profile through the AoR for tactical controller suitability Select clearance to achieve desired profile

		Select clearance to respect agreed constraints or coordinations
		Revise entry conditions if needed in coordination with upstream sector
		Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA
<ALLOCATED_TO>	<Role>	ATC Sector Planning Role
		ATC Sector Executive Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route
		En-Route Very High Complexity
		En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS02.0031
Title	Reliability of unambiguous trajectory display on CWP
Requirement	Civil ATS En-Route Service Provider shall have reliable unambiguous display of alternative trajectory from that of actual trajectory.
Status	<validated>
Rationale	This requirement is linked with the ATM capability: • Separation provision (airspace) This requirement takes as reference: • Solution #33: REQ-04.07.02-SPR-FRTC.1006 In SESAR 1 EXE-07.05.03-VP-465, 86% of ATCOs reported no change in workload when controlling en-route flights flown with UPR FPLs, and 83% of ATCOs reported no change in workload when controlling departing/arriving flights flown with UPR FPLs. In DSNA simulation leg of SESAR 1 EXE-04.03-VP-798, in Low to Medium FRA, the level of ATCO's situation awareness seemed acceptable after a transition time, but with more involved cognitive resources (i.e. workload and fatigue).

	The SESAR 1 validation results related to Solution #33 do not directly apply to Solution PJ06-01, they are provided as illustrative results from previous research. Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-041 and OBJ-06.01-V3-VALP-043) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Assess planned/desired profile for problems within AoR/AoI in cross-border FRA Establish necessary separation Select clearance to respect agreed constraints or coordinations Issue clearances Determine planning problems at offered entry conditions in cross-border FRA Determine safe potential exit conditions in cross-border FRA Select clearance to achieve desired profile Assess planned profile constraints or agreed coordinations in cross-border FRA Assess trajectory profile through the AoR for tactical controller suitability Refer to tactical who assesses problems
<ALLOCATED_TO>	<Role>	ATC Sector Planning Role ATC Sector Executive Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route High Complexity En-Route

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS02.0032
Title	Permanent and continuous supportability of Conformance Monitoring Tool
Requirement	Civil ATS En-Route Service Provider shall be supported by the Conformance Monitoring Tool, within a permanent and continuous check of the flight adherence to the planned trajectory
Status	<validated>
Rationale	This requirement is linked with the Trajectory Conformance Monitoring ATM capability. This requirement takes as reference: • REQ-04.07.02-SPR-FRTA.1002 In SESAR 1 EXE-07.05.03-VP-465, 86% of ATCOs reported no change in workload when controlling en-route flights flown with UPR FPLs, and 83% of ATCOs reported no change in workload when controlling departing/arriving flights flown with UPR FPLs. In Skyguide simulation leg of SESAR 1 EXE-04.03-VP-797 dealing with FRA scenarios with advanced ATC support tools including monitoring aids (CFL, route, Frequency change…), it was demonstrated that these support tools are considered efficient (i.e. providing appropriate data in due time), absolutely required in high traffic load situations, and highly recommended in low to medium traffic load situations. Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-041 and OBJ-06.01-V3-VALP-043) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019). In PJ06.01 VALR results: - EX1-CRT-06.01-V3-VALP-041-003: "With adapted support tools, the identification of trajectories and the monitoring of flight

	progress trajectories adherence has been considered acceptable by ATCOs." -EX2-CRT-06.01-V3-VALP-041-003: "ATCOs considered acceptable the monitoring of flight progress. The effort to perform this task was higher in the military scenario."
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Monitor clearance implementation Check conformance to planned constraints
<ALLOCATED_TO>	<Role>	ATC Sector Planning Role ATC Sector Executive Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route Very High Complexity En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS02.0033
Title	Reliability of Conflict Detection Tool beyond FDPS AoR
Requirement	ATC Sector Planning Role shall have reliable information about all mid-term encounters within Conflict Detection Tool - involving at least one distributed flight and with detected conflict located beyond the sector/ACC area of responsibility
Status	<validated>

Rationale	This requirement is linked with the ATM capability:

• Separation provision (airspace)

This requirement takes as reference:

• REQ-04.07.02-SPR-FRPC.1102

In DSNA simulation leg of SESAR 1 EXE-04.03-VP-798, all controllers reported that a good MTCD was mandatory in FRA whatever the level of traffic density or complexity was. Validation results also showed that any CD/R tool shall display encounters within the sector and near its boundaries, i.e. in the area of interest of the sector as participants promoted the "good neighbour" behaviour in FRA.

In ENAV simulation leg of SESAR 1 EXE-04.03-VP-798, both PC and EC feedback pointed out a significant potentiality in applying IOP concept comparing with OLDI's one it's necessary to say that the IOP concept it would be useful only with the addition of other needs like restructure of Italian airspace, strong and manageable platform system and a review of PC and TC roles and responsibilities (consider also the fact that in a FRA environment, due to its features, there is more flexibility for ATCO comparing to DRA environment).

The SESAR 1 validation results related to Solution #33 do not directly apply to Solution PJ06-01, they are provided as illustrative results from previous research.

Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-041 and OBJ-06.01-V3-VALP-043) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019) |
| Category | <Performance> |

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Determine safe potential exit conditions in cross-border FRA

Assess trajectory profile through the AoR for tactical controller suitability |

		Determine planning problems at offered entry conditions in cross-border FRA Refer to tactical who assesses problems
<ALLOCATED_TO>	<Role>	ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

4.6.3 INTEROP Requirements

NA

4.7 Coordination and Transfer

4.7.1 SPR Requirements

4.7.1.1 Functional Safety Requirements (from success case)

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0041
Title	Planning coordination across ACC/sector boundaries
Requirement	The ATCOs shall be able to perform coordination of flights across ACC/sector boundaries not necessarily supported by published coordination point.
Status	<validated>
Rationale	In FRA across ACC/FIR borders, coordination of flights at ATC planning phase (data distribution, negotiation of entry/exit conditions) on user-defined routes across ACC/sector boundaries outside published Coordination Points will need to be supported by the ATC systems in order to assist the ATCOs. This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-FP-001] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_022]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA Make coordination offer to downstream sector Agree coordination actions

		Revise entry conditions if needed in coordination with upstream sector
		Reject flight
		Agree entry coordination in cross-border FRA
<ALLOCATED_TO>	<Role>	ATC Sector Planning Role
		ATC Sector Executive Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity
		En-Route
		En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0049
Title	Support tools and procedures for coordination of flights with unnamed coordination points
Requirement	The ATC Sector Planning Role shall be provided with tools and procedures to support coordination of flights across ACC/sector boundaries with unnamed coordination points, with the identification of a flight to any adjacent sector and support the negotiation of coordinations.
Status	<validated>
Rationale	This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-FP-009] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_029]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01

<ALLOCATED_TO>	<Activity>	Reject flight
		Make coordination offer to downstream sector
		Agree entry coordination in cross-border FRA
		Revise entry conditions if needed in coordination with upstream sector
		Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA
<ALLOCATED_TO>	<Role>	ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route
		En-Route Very High Complexity
		En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0119
Title	Training on new entry and exit conditions
Requirement	ATCOs shall be trained/familiarized with new entry and exit conditions of a sector/ATSU, in free routing environment, without reference to published route network or fixed coordination point.
Status	<validated>
Rationale	This requirement takes as reference the safety objective of SESAR solution PJ.06-01 from Final Safety Assessment Report [SO-FP-002] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_001]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01

<ALLOCATED_TO>	<Activity>	Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA
		Revise entry conditions if needed in coordination with upstream sector
		Agree coordination actions
		Reject flight
		Make coordination offer to downstream sector
		Agree entry coordination in cross-border FRA
<ALLOCATED_TO>	<Role>	ATC Sector Executive Role
		ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity
		En-Route
		En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0120
Title	Training to use skip function
Requirement	ATCOs shall be trained/familiarized to use the SKIP function in Free Routing environment.
Status	<validated>
Rationale	SKIP function (i.e. ability to remove a flight of her/his sector from the ordered list of sectors)
	This requirement takes as reference the safety objective of SESAR solution PJ.06-01 from Final Safety Assessment Report [SO-FP-003]
	This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_002]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Reject flight Make coordination offer to downstream sector Agree coordination actions Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA Agree entry coordination in cross-border FRA Revise entry conditions if needed in coordination with upstream sector
<ALLOCATED_TO>	<Role>	ATC Sector Executive Role ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0122
Title	Training on coordination negotiation tool
Requirement	Planning Controller shall be trained/familiarized on the coordination negotiation tool and associated operating procedures.
Status	<validated>
Rationale	This requirement takes as reference the safety objective of SESAR solution PJ.06-01 from Final Safety Assessment Report [SO-FP-009] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_004]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Agree entry coordination in cross-border FRA Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA Revise entry conditions if needed in coordination with upstream sector Reject flight Make coordination offer to downstream sector
<ALLOCATED_TO>	<Role>	ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route Very High Complexity En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0126
Title	ATC operating procedures description on acceptable entry and exit conditions
Requirement	ATC operating procedures shall describe the acceptable entry and exit conditions of a sector/ATSU, in free routing environment, without reference to published route network or fixed coordination point.
Status	<validated>
Rationale	This requirement takes as reference the safety objective of SESAR solution PJ.06-01 from Final Safety Assessment Report [SO-FP-001], [SO-FP-002], [SO-FP-009] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_009]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)

Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Agree entry coordination in cross-border FRA Reject flight Revise entry conditions if needed in coordination with upstream sector Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA Make coordination offer to downstream sector Agree coordination actions
<ALLOCATED_TO>	<Role>	ATC Sector Executive Role ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route High Complexity En-Route Very High Complexity En-Route

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0127
Title	ATC operating procedures description on the usage of the SKIP function
Requirement	ATC operating procedures shall describe the usage a SKIP function in Free Routing environment.
Status	<validated>

	SKIP function refers to the ability to remove a flight of her/his sector from the ordered list of sectors. Examples of operating procedures are: which sector initiate the SKIP, skipped sector remains responsible of the flight, etc.
Rationale	This requirement takes as reference the safety objective of SESAR solution PJ.06-01 from Final Safety Assessment Report [SO-FP-003]
	This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_010]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Agree entry coordination in cross-border FRA Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA Agree coordination actions Make coordination offer to downstream sector Reject flight Revise entry conditions if needed in coordination with upstream sector
<ALLOCATED_TO>	<Role>	ATC Sector Planning Role ATC Sector Executive Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

4.7.1.2 Functional Safety Requirements (from failure case)

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO03.0134
Title	Specific coordination procedures shall be defined
Requirement	Specific coordination procedures shall be defined for the case of inter sector/ACC coordination tool is lost, defining non-plannable points to be used in those situations.
Status	<validated>
Rationale	e.g. defining non-plannable points to be used in those situations. This requirement takes as reference the safety objective of SESAR solution PJ.06-01 from Final Safety Assessment Report [SO-IR-009] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_049]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Agree entry coordination in cross-border FRA Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA Make coordination offer to downstream sector Agree coordination actions Reject flight Revise entry conditions if needed in coordination with upstream sector
<ALLOCATED_TO>	<Role>	ATC Sector Planning Role

		ATC Sector Executive Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route Very High Complexity En-Route High Complexity

4.7.1.3 Human Performance Requirements

[REQ]

Identifier	REQ-06.01-SPRINTEROP-PC01.0010
Title	ATC planning coordination procedures adapted to FRA
Requirement	The Planning Controller shall be provided with procedures for ACC/sector coordination of flights not necessarily supported by published coordination points
Status	<validated>
Rationale	In Free Routing cross-border environment, the need is to cope with the lack of published Coordination Points for user-defined routes across ATSU/sector AoRs (including at the border between neighbouring FRA volumes or within cross-border FRA) to support seamless Free Routing operations. Requirement takes reference in Arg. 1.2.5- Feasibility of new procedures for managing traffic complexity PJ06.01 EVIDENCES: Arg. 1.2.5 [Closed] The working methods and procedures were considered acceptable both in high and very high complexity environments. Globally, ATCOs considered that they were able to develop and apply appropriate working methods for all scenarios. In the high complexity environment RTS during the final debriefing controllers mentioned they would benefit from a more clear definition of handover procedures during transitions between sectors. This was related to the limited training ATCOs had on the platform.

	Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-047)) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Operational> , <Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Reject flight Revise entry conditions if needed in coordination with upstream sector Make coordination offer to downstream sector Agree entry coordination in cross-border FRA Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA
<ALLOCATED_TO>	<Role>	ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-PC01.0030
Title	Consistent ATC planning coordination procedures between adjacent ACCs
Requirement	Adjacent ACCs shall consistently apply ATC planning procedures for inter-sector coordination across ACCs
Status	<validated>

Rationale	Consistent ATC coordination procedures permit seamless Free Routing operations and cross ACC/FIR boundary processing. Requirement takes reference in Arg. 1.2.5- Feasibility of new procedures for managing traffic complexity PJ06.01 EVIDENCES: Arg. 1.2.5 [Closed] The working methods and procedures were considered acceptable both in high and very high complexity environments. Globally, ATCOs considered that they were able to develop and apply appropriate working methods for all scenarios. In the high complexity environment RTS during the final debriefing controllers mentioned they would benefit from a more clear definition of handover procedures during transitions between sectors. This was related to the limited training ATCOs had on the platform. Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-047) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Operational> , <Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Revise entry conditions if needed in coordination with upstream sector Reject flight Make coordination offer to downstream sector Agree entry coordination in cross-border FRA Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA
<ALLOCATED_TO>	<Role>	ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity

		En-Route
		En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-TC01.0010
Title	Inter-sector tactical coordination procedures adapted to FRA
Requirement	The ATCOs shall be provided with procedures for tactical coordination of flights not necessarily supported by published coordination points.
Status	<validated>
Rationale	In Free Routing environment, some specific rules might need to be defined in order to clearly allocate conflict resolution responsibility in case of converging flows managed by two contiguous ATC sectors or frequent conflict situations over/close to the ACC/sector boundaries. Requirement takes reference in Arg. 1.2.5- Feasibility of new procedures for managing traffic complexity PJ06.01 EVIDENCES: Arg. 1.2.5 [Closed] The working methods and procedures were considered acceptable both in high and very high complexity environments. Globally, ATCOs considered that they were able to develop and apply appropriate working methods for all scenarios. In the high complexity environment RTS during the final debriefing controllers mentioned they would benefit from a more clear definition of handover procedures during transitions between sectors. This was related to the limited training ATCOs had on the platform. Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-047) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Human Performance> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Agree coordination actions
<ALLOCATED_TO>	<Role>	ATC Sector Executive Role ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route High Complexity En-Route En-Route Very High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-TC01.0030
Title	Consistent ATC tactical coordination procedures between adjacent ATSUs
Requirement	Adjacent ACCs shall consistently apply ATC procedures for inter-sector tactical coordination across ACCs
Status	<validated>
Rationale	Consistent ATC coordination procedures permit seamless Free Routing operations and cross ACC boundary processing. Requirement takes reference in Arg. 1.2.5- Feasibility of new procedures for managing traffic complexity. PJ06.01 EVIDENCES: Arg. 1.2.5 [Closed] The working methods and procedures were considered acceptable both in high and very high complexity environments. Globally, ATCOs considered that they were able to develop and apply appropriate working methods for all scenarios. In the high complexity environment RTS during the final debriefing controllers mentioned they would benefit from a more clear definition of handover procedures during transitions

	between sectors. This was related to the limited training ATCOs had on the platform. Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-047) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Operational> , <Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Agree coordination actions
<ALLOCATED_TO>	<Role>	ATC Sector Executive Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route Very High Complexity En-Route High Complexity

4.7.1.4 Non-Functional Safety Requirements

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO02.0083
Title	Failure of sector/ATSU coordination procedure
Requirement	The frequency of occurrence of a failure to apply the sector/ACC coordination procedure, either by ATC Sector Planning Role or other actor in coordination not following LoA, shall not be greater than 3.33E-05 per flight hour.
Status	<validated>

Rationale	This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-IR-001] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_IR_OPS_001]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Agree entry coordination in cross-border FRA Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA Make coordination offer to downstream sector Reject flight Agree coordination actions Revise entry conditions if needed in coordination with upstream sector
<ALLOCATED_TO>	<Role>	ATC Sector Planning Role ATC Sector Executive Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route Very High Complexity En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO02.0084
Title	Failure of flight removal from the ordered list of sectors

Requirement	The frequency of occurrence of an ATCO failure to remove a flight of her/his sector, from the ordered list of sectors that are expected to assume a given flight, shall not be greater than 3.33E-05 per flight hour.
Status	<validated>
Rationale	This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-IR-002] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_IR_OPS_002]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA Make coordination offer to downstream sector Reject flight Agree entry coordination in cross-border FRA Revise entry conditions if needed in coordination with upstream sector Agree coordination actions
<ALLOCATED_TO>	<Role>	ATC Sector Executive Role ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route Very High Complexity En-Route High Complexity

4.7.1.5 Non-Functional Performance Requirements

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS02.0015
Title	Reliability of ATS Flight Data Processing System
Requirement	Civil ATS En-Route Service Provider shall have reliable Flight Data Processing System to support the usage of cross border Free Routing Operations without mandatory Coordination Points to be overflown
Status	<validated>
Rationale	This requirement is linked with the ATM capability: • Coordination and Transfer This requirement takes as reference: • Solution #33: REQ-04.07.02-SPR-FRPC.1001 According to PCP (EU No 716/2014): ATC systems shall implement the following: 'Flight planning systems to support FRA and cross-border operations.' Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-041 & OBJ-06.01-V3-VALP-043) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Activity>	Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA Coordinate with tactical controller for situation awareness sharing or tactical resolution assessment Agree entry coordination in cross-border FRA

		Revise entry conditions if needed in coordination with upstream sector
		Reject flight
		Make coordination offer to downstream sector
		Agree coordination actions
<ALLOCATED_TO>	<Role>	ATC Sector Executive Role
		ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route
		En-Route High Complexity
		En-Route Very High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS02.0025
Title	Supportability of ATC coordination tools
Requirement	Civil ATS En-Route Service Provider shall be supported by ATC coordination tools, outside ATS routes and with unnamed coordination points, on the negotiation of entry/exit conditions at sector level.
Status	<validated>
Rationale	This requirement is linked with the ATM capability: • Coordination and Transfer This requirement takes as reference: • Solution #33: REQ-04.07.02-SPR-FRPC.1008 In SESAR 1 EXE-07.05.03-VP-465, although there were some coordination issues, 74% of ATCOs said that they received sufficient information from the previous sector regarding the UPR FPL. In Skyguide simulation leg of SESAR 1 EXE-04.03-VP-797 dealing with FRA scenarios with advanced 4D electronic coordination tools (IOP-like capability and silent screen-to-screen inter-sector & inter-centre coordination), it was demonstrated the capabilities of electronic coordination are considered of great

	added value by ATCOs for efficient communication between adjacent sectors in FRA environment. Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-041 and OBJ-06.01-V3-VALP-043) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	\<Performance\>

[REQ Trace]

Relationship	Linked Element Type	Identifier
\<ALLOCATED_TO\>	\<SESAR Solution\>	PJ.06-01
\<ALLOCATED_TO\>	\<Activity\>	Make coordination offer to downstream sector Reject flight Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA Agree entry coordination in cross-border FRA Revise entry conditions if needed in coordination with upstream sector Agree coordination actions
\<ALLOCATED_TO\>	\<Role\>	ATC Sector Executive Role ATC Sector Planning Role
\<ALLOCATED_TO\>	\<Sub-Operating Environment\>	En-Route En-Route Very High Complexity En-Route High Complexity

4.7.2 INTEROP Requirements

[REQ]

Identifier	REQ-06.01-SPRINTEROP-IO01.0003
Title	Operability of flight planning trajectories through Airspace Reservations with tactical re-routing
Requirement	An ATSU shall be able to process flight planning trajectories through TRA / TSA providing tactical re-routing, while in high and very high complex Free Routing Operations.
Status	<validated>
Rationale	This requirement is linked with the ATM capability: • Free Route Airspace Design • Air Traffic Flow Management This requirement takes as reference: • Solution #33: REQ-04.07.02-SPR-FRFP.1003 Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-041 & OBJ-06.01-V3-VALP-043) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019). EXE-06.01-V3-VALP-001: Not used during the exercise (Mil Off scenarios) but this REQ is confirmed by ATCOs as already used in OPS today
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Information Exchange>	[NOV] OLDI Flight Information
<ALLOCATED_TO>	<Information Flow>	Distribute accepted FPL o--> Assess planned/desired profile for problems within AoR/AoI in cross-border FRA
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity

| | | En-Route High Complexity |
| | | En-Route |

[REQ]

Identifier	REQ-06.01-SPRINTEROP-IO01.0010
Title	Enhanced FDPS database beyond ATSU AoR
Requirement	An ATSU shall be able to process routes of flights containing all points of interest, including points required for ATC purposes outside the ATSU area of responsibility.
Status	<validated>
Rationale	This requirement is linked with the ATM capabilities: •　Coordination and Transfer in Free Routing cross-border environment •　Separation provision in Free Routing cross-border environment This requirement takes as reference: •　Solution #33: REQ-04.07.02-SPR-FRAM.1004 According to PCP (EU No 716/2014): ATC systems shall implement the following: 'Flight planning systems to support FRA and cross-border operations.' The FDPS database (= Working Area or System Area) of an ATSU shall include all points of interest including points outside the ATSU area of responsibility required for ATC purposes To ensure data consistency, the individual systems should use a common data repository to maintain the environmental data, e.g. using EAD data, or ADSP. Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-043) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Information Exchange>	[NOV] OLDI Messages towards Downstream
<ALLOCATED_TO>	<Information Flow>	Make coordination offer to downstream sector (by upstream ATSU) o--> Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-IO01.0011
Title	Dialogue Procedure – Coordination messages described in the OLDI standard
Requirement	ATSUs shall be able to allow negotiations and dialogues for flights across ATSU AoR boundaries, based on FDP electronic Dialogue Procedure Coordination messages.
Status	<validated>
Rationale	This requirement is linked with the ATM capabilities: - Coordination and Transfer in Free Routing cross-border environment - Separation provision in Free Routing cross-border environment This requirement takes as reference: - Solution #33: REQ-04.07.02-SPR-FRAM.1004 According to PCP (EU No 716/2014): ATC systems shall implement 'Flight planning systems to support FRA and cross-border operations.' Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-043) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)

	The new operational RQ has been partially covered in the validation of EXE-06.01-V3-VALP-001: - Coordination between Skyguide ACCs: There was no limitation as all electronic coordination actions (request, proposals, counter-proposals) were available between Geneva and Zurich, all screen-to-screen electronic coordinations inter-sectors and inter-centers were available at all ATC sectors. however it was not based on OLDI standard, Geneva and Zurich ACCs were using a common flight data source (virtual centre configuration) - Coordination between Skyguide and ENAV ACCs: was not developed, platforms were not connected In Free Routing cross-border environment, ATM systems have to be able to process the Dialogue Procedure messages (OLDI 4.3) in accordance with the local letters of agreement.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Information Exchange>	[NOV] OLDI Messages towards Downstream [NOV] OLDI Messages towards Upstream
<ALLOCATED_TO>	<Information Flow>	Make coordination offer to downstream sector o--> Revise entry conditions if needed in coordination with upstream sector (by downstream ATSU)
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route High Complexity En-Route

[REQ]

Identifier	REQ-06.01-SPRINTEROP-IO01.0030
Title	Trajectory extraction of an ATSU embedded in a cross border defined Free Route Area

Requirement	An ATSU embedded in a cross border Free Route Area shall be able to handle flights with flight plan routes, which contain only points that are defined as ENTRY/EXIT points to/from the cross border FRA area, even if these points are outside the Area of Responsibility of the respective ATSU.
Status	<validated>
Rationale	This requirement is linked with the ATM capabilities: • Coordination and Transfer in Free Routing cross-border environment • Separation provision in Free Routing cross-border environment This requirement takes as reference: • Solution #33: REQ-04.07.02-SPR-FRAM.1004 According to PCP (EU No 716/2014): ATC systems shall implement the following: 'Flight planning systems to support FRA and cross-border operations.' Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-043) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Information Exchange>	[NOV] OLDI Messages towards Downstream
<ALLOCATED_TO>	<Information Flow>	Make coordination offer to downstream sector (by upstream ATSU) o--> Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route High Complexity En-Route En-Route Very High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-IO01.0040
Title	For the purpose of conflict detection, an ATSU shall process flight data from adjacent ATSUs within the Areas of Interest for flights which are not expected to enter the own AoR.
Requirement	ATSU shall make use of flight data from adjacent Areas of Interest to enable conflict detection, calculation and display of trajectory predictions in a common AoI between different ACCs.
Status	<validated>
Rationale	This requirement is linked with the ATM capabilities: • Coordination and Transfer in Free Routing cross-border environment • Separation provision in Free Routing cross-border environment This requirement takes as reference: • Solution #33: REQ-04.07.02-SPR-FRAM.1004 According to PCP (EU No 716/2014): ATC systems shall implement the following: 'Flight planning systems to support FRA and cross-border operations.' Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-043) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Information Flow>	Distribute accepted FPL (by neighbour ATSU) o--> Determine safe potential exit conditions in cross-border FRA
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route Very High Complexity En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-IO01.0060
Title	Exchange of OLDI Route Information F15
Requirement	ATSUs shall exchange and process the further route of flight for all flights entering / exiting the AoR.
Status	<validated>
Rationale	The updated route info within the OLDI messages is a pre-requisite for having an accurate planned trajectory required for the proper functioning of ATC tools. The content of route information provided by the OLDI messages should also be enhanced by using the interactive graphical trajectory editing tools that supports the LAT/LONG point as well as the route points with range and bearing from the published fixes.

Source: OLDI 4.3 Annex G

ATSUs shall use interactive graphical trajectory editing tools to modify and process revised LAT/LONG points and route points based on range and bearing from the published fixes.

Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-043) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019) |
| Category | <Interoperability> |

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Information Exchange>	[NOV] OLDI Messages towards Downstream

[NOV] OLDI Messages from Upstream |
| <ALLOCATED_TO> | <Information Flow> | Make coordination offer to downstream sector (by upstream ATSU) o--> Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA |
| <ALLOCATED_TO> | <Sub-Operating Environment> | En-Route High Complexity

En-Route Very High Complexity

En-Route |

[REQ]

Identifier	REQ-06.01-SPRINTEROP-IO01.0061
Title	Exchange of modified and updated OLDI Route Information F15
Requirement	ATSUs shall exchange and process modifications to the further route of flight for all flights entering / exiting the AoR.
Status	<validated>
Rationale	The modified and updated route info within the OLDI messages is a pre-requisite for having an accurate planned trajectory required for the proper functioning of ATC tools. The content of route information provided by the OLDI messages should also be enhanced by using the interactive graphical trajectory editing tools that supports the LAT/LONG point as well as the route points with range and bearing from the published fixes. Source: OLDI 4.3 Annex G ATSUs shall use interactive graphical trajectory editing tools to modify and process revised LAT/LONG points and route points based on range and bearing from the published fixes. Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-043) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019) Note: Validation EXE-06.01-V3-VALP-001: Considered as validated by Expert Group, although skyguide ACCs were using the same flight data source (virtual centre configuration) and the exercises unfortunately did not involve ENAV platform so there was no REV message exchanged.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Information Exchange>	[NOV] OLDI Messages towards Downstream [NOV] OLDI Messages from Upstream

<ALLOCATED_TO>	<Information Flow>	Revise entry conditions if needed in coordination with upstream sector o--> Make coordination offer to downstream sector (by upstream ATSU) Make coordination offer to downstream sector (by upstream ATSU) o--> Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route High Complexity En-Route Very High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-IO01.0080
Title	Abrogate coordination with the original accepting ATSU
Requirement	Upstream ATSU shall abrogate coordination with the original downstream ATSU if the flight has been rerouted to another downstream ATSU and display abrogation to controller.
Status	<validated>
Rationale	In case of tactical rerouting initiated by upstream unit, the MAC message is considered beneficial for the improved ATCO situational awareness of the change flight intent in the downstream unit. Source: OLDI draft 4.3 Annex G Abrogate coordination with the original accepting ATSU and display abrogation to controller. Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-043) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01

<ALLOCATED_TO>	<Information Exchange>	[NOV] OLDI Messages towards Downstream
<ALLOCATED_TO>	<Information Flow>	Make coordination offer to downstream sector (by upstream ATSU) o--> Assess entry conditions and desired/planned profile through AoR/AoI in cross-border FRA
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route High Complexity En-Route Very High Complexity En-Route

[REQ]

Identifier	REQ-06.01-SPRINTEROP-IO01.0090
Title	Coordination requests initiated by the downstream unit to the upstream unit
Requirement	A downstream ATSU shall be able to perform coordination requests, such as proposed transfer Flight Level, Route or direct routing request to the upstream ATSU.
Status	<validated>
Rationale	In some cases, Free Routing operation requires the tactical intervention and coordination at the short notice: In case a tactical direct is requested by the downstream unit (e.g. in case of activation of a military area or in case of adverse weather), the CDN allows that unit to offer that the aircraft be sent on that direct. It also allows proposing an alternative transfer flight level. Source: OLDI draft 4.3 Annex G Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-043) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019) - Coordination between Skyguide ACCs: There was no limitation as all electronic coordination actions (request, proposals, counter-proposals) were available between Geneva and Zurich, all screen-to-screen electronic coordinations inter-sectors and inter-centers were available at all ATC sectors. however it was not based on OLDI standard, Geneva and Zurich ACCs were using a common flight data source (virtual centre configuration)

	- Coordination between Skyguide and ENAV ACCs: was not developed, platforms were not connected, but considered validated by expert group.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Information Exchange>	[NOV] OLDI Messages towards Upstream
<ALLOCATED_TO>	<Information Flow>	Revise entry conditions if needed in coordination with upstream sector (by downstream ATSU) o--> Make coordination offer to downstream sector
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-IO01.0110
Title	HMI display of activated TRA/TSA of downstream ATS Unit(s)
Requirement	An ATSU shall exchange information about the activation status of operationally relevant TRAs or TSAs of adjacent ATS Unit(s) relevant for the cross border FRA area.
Status	<validated>
Rationale	Free Routing cross border operation needs full awareness at the transferring ATSU of activated TRA/TSAs within the AoR of the accepting unit(s). Dependent on the OPS procedures how to treat active TRA/TSA, it might be relevant to • either clear flights to specific intermediate waypoints in the downstream ATSU, in order to circumnavigate active TRA/TSA, or • prepare for tactical vectoring within the downstream ATSU

	Although in Free routing operations the filed flight plan is actually checked by IFPS, if trajectory runs through an active TRA/TSA, ATCOs need to be aware of the status of downstream TRA/TSA for the purpose of preplanning and specific route clearances beyond the AoR. Requirement is validated with reference on SESAR 2020 PJ06.01 VALR results (OBJ-06.01-V3-VALP-043) and also confirmed in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Information Flow>	Automatically update status of ARES o--> Determine planning problems at offered entry conditions in cross-border FRA Distribute accepted FPL o--> Assess planned/desired profile for problems within AoR/AoI in cross-border FRA Automatically update status of ARES o--> Determine safe potential exit conditions in cross-border FRA
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route High Complexity En-Route Very High Complexity

4.8 Collision Avoidance

4.8.1 SPR Requirements

4.8.1.1 Functional Safety Requirements

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0080
Title	Short-Term Conflict Alert system support
Requirement	The ATCOs shall be assisted by a Short-Term Conflict Alert system.
Status	<validated>
Rationale	This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-FP-030] This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_037]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Role>	ATC Sector Executive Role ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route High Complexity En-Route Very High Complexity En-Route

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0081
Title	Area Proximity Warning system support
Requirement	The ATCOs shall be assisted by an Area Proximity Warning system.
Status	<validated>
Rationale	This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-FP-031] and [SO-FP-014]. This requirement takes as reference the safety requirement of SESAR solution PJ06.01 Final Safety Assessment Report [SR_FP_OPS_038]. Requirement is considered validated through the SRM (Safety Reference Material) methodology and agreed as validated in Expert Group (workshop 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Role>	ATC Sector Executive Role ATC Sector Planning Role
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

4.9 Deleted Requirements

4.9.1 Initial OSED Requirements

Operational requirements for Dynamic Demand and Capacity Balancing by INAP (at actor/role level)

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM01.0010
Title	INAP in FRA of high complexity
Requirement	In Free Routing Airspace of permanently or temporarily high complexity, INAP functions shall be performed to maintain traffic complexity to an acceptable level for ATCOs
Status	<deleted>
Rationale	Within a Free Routing Airspace, the unstructured traffic flows may be sometimes difficult to manage by ATCOs particularly in airspace of high complexity. This emphasis the need for air traffic flow / complexity management at local level (in the frame of INAP).
	INAP encompasses the 'standard' DCB role (at local level) and the new EAP role. Extended ATC Planning at ACC level will help maintaining Sector Team workload at optimum level.
	This requirement is deleted as covered at SPR level by the safety objective of SESAR Solution PJ.06-01 Initial Safety Assessment Report [SO-FP-0018]
Category	<Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Service>	
<Information Exchange>	
<Function>	
<Activity>	Dynamically Balance Network Capacity with Demand
<Functional Block><role>	
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM01.0020
Title	Local complexity assessment support tool in FRA of high complexity
Requirement	In Free Routing Airspace of permanently or temporarily high complexity, the INAP actor(s) shall be able to assess traffic complexity independently from a fixed ATS route network
Status	<deleted>
Rationale	In Free Routing Airspace, the traffic flows will be less structured and conflicts could appear anywhere as a result of removing predefined crossing points existing in the ARN.

This is needs to be taken into account when assessing the complexity within the airspace.

This requirement is deleted as covered at SPR level by the safety objective of SESAR Solution PJ.06-01 Initial Safety Assessment Report [SO-FP-0020] |
| Category | <Operational> |

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Service>	
<Information Exchange>	
<Function>	
<Activity>	Detect Demand and Capacity imbalances
<Functional Block><role>	
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM01.0080
Title	Manually Forced Flights Count by INAP actor(s) in FRA of high complexity
Requirement	In Free Routing Airspace of permanently or temporarily high complexity, the INAP actor(s) shall be able to monitor the manually forced flights on all potential TVs in their area of responsibility

Status	<deleted>
Rationale	The Manually Forced Flights Label is an indicator to understand an unpredicted high Occupancy at a glance in a regulated TV. In order to solve the peak in this case, one or more dDCB/de-complexing measure(s) could be the solution. This requirement is deleted as out of scope of the INAP solution under validation in PJ.06-01.
Category	<Human Performance>, <Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Detect Demand and Capacity imbalances
<Role>	Local Traffic Manager Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

Operational requirements for Dynamic Demand and Capacity Balancing by INAP (at system level)

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM02.0010
Title	Local complexity assessment tool in FRA of high complexity
Requirement	In Free Routing Airspace of permanently or temporarily high complexity, the Local Traffic Complexity Management tools shall be trajectory-based
Status	<deleted>
Rationale	In Free Routing Airspace, the traffic flows will be less structured and conflicts could appear anywhere as a result of removing predefined crossing points existing in the ARN. This is needs to be taken into account when assessing the complexity within the airspace. This requirement is deleted as system-oriented rather than operational.
Category	<Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Detect Demand and Capacity imbalances
<Functional Block><role>	
<Sub-Operating Environment>	En-Route High Complexity

Operational requirements for Planning Separation Assurance (at actor/role level)

[REQ]

Identifier	REQ-06.01-SPRINTEROP-PC01.0020
Title	ATC planning coordination support tools adapted to FRA across ACC/FIR borders
Requirement	In Free Routing Airspace in cross-border environment, the ATCOs shall be able to perform planning coordination of flights across ATSU/sector boundaries not necessarily supported by published Coordination Points
Status	<deleted>
Rationale	In FRA across ACC/FIR borders, coordination of flights at ATC planning phase (data distribution, negotiation of entry/exit conditions) on user-defined routes across ATSU/sector boundaries outside published Coordination Points will need to be supported by the ATC systems in order to assist the ATCOs. This requirement is deleted as covered at SPR level by the safety objective of SESAR Solution PJ.06-01 Initial Safety Assessment Report [SO-FP-001]
Category	<Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Service>	
<Information Exchange>	
<Function>	
<Activity>	Provide Planning Separation Assurance

<Functional Block><role>	
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-PC01.0040
Title	Coordination What-if for ATC planning control in FRA of high complexity
Requirement	In Free Routing Airspace of permanently or temporarily high complexity, the ATCOs should be able to assess alternative trajectories in support of the negotiation of coordination conditions with adjacent ATC sectors
Status	<deleted>
Rationale	With no airspace reference, the coordination of flights in Free Routing Airspace would take advantage of a support to unambiguously exchange about a given aircraft. In FRA across ACC/FIR borders where interoperability aspects are taken into account, conflict detection could be handled at sector level before coordination of flight, thus this functionality is nice-to-have rather than an essential function. This requirement is deleted as covered at SPR level by the safety objective of SESAR Solution PJ.06-01 Initial Safety Assessment Report [SO-FP-010]
Category	<Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Service>	
<Information Exchange>	
<Function>	
<Activity>	Provide Planning Separation Assurance
<Functional Block><role>	
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-PC01.0050

Title	Conflict detection support tool for ATC planning control in FRA of high complexity
Requirement	In Free Routing Airspace of permanently or temporarily high complexity, the ATCOs shall be able to detect mid-term encounters between two flights along their planned trajectories within the ATC sector area of interest
Status	<deleted>
Rationale	In Free Routing Airspace, the ATCOs need a support to assess the global air situation including flights that follow an unfamiliar route scheme. Also conflicts may occur at border between two sectors and the ATCOs need a support to detect such conflicts in advance. A mid-term detection of encounters at the ATC planning phase permits to predict potential loss of separation between two planned trajectories of interest for the sector (20 minutes time horizon as an order of magnitude). This functionality is considered as necessary in airspace of medium complexity or in airspace with high variability in traffic complexity. This requirement is deleted as covered at SPR level by the safety objective of SESAR Solution PJ.06-01 Initial Safety Assessment Report [SO-FP-007]
Category	<Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Service>	
<Information Exchange>	
<Function>	
<Activity>	Provide Planning Separation Assurance
<Functional Block><role>	
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-PC01.0060
Title	Detection of predicted infringement of active ARES in support to ATC planning control in FRA of high complexity

Requirement	In Free Routing Airspace of permanently or temporarily high complexity, the ATCOs shall be able to detect predicted infringement of active ARES by flights along their planned trajectories within the ATC sector area of interest
Status	<deleted>
Rationale	With no route scheme, the ATCOs need a support to identify the flight that might infringe an active ARES. This is particularly true in environment with AFUA where dimension of the active ARES can vary from one day to the other.

This support has to be provided at least within the Area of Responsibility (such a tool is considered as baseline).

Support within the whole Area of Interest of the sector will limit the need for coordination, particularly for ARES in border of the sector, but is not considered as mandatory.

This requirement is deleted as covered at SPR level by the safety objective of SESAR Solution PJ.06-01 Initial Safety Assessment Report [SO-FP-0014] |
| Category | <Operational> |

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Service>	
<Information Exchange>	
<Function>	
<Activity>	Provide Planning Separation Assurance
<Functional Block><role>	
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-PC01.0070
Title	Display of selected planned trajectory on CWP in FRA across ACC/FIR borders
Requirement	In Free Routing Airspace in cross-border environment, the ATCOs shall be able to display the planned trajectory of a selected flight beyond the ATSU boundary

Status	<deleted>
Rationale	In Free Routing Airspace, a tool allowing the display of the planned 2D trajectory of at least one selected flight is essential for ATCOs to build her/his mental image of the situation. In case of Free Routing across ACC/FIR borders, the displayed trajectory would need to be possible beyond the ATSU boundary. This requirement is deleted as covered at SPR level by the safety objective of SESAR Solution PJ.06-01 Initial Safety Assessment Report [SO-FP-005]
Category	<Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Service>	
<Information Exchange>	
<Function>	
<Activity>	Provide Planning Separation Assurance
<Functional Block><role>	
<Sub-Operating Environment>	En-Route High Complexity

Operational requirements for Tactical Separation Assurance (at actor/role level)

[REQ]

Identifier	REQ-06.01-SPRINTEROP-TC01.0020
Title	ATC tactical coordination support tools adapted to FRA across ACC/FIR borders
Requirement	In Free Routing Airspace in high complexity cross-border environment, the ATCOs shall be able to perform tactical coordination of flights across ATSU/sector boundaries not necessarily supported by published Coordination Points
Status	<deleted>
Rationale	In FRA of high complexity across ACC/FIR borders, characterized less structured traffic and possibly more need for tactical actions requiring coordination of exit conditions, the ATCOs need to be provided with tactical

	coordination support tools allowing negotiating trajectory revision with adjacent ATC sectors outside published Coordination Points. These tactical coordination support tools need to assist the ATCOs in assessing the effect of a trajectory revision even if based on a point belonging to the initial flight plan, but not necessarily known by the concerned ATC sector. These coordination support tools might include the display of the trajectory revision proposal, as well as negotiation functions (agree, reject, counter proposal). This requirement is deleted as covered at SPR level by the safety objective of SESAR Solution PJ.06-01 Initial Safety Assessment Report [SO-FP-0017]
Category	<Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Provide Tactical Separation Assurance
<Functional Block><role>	
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-TC01.0040
Title	Conflict detection support tool for ATC tactical control in FRA of high complexity across ACC/FIR borders
Requirement	In Free Routing Airspace of permanently or temporarily high complexity, the ATCOs shall be able to detect tactical encounters between two or more flights not necessarily on a fixed ATS route network
Status	<deleted>
Rationale	In FRA in high complexity cross-border environment, the Executive Controller needs a support to assess the global air situation including flights that follow an unfamiliar route scheme. A short-term detection of encounters at the ATC tactical phase permits to predict potential loss of separation between two or more trajectories within the ATSU/sector AoR/AoI. The tactical conflict detection tool must take into account situations when one or more flight is cleared direct to a point located far away from ATC sector AoR/AoI. This encompasses the analysis of

trajectories slowly converging.

This requirement is deleted as covered at SPR level by the safety objective of SESAR Solution PJ.06-01 Initial Safety Assessment Report [SO-FP-011]

Category	<Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Service>	
<Information Exchange>	
<Function>	
<Activity>	Provide Tactical Separation Assurance
<Functional Block><role>	
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-TC01.0050
Title	What-if probing tool for ATC tactical control in FRA across ACC/FIR borders
Requirement	In Free Route Airspace in high complexity cross-border environment, the ATCOs shall be able to assess tactical trajectory revision options including alternative trajectories across ATSU/sector boundaries
Status	<deleted>
Rationale	In FRA in high complexity cross-border environment, characterized by unusual traffic patterns and clearances not necessarily based on points located within ATSU AoR/AoI, the ATCOs need to be provided with a what-if tool allowing the assessment of trajectories revision options when required.
	The tactical What-if probing tool needs to assist the ATCOs in assessing the effect of a trajectory revision even if based on a point belonging to the initial flight plan, but not necessarily known by the concerned ATC sector.
	This requirement is deleted as covered at SPR level by the safety objective of SESAR Solution PJ.06-01 Initial Safety Assessment Report [SO-FP-0016]
Category	<Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Service>	
<Information Exchange>	
<Function>	
<Activity>	Provide Tactical Separation Assurance
<Functional Block><role>	
<Sub-Operating Environment>	En-Route High Complexity

Operational requirements for Planning and/or Tactical Separation Assurance (at system level)

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SP02.0010
Title	FDPS database in FRA across ACC/FIR borders
Requirement	In Free Routing Airspace across ACC/FIR borders, FDPS database shall include all points of interest for the ATCOs including points outside the ATSU area of responsibility where necessary for ATC purposes
Status	<deleted>
Rationale	To support air traffic control of flights in Free Routing across ACC/FIR borders, FDPS database will need to include some points in the neighbouring area that could be used for coordination purposes and to manage clearances towards planned trajectory points even if these points are out of the ATSU/sector AoR/AoI.

This requirement is deleted as system-oriented rather than operational. |
| Category | <Operational> |

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Service>	
<Information Exchange>	
<Function>	
<Activity>	Provide Planning Separation Assurance
<Functional Block><role>	
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SP02.0020
Title	Flight Data distribution at ATS level in FRA across ACC/FIR borders
Requirement	In Free Routing Airspace across ACC/FIR borders, flight data distribution shall be possible across ATSU/sector boundaries with unnamed Coordination Points
Status	<deleted>
Rationale	Coordination of flights in Free Routing across ATSU/sector boundaries outside named Coordination Points will need to be supported by the ATC Flight Data Processing and Distribution systems. This requirement is deleted as system-oriented rather than operational.
Category	<Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Service>	
<Information Exchange>	
<Function>	
<Activity>	Provide Planning Separation Assurance
<Functional Block><role>	
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SP02.0030
Title	Display of flights in AoI of the sector/ATSU on CWP in FRA across ACC/FIR borders
Requirement	In Free Routing Airspace across ACC/FIR borders, flights entering the sector/ACC shall be displayed on the Controller Working Position early enough to manage potential conflicts at or close to sector boundaries
Status	<deleted>
Rationale	To manage flights in Free Routing Airspace, the PC needs be able to detect mid-term encounters as soon as possible prior to the entry into the sectorThis requirement is deleted as system-oriented rather than operational.
Category	<Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Service>	
<Information Exchange>	
<Function>	
<Activity>	Provide Planning Separation Assurance
<Functional Block><role>	
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SP02.0040
Title	Support tool for negotiation of entry/exit conditions in FRA of high complexity
Requirement	In Free Routing Airspace of permanently or temporarily high complexity, ATC coordination tools shall support the negotiation of entry/exit conditions at sector level outside ATS routes and with unnamed coordination points
Status	<deleted>
Rationale	Coordination of flights in Free Routing across ATSU/sector boundaries outside named Coordination Points will need to be supported by the ATC systems in order to negotiate entry/exit conditions at sector level. This requirement is deleted as system-oriented rather than operational.
Category	<Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Service>	
<Information Exchange>	
<Function>	
<Activity>	Provide Planning Separation Assurance
<Functional Block><role>	
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SP02.0050
Title	Detection of relevant encounters by ATC planning support tool in FRA across ACC/FIR borders
Requirement	In Free Routing Airspace across ACC/FIR borders, the mid-term Conflict Detection Tool shall inform the controller about all relevant mid-term encounters: • involving at least one distributed flight and • with detected conflict located within the ATC sector AoI
Status	<deleted>
Rationale	In Free Routing Airspace defined at a large geographical scale, sectors cannot be designed to ensure that crossing points are all internal to a sector and far from the sector boundaries. Also, convergence phenomena can happen with flights direct to points located far away from the sector possibly resulting in slow converging trajectories with possible separation infringement inside the sector. To manage Free Routing operations, the Conflict Detection Tool for ATC Planning Control is essential to support the mid-term detection of encounters by ATCOs. To be efficient, the tool would need to detect all relevant mid-term encounters in the ATC sector area of interest. This requirement is deleted as system-oriented rather than operational.
Category	<Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Service>	
<Information Exchange>	
<Function>	
<Activity>	Provide Planning Separation Assurance
<Functional Block><role>	
<Sub-Operating Environment>	En-Route High Complexity

4.9.2 Intermediate SPR-INTEROP/OSED Requirements

4.9.2.1 INAP related requirements

Operational Safety Requirements for Dynamic Demand and Capacity Balancing by INAP (at SPR level)

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0059
Title	Apply dDCB activities and STAM
Requirement	The INAP actor(s) shall be able to apply dDCB measures and STAM during short-term planning to execution phase
Status	<deleted>
Rationale	Within a Free Routing Airspace, the less constrained traffic flows may be sometimes difficult to manage by ATCOs particularly in airspace of high complexity. This emphasis the need for air traffic flow / complexity management at local level (in the frame of INAP). INAP functions have to be performed to maintain traffic complexity to an acceptable level for ATCOs. INAP encompasses the 'standard' DCB role (at local level) and the new EAP role. Extended ATC Planning at ACC level will help maintaining Sector Team workload at optimum level. dDCB activities and Short-Term ATFCM Measures include: detection of hotspot, preparation of STAM, coordination of STAM, implementation of STAM, monitoring of hotspot. This requirement applies to the basic EAP function (Solution #118) and is also necessary to improve Air Traffic Flow /

	Complexity Management (in the frame of INAP) in FRA of high complexity. This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Initial Safety Assessment Report [SO-FP-0018] Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Safety>, <Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Analyse imbalance and/or complexity issue Detect Demand and Capacity imbalances
<Role>	Local Traffic Manager Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO010060
Title	Detect the traffic imbalances
Requirement	The INAP actor(s) shall have the possibility to detect the traffic imbalances
Status	<deleted>
Rationale	This requirement applies to the basic EAP function (Solution #118) and is also necessary to improve Air Traffic Flow / Complexity Management (in the frame of INAP) in FRA of high complexity. This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Initial Safety Assessment Report [SO-FP-0019] Requirement is deleted as it was considered out of scope of Solution PJ06.01.

Category	\<Safety\>

[REQ Trace]

Linked Element Type	Identifier
\<SESAR Solution\>	PJ.06-01
\<Activity\>	Analyse imbalance and/or complexity issue

Detect Demand and Capacity imbalances |
| \<Role\> | Local Traffic Manager

Extended ATC Planner (EAP) |
| \<Sub-Operating Environment\> | En-Route High Complexity |

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0061
Title	Assess traffic complexity independently from a fixed ATS route network
Requirement	The INAP actor(s) shall be able to assess traffic complexity independently from a fixed ATS route network
Status	\<deleted\>
Rationale	In Free Routing Airspace, the traffic flows will be less structured and conflicts could appear anywhere as a result of removing predefined crossing points existing in the ARN.

This needs to be taken into account when assessing the complexity within the airspace.

This requirement goes beyond the scope of the basic EAP function (Solution #118) and is necessary to improve Air Traffic Flow / Complexity Management (in the frame of INAP) in FRA of high complexity.

This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Initial Safety Assessment Report [SO-FP-0020]

Requirement is deleted as it was considered out of scope of Solution PJ06.01. |
| Category | \<Safety\>, \<Operational\> |

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Detect Demand and Capacity imbalances Analyse imbalance and/or complexity issue
<Role>	Extended ATC Planner (EAP) Local Traffic Manager
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0062
Title	Analyse traffic imbalance
Requirement	The INAP actor(s) shall have the possibility to analyse traffic imbalance based on Occupancy Threshold Monitoring Values
Status	<deleted>
Rationale	This requirement applies to the basic EAP function (Solution #118) and is also necessary to improve Air Traffic Flow / Complexity Management (in the frame of INAP) in FRA of high complexity. This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Initial Safety Assessment Report [SO-FP-0021] Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Safety>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Analyse imbalance and/or complexity issue
<Role>	Local Traffic Manager

	Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0063
Title	Analyse traffic complexity
Requirement	The INAP actor(s) shall have the possibility to analyse traffic complexity
Status	<deleted>
Rationale	This requirement goes beyond the scope of the basic EAP function (Solution #118) and is necessary to improve Air Traffic Flow / Complexity Management (in the frame of INAP) in FRA of high complexity. This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Initial Safety Assessment Report [SO-FP-0022] Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Safety>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Analyse imbalance and/or complexity issue
<Role>	Local Traffic Manager Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0064
Title	Assess the induced effects of a STAM re-routing measure

Requirement	During the preparation of STAM, the INAP actor(s) shall be able to assess the induced effects of a STAM re-routing measure
Status	<deleted>
Rationale	This requirement goes beyond the scope of the basic EAP function (Solution #118) and is necessary to improve Air Traffic Flow / Complexity Management (in the frame of INAP) in FRA of high complexity. This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Initial Safety Assessment Report [SO-FP-0023] Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Safety>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Prepare STAM
<Role>	Local Traffic Manager Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0065
Title	Assess the induced effects of a STAM level capping measure
Requirement	During the preparation of STAM, the INAP actor(s) shall be able to assess the induced effects of a STAM level capping measure across FRA vertical limits
Status	<deleted>

Rationale	This requirement applies to the basic EAP function (Solution #118) and is also necessary to improve Air Traffic Flow / Complexity Management (in the frame of INAP) in FRA of high complexity. This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Initial Safety Assessment Report [SO-FP-0024] Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Safety>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Prepare STAM
<Role>	Extended ATC Planner (EAP) Local Traffic Manager
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0066
Title	Coordinate the STAM re-routing measure
Requirement	The INAP actor(s) shall be able to coordinate the STAM re-routing measure with the adjoining INAP
Status	<deleted>

Rationale	This requirement applies to the basic EAP function (Solution #118) and is also necessary to improve Air Traffic Flow / Complexity Management (in the frame of INAP) in FRA of high complexity. This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Initial Safety Assessment Report [SO-FP-0025] Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Safety>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Coordinate STAM
<Role>	Local Traffic Manager Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0076
Title	Coordinate the STAM level capping measure
Requirement	The INAP actor(s) shall be able to coordinate the STAM level capping measure across FRA vertical limits with the adjoining INAP
Status	<deleted>

Rationale	This requirement applies to the basic EAP function (Solution #118) and is also necessary to improve Air Traffic Flow / Complexity Management (in the frame of INAP) in FRA of high complexity. This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Initial Safety Assessment Report [SO-FP-0026] Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Safety>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Coordinate STAM
<Role>	Extended ATC Planner (EAP) Local Traffic Manager
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0077
Title	Assess and implement STAM re-routing measure
Requirement	The implementing ATC Sector Planning Role shall be able to assess and implement the STAM re-routing measure
Status	<deleted>

Rationale	The Planning Controller has to handle the de-complexification measures agreed with INAP actor(s) within the TV under PC responsibility

The PC is in charge of implementing the STAM re-routing measure to de-complexify a TV after the LTM-EAP analysis and informs back the LTM-EAP on the measure implementation progress.

If eventually not possible for the PC to implement the STAM re-routing measure, this also needs to be reported to LTM-EAP.

This requirement goes beyond the scope of the basic EAP function (Solution #118) and is necessary to improve Air Traffic Flow / Complexity Management (in the frame of INAP) in FRA of high complexity.

This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Initial Safety Assessment Report [SO-FP-0027]

Requirement is deleted as it was considered out of scope of Solution PJ06.01. |
| Category | <Safety> , <Operational> |

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Implement STAM
<Role>	ATC Sector Planning Role
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0078
Title	Assess and implement STAM level capping.
Requirement	The implementing ATC Sector Planning Role shall be able to assess and implement the STAM level capping measure across FRA limit if relevant
Status	<deleted>

Rationale	The Planning Controller has to handle the de-complexification measures agreed with INAP actor(s) within the TV under PC responsibility

The PC is in charge of implementing the STAM level capping measure to de-complexify a TV after the LTM-EAP analysis and informs back the LTM-EAP on the measure implementation progress.

If eventually not possible for the PC to implement the STAM level capping measure, this also needs to be reported to LTM-EAP.

This requirement applies to the basic EAP function (Solution #118) and is also necessary to improve Air Traffic Flow / Complexity Management (in the frame of INAP) in FRA of high complexity.

This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Initial Safety Assessment Report [SO-FP-0028]

Requirement is deleted as it was considered out of scope in PJ06.01. |
| Category | <Safety> , <Operational> |

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Implement STAM
<Role>	ATC Sector Planning Role
<Sub-Operating Environment>	En-Route High Complexity

Human Performance Requirements for Dynamic Demand and Capacity Balancing by INAP (at HP argument level)

[REQ]

Identifier	REQ-06.01-SPRINTEROP-HP01.0024
Title	Clarity and completeness of role and responsibilities of human actors in INAP

Requirement	Civil ATS En-Route Service Provider shall define clear and complete role and responsibilities of INAP actors
Status	<deleted>
Rationale	Requirement takes reference in PJ06-01 D2.1.430 HP Plan, where impacts on the following arguments have been identified: • Arg. 1.1.1- Roles & responsibilities cover all affected human actors • Arg. 1.1.2- Descriptions of roles & responsibilities cover all tasks to be performed by the human actors • Arg. 1.1.3- Roles and responsibilities are clear and consistent According to the PJ19.4 D4.1 Performance Framework: "Examples of relevant HP Activities are task analyses and workshops involving users." Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Human Performance>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Role>	Local Traffic Manager Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-HP01.0025
Title	Adequacy of operating methods (procedures) in supporting human performance in INAP
Requirement	Civil ATS En-Route Service Provider shall have adequate operating methods (procedures) supporting human performance of INAP actors
Status	<deleted>

Rationale	Requirement takes reference in PJ06-01 D2.1.430 HP Plan, where impact on the following argument has been identified: • Arg. 1.2.5- Feasibility of new procedures for managing traffic complexity (INAP) PJ06-01 D2.1.020 Appendix A BIM for ANSP identifies the impact on HP1.2 performance indicator at INAP level. According to PJ19.4 D4.1 Performance Framework: "Examples of relevant HP Activities are requirement identification techniques with involvement of safety and operational experts." Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Human Performance>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Role>	Local Traffic Manager ATC Sector Planning Role Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-HP01.0026
Title	Capability of human actors in INAP to achieve their tasks
Requirement	Civil ATS En-Route Service Provider shall provide the capability to INAP actors to achieve their tasks in a timely manner, with limited error rate and acceptable workload level
Status	<deleted>

Rationale	PJ06-01 D2.1.020 Appendix A BIM for ANSP identifies the impact on HP1.3 performance indicator at INAP level. According to PJ19.4 D4.1: "Examples of relevant HP Activities are: task analysis, simulations based on low fidelity mock-ups, focus groups carrying out HP Issue Analysis, questionnaires, HAZOP and ISA/NASA TLX workload measurements" Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Human Performance>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Role>	Local Traffic Manager Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-HP01.0027
Title	Adequacy of human machine interface in INAP
Requirement	Civil ATS En-Route Service Provider shall have adequate human machine interface in supporting the INAP actors in carrying out their tasks
Status	<deleted>

Rationale	Requirement takes reference in PJ06-01 D2.1.430 HP Plan, where impact on the following arguments has been identified: • Arg. 2.3.1- Provided information is fit for purpose and satisfies information requirements of the humans • Arg. 2.3.6- Usability of the user interface (input devices, visual displays/output devices, alarms& alerts) • Arg. 2.3.8- User interface design supports a sufficient level of individual situational awareness PJ06-01 D2.1.020 Appendix A BIM for ANSP also identifies the impact on HP2 performance indicator at INAP level. According to PJ19.4 D4.1: "Examples of relevant HP Activities are, according to the different maturity levels: elicitation of requirements with end-users in accordance with 'SESAR 16.5.3 Guidance for Effective Information Presentation', (cognitive) task analysis, simulations based on low fidelity mock-ups, cognitive walkthrough techniques, subjective and objective HP methods used in real time simulations and operational trials." Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Human Performance>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Role>	Local Traffic Manager Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-HP01.0028
Title	Adequacy of INAP and ATC Sector team communication
Requirement	Civil ATS En-Route Service Provider shall ensure adequate INAP and ATC team communication with regard to communication modalities, technical enablers and impact on situation awareness/workload

Status	<deleted>
Rationale	Requirement takes reference in PJ06-01 D2.1.430 HP Plan, where impact on the following arguments has been identified: • Arg. 3.3.1- Intra-team and inter-team communications support the information requirements of team members. • Arg. 3.3.2- Phraseology supports for intra-team and inter-team communication • Arg. 3.3.4- Communications load According to PJ19.4 D4.1: "Examples of relevant HP Activities are, according to the different maturity levels: task analysis, simulations based on low fidelity mock-ups, subjective and objective HP methods in real time simulations and operational trials, application of Situation Awareness Global Assessment Technique (SAGAT) and the Situational Awareness Rating Technique (SART)." Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Human Performance>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Role>	Local Traffic Manager Extended ATC Planner (EAP) ATC Sector Planning Role
<Sub-Operating Environment>	En-Route High Complexity

Human Performance Requirements for Dynamic Demand and Capacity Balancing by INAP (at OSED level)

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM01.0040
Title	ATCO workload monitoring by INAP actor(s)
Requirement	The INAP actor(s) shall assess ATCO workload on all potential TV in their area of responsibility

Status	\<deleted\>
Rationale	In Free Routing Airspace, the less constrained traffic flows may be sometimes difficult to manage by ATCOs particularly in airspace of high complexity. Besides, the potentially high variability of the traffic demand could lead to an increase of the traffic complexity at ACC/sector level. The INAP actor(s) monitors several indicators to assess the ATCO workload to assist the local DCB actor(s) in dynamically balancing demand and capacity. The INAP actor(s) needs to assess ATCO workload on all potential Traffic Volumes (TVs) as the TVs that will be in operation are not definitively known in the short-term DCB phase. This requirement applies to the basic EAP function (Solution #118) and is also necessary to enable Human Performance of INAP actor(s) in high complexity Free Routing environment. Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	\<Human Performance\>, \<Operational\>

[REQ Trace]

Linked Element Type	Identifier
\<SESAR Solution\>	PJ.06-01
\<Activity\>	Detect Demand and Capacity imbalances
\<Role\>	Local Traffic Manager Extended ATC Planner (EAP)
\<Sub-Operating Environment\>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM01.0050
Title	Occupancy Count monitoring by INAP actor(s)
Requirement	The INAP actor(s) shall monitor the predicted Occupancy on all potential TVs in their area of responsibility
Status	\<deleted\>
Rationale	In Free Routing Airspace, the potentially high variability of the traffic demand could lead to an increase of the traffic complexity at ACC/sector

	level, thus potentially entailing new requirements to cope with peaks of demand. The Occupancy Count is an indicator for assessing the ATCO workload at a glance. This requirement applies to the basic EAP function (Solution #118) and is also necessary to enable Human Performance of INAP actor(s) in high complexity Free Routing environment. Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Human Performance>, <Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Detect Demand and Capacity imbalances
<Role>	Local Traffic Manager Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM01.0110
Title	De-complexification measures by INAP actor(s)
Requirement	The INAP actor(s) shall consider implementing de-complexification measures (at local level) whenever early resolution brings operational benefits compared to baseline dDCB solutions
Status	<deleted>

Rationale	In Free Routing Airspace, the less constrained traffic flows may be sometimes difficult to manage at ATC level notably when there may be conflicts close to the ACC/sector boundaries.
	Thanks to a better view of traffic at ACC level, the INAP actor(s) will be able to decide which ATC sector team could be used to best solve the complexity problem.
	De-complexification measures by INAP actor(s) aim to prevent conservative use of regulation in FRA of high complexity.
	This requirement applies to the basic EAP function (Solution #118) and is also necessary to enable Human Performance of INAP actor(s) in high complexity Free Routing environment.
	Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Human Performance>, <Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Implement and fine-tune DDCB measure
<Role>	Local Traffic Manager Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM01.0140
Title	Traffic Volume de-complexification by INAP actor(s)
Requirement	The INAP actor(s) shall provide measures to de-complexify a given TV taking into account the complexity induced by individual flights
Status	<deleted>
Rationale	In Free Routing Airspace, the less constrained traffic flows and the potentially high variability of the traffic demand could lead to an increase of the traffic complexity at ACC/sector level.
	Assessing the complexity induced by individual flights (e.g. Flights close to ACC/sector boundaries, Intruders, etc.) is essential for INAP actor(s) to

	determine appropriate de-complexification measures that will maintain the ATCOs workload to an acceptable level.
	This requirement applies to the basic EAP function (Solution #118) and is also necessary to enable Human Performance of INAP actor(s) in high complexity Free Routing environment.
	Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Human Performance>, <Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Implement and fine-tune DDCB measure
<Role>	Local Traffic Manager Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM01.0060
Title	Occupancy Curves Monitoring by INAP actor(s)
Requirement	The INAP actor(s) shall be able to monitor the Occupancy Curves with relevant information, including: • categories of flights • three thresholds : the peak value, the sustain value, the maximum acceptable duration of sustained heavy traffic.
Status	<deleted>
Rationale	In Free Routing Airspace, the potentially high variability of the traffic demand could lead to an increase of the traffic complexity at ACC/sector level, thus potentially entailing new requirements to cope with peaks of demand. The categories of flights and these three thresholds are useful for occupancy curves understanding and analysing.

	This requirement applies to the basic EAP function (Solution #118) and is also necessary to enable Human Performance of INAP actor(s) in high complexity Free Routing environment.
Category	<Human Performance>, <Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Detect Demand and Capacity imbalances
<Role>	Local Traffic Manager Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM01.0070
Title	Intruders Count Monitoring by INAP actor(s)
Requirement	The INAP actor(s) shall be able to monitor the predicted Intruders on all potential TVs in their area of responsibility
Status	<deleted>
Rationale	In Free Routing Airspace, the potentially high variability of the traffic demand could lead to an increase of the traffic complexity at ACC/sector level, thus potentially entailing new requirements to cope with peaks of demand/complexity. The Intruders tag and counts are useful indicators to understand an unpredicted high Occupancy at a glance due to intruders in a TFV. In order to solve the peak in this case, one or more dDCB/de-complexing measure(s) could be the solution. This requirement applies to the basic EAP function (Solution #118) and is also necessary to enable Human Performance of INAP actor(s) in high complexity Free Routing environment. Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Human Performance>, <Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Detect Demand and Capacity imbalances
<Role>	Local Traffic Manager Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM01.0090
Title	Complexity Monitoring of TVs by INAP actor(s)
Requirement	The INAP actor(s) shall be able to assess the predicted Complexity on all potential TVs in their area of responsibility
Status	<deleted>
Rationale	In Free Routing Airspace, the less constrained traffic flows and the potentially high variability of the traffic demand could lead to an increase of the traffic complexity at ACC/sector level. The predicted Complexity is a direct indicator to identify at a glance a complex TV. In order to solve a complexity issue, one or more dDCB/de-complexing measure(s) could be the solution. This requirement goes beyond the scope of the basic EAP function (Solution #118) and is necessary to enable Human Performance of INAP actor(s) in high complexity Free Routing environment. Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Analyse imbalance and/or complexity issue
<Role>	Local Traffic Manager Extended ATC Planner (EAP)

<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM01.0100
Title	Flight contribution to a TV Complexity Assessment by INAP actor(s)
Requirement	The INAP actor(s) shall be able to assess flights contributing to Complexity per TV
Status	<deleted>
Rationale	In Free Routing Airspace, the less constrained traffic flows and the potentially high variability of the traffic demand could lead to an increase of the traffic complexity at ACC/sector level.

This identification would help the INAP actor(s) to identify flights best candidates for dDCB/de-complexing measures in the solution definition.

This requirement goes beyond the scope of the basic EAP function (Solution #118) and is necessary to enable Human Performance of INAP actor(s) in high complexity Free Routing environment.

Requirement is deleted as it was considered out of scope of Solution PJ06.01. |
| Category | <Human Performance>, <Operational> |

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Analyse imbalance and/or complexity issue
<Role>	Local Traffic Manager

Extended ATC Planner (EAP) |
| <Sub-Operating Environment> | En-Route High Complexity |

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM01.0120
Title	STAM creation and preparation by INAP actor(s)

Requirement	The INAP actor(s) shall be able to create and prepare short-term ATFCM measures within their area of responsibility
Status	<deleted>
Rationale	In Free Routing Airspace, the less constrained traffic flows and the potentially high variability of the traffic demand could lead to an increase of the traffic complexity at ACC/sector level. If implemented, the EAP may have to de-complexify a given area on request from the LTM. The dDCB/STAM measure could be a request for change of level, speed, route of one or more flights in the INAP actor(s) area of responsibility. This requirement applies to the basic EAP function (Solution #118) and is also necessary to enable Human Performance of INAP actor(s) in high complexity Free Routing environment. Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Human Performance>, <Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Implement and fine-tune DDCB measure
<Role>	Local Traffic Manager Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM01.0130
Title	STAM proposal by INAP actor(s)
Requirement	The INAP actor(s) shall be able to propose short-term ATFCM measures to Implementing ATC Sector actors
Status	<deleted>

Rationale	In Free Routing Airspace, the less constrained traffic flows and the potentially high variability of the traffic demand could lead to an increase of the traffic complexity at ACC/sector level.
	When a solution to a complexity issue is prepared, the INAP actor needs to be able to propose it to the relevant ATC Sector Planning Controller for analysis and implementation if feasible.
	This requirement applies to the basic EAP function (Solution #118) and is also necessary to enable Human Performance of INAP actor(s) in high complexity Free Routing environment.
	Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Human Performance>, <Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Implement and fine-tune DDCB measure
<Role>	Local Traffic Manager Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM01.0170
Title	Traffic de-complexification by PC
Requirement	The Planning Controller shall be able to handle the short-term ATFCM measures agreed with INAP actor(s) within the TV under PC responsibility
Status	<deleted>
Rationale	In Free Routing Airspace, the less constrained traffic flows and the potentially high variability of the traffic demand could lead to an increase of the traffic complexity at ACC/sector level.
	The PC is in charge of implementing the MOD to de-complexify a TV after the INAP analysis and informs back the LTM-EAP on the MOD implementation progress.

	If eventually not possible for the PC to implement the dDCB/de-complexing measure, this also needs to be reported to LTM-EAP.
	This requirement applies to the basic EAP function (Solution #118) and is also necessary to enable Human Performance of INAP actor(s) in high complexity Free Routing environment.
	Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Human Performance>, <Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Implement trajectory management solutions
<Role>	Local Traffic Manager Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM01.0210
Title	Flights Visualization – Analysis of Trajectories on INAP Working Position
Requirement	The INAP actor(s) shall be able to analyse flights predicted trajectories within their area of responsibility
Status	<deleted>
Rationale	In Free Routing Airspace, the less constrained traffic flows may be sometimes difficult to manage by ATCOs particularly in airspace of high complexity.
	The need is to help the INAP actor(s) to analyse the ATCO workload in current and future time horizons with for example trajectory extrapolation, trends, time slider.
	This requirement applies to the basic EAP function (Solution #118) and is also necessary to enable Human Performance of INAP actor(s) in high complexity Free Routing environment.

	Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Human Performance>, <Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Analyse imbalance and/or complexity issue
<Role>	Local Traffic Manager Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM01.0180
Title	Flight plan on INAP Working Position
Requirement	The INAP actor(s) shall be able to display the flight plan of every flight in their area of responsibility
Status	<deleted>
Rationale	In Free Routing Airspace, the less constrained traffic flows may be sometimes difficult to manage by ATCOs particularly in airspace of high complexity. This emphasis the need for air traffic flow / complexity management at local level (in the frame of INAP). When available, all flight plan data, including Filed Profile, Regulated Profile, and Current Profile should be provided to help the INAP analysis. This requirement applies to the basic EAP function (Solution #118) and is also necessary to enable Human Performance of INAP actor(s) in high complexity Free Routing environment. Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Human Performance>, <Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Analyse imbalance and/or complexity issue
<Role>	Local Traffic Manager Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM01.0190
Title	Flight data monitoring on INAP Working Position
Requirement	The INAP actor(s) shall be able to display the flight lists related to a given TV, time range, hotspot or any complexity indicator
Status	<deleted>
Rationale	In Free Routing Airspace, the less constrained traffic flows and the potentially high variability of the traffic demand could lead to an increase of the traffic complexity at ACC/sector level. The need is to help the INAP actor(s) to define solutions for de-complexification or dynamic demand balancing and more specifically for analysis and cherry picking of candidate for dDCB/short-term ATFCM measures for instance. This requirement goes beyond the scope of the basic EAP function (Solution #118) and is necessary to improve Air Traffic Flow / Complexity Management (in the frame of INAP) in FRA of high complexity. Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Human Performance>, <Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Analyse imbalance and/or complexity issue
<Role>	Local Traffic Manager Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM01.0200
Title	Display of predicted air situation on INAP Working Position
Requirement	The INAP actor(s) shall be able to display the predicted air situation within their area of responsibility
Status	<deleted>
Rationale	In Free Routing Airspace, the potentially high variability of the traffic demand could lead to an increase of the traffic complexity at ACC/sector level. The need is to refine the analysis performed in the frame of INAP with the sectors allocation, airspace reservations, and other elements of interest. This requirement applies to the basic EAP function (Solution #118) and is also necessary to enable Human Performance of INAP actor(s) in high complexity Free Routing environment. Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Human Performance>, <Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Analyse imbalance and/or complexity issue
<Role>	Local Traffic Manager

	Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM01.0220
Title	Flights Visualization – Geographical and airspace elements on INAP Working Position
Requirement	The INAP actor(s) shall be able to visualise any geographical and airspace elements (military zone, contours, sectors,…) deemed relevant
Status	<deleted>
Rationale	In Free Routing Airspace, the less constrained traffic flows and the potentially high variability of the traffic demand could lead to an increase of the traffic complexity at ACC/sector level.

The need is to help the INAP actor(s) to analyse the ATCO workload in current and future time horizons and get a complete overview of the flights in their environment.

This requirement applies to the basic EAP function (Solution #118) and is also necessary to enable Human Performance of INAP actor(s) in high complexity Free Routing environment.

Requirement is deleted as it was considered out of scope of Solution PJ06.01. |
| Category | <Human Performance>, <Operational> |

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Analyse imbalance and/or complexity issue
<Role>	Local Traffic Manager

Extended ATC Planner (EAP) |
| <Sub-Operating Environment> | En-Route High Complexity |

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM01.0030

Title	Collaboration between INAP actor(s)
Requirement	The Extended ATC Planner (EAP), if implemented, shall work in close collaboration with the Local Traffic Manager (LTM) / Flow Traffic Manager (FTM).
Status	<deleted>
Rationale	In Free Routing Airspace, the less constrained traffic flows and the potentially high variability of the traffic demand emphasis the need for air traffic flow / complexity management at local level (in the frame of INAP). The INAP actors encompass the 'standard' local DCB actor(s) and a possibly new one in charge of Extended ATC Planning, if implemented as a separate actor. All these actors will need to work in collaboration for effective INAP function. This requirement applies to the basic EAP function (Solution #118) and is also necessary to enable Human Performance of INAP actor(s) in high complexity Free Routing environment. Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Human Performance>, <Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Coordinate de-complexing solution
<Role>	Local Traffic Manager Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM01.0150
Title	De-complexification measures - Shared Situation Awareness by INAP actor(s)/ATCOs
Requirement	The INAP actor(s) shall be able to inform the ATC Sector actors affected by a complexity hotspot of every accepted short-term ATFCM measures
Status	<deleted>

Rationale	In Free Routing Airspace, the less constrained traffic flows and the potentially high variability of the traffic demand emphasis the need for air traffic flow / complexity management at local level (in the frame of INAP).
	The need is to provide situation awareness to all involved actors in INAP function.
	The complex sector is the sector which will receive the flight on an alternate trajectory due to de-complexification solution performed by the implementing sector. The sector then needs to be informed as the route of the impacted flight will be different (speed, level, heading,…) from the initial planned one.
	This requirement applies to the basic EAP function (Solution #118) and is also necessary to enable Human Performance of INAP actor(s) in high complexity Free Routing environment.
	Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Human Performance>, <Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Implement and fine-tune DDCB measure
<Role>	Local Traffic Manager Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM01.0155
Title	Complexity issue - Shared Situation Awareness by INAP actor(s)/ATCOs
Requirement	The INAP actor(s) should be able to inform all ATC Sector actors potentially interested/affected by a complexity hotspot or a short-term ATFCM measure
Status	<deleted>

Rationale	In Free Routing Airspace, the less constrained traffic flows and the potentially high variability of the traffic demand emphasis the need for air traffic flow / complexity management at local level (in the frame of INAP).
	The need is to provide situation awareness to all involved actors in INAP function.
	Other ATC sectors (than the off-loaded ATC sector(s) and the on-loaded ATC sector(s)) might be interested in being informed to prevent them from issuing instructions/clearances that would have on adverse effect on complexity in surrounding ATC sectors or debase de-complexification measures set up at INAP level.
	This requirement applies to the basic EAP function (Solution #118) and is also necessary to enable Human Performance of INAP actor(s) in high complexity Free Routing environment.
	Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Human Performance>, <Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Implement and fine-tune DDCB measure
<Role>	Local Traffic Manager Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM01.0160
Title	DCB / ATFCM information - Shared situation awareness between INAP actor(s) and ATCOs
Requirement	The INAP actor(s) shall be able to provide any ATC Sector actor within his/her ATSU with information related to DCB / ATFCM as deemed relevant (either requested by ATC or on INAP actor initiative)
Status	<deleted>

Rationale	In Free Routing Airspace, the less constrained traffic flows and the potentially high variability of the traffic demand emphasis the need for air traffic flow / complexity management at local level (in the frame of INAP).
	The need is to provide situation awareness to all involved actors in INAP function. This will facilitate the collaboration between the INAP actor(s) and ATC sector actors.
	This requirement goes beyond the scope of the basic EAP function (Solution #118) and is necessary to improve Air Traffic Flow / Complexity Management (in the frame of INAP) in FRA of high complexity.
	Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Human Performance>, <Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Implement and fine-tune DDCB measure
<Role>	Local Traffic Manager Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

Non-functional Safety Requirements for Dynamic Demand and Capacity Balancing by INAP (at SPR level)

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO02.0105
Title	Loss of the INAP support tools
Requirement	The frequency of occurrence of a loss of the INAP support tools to detect and analyse traffic imbalances and complexity issues (i.e. dDCB capability), shall not be greater than 1.00E-03 per flight hour
Status	<deleted>

Rationale	This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Initial Safety Assessment Report [SO-IR-023] Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Safety>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Analyse imbalance and/or complexity issue Detect Demand and Capacity imbalances
<Role>	Local Traffic Manager Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO02.0106
Title	Corruption of the INAP support tools
Requirement	The frequency of occurrence of a corruption of the INAP support tools to detect and analyse traffic imbalances and complexity issues (i.e. erroneous dDCB application), shall not be greater than 3,33E-05 per flight hour
Status	<deleted>
Rationale	This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Initial Safety Assessment Report [SO-IR-024] Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Safety>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Detect Demand and Capacity imbalances Analyse imbalance and/or complexity issue
<Role>	Local Traffic Manager Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO02.0107
Title	Error of STAM measures occurrence
Requirement	The frequency of occurrence of an erroneous preparation/coordination/implementation of STAM measures, shall not be greater than 1.00E-03 per flight hour
Status	<deleted>
Rationale	This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Initial Safety Assessment Report [SO-IR-025] Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Safety>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Prepare STAM Coordinate STAM Implement STAM
<Role>	Local Traffic Manager Extended ATC Planner (EAP) ATC Sector Planning Role

<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO02.0114
Title	Occurrence of flight trajectory not compliant with STAM measures in FRA
Requirement	The frequency of occurrence of an aircraft flying a trajectory not compliant with STAM measures in FRA, shall not be greater than 1.00E-03 per flight hour
Status	<deleted>
Rationale	This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Initial Safety Assessment Report [SO-IR-032] Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Safety>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Coordinate STAM Prepare STAM Detect Demand and Capacity imbalances Analyse imbalance and/or complexity issue Implement STAM
<Role>	Local Traffic Manager Extended ATC Planner (EAP) ATC Sector Planning Role
<Sub-Operating Environment>	En-Route High Complexity

Non-functional Performance Requirements for Dynamic Demand and Capacity Balancing by INAP (at OSED level)

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM04.0041
Title	Look-ahead time for ATCO workload monitoring by INAP actor(s)
Requirement	The INAP actor(s) shall be able to assess ATCO workload, within a timeframe of one hour
Status	<deleted>
Rationale	The INAP actor(s) monitors several indicators to assess the ATCO workload in a time horizon of at least one hour to assist the local DCB actor(s) in the short term with about 1 hour anticipation. This does not mean that the supporting tools should only display a time horizon of one hour. The timeframe of the tools may be longer to help assessing the ATCO workload within a one hour timeframe. This requirement applies to the basic EAP function (Solution #118) and is also necessary to enable Human Performance of INAP actor(s) in high complexity Free Routing environment. Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Performance>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Detect Demand and Capacity imbalances
<Role>	Local Traffic Manager Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM04.0051
Title	Look-ahead time for Occupancy Count monitoring by INAP actor(s)
Requirement	The INAP actor(s) shall be able to monitor the predicted Occupancy of Traffic Volumes, within a timeframe of one hour
Status	<deleted>

| Rationale | The need is to enable detection of traffic imbalance by INAP actor(s) based on Occupancy Threshold Monitoring Values, in the short term with about 1 hour anticipation.

This requirement applies to the basic EAP function (Solution #118) and is also necessary to enable Human Performance of INAP actor(s) in high complexity Free Routing environment.

Requirement is deleted as it was considered out of scope of Solution PJ06.01. |
|---|---|
| Category | <Performance> |

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Detect Demand and Capacity imbalances
<Role>	Local Traffic Manager

Extended ATC Planner (EAP) |
| <Sub-Operating Environment> | En-Route High Complexity |

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM04.0201
Title	Look-ahead time for display of predicted air situation on INAP Working Position
Requirement	The INAP actor(s) shall be able to display the predicted air situation, at a reference time from the present up to two hours in the future
Status	<deleted>
Rationale	The need is to refine the analysis performed in the frame of INAP with the sectors allocation, airspace reservations, and other elements of interest with a prediction up to 2 hours in the future.

This requirement applies to the basic EAP function (Solution #118) and is also necessary to enable Human Performance of INAP actor(s) in high complexity Free Routing environment.

Requirement is deleted as it was considered out of scope of Solution PJ06.01. |
| Category | <Performance> |

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Analyse imbalance and/or complexity issue
<Role>	Local Traffic Manager Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM04.0211
Title	Look-ahead time for Flights Visualization – Analysis of Trajectories on INAP Working Position
Requirement	The INAP actor(s) shall be able to analyse flights predicted trajectories, up to two hours in the future
Status	<deleted>
Rationale	The need is to refine the analysis performed in the frame of INAP with the trajectories involved in hotspots / complexity issues with a prediction up to 2 hours in the future. This requirement applies to the basic EAP function (Solution #118) and is also necessary to enable Human Performance of INAP actor(s) in high complexity Free Routing environment. Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Activity>	Analyse imbalance and/or complexity issue
<Role>	Local Traffic Manager Extended ATC Planner (EAP)

<Sub-Operating Environment>	En-Route High Complexity

Non-functional Performance Requirements for Traffic Flow / Complexity Management (at SPR level)

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS02.0017
Title	Operability of Complexity ATC tools to re-organize traffic flows
Requirement	Civil ATS En-Route Service Provide shall be able to use operable trajectory based complexity assessment tools
Status	<deleted>
Rationale	This requirement is linked with the ATM capability: • Air Traffic Complexity Management This requirement takes as reference: • Solution #33: REQ-04.07.02-SPR-FRFM.1002 which was <in progress> at the end of SESAR 1. This requirement goes beyond the scope of the basic EAP function (Solution #118) and is necessary to improve Air Traffic Flow / Complexity Management (in the frame of INAP) in FRA of high complexity. Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Performance>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Functional Block>	Local Air Traffic Complexity Management
<Role>	Local Traffic Manager Extended ATC Planner (EAP)
<Sub-Operating Environment>	En-Route High Complexity

INTEROP Requirements for Traffic Flow / Complexity Management (at Procedure level)

[REQ]

Identifier	REQ-06.01-SPRINTEROP-IO01.1030
Title	Decomplexification/optimization measure close to ATSU AoRs
Requirement	The principle of monitoring traffic complexity, hot spots and deduce some optimization principles in areas close to ATSU AoRs shall be executed by each ATSU
Status	<deleted>
Rationale	This is a requirement, based on human ATCO monitoring and reporting capabilities. Especially in areas close to sector boundaries, the hotspot awareness in a complex Free Route environment needs to be fostered, in order to align sector delineations or establish specific procedures. The future EAP role could be the relevant tool… EAP has made the decision thanks to the different inputs provided by the system (complexity with associated uncertainty, performance -global vs. local, optimization of trajectories, ...) and has now to let the different actors know about it. System supports the distribution of the plan designed by EAP (optimisation/ decomplexification measure can be a set of measures- ad hoc or part of a pre-determined and pre-agreed scenario, involving one or several partners) towards the various actors (e.g. same ATSU's Supervisor and CWPs, implementing/ involved ATSUs Supervisors and EAPs, FOCs, Airports, NM, etc...). The plan (description of measure, reason and impacts) is then shared between all the actors who can contribute (actively or passively) to its efficiency and/ or benefit from its timely and seamless implementation. This requirement goes beyond the scope of the basic EAP function (Solution #118) and is necessary to improve Air Traffic Flow / Complexity Management (in the frame of INAP) in FRA of high complexity. Requirement is deleted as it was considered out of scope of Solution PJ06.01.
Category	<Operational>

[REQ Trace]

Linked Element Type	Identifier
<SESAR Solution>	PJ.06-01
<Role>	ATC Sector Planning Role ATC Sector Executive Role

<Functional Block>	Flight Planning - Lifecycle Management - Data Distribution
	Controller Human Machine Interaction Management (ER/APP)
<Sub-Operating Environment>	En-Route High Complexity

4.9.2.2 ATS related requirements

4.9.2.2.1 Safety Requirements

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0058
Title	Ability to perform tactical coordination of flights across ACC/sector boundaries
Requirement	The ATCOs shall be able to perform tactical coordination of flights across ACC/sector boundaries not necessarily supported by published coordination points.
Status	<deleted>
Rationale	In FRA of high complexity across ACC/FIR borders, characterized less structured traffic and possibly more need for tactical actions requiring coordination of exit conditions, the ATCOs need to be provided with tactical coordination support tools allowing negotiating trajectory revision with adjacent ATC sectors outside published Coordination Points.

These tactical coordination support tools need to assist the ATCOs in assessing the effect of a trajectory revision even if based on a point belonging to the initial flight plan, but not necessarily known by the concerned ATC sector.

These coordination support tools might include the display of the trajectory revision proposal, as well as negotiation functions (agree, reject, counter proposal).

This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Final Safety Assessment Report [SO-FP-017]

Requirement is deleted in Expert Group (PJ06.01 workshop, 11-12 September 2019) |

Category	<Safety> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route Very High Complexity En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SO01.0116
Title	Availability of points of interest in FDPS database
Requirement	ATCOs shall have included all points of interest within the FDPS database.
Status	<deleted>
Rationale	Points of interest: (e.g. all waypoints within the maximum length of the segments) This requirement is linked with the ATM capabilities: • Coordination and Transfer in Free Routing cross-border environment • Separation provision in Free Routing cross-border environment This requirement takes as reference the safety objective of SESAR Solution PJ.06-01 Initial Safety Assessment Report [SO-FP-034] Requirement is deleted as it was considered covered by REQ-06.01-SPRINTEROP-IO01.0010 in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route Very High Complexity En-Route High Complexity

4.9.2.2.2 Performance Requirements

[REQ]

Identifier	REQ-06.01-SPRINTEROP-SP04.0010
Title	Timely display of flights in AoI of the sector/ATSU on Controller Working Position
Requirement	The ATCOs shall be able to display the planned trajectory of flights entering the sector/ACC, within at least X mn prior to the entry into the sector.
Status	<deleted>
Rationale	To manage flights in Free Routing Airspace, the PC needs be able to detect mid-term encounters as soon as possible prior to the entry into the sector. The flights entering the sector/ACC need therefore to be displayed early enough to manage potential conflicts at or close to sector/ACC boundaries. This requirement is deleted as not covered by the SESAR2020 Validation Exercises and as out of scope of the solution.
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route

		En-Route Very High Complexity
		En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-PC04.0010
Title	Timely mid-term conflict detection by ATCO
Requirement	The ATCOs shall be able to detect mid-term encounters between planned trajectories, within at least X mn before predicted loss of separation in Y% of cases.
Status	<deleted>
Rationale	In Free Routing Airspace, the ATCOs need a support to assess the global air situation including flights that follow an unfamiliar route scheme. Also conflicts may occur at the boundary between two ATC sectors and the ATCOs need a support to detect such conflicts in advance. A mid-term detection of encounters at the ATC planning phase permits to predict potential loss of separation between two planned trajectories of interest for the sector (20 minutes time horizon as an order of magnitude). This functionality is considered as necessary in airspace of medium complexity or in airspace with high variability in traffic complexity. This requirement is deleted as not covered by the SESAR2020 Validation Exercises and as out of scope of the solution.
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route High Complexity En-Route

[REQ]

Identifier	REQ-06.01-SPRINTEROP-TC04.0010
Title	Timely tactical conflict detection by ATCO
Requirement	The ATCOs shall be able to detect tactical encounters between reference trajectories, within at least X mn before predicted loss of separation in Y% of cases.
Status	<deleted>
Rationale	In Free Routing Airspace, the ATCOs need a support to detect in advance conflicts that can occur anywhere (as a result of removing predefined crossing points existing in the ATS Route Network). A timely detection of encounters at the ATC tactical phase permits the ATCOs to assess the situation and if necessary take action to ensure that the applicable separation minima will not be infringed in the vast majority of cases. This functionality is considered as necessary in airspace of medium complexity or in airspace with high variability in traffic complexity. This requirement is deleted as not covered by the SESAR2020 Validation Exercises and as out of scope of the solution.
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS02.0029
Title	Performance of Tactical Conflict Detection Tool
Requirement	ATC Sector Executive Role shall be able to perform detection of tactical encounters between two flights, within a predefined time horizon of at least X minutes up to Y minutes, supported by Conflict Detection Tool
Status	<deleted>
Rationale	This requirement is linked with the ATM capabilities: • Aircraft-to-Aircraft separation provision (airspace) This requirement takes as reference: • Solution #33: REQ-04.07.02-SPR-FRTC.1004 In SESAR 1 EXE-07.05.03-VP-465, 86% of ATCOs reported no change in workload when controlling en-route flights flown with UPR FPLs, and 83% of ATCOs reported no change in workload when controlling departing/arriving flights flown with UPR FPLs. In DSNA simulation leg of SESAR 1 EXE-04.03-VP-798, validation results showed that even if the TCT tool brings a huge added value, it should not be considered as mandatory in Low to medium FRA environment as these complexities was manageable without it. The SESAR 1 validation results related to Solution #33 do not directly apply to Solution PJ06-01, they are provided as illustrative results from previous research. Requirement is agreed to be deleted in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity

		En-Route
		En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM00.0020
Title	Occupancy thresholds (peak value, sustain value, maximum acceptable duration of sustained heavy traffic)
Requirement	Civil ATS En-Route Service Provider shall adapt the peak value, the sustain value and the maximum acceptable duration of sustained heavy traffic of sectors to Free Routing operations.
Status	<deleted>
Rationale	In Free Routing Airspace, the less structured traffic flows may have an impact on sector design and configurations to best accommodate the ATCOs workload, particularly in airspace of high complexity. As a consequence, the occupancy thresholds that need to be monitored at local DCB / INAP level will need to be adapted to the Free Routing environment. This requirement is deleted as not covered by the SESAR2020 Validation Exercises and as out of scope of the solution.
Category	<Performance> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route Very High Complexity En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-FM00.0030

Title	Trajectory-based TVs
Requirement	Civil ATS En-Route Service Provider shall adapt monitored Traffic Volumes to Free Routing operations.
Status	<deleted>
Rationale	In Free Routing Airspace, the traffic flows will be less structured and conflicts could appear anywhere as a result of removing predefined crossing points existing in the ATS Route Network. This needs to be taken into account when assessing the complexity within the airspace through the monitoring of Traffic Volumes. To be adapted to free routing operations, the TVs need to be trajectory-based (or flow-oriented) rather than fixed geographical volumes. This requirement is deleted as not covered by the SESAR2020 Validation Exercises and as out of scope of the solution.
Category	<Performance> , <Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS01.0012
Title	ATS expeditious flow of traffic
Requirement	Civil ATS En-Route Service Provider shall be able to expedite the flow of traffic without negatively impacting ATFCM delays
Status	<deleted>
Rationale	This requirement is linked with the ATM capability:

	• ATM Performance Management on Flexibility and Predictability Focus Areas • Air Traffic Complexity Management This requirement takes as reference: • Solution #33: REQ-04.07.02-SPR-FR00.1005 • Transition VALS: OBJ-PJ0601-VALST3.001 Success criteria 1 and 9 In SESAR 1 EXE-07.05.03-VP-465, validation results showed that 91% of UPR FPLs were flown as planned compared to 78% of non UPR FPLs In SESAR 1 FREE SOLUTIONS Large Scale Demonstration, no ATFCM delay was attributed to flights of the FRA trial. The SESAR 1 validation results related to Solution #33 do not directly apply to Solution PJ06-01, they are provided as illustrative results from previous research. This requirement is deleted as not covered by the SESAR2020 Validation Exercises and confirmed as out of scope of the solution in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	\<Performance\>

[REQ Trace]

Relationship	Linked Element Type	Identifier
\<ALLOCATED_TO\>	\<SESAR Solution\>	PJ.06-01
\<ALLOCATED_TO\>	\<Sub-Operating Environment\>	En-Route Very High Complexity En-Route En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS01.0013
Title	Expeditious flow of traffic by ATS under high variability of traffic complexity

Requirement	Civil ATS En-Route Service Provider shall be able to expedite traffic flows with high variability in traffic complexity at sector/ATSU level, without negatively impacting ATFCM delays.
Status	<deleted>
Rationale	This requirement is linked with the ATM capability: • ATM Performance Management on Flexibility and Predictability Focus Areas. • Air Traffic Complexity Management This requirement takes as reference: • Solution #33: REQ-04.07.02-SPR-FR00.1007 which was <in progress> at the end of SESAR 1 • Transition VALS: OBJ-PJ0601-VALST3.001 Success criteria 1 and 9 In SESAR 1 EXE-04.03-VP-797, assessment of the NM revealed a huge number of new hotspot within the considered FRA airspace. Therefore, it was decided to focus on hotspots over the simulated area. DCB measures taken to reduce these hotspots increased drastically number of regulated flights and ATFCM En-Route delay per delayed flights. The SESAR 1 validation results related to Solution #33 do not directly apply to Solution PJ06-01, they are provided as illustrative results from previous research. This requirement is deleted as it not covered by the SESAR2020 Validation Exercises and confirmed as out of scope of the solution in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route Very High Complexity

		En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS01.0005
Title	Tactical rerouting maximum increment of the flight plan route distance
Requirement	ATC Sector Executive Role, when tactical rerouting is provided, shall not increment flight plan route distance, independently from the number of active Airspace Reservations, longer than the great circle distance +X%
Status	<deleted>
Rationale	This requirement is linked with the ATM capabilities: • The "Aircraft-To-Aircraft Separation Provision (airspace)" capability, within "Provide Tactical Separation Assurance" Activity View. • The ATM Performance Management capability, within Flexibility KPA/Modification of the Trajectory and Modification to ARES requirement influence factors This requirement takes as reference: • Solution #33: REQ-04.07.02-SPR-FR00.1003, which validation technique was "Expert Group" then, there are no quantitative measured results. Requirement was not traced by EXEs and it was proposed to be deleted in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity

		En-Route
		En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-QS01.0008
Title	Horizontal limits for FRA
Requirement	Air Navigation Service Provider shall not negatively impact Airspace Capacity with the definition of the Free Route Airspace horizontal limits as large as possible (cross-border or not)
Status	<deleted>
Rationale	This requirement is linked with the ATM capabilities: • Free Route Airspace Design for the establishment of the FRA horizontal border either at ACC, State or cross-border FRA level. • ATM Performance Management, so that the horizontal limit publication does not reduce the En-Route airspace capacity. This requirement takes as reference: • Solution #33: REQ-04.07.02-SPR-FRAM.1003 • Transition VALS: OBJ-PJ0601-VALST3.001 Success criteria 12 According to Free Route Airspace (FRA) Application in NMOC – Guidelines [39]: In order to allow definition of how traffic shall "vertically" enter the FRA area from the underlying airspace, or "vertically" leave the FRA area into the airspace below, the concept of horizontal border is introduced in CACD (Central Airspace and Capacity Database) The SESAR 2020 EXE-06.01-V3-VALP-001 and EXE-06.01-V3-VALP-002 could not contribute to assess cross-border FRA structures with horizontal limits "as large as possible". This requirement is deleted as the impact of structurally limited FRA on Airspace Capacity was considered covered by REQ-06.01-

	SPRINTEROP-QS01.0007 in Expert Group (PJ06.01 workshop, 11-12 September 2019).
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

4.9.2.2.3 INTEROP Requirements

[REQ]

Identifier	REQ-06.01-SPRINTEROP-IO01.0001
Title	Interoperability of coordination points for ATSU to ATSU Flight Data Exchange
Requirement	ATM systems shall be able to exchange flight data across ATSU AoRs using coordination points as - Coordinates LAT/LONG (optionally applying a gate concept, see 'rationale') - Bearing and distance from a navigation aid or defined COP, or - published 5 LNC (COP)
Status	<deleted>
Rationale	This requirement is linked with the ATM capability • Coordination and Transfer This requirement takes as reference: Solution #33: REQ-04.07.02-SPR-FRPC.1001 Within a FRA environment, data exchange via fixed published route points is the exemption; the majority of COPs to be exchanged needs to be based on LAT/LONG and Bearing and Distance. Note:

	Occasionally the so called GATE concept might be applied, as described in OLDI ed. 4.3 Annex G This requirement is deleted as system-oriented rather than operational.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route High Complexity En-Route

[REQ]

Identifier	REQ-06.01-SPRINTEROP-IO01.0050
Title	Data exchange in close proximity of the AoR
Requirement	An ATSU shall exchange flight data to/from the Areas of Interest specifically for flights which are not expected to enter the own AoR.
Status	<deleted>
Rationale	Free Routing operation requires that ATS units need to be aware of the traffic flying in close proximity to their Area of Responsibility (AoR) but not actually planned to penetrate their sectors, in order to support conflict probing during FRA clearances. For this type of traffic close to the AoR boundaries, the OLDI specification provides the capability of INF, BFD or CFD data exchanges that might provide the required awareness of traffic intent to be used for conflict probe function. Source: OLDI 4.3 Annex G SESAR 2020 In the exercise EXE-06.01-V3-VALP-001 this RQ was not covered: Skyguide ACCS operated in Virtual Centre configuration without connection to ENAV Platform. The Italian FDP emulated

	exchanging basic messages ABI, ACT intergrating lat/long points (intersection of planned trajectory with sectors boundaries) Requirement is deleted as it was considered covered by REQ-06.01-SPRINTEROP-IO01.0040 in Expert Group (PJ06.01 workshop, 11-12 September 2019)
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-IO01.0100
Title	Coordination requests initiated by the transferring unit to the accepting unit by means of SDM message.
Requirement	The FDP system shall enable coordination requests, initiated by the transferring unit to the accepting unit regarding: - Assigned Heading/Track or Direct Clearance; - Assigned Speed; - Assigned Rate of Climb/Descent; - Cleared Flight Level. Messages from the Accepting Unit: The SDM message shall contain the following items of data: - Frequency
Status	<deleted>

Rationale	In some cases, Free Routing operation requires the tactical intervention and coordination at short notice:

The use of SDM (Supplementary Data Message) from the Accepting to the Transferring Unit will help in bringing situational awareness about the sector and frequency to which the flight has to be transferred. Implementing this message may support "skipping" the default entry sector without implementing the SCO / SKC messages.

Source: OLDI draft 4.3 Annex G

This requirement is deleted as system-oriented rather than operational. |
| Category | <Interoperability> |

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity

En-Route

En-Route High Complexity |

[REQ]

Identifier	REQ-06.01-SPRINTEROP-IO01.0004
Title	Processing and display of trajectories beyond ATSU AoR
Requirement	The ATM / Flight Data Processing system shall enable the processing and display of alternative trajectories to a next waypoint outside the sector/ATSU area of responsibility.
Status	<deleted>

Rationale	This requirement is linked with the ATM capabilities: • Aircraft-to-Aircraft separation provision (airspace) • Coordination and Transfer This requirement takes as reference: • Solution #33: REQ-04.07.02-SPR-FRTC.1005 In SESAR 1 EXE-07.05.03-VP-465, 86% of ATCOs reported no change in workload when controlling en-route flights flown with UPR FPLs, and 83% of ATCOs reported no change in workload when controlling departing/arriving flights flown with UPR FPLs. In DSNA simulation leg of SESAR 1 EXE-04.03-VP-798, in Low to Medium FRA, the level of ATCO's situation awareness seemed acceptable after a transition time, but with more involved cognitive resources (i.e. workload and fatigue). This requirement is deleted as system-oriented rather than operational.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route Very High Complexity En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-IO01.0041
Title	Enhanced tools for coordination and conflict detection for trajectories beyond ATSU AoR
Requirement	The ATM system shall - where applicable - provide inter-ATSU coordination and conflict detection tools based on associated working methods/procedures considering long range coordination across several ATSUs.

Status	<deleted>
Rationale	This requirement is linked with the ATM capabilities: • Aircraft-to-Aircraft separation provision (airspace) • Coordination and Transfer and might be specifically relevant in cases of revised trajectories. This requirement takes as reference: • Solution #104: Sector Team Operations - En-route Air Traffic Organiser • Solution #33: REQ-04.07.02-SPR-FRTC.1005 In SESAR 1 EXE-07.05.03-VP-465, 86% of ATCOs reported no change in workload when controlling en-route flights flown with UPR FPLs, and 83% of ATCOs reported no change in workload when controlling departing/arriving flights flown with UPR FPLs. In DSNA simulation leg of SESAR 1 EXE-04.03-VP-798, in Low to Medium FRA, the level of ATCO's situation awareness seemed acceptable after a transition time, but with more involved cognitive resources (i.e. workload and fatigue). This requirement is deleted as system-oriented rather than operational.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route Very High Complexity En-Route High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-IO01.0070
Title	Use of interactive graphical trajectory editing tools
Requirement	The FDP system shall use interactive graphical trajectory editing tools to define LAT/LONG points as well as the route points with range and bearing from the published fixes.
Status	<deleted>
Rationale	The updated route info within the OLDI messages is a pre-requisite for having an accurate planned trajectory required for the proper functioning of ATC tools. The content of route information provided by the OLDI messages should also be enhanced by using the interactive graphical trajectory editing tools that supports the LAT/LONG point as well as the route points with range and bearing from the published fixes. Source: OLDI draft 4.3 Annex G This requirement is deleted as system-oriented rather than operational.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route Very High Complexity En-Route High Complexity En-Route

[REQ]

Identifier	REQ-06.01-SPRINTEROP-IO01.1000
Title	Separation assurance actions initiated by upstream (transferring) ATSU/sector

Requirement	For flights entering the downstream AoR from one upstream (transferring) sector, the responsibility of initiation of actions ensuring prescribed separation within the Area of Responsibility of the downstream (accepting) sector shall lie within the upstream (transferring) sector, if a separation infringement is detected -within a standard distance that is measured from the boundary of the upstream sector into the Area of Separation Interest, e.g. 20 NM or -within elapsed flight time that is measured from the moment when the second aircraft enters the Area of Responsibility of the downstream sector till the moment of the loss of the prescribed separation (dynamic width), e.g. 5 minutes.
Status	<deleted>
Rationale	The removal of published routes leads to a change in the number and location of conflict points. Moreover, in Free Routing cross-border environment conflicts may happen along sector/ACC boundaries due to the free trajectories. This may cause extensive coordination and uncertainty as to who is responsible for separation. The Area of Interest for Separation (AoS) is an area that lies along a boundary between two ATC sectors of different ATS Units (ACCs) and within which the primary responsibility for the initiation of actions ensuring prescribed separation within the Area of Responsibility of the downstream (accepting) sector between flights transferred from the same upstream (transferring) sector lies within the upstream sector. The definition of dimensions of such an area can be based on: A standard distance that is measured from the boundary of the upstream (transferring) sector into the Area of Responsibility of the downstream sector, e.g. 20NM, or elapsed flight time that is measured from the moment when the second aircraft enters the AoR of the downstream sector till the moment of the loss of the prescribed separation (dynamic width), e.g. 5 minutes. Note: A standard coordination is one which is performed in accordance with a Letter of Agreement (LOA) between the ATSUs concerned. Provided the coordination offered by Transferring ATSU falls within the scope of the LOA, the coordination is automatically accepted by the Accepting ATSU. Generally the standard coordination activity is triggered by a timer, or distance before the boundary in the Transferring ATSU system, which is set in accordance with the LoA. Alternatively the Transferring ATSU controller team (usually the planner controller) may manually initiate the standard coordination

	activity (corresponding to an OLDI 'forced activation'). The latter may occur when there is an operational need to coordinate the flight earlier than the automated trigger, or where the automated trigger fails to initiate coordination. Validation results: the requirement has been validated in EXE-06.01-V3-VALP-001. In EXE-06.01-V3-VALP-002, ATCOs preferred to perform an early release or if not possible, coordinate between the planning controllers. The extension of the responsibility to the upstream sector was not agreed by all the controllers.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route High Complexity En-Route En-Route Very High Complexity

[REQ]

Identifier	REQ-06.01-SPRINTEROP-IO01.1040
Title	Early application of extended AMAN procedures involving one or several upstream ATSUs
Requirement	Especially within a high complex FRA environment, extended AMAN procedures need to be embedded and institutionalized (eg CTA technique) involving one or several upstream ATSUs.
Status	<deleted>

Rationale	Especially within a high complex FRA environment, extended AMAN procedures need to be early embedded and institutionalized (eg CTA technique):
	It is expected that CTA will apply in both medium/medium [TS-0103] and in high/high [TS-0109] complexity and density situations. For the high/high density environment the balance of the sequencing techniques used (e.g. amount of use of TTL/TTG versus amount of use of CTA) may be different to that envisaged for the medium/medium environment, and additional tools may also be required for the high/high ops, but this has not yet been fully validated.
	Within the operation of Extended AMAN, several techniques can be used to sequence aircraft for arrival at destination. If the aircraft is still on the ground at a satellite airport, delay for AMAN purposes at destination may be absorbed by adjusting the departure take-off time in order to meet the target at destination. If the aircraft is airborne, simple AMAN advisories such as Time to Lose or Gain (and/or speed advisories) may be issued, where the constraint is met by the ATCO issuing appropriate control instructions to the flight. In addition, advanced techniques such as Controlled Time of Arrival (CTA) may now also be used, where on-board avionics and flight management systems are used by the flight crew to achieve the constraint time over the metering fix.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.06-01
<ALLOCATED_TO>	<Sub-Operating Environment>	En-Route En-Route High Complexity En-Route Very High Complexity

5 References and Applicable Documents

5.1 Applicable Documents

Content Integration

[1] PJ.19 D5.1 EATMA Guidance Material Version (2018)

[2] EATMA Community pages

[3] SESAR ATM Lexicon

Content Development

[4] PJ.19 D19.2.1SESAR 2020 Concept Of Operations (CONOPS 2019)

System and Service Development

[5] 08.01.01 D52: SWIM Foundation v2

[6] 08.01.01 D49: SWIM Compliance Criteria

[7] 08.01.03 D47: AIRM v4.1.0

[8] 08.03.10 D45: ISRM Foundation v00.08.00

[9] B.04.03 D102 SESAR Working Method on Services

[10] B.04.03 D128 ADD SESAR1

[11] B.04.05 Common Service Foundation Method

Performance Management

[12] PJ.19 D4.1 Performance Framework (2019)

[13] B.04.01 D42 SESAR2020 Transition Validation

[14] B.05 D86 Guidance on KPIs and Data Collection support to SESAR 2020 transition.

[15] 16.06.06-D68 Part 1 –SESAR Cost Benefit Analysis – Integrated Model

[16] 16.06.06-D51-SESAR_1 Business Case Consolidated_Deliverable-00.01.00 and CBA

[17] Method to assess cost of European ATM improvements and technologies, EUROCONTROL (2014)

[18] ATM Cost Breakdown Structure_ed02_2014

[19] Standard Inputs for EUROCONTROL Cost Benefit Analyses

[20] 16.06.06_D26-08 ATM CBA Quality Checklist

[21] 16.06.06_D26_04_Guidelines_for_Producing_Benefit_and_Impact_Mechanisms

Validation

[22] 03.00 D16 WP3 Engineering methodology

[23] Transition VALS SESAR 2020 - Consolidated deliverable with contribution from Operational Federating Projects

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

[25]PJ.19-04 D4.8 Validation Targets 2019

System Engineering

[26] SESAR 2020 Requirements and V&V guidelines, Edition 00.01.01

Safety

[27] SESAR, Safety Reference Material, Edition 4.0, April 2016

[28] SESAR, Guidance to Apply the Safety Reference Material, Edition 3.0, April 2016

[29] SESAR, Final Guidance Material to Execute Proof of Concept, Ed00.04.00, August 2015

[30] SESAR, Resilience Engineering Guidance, May 2016

Human Performance

[31] 16.06.05 D27 HP Reference Material D27

[32] 16.04.02 D04 e-HP Repository - Release note

Environment Assessment

[33] SESAR, Environment Reference Material, alias, "Environmental impact assessment as part of the global SESAR validation", Project 16.06.03, Deliverable D26, 2014.

[34] ICAO CAEP – "Guidance on Environmental Assessment of Proposed Air Traffic Management Operational Changes" document, Doc 10031.

Security

[35] 16.06.02 D103 SESAR Security Ref Material Level

[36] 16.06.02 D137 Minimum Set of Security Controls (MSSCs).

[37] 16.06.02 D131 Security Database Application (CTRL_S)

5.2 Reference Documents

[38] **ED-78A** GUIDELINES FOR APPROVAL OF THE PROVISION AND USE OF AIR TRAFFIC SERVICES SUPPORTED BY DATA COMMUNICATIONS.[24]

[39] **European ATM Master Plan**, Executive View, Edition 2015

[40] **European ATM Architecture (EATMA) V12 / Data Set 19**

[41] **European Route Network Improvement Plan (ERNIP), Part 1**, European Airspace Design Methodology Guidelines - General principles and technical specifications for airspace design, Edition 2.0, December 2018

[42] **European Route Network Improvement Plan (ERNIP),** Monitoring report – AIRAC 1707

[43] **EUROCONTROL Free Route Airspace (FRA) design application in NMOC** – Guidelines, Edition 1.0, August 2019
https://www.eurocontrol.int/publication/free-route-airspace-fra-design-application-nmoc-guidelines

[44] **EUROCONTROL Free Route Workshop - Free Route Airspace Definitions**, Tihomir Todorov , 29 JUN 2015

[45] EUROCONTROL - GUID-159 - **EUROCONTROL Guidelines for Short Term Conflict Alert (STCA)** - Part I to III – Edition 1.0, January 2017
http://www.eurocontrol.int/publications/eurocontrol-guidelines-short-term-conflict-alert-stca-part-i-iii

[46] EUROCONTROL - GUID-161 - **EUROCONTROL Guidelines for Area Proximity Warning (APW)** - Part I to III – Edition 1.0, January 2017
https://www.eurocontrol.int/publication/eurocontrol-guidelines-area-proximity-warning

[47] EUROCONTROL - SPEC 106 - **EUROCONTROL Specification for On-Line Data Interchange (OLDI)** - Edition 4.3, December 2017
https://www.eurocontrol.int/publications/eurocontrol-specification-line-data-interchange-oldi

[48] EUROCONTROL - SPEC 139 - **EUROCONTROL Specification for Medium-Term Conflict Detection** - Edition 2.0, March 2017
http://www.eurocontrol.int/publications/medium-term-conflict-detection-mtcd-specification

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[24] The EUROCAE ED-78A has been used as an initial guidance material. ED-78A is useful, but is not an applicable document, because it mostly addresses the V4-V5 phases, whilst the SESAR R&D programme is focussed on development (V1-V2-V3, and because of its partial compliance with safety regulatory requirements).

[49] EUROCONTROL - SPEC 142 - **EUROCONTROL Specification for Monitoring Aids** - Edition 2.0, March 2017
https://www.eurocontrol.int/publication/eurocontrol-specification-monitoring-aids-mona

[50] EUROCONTROL - SPEC 143 - **EUROCONTROL Specification for Trajectory Prediction** - Edition 2.0, March2017
http://www.eurocontrol.int/publications/trajectory-prediction-specification

[51] **EUROCONTROL Aviation in 2040 – Challenges of growth**, Annex 1 Flight Forecast to 2040, Edition 2018

[52] **High Level Network Operational Framework 2019** , Edition 2.0, January 2016

[53] **PRR 2018 - Performance Review Report**, An Assessment of Air traffic Management in Europe during the Calendar Year 2018, May 2019

[54] **SESAR Deployment Programme (Edition 2017)**, May 2017

[55] **SJU Free Route Task Force final report, Edition 00.01.00**

[56] **01.09-D2 WE-FREE Demonstration Report**, Edition 00.00.06, May 2014

[57] **02.01-D12 FRAMaK** – Final Project Report (Demonstration Report), Edition 00.02.03, July 2014

[58] **LSD.01.05-D3 FREE SOLUTIONS Demonstration Report**, Edition 00.03.03, July 2016

[59] **04.03-M602 Validation Report of EXE-04.03-VP-797**, Edition 00.01.00, September 2016

[60] **04.03-M603 Validation Report of EXE-04.03-VP-798**, Edition 00.01.00, September 2016

[61] **04.07.02-D37 Free Route Operational Service and Environment Definition (OSED) for Step 1 - Iteration 2**, Edition 00.02.01, January 2015

[62] **04.07.02-D63 Free Route Safety and Performance Requirements (SPR) for Step 1**, Edition 00.01.03, November 2016

[63] **07.05.03-D35 Validation Report for Step 1 User Preferred Routing**, Edition 00.02.00, December 2013

[64] **11.01.05-D23 Contribution to EXE-04.03-VP-797- Free Route Step 1 V2 Validation Report**, Edition 00.01.00, August 2016

[65] **Solution 06-01: Validation Plan (VALP) for V3** - Part I, Edition 00.01.00, July 2018

[66] **Solution 06-01: Validation Plan (VALP) for V3** - Part II- Safety Plan, Edition 00.01.00, July 2018

[67] **Solution 06-01: Validation Plan (VALP) Template for V3** - Part IV - Human Performance Assessment Plan, Edition 00.01.00, October 2017

[68]**Solution 06-01: Cos Benefit Analysis (CB3) for V3**, Edition 00.01.00, To be issued[57

Appendix A   Cost and Benefit Mechanisms

A.1 Stakeholders identification and Expectations

This section describes who the stakeholders are and how they are concerned by the scope of the Solution PJ.06-01.

Stakeholder	Involvement	Why it matters to stakeholder
Airspace Users (Civil and Military AUs, Commercial Airlines, Business Aviation, Flight/Wing Operations Centres, Pilots)	Free Routing operations (flight planning + execution) in En-Route airspace including in high complexity and cross-border environments	AUs expect to improve **Operational Efficiency** (fuel efficiency, cost effectiveness, …) and **Predictability** with no negative impact on **Safety** or airspace **Capacity**
ANSPs (Civil and Military ANSPs, En-route ACCs, ATCOs (Planning and Tactical/Executive)	ANSPs will offer more flight planning options to AUs in FRA including in high complexity cross-border environments ATCOs will provide planning and tactical separation to controlled flights	ANSPs expect to maintain **Safety** and airspace **Capacity** in FRA of high complexity ATCOs expect to minimise the impact of Free Routing operations on their Human Performance (workload, situational awareness, …) and thus help to maintain **Safety** and airspace **Capacity**

Table 27: Stakeholder's expectations

A.2 Benefits mechanisms

Hereafter is a high-level description of the Benefit and Impact Mechanism of the Solution PJ.06-01 for each impacted Stakeholder. This description has been developed at the OSED level (using the reference Guidelines for Producing Benefit and Impact Mechanisms [14]) and aligned with the SESAR 2020 Performance Framework [12]. These benefit mechanisms might also be refined in the context of the different Validation Exercises related to the Solution.

A.2.1 Structure and syntax

A Benefit and Impact Mechanism (BIM):

- • Is a cause-effect description of the impacts of the proposed solution;

- • Describes and identifies all relevant impacts, whether positive or negative, that the proposed solution is expected/ shown to provide.

A Benefit and Impact Mechanism consists of a diagram showing an overview of the links between the boxes in the different columns, this is supplemented by textual descriptions of the feature and the numbered mechanisms.

The BIM diagram is laid out in columns:

Column Title	Box Shape	Column Description
OI Step(s)	OI Step Code: OI Step Description	Identifies the OI Step that will bring changes to the world of ATM and briefly describes it
Changes	Change 1	Short description of a change brought about by the OI Step
Performance Indicators / Metrics	Indicator A	Aspects which can be measured (or calculated from other metrics) to identify if the expected positive and negative impacts are actually realised. These need to be things that can be measured in the validation exercises.
Impacts (Positive or Negative)	Impact 1	Describes the expected positive or negative impacts
KPA / TA Impacted	KPA 1	The KPA which is related to the Impact, as defined in the SESAR2020 Performance Framework.

Table 28: Benefit and Impact Mechanism Syntax – Columns

The boxes in these columns are linked by numbered arrows which represent the mechanisms.

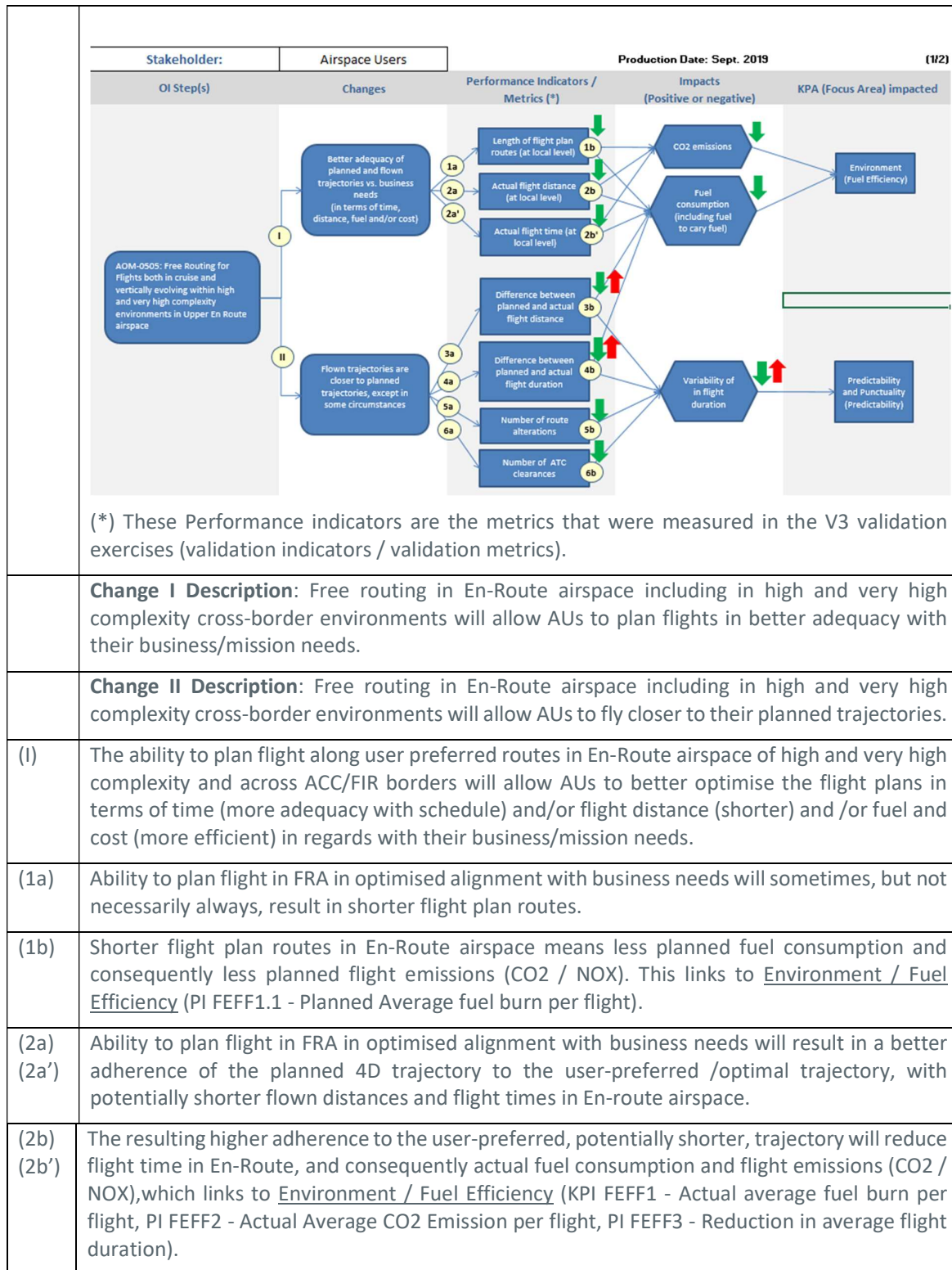| (n)	The numbers provide links to the mechanism descriptions in the text.

Table 29: Benefit and Impact Mechanism Syntax – Mechanisms

The arrows associated with the Indicators and the Positive or Negative Impacts are:

OI Step(s)	OI Step Code: OI Step Description	Identifies the OI Step that will bring changes to the world of ATM and briefly describes it
⬇ (green)		A beneficial decrease e.g. a reduction in CO2 emissions (indicator) or a reduction in controller workload (positive impact)
⬆ (red)		A detrimental increase e.g. an increase in CO2 emissions (indicator) or an increase in controller workload (negative impact)
⬆ (green)		A beneficial increase e.g. an increase in no. of movements (indicator) or an increase in safety (positive impact)
⬇ (red)		A detrimental decrease e.g. a reduction in no. of movements (indicator) or a reduction in safety (negative impact)
⇨ (outline)		A change in the indicator, a positive or negative impact is expected but with current knowledge the direction is still not clear. Can be coloured to show the main expectation. It is preferable to use a direction arrow, however this is provided as a 'last resort', for example where input from a TA expert is required or if there are two possible hypotheses on the change which need to be explored in the validation activities.

Table 30: Benefit and Impact Mechanism Syntax – Coloured Arrows

A.2.2 Airspace User benefits mechanism

(*) These Performance indicators are the metrics that were measured in the V3 validation exercises (validation indicators / validation metrics).

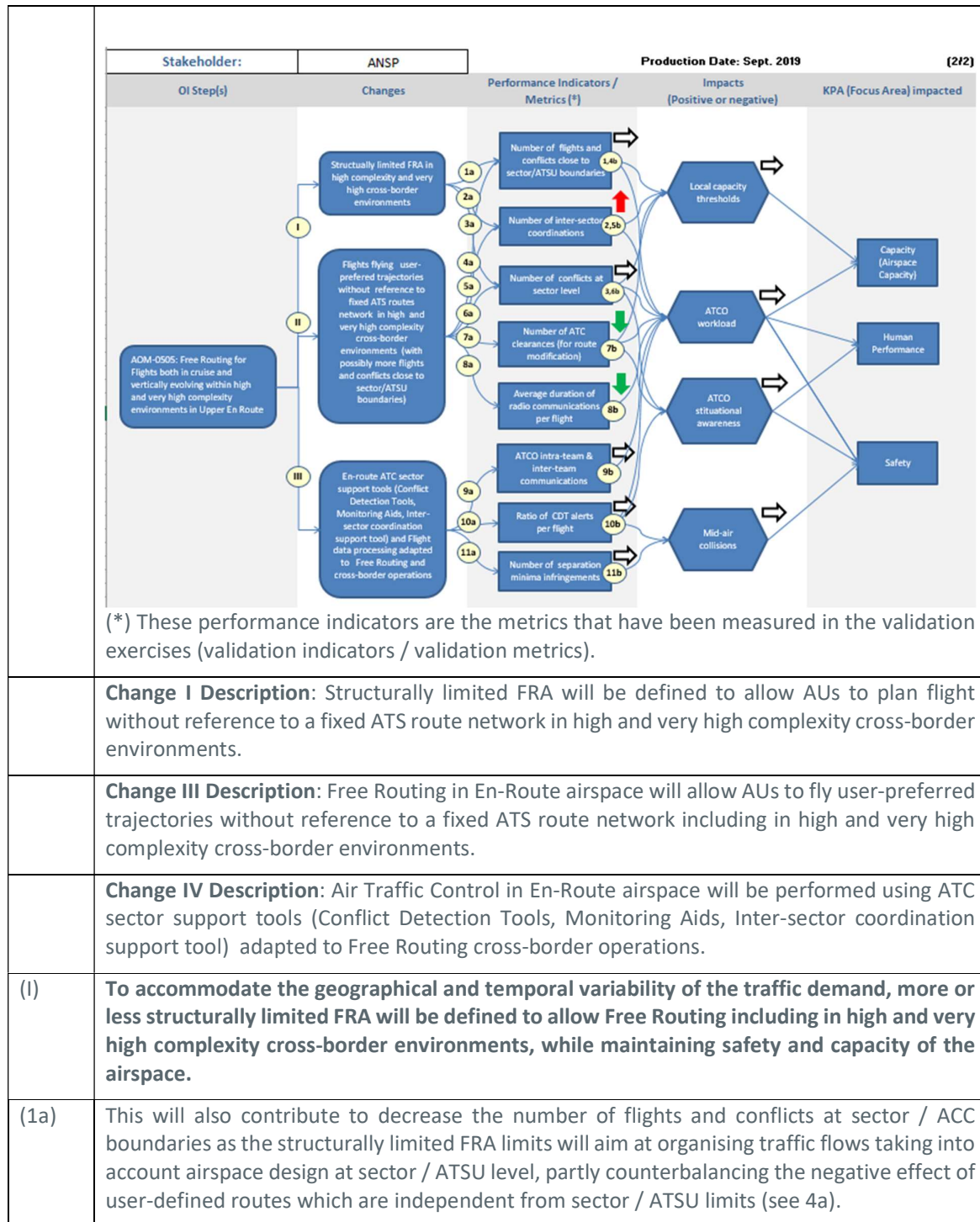|	
	Change I Description: Free routing in En-Route airspace including in high and very high complexity cross-border environments will allow AUs to plan flights in better adequacy with their business/mission needs.
	Change II Description: Free routing in En-Route airspace including in high and very high complexity cross-border environments will allow AUs to fly closer to their planned trajectories.
(I)	The ability to plan flight along user preferred routes in En-Route airspace of high and very high complexity and across ACC/FIR borders will allow AUs to better optimise the flight plans in terms of time (more adequacy with schedule) and/or flight distance (shorter) and /or fuel and cost (more efficient) in regards with their business/mission needs.
(1a)	Ability to plan flight in FRA in optimised alignment with business needs will sometimes, but not necessarily always, result in shorter flight plan routes.
(1b)	Shorter flight plan routes in En-Route airspace means less planned fuel consumption and consequently less planned flight emissions (CO2 / NOX). This links to _Environment / Fuel Efficiency_ (PI FEFF1.1 - Planned Average fuel burn per flight).
(2a) (2a')	Ability to plan flight in FRA in optimised alignment with business needs will result in a better adherence of the planned 4D trajectory to the user-preferred /optimal trajectory, with potentially shorter flown distances and flight times in En-route airspace.
(2b) (2b')	The resulting higher adherence to the user-preferred, potentially shorter, trajectory will reduce flight time in En-Route, and consequently actual fuel consumption and flight emissions (CO2 / NOX),which links to _Environment / Fuel Efficiency_ (KPI FEFF1 - Actual average fuel burn per flight, PI FEFF2 - Actual Average CO2 Emission per flight, PI FEFF3 - Reduction in average flight duration).

(II)	The ability to plan flight along user preferred routes including in FRA of high or very high complexity will allow AUs to fly flight much closer to planned trajectories as the flight plan will be in optimised alignment with business needs (with for instance less tactical directs requested by pilots or given by ATCO to expedite the traffic). However, tactical interventions will still be required in some circumstances to manage the traffic at local level.
(3a) (4a)	As the planned trajectories in En-Route airspace will be much closer with business needs, the difference (in distance and time) between planned and executed trajectories will be reduced on average, yet with potentially significant trajectory alterations required in some circumstances.
(5a) (6a)	As the executed trajectories in upper En-Route airspace will be much closer to planned and optimised trajectories, the need for tactical interventions to expedite the traffic will be reduced.
(3b) (4b)	The resulting higher adherence to the planned, optimised and possibly shorter, trajectory in En-Route airspace will improve: • fuel consumption (including less fuel-to-carry fuel) and flight emissions (CO2 / NOX), which links to Environment / Fuel Efficiency (KPI FEFF1 - Actual average fuel burn per flight; PI FEFF2 - Actual Average CO2 Emission per flight, PI FEFF3 - Reduction in average flight duration).
(3b) (4b) (5b) (6b)	The impact on in-flight variability will vary depending on the implementation of FRA across ACC/FIR boundaries, and the level of flight plan optimisation allowed at airspace design level: • there will be less trajectory revisions in En-Route, so trajectories will be more stable on average (i.e. reduction of the difference between [KEP and KEA]) • the variability of the difference between planned and flown flight times will depend on the extent of trajectory alterations required at local level, which links to Predictability (KPI PRD1 - Variance of Difference in actual & Flight Plan or RBT durations; PRD6 - En-Route variability).

Table 31: Airspace Users benefits mechanism

A.2.3 ANSP benefits mechanism

(*) These performance indicators are the metrics that have been measured in the validation exercises (validation indicators / validation metrics).

	Change I Description: Structurally limited FRA will be defined to allow AUs to plan flight without reference to a fixed ATS route network in high and very high complexity cross-border environments.
	Change III Description: Free Routing in En-Route airspace will allow AUs to fly user-preferred trajectories without reference to a fixed ATS route network including in high and very high complexity cross-border environments.
	Change IV Description: Air Traffic Control in En-Route airspace will be performed using ATC sector support tools (Conflict Detection Tools, Monitoring Aids, Inter-sector coordination support tool) adapted to Free Routing cross-border operations.
(I)	**To accommodate the geographical and temporal variability of the traffic demand, more or less structurally limited FRA will be defined to allow Free Routing including in high and very high complexity cross-border environments, while maintaining safety and capacity of the airspace.**
(1a)	This will also contribute to decrease the number of flights and conflicts at sector / ACC boundaries as the structurally limited FRA limits will aim at organising traffic flows taking into account airspace design at sector / ATSU level, partly counterbalancing the negative effect of user-defined routes which are independent from sector / ATSU limits (see 4a).

(2a)	This will also contribute to limit the impact on the number of inter-sector coordinations, which is yet expected to increase as the user-defined routes are independent from sector / ATSU limits (see 5a).
(3a)	This will also contribute to not increase the number of conflicts at sector level (on average).
(II)	**Free Routing will allow AUs to fly user-preferred trajectories without reference to a fixed ATS route network or published directs in FRA including in high and very high complexity cross-border environments.**
(4a)	The ability for AUs to flight without being constrained by a fixed ATS route network will potentially increase the number of flights and conflicts at sector / ACC boundaries as the user-defined routes are independent from sector / ATSU limits.
(1b, 4b)	The number of flights and conflicts close to boundaries will increase the ATCO workload, which negative impact is expected to be in part by the positive effects of change II (see7b and 8b) and on the other part by change III (see 9b and 10b).
	This links to both Human Performance (KPI HP2 Suitability of technical system in supporting the tasks of human actors) and Safety (PI SAF1.5 Planned conflicts, SAF1.6 ATC Induced Tactical conflicts). This also links to Capacity (KPI CAP2 - ER Capacity), which is expected to be maintained.
	This will potentially reduce the local capacity thresholds declared in the airspace, which negative impact is expected to be counterbalanced by the positive effects of change I (see 3b) and change II (see 6b and 7b). This links to Capacity (KPI CAP2 - ER Capacity), which is expected to be maintained.
(5a)	The ability for AUs to fly without being constrained by a fixed ATS route network in FRA will increase the number of inter-sector co-ordinations as the user-defined routes being independent from sector / ATSU limits, flight could fly close to sector/ACC boundaries.
(2b, 5b)	This increased need for inter-sector co-ordinations will increase the ATCO workload, which negative impact is expected to be counterbalanced in part by the positive effects of change I (see 1b) and on the other part by change II (see7b and 8b).
	This links to Human Performance (KPI HP2 Suitability of technical system in supporting the tasks of human actors) and Safety (PI SAF1.5 Planned conflicts, SAF1.6 ATC Induced Tactical conflicts). This also links to Capacity (KPI CAP2 - ER Capacity), which is expected to be maintained.
	This will potentially reduce the local capacity thresholds declared in the airspace, which negative impact is expected to be counterbalanced by the positive effects of change I (see 1b) and change II (see 7b and 8b). This links to Capacity (KPI CAP2 - ER Capacity), which is expected to be maintained.
(6a)	The ability for AUs to fly without reference to a fixed ATS route network in FRA will not significantly decrease the number of conflicts at sector level which is expected to be maintained, as flights are expected to be more widely spread among the airspace yet with some possible convergence phenomenon of traffic flows leading to a number of interactions, hotspots and conflicts at sector/ACC levels.
(3b, 6b)	The resulting number of conflicts at sector level will not increase the ATCO workload, which links to both Human Performance (PI HP1.2 Adequacy of operating methods (procedures) in

	supporting human performance) and Safety (PI SAF1.5 Planned conflicts). This also links to Capacity (KPI CAP2 - ER Capacity), which is expected to be maintained. This will also contribute to not reduce the local capacity thresholds declared in the airspace. This links to Capacity (KPI CAP2 - ER Capacity), which is expected to be maintained.
(7a)	The ability for AUs to fly without reference to a fixed ATS route network in FRA will decrease the number of ATC clearances for route modification (requested by pilots or given by ATCO to expedite the traffic) as flown trajectories are closer to user-preferred and optimised trajectories.
(8a)	The ability for AUs to fly without reference to a fixed ATS route network in FRA will decrease the average duration of radio communications per flight as the need for trajectory revisions will be reduced.
(7b) (8b)	The decrease need for trajectory revision, and consequently ATC clearances for route modification and average duration of air-ground communications, will improve: • ATCO situational awareness, counterbalancing partly the effect induced by change II (see 4b and 5b). This links to both Human Performance (PI HP1.2 Adequacy of operating methods (procedures) in supporting human performance) and Safety (SAF1.6 ATC Induced Tactical conflicts). • ATCO workload expected to be reduced, counterbalancing partly the negative impact of change II (see 4b and 5b), which links to Human Performance (PI HP1.2 Adequacy of operating methods (procedures) in supporting human performance) and Safety (SAF1.6 ATC Induced Tactical conflicts). This also links to Capacity (KPI CAP2 - ER Capacity), which is expected to be maintained. This will also contribute to not reduce the local capacity thresholds declared in the airspace. This links to Capacity (KPI CAP2 - ER Capacity), which is expected to be maintained.
(III)	**Air Traffic Control in En-Route airspace will be performed using ATC sector support tools (Conflict Detection & Resolution Tools, Monitoring Aids, Inter-sector coordination support tool) adapted to Free Routing cross-border operations.**
(9a)	Appropriate ATC support tools (e.g. Trajectory display - flight leg, CDT for planning / tactical control, what-if and/or what-else, monitoring aids, electronic coordination) and Flight Data Processing adapted to Free Routing and cross-border operations will support efficient ATCO intra-team and inter-team communications, which might otherwise be impacted due to the increased need for inter-sector co-ordinations induced by change II (see 5a) and the decrease of ATCO situational awareness induced by change II (see 6a)
(9b)	These efficient ATC team communications will contribute to not increase the ATCO workload and contribute to partly counterbalance the negative impact of change II (see 5b). This links to Human Performance (KPI HP2 Suitability of technical system in supporting the tasks of human actors) and Safety (PI SAF1.4 Crew/Aircraft Induced conflicts).
(10a)	Appropriate ATC support tools, combined with the positive effect of change I (see 3a) and change II (see 6a) on the number of conflicts at sector level, will not significantly increase the ratio of CDT alerts per flight which is expected to be maintained.
(10b)	This will contribute to counterbalance the negative impact of change II on ATCO performance and improve:

	• ATCO situational awareness, which links to <u>Human Performance</u> (KPI HP2 Suitability of technical system in supporting the tasks of human actors) and <u>Safety</u> (PI SAF1.4 Crew/Aircraft Induced conflicts). • ATCO workload expected to be reduced, counterbalancing partly the negative impact of change II (see 4b and 5b). This links to both <u>Human Performance</u> ((KPI HP2 Suitability of technical system in supporting the tasks of human actors) and <u>Safety</u> (PI SAF1.2 Imminent Collisions). This also links to <u>Capacity</u> (KPI CAP2 - ER Capacity), which is expected to be maintained.
(11a)	Appropriate ATC support tools, combined with the positive effect of change I (see 3a) and change II (see 6a) on the number of conflicts at sector level, will also not significantly increase the number of separation minima infringements, which is expected to be maintained.
(11b)	This will contribute to not increase the number of mid-air collisions in En-Route, which links to <u>Safety</u> (PI SAF1.1 Mid-Air Collisions, SAF1.2 Imminent Collisions).

Table 32: ANSP benefits mechanism – focus on ATC

A.3 Costs mechanisms

The current section describes how the cost assessment is conducted and how the input costs for the CBA are assembled.

PJ06.01 aims to do a specific free routing cost estimation according to the scope of the project, and that will differ from free routing considered under the PCP CBA which made a top-down cost estimation for the ACCs which could have deployed Free Route[25] and Advanced FUA (A-FUA). The PCP CBA concluded that the cost to deploy FRA and A-FUA in a very-high or high capacity ACC is 15.37 millions €, while the cost for deploying in a Medium or Low complex ACC is some 4 millions €. These values were estimated in spring 2013 when no FRA / A-FUA products were yet available in the market and it was assumed that all enablers which are pre-requisite for PCP deployment were already deployed in a given ACC system to be upgraded or replaced.

Given the inherent limitations of the PCP CBA cost estimation exercise, the objective of PJ06.01 CBA is to capture more specific new and refined cost estimations. For this purpose, a combination of a bottom-up approach together with a top-down is proposed where the cost estimation analysis starts from the enablers and then is consolidated at CBA scenario level using extrapolation techniques.

TOTAL COSTS (at ANSP level) = SYSTEM COSTS (Basic + Advanced) + ATCO TRAINING COSTS

The steps to undertake the PJ.06-01 cost estimation are listed below and the high level methodology is summarized in Figure 9:

1. Get the list of new or revised enablers elaborated by PJ06.01 (input from OSED).
2. Define the CBA scenarios based on technical scenarios for which the cost-estimation will be performed. Aligned with PJ20 and PJ19.4 indications and common assumptions 2019.
3. Formulate the cost estimation using a bottom-up exercise.The cost is estimated making an assessment of costs for each enabler contained in the PJ.06-01 list (bottom-up exercise). ENAV, Skyguide and DSNA were the ANSPs involved in the partner consultation exercise.
4. Establish which ACCs are candidates for PJ.06-01 enablers' deployment, using a forecast of complexity metrics for 2025 developed and consolidated by PJ20 and PJ19.4. The applicability area includes Upper airspace Very High Complexity and High Complexity ACCs and some targeted medium complex ACCs that are close to High Complexity or that often suffer peaks of traffic at certain moments of the day.
5. Add ATCO training costs corresponding to 4 days of training and ATCO salaries at each ANSP.

The ANSPs cost model is a 'middle-out' approach derived from a bottom-up and top-down approaches. The first one is intended to obtain figures down to the lowest granularity (i.e. each cost category) whereas the top-down is used to extrapolate the results obtained for each partner ANSP to the rest of the ANSPs in the geographical scope.

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[25] The PCP states that "Free Route may be deployed both through the use of Direct Routing Airspace and through FRA". The respective deployment target dates for the two concept options are follows: DCT as from 1st January 2018 — FRA as from 1st January 2022

A bottom-up approach was used to estimate the ANSPs pre-implementation, implementation and operating costs. The scope of each enabler was analysed, discussed, reviewed and challenged within the CBA team as well as with other operational and technical experts in the PJ.06 ToBeFree project. With the support of the partners it was possible to associate a cost to each enabler. Inputs for enabler costs were then aggregated at each basic or advanced solution level.
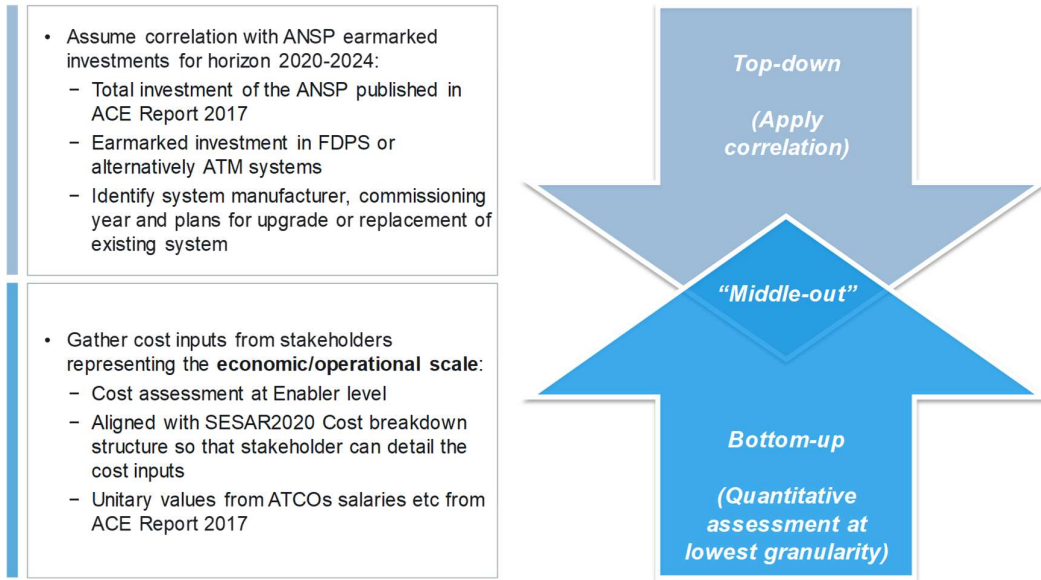

Figure 9: "Middle-out" methodology for PJ.06-01 cost estimation developed by ALG

The cost items estimated in PJ.06-01 are in the following table. Costs have been assessed by the PJ.06-01 partners affected by the cost items, basically ANSPs.

Cost Item	Cost type	Cost assessors
Initial Training	One-off	ANSPs
Project Management	One-off	ANSPs
Administrative costs	One-off	ANSPs
Certification	One-off	ANSPs
Installation/Commissioning	One-off	ANSPs
Purchase of equipment and construction costs	Capital implementation cost	ANSPs and Manufacturers
Operational and technical trials for entry into operation: - Project management during trials - Human and material resources	Transition implementation cost	ANSPs and Manufacturers
Yearly Equipment maintenance and training	Maintenance	ANSPs and Manufacturers
Communication costs Energy, Supplies, Utilities, Property Taxes Rent & Lease Furniture & equipment	Administration	ANSPs

Table 33: Cost items estimated for PJ.06-01 Solution

1   Example of the template provided to partner ANSPs to gather their cost inputs that were discussed with ATM and FDPS systems experts.

2   Basic Solution:

EN	Description	ACC Unit cost (€)							Overall Unit cost (€)			Assumptions
		One-off implementation cost (€/unit)	Capital implementation cost (€/unit)	Transition implementation cost (€/unit)	Maintenance cost (€ - yearly)	Administration cost (€ - yearly)	Number of ACC Units of ANSP	Number of ACC Units	Total implementation cost (C+D+E)	Total Operating cost (F+G)	Total cost (V+W)	
ER APP ATC 78	Enhance FDP to use 4D trajectories to support extended direct routing beyond local AoR	*Please fill in*	*Please fill in*	*Please fill in*	*Please fill in*	*Please fill in*						
TOTAL	Overall cost value for PJ06 Basic Solution						*Please fill in*	*Please fill in*				*Please fill in*

3

4   The same table was provided for the Enablers related to Advanced Solution. Cost inputs are not shown for confidentiality reasons and are kept
5   internal within the CBA task.

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The cost model keeps track of all the costs associated with implementing a project from an ANSP perspective. Pre-implementation costs are incurred prior to the implementation year. Implementation costs are incurred during the implementation period. They include one-time implementation costs, one-off implementation costs and ground/space costs that require capital replacement over time. Operating costs are also included in this model, computed as a percentage of capital expenditure costs based on the three cost inputs gathered from partner ANSPs.

In order to crosscheck the reliability of the information provided, the inputs of the cost assessment were compared to an analysis performed with data coming from ACE Report and LSSIP report per each country in order to see if the figures could correlate with the ATM investment of each particular ANSP and the plans for the FDPS system. Figure 10 depicts the general methodology of the cost model developed in the PJ.06-01 CBA V3.
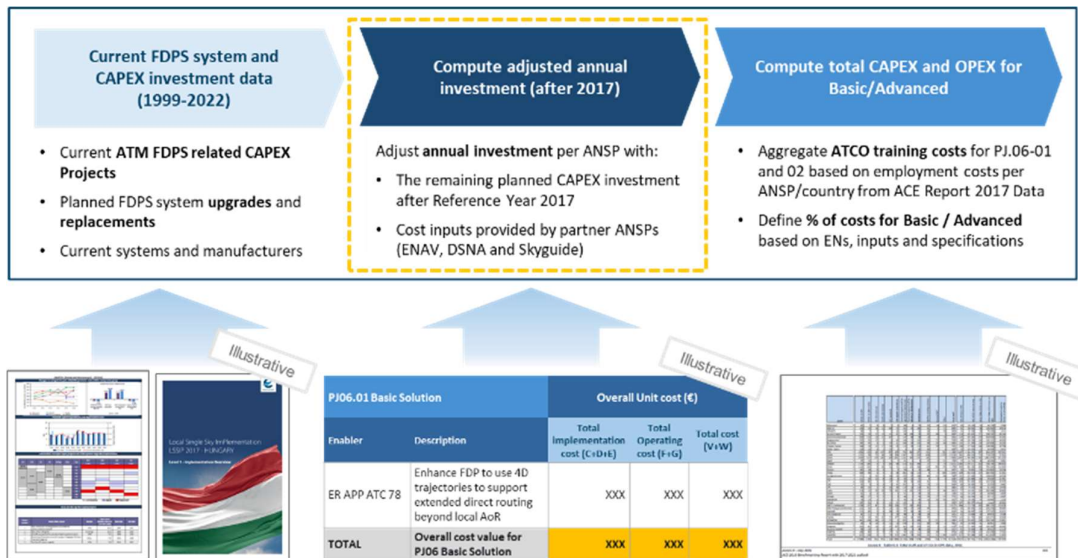
Figure 10 PJ.06-01 Cost Model general methodology and sources used (extracted from V3 CBA)

The level of granularity for the costs is the ANSPs, for which available information about the current FDPS systems are available, mainly including commissioning year of the current system, manufacturer, and plans for future upgrades/replacements. That information is published in the LSSIP Reports, the most updated ones are from 2017. On the other hand, the earmarked ATM investments that could be directly related to FDP systems can be obtained from the ACE Report. The last version of the document also dates from 2017.

More details on the cost assessment calculations can be found in the PJ.06-01 V3 CBA [68].

Appendix B   Dynamic Demand and Capacity Balancing by INAP

B.1 Introduction

Although out of scope of the PJ06-01 Solution at the end of V3, the improvement of Air Traffic Management / Complexity Management in the frame of INAP have been addressed in an intermediate version of this SPR-INTEROP/OSED document.

To pave the way to further research and development work on DCB aspects at local level (through the INAP function), this appendix describes: a) the possible evolution of the local dDCB operating method in Free Routing environment of high and very high complexity, and b) the possible benefits at ANSP level to maintain traffic complexity at an acceptable level for ATCOs (as an option to less structurally limited Free Routing Airspace).

B.2 Previous Operating Method

B.2.1 Local dDCB Operating Method

Below is an overview of the previous Local ATFCM Activities in their context (as described in the applicable version of EATMA).

Cf. "Dynamically balance network capacity with demand" Activity View in the applicable version of EATMA

Operating Method Item	Dynamically balance network capacity with demand (at local level)
Operator	Node : Sub-regional/Local ATFCM Performed by Actor/Role : Local Traffic Manager
Automatic actions	Entry/occupancy counts display Hotspot distribution
Procedures	Leading role in the DCB/dDCB processes in execution phase : • Monitors the situation at local level • Detects demands and capacity imbalances • Analyses imbalance and/or complexity issues • Declares hotspots • Develops dDCB measures to solve hotspots at local/FAB level • Coordinates locally and adequately within the FAB area and appropriate partners (other Local Traffic Managers, AUs, Airports, Flow Manager, Network Manager, ATC actors,...).

Operating Method Item	Dynamically balance network capacity with demand (at local level)
	• Implements dDCB measures or delegates the implementation to the adequate actor. • Assesses the impact of dDCB measures • Monitors the application of dDCB measures
Triggering events	Entry/occupancy rises above a defined capacity threshold.
Inputs	• Entry/occupancy counts • Capacities per sector
Outputs	• Airspace Configuration • Flow / trajectory management measures • Declared hotspot(s) • Other dDCB measures?

B.3 New SESAR Operating Method

B.3.1 New local dDCB Operating Method within INAP

Previous exercises assessing FRA environment reached the conclusion that complexity is an issue in FRA. Indeed, Validation Report EXE-04.03-VP-797 states that "*VP-797 exercise has clearly demonstrated the importance of organising traffic flows at regional and local levels. A better traffic structure will contribute to optimize airspace capacity use, reduce ATCOs workload per flight, and maintain safety level while improving traffic predictability and benefits for all air and ground actors.*"

Furthermore, the following conclusions were drawn in Validation Report EXE-04.03-VP-798:

VP-798-DSNA-Conclusion-08	**Traffic Regulation**	According to VP-798 DSNA leg, new flow segregation methods need to be implemented to compensate for the lack of strategic separation, which is used to reduce traffic complexity in an ARN. Indeed, the classic NM regulation methods may not be sufficient to reduce complexity to an acceptable level in FRA.
VP-798-DSNA-Conclusion-56	**Workload in FRA**	According to VP-798 DSNA leg, FRA in Low to Medium complexity (without E sector) increases the PC's workload, which nevertheless remains acceptable. Nevertheless, if high peaks of traffic load and/or complexity would happen, the workload could be unmanageable. Workload management and anticipation of complexity variation will be key matter to monitor and manage in FRA environment.

Therefore, new methods of de-complexing the traffic might have to be implemented in FRA, which is the purpose of INAP about 'standard' DCB (at local level) and EAP (Extended ATC Planning).

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Below is an overview of the new dDCB and EAP Activities in their context (as described in the applicable version of EATMA).

Cf. "Dynamically balance network capacity with demand with STAM" Activity View in the applicable version of EATMA
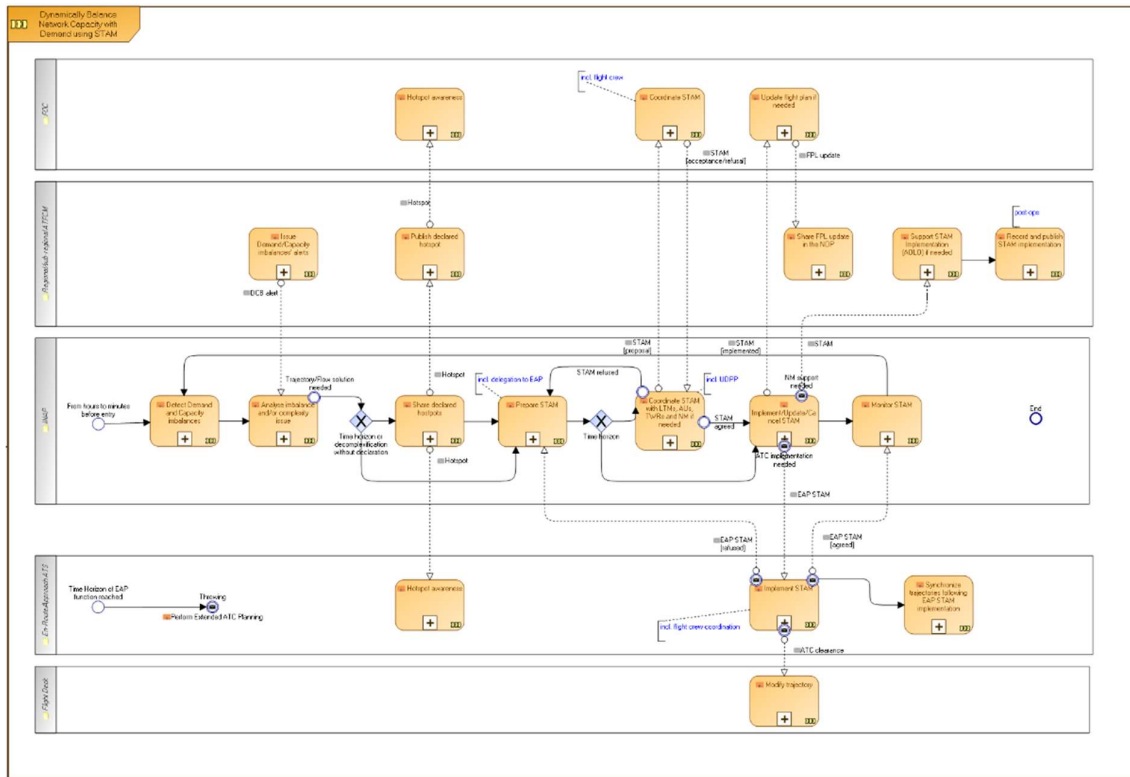
Cf. "Perform Extended ATC Planning" Activity View in the applicable version of EATMA

"This process describes the main activities related to the management of the traffic complexity in en-route ACCs: complexity assessment, determination of de-complexing measures and their application

and monitoring. The applied measures can consist on the deployment of pre-determined ATC Sector Configurations and the modification of individual trajectories or traffic flows".
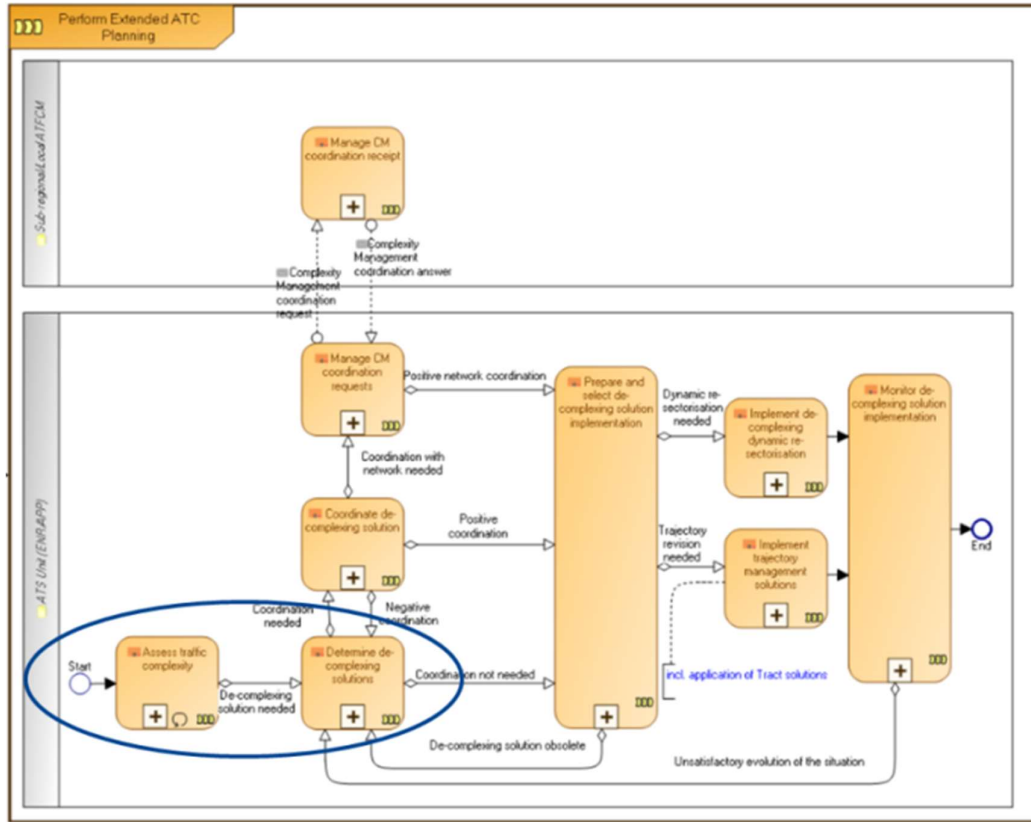
Note: This EAP model might be changed in future version of EATMA to reflect the work progress done by PJ07-08-09 PCIT on Use Cases transversal topics (including those possibly impacted by the Free Routing concept).

The new operating method for INAP actor(s) in Free Routing high complexity environment is summarised in the table below (with main features expected to support Free Routing operations in high complexity cross-border environment highlighted in bold).

Operating Method Item	Dynamically balance network capacity with demand (at INAP level)
Operator	Node : INAP
	Performed by Actor/Role : Local Traffic Manager and/or EAP and/or MSP

Operating Method Item	Dynamically balance network capacity with demand (at INAP level)
Automatic actions	Entry/occupancy counts display **Traffic complexity display** Hotspot distribution to relevant actors
Procedures	• Detects demands and capacity imbalances • **Assesses traffic complexity** • Analyses imbalance and/or complexity issues • Develops dDCB measures to solve hotspots at local/FAB level • **Determines de-complexing solutions** • Coordinates locally and adequately within the FAB area and appropriate partners (other Local Traffic Managers, AUs, Airports, Flow Manager, Network Manager, ATC actors,...). • Implements dDCB/**de-complexing** measures or delegates the implementation to the adequate actor. • Assesses the impact of dDCB/**de-complexing** measures • Monitors the application of dDCB/**de-complexing** measures
Triggering events	Entry/occupancy/**complexity** rises above a defined capacity threshold. A hotspot is created.
Inputs	• Entry/occupancy counts • Capacities per sector **in FRA.** • **Traffic complexity assessment per sector in FRA**
Outputs	• Airspace Configuration • Flow / trajectory management measures • Other dDCB measures? • **De-complexing solutions (e.g. STAMs for de-complexification, organizing traffic at COPs, attributing Target Times)**

Operating Method Item	Dynamically balance network capacity with demand (at INAP level)
Additional feature	**FRA environment specific features**: capacities are defined for sectors with a conventional ATS network. New capacities have to be defined to take into account the impact of FRA on the workload. Moreover complexity metrics independent from the route network (or lack of) will have to complement entry and occupancy counts.

Disclaimer: It should be noted that other local specific dDCB operating methods may exist in Free Routing environment and that INAP traffic complexity management is an optional feature of the Operational Improvement step AOM-0505.

B.3.2 Use Cases

Use Case #1.1: "Apply a Dynamic ATFCM (STAM) Constraint to a Flight to solve a complexity hotspot"

Use Case Item	Apply a Dynamic ATFCM (STAM) Constraint to a Flight to solve a complexity hotspot
Scope	System, black-box. System means a Network Management compliant system
Level	User goal
Summary	The use case describes the process of applying a STAM measure to a flight in FRA environment involved in a complexity hotspot, for the purpose of resolving the hotspot ensuring Sector complexity remains at an acceptable level for ATC.
Actors	**Responsible Local Traffic Manager (LTM)** (Primary) – identifies a complexity peak (Hotspot) and selects STAM measure(s) to be applied.
	Adjacent LTM (Support) – coordinates selected STAM measure(s) where required.
	Implementing ATSU (Support) – comprises the ATC sector responsible for implementing the STAM measure, where required.
	Network Manager (Support) – provides ETFMS data and receives and distributes revised profiles, where required.
Pre-conditions	Tactical flow and trajectory data (based on ETMFS data enriched with local FDPS data) are available with sufficient confidence for a complexity peak to be identified.

Use Case Item	Apply a Dynamic ATFCM (STAM) Constraint to a Flight to solve a complexity hotspot
Post-conditions	**Success end-state** – STAM measure implemented successfully and the trajectory/ies is/are removed from the Hotspot. **Failed end state** – STAM measure is not applied.
Notes	Coordination between different LTMs is only required if the selected STAM measure is expected to be implemented by an ATSU outside the AoR of the primary LTM.
Trigger	The use case starts when a LTM identifies a complexity peak in one of its Sectors.
Main flow	1. The LTM identifies a complexity peak in their airspace. 2. The LTM selects the flight(s) and the associated STAM measure(s), thereby intending to lower complexity. 3. The STAM measures concern flight(s) which are airborne. The LTM asks the ATCOs on the implementing sector to alter the 4D trajectory of the flight. 4. The ATCOs on the implementing sector agree to the request. 5. The STAM measure is implemented by the implementing sector, and the trajectory is updated in the complexity assessment tool. 6. The use case ends when the trajectory is removed from the complexity Hotspot.
Alternative flows	3. The STAM measures concern flight(s) which are outside the LTM AoR. The LTM asks the adjacent LTM to forward the request to the applicable sector. 4. The adjacent LTM asks the implementing sector to alter the 4D trajectory of the flight. 5. The flow continues at step 4.

Use Case Item	Apply a Dynamic ATFCM (STAM) Constraint to a Flight to solve a complexity hotspot
Failure flows	[4.] Implementing sector does not agree to the proposed STAM measures • At step 4 the negotiation between the responsible LTM and the ATCOs is unsuccessful. • The STAM measure is not applied and the responsible LTM will initiate an alternative measure. • The use case ends with either an alternative complexity reduction measure implemented, or the ATCOs handling the complexity peak. [5.] Implementing ATSU does not comply with proposed STAM measure • Due to traffic Situation the Implementing ATSU is not able to implement the previously agreed STAM measure on the flight. • The use case ends when the flight selected for the STAM measure enters the hotspot it was supposed to avoid.

B.4 Differences between new and previous Operating Methods

To enable safe and efficient Free Routing operations in En-route airspace of high complexity, the Solution PJ.06-01 could be completed by other changes at local ATM level:

• Integrated Network and Extended ATC Planning, which could be applied (as an option for less structurally limited FRA) to maintain the airspace complexity to an acceptable level for ATCOs;

Considering the nature of the change brought by the Free Routing operations, which impacts the activities of the local ATM actors in a new operating environment, additional R&D activities are required (beyond the ones already conducted in SESAR 1) to demonstrate the V3 maturity of the INAP Solution and its added value in support to the implementation of FRA in high and very high complexity environments.

The table below explains, succinctly, the main differences between the new and the previous INAP operating methods highlighting what are the key aspects that will change in relation with the Traffic Complexity Management Capability.

ATM Capabilities (in EATMA)	Current Operating Method	New Operating Method
Traffic Complexity	Traffic Complexity Management by Local Traffic Manager (in coordination	and

ATM Capabilities (in EATMA)	Current Operating Method	New Operating Method
Management (at local level)	with NM) using baseline dDCB tools	Traffic Complexity Management (during short-term / execution phase of flight) by Local Traffic Manager (in coordination with NM), and possibly Extended ATC Planner (in relation with ATCOs), in Free Routing high complexity cross-border environment: • Traffic complexity metrics using more accurate trajectory data (from ETFMS and local FDPS) • De-complexification measures at local level (e.g. new sector configuration, STAM on traffic/flow, etc.).

B.5 Benefit mechanism

Where considered relevant to be implemented by local ANSPs, the INAP function may be an option for less structurally limited Free Routing Airspace where considered relevant to be implemented by local ANSPs.

The table below describes from the ANSP Stakeholder perspective how the INAP actor(s) are concerned by Free Routing operations.

Stakeholder	Involvement	Why it matters to stakeholder
ANSPs (Civil and Military ANSPs, En-route ACCs, local dDCB actors (LTM/EAP/MSP))	ANSPs will offer more flight planning options to AUs in FRA including in high complexity cross-border environments Local dCDB actors will manage local traffic complexity and perform extended ATC planning (optional)	ANSPs expect to maintain **Safety** and airspace **Capacity** in FRA of high complexity Local dCDB actors expect to maintain traffic complexity in FRA to an acceptable level for ATCOs, and thus help to maintain to **Capacity**

The BIM presented hereafter is focused on the benefits expected from the INAP function in Free Routing environment.

Stakeholder:		ANSP		Production Date: November/2017		(2/3)
OI Step(s)		Changes	Performance Indicators / Metrics (*)	Impacts (Positive or negative)	KPA (Focus Area) impacted	

(*) The indicators are the metrics that will be measured in the validation exercises (validation indicators / validation metrics), where relevant these should match the Key Performance Indicators of the SESAR 2020 performance Framework.

	Change I Description: Structurally limited FRA will be defined to allow AUs to plan flight without reference to a fixed ATS route network in high complexity cross-border environments.
	Change II Description: Integrated Network and Extended ATC Planning will be applied (as an option for less structurally limited FRA) to maintain the airspace complexity to an acceptable level for ATCOs.
	Change III Description: Free Routing in En-Route airspace will allow AUs to fly user-preferred trajectories without reference to a fixed ATS route network including in high complexity cross-border environments.
(I)	**To accommodate the geographical and temporal variability of the traffic demand, more or less structurally limited FRA will be defined to allow Free Routing including in high complexity cross-border environments, while maintaining safety and capacity of the airspace.**
(1a)	This will allow to not increase the number of ATFCM measures required to solve demand and capacity imbalances in FRA during the medium-term flight planning phase (while ensuring a level of airspace complexity manageable during short-term flight planning to execution phase). *Please note that it might be possible to only partially assess this indicator (e.g. ATFCM delays) during the preparation phase of the Solution 1 RTS.*
(1b)	The reduced need for ATFCM measures at Network level during flight planning phase in FRA with structural limits will improve:

	• local capacities and TV monitoring values declared in the airspace (compared to unstructured FRA). This links to Capacity (KPI CAP2 - ER Capacity), which is expected to be maintained (compared to non-FRA). • local DCB actors workload, which links to both Human Performance (PI HP1.3 Capability of human actors to achieve their tasks in a timely manner, with limited error rate and acceptable workload level), and Safety (PI SAF1.7 Pre-Tactical conflicts, SAF1.8 Induced pre-tactical conflicts). This also links to Capacity (KPI CAP2 - ER Capacity), which is expected to be maintained.
(2a)	This will also decrease the number of flights and conflicts at sector / ACC boundaries as the structurally limited FRA limits will aim at organising traffic flows taking into account airspace design at sector / ATSU level, partly counterbalancing the effect of user-defined routes independent from sector / ATSU limits (see 5a). This will also contribute to decrease the number of conflicts at sector level (on average).
(II)	**As an option for less structurally limited FRA, Integrated Network and Extended ATC Planning will be applied in some environments to maintain the airspace complexity to an acceptable level for ATCOs.**
(3a)	This will bring more need for traffic complexity management (at INAP level) with an increase need of local dDCB actions during short-term flight planning to execution phase.
(3b)	The increased number local dDCB actions (STAMs, de-complexification measures, etc.) will have an impact on: • local capacities and TV monitoring values declared in the airspace. This links to Capacity (KPI CAP2 - ER Capacity), which is expected to be maintained (compared to non-FRA). • traffic complexity, which will be maintained to an acceptable level by reducing the number of flights in conflicts in a TV through STAMs, by applying de-complexification measures by cherry picking on flights inducing complexity in a TV, or by more easily managing unforeseen hotspots due to Intruder flights. This links to Human Performance (PI HP1.2 Adequacy of operating methods (procedures) in supporting human performance) at INAP level. This also links to Safety (PI SAF1.7 Pre-Tactical conflicts) and indirectly to Capacity (KPI CAP2 - ER Capacity), which is expected to be maintained. • local DCB actors workload, which will be increased. This is expected to be counterbalanced by dedicated tools, which links to Human Performance (PI HP1.3 Capability of human actors to achieve their tasks in a timely manner, with limited error rate and acceptable workload level and KPI HP2 Suitability of technical system in supporting the tasks of human actors). This also links to Safety (PI SAF1.7 Pre-Tactical conflicts, SAF1.8 Induced pre-tactical conflicts) and Capacity (KPI CAP2 - ER Capacity), which is expected to be maintained. • ATCO workload expected to be reduced by local dDCB actions, which links to both Human Performance (PI HP1.3 Capability of human actors to achieve their tasks in a timely manner, with limited error rate and acceptable workload level) and Safety (PI SAF1.5 Planned conflicts). This also links to Capacity (KPI CAP2 - ER Capacity), which is expected to be maintained.

(4a)	This will contribute to decrease the number conflicts at sector level (on average), as the INAP function will manage local hotspots using STAM or de-complexication measures, partly counterbalancing the possible negative effect of user-defined routes independent from sector / ATSU limits (see 7a).
(III)	**Free Routing will allow AUs to plan for user-preferred trajectories without reference to a fixed ATS route network in FRA including in high complexity cross-border environments.**
(5a)	The ability for AUs to plan user-preferred routes in FRA without being constrained by a fixed ATS route network will increase the number of flights and conflicts at sector / ACC boundaries as the user-defined routes are independent from sector / ATSU limits.
(5b)	The flights and conflicts close to sector / ACC boundaries will increase the traffic complexity and the ATCO workload, and potentially affect the local capacities and TV monitoring values, but this negative impact is expected to be counterbalanced partly by the local dDCB actions (see 3b).
	This links to both Human Performance (PI HP1.2 Adequacy of operating methods (procedures) in supporting human performance) and Safety (PI SAF1.5 Planned conflicts, SAF1.6 ATC Induced Tactical conflicts). This also links to Capacity (KPI CAP2 - ER Capacity), which is expected to be maintained.
(7a)	The ability for AUs to plan flight without reference to a fixed ATS route network in FRA will not significantly decrease the number of conflicts at sector level, as flights are expected to be more widely spread among the airspace yet with some possible convergence phenomenon of traffic flows leading to a number of interactions, hotspots and conflicts at sector/ACC levels.
(7b)	The resulting number of conflicts at sector level will not increase the ATCO workload, which links to both Human Performance (PI HP1.2 Adequacy of operating methods (procedures) in supporting human performance) and Safety (PI SAF1.5 Planned conflicts). This also links to Capacity (KPI CAP2 - ER Capacity), which is expected to be maintained.
	This will also contribute to not reduce the local capacities and TV monitoring values declared in the airspace. This links to Capacity (KPI CAP2 - ER Capacity), which is expected to be maintained.

Table 34: ANSP benefits mechanism – focus on INAP