SESAR Solution PJ09-W2-44 SPR-INTEROP/OSED for V3 - Part I

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DNMS

DNMS - AIRSPACE CAPACITY MANAGEMENT

This OSED is part of a project that has received funding from the SESAR Joint Undertaking under grant agreement No 874463 under European Union's Horizon 2020 research and innovation programme.

Abstract

The current document is the final version of the OSED. It complements the intermediate issue with:

- Matured concept definition and Complete list of requirements
- In addition this issue clarifies further more the concept, using work performed in VALP and TS.

The OSED aims at defining operational services and environments within the scope of PJ.09-W2-44. The SESAR W2 Solution 44, "Dynamic Airspace Configuration (DAC)" is built upon wave 1 results of solutions PJ08-01 and PJ09-02.

The core focus of the solution is the integration of DAC and Integrated Network Management ATC Planning (INAP) concepts, especially on the INAP timeframe where the two overlap, in a seamless way thanks to:

- Further development of the DAC concept, notably optimised configurations and seamless integration of DAC at pre-tactical and tactical phases,
- Adequate automatic support for spots detection, traffic analysis and measures monitoring,
- Development of new features to support analysis and resolution, namely what-if and what-else,

- Development of new indicators to fine-tune analysis and ease monitoring, namely the complexity and the uncertainty,
- Alignment of processes, roles and measures, based on the above mentioned features, ensuring the right level of coordination and shared situation awareness at local, sub-regional and regional network levels.

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1 Executive Summary

This document aims at defining operational services and environments within the scope of PJ.09-W2-44. The SESAR W2 Solution 44, "Dynamic Airspace Configuration (DAC)" is built upon wave 1 results of solutions PJ08-01 and PJ09-02.

The current maturity of the solution is V2 and is expected to reach V3 by the end of Wave 2 (end of 2022). To achieve this, a thread of 7 exercises is planned from Q4 2021 to Q4 2022.

The core focus of the solution is the integration of DAC and Integrated Network Management ATC Planning (INAP) concepts, especially on the INAP timeframe where the two overlap, in a seamless way, thanks to:

- Further development of the DAC concept (see detail below), notably optimised configurations and seamless integration of DAC at pre-tactical and tactical phases,
- Adequate automatic support for spots detection, traffic analysis and measures monitoring,
- Development of new features to support analysis and resolution, namely what-if and what-else,
- Development of new indicators to fine-tune analysis and ease monitoring, namely the complexity and the uncertainty,
- Alignment of processes, roles and measures, based on the above-mentioned features, ensuring the right level of coordination and shared situation awareness at local, sub-regional and regional network levels.

2 Introduction

2.1 Purpose of the document

This document provides the requirements specification, covering functional, non-functional and interface aspects related to SESAR Solution PJ.09-W2-44, V3 phase. It is part of the SESAR Solution Datapack for V3 maturity.

It is composed of several parts:

- PART I provides the Safety and Performance Requirements (SPR) and Interoperability Requirements (INTEROP), related to a SESAR Solution, that will be defined prior validation activities at V3 Level and validated after the validation activities. This part is considered as the core document,
- PART II to IV relates to assessment reports on Safety, Environment, Performance and Human Performance.

It is to be noted that the Security Assessment report is a non-disclosable document and is therefore not included in the OSED hand-over.

This document is completed by various appendix, the Benefit Mechanism, showing how the SESAR solution elements contribute (positively or negatively) to the delivery of performance benefits, the Storyboard and the MEGA Models.

The present issue is the final draft composed of PART I, from chapters 1 to 5, and the Appendix A Benefit Mechanism, B Storyboards and C the MEGA Models.

2.2 Scope

This document describes the concepts which will be addressed at V3 level by the eight exercises scheduled from Q4 2021 to Q4 2022 to validate the OIs under the scope of this solution (refer to §3.1).

This final version of the OSED is enriched with comments and work from Human Performance, Safety and Security Reports workshops.

The final OSED will be handed over with the assessment reports (with the exception of the security assessment due to its non-disclosable status): Parts II to V.

In order to ease readability and make the most of the present document, the authors strongly suggest readers to get familiar with W1 concepts described in the W1-PJ08 and W1–PJ09 OSEDs [38] & [39], as the new methods described in this document are built on these concepts, integrating them together and bringing them a step further for the benefit of the operational actors and stakeholders.

This concerns in particular the following concepts:

- DAC (refer to [39], especially §3.1),
- DCB (refer to [39] §3.2.1.2),
- INAP (refer to [38] §3.5.2.5),
- Free Route Operations (refer to[39] - §3.2.1.5).

In addition, as this document is built upon results and activities performed during Wave 1, the authors also suggest readers to take into consideration the final project reports of the solution W1-PJ08 and W1–PJ09 [39] & [38].

2.3 Intended readership

This document is aimed at the following stakeholders:

- PJ.09-W2-44 solution members, which will decline the presented concepts and use cased on their validation exercises and ensure they are align with the solution full spectrum,
- PJ.09-W2-45 and PJ.09-W2-49 solution members, as part of the PJ.09-W2 project for mutual awareness of solutions progress and contents as they are inter-connected (see fig.1 for dependencies),
- SJU Program representatives, as the owner and final approver of the document,
- SESAR Wave 2 Solution 93 and SESAR Wave 3 PJ32, which will be recipient of DAC principles, especially cross border operations.

2.4 Background

The SESAR W2 Solution 44, “Dynamic Airspace Configuration (DAC)” is built upon wave 1 results of PJ08-01 and PJ09-02.

As stated above, the following documents should be taken into consideration:

- OSED PJ08 - [39] to get familiar with DAC related concepts,
- OSED PJ09 - [38] to get familiar with INAP related concepts,
- VALR PJ08 - [42], VALR PJ09 - [40], FPR PJ08 - [43], FPR PJ09 - [41] to get familiar with previous work, results obtained and recommendations for the wave 2.

2.5 Structure of the document

The present document (PART I) is composed of 5 chapters:

- Chapter 1 gives an overview of concepts and elements addressed,
- Chapter 2 provides purpose, scope and background of the present document, as well as a reader guide and a glossary,
- Chapter 3 describes operational aspects of addressed concepts,
- Chapter 4 gathers requirements related to operational, safety, performance and interoperability,
- Chapter 5 provides all applicable and reference documents.

The document also includes three appendices:

- Appendix A, which provides benefit & costs mechanism analysis.
- Appendix B, which provides INAP storyboard to provide an overview of INAP timeframe with activities and actors involved. This storyboard was a work document to prepare Use cases.
- Appendix C, which provides the MEGA models related to the solution.

2.6 Glossary of terms

Term	Definition	Source of the definition
AIR-REPORT	A report from an aircraft in flight prepared in conformity with requirements for position, and operational and/or meteorological reporting.	ICAO Annex
Airspace Block (AB)	A primary volume of airspace which has to be configured to build workable Sectors of Control defined as Configured sectors in this concept (CS).	SESAR W1 PJ08 OSED
Airspace Building Block	Elementary volume of modularised airspace (As defined by the appropriate ANSP) that are too small individually for controlling purposes, but instead form the basic constituent parts of a Controlled Airspace Block as part of an optimising process.	SWP 7.2 DOD
Airspace Configuration	Is a pre-defined and coordinated organisation of routes and their associated airspace structures, temporary airspace reservations and ATC sectorisation.	SWP 7.2 DOD
Airspace Reservation (ARES)	Airspace Reservation is a defined volume of airspace temporarily reserved for exclusive or specific use by categories of users.	European Route Network Improvement Plan (ERNIP), Part

		3 - The ASM Handbook
Airspace Restriction	Airspace Restriction is a defined volume of airspace within which, variously, activities dangerous to the flight of aircraft may be conducted at specified times (a 'danger area'); or such airspace situated above the land areas or territorial waters of a State, within which the flight of aircraft is restricted in accordance with certain specified conditions (a 'restricted area'); or airspace situated above the land areas or territorial waters of a State, within which the flight of aircraft is prohibited (a 'prohibited area').	European Route Network Improvement Plan (ERNIP), Part 3 - The ASM Handbook
Airspace Structure	Airspace Structures are specific portions of airspace designed to accommodate the safe operation of aircraft. In the context of the FUA Concept, "Airspace Structures" include Controlled Airspace, ATS Route, including CDRs, ATC Sectors, Danger Area (D), Restricted Area (R), Prohibited Area (P), Temporary Segregated Area (TSA), Temporary Reserved Area (TRA), Cross-Border Area (CBA).	European Route Network Improvement Plan (ERNIP), Part 3 - The ASM Handbook
Business Trajectory	A 4D trajectory which expresses the business intentions of the user with or without constrains. It includes both ground and airborne segments of the aircraft operation (gate-to-gate) and is built from, and updated with, the most timely and accurate data available.	P11.01.01 Transversal consistency of BT/MT requirements (across WPs) D11.01.01-1 Definition of trajectory requirements for Step 1, including gap analysis, support to standardization report from Airspace Users perspective
Configured Sector	Configured Sector is the Result of the Sector Configuration process. This is the actual airspace a controller will be assigned to provide ATS services	SESAR W1 PJ08 OSED

Computed Take-off Time (CTOT)	An Air Traffic Flow & Capacity Management (ATFCM) departure slot, forming part of an Air Traffic Control (ATC) clearance, which is issued to a flight affected by Network Management regulations. It is defined by a time and tolerance (-5 to +10 minutes) during which period the flight is expected to take-off.	ICAO Doc 7030/4 – EUR D11.01.01-1 Definition of trajectory requirements for Step 1, including gap analysis, support to standardization report from Airspace Users perspective
Controlled Airspace Block	A Controlled Airspace Block (replacing the current predefined elementary sectors) is a section of modularized airspace within which a Tactical Air Traffic Controller performs his controlling functions defined as a result of dynamic airspace configuration process. Controlled Airspace Blocks are created as a result of a dynamic airspace configuration process in which each controlled block is an optimised grouping of Airspace Building Blocks under consideration of the forecast traffic pattern and ATCO availability and Safety/Performance metrics. The Controlled Airspace Block forms the elementary size of a “Hotspot Unit.”	SWP 7.2 DOD
Collaborative Decision Making (CDM)	Collaborative decision-making (CDM) is defined as a process focused on how to decide on a course of action articulated between two or more community members. Through this process, ATM community members share information related to that decision and agree on and apply the decision-making approach and principles. The overall objective of the process is to improve the performance of the ATM system as a whole while balancing the needs of individual ATM community members. From a military perspective CDM is a process from which all participating parties can gain benefits through the negotiation of proposed options. The negotiation stops either at the moment when all participating parties agree with the result or when they reach a limit in their capability to accept further compromise due to defined priorities.	ICAO Doc 9971 + B4.2 (mil aspects) SESAR 2020 Concept Of Operations Edition 2017

DAC role	DAC role refers to composition of responsibilities for of carrying out of main DAC management related tasks and activities associated with DAC management processes at Local or Sub regional levels which include DAC planning, assessment, negotiation, publication and sharing, decision making and implementation.	SESAR W1 PJ08 OSED
Dynamic mobile area (DMA)	Dynamic mobile area (DMA) is an integral part of the MT described by a 4D data set, where the velocity parameter is equal to zero. DMA constitutes a defined volume of airspace that satisfies specific requirements from different Airspace Users. There are two types of DMA that have been identified for Step 2: DMA Type 1 is a volume of airspace of defined dimensions as integral part of MT at flexible geographical locations agreed upon a CDM process, satisfying Airspace Users requirements in terms of a time and/or distance constraint parameters from a reference point as specified by AU (e.g. Aerodrome of Departure). DMA Type 2: is a volume of airspace of defined dimensions described as integral part of MT and agreed upon a CDM process, satisfying the Airspace Users requirements.	SESAR 2020 Concept Of Operations Edition 2017
Elementary Sector (ES)	ATC workable 3D airspace that can be controlled by ATCO for ATS provision and that cannot be split further down into workable/controllable sector(s)	SESAR W1 PJ08 OSED
Flexible boundaries (FB)	Sector boundaries that can be modified or refined to facilitate / optimise FRA trajectories. It is expected that Flexible boundaries can be facilitated through the use of: - Flexible Drawing Tool. SAM (Sharable airspace module) - smallest, non-workable volume of airspace that can be dynamically attached (belong to) to any neighbouring ES or SAB, used to marginally adapt sector boundaries, i.e. +/- 10nm	SESAR W1 PJ08 OSED
Flight Intents/ Flight Intentions	The future aircraft trajectory expressed as a 4-D profile until destination (taking account of aircraft performance, weather, terrain, and ATM service	ICAO Doc 9854

	constraints), calculated and "owned" by the aircraft flight management system, and agreed by the pilot.	
Flight Operation Centre (FOC)	Flight Operation Centre is a part (department, employee) of an Airspace user or a system used by an Airspace user providing FOC services and support like operational control, flight planning, pre-flight briefing, in-flight support and post-flight analyses in accordance to AU's Operational Manual and Standard Operational Procedures.	P11.01.01 Transversal consistency of BT/MT requirements (across WPs) D11.01.01-1 Definition of trajectory requirements for Step 1, including gap analysis, support to standardization report from Airspace Users perspective
Forecast Business Trajectory	4D definition of the trajectory associated with a level of uncertainties which evolved according to the time horizon. The FBT uncertainties are characterised by Time uncertainty, Lateral uncertainty, Vertical uncertainty. The purpose is to elaborate the best predictable 4D Trajectory representation called Forecast Business Trajectory (FBT) using uncertainty modelling and including result on FBT itself. The FBT shall be built from historical data (statistical model) and various database (Airport, AO, …), then the FBT shall be refined all along the timeline based on SBT (2D + schedule or 3D + schedule or 4D profile), and trajectory elements that will be known only at a later stage of the planning process (information on 4D route, Constraints …) FBT will be complemented by prediction algorithms and simulation tools used to anticipate flight intentions which are not yet known at the considered anticipated time (SBT maturity, weather conditions, etc.)	SESAR W1 PJ08 OSED
HotSpot	The HotSpot is a 4D volume (defined in time and space) representing a potential DCB imbalance (not critical as not impairing Safety), identified by ANSP(s) and potentially NM.	OSED P13.02.03 SESAR1

	This imbalance is shared with partners, and ANSPs define solutions, supported by Collaborative Decision Making process and tools (either in strategical and pre-tactical phases, or in tactical phase with INAP). A hotspot situation represent a nominal, safety non critical and planned event.	
Imbalance	Imbalance between Demand and Capacity (measured by the occupancy rate in a Controlled Airspace Block)	SESAR W1 PJ08 OSED
INAP Timeframe	INAP covers three main time periods, all referred to the time of occurrence of the hotspot (i.e. 0H): - **From -6H to -2H:** It is assumed that -2H is the cut-off time for CASA application, so this implies that most of the flights are still on ground, - **From -2H to -40'**: This period represents the gap that INAP is filling in the DCB process, - **From -40' to -15':** In this period small adjustments are possible to optimise capacity without a safety issue. ***IMPORTANT NOTICE*** The figures provided are indicative and can slightly differ from one ACC to another, depending of the sector configurations. It should be up to INAP actors to adjust local time periods. To ease readiness of the document, 6hours and 15 minutes will commonly be used as reference in the following sections.	OSED PJ.09-W2-44
Models A & B (DAC Management Process)	There are two main DAC management process models that are covered by this OSED: centralised and distributed DAC management models: Model A "Partially Distributed DAC Management Model" and Model B "Fully Distributed DAC Management Model" that are described below. Model A is the "top down" DAC management model characterised by leading role of Network Manager who is kicking off, coordinating and monitoring the DAC planning process with local actors (at national or sub-regional level depending on local organisation) assisting NM with local expertise, data and knowledge. Model B is "bottom-up" DAC management model characterised by leading role of local actors (at national	OSED PJ08 W1

	or sub-regional level depending on local organisation) in DAC management process.	
netLoad	The Network Load (netLoad) is an indicator developed to determine the severity of areas within the network, looking at the propagation of imbalances to non-nominal and critical areas from a network point of view.	OSED PJ.09-W2-49
netSpot	The Network Spot (netSpot) is a captured geographical area that includes linked airspace clusters predicted to be in non-nominal or critical states. The netSpot represents a reference for all concerned actors and stakeholders indicating that: - a congestion is propagating at the network level moving to a non nominal or critical situations, - a global strategy will be coordinated and implemented to resolve it.	OSED PJ.09-W2-49
Network Operations Plan (NOP)	[NOP consists of]: 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. The NOP has a dynamic and rolling lifecycle starting in the strategic phase and progressively updated up to and including the execution and post-operations phases. It supports and reflects the result of the collaborative ATM planning process: at each phase, stakeholders collaborate at developing a common view of the planned network situation, allowing each of them to take informed decisions considering the network effect and the Network Manager to ensure the overall coordination of individual decisions needed to support network performance.	SWP 7.2 DOD
OptiSpot	The OptiSpot is a 4D volume (defined in time and space) representing a traffic situation where opportunity for optimization has been identified by ANSP (INAP). An ATFCM situation yet to be optimized represents a nominal, safe and planned event.	OSED PJ09 W1

Revision of the Reference Business or Mission Trajectory	The revision of the Reference Business or Mission Trajectory (RBT/RMT) is triggered at Controller or Flight crew initiative when there is the need to change the route and/or altitude constraints and/or time constraints, mainly due to hazards (traffic, weather), fine sequencing (CTA or CTO allocation) or inability for the aircraft system to meet a constraint (CTA missed).	SESAR 2020 Concept Of Operations Edition 2017
Shareable Airspace Block (SAB)	non-workable volume of airspace that can be dynamically configured (Attached) in a pre-defined way to any adjacent Elementary Sector (ES) or Airspace Block (AB) to build Configured Sectors (CS)	SESAR W1 PJ08 OSED
SAM (Sharable airspace module)	smallest, non-workable volume of airspace that can be dynamically attached (belong to) to any neighbouring ES or SAB, used to marginally adapt sector boundaries, i.e. +/- 10nm	SESAR W1 PJ08 OSED
Shared Business/Mission Trajectory	Published Business/Mission trajectory that is available for collaborative ATM planning purposes. The refinement of the SBT/SMT is an iterative process.	ATM Lexicon
Reference Business/Mission Trajectory	The business/mission trajectory which the airspace user agrees to fly and the ANSP and Airports agree to facilitate (subject to separation provision).	ATM Lexicon [2] SESAR Integrated Dictionary
Vertical Sharable Airspace Module (VSAMS)	Non workable volumes of airspace vertically split in 1000ft segments which must be configured with a minimum number of VSAMS to create a CS.	
Wing Operations Centre	The WOC is a generic term, which gathers the operational processes and services directly related to the airspace users and linked to Mission Trajectories and other aerial activities. This definition avoids detailing the diverse organisational structures existing in Europe. It is the Military equivalent to the civil Flight Operations Centre (FOC)	P11.01.01 Transversal consistency of BT/MT requirements (across WPs) D11.01.01-1 Definition of trajectory requirements for Step 1, including gap analysis, support to standardization report from

		Airspace Users perspective
What-if tools	„What-If" re-routing simulations allow selecting a single flight and perform re-route trials using flight route alternatives provided by the system, so that the delay imposed on this single flight is minimized and there is no overload on the traffic volumes crossed by the re-route flight. The system automatically provides the benefit and overload, and also automatically calculates and displays the EET and route length differences between the original flight route and the provided flight route alternatives.	SESAR W1 PJ08 OSED

Table 1: Glossary of terms

[1] SESAR ATM Lexicon
[2] SESAR Integrated Dictionary, http://www.eurocontrol.int/lexicon/lexicon/en/index.php/SESAR
[3] SESAR 2020 Concept Of Operations Edition 2017
[4] B.05 D86 Guidance on KPIs and Data Collection support to SESAR 2020 transition.
[5] SESAR PJ08 OSED, Ed 03.00.01

2.7 List of Acronyms

Acronym	Definition
A/G	Air / Ground
AB	Airspace Block
ACC	Area Control Center
AI	Artificial Intelligence
AMC	Airspace Management Cell
AoR	Area of Responsibility
APOC	Airport Operations Centre
APW	Area Proximity Warning
ARES	Airspace Reservation /Restriction
ASM	Airspace Management
ATC	Air Traffic Control

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ATCO	Air Traffic Controller
ATF(C)M	Air Traffic Flow (and Capacity) Management
ATM	Air Traffic Management
ATS(U)	Air Traffic Services (Unit)
AU	Airspace Users
CAP	Capacity
CB	Cumulonimbus (Storm Clouds impacting safety)
CDM	Collaborative Decision Making
CDR	Conditional Route
CD/R	Conflict Detection & Resolution
CNS	Communication Navigation and Surveillance
CONOPS	Concept of Operations
CS	Collapsed Sector or Configured Sector
CWP	Controller Working Position
DAC	Dynamic Airspace Configuration
DCB	Demand & Capacity Balancing
DDR	Demand Data Repository
DMA	Dynamic Mobile Area
EATMA	European ATM Architecture
E-ATMS	European Air Traffic Management System
EC	Executive Controller
ECAC	European Civil Aviation Conference
EDAC	European DAC
EEG	Electroencephalogram
EOBT	Estimated OFF Block Time
ES	Elementary Sector
FAB	Functional Airspace Block
FBT	Forecast Business Trajectory
FEFF	Flight Efficiency
FL	Flight Level
FM	Flow Manager

FOC	Flight Operations Centre
HEC	Hourly Entry Count
HLAPB	High Level Airspace Policy Body
HP	Human Performance
HPAR	Human Performance Assessment Report
INAP	Integrated Network Management and Extended ATC Planning function
INTEROP	Interoperability Requirements
IOP	Interoperability
ISA	Instantaneous-Self Assessment
KPA	Key Performance Area
KPI	Key Performance Indicator
LCM	Local Capacity Manager
LoA	Letter of Agreement
LTM	Local Traffic Manager
MBT	Military Business Trajectory
MIL	MILitary
MTCD	Medium Term Conflict Detection
MV	Monitoring Value
NM	Network Manager
NMf	Network Management function
NOP	Network Operations Plan
NSA	National Supervisory Authorities
NWP	Network Position
OC	Occupancy Count
OI	Operational Improvement
OSED	Operational Service and Environment Definition
PAR	Performance Assessment Report
PC	Planning Controller
PRED	Predictability
RAD	Route Availability Document
RASCI	Responsible, Accountable, Support, Consulted, Informed

RBT	Reference Business Trajectory
RT	Radio Transmission
SAB	Sharable Airspace Block
SAC	Safety Criteria
SAM	Sharable Airspace Module
SAR	Safety Assessment Report
SBT	Shared Business Trajectory
SD & C	Sector Design and Configuration
SecAR	Security Assessment Report
SESAR	Single European Sky ATM Research Programme
SID	Standard Instrument Departure
SJU	SESAR Joint Undertaking (Agency of the European Commission)
SMT	Shared Mission Trajectory
SPR	Safety and Performance Requirements
STAR	Standard Instrument Arrival
SWIM	System Wide Information Model
TDF	Traffic Demand Forecast
TMV	Traffic Monitoring Volume
TS	Technical Specification
TTA / TTO	Target Time on Arrival / Target Time Over
WOC	Wing Operations Centre
xFL	Exit Flight Level

3 Operational Service and Environment Definition

The following sub-sections describe the operational environment applicable for the SESAR Solution W2-S44 under the scope of this deliverable, as well as the context for assessing and establishing operational, safety, performance and interoperability requirements (which will be captured in the chapter 4 of this document).

3.1 SESAR Solution PJ.09-W2-44: a summary

The SESAR W2 Solution 44, "Dynamic Airspace Configuration (DAC)" is built upon wave 1 results of solutions PJ08-01 and PJ09-02.

The core focus of the PJ.09-W2-44 solution is the use of DAC concept into the DCB process including the Integrated Network Management ATC Planning (INAP) concept, in an integrated way, and not as two different steps. A particular emphasis will be put on the INAP timeframe where the two overlap. The INAP timeframe could be established between a few hours to a few minutes before a spot occurs, e.g. from ~-6 hours to ~-15 min, the limits thresholds being to be adjusted according to local specificities (refer to §2.6).

To manage a seamless integration, the solution will investigate:

- Further development of the DAC concept for DCB integration, notably the implementation of the optimised configurations and the seamless integration of DAC at pre-tactical and tactical phases,
- Adequate automatic support for spots detection, traffic analysis and measures monitoring,
- Development of new features to support the analysis and resolution of hotspots, namely what-if and what-else,
- Development of new indicators to fine-tune analysis and ease monitoring, namely the complexity and the uncertainty,
- Alignment of processes, roles and measures, based on the above-mentioned features, ensuring the right level of coordination and shared situation awareness at local, sub-regional and regional network levels.

The further development of DAC concept includes:

- Development of optimised functions for hotspots resolution based on both capacity and demand measures,
- A Sector Configuration Performance Based Approach defined according to a set of DAC KPA/KPI Assessment Criteria and linked to adequate What-if functions,
- Establishment of guidelines for the design of DAC airspace basic structures, i.e. Airspace Building Blocks and Controlling Building Blocks,

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- Identification of proper criteria to set the Airspace Block Attributes, which optimise Sector Configuration,
- Integrate the use of complexity, ATCO workload and ATCO availability within the sector configuration optimisation process,
- Reinforcement of a seamless DCB process (ASM-ATFM-ATC-CDM processes),
- Include Cross border Dynamic Airspace Configurations,
- Full concept Integration within the Network Operations Plan (NOP).

The schema below presents the scope of the solution PJ.09-W2-44 with the main concepts developed within the solution. It also highlights dependencies with other solutions (in red dotted line) and main stakeholders impacted (all around the S44 rectangle):

- Solution PJ.09-W2-49 'Collaborative Network Performance Management' will provide a common framework to assess and share network performance,

- Solution PJ.09-W2-44 DAC-whose focus is the DAC/DCB integration within INAP- envisages a set of functions to support spot detection and resolution at INAP timeframe,

    - Amongst them, the what-else function, which needs to be fed by enhanced traffic prediction as developed in Solution PJ.09-W2-45 'Enhanced Network Traffic Prediction and shared complexity representation',

    - Moreover, Solution PJ.10-W2-93 'Delegation of services amongst ATSUs' will be interested on the cross borders operations to describe the delegation roles and responsibilities. In addition and though not represented on the schema as the dependency is lighter, the Solution Wave 3 PJ32 will be interested as well for similar topics.

- Solution PJ.09-W2-44 DAC and the functions supporting it (Spot detection and monitoring, catalogue of DCB Measures, What-If/What-Else, Complexity Assessment and Uncertainty Assessment) shall be integrated with the ATFM and Trajectory Management. Although, the LTM and EAP can be considered the central roles of the INAP DAC/DCB processes supporting ATFCM, a CDM process is necessary involving AUs, NM and Airports (through Airport Operations Centre -APOC- coordination). To do so, Solution PJ.07-W2-39 'Collaborative framework managing delay constraints on arrivals' is in charge of the development of this collaborative framework,

- Solution PJ.07-W2-38 'Enhanced integration of AU trajectory definition and network management processes' is also interested in DAC solution as they will be analysing the impact of ATM planning on AUs' costs of operations,

- Finally, ATC processes will take place, being the ATC performance dependant of the capability of the DAC ASM/ATFM processes to provide an airspace capacity adapted to the traffic demand. Therefore, the ATC DAC procedures and the ATCO human performance in DAC environment will be assessed as part of Solution PJ.09-W2-44.

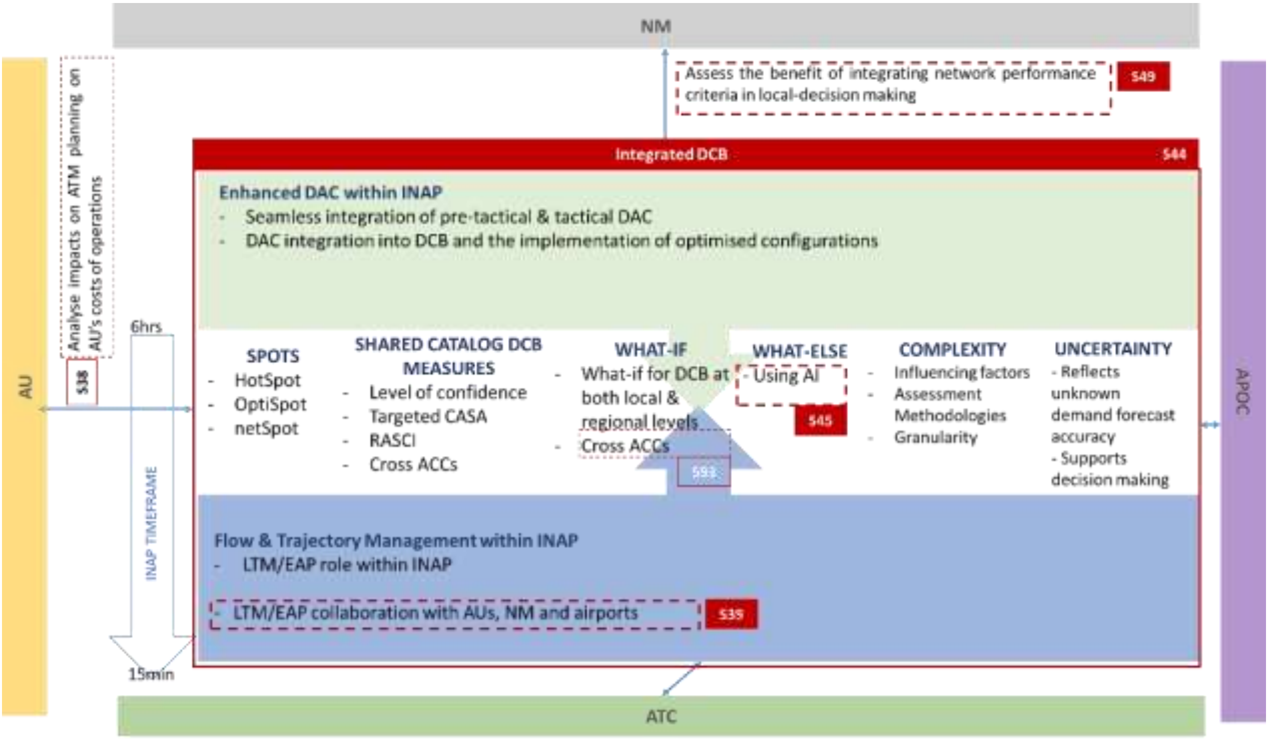

Figure 1. PJ.09-W2-44 Diagram of concepts

The table below presents the OI steps included in this solution, based on known elements at the time of the writing, i.e.: based upon Dataset 23 draft v16.0.

SESAR Solution ID	SESAR Solution Description	Master or Contributing (M or C)	OI Steps ID and Title (from EATMA)	Enablers ID and Title (from EATMA)	OI/EN Coverage
PJ.09-W2-44	Dynamic Airspace Configuration	M	AOM-0805: Collaborative Airspace Configuration	AAMS-13 ASM scenario management sub-system equipped with tools for assessing the impact of airspace changes on capacity	Full use
				AIMS-04 (Optional) Network management functions supported with real-time airspace data	Full Use

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SESAR Solution ID	SESAR Solution Description	Master or Contributing (M or C)	OI Steps ID and Title (from EATMA)	Enablers ID and Title (from EATMA)	OI/EN Coverage
				ER-APP ATC 80 Enable ATC System to Use Dynamically-Defined Airspace Reservations	Full Develop
				NIMS-04: ATFCM capacity planning sub-system enhanced to take into account dynamic sector shapes	Full Use
				NIMS-30 ATFCM scenario management equipped with tools for assessing the impact of DAC and capacity changes on trajectory efficiency	Full Use
				PRO-010 (optional) Procedures to ensure that all actors involved in the airspace reservations are well aware about the real status of airspace availability and subsequent changes	Full Use
			AOM-0809-A: Initial Sector Design and Configurations Unconstrained by	NIMS-04: ATFCM capacity planning sub-system enhanced to take into account dynamic sector shapes	Full Develop

SESAR Solution ID	SESAR Solution Description	Master or Contributing (M or C)	OI Steps ID and Title (from EATMA)	Enablers ID and Title (from EATMA)	OI/EN Coverage
			Predetermined Boundaries	NIMS-30 ATFCM scenario management equipped with tools for assessing the impact of DAC and capacity changes on trajectory efficiency	Full Use
				PRO-010 (optional) Procedures to ensure that all actors involved in the airspace reservations are well aware about the real status of airspace availability and subsequent changes	Full Use
			CM-0102-B: Dynamic Airspace Management based on complexity	AAMS-19 Dynamic Airspace Configuration tools for the Integrated local DCB working position	Full Develop
			DCB-0210: Full integration of Dynamic Airspace Configurations into DCB	AAMS-02 Dynamic Airspace Configuration tools for the Integrated Network Working Position	Full Develop
				NIMS-30 ATFCM scenario management equipped with tools for assessing the impact of DAC and capacity changes on trajectory efficiency	Full Use

SESAR Solution ID	SESAR Solution Description	Master or Contributing (M or C)	OI Steps ID and Title (from EATMA)	Enablers ID and Title (from EATMA)	OI/EN Coverage
				SVC-073 Consumption of G/G and initial A/G ASM-ATFCM Information Services on Wide Area communications	Full Use
			CM-0104-C: Automated Support to INAP (Integrated Network Management and Extended ATC Planning) Function	ER-APP ATC 17 Enhance Traffic and Flow Management sub-systems to support dynamic flow management in co-ordination with local, regional, and European levels	Full Use
				NIMS-46 Integrated local DCB working position	Full Develop
				SVC-073 Consumption of G/G and initial A/G ASM-ATFCM Information Services on Wide Area communications	Full Use
			CM-0103-B: Automated Support for Traffic Complexity Assessment	NIMS-36 Enhanced Complexity Assessment Tool	Full Develop

Table 2: SESAR Solution PJ.09-W2-44 Scope and related OI steps/enablers

The table below summarizes the High Level Operational Requirements applicable to the solution.

High Level Concept of Operations Requirement ID	High Level Concept of Operations Requirement	Reference to relevant Concept of Operations Sections, e.g. Operational Scenario applicable to the SESAR Solution
S44-HLOR-01	Dynamic airspace management shall increase : • Airspace capacity • Flight Predictability • ANSP cost -efficiency for both civil and military users within/across ANSPs' AoRs, through : • increased granularity and flexibility in airspace configuration by : • integration of concepts and procedures providing flexible sectorisation boundaries to be dynamically modified based on demand (Free Routing trajectories and AFUA needs), so that the ATM environment is able to match resources to hotspots; • employing CDM processes relating to DAC, and with coordination between DAC and DCB to define optimal solutions; • sharing DAC information with stakeholders via the NOP, with new capability to allow AUs to contribute to the DAC process before its completion; • management of the RBT in the execution as the DAC process evolves from the planning phase; • utilising automated tool functionalities for airspace management processes	

Table 3: Link to Concept of Operations

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

At the time of the writing, no deviation has been identified.

3.2 Detailed Operational Environment

The key developments of SESAR operational concepts (identified to date), relevant to the development of PJ.09-W2-44, rely on DAC process and INAP related functionalities developed in Wave 1.

The following sub-sections:

- first present the background from Wave 1 with summary of the two main concepts (§3.2.1),
- then provide descriptions of the concepts addressed to allow a seamless DCB process, with DAC and INAP concepts used in an integrated way and not as two separate steps.

The table below shows the linked SESAR operational nodes :

- In bold, the nodes belonging to the Network Operations area,
- In standard, the nodes belonging to others areas.

Linked SESAR operational nodes	Operating Environment
Airspace Organisation **Airspace Management** **Air Traffic Flow & Capacity Management** Airspace User Ops Support Airport Ops Support	Fixed and FRA Strategic, Pre-tactical & tactical phases with a focus on INAP timeframe ER & TMA Civil & Military traffic

Table 4: Addressed Operational Nodes

The Sub-operating environments (OE) associated to this solution PJ09-W2-S44 that are under the scope of this document regarding the applicable Validation targets are:

- **Capacity:** En Route very high complexity, En Route high complexity, Terminal Very high complexity, Terminal high complexity.
- **Operational efficiency (fuel efficiency/punctuality/flight time/predictability):** En Route very high complexity, En Route high complexity.
- **Cost effiency:** En Route very high complexity, En Route high complexity.

3.2.1 Basis from Wave 1, a summary

Refer to [39] & [38] *for more details on the concepts summarized hereafter*

3.2.1.1 DAC Process

DAC process consists of **organising, planning and managing airspace configurations**:

- to meet User Preferred Routing, in a Free Route operating environment,

- to respond to any change in traffic demand; unexpected events, and update in airspace reservations in the optimum way,
- to allow better distribution of ATCO workload.

The objective of the DAC process is to **identify optimised airspace configurations** (including configuration plans for transitions) for a defined airspace through the implementation of airspace design and configuration sub-processes based on the forecasted air traffic complexity, ATCO workload and ATCO availability as well as the traditional count methodologies provided by the Imbalance Prediction and Monitoring Service (Hourly Entry Counts and Occupancy). The identified optimised airspace configuration should **meet forecasted traffic demand and reach the defined performance targets both at Local and Network levels and with minimal impact on the Business/Mission Trajectories.**

With Dynamic Airspace Configuration in place, it will be possible to manage dynamically all capacity elements and constraints in one single, **seamless process.**

- Sector configurations are arranged according to an initial set of decision criteria (among which capacity load and stability, accuracy versus uncertainties, or local parameters –staffing, capacity level calculation or stability parameters),
- The assessment of the criteria results on an airspace configuration that is negotiated through the DCB Collaborative Decision Making Process (CDM) with the ATM Actors, including Military (negotiating the automated allocation Dynamic Mobile Areas, DMA),
- The final configuration plan is made available to the ATSU Supervisor, LTM and EAP. These final actors, should be able to optimise the configuration plan to adapt capacity to demand and meet the needs of the ATM community while minimising demand adjustments. To achieve these objectives, the What-If service becomes a fundamental asset.

3.2.1.1.1 DAC Toolbox

“Dynamic Airspace Configurations” concept, as developed in SESAR Wave 1 PJ08 AAM project, provides ANSPs with different options to manage capacity, through varying the degree of Sector Design and Configuration dynamicity, the level of automation and the innovation in human performance and related training to better support a higher flexibility in the airspace configuration. The set of all possible DAC options are presented in a DAC Toolbox containing three axis: Design and Configuration Axis, Automation Axis and Human and training axis. On one side, DAC Toolbox allows ANSP’s to choose the degree of dynamicity in each axis that best fits their needs, on the other it allows to select to the most adequate combination of the three interdependent variables (e.g. as design and configuration dynamicity increases, the requirements for automation increase).

Sector Design and Configuration Axis, is based on Airspace Building Blocks and Controlled Airspace Block airspace design architecture. It introduces different airspace design elements, which can be configured into different configurations resulting in a Configured Sector (CS). Configured Sector is the Result of the Sector Configuration process. This is the actual airspace a controller will be assigned to provide ATS services

- **Elementary Sector (ES)** – ATC workable 3D airspace that can be controlled by ATCO for ATS provision and that cannot be split further down into workable/controllable sector(s),
- **Airspace Block (AB) -** A primary volume of airspace which has to be configured to build workable Sectors of Control defined as Configured sectors in this concept (CS),

- **Shareable Airspace Block (SAB)** – non-workable volume of airspace that can be dynamically configured (Attached) in a pre-defined way to any adjacent Elementary Sector (ES) or Airspace Block (AB) to build Configured Sectors (CS),
- **Flexible boundaries (FB) –** Sector boundaries that can be modified or refined to facilitate / optimise FRA trajectories. It is expected that Flexible boundaries can be facilitated through the use of:
  - Flexible Drawing Tool,
  - **SAM** (**Sharable airspace module)** - smallest, non-workable volume of airspace that can be dynamically attached (belong to) to any neighbouring ES or SAB, used to marginally adapt sector boundaries, i.e. +/- 10nm.
- **Vertical Sharable Airspace Module (VSAMS) –** Non workable volumes of airspace vertically split in 1000ft segments which must be configured with a minimum number of VSAMS to create a CS.

Six configuration options were proposed by DAC concept wave 1 ((A, B, C, D, E. F) depending of their use of Elementary Sectors (ES) or Airspace Blocks (AB) isolated or in combination with other elements (SAB and FB) in the lateral plain. In the Vertical Plain, the concept proposes the integration of the two options already available (Standard Vertical Cuts and Sharable Vertical volumes sandwiched between sectors) with the automated integration of level cuts or the manual cutting of airspace volumes (ES/AB/SAB/SAM) into 1000ft segments (see figure below).

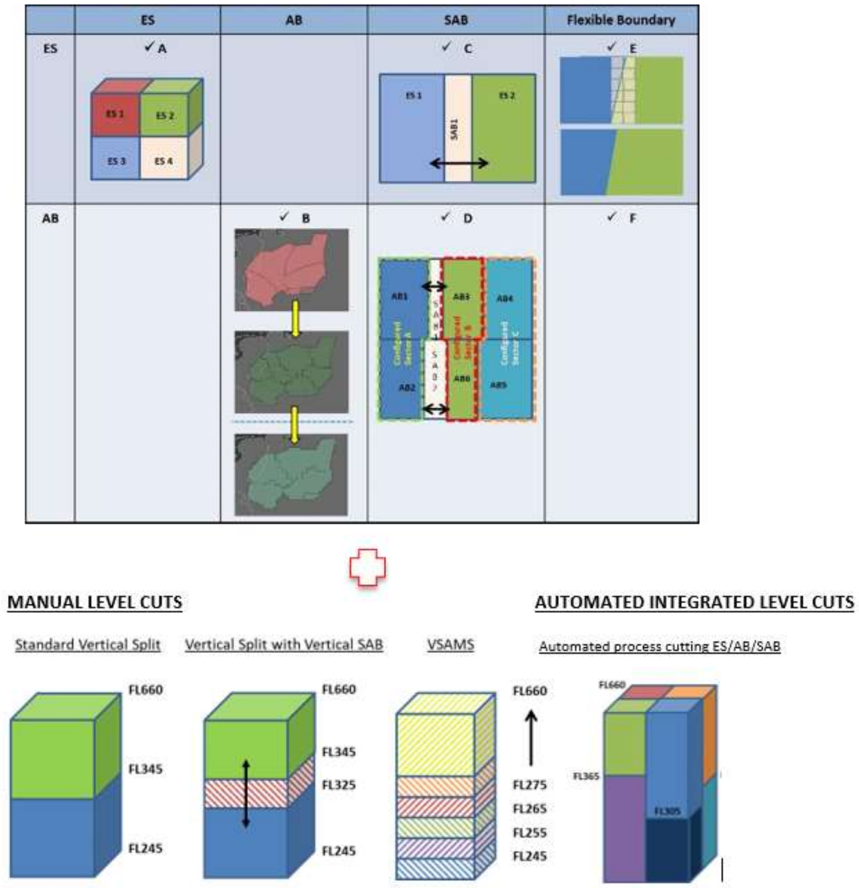

Figure 2. Lateral plain and Vertical plain Configuration options

Automation Axis comprises several categories, such as **Intelligence Artificial (IA)** in support of data mining or Machine Learning (ML) methods to support airspace design algorithms, predict ATFM thresholds, predict requirements on ATCO resources; or in support of real time multi-objective optimisation. **SOA and Web-services solution** might help to integrate DAC functions in different workspaces and embedding DAC and DCB functions. Different DAC aspects were appointed as good candidates to be substantially improved through automation:

- Sector Design and Configuration,
- DAC tactical operations,
- Prediction of periods of imbalance,
- Monitoring and assessment of airspace configuration,
- iSupport Functions to the Human Actor.

Human and training Axis was not developed in wave 1. Training was out of the scope although the need to subject to human analysis and acceptance the outcome of the Design and Configuration Process with the selected level of automation was highlighted.

3.2.1.1.2 DAC Timeline

DAC timeline, as developed in SESAR wave 1 concept, comprises the phases described below.

Long term processes aiming at designing the airspace to enable the implementation of the dynamic configurations and allow the planning of the ATM resources that should be made available to respond to the various performance objectives. As ATM resource planning are normally constrained by local procedures and regulations, these processes will normally take place from years to 6-months before the relevant flights occur.

Medium Term Processes to Short Term Processes, the processes by which ANSPs make plans for airspace configurations according to the expected traffic pattern (via a CDM process where appropriate). The processes in medium and short-term are broadly similar (the principal difference is that the data reliability/certainty – particularly for estimated demand). These processes take place “Months to Days” (Medium Term) and Days to Hours (Short Term) before the relevant flights occur.

In the INAP time horizon, Dynamic Airspace Configuration is a crucial task to assist Demand and Capacity Balancing activities; DAC is part of the toolset available to the INAP actors to manage complexity and facilitate users preferred routing, achieving specific performance objectives.

Execution processes are those by which airspace configurations are implemented and fine-tuned if appropriate according to the running traffic pattern. These processes take place in the hours before the relevant flights occur, through to the time that the relevant flights are airborne.

Post Operational Analysis processes are those by which the efficiency of the above is reviewed and recommendations for change made (if necessary). These processes can take place any time after the relevant flights occur.

The use of the different DAC Toolbox elements in the DAC timeline was also identified to account for the restrictions of use due to its link to system changes, training requirements or changes of procedures.

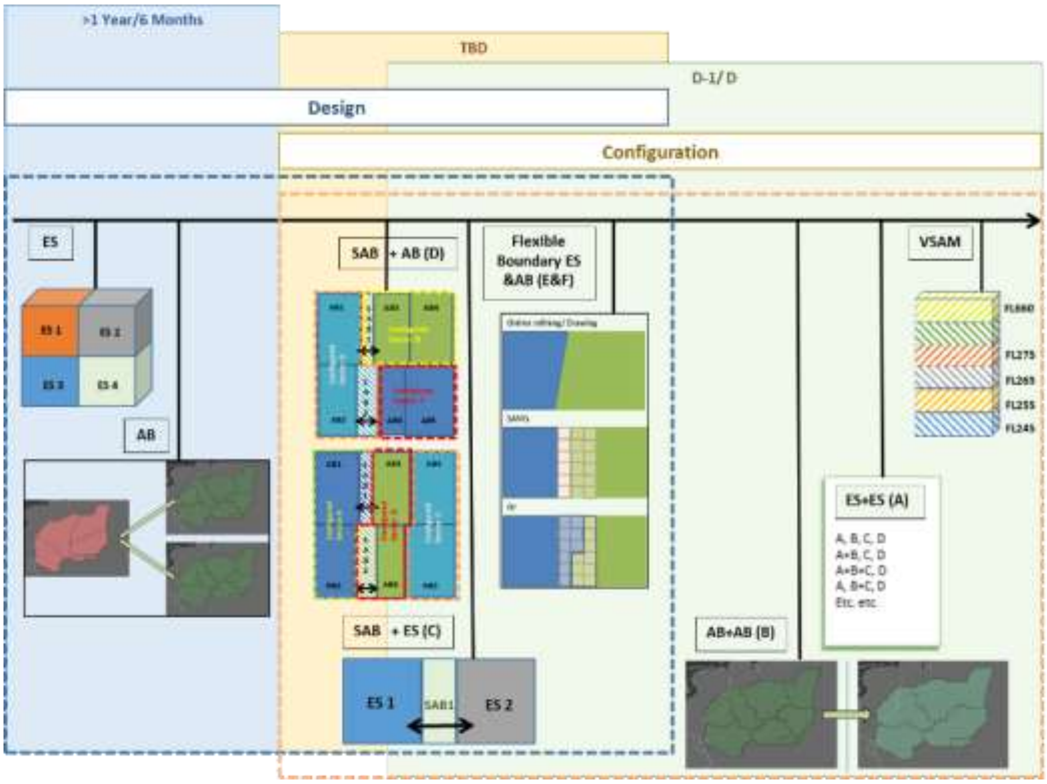

Figure 3. DAC Options Timeline

3.2.1.1.3 DAC Process Model

There were two main DAC management process models covered in wave 1: centralised and distributed DAC management models: Model A "Partially Distributed DAC Management Model" and Model B "Fully Distributed DAC Management Model".

Model A is the "top down" DAC management model characterised by leading role of Network Manager who is kicking off, coordinating and monitoring the DAC planning process with local actors (at national or sub-regional level depending on local organisation) assisting NM with local expertise, data and knowledge. However, the closer to the execution phase the more responsibilities are shifted from NM towards local DAC management level.

Model B is "bottom-up" DAC management model characterised by leading role of local actors (at national or sub-regional level depending on local organisation) in DAC management process in nominal case with monitoring, moderating and facilitating role of the Network Manager.

The selection of one model or the other will have an impact on the allocation of functions and responsibilities to the actors involved in DAC process.

3.2.1.2 INAP Function

The INAP function encompasses some of the activities of the Local Traffic Manager (LTM) in tactical phase, the activities of the Extended ATC Planning(s) (EAP) and the activities linked to decomplexification managed by Planner Controller (PC) on Controller Working Positions (CWP), in a seamless and closely intertwined manner. These local ATM actors, working on different timeframes and associated levels of uncertainty and granularity, will render better service to Airspace Users, in close connection with NM, thanks to shared situational awareness regarding the problems identification, solution means and performance objectives.

EAP role has been introduced in SESAR 1. Solution 09.02 has further investigated and validated this role, together with associated responsibilities, working methods and toolset, towards full integration with local Network Management function and ATC within INAP.

LTM (Local Traffic Manager) replaces the Flow Manager Position (FMP) with additional responsibilities and tools, working in close collaboration with the EAP in case of a different actors, sharing the same situation awareness, based on common information sources and extensive means of communication. CWPs are also involved in the INAP process, notably the PC, extending the PC's situation awareness beyond the scope of his/ her Area of Interest.

It is important to note that EAP is a role, and not necessarily a dedicated actor: depending on local management of staff, EAP and LTM roles could very well be ensured by a single person. It will depend on the ANSP the allocation of the EAP role to a specific actor and define pre-requisites to fulfil the position.

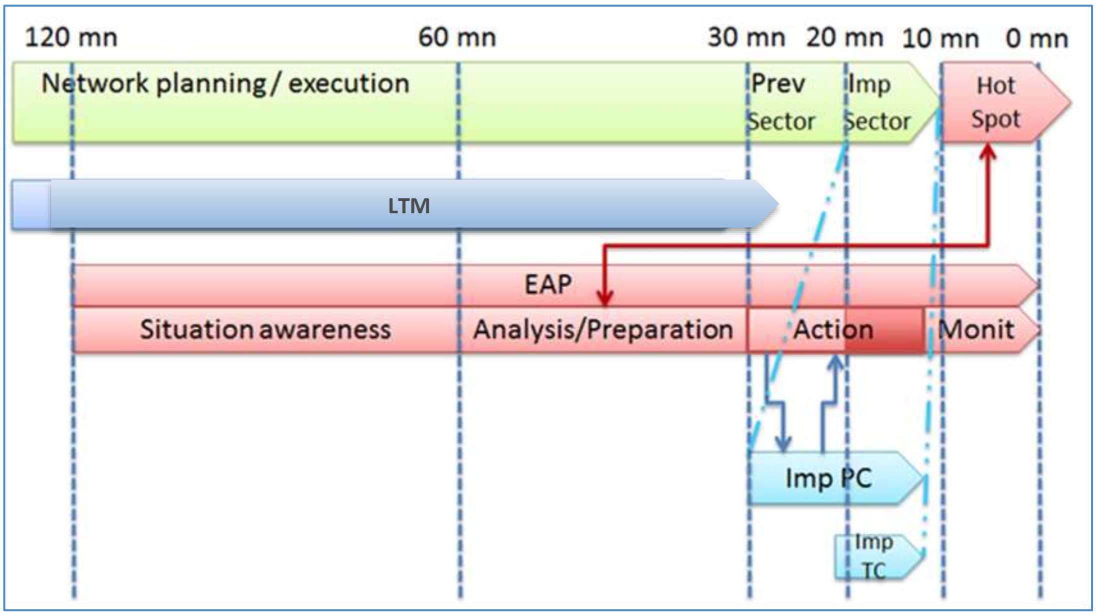

Figure 4. EATMA Model - INAP with EAP role – Extract from PJ.09 W1 OSED

Note: In the figure above, "Prev" stands for Previous sector (upstream from the 'Implementing sector'), in charge of the implementation of the measure, in order to off-load the sector where the hotspot has been identified, 'Imp PC' stands for Implementing Planning Controller, 'Imp TC' stands for Implementing Tactical Controller.

3.2.1.3 PJ.09-W2-44 overview

The core focus of the solution is the integration of DAC and Integrated Network Management ATC Planning (INAP) concepts, especially on the INAP timeframe where the two may overlap. This is expected to be reached by development of additional features and services presented in this document.

To identify how to bridge the gap between INAP actors and DAC in an integrated DCB, the solution OSED contributors have performed brainstorming sessions, resulting in several sub-concepts. They are expected to be refined with the course of the solution progress and the validation exercises results.

The table below provides an overview of the sub-concepts to be developed and the link with the OIs coverage.

Integrated DCB : DAC & INAP actors in a seamless process	OIs coverage (based on known elements at the time of the writing)
Refine the DAC operational concept and associated algorithm	AOM-0805
Develop automatic DAC based, sector configuration proposal tool	AOM-0809-A
Align INAP processes, roles and measures to extend INAP operations and include DAC as part of DCB	CM-0104-B & CM-0302 *(both are proposed to be merged)* DCB-0210
Development of new features and indicators : complexity, what-if and what-else, uncertainty	CM-0103-B CM-0102-B

Table 5: Summary of concepts to be developed within PJ.09-W2-44 and related OIs

3.2.2 Operational Characteristics

The operational environment of this solution, regarding the application of an integrated DCB, including DAC environment where the airspace structure acquires high flexibility level and INAP environment where a set of demand measures can be mixed with capacity measures to manage imbalances in tactical phase, is characterised by the following SESAR operational concepts:

- **Demand and Capacity Balancing** (DCB), a process that aims at adjusting demand and capacity, mitigating the negative impact of this adjustment on AUs flight profiles and network performance. The integrated DCB includes Dynamic Airspace Configurations measures mixed with INAP measures to manage spots,
- **Imbalance Prediction & Monitoring Service**, allowing DCB actors to make decisions on the most appropriate solution (that could be capacity and/or demand measure(s)) at the right level of granularity, considering the different imbalance prediction methodologies. This includes the definition, methodologies and granularity of the complexity assessment and development of what-if and what-else services,
    - **Complexity management** – an enabler for integrated DCB, via improved estimates of controller workload – derived from the improved predictions of traffic demand,

- **What-if & What-Else Services, -** an enabler for integrated DCB, via simulations of DCB measures expected impact and efficiency,
- **Forecasted traffic demand**, a result of predicted trajectories through which configurations plan and DCB measures can be created accordingly with the highest level of accuracy.

- **Collaborative Decision-Making (CDM)** process between DCB actors, to guarantee the application of the best consensual solution possible and the integration of different methods to achieve it. *(CDM with AUs is also addressed by on-going SESAR Solution PJ07),*
- **NOP**, an enabler of DCB as it shares the relevant information among the involved actors,
- **Performance-based operations environment**, where a KPI performance framework is continuously monitored and assessed to support the entire integrated DCB process, and especially the dynamic airspace configuration process,
- **Network performance enhancement**, a key criterion for decision-making and monitoring of integrated DCB operations, such as sector configuration where the basis to create a configuration plan is a series of performance indicators,
- **Free Route Operations Environment (FRA),** where the integrated DCB process is expected to be applied and adjusted to specificities compared to fixed route environment.

3.2.3 Roles and Responsibilities

This section describes the Roles involved in the use of Operational Activities (as available in EATMA) and what their responsibilities and tasks are.

3.2.3.1 General

Within this OSED following terms are used in following corresponding meaning:

A **role** is an aspect of a person or organisation that enables them to fulfil a particular **function**

- A role is a collection of responsibilities that an ATM actor can take.

A Responsibility is the obligation to conduct assigned **tasks** to a successful conclusion

Note: several ATM actors can perform a role. A unique ATM actor can perform several roles.

In the context of this OSED, when describing Dynamic Airspace Configurations operational processes, tasks, responsibilities, Use Cases, etc., the term "LCM" is used in the meaning "Local Capacity Manager".

Identification of roles and responsibilities addresses two questions:

- Identification (and definition) of the tasks that need to be done,
- Allocation of the tasks to specific roles.

Nodes	Roles	Functions
Airspace Users (AUs)	FOC (Flight Operations Centre)	ATFM
	WOC (Wing Operations Centre)	DAC

Nodes	Roles	Functions
Regional Network Management	NM (European Network Management)	DAC, ATFM
State	HLAPB (High Level Airspace Policy Body)	DAC
Air Navigation Service Provider (ANSP) Local & Sub-regional levels (depending on ANSP specificities)	Strategic & Pre-Tactical : ANSP ATFCM Unit Tactical : LTM (Local Traffic Manager) & EAP (Extended ATC Planning)	DAC, ATFM
	ATSU Supervisor	DAC, ATFM
	ATCO (Air Traffic Controller)	ATC
Airport	APOC (Airport Operations Centre)	ATFM

Table 6: Roles Summary

Most of the actors listed above, involved in dynamic DCB processes are practically the same as the ones exposed in OSEDs from SESAR Solution 08.01 and SESAR Solution 09.02. However, some nuances are explicit, e.g. the actions and related responsibilities defined for DAC Role are suggested to be allocated to Local Traffic Manger (LTM) who is the responsible to run integrated DCB process in cooperation with Network Manager (NM).

The major change is the merging of previous PJ08 role Local Capacity Manager (LCM) with the Local Traffic Manager (LTM) at tactical level and the introduction of the ANSP ATFCM Unit to manage DCB activities at strategic & pre-tactical levels.

The main challenge implied within PJ.09-W2-44 when compared to PJ08-01 DAC OSED and PJ09 INAP OSED [38] & [39] is the integration of the ASM/ATFM/ATC & CDM processes and definition of proper timing and conditions for their simultaneous application and/or dynamic switch between them. This should be further detailed in the New Operating Method §3.3.2.

3.2.3.2 Airspace User

3.2.3.2.1 Flight Operations Centre (FOC)

The airspace users should provide their intentions and planning at strategic horizon. They will also have to follow the ATFCM measures established, changing and updating accordingly their SBT and RBT trajectories.

3.2.3.2.2 Wing Operations Centre (WOC)

Local military airspace users are also involved in DCB processes, as they have operational processes and services that affects directly to the activity of other airspace users. The responsibilities this actor has are summarized as follow:

- Defines ARES (all types of fixed ARES, and DMAs) to be processed by DAC in accordance with AUs mission request and to enable DAC applying mainly DMA design principles,
- Share and update their Mission Trajectories (via NOP/NM) and ARES in accordance with the rules and procedures established by national authorities,
- Supports integration of ASM with ATFM by sharing trajectory requests with embedded ARES (where suitable) or independent ARES requests. The sharing of trajectories and ARES requests triggers the CDM process for DAC,

- Participates in CDM for the parameters (location, volume, FL band, activation period) of the requested ARES to preserve military AU requirements.

3.2.3.3 State

3.2.3.3.1 High Level Airspace Policy Body (HLAPB)

The High Level Airspace Policy Body is established at national or sub-regional level (FAB), with participation of civil and military airspace users as appropriate and supported by the NM. It is responsible for strategic ASM policy (at national or sub-regional level), planning and coordination, as well as setting up of strategic aims and high level performance and airspace targets together with their periodical review. Some of its responsibilities concerning DCB are:

- Assure the prerequisites for the most optimum operational Airspace Configuration for the volume(s) of airspace within its responsibility,
- Coordinate with the adjacent HLAPB actors (in order to ensure that national /sub-regional airspace design projects are compatible and consistent with cross-border airspace policy,
- Coordinate with the Network Manager to ensure when appropriate that national/sub-regional airspace design projects are compatible and consistent with all the plans, in particular with the overall Network Strategy Plan and its implementation through the Network Operations Plan,
- Define a strategic framework (actors, roles, responsibilities, process main elements, and negotiation and priority rules) for civil-military CDM in DAC,
- Rely on the expertise of all the stakeholders within the CDM process, mainly on the national or sub-regional expertise as Flow Managers, Airspace Managers, Local Capacity/Traffic Managers, working in the area of its responsibility,
- Support National Supervisory Authorities (NSAs) (or its sub-regional equivalent) in performance monitoring activities.

3.2.3.4 Regional Network Management

3.2.3.4.1 Network Manager (NM)

This role has to coordinate and share the information related to DCB measures, including capacity and demand measures. Hence, coordinating and answering requests from local DCB actors, such as LTM/EAP. Due to this, its responsibilities are:

- Coordinate and advise through CDM process planning and development of Network Dynamic airspace configurations management process that meet defined Network and Local operational performance targets for referred period in strategic and pre-tactical to tactical phases,
- Coordinate and lead discussions among NM involved actors towards agreement on targeted performance for reference period in CDM mode,
- Develop Network DAC solution scenario as a trigger of DAC planning and management process aiming at achieving AU requirements,
- Facilitate Inter FAB coordination,

- Perform or at least facilitate periodical Network Impact Assessments and monitor results of What-if simulation being done by local DCB actors with regards to demand and capacity measures,
- Detect (planned) Network situations that lead to Network performance degradation below acceptable levels and associated problems and suggest the DCB amendments or refinement,
- Maintain and update NOP, FBTs (DDR), MBTs, etc.…,
- Answer to local DCB actors request/call for assistance/'facilitation coordination, etc.,
- Monitor deviation from defined Network DCB solution scenario and overall Network situation,
- Monitor Network situation.

3.2.3.5 ANSP, local & sub-regional level

3.2.3.5.1 ANSP management

ANSPs will be responsible for strategic capacity and staff planning. As for the strategic capacity, their airspace designers will be the ones that create and develop the new sectors and configurations in the DAC environment. Airspace designers shall evaluate the usability of the airspace structures and refine them based on data analytics:

- Assessment of the Guidelines for Airspace Building Blocks and Configured Sectors,
- Evaluation of the Complexity factors,
- ATCO Usability reports,

Monitored KPI of the sector configurations.

3.2.3.5.2 ANSP ATFCM Unit

This actor is in charge of DCB tasks in strategic & pre-tactical timeframes. The actor is also in charge of performing a joint civil-military function at national level, whose main role is to manage civil/military airspace allocation and flow and capacity management, including sector configuration management role at ANSP level (local and/or sub-regional levels).

There should be a deeper coordination between this actor and other DCB actors in all of the DCB process phases, from strategic to tactical phase, integrating ASM, ATFM and functionalities so that their processes can be performed in a combined manner allowing for a cooperative management of Airspace Configurations and DCB measures.

In a strategic phase, this actor should coordinate the development and design of new sector configurations based on both demand and capacity measures, as well as the elaboration of an appropriate configuration plans. Also, this coordination is needed in the pre-tactical and tactical phase, in coordination with other DCB actors (namely LTM at tactical level) in order to update the configuration plan to respond to changes in environmental conditions.

At strategic & pre-tactical levels, the main responsibilities of the ANSP ATFCM Unit are the following:

- Plan and develop, or at least assist the NM in planning and developing, dynamic airspace configurations that meet defined Network and Local operational performance targets for referred period in strategic and pre-tactical phases, and specifically in development of Network Reference performance oriented DAC solution,

- Develop Dynamic airspace configurations for the execution phase, and even deploying them when a centralised management model (Model A) is established (for information on models A & B, refer to §2.6),
- Monitor Airspace configuration deployed considering Network and local performance,
- Retrieve and process MIL AUs SMTs and shared DMAs,
- Identifies civil-military performance indicators to be processed for a specific airspace configuration so that to fulfil at optimal extent local/network performance targets and to fully respond to military mission requirements,
- Assesses impact of DAC on military requirements and advises WOC on possible DMA adaptation or modifications where suitable,
- Coordinates with civil and military airspace users the implementation of priority rules for a specific airspace situation when and if the problem detected – using "What-if" tool to find new sectorisation, matching the demand with acceptable level of performance,
- If there are no airspace sectorisation matching the demand with acceptable level of performance, negotiate with military AUs other DMAs that satisfy required level of performance (preferably both: local, sub-regional and network ones),
- As a result of such new DMA parameters identify SBTs/RBTs that are not compliant anymore with new DAC and pass them to DCB for further coordination with Civil AUs, and SMTs that must be revised by WOC in accordance with new/modified DMAs activation parameters,
- Coordinate via CDM process with other DCBs/FAB and NM, as well as other local/sub-regional and regional actors involved,
- Take final decision on the DAC, when having a centralised management model (Model A) (for information on models A & B, refer to §2.6),
- Make final decision on the DAC planning, concerning sector configuration, and DMAs,
- Promulgate new/latest DAC configuration (EDAC) on the NOP.

3.2.3.5.3 Local Traffic Manager (LTM)

LTM role is a set of responsibilities related to DCB processes and is involved at short-term into tactical level.

The LTM is involved in DCB processes at short-term into tactical level. LTM ensures consistency between all DCB measures in close coordination with ATSU Supervisor and ANSP ATFCM Unit. The LTM uses traffic load monitoring tools, to compare demand with declared capacity in the Network Operations Plan and to assess sectors workloads and complexity compared to predefined thresholds. The Local Traffic Manager's responsibilities refer to the Airspace Management and Demand and Capacity Balancing.

- The development of this role is a major element within this solution. For this reason, detailed tasks and responsibilities provided in new operating method, section §3.3.2.6
- Below is an overview of the main activities:
- The LTM is a major actor of DCB processes for tactical phases. In case of imbalance, (s)he is responsible for identifying the adequate capacity and demand measures to be taken, in

coordination with the appropriate partners (that could include NM (Network Manager), other LTM and AU),

- The LTM provides a bridge in understanding between operational perceptions of complexity, workload and demand and how that translates into ATFCM requirements as deliverable occupancy and workload values,
- The LTM works closely with ATSU Supervisors and Extended ATC Planning. The LTM is also likely to be either an ATSU Supervisor, or report to one, and as such will retain local safety accountability. Any ATFCM initiatives will have to be approved by him/her.

3.2.3.5.4 Extended ATC Planning (EAP)

The EAP role alleviates the LTM workload by working with him/her on flows. The EAP acts in their given EAP Area (which can cover several ATC areas of responsibility within the ATSU and are to be defined locally by each ANSP definition), under close coordination with the LTM, as the LTM has a global view over the whole ATSU's area. The primary characteristic of EAP role is to work in close contact with ATCOs on CWP, anticipating and solving as much as practicable complexity imbalances that might arise or remain in very short timeframe before entry of traffic in ATCOs Area of Responsibility (AoR), thanks to analysis and resolution capabilities with finer level of granularity (high certainty and real time update of traffic prediction). To reach this objective, specific EAP training and/ or rating scheme could be applied to satisfy local organization needs. Depending on the expected level of traffic complexity and local procedures, EAP position can either be collapsed with LTM position, or be ensured by a specific EAP actor (when needed). The EAP is indeed not systematically an additional staff member in the ATSU, it is a role, which covers a set of services/functions and which can be assumed by different people (like Planning Controller, Multi Sector Planner or LTM) in the ATSU, as a standalone role or in combination with another DCB role. However, specific requirements to cover EAP role can be designed, for the benefit of the local and sub-regional Network functions.

Note: tasks and responsibilities are detailed in new operating method, section §3.3.2.6.

3.2.3.5.5 ATSU Supervisor

ATSU Supervisor is the Chief of the Operations Room, therefore accountable of everything that occurs in the room under his perimeter (it might happen that the ATSU Supervisor is responsible for part of the room and another one for the rest, as when TMA and ER are located in the same room for instance), and in particular of the DCB activities. In nominal conditions, the ATSU Supervisor delegates the responsibilities of local DCB to LTM. ATSU Supervisors act as an advisor to LTM, monitoring his/her actions. In any case they have the capability to overrule LTM decisions. They manage and optimize resources for capacity measures with staff information. In coordination with LTM, they are responsible for the ACC sector configurations and the tactical management of the airspace configuration, under his perimeter.

3.2.3.5.6 ATC controllers

ATC controllers' role and responsibilities are the same as those they have today; they are responsible for the aircraft inside their AoR.

However, with the new DAC environment, they will have to adapt to more frequent sector configuration changes as well as being trained in new DAC sector configurations, which will be more dynamic and flexible. This highlights the importance of a good situation awareness level to respond in a safe and efficient manner in this changing environment. To help ATC controllers to overcome those difficulties, some measures are proposed:

- Adequate sectors configurations time parameters,
- System support (ATC systems, DCB).

3.2.3.6 Airport

3.2.3.6.1 APOC

The airport operations centre (APOC) is the nerve centre in this concept, allowing an unparalleled overview of operations and facilitating effective, fast decisions on how the airport can function most efficiently, especially under challenging circumstances. The APOC makes use of information from the airport operations plan (AOP), a single rolling plan agreed upon by all stakeholders, which is linked to the network operations plan (NOP).

3.2.4 CNS/ATS description:

There are no severe technical constraints related to CNS airborne-ground technology as for the application of the DCB processes. The proposed new concept of operations can be implemented with the actual CNS systems.

However, DAC will require automation tools to support the design and configuration of the airspace. These tools will integrate the design criteria into design and configuration algorithms that account for the specific ANSP business strategies. Those algorithms shall support INAP actors to select the appropriate moment to make the change in order to minimise the workload impact on controllers. As there will be a wide variety of airspace structures, DAC tools shall properly support the users ensuring that situational awareness is not affected.

ATCO operational platform shall incorporate reliable communications systems to ensure multilateral coordination ensuring an appropriate safety level in this environment, together with an appropriate level of reliability for those INAP-related communications systems supporting a seamless process. In addition, ATCO CWP should be able to display (e.g. radar label) the ATFCM measures applied to a particular flight.

There is a need to automate allocation, management and display of frequencies in the ATC system. It might be needed for instance that the CWP displays the actual frequency of each aircraft and the required frequencies to support the implementation of the sectorisation change.

Cross Border airspace configuration will require cross border CNS interoperability and/or integration of transnational systems; required features will be analysed in SESAR Wave 2 Solution 93.

As far as INAP concept is concerned, automated support for imbalance detection and hotspot resolution is required (e.g. what-if/what-else services). In addition, it is worth mentioning that the ATM systems should be able to share data, such as FDPS updates with ATCO clearances, to allow more efficiency in the collaborative process between INAP actors themselves and with all other actors.

3.2.5 Applicable standards and regulations

3.2.5.1 Regulations

The benefits of the PJ09-W2-44 solution can already be achieved at local level, even though it has more impact when performed at network level with all stakeholders. This can be achieved through the applicable regulations currently existing. No specific regulation is thus foreseen for the DAC implementation.

3.2.5.2 Standards

To achieve the benefits of the collaborative and cross-borders processes described within the solution, it is critical that the data exchanges among the various stakeholders are harmonized and standardized to fit with the various local ground systems. This can be achieved through the SWIM and B2B services and do not require additional standardization work.

3.3 Detailed Operating Method

The Previous Operating Method baseline environment are the ones described in SESAR solutions OSED, refer to [38] & [39]. Thus, in previous operating method, only a summary is provided on the key elements that will be most impacted by implementation of this solution, namely:

- The optimised configurations,
- The hotspot management,
- The DCB catalogue of measures within INAP timeframe.

The new SESAR Operating method is presented in 3.3.2.

3.3.1 Previous Operating Method

Airspace configuration management is currently performed within two different ATM services: ASM process dealing with ARES delineation, planning and activation; while ATC sectorisation is addressed by ATFCM service. DAC wording and concept is not implemented, though a certain level of dynamicity in airspace configuration is in operation. In this section we will therefore talk about ‘Airspace Configuration Management’ process when referring to the basis of the DAC.

INAP process is implemented within the DCB process in some areas, at various levels, e.g. closer integration with CWPs and/or an extended timeframe of responsibility closer to ATCO timeframe.

Both concepts, Airspace Configuration Management and INAP, are almost totally isolated since there is no integration of the Airspace configuration Management within the INAP process. A limited Airspace Configuration Management (called DAC within SESAR work) has been applied during the INAP timeframe in PJ09 Wave 1 validation activities, through the consideration of flexible vertical boundaries in the division of elementary sectors

The schema bellows show the respective INAP and Airspace Configuration Management Timeframes.

Figure 5. INAP and Airspace Configuration Management Timeframes

INAP Timeframe (refer also to §2.6)

INAP covers three main time periods, all referred to the time of occurrence of the hotspot (i.e. 0H):

- **From -6H to -2H:** It is assumed that -2H is the cut-off time for CASA application, so this implies that most of the flights are still on ground,
- **From -2H to -40':** This period represents the gap that INAP concept is filling in the DCB process,
- **From -40' to -15':** In this period small adjustments are possible to optimise capacity without a safety issue.

The INAP timeframe covers from -6H before the occurrence of the hotspot to -15'. However, it does not imply that DAC or INAP measures are restricted to this timeframe. In terms of DAC, it could be applied before the -6H cut-off and in terms of INAP Measures, both Regulations and ATFCM Scenarios could be implemented before that cut-off time. The rest of INAP Measures should be applied within the INAP timeframe. Table 7below summarises the timeframe of application of each measure.

UNTIL -6H	-6H TO -15' (INAP Timeframe)
- Dynamic Airspace Configuration (DAC) - ATFCM Scenario - Regulation	• Dynamic Airspace Configuration (DAC) • ATFCM Scenario (until -3H) • Regulation (until -2H) • Mandatory Cherry Picking (MCP) • Short Term ATFM Measures (STAM) on ground flights (e.g. Flight Level-Capping, Horizontal Re-Routing, etc.) • Short Term ATFM Measures (STAM) on airborne flights (level-capping, speed adjustments, etc.)

Table 7: Summary of the timeframe of application of main DAC & INAP measures

3.3.1.1 Optimised Configurations

Regarding the current method to propose optimised configurations, it must be said that many of these configurations are still based on fixed airspace structures. These structures are the operational sectors designed based on fixed ATS routes. However, there are already some airspaces where free route is already implemented and it is expected that almost all the European airspace will be a Free Route Environment (FRA) by the end of 2024.

The proposed optimised configurations are determined by the availability of suitable human resources to control traffic within these configurations (e.g. ATCOs with appropriate licenses and ratings). This is one of the reasons why the configuration plan is made in a strategic phase, months before the day of operation. This configuration plan is made by crossing the forecasted demand for D-day with the sectors capacity threshold in order to determine the better way to open them and allocate the predicted traffic, while avoiding sectors overloads and distributing equally the workload between air traffic controllers.

Once the configurations plan is made it can suffer modifications according to changes in the situation (e.g. increase/decrease forecasted demand; increase/decrease of number of ATCOs, etc.) before the day of operation. Also, there can be changes even during the moment of operation, but these are rare changes, as DAC concept is not fully implemented nowadays (although, some ANSPs are already working with multiple layers in the vertical profile of an airspace volume, which is similar to VSAMS concept), and the configuration changes are considered in a more static way.

For more detailed information please consult the section §3.3.3 of the present document that compares the current operating method with the new proposed one.

3.3.1.2 INAP Demands & HotSpot Management

The demand measures are the following:

Demand Measure	Actors	Timeframe	Spots	Granularity
Coordinated modification of a flight plan	FMP, AU	Pre-tactical, Tactical Phase - Flight preparation	Hotspot	Flight
ATFM scenario	NM, FMP	Strategic, Pre-tactical and tactical phases	Hotspot	Flow
Regulation	FMP, NM	Pre-tactical & Tactical Phase	Hotspot	Flow
Regulation Mandatory Cherry Picking	FMP, NM	Tactical Phase	Hotspot	Set of flights

Short Term ATFM Measures on airborne flights (level-capping, horizontal re-routing, speed adjustment, etc.)	FMP, ATCO	Tactical Phase	Hotspot	Flight

Table 8: INAP catalogue of measures - previous operating method

Hotspot Management relies on the collection and dissemination by the NM of the forecast demand computed upon the filing repository and updated in real-time using Local Demand refinement performed by the FMP using up-to-date weather information and relevant historic data.

The FMP detects the hotspot and activates the appropriate measure based on his/her expertise, in coordination with the other actors.

It does not support:

- other category of spots, (refer to §2.6 for other spots definitions),
- hotspot monitoring (to detect hotspot resolution deviation).

3.3.2 New SESAR Operating Method

The new Operating Method introduces the DAC concept and extends the INAP concept in a perspective of an integrated DCB process.

In previous SESAR Operating Method, sectorisation and resolution of demand and capacity imbalances was performed independently, resulting in system inefficiencies which aimed to be improved. This integration of DAC within DCB bridges the gap in the DCB process performed by INAP actors and is made possible through suitable automation support and improved situational awareness.

The integration of DAC within DCB has three main objectives:

- first, to respond to local and network performances targets,
- then, to manage airspace configuration by accommodating traffic demand, solving complexity issues and balancing workload and optimizing resources,
- and finally, to serve as a support to DCB Measures implementation, in case the capacity measures issued from DAC process is not enough and requires to be complemented with demand measures.

The integration of DAC into DCB allows to optimally adapt the capacity to the demand and minimize demand adjustments. Integrated airspace solutions are obtained through an iterative optimisation and CDM processes focusing on local & sub-regional levels and involving regional levels. The full integration of DAC process within the DCB concept contributes to the Network performance through closer interaction between ATM operating phases, with consolidated and harmonised solutions integrated in the Planning and Execution phases at local, sub-regional and regional levels.

Different DCB phases can be distinguished according to the time horizon:

- Strategic process,
- Pre-tactical process,
- Tactical process,
- Post-Ops process.

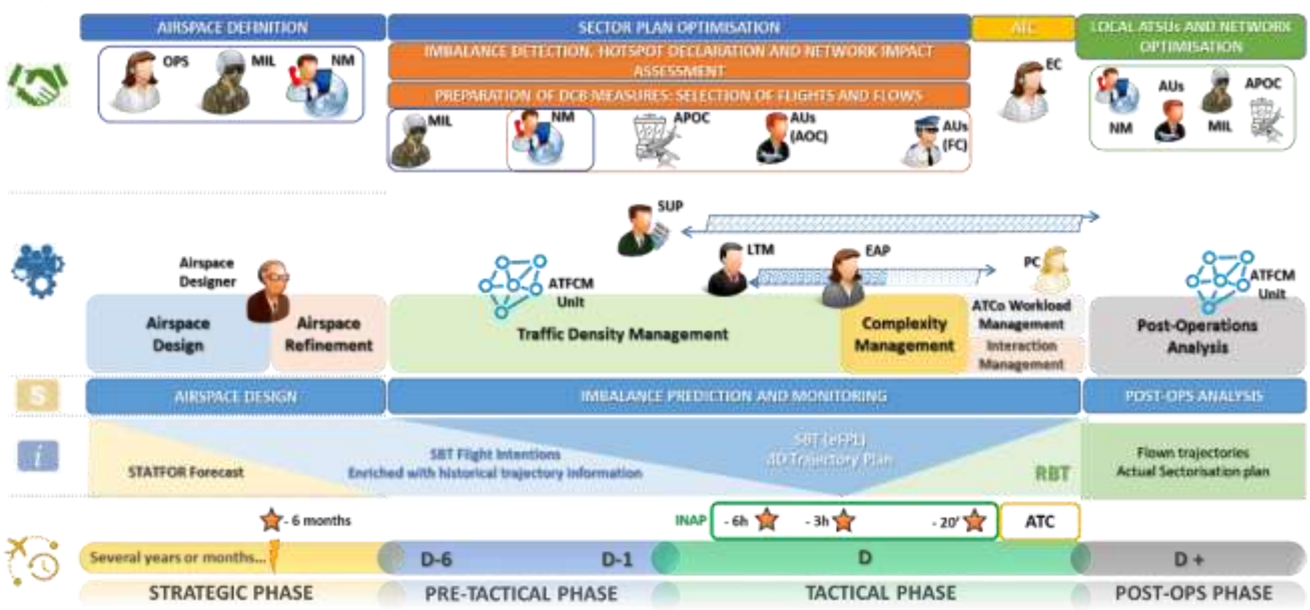

Figure 6. DCB integrated timeframe, schematic view

DAC concept is considered in this solution in the same way as presented in SESAR Solution 08.01, new operating method section [39], enhanced with seamless integration of pre-tactical and tactical DAC and the implementation of optimised configurations.

INAP concept is considered in this solution in the same way as presented in SESAR Solution 09, new operating method section [38], refined regarding INAP roles and extended to Capacity Management at tactical level.

The DCB strategy does not rely only on a consecutive implementation of a DAC measure and then of an ATFCM measure to resolve remaining imbalances; the integrated DCB processes, assisted by decision-support tools, enable to refine optimised combined solutions of the different DCB measures, depending on time horizon, optimisation criteria and performance targets.

In this context, INAP role acts as a collaborative framework where different stakeholders' needs and preferences are taken into consideration when deciding the most suitable solution to fix DCB and complexity issues. INAP environment enables common situation awareness and offers improved capabilities for complexity assessment and resolution, identifying contributing causes and proposing what-if/what-else functions to find adequate solutions, including airspace configuration, the primary option to avoid, if possible, measures on flows and trajectories.

In the INAP time horizon, Dynamic Airspace Configuration is a crucial task to assist Demand and Capacity Balancing activities; DAC is part of the toolset available to the DCB actors in INAP timeframe to manage complexity and facilitate users preferred routing, achieving specific performance objectives.

The way DAC is used within INAP role, focuses on the following topics:

- Managing Airspace Configuration to organise available capacity with the main objectives of
    - accommodating traffic demand, taking into defined performances targets and considering AUs requests and preferences,
    - solving the induced complexity issues,
    - balancing workload and optimizing resources,
    - combining DAC with demand measures such as STAM, predefined scenarios, etc. Once capacity has been optimized and if imbalances remain to be solved, INAP actors have to elaborate measures to manage remaining complexity problems. The elaboration of the solution may trigger a need for airspace re-configuration to fit with the new picture of the traffic distribution (e.g. level capping measures may lead to change the sectors configuration to balance the CWPs' workload): DAC will support this activity. DAC is not standing outside the solution design, but rather as an enabling element of this solution.

The new operating method is described as follows in the next chapters:

- Imbalance Prediction & Monitoring Service, with the new services: complexity, what-if, what-else,
- DCB spots management,
- DCB integrated catalogue of measures, included the new ones, such as Targeted CASA and optimized configurations,
- DCB RASCI matrix with roles definition,
- DCB Processes per time horizon,
    - Strategic
    - Pre-tactical
    - Tactical
    - Post-ops
- Links to stakeholders & dependencies,
    - NM
    - CDM
    - Cross Borders
    - NOP
- DCB Assessment Criteria.

3.3.2.1 Key concepts

3.3.2.1.1 Spot Management

Regardless the methodology used (as of today with Hourly Entry Counts (HEC) or OC (Occupancy Counts) and/or enriched with new indicators with weighted complexity, complexity…), the imbalances are characterized with Traffic Monitoring Values (TMV). These thresholds represent different objectives (safety, rate optimisation, critical & crisis situation ….) and are related to different meanings. In wave 1, several TMV features have been defined and correspond to different types of spot:

- **TMV-safety**: Initially introduced in SESAR1 with the peak and sustain thresholds. It aims at preventing excessive ATC workload and to ensure that the traffic delivered to ATC controllers will always be manageable in the safe limits of workload. It represents potential indications in term of controller workload, and implicitly potential safety risks. Today, TMV-safety are defined with two thresholds (peak, sustain). It defines the context of a safety potential issue in nominal situations marked out by a **Hotspo**t. Thus, a hotspot is triggered by TMV (safety marks) violation after LTM decision,
- **TMV-rate**: It aims at preventing bunch (without safety issue) and to ensure that the traffic delivered to ATC controllers will always be manageable in an organised and smoothed way. It aims also at providing room for better use of spare capacity. It defines the context of an optimisation issue marked out by an **Optispot**. Thus, an Optispot is triggered by TMV (rate marks) violation after LTM decision.

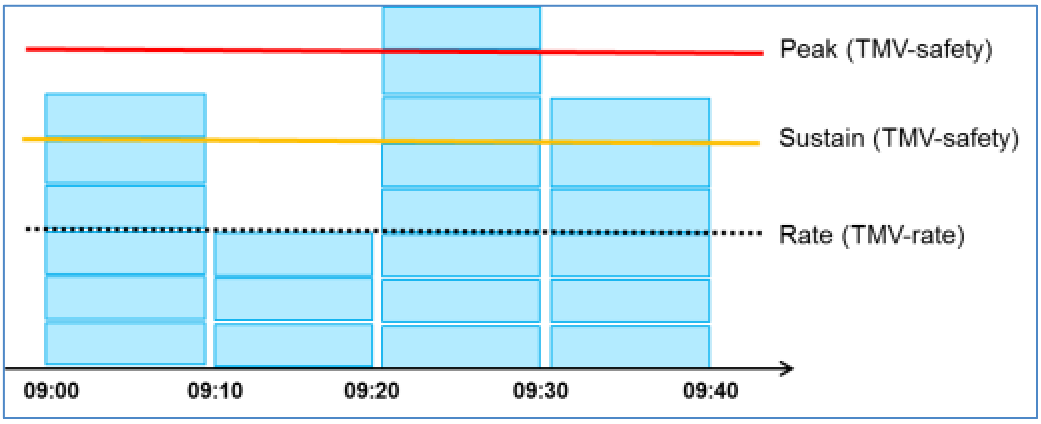

Figure 7. TMV for Hotspot Management

Thus, different categories of spots are considered. A spot attribute categorizes the problem to be managed: Hotspot and Optispot. In addition at network level a third spot is considered, the netSpot. Though this last one is not to be handled at local / sub-regional levels, collaboration is needed to ensure consistency and efficient solving. (refer to §2.6**Error! Reference source not found.** for definitions).

For each spot category, there is a corresponding Catalogue of Solutions.

3.3.2.1.2 Imbalance Prediction, Monitoring and Repository Services

Depending on the timeframe and related uncertainties, different imbalance prediction approaches are proposed to manage the different granularities and nature of demand-capacity imbalances. In addition, dedicated methodologies are proposed to detect the imbalances at the right level of granularity.

- **Traffic density management,** with the aim of managing that there are not too many flights in a particular traffic volume,
    - This is mainly based on count methodologies, such as Hourly or 20' Entry Counts and Occupancy Counts.
- **Traffic complexity management**, with the aim of managing that there is not too much complexity induced by the flights or flows within a particular traffic volume. Although the agreed timeframe for an effective complexity management has been framed in the [3h – 20min] time horizon, due to the air traffic volatility and related uncertainties, complexity information should be provided as soon as reliable data is available,
    - This relies on the different local complexity assessment methodologies implemented by each ANSP.
- **Traffic interaction management,** with the aim of managing that there are not too many interactions of a certain type (adapted to the local specificities of the Traffic Volume or flows under analysis),
    - This relies as well on local specificities and could be supported by ATC layer automated support tools, such as MTCD with an extended look-ahead horizon.
- **ATCO workload management,** with the aim of managing the controller workload in order to avoid mental overloads or ATCO performance impairment in at least the following three situations: when the ATCO is requested to implement a STAM measure by the EAP to solve a downstream hotspot; when a new unknown sectorisation is presented to the ATCO and the extra workload to understand the situation needs to be assessed; or when the traffic complexity in the Traffic Volume under the ATCO responsibility is too high that a safety issue may occur,
    - This envisages mainly the gathering of subjective controller workload estimations at the CWP, but may rely as well on predictive models that estimates the ATC actions to be performed by the ATCO for a given air traffic situation.
- **At pre-tactical and tactical phases, the Network Manager monitors the Network Loads** (netLoad) across the network and the evolution of the performance targets KPIs. This monitoring provides indication on the prediction of linked imbalance clusters and the emergence of a Network Spot (netSpot). A draft netSpot is identified by the Network Manager and shared with the concerned local actors (LTM) for coordination. The collaborative coordination process shall allow the concerned actors (i.e. NM and Local LTMs) to exchange information and to discuss the characteristics of the identified draft netSpot (list of actors, delineation, start time, end time, severity, etc…) resulting in the confirmation or not of the potential (i.e. draft) netSpot. During this collaborative process, in case of confirmation of the

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netSpot, the NM and the local LTMs shall collaboratively design a network solution for the identified DCB issue. When an agreement is reached amongst the actors, the NM shall publish the netSpot on the NOP to inform all NMF & AU stakeholders. After publication, the NM monitors the published netSpot continuously until its resolution,

These different methodologies are integrated in a seamless process to offer a continuous imbalance prediction and monitoring capability. In addition, each methodology should offer:

- Monitoring values, aiming at detecting the deviation between the measured traffic imbalance with regards to the traffic volume monitoring reference values. These monitoring values should be set on per sector basis based on the sustain/peak complexity/workload that an ATCO can accept obtained from expert judgment (LTM and ATCOs experience), human factors, simulations and historical data,
- Automated support to the INAP actors, meaning appropriate outputs that could be used as input by hotspot resolution and sector configuration optimization tools integrated into the INAP toolset.

Bearing in mind that count methodologies (Traffic Density Management) already exist and are integrated into the current ATFCM procedures and that supporting tools such as MTCD to predict conflicts (Traffic Interaction Management) are used within the tactical phase (partially out of INAP time horizon), PJ09-W2 activities further investigate the operating method with regards to the use of local traffic complexity information and the consolidation of local imbalances at network level along with the ATCO workload.

3.3.2.1.2.1 Traffic Monitoring Values

Regardless the methodology used for the prediction of imbalances by the Imbalance Prediction and Monitoring Service, the identification of imbalances and the declaration of local hotspots rely on the definition of appropriate traffic monitoring values or thresholds. The following monitoring values have been identified as needed:

- **Sector capacity**: meaning the maximum throughput per unit time (usually 60 min) that can be sustainable along that particular sector and unit time,
- **Occupancy Traffic Monitoring Values** (Peak and Sustained): with the aim of preventing excessive ATCO workload during peak or sustained periods that may lead to safety issues,
- **Complexity Monitoring Values**: with the aim of preventing periods of excessive complexity that could lead to safety issues (complexity peaks or high complexity values sustained along the time),
- **ATCO Workload Monitoring Values:** with the aim of preventing ATCO mental overloads originated by high traffic density, complexity peaks and or sectorisation changes.

In general terms, these traffic monitoring values usually are calculated in advance, at least the initial reference, by means of fast time simulations, analysis of historical data and operational staff support. However, the need for establishing monitoring values for non-predefined sectors, calculated both in advance or dynamically during the Tactical Phase, requires ANSPs to take advantage of the latest developments in the Artificial Intelligence and Machine Learning fields to be able to predict these thresholds and update them into the NOP (refer to §3.3.2.9).

3.3.2.1.2.2 Uncertainty

Demand uncertainty reflects the unknown demand forecast accuracy to be taken into account when predicting imbalances. Demand forecasts are generated at different time horizons to support decision making. These demand forecasts become more accurate and complete as getting closer to operation. However, it is important to have a measurement of the uncertainty in each timeframe, so to know how accurate and reliable traffic predictions are and decide on the best DCB actions to implement.

Demand predictions are a combination of information of aircrafts already airborne with flight plans of those which are not yet. As already explained, sectors have a maximum throughput per unit of time, indicated by its capacity. Demand and its associated uncertainty at each timeframe should be managed to determine whether it is above this sector capacity under study or not so as to set the most appropriate DCB measure. This could be both a sector configuration change or a demand measure. The actor in charge should decide which has the lesser impact.

Uncertainty is intrinsically related with the timeframe in which demand prediction is analysed. In the strategic phase, information is uncertain bynature, so DCB decisions are not based on uncertainty calculations. What is used is historical data and expert judgment. As time gets closer to operations, in the pre-tactical and tactical phase, the use of uncertainty becomes more relevant, since the selection of one DCB measure or the other to solve a potential imbalance should be based on several indicators among which uncertainty is one. Uncertainty becomes an important criterion.

Uncertainty should be presented to the DCB actor in the tool used to monitor the evolution of traffic. This tool should integrate an uncertainty calculator which accounts for the main sources of uncertainty:

- **Timeframe**: The timeframe of analysis is of the upmost importance, as in pre-tactical to tactical, much of the information available is still at the level of intentions, while in the tactical phase information is more accurate,
- **Type of spot**: The type of spot analysed will determine how relevant is the indicator of uncertainty in the decision making. In the cases of optispots, more flexibility is allowed than in the case of hotspots, in which safety is compromised,
- **Trajectory prediction uncertainty**: when computing trajectory predictions, many parameters are taken into accounts. Some of them are:
    - **Aircraft intentions**: difference between expected and current behaviour of the aircraft, based mainly on flight plan information.
    - **Meteorological conditions**: difference between predicted and real weather conditions.
    - **Modelling errors**: uncertainty derived from trajectory prediction modelling error.
    - **Flight technical errors**: inaccuracies in flight control, not possible to model or forecast.
- **Quality of the information:** the quality of the information received and used to compute uncertainty is of upmost importance as it is not the same to make calculations based on information automatically received than in information obtained from non-reliable sources.

Based on the uncertainty data of the different sources of information, the calculation is performed, accounting also for historical data, as they provide a valuable source of information on how the situation could evolve. The detailed process followed for its calculation will be detailed in future versions of the OSED.

The way to present the uncertainty information to the DCB actor relies on the specific needs of each ANSP. It could be presented as a percentage in a 0 to 100% scale, where 0% indicates no uncertainty and 100% total uncertainty. Another option is to use a colour scale with 3 ranges, in the sort of a "traffic-light", where green indicates low uncertainty, yellow medium uncertainty and red, high uncertainty. The presentation of the uncertainty will be adapted to the available tool in each ANSP, although its calculation remains similar to ensure coherency across ANSPs.

Uncertainty impacts the quality of the assessments performed, as well as the representatives of the different metrics to be used by the DCB actor in action at the phase under analysis. Its use is very important in the decision-making process performed in the what-if function. (refer to §3.3.2.1.4).

3.3.2.1.2.3 Imbalance Repository Service

ANSPs identify local imbalances based on their local methodologies (entry/occupancy counts, complexity). These local imbalances are shared with NM and need consolidation to assess the imbalance situation at network level. To ensure the interoperability of the local methodologies, it is proposed to consider the severity value of the imbalances as elements to be shared.

To support such capability, an imbalance repository is developed to collect all the local imbalances figures from ANSPs. This Imbalance Repository Service aggregates the local imbalance figures in order to provide a consolidated network imbalance view.

3.3.2.1.3 DCB Catalogue of measures within INAP timeframe

The catalogue of DCB measures presented in the table below completes the INAP measures presented in previous operating method (§3.3.1.2). The catalogue has been developed with PJ09.02 Wave 1 and is completed and refined within the work of PJ.09-W2-44 solution with Targeted CASA regulation & optimised configurations. These two measures are detailed in next paragraphs.

The table is to be read as follows : In time Horizon columns, when cells are greyed, it means that the DCB Measure is applicable.

DCB MEASURE at INAP TIMEFRAME	DEFINITION	APPLICATION	TIME HORIZON				ACTOR
			H-6h to H-3h	H-3h to H-2h	H-2h to H-40'	H-40' to H-20'	
Dynamic Airspace Configuration	Before resorting other measures, the LTM tries to adjust capacity values at short-notice to absorb the upcoming traffic overload (Capacity measure). The dynamic optimisation of the capacity within the ACC can be	Group of Sectors					LTM

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DCB MEASURE at INAP TIMEFRAME	DEFINITION	APPLICATION	TIME HORIZON				ACTOR
			H-6h to H-3h	H-3h to H-2h	H-2h to H-40'	H-40' to H-20'	
	done through a temporary sector configuration change						
CTOT	CTOT (Calculated Take-Off Time): Delay incurred on the ground, either at the gate or on the taxiway. A time calculated backward (only in case of TTA/TTO) by NM and still managed as a departure constraint [-5,+10].	Individual Flights					LTM via NM
Ground Level Capping (A/C ON GROUND)	Measure limiting the highest flight level that can be flight planned. The Level Capping is used for offloading an overloaded sector by transferring the excess of flights into a lower loaded sector or to solve a peak of complexity.	Flows/Individual Flights					LTM via NM
Re-routing/ Re-filing (FPL Modification)	*Re-Filing: measure which requires to re-file an alternate route/flight level in order to resolve ATC capacity problems and minimise delays (always 2 hours before the EOBT). *Re-Rerouting: same measure but after 2H before EOBT should be coordinated with the FOC.	Flows/Individual Flights	Re-filing (up to 2 hours before the EOBT)	Re-filing (up to 2 hours before the EOBT)	Re-routing	Re-routing	AU
Ground Delay	Allocation of a small delay that can be assimilated to targeted ground regulation (Pseudo-CTOT): slot allocation on selected flights. The flight is assigned a pseudo CTOT that is forced into the slot list and has the same characteristics as a current CASA slot: slot tolerance window of [-5min;+10min].	Individual Flights					LTM via NM

DCB MEASURE at INAP TIMEFRAME	DEFINITION	APPLICATION	TIME HORIZON				ACTOR
			H-6h to H-3h	H-3h to H-2h	H-2h to H-40'	H-40' to H-20'	
Take-Off Not Before	Small ground delays to targeted flights valid until a given time. Afterwards the flight is not constrained on departure time.	Individual Flights					LTM via NM
Take-Off Not After	Departure time constraint after a given time: until the specified time, the flight is not constrained on departure time but afterwards will be constrained.	Individual Flights					LTM via NM
MDI/ ADI	*MDI (Minimum Departure Interval): Sequencing specific flights on ground by applying minimum departure time intervals. Measure for flows. The MDI is a minimum time separation implying a small ground delay to some flights *ADI (Average Departure Interval): Same as MDI but not minimum departure interval constraints.	Flows					LTM
TTA	TTA (Target Time of Arrival at congested Airport): DCB Planning Constraint set on the Time of Entry of flights into an airport hotspot during the SBT phase to smooth the traffic.	Individual Flights					LTM/EAP via NM
TTO	TTO (Target Time Over the congested E/R point): DCB Planning Constraint set on the Time of Entry of flights over a specific WP during the SBT phase to smooth the traffic.	Individual Flights					LTM/EAP via NM
MIT	MIT (Miles-In-Trail) is used when a LTM identifies a problematic flow crossing a sector (i.e. LFPG departures) and requests delivery at defined regular intervals (such as 10	Flows				speed regulation	LTM

DCB MEASURE at INAP TIMEFRAME	DEFINITION	APPLICATION	TIME HORIZON				ACTOR
			H-6h to H-3h	H-3h to H-2h	H-2h to H-40'	H-40' to H-20'	
	miles) for a short period of time. It is a procedure where a stream of traffic with same direction and at same cruising flight level is imposed to maintain the same speed/mach number						
Air Level Capping (A/C ON AIR)	Measure limiting the highest flight level that can fly during the RBT phase. The Level Capping is used for offloading an overloaded sector by transferring the excess of flights into a lower loaded sector or to solve a peak of complexity.	Individual Flights					LTM or EAP via ATC
DPI Sequence	Departure planning information (DPI). Messages exchanged between a CDM airport and ETFMS giving a target take off time, taxi-time, aircraft type/registration and SID	Individual Flights					NM and AOP
Speed Regulation/ TTL/ TTG/Holding	*Speed Regulation: Speed constraints on airborne flights are applied directly by the ATC. *TTL/TTG : time measurements to support the building of a sequence following the required spacing between an aircraft and an area/point. *Holding: The length of time that the aircraft should maintain track on the inbound leg of the holding pattern	Individual Flights					ATC (with or without EAP)
tTTA	tTTA (tactical Target Time at the Arrival) are similar to TTA measures but provided during the RBT revision phase for arrival streams	Individual Flights					EAP via ATC
tTTo	tTTO (tactical Target Time Over) are similar to TTO measures but	Individual Flights					EAP via ATC

DCB MEASURE at INAP TIMEFRAME	DEFINITION	APPLICATION	TIME HORIZON				ACTOR
			H-6h to H-3h	H-3h to H-2h	H-2h to H-40'	H-40' to H-20'	
	provided during the RBT revision phase						

Figure 8. DCB measures within INAP timeframe

3.3.2.1.3.1 Targeted CASA regulation

Targeted CASA regulations are a DCB measure that mitigates the impact of current CASA regulations and thus reduces the number of minutes of delay at Traffic Volume and Network level, as well as the number of flights affected by the measures applied. The process described hereafter assumes that regulations are managed as per now, i.e. CTOT at departure.

It includes workflows required for ACC LTMs to electronically coordinate CASA regulations, that are limited to specific flows, with the NM. The NMOC performs a network impact assessment before approving the regulation request. The NM infrastructure is used for the coordination (B2B service) mechanism and to distribute the resulting flight planning updates across the network.

3.3.2.1.3.2 Optimised configurations based on capacity and demand measures

One of the key elements of Demand and Capacity Balance (DCB) process is the Dynamic Airspace Configurations (DAC), another process whose objective is to adjust the airspace capacity to traffic demand needs.

DAC concept adapts capacity to demand through the design and proposal of the sector configuration which offer the best response to a set of performance criteria, looking for the best possible configuration according to different ***constrains*** and ***optimisation criteria***. In order to maximise the flexibility of the airspace design to achieve the performance targets, DAC concept develops a DAC Toolbox (see detailed operating method in section 3.2.1.1.1), which develops the sector design and configuration, human factors and automation axis.

A set of different optimisation criteria can be considered for the proposition of the best configuration possible. In the following, some of these criteria are summarised:

- **Sector Imbalance thresholds**. There is a need to establish a threshold value above which the ATCO in charge of the sector cannot operate it in a safely manner,
- **Flows crossing the airspace.** It is necessary to identify the main flows that cross the airspace, so the design of sectors and configurations is done according to these flows. In this way,

sectors shape will try to follow the main flows direction and, if possible, their borders will avoid crossing them, prioritising this design criterion as one of the most important ones.

All of these parameters should be considered in a sector configuration algorithm, which will integrate a set of sector design and configuration (SD&C) criteria (see detailed operating method in section 3.3.2.1.3.2.2) to propose the optimal configuration.

Each ANSP shall decide the level of SD&C granularity (refer to §3.3.2.4.2.1), the automation level and the training features that best fit its needs and built its own DAC environment, whatever the selection of the DAC tool elements they select, they shall respect a number of constraints:

- **Availability of human resources to provide the ATS**, especially the availability of air traffic controllers. Generally, in an en-route environment, two ATCOs control each opened sector, an executive and a planner air traffic controller. On many occasions, when demand surpasses capacity, even with a more dynamic and finer design of airspace sectors, it is not possible to meet the new demand because of the deficient amount of human resources. Additionally, licensing and proficiency requirements may limit a more flexible allocation of ATCOs within ATSUs. This could be mitigated by, e.g. non-geographic sector validations. Complementarily, the lack on human resources could be solved with the delegation of airspace among ATSUs, which would allow a more efficient use of ATCOs and the opening of a greater number of sectors. This last concept is being developed in SESAR Wave 2 solution 93,
- **The delineation of the sector boundaries to optimise the use of the airspace.** The effectiveness of the proposed DAC configurations for allocating the current traffic demand is constricted by the external boundaries of the airspace where the DAC concept is applied. These boundaries limit the optimal design of sectors' shape, with borders that might cut flows unnecessarily. FAB (Functional Airspace Blocks) concept is related to this constraint. The restructuration of the airspace in functional blocks could help to mitigate this problem, as the external borders between ACC will be more operationally appropriated and not just responding to country borders,
- **The Human Factor** will determine the usability of the proposed configurations, in addition to the monitoring and optimisation of the number of movements or the required resources estimated for a sector configuration plan, there are a number of human factor related aspects that should be considered and derived in operational constraints. Firstly, there is a need to ensure that the airspace design can be safely managed by the human operator, what may derive in setting different constraints related to the shape, time duration, or level of granularity of the airspace configuration; secondly, there is a need to identify and develop ATCO competences in an ATCO training curricula and set a procedure to acquire, maintain and update the existing ATCO certificates.

However, as it is said before, DAC processes do not always solve the problem of capacity and demand balancing or the solution uniquely based on capacity measures is not necessarily the best one in terms of safety, capacity, cost efficiency or human Performance. The simpler example of this situation would be when there is no possibility to open another sector to accommodate the demand. Other examples are the following situations:

- When a demand measure would save significant ATCO resources with a minimum impact on trajectory,
- When a capacity measure would lead to additional demand measure but with less impacts on AUs and ATFCM delay,
- When the most optimal sector configuration encompasses complex or non-standard airspace configurations (with a consequent impact on safety) and which could be avoided if a demand measure is applied.

In these three cases, a combination of demand and capacity measures are necessary. Some of the demand measures could lead to changes in the traffic demand in a regional, sub-regional and/or at local level.

Combined used of Capacity and Demand measures will attend to the achievement of a local and Network performance (see detailed KPA/KPI Assessment criteria in section §3.3.2.10), amongst them, it is important to have in mind, the application of demand or capacity measures that minimises AU impact, so the latter impact is the most transparent possible for the users. Because of this, it would be preferable to solve the detected demand and capacity imbalances, together with the improvement of performance levels, by integrating the different demand and capacity measures into one unique solution and by assessing the impact of those combined measures into local and network performance indicators, trying to implement the best possible solution.

Also in this situation, there could be a group of configurations that are more suitable for applying a concrete group of ATFCM measures. For example, the application of a STAM measure such as level capping could be more useful with a configuration that divides the airspace into upper and lower sectors, trying to balance the workload between ATCOs and avoiding unnecessary coordination between them. Hence, these optimised configurations will be based on both capacity and demand measures, and will represent a deeper integration and combination of those measures (see section §3.3.2.4.2 for further detail).

3.3.2.1.3.2.1 Guidelines for Airspace Building Blocks and Configured Sectors

DAC Toolbox includes several types of Airspace Structures, namely Elementary Sector (ES), Sharable Airspace Block (SAB), Sharable Airspace Module (SAM), etc. A set of design guidelines are identified to ensure the ***usability*** and ***maximum effectiveness*** of these structures. These design guidelines have been identified as useful in PJ08 validation results [42] and in the COTTON SESAR Exploratory Research Project [45][46].

- When designing airspace structures, or consolidating Configured Sectors based on the combination of structures, there is a number of sector shape aspects whose evaluation will facilitate the building of usable and efficient airspace structures:
    - Achieving certain values of ***Convexity*** might favour minimising the number of re-entering flights in a Configured Sector. Therefore, it is recommended that airspace structures are convex,

- It will be desirable having ***airspace structures following the directions of the main flows they contain*** as this will reduce the number of coordination with collateral controllers,
- As there must be a ***minimum distance between sector boundaries to the areas where major interacting flights happen*** to allow the ATCO conflict resolution and proper coordination, it is recommended that the boundaries of the airspace structures keeps a minimum distance to major interacting areas,
- It will be desirable that airspace structures allow enough vertical cuts to ***minimise Balconies*** (i.e. several lower and/or upper levels within a Configured Sector) and favour the same lower and/or upper level in collateral sectors,
- ***Interacting flows should be contained within the same airspace structure*** in order to avoid coordination and ensure safety. Building the airspace structures around identified areas where flows interact will ensure that interacting areas are not crossed by sector boundaries. These criteria can lead to undesired results of the application of the criteria in high traffic density scenarios because an automatic design tool may propose many airspace divisions in a low traffic density area and no divisions at all in a high traffic density area. For this reason, it is recommended to fine tune the interacting area according to the traffic density of the geographical area,
- Although airspace structure boundaries shall be built following traffic flows, the boundaries of the configured sectors should be smooth, for this reason, once the airspace structure definition based on traffic flows is achieved, a review process will be carried out to ensure that the configured sectors using them will have boundaries as smooth as possible,
- Configured Sectors’ design can be improved by implementing vertical cuts at the same levels to all the airspace structures in order to avoid configuring sectors with different low or upper levels and balconies.

- **Characterising Airspace Structures** based on the traffic flows contained on them will facilitate the sector design and configuration process, this would allow estimating how easily they can be integrated to consolidate Configured Sectors, for example those containing same or interacting flows will be easily integrated.
    - Traffic flows could be characterised (evolving-cruise, density, origin/destination, uncertainty, converging) in order to help the characterisation to the volume (potentially implied procedures or expertise),
    - Historical data could support/update this characterisation, which may support airspace designers’ decision making to select the most optimal configuration as well as the workload implied by a change,
    - Report on sector usability might be requested to the ATCO after a shift in order to collect data related to the sector usability, which may support refinement of the structures.

3.3.2.1.3.2.2 Criteria to look for the Sector Configuration satisfying the performance targets

Once the pieces of the airspace have been defined using the guidelines established in the previous section, these pieces must be used to define a sector configuration, which shall provide the needed capacity (according to the traffic demand) while satisfying in the best manner the achievement of a set of performance targets and operational constraints. The identification of the needed performance targets and constraints as well as the prioritisation of their fulfilment will depend on the ANSP business strategies.

Afterwards, a set of potential criteria to be considered in the sector configuration process is provided. Each of the criterion may persecute one out of the three different goals: achieve a better demand and capacity balance; improve ATM performance; or ensure sector configuration operational feasibility (e.g. comply with regulations or account for resource management constraints). But, of course, when selecting the criteria, the set of selected criteria should address the three goals.

The technical solution to implement them might be through optimisation algorithms or using machine learning methods. In any case, each ANSP may decide which selection of criteria best reflects its business strategy:

- **Maximum number of ATCO** that could be used during a specific period. This is obviously related to the number of opened sectors, which can also be treated as a different criterion in case the ANSP strategy is to minimize the number of sectors but not only. A strategy could also be to use a number of ATCOs below the maximum at a given time of the day in order to keep the maximum number of ATCOs available a little bit later (for instance half an hour when a peak of traffic is observed),

- **Minimum period of sectorisation**, which is the time where the sectorisation is active and there are no changes. This criterion is very related to the situational awareness of the ATCO,

- Related to the previous point, it is necessary to have **an impact measure**, which shall quantify the impact that a sector configuration change will have comparing with any other measure,
- **Complexity**. Sector configuration shall be optimised according to the predicted complexity based upon the demand prediction and other elements (e.g. traffic factors, airspace factors, weather factors) in a certain period. (see also 3.3.2.1.6),
- **Underloads**. In some cases, sector configuration algorithms are optimised to reduce the number and the duration of overloads, but some projects have demonstrated that this optimisation can produce underload periods where the capacity is over dimensioned. For this reason, it is strongly necessary to consider not only overloads but also underloads to optimise the sector configuration based on the forecast demand,
- **Flight duration within the sector** shall be evaluated to minimise short-time crossings,
- **Narrow shapes** are demonstrated not being beneficial for situational awareness as require changes of attention around different geographical areas,
- Moreover, **screen visualisation of the configured sectors** shall be considered in order to improve the ATCO situational awareness,
- The **number of conflict areas** to which the ATCO will have to pay attention shall be limited. Moreover, potential conflicts shall not be close to the sector borders in order to produce a seamless coordination between adjacent sectors or ACCs,
- **Vertical and horizontal size of the Configured Sectors** should be sufficient to allow a minimum flight crossing duration and a minimum volume/space to solve conflicts,

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- **Procedures**. The optimisation of sectorisations shall include standard procedures, such as SID or STARS, as well as coordination between sectors and LoAs between ACCs,
- **Impact of DCB measures**. The optimisation of sector configuration shall lead to lower the impact of DCB measures. It should be notice that this impact is also included and considered in some of the previous criteria, such as in complexity, flight duration within the sector, etc.

In addition to these criteria, it would be important to implement an additional input that would take into consideration the ATCO feedback of previous implemented configurations. This way, in case of machine learning based algorithm, it will learn about the usability of previous sectorisations and be able to refine the proposed ones in future usage.

3.3.2.1.3.2.3 Airspace Configuration based on flows

When designing airspace sectors, it is preferable that they follow the directions of the main flows that cross said airspace. The same happens when planning airspace configurations to be implemented. When proposing a new sector configuration, those sectors should adapt to the existing flows, thus minimizing possible re-entries and short-crossings (i.e. flights within the sector for less than X seconds, X being the number of seconds below which the ATC procedures consider it is not worth to transfer the aircraft), together with reducing the number of coordinations that must be done between collateral air traffic controllers.

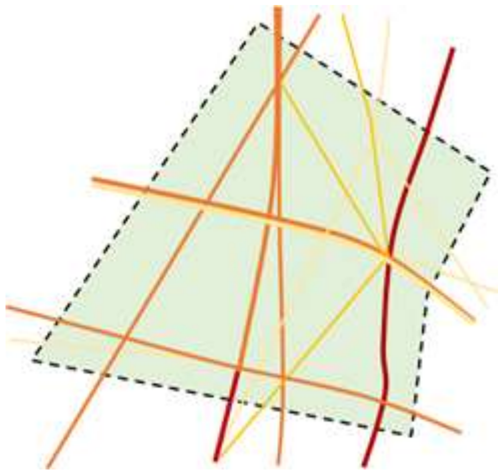

Figure 9. Schematic view of a sector and crossing flows

Therefore, airspace configuration process, along with sectors' shape design, should be based on the direction of main flows, not only in the horizontal plane, as shown in the figure above, but also in the vertical plane, following the same principles.

A change in the direction of some of the main flows and/or an appearance of a new main flow is very likely to cause a change in the sectors' borders that conform the current configuration. This adjustment to the new flows could be performed through multiple design options. For example, the new implemented Configured Sectors could be made from the same Airspace Block (AB) already used in the previous configuration, but now using different combinations of SAMs, or those Configured Sectors

(CS) could be made from totally different AB. In any case, the new sectors would be better adapted to the new flows and the best solution possible from a DCB and performance perspective.

This last idea is represented in the figure below, in which different sector configurations are proposed. Also in this figure, the flows crossing the airspace can be observed and are classified using a colour scale according to the amount of traffic demand they contain (the darker the colour, the more important the flow is). The first sector configuration, at time t - i, is the previous sector configuration that is well adapted to the main flows contained inside the airspace. Nonetheless, at time t, this configuration is no longer the best adapted one, since the two main flows (coloured in red) have changed their directions. The change in direction of flows should be predicted with enough time before time t, such that a new configuration (the t+i configuration in Figure 9) can be implemented in a timely manner and the traffic flows can be managed effectively.

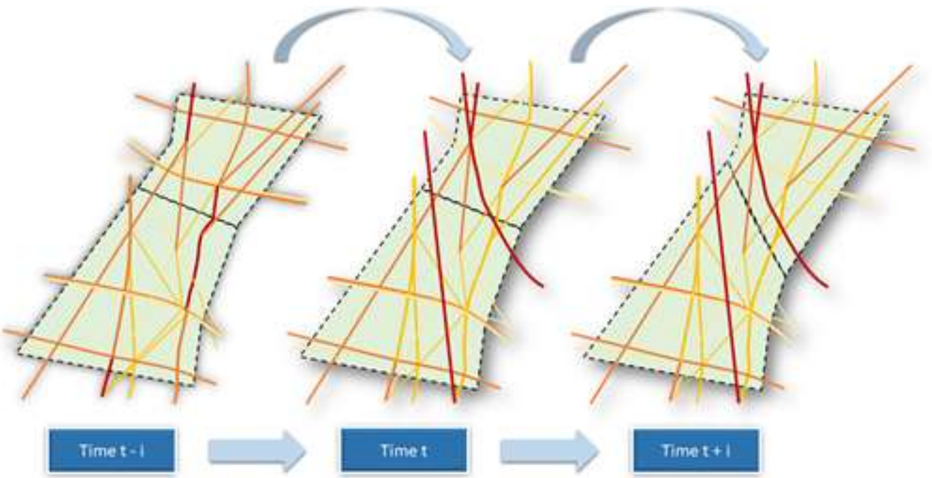

Figure 10. Schematic views of a sector configuration and main flows evolution through time

3.3.2.1.3.2.4 Identification of Constraints and flows prioritisation feeding DAC

As mentioned before in the previous sections, an identification of the constraints affecting DAC processes must be performed in the different time horizon phases, where these limitations might not be the same or at least not so critical depending on the considered phase.

In a strategic phase, that is years to months before D day, the constraints regarding DAC processes should not be that critical as there is more time to solve or mitigate the unfavourable conditions. In this phase, limitations such as external sector boundaries should be dealt with, trying to minimize their negative impact in DAC sector configuration effectiveness and optimising the use of the airspace.

Regarding this last limitation, years before the operation, when the sectors and configurations are not even designed, a modification or adjustment of the external borders of the airspace at issue could be performed and should be studied. At this time, external borders should not be considered as an actual limitation since they can be modified in this time horizon. This boundaries change should be made according to operational needs and following the main flows that cross said airspace.

Furthermore, other concepts like FAB concept would help to improve this situation by organising the airspace responding to operational requirements and not to political borders and enhancing cooperation among air navigation service providers.

Although this sector boundary problems could be solved in the strategic phase, sometimes it is not possible. In this case, sector borders become a constraint to consider also in this strategic phase, especially months before the operation, when designing sectors and sector configurations.

Additionally, despite not being an actual limitation of this phase, the availability of ATC human resources must be considered when deciding how many air traffic controllers to train and have according to the control needs. Since this training must be done in the strategic phase, from years to months before the operation day, how well it is done will determine how critical this constraint will be in the next phases.

Also, in this strategic phase, it should be decided and updated the procedures for maintaining and acquiring ATCO licenses. Since DAC concept implies a new operating method, where sectors will be more flexible and changeable, this will lead, very likely, to new licencing requirements, where the current regulations regarding ATCO licenses will be no longer applicable. This issue is further developed in SESAR solution 73.

Another constraint to have in mind in this time horizon, is the usability of sector configurations regarding Human Performance to guarantee the ATC resources can perform their tasks in a safe manner. This usability will condition the designing process of sectors' shape.

In the pre-tactical and tactical phase, the three previously mentioned limitations are now considered more critical constraints and will affect the configurations plan directly.

Figure 11. Configurations Plan constraints

In those timeframes, if the external borders are not operational feasible the benefits from implementing DAC concept will be reduced. A considered bad boundary would be the one that does not respond to the main flows, thus producing different short-crossings and more coordination between the air traffic controllers of collateral sectors, which increases their workload unnecessarily.

In a similar way, the number of traffic controllers will determine the sector configuration proposed in these time horizons. Currently and most probably, during the first phases of DAC implementation, these ATCOs need to have the right license to control the sector in question. To maintain and acquire this license the air traffic controllers should guarantee they know well said sector. If there are not enough ATCOs, the number of opened sectors could be restricted, limiting the capacity, and potentially leading to penalising demand measures with delays, and/or horizontal/vertical reroute as consequences. Also, as proposed in SESAR solution 93, a delegation of airspace between ATSUs could be made to solve the problem of lacking ATC resources and to optimise the use of said resources.

The Human Factor is also a vital constraint. Especially the usability of configurations in terms of sector shape, time duration and the level of granularity. In pre-tactical and tactical phases most of the sectors will be already designed. Nonetheless, in these phases, a change of sectors' borders, by adding different SAMs, could modify the previous sectors. While changing these sectors, the usability of the new composed sectors must always be considered.

Also, the time duration of a configuration will define the usability of that configuration. Having a sector configuration open for a very short period of time will not be operationally feasible, since the implementation of this configuration involves two sector configuration changes that produce a greater workload for the ATCOs. Therefore, the benefits of applying such configuration does not compensate the increase of workload.

On the other hand, the main flows feeding the airspace at issue must be considered in DAC sector configuration process. There will be some flows that are considered more important from the perspective of aircraft number and/or for their impact in other main flows and in local/network performance levels. These flows could be identified at a sectors level or at a FAB level, that is, at local or sub-regional level, respectively.

Once the most important flows are identified, the applied sector configurations, together with the demand measures, should try not to disturb those flows, avoiding delaying them or re-routing them. This means there will be a prioritisation of certain flows with respect to others considered less relevant. The latter flows will be consequently more affected by the needed measures to balance demand and capacity. All these considerations should be included in the optimisation algorithm criteria in order to propose the best sector configuration.

3.3.2.1.3.2.5 Optimised Configuration as a result of predicted trajectories and based on WL/ATCO availability

Looking for an optimisation of airspace based on workload and ATCO availability, it is proposed an optimisation process, which would take place at the pre-tactical phase (DAC short term to execution as referred in PJ08.01 OSED, i.e. days to hours before the relevant flights occur to the actual flight) for those sector configurations previously defined during the long term and medium term time horizons. The proposed process is based on using the trajectories prediction **to estimate indicators which characterise the needed capacity.** As part of it, complexity generators can be used to compute an indicator per sector, which ranks the usability of the sector. Then the idea is that in using this information within the sector configuration process we are able to achieve balance of the usability indicators considering ATCO resource availability.

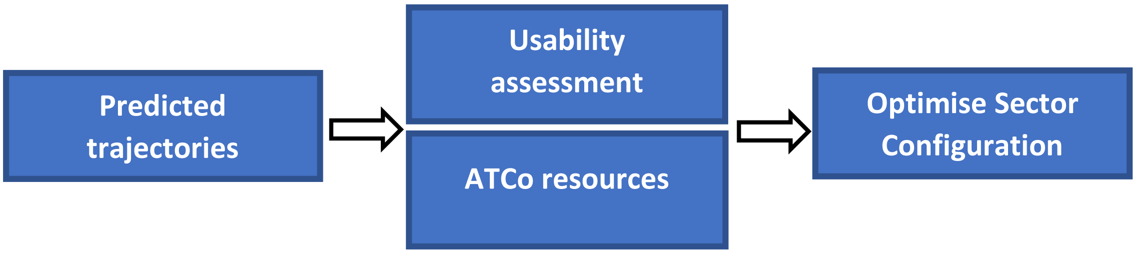

Figure 12. Outline of the process.

Sector optimisation process starts from a specific airspace in which a sector configuration has been established. The goal would be revising this configuration based on the available flight trajectory forecast (see Solution 45) and its expected impact on ATCO workload and consequently on usability. Therefore, as input for this optimisation, information for the Traffic Demand Forecast (TDF) is required.

The result of this process needs to be assessed together with the result of the ATCO resource management process. It must be noted that ATCO Resource availability information is normally known and established at this timeframe, unless unexpected availability of an ATCO.

The TDF will be more accurate as the operation time approaches. The used forecast will be, depending on the stage, initial (i-TDF), updated (u-TDF), actual (a-TDF) and post-forecast (p-TDF), as Solution 45 establishes. For optimisation processes, it shall consider the first three.

- Initial TDF (i-TDF), which is based on the distribution of the major air traffic flows and it is composed by initial Predicted Flight Instance (PREFI). This prediction is provided by an AI model using historical data and external parameters,
- Update TDF (u-TDF), i-TDF is updated with an ML integration, confirmed airport schedules, especial purposes, civil and military airspace reserves, NOTAM and ANSP and ATFCM measures,
- Actual TDF (a-TDF), which integrates FPL from Airspace Users and pre-tactical measures from FMP/EAP. This stage is less important for the process than the other ones, because, by the time this forecast is made, the optimisation should be done in order to provide the information and integrate it in this forecast.

Therefore, to attain a forecast with enough certainty to obtain an efficient optimisation performance, historical data and external parameters are needed such as military activities, weather data, airport schedules, NOTAMs, ANSP and ATFCM measures, airspace reserves and special events.

Once the predicted trajectories are processed, an Assessment Process is launched to evaluate the usability of the proposed sector configuration considering a set of factors mentioned in the following paragraphs.

The first step is detecting potential Cognitive Complexity Generators by means of the predicted short-term trajectories. Once they have been detected, their impact on the workload of assigned ATCO (or expected to be assigned) to that studied airspace is evaluated, considering the location and the type of each conflict. Some examples of complexity generators that could be used are interaction between standard flows, out-of-standard flights, evolving flights or potential crossings, or sector shape complexity factors (see COTTON D2.2 for further information about complexity generators that could be used). Other complexity factor to consider could be a geometrical comparison between the sector shape and the trajectory.

Other factor that affects to the controller's workload is the number of trajectories in a sector in terms of the more or less coordination between controllers of different sectors. Therefore, as the previous one, this value shall be considered in order to optimise the airspace. As a combination of the previous factors, a usability value can be given each sector by an algorithm. In order to clarify concepts, it is provided the following image.

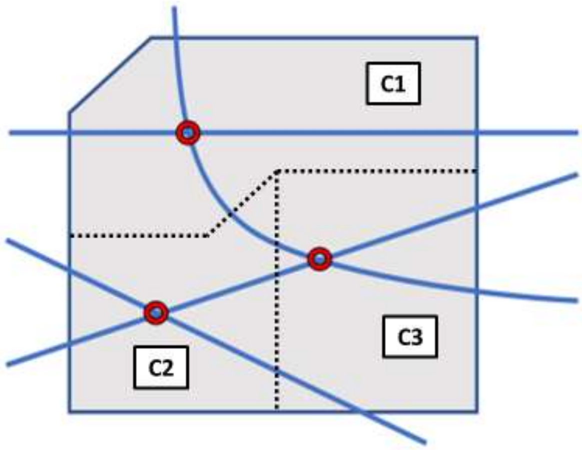

Figure 13. Usability value allocated to each sector.

As we can see in the picture 13, some values have been given to each sector. These values are those usability values that are result of the combination of: complexity metrics, number of coordination communications based on the trajectories that cross a sector and workload produced by short trajectories in each sector.

An estimation of the time needed to resolve all the conflicts in each sector could be another complexity generator.

Considering the previous values, it shall be obtained an estimated value that expresses the suitability of the proposed sector configuration. Based on it, it is pretended to achieve an optimal sector configuration by transforming those sectors that were set up in long-term and by using the tools specified in 3.3.2.1.3.2.1. The objective is to get a split airspace in which the combination of sectors has the most possible balanced combination of that value mentioned in this paragraph, i.e. controller's workload is the same for the new optimised sectors.

These modifications would favour an increment of the size of sectors with less workload, getting more workload, and a reduction of those with more workload, giving workload to the others. This optimisation allows an optimal split airspace from the point of view of ATC workload.

Nevertheless, the process shall be different depending on the time horizons. Due to the ATCO availability, the optimisation method should serve to support the identification of appropriate measures to achieve the most possible balanced distribution of workload amongst the available controllers.

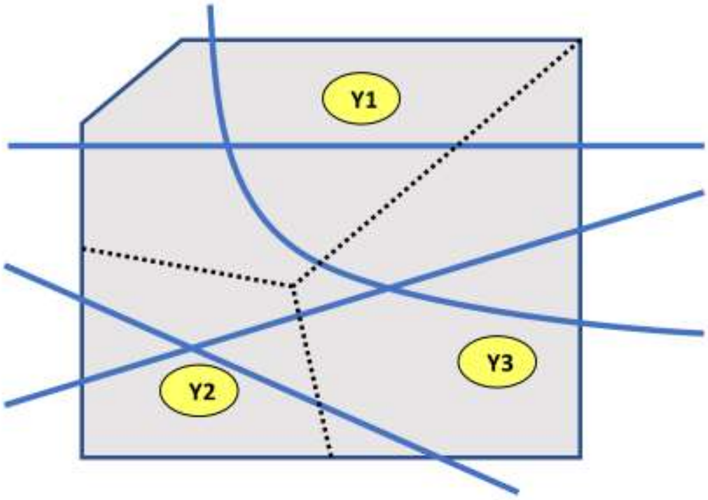

Figure 14. New optimised sectors, where the usability values (Y1, Y2, Y3) would be balanced

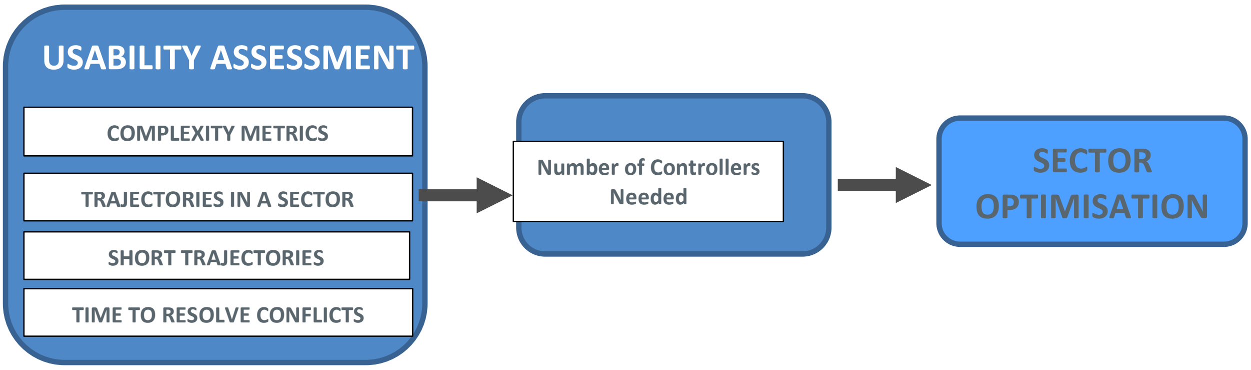

Figure 15. Sector Optimisation Process

Since the basis of the optimisation is a previously established configuration, the number of sectors is already fixed, so the modification measures are limited. it is necessary to distinguish between optimisations that are made in pre-tactical and tactical phases.

The measures that can be made in pre-tactical to manage the optimisation are:

- Modifications in the horizontal boundaries of the sectors to reassign trajectories/flows from one sector to another to balance the workload in the studied airspace,
- Modifications in the vertical limits of the sectors with the same previous objective,
- Split sectors if the change in the required resource can be matched by the available resources. This would suppose a less change awareness for controllers,
- Merge sectors to mitigate the excess of planned capacity with regards to the demand,
- Review of ATCO roster shall be done considering regulatory standards (maximum shift duration, minimum break, etc.) and the restrictions imposed to keep their licenses,
- The technical objective of these measures is to obtain the most balanced values of expected workload between sectors without the need to apply a demand measure.

During tactical period, there is a sure input of what the ATCO availability will be. Therefore, the flexibility is even lower and the modifications to be made will be final ones. The measures that the process can carry out in tactical are:

- Changes in the horizontal boundaries of the sectors to reassign trajectories/flows from one sector to another to balance the workload in the analysed airspace based on a fixed availability value,
- Changes in the vertical limits of the sectors with the same previous objective and considering the fixed availability values,
- Changes in both vertical and horizontal limits of the sectors, that is, a combination of the two previous points, with the same objective and consider the fixed availability values. So that, part of a sector may become part of another, based on a flight level and specific geographical coordinates,
- Fine tune sector configuration plan by identifying the best moment to implement a sector configuration change, in order to have the least impact possible on ATCO awareness,
- Assess combination of demand and capacity measures, as it will be developed lately, in order to ensure the changes will be positives in an overall environment,
- Reassessment of a configuration due to unexpected reduction of availability of resources.

The technical objective of these modifications is balancing the comparison between number of available controllers and needed controllers. Therefore, unlike the medium-term process, the number of readjusted sectors should be minimum by this method, and mainly motivated to avoid potential imbalances.

In support of this process, it would be advisable to provide an optimisation algorithm considering the modification of the airspace avoiding short trajectories in a sector, which can imply a greater complexity; and the modification of the airspace trying to reduce the number of coordination communication between sectors, avoiding those ones that could be consider unnecessary for example attaching a part of a sector to another.

Finally, a Cost Assessment of the sector configuration change shall also be carried out from a capacity and safety point of view. It is not enough to estimate the best possible configuration solely based on demand consideration as this may be counterproductive in terms of situational awareness, safety risk, change impact on ATCO, etc. Then, it is possible that the benefits resulted from the configuration change would not be as worthy if the impact on those aspects is high.

Therefore, it is also needed criteria that consider the previous configuration, as well as the enhancement that changes will suppose. Also having this idea in mind, it is recommended to consider a set of beneficial configurations for the change. With the new operating method, the number of possible configurations that form said set will be likely increased, allowing a higher flexibility in the sectorisation. This way, there will not only be the best one from the perspective of sole capacity considered in the optimisation process but also it will be possible to select the one with the best balance between capacity, high ATCO productivity and minor impact on situational awareness.

Another factor that should be considered in the algorithm is not only single configurations but the sequence of configurations throughout the day of operation. Indeed, it is possible that the change is established for a limited time period. Meaning that, after it, it is necessary to return to the previous configuration or another similar. So, in this case, the workload required to set and unset the change should be considered to evaluate properly if the change is still worthy or not, especially if the change implies splitting or reconfiguring a sector. The change workload should remain lower than the expected benefits from the change to a new configuration. In other words, it should be necessary to consider the configurations path, including the precedent and upcoming sector configurations, in the plan.

As summary the idea would be ensuring that the decision to implement a sectorisation change is supported by the traffic level, the established sectorisation, the coming sectorisations in a future and the effect of the change itself. Altogether will serve to evaluate change feasibility in terms of impact on capacity, cost efficiency and safety.

Finally, the algorithm should even consider demand measures because, although the main objective is not applying demand measures, it could be that the impact that a reduced number of demand measures has lower affection to the usability aspects than a configuration change could have. For example, changes in two trajectories or two or three delayed flights may suppose less impact than a new sectorisation on ATCO. To complete this paragraph, you may refer to 3.3.2.4.2.2.

Finished an airspace optimisation process and in a short-term time horizon before the operation, it occurs that a set of imbalances between demand and capacity continues to exist. In these cases, it shall inevitably make use of DCB measures that impact demand.

3.3.2.1.3.2.6 ATCO procedures related to DAC and Human axis

3.3.2.1.3.2.6.1 Sector Configuration Algorithm & Airspace Block Attributes (minimum sector duration, maximum load duration, etc.)

The sector configuration algorithm should consider different criteria to achieve the best possible solution according to the current constraints it has to deal with (see section 3.3.2.1.3.2.2).

When proposing a new sector configuration, the used algorithm should incorporate in its calculation as requirements, the stablished Airspace Blocks attributes, which are going to define said sector configuration. These attributes are:

- **Airspace blocks Family arrangement**. The rules about how the different airspace blocks can be grouped should be determined in advance. In general, grouping AB should follow the same guidelines for building Airspace Blocks and Configured Sectors, already presented in previous sections of this document.

As a reminder, it should be preferable to avoid, at much as possible, the balconies in CS, while trying to accommodate the traffic flows in the best way possible and avoiding no allowed unions (e.g. union of non-collateral airspace blocks, etc.) to guarantee the usability of such group of AB.

- **Delegations**. Two different types of airspace delegation could be performed:
    - **Delegations between same organisational level.** This delegation refers to the one produced between two ATS units (e.g. between ACC Madrid and ACC Sevilla). This implies an interoperability between ATSUs systems, together with the possession of the right licenses of the participating ATCOs to allow such delegation of control,
    - **Delegations between upper and lower organisational level.** For example, between a FAB and ANSP.
- **Notified time to change sector configuration.** It is important when implementing a new configuration to inform the involved air traffic controllers. This notification will be done by the ATSU supervisor and with enough time (e.g. 10 min) for the controller to assimilate the new situation and to maintain a good level of situation awareness,
- **Minimum Sector Duration.** Stability of a sector configuration (e.g. 20 min). As it is said before, a very short time of sector duration will not be useful in terms of workload and cost efficiency, as the cost of changing the configuration will outweigh the benefits of such change,
- **Maximum Load Duration.** Maximum duration of the maximum load peak before triggering reorganisation (e.g. 10 min),
- **Maximum time duration of negative performance indicator peak.** In relation to performance improvement needs, there will be other performance indicators, apart from the load value, that will trigger a reorganisation of the sector configuration when these indicators reach a certain value over a period of time (e.g. 15 min). The considered performance indicators will be probably more than one and they could measure performance levels from a network or local perspective, focusing in a Configured sector level or configuration one.

3.3.2.1.4 What-If Service

3.3.2.1.4.1 General description

The What-If Service will be one of the core functionalities of the ANSP DCB support tool, providing all the involved actors (ATC Supervisor, LTM and EAP) with an automated support for the assessment and decision making of the most appropriate measures to resolve a local imbalance or provide opportunity for local performance enhancement (optimizing available staff).

The What-If service shall incorporate both airspace management measures and demand measures to allow the end user to decide, during the different time horizons, from the Pre-Tactical to Tactical Phase (up to a range of value or discretion for each ACC) what are the measures with higher effectiveness and performance with regards to the resolution of a declared hotspot. The What-If service should also allow the exchange of the actions and measures to be taken with the impacted actors through the appropriate CDM mechanisms.

This What-If service will complement the Imbalance Prediction and Monitoring Service: by monitoring available staff, traffic, workload and complexity within defined airspace volumes, overload situations should be avoided as much as possible and/or adequate solutions to complexity issues derived from the assessment performed should be found with the support of the What-If Service. The output will be useful for the integration of DAC into INAP processes.

In consideration of these basic characteristics, the What-If Service will be therefore customized for each type of DCB measure (capacity or demand) at different time horizons, to answer to the different and specific needs of the operator in order to assess the performance of the resolution proposal.

Even though the capacity and demand services have been presented as separated measures, the What-If functionality shall support the complete process, i.e. as demand and capacity measures are part of the whole DCB process, the optimum solution may be, generally, a combination of both measures. Under these considerations, the What-If tool shall be able, on the one hand, to define a combination of capacity and demand measures and, on the other hand, to assess and calculate the performance indicators regardless of the measure nature.

What-If Service	What-If Service Definition	What-If Service Requirements	Performance Indicators
Sectorisation (split, collapse, change of configuration, SAM, flexible boundaries)	What-If on the available capacity (predefined acceptable configurations, available configurations based on other constraints, assessment of DAC configurations before their activation on the CWP). This will support operational personnel in identifying the best sector configuration at the whole airspace level or at ACC level and, within an ACC, at sector level, to manage the demand.	According to the DCB timeline, airspace management measures include both airspace configuration actions and airspace refinement elements. Therefore, the LTM/EAP shall be able to take measures on both approaches by the support of the What-If functionality. On the one hand, by regrouping the airspace volumes that were defined in the strategic phase, the LTM/EAP acts within the airspace configuration process. In order to do so, LTM/EAP shall be able to select different airspace volumes, group them and define the outcome airspace volume as operational sector/ CAB. On the other hand, and in line with gaining flexibility and dynamicity, LTM/EAP shall be able to redefine the vertical and lateral boundaries of the operational sectors/CAB and even of the airspace volume, by the use of flexible boundaries and the definition of VSAMs definition. After the definition of the new airspace configuration or, in the latter case, the airspace design refinement, What-if functionality must reassess the different performance indicators.	HEC, OCC, Complexity, Workload, Sectorisation Usability

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		Once the what-if process has been completed, the user should be able to implement the change from the What-If tool.	
Demand Measures	What-if on demand and trajectory measures such as MCP-Ground Delay, Level-Capping, Horizontal Re-Routing (both at flight and flow levels, ground and airborne).	As part of the what-if capabilities required from the system, the LTM/EAP shall be able to select individual flights from the list and change manually one or more of their trajectory elements in order to simulate and assess the impact on demand, workload, complexity indicators and/or other kind of performance indicators. Once the what-if process has been completed, the user should be able to select a combination of measures on individual flights and/or traffic flows. As soon as the what-if process has been completed, the user should be able to select both the candidate flow and the STAM measures to be proposed for implementation.	HEC, OCC, Complexity, Workload, Total delay, Average Delay per flight, Number of delayed flights, Additional Flight Time, Additional Flown Distance, Additional Fuel Consumption, Additional CO2 emissions.
ATFM Scenarios (Level-capping and Horizontal Rerouting)	What-if on the application of ATFM scenarios published in the NOP.		HEC, OCC, Complexity, Workload, Additional Flight Time, Additional Flown Distance, Additional Fuel Consumption, Additional CO2 emissions.
ATFM Regulation	What-if on the application of ATFM Regulations, simulating the impact of different regulation time windows and regulation rates.	The LTM/EAP shall be able to simulate the impact of different Regulation Durations and Regulation Rates.	HEC, OCC, Complexity, Workload, Total delay, Average Delay per flight, Number of delayed flights.

Table 9: What-if services

What-If Services for capacity and demand measures, should work in an integrated manner to achieve a seamless DCB process in which the involved actors are able to compare different capacity and demand measures proposals for a specific airspace situation (e.g. sector configuration scheme; and/or a set of proposed demand measures complementary to the sector configuration and most likely to solve the identified imbalance).

What-If services will be accessible through an HMI, with functionalities allowing their launch, as well as the presentation of their results. The What-If relies on the service functionalities, which are closely linked to the HMI, as the LTM/EAP shall propose a solution, assess the impact and the benefits of that solution in terms of performance indicators and finally, implement it. Therefore, the What-If tool shall display, on the one hand, the starting airspace design and on the other hand, the foreseen trajectories and, from that point on, the HMI shall let the user propose the capacity and demand measures according to the DCB timeline.

3.3.2.1.4.2 Local What-if in support of NM What-If function

Local What-If Service can support the NM What-If function in different processes described hereafter:

- At Strategic, Pre-Tactical and Tactical Levels, the solution to a local imbalance provided by the local What-If function is then used by the NM to consolidate the Network view,
- During the CDM process aimed at defining an optimal DAC configurations plan on D-1 and D of operations, by checking the consistency of the Optimum Network scenario suggested by NM vs local performance targets and performing tuning actions by running a local What-If with capacity or demand measures, selecting the most optimum combinations of DCB measures allowing the adherence to performance targets, and coordinating them with NM,
- During the Tactical phase, when the LTM is notified of a possible imbalance identified by the NM through its own Imbalance Prediction and Monitoring Service. The LTM assists NM with local expertise, data and knowledge, assessing the imbalance and depending on the nature, declaring a hotspot or an optispot,
- At tactical level, during the coordination process of Target flow CASA regulations, when the INAP actor (or the local system) interacts with the NM to select (propose) the most appropriate flows in order to have the minimum ATFM impact.

3.3.2.1.5 What-else feature

3.3.2.1.5.1 General description

The What-else feature, even if it is relatively immature at this stage, is expected to be part of any decision making process characterized by uncertainty and complexity in strategic to tactical phases.

This service is built on AI techniques bringing a greater capacity than human in computational information processing, as well as an analytical approach. For these reasons, what-else service through embedded AI techniques, is able to extend humans' cognition when addressing complexity and to reduce some of the inconsistencies known in current operations due to human subjectivity and variability of INAP actors experience.

The AI Techniques, using historic data as training datasets, are capable of learning from previous human actor's actions and generate knowledge from experience, able to explore billions of possible solutions and choose among them the best one(s), recognizing in the explored data regularities and rules, discovering different decision making strategies or "hidden strategies", not visible to human operators, and searching for improved strategies, thus enhancing the scenarios with more relevant indicators that can help INAP actors to easily identify, agree and share common and, to some extent, more realistic picture.

In the context of Solution 44, partners aim at taking advantage of the latest developments in the AI Techniques field with the use of computational agent-based-model through the application of Deep Learning or Reinforcement learning. The What-else service is intended to help INAP actors to find potential alternative solutions in case of unsatisfactory solutions obtained using other tool or services, such as the What-If service, and therefore select optimum DCB solution that may include capacity and/or demand measures.

3.3.2.1.5.2 What-else Implementation

The what-else service has not been developed within the solution. Only a first description and analyses after workshops among experts have been performed. It is planned to be further pursued within SESAR 3. The schema below presents the general implementation foreseen.

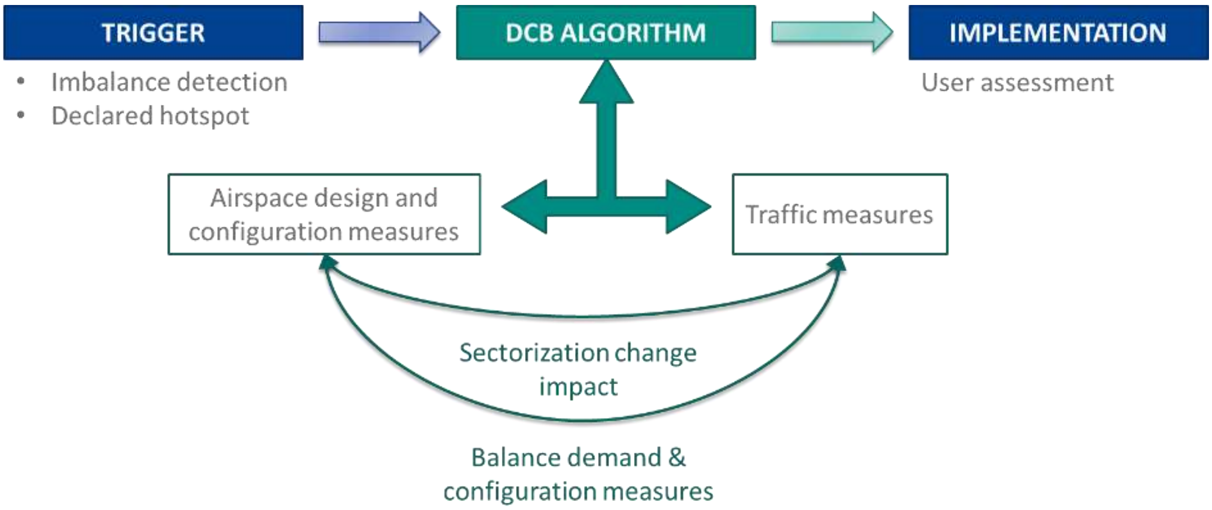

Figure 16. What-Else Implementation Schema

3.3.2.1.6 Local Complexity Service

3.3.2.1.6.1 Complexity and ATCO Workload Definition

In natural systems, the concept of complexity is closely tied to the notion of “entropy” which has been used to describe the state of “disorder” in a system. Air traffic control (ATC) has all the characteristics of a complex and dynamic system: there are many elements (aircraft and constraints) that are interconnected. All these elements are changing constantly due to both the actions of the air traffic controller (ATCO) and their own dynamics. Some of the variables are not transparent to the ATCO, but the objective is to manage the traffic safely, orderly and efficiently at the same time. SESAR has defined traffic complexity as *"…a measure of the difficulty that a particular traffic situation will present to an air traffic controller…"* [44]. The consensus view among the ATC research and operational community is that traffic complexity is a key driver of the ATCO mental workload, which in turn is thought to ultimately limit the ATM system capacity. This is one of the main reasons behind the use of complexity data as additional information by the ATSU Supervisor, LTM and EAP to detect imbalances, declare hotspots, and make decisions regarding the application of the most appropriate DCB measures to resolve them.

In addition, the nature of ATC Tasks performance is strongly cognitive related. ATC tasks such as monitoring traffic, traffic assumption, hand-over, conflict detection, conflict resolution or coordination, imply multiple cognitive processes such as perception, comprehension, projection, decision making and execution. All these cognitive processes are consumers of the ATCO attentional resources. ATCO Mental Workload is defined then as the relationship between the cognitive demand of attentional resources to perform the control tasks (dependant on traffic complexity and automation levels among others) and the available mental resources that directly depend on factors such as skills, training, experience, fatigue and stress.

Ultimately, capacity is the maximum throughput that an ATCO can manage in a challenging volume of airspace and is limited, as previously mentioned, by the ATCO workload.

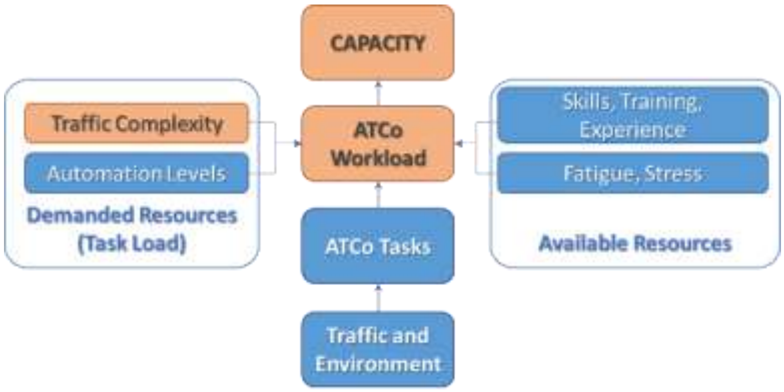

Figure 17. Relationship between Traffic Complexity, ATCO Workload and Capacity

On the other hand, traffic complexity can be considered as a non-subjective description of the traffic situation, but the workload perceived by the ATCO will depend mainly on the function allocation between the human and the machine (automation levels). Therefore, for capacity estimations, it is of paramount importance the consideration of the different levels of automation foreseen in future time horizons. Regarding the available resources, is commonly assumed in ATM that the workload estimation is foreseen for an average ATCO (same training, same skills and experience) and he/she is not suffering from fatigue or stress, meaning that the available resources are fixed and, as a consequence, the ATCO workload assessment correlates with the traffic complexity and levels of automation.

For these reasons, the following sub-sections of the OSED are focused on a deeper understanding on Traffic Complexity Assessment and their usage for imbalances prediction and monitoring and capacity estimations.

3.3.2.1.6.2 Local Complexity Assessment Methodologies

Due to the specificities and particular problems over the airspace of the different ANSPs, several local complexity assessment methodologies may be defined and used across the ECAC area.

Even though the concept of operations document is not strictly concerned with the specific complexity calculation and estimation methods, following, four different approaches are briefly introduced.

- **Dynamic Density**. This is a formula based calculation method that is computed as the summation of a series of predefined factors with associated weights. This approach is a good method to provide estimations into well-known situations (e.g. trajectories with low uncertainty levels) and not so good when confronted with new operational concepts, high-uncertainty or when there is no operational experience available,
- **Cognitive Complexity** (or cognitive difficulty of controlling an air traffic situation). This complexity assessment methodology is based on the mental ATCO's structural abstractions that are used to mitigate traffic complexity. The assumption behind this methodology is that all the factors that do not correspond to familiar patterns (such as flows, groupings, etc.) are potential sources of cognitive complexity generation. In particular, the methodology is built on traffic and flow features that increase the ATCO cognitive difficulty to manage the air traffic flows. Amongst the most common features considered as non-complexity facilitators are the interactions between standard flows, flights out of standard flows, potential conflicts and flights in evolution,
- **Weighted Density.** This complexity approach is based on the modulation of the occupancy counts through the consideration of weighted complexity contributing factors,
- **ATCO Workload.** The workload assessment methodologies can be based on models (usually for prediction) or based on empirical data collection (for monitoring and post-ops analysis),

    - Models: This approach is based on an ATCO Psychological Model that considers two main components: the functional structure of the controller cognitive system and the attentional resources needed for its functioning to carry out the ATC tasks. These models need as inputs the Air Traffic Control (ATC) Events. The ATC Events are the psychological stimulus to which the ATCO responds (e.g. solve conflicts) and an ATCO Task Model composed by ATC Actions that are carried out with the implication of cognitive processes that consume attentional resources. The workload quantification is calculated by using attentional resources theories that considers a non-linear workload increases when tasks performed in parallel overlap in time and demand the same cognitive processes. This method is good to provide estimations in post-ops analysis, where ATC events are available. It is also possible to use it for prediction if the ATC Events are known in advance and for so, predictive models based on machine learning may be a good option,
    - Empirical data: There are three main methods for ATCO workload data collection: performance, physiological and subjective measures. Performance measures consist in the performance of a secondary easy task along with the primary task (ATC control), assuming that if the operator experiments performance difficulties on the secondary task, the primary tasks is consuming considerable cognitive resources and hence the workload is high. Performance measures in ATC are not used for being highly intrusive. Psycho-physiological measures are based on the known correlation between Mental Workload and specific psycho-physiological variables, such as EEG, eye-tracking parameters or the heart rate. Current technology allows the use of these measures in ATC (wearable EEG helmets, eye-tracking glasses or smart bracelets). Finally, subjective measures could be also obtained by asking the operator to estimate the workload he/she is feeling when performing the tasks. The latter are typically used in ATC simulations by means of gathering NASA-TLX questionnaires and Instantaneous-Self Assessment (ISA) values, but not in real time operations.

- **Systems engineering.** Included in this category are all those methods (such as social graph network theory or Lyapunov's coefficients) that provide a representation of the complexity. The majority of these methods are computationally intensive and not recommended for real time operations. These approaches could be used, however, for airspace design purposes.

Although several complexity assessment methodologies could be defined, as explained before, it has been considered as appropriate to provide a list of common factors that have been agreed as sources of complexity and as a consequence, of workload. These factors could be part of the different local complexity approaches, or they just could be subject to be monitored by the LTM/EAP for situational awareness purposes.

The factors influencing complexity can be classified into two different categories depending on its nature: static features, such as airspace and operational restrictions; and dynamic features, dependent on the air traffic situation.

- **Airspace Factors** are those factors related to the characteristics of the airspace that is under ATCO Area of Responsibility. These factors include properties such as the distribution of navigational aids, and other geometrical aspects such as sector shape and its implications during the coordination tasks. In general, Airspace Factors are quasi-static and their negative influence should be avoided when designing new airspace structures during the Airspace Design process,
    - Sector dimensions (shape, physical size, number of flight levels, relevant airspace beyond sector boundaries).
    - Letters of Agreement (LoAs) and standardised procedures.
    - Number and position of standard entry and exit points.
    - Spatial distribution of airways and navigational aids (usefulness of placement).
    - Standard flows (number of, lack of, orientation of these flows with regards to the sector shape, trajectory complexity).
    - Interactions between standard flows (crossing points and merge points)
    - Coordination with other controllers (Hand-over, Coordination Points)

- **Traffic Factors** are dynamic factors that depend on the instantaneous distribution of traffic within a particular airspace. Many traffic factors are directly related to or are consequences of the airspace factors. For example, the location of the closest approach point of an aircraft encounter will depend on the routes flown by each aircraft; these routes are often a function of the standard flows defined through the airspace. The contribution to workload of the encounter can be strongly influenced by the relation between the position of the closest point of approach to airspace factors such as the sector boundary. Traffic Factors are the ones that should be deeply analysed during the prediction and monitoring of imbalances,
    - **Interactions between flows and flights:** this factor captures the complexity of merging and crossings of flows and flights within a traffic volume. In high density scenarios, where the traffic along the paths defined by the flows is really high, the complexity of merging and crossing points increases as the situation requires higher levels of precise planning. This factor includes also the complexity of traffic flows converging at the same point, and the merging and crossing of aircraft at narrow angles,
    - **Traffic mixture in relation to flights in climb, cruise and descent:** this factor looks at the vertical movement of the traffic within a particular traffic volume, assuming that handling mix of climbing, cruising and descending traffic is more complex than handling only cruising traffic,
    - **Non-standard flights:** this factor tries to capture the complexity and increase on ATCO workload when handling non-familiar air traffic situations, such as flights following non-standard routes or flights whose route is not frequent enough, flights with unusual RFL for the type of aircraft operated, and flights with routes containing dangerous and sharp turns, amongst others,

- **Potential conflicts or proximate pairs:** the number of proximate pairs and potential conflicts gives an indication of the ATCO workload and complexity associated to separation tasks. This factor is entitled to identify the traffic volume complexity due to multiple crossing points or crossing points close to sector boundaries,
- **Traffic density distribution:** this factor looks at the geographical concentration of aircraft in certain parts of the airspace or in certain peak hours. It does reflect the increase of complexity when the ATCO has to handle more aircraft in a smaller volume of airspace and/or less time,
- **Mixture of aircraft types and performances:** this factor captures the differences between aircraft in a given traffic volume in terms of performance. It is assumed that a situation where aircraft have similar performances – and in particular speeds – is less complex to handle compared to the same situation with a mixture of aircraft performances. This factor may also refer to the mix of commercial and military aircraft under the same area of responsibility,
- **Intruder flights:** this factor refers to all those flights entering a sector where it was not expected, which might lead to potential complexity peaks, sector overloads and potential safety issues,
- **Yo-Yo flights:** this factor is intended to capture all those flight plans with different RFLs (following climb/descend/climb paths in a sequence of less than three sectors) to avoid regulations. This kind of flights increase, at the end, the ATCO workload and complexity of the supposed avoided sector, because AUs do not usually adhere to these flight plans and request shortcuts or higher flight levels once they are on frequency, creating then intruders. These flights could lead to severe complexity spots and thus, potential safety issues.

- **Operational Constraints** are additional operational factors that place restrictions on possible control actions. These factors tend to represent short-term or temporary variations in operational conditions.

  - Restrictions on the available volume of airspace for aircraft manoeuvring (presence of convective weather, activation of special use of airspace for military activity, aircraft in holding patterns). This factor is intended to represent the distribution of traffic flows within the airspace to mainly capture the existence of airspace areas that restrict the aircraft manoeuvring area. The presence of military areas can increase complexity in the sense that ATCOs will have less airspace available for aircraft vectoring,
  - Procedural restrictions (noise abatement procedures, RAD restrictions),
  - Communication limitations,
  - Wind Effects (direction, strength, changes).

3.3.2.1.6.3 Local Complexity Granularity

The granularity at which the local complexity information is needed to allow an efficient DCB decision-making process varies from the strategic to the tactical phase, in order to provide appropriate inputs for airspace design, sector configuration optimisation and, in the broader context, DCB measures elaboration.

In general terms, granularity could be defined as *"the level of detail with which complexity can be predicted, measured and evaluated, which is directly related to the demand data available. The closer to the execution phase, the more accurate the complexity prediction will be"*.

In this way, granularity relates also to the number of factors or elements that the user or system considers when determining complexity, considering both airspace and time horizon. Additional elements will lead to finer resolution of the complexity model: the coarser the model, the coarser the results obtained.

From the DAC perspective, the minimum level of granularity required to provide appropriate inputs during the airspace design process at strategic phase is set at airspace building blocks level (SAM and SAB). This level of granularity will offer the possibility to assess multiple airspace combinations that will determine the set of optimum sector configurations for a particular ANSP, considering the need of having sector boundaries as much flexible as possible due to the existence of a Free-Routing environment. But this level of granularity is not only required during the strategic phase, but also in pre-tactical and execution phases, where the variability and uncertainty of traffic demand will make mandatory the continuous assessment of the optimum sector configuration plan.

On the other side, for the detection of imbalances and elaboration of DCB measures for the resolution of hotspots, complexity should be defined, at least, at the following levels of granularity: Traffic Volume, flow, and flight. These levels will provide appropriate insights on the root causes of the complexity issues for the detected imbalances and will allow INAP actors to make an informed-based decision on the most appropriate candidate flights to be impacted by the DCB measures prepared for the resolution of the hotspots declared.

And above all, granularity ensures a common understanding of the complexity levels that enables a consistent and fair process to select and implement DCB solutions, supporting an early deconfliction process in a seamless, efficient and consistent manner.

3.3.2.1.6.4 Local Complexity Usage

The use of local complexity assessments envisages the full DCB process, giving support from the strategic to the tactical phase, and more specifically during the INAP timeframe as part of the Imbalance Prediction and Monitoring Service [3h-20min] [1]. For each stage of the DCB process, different complexity assessment methodologies are to be used depending on the input available and expected outcome (as described in 3.3.2.1.6 – Local Complexity Assessment Methodologies section). Each usage is further described in the related process (strategic, pre-tactical, tactical & post-ops).

3.3.2.1.6.5 Local Complexity Impact Assessment

As previously described in 3.3.2.1.6.3 – Local Complexity Granularity3.2.3.5, the LTM and EAP are responsible to monitor the air traffic situation, detect imbalances, declare hotspots, elaborate and implement the most appropriate DCB measures, and monitor the hotspot resolution status under their Area of Responsibility. During the elaboration of the required DCB measures, the LTM and EAP are responsible as well to perform a local complexity impact assessment of the measures proposed, and analyse if these measures have an impact in adjacent sectors.

[1] This timeframe corresponds to the Entry Time in the Area of Responsibility where the ATFCM service is provided, and in particular, where a hotspot has been declared.

- If the adjacent sectors impacted belongs to the same cluster of sectors or ACC, the local complexity values should be available by means of the Imbalance Prediction and Monitoring Service,
- If the adjacent sectors impacted belongs to a different cluster of sectors or ACC, but this ACC belongs to the same ANSP, the local complexity values should be also available by means of the Imbalance Prediction and Monitoring Service. However, if this is the case, the LTM or EAP that trigger the measure will coordinate the impact of the measures with the LTM/EAP of the adjacent ACC,
- If the adjacent sectors impacted belongs to a cluster of sectors or ACC of a neighbouring ANSP, the LTM/EAP will request a Network Impact Assessment, which should provide the impact in terms of complexity through the provision of the Regional Complexity Indicator aggregated by the Network Management Function.
  -

3.3.2.1.6.6 Consolidation of Local Complexity Assessments

In order to support the Network Management Function (NMf) in the building of a Regional Complexity Indicator that will allow a common situational awareness of the air traffic complexity status across the network by all the affected stakeholders, the INAP related supporting tool will automatically share with the NMf the local complexity assessment results for each Traffic Volume along the timeline. This shall be done based on agreed and standardised rules and procedures.

Since each ANSP may identify imbalances based on their local complexity methodologies, it shall be agreed a common way of exchange this complexity information with the NM in order to ensure a common understating by all actors, including neighbouring ANSPs, of the Network Impact Assessment.

In this way, the proposal is to translate the local complexity values, calculated by each ANSP methodology, into the following code of colours:

- **Green**: This level indicates that the complexity is lower than the established local thresholds. A green value indicates that more aircraft are welcome into the area of measurement (although with each new aircraft, the complexity level will be recalculated),
- **Yellow:** At this level, complexity is above the sustained established local threshold less than the 50% of the time within a period of 30 minutes. A yellow value indicates that the addition of aircraft to the area of measurement should be analysed with care,
- **Orange:** This level indicates that complexity is above the sustained established local threshold more than the 50% of the time within a period of 30 minutes. An orange value indicates that no additional aircraft should be sent into the area of measurement, and a certain number of flights should be removed to keep the complexity above the sustained threshold less than the 50% of the time within 30 minutes,
- **Red:** This level indicates that the complexity value is over the established complexity peak local threshold. Aircraft planned through this volume should be removed and sent elsewhere.

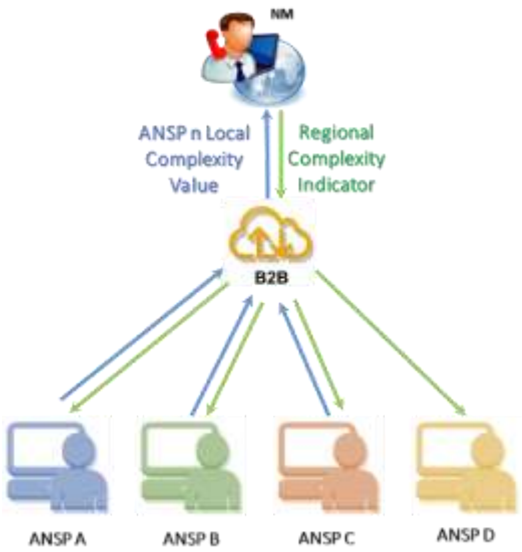

Figure 18. Consolidation of Local Complexity Assessments

3.3.2.2 Strategic process

The strategic process takes place from years to months, ideally to six months, before the day of operation. This process starts with a definition and analysis of the airspace at issue. This analysis includes a traffic demand forecast for D-day, using different data sources such as historical data to predict the trajectories. Once it is clear the characteristics of said airspace environment, an identification of constraints affecting SD&C must be performed.

The main constraints for the design of new configurations are related to ATC resources and external airspace borders (FAB concept will help to solve this problem with borders more operationally feasible), together with other regulatory limitations. These ATC resources are the number of controllers in possession of the corresponding licenses. To get these licenses the ATCOs have to be trained in the new sectors to guarantee their knowledge on them. This means the design and development of new sectors and configurations, together with ATCOs training phase, have to be done in this strategic process[2].

In the new operational method proposed, the designing of new sectors and configurations is conceived from a more automatic perspective, with the use of Machine learning algorithms and Big data technics to help in this problem. These algorithms should consider parameters such as the flows crossing the airspace. Contrary to the current operating method where there are fixed ATS routes instead of free route trajectories, in this new environment the AUs share their 4D trajectory and agree this trajectory with the involved actors in a more flexible way. Therefore, the identification of the main flows crossing the airspace becomes a less direct process as they are no longer following fixed routes. This also means

[2] Although it is out of the scope of the present project, it is important to mention that the potential for tools-based non-geographical licence approach may suppose a partial mitigation concerning ATCO training process. Reader can refer to SESAR Wave 2 Solution 73-C.

that in the new operational method there is a shift from individual trajectories, which drive occupancy counts, to flows, when designing the airspace.

The algorithm used to design these sector configurations could also identify the main flows crossing the airspace, or at least it should have this information as an input. Thus, the algorithm can design the sector according to these flows, prioritising them when building sectors' shape. In addition, these flows should be characterised, identifying their number, frequency, geographical position, as well as their interactions with other flows to detected potential conflicts between them, and the flights density of each flow, as the number of flights per unit that follow that flow.

By analysing the forecasted traffic demand, including the main flows, a group of useful demand measures (such as a set of STAM measures, or other ATFCM measures, which could be implemented earlier – please refer to §3.3.2.7) could be determined months before the day of operation. Accompanying these demand measures, a group of sector configurations could also be identified as the ones that work better together with these particular demand measures. Thus, having a set of ATFCM measures associated to a specific set of sector configurations. As stated in the previous paragraphs, the needed analysis and this airspace design concept will be only feasible with the help of big data and machine learning algorithms and technics, together with a good feedback loop from post-operational analysis.

The logic behind adapting the sector configuration to demand measures is that applying demand measures changes the trajectories of some of the flights crossing the airspace at issue or even the trajectory of the main flows. This means a modification of the traffic conditions on which the previous sector configuration was based on. Then this configuration is no longer the optimised one. Also, by combining demand and capacity measures, more efficient DCB solutions can be implemented in terms of performance impact.

Therefore, when the demand and capacity balancing process requires the application of ATFCM methods, there will be already a set of configurations whose performance is better compared to that of the optimised configurations proposed only based on capacity measures.

3.3.2.2.1 Complexity Assessment during the Strategic Phase (from several years or months in advance up to D-7)

During the strategic phase, the use of local complexity information should support the airspace design process that takes place from several years or months in advance and up to 6 months previous to operations.

In particular, complexity assessment should help the ANSP Airspace Designer in the definition of the most appropriate airspace blocks (AB) and sharable airspace blocks (SAB) to finally build the set of configured sectors (CS) of a particular ACC. Complexity assessment metrics will allow the evaluation of how the expected traffic flows could be distributed along the airspace under analysis considering appropriate sector boundaries and shapes, as well as transition layers. At this stage, complexity assessment may not exclusively rely on traffic parameters, but most importantly on geometrical aspects and flow interactions.

In addition, complexity assessment will gain special importance at this stage considering that air traffic flows will be handled in a Free-Routing environment, providing valuable input in the definition of flexible sector boundaries to avoid the existence of multiple critical crossing points under the same area of responsibility of an ATCO, as well as in the definition of the most adequate transition level to ATS structured airspace and in the selection of the E/X/A/D points.

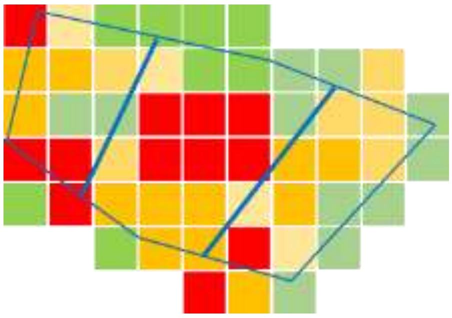

Figure 19. Example of ACC complexity cell grid for complexity assessment during airspace design process

The expected output of this stage (from years in advance and up to six months previous to D-day) is an automated analysis of a set of complexity metrics that will help airspace designers on deciding the airspace volumes distribution of the area under definition. From six months and up to the Pre-Tactical Phase, complexity metrics could be used for refinement and airspace configuration purposes, as traffic information and flows distribution becomes more reliable.

3.3.2.3 Pre-tactical processes

The pre-tactical process will start from several days to the day before the day of operation, while the tactical process will cover the day of operations. In both processes, as time goes by, more accurate information is received, as more data about AUs intentions is shared, improving the prediction of traffic demand and trajectories, and that could lead to updating the configurations plan. In addition, and since the update may be based on combining both capacity and demand measures, this update will be performed following a collaborative decision process between all actors involved, especially in the tactical process, where flight execution is nearer.

The CDM process steps and considerations regarding the application of the best possible DCB solution in pre-tactical processes are very similar to the ones in the next phase, presented in the following section. Although, in the tactical phase it will be unlikely to see CDM taking place with actors not directly involved in assuring safety, unlike in the pre-tactical phase. In the case of capacity measures, the difference lies in the fact that in these early phases any modification to the proposed sector configurations to be open affects the configurations plan, while in the tactical phase it could also affect the already implemented configurations. Something similar happens with demand measures.

3.3.2.3.1 Complexity Assessment during the Pre-Tactical Phase (D-6 – D-1)

The main objective of the pre-tactical phase is to optimise efficiency and to balance demand and capacity through an effective organisation of resources.

At this stage, the level of uncertainty and volatility of air traffic demand may be too high to make decisions based on complexity information. It may be possible as time progresses to D-1, however, to use complexity information to support the detection of major demand-capacity imbalances that could lead to severe peaks of ATCO workload and thus, trigger the application of ATFCM scenarios, other kind of ATFCM measures, or even ATFCM Regulations.

In addition, at this stage complexity information could be used as input to the automated sector optimisation tool that will be used by the ANSP to determine the sector configuration plan for the day of operations. However, due to the uncertainty associated to complexity values at this phase, the weight of complexity in the optimisation algorithm should be probably set as low as possible, giving more importance to the availability of resources or the avoidance of high levels of traffic density.

3.3.2.4 Tactical process

In tactical process, that is hours before operation, different types of tactical demand measures (e.g. regulations) can be applied (refer to the DCB catalogue §3.3.2.63.3.2.1.6).

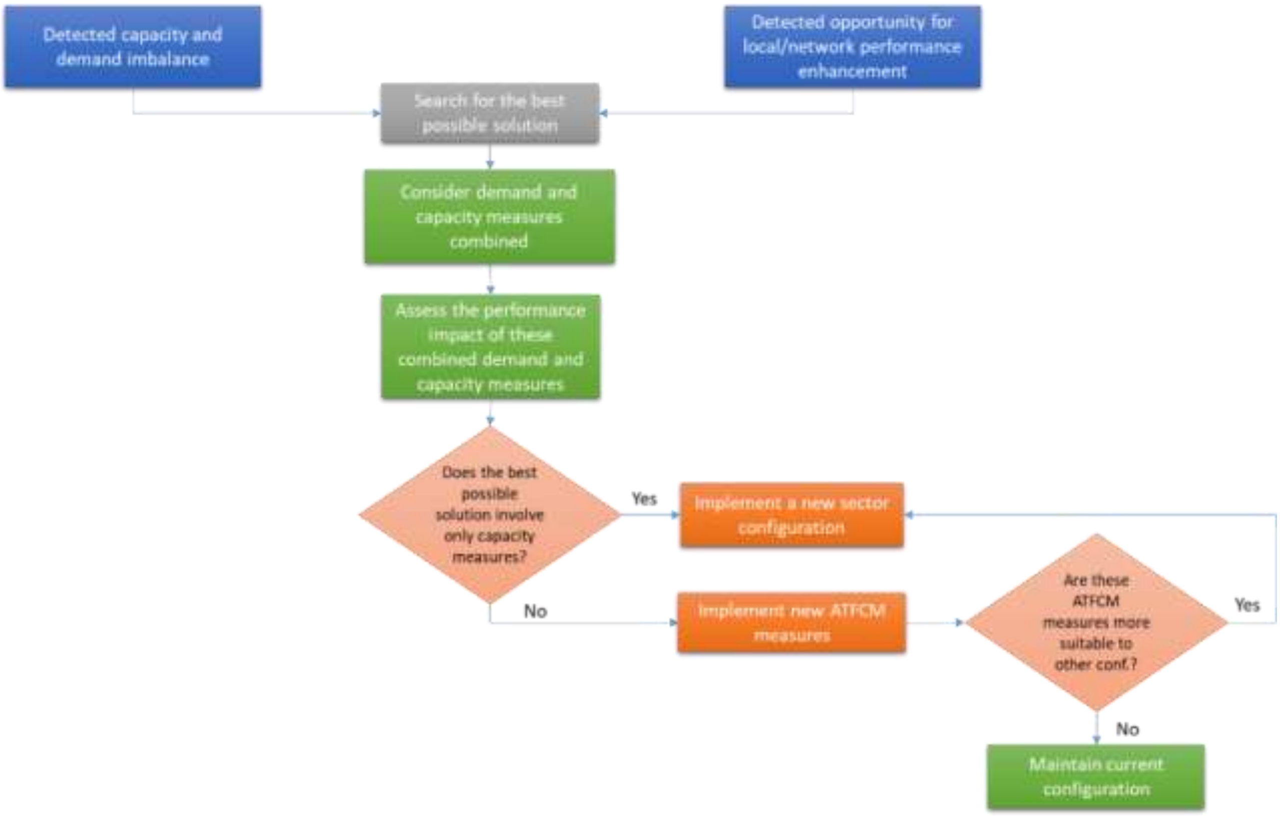

Figure 20. Optimised Configuration based on capacity and demand measures - execution process steps

The previous diagram summarises the steps the decision making process should include when there is a necessity to put into practise demand and/or capacity measures. This need comes from two different situations. The first one, when a capacity and demand imbalance is detected and the second one, when an opportunity of network or local performance improvement is identified, without this being motivated by any capacity problem. This means that capacity and demand must be monitored, as well as other performance indicators. See 3.3.2.10 for further detail about KPA/KPI affecting DAC processes.

3.3.2.4.1 General Process within INAP timeframe

The process followed by INAP actors in the selection of a measure to solve an imbalance situation or address an optispot during INAP timeframe is composed of the following (general) steps:

1. Detect the imbalance based on traffic situation and looking at HEC, OC and complexity values,
2. Identify possible solution based on automation support provided by What-If and the indicators values,

3. Coordinate the solution selected, which could be the implementation of a change of sectorisation itself (DAC), the combination of a different sectorisation and a DCB Measure or a DCB or combination of DCB Measures, with all involved actors, including NM, Airports and AUs affected,
4. Implement the selected measure,
5. Assess solution impact by monitoring the evolution of the implemented measure and the resolution of the imbalance identified.
    a. In case of failure, reiterate to identify a new solution to solve possible new imbalances detected.

When assessing performance impact, it can be very relevant depending of the time horizon that is being considered. Because the closer the operation is, especially from one hour to twenty minutes before the operation, the greater the cost of implementing new capacity measures, such as a new sectorisation, might be, especially when compared to the "cost" that other demand measures would have.

Note: the "cost" in the sentence above refers to safety impact and loss of efficiency.

3.3.2.4.2 Identification of the possible solutions and selection of the best one(s)

Out of the INAP timeframe, the LTM is responsible for the application of the Dynamic Airspace Configuration (DAC) and the application of the DCB Measures, namely the ATFCM Scenarios and the Regulations. Depending on the ANSP, there could be different actors performing these roles or integrated in a single one, as already indicated 3.2.3.5.

The local roles within INAP, are able to assess and resolve local complex situations (e.g. hotspots) through assessment of evolving traffic situation and evaluation of opportunities, in order to identify and manage the best performing option between Dynamic Airspace Configuration measures or flow management measures : the NM role is consolidating the local actions (problem notification, planned solution) in order to provide a Network View. Like so the INAP function encompasses some of the activities of the LTM in tactical, in a seamless manner and in order to:

- Detect, then analyse imbalances and potentially declare a hotspot (TFV, start time, end time),

- share any relevant information with partners via the CDM mechanism.

If a hotspot is declared, in the **INAP timeframe**, LTM using the toolset encompassing DCB measures, can choose to apply different actions, associated with different levels of granularity:

- maximize the available capacity by using Dynamic Airspace configuration (e.g. re-shaping of sectors based on dynamic[3] sector configurations) and, or,

[3] *the concept of "dynamic" on which the DAC algorithm is based wants to overcome the concept of "pre-defined" configuration. Certainly, the high number of possible configurations is a risk for concept feasibility, and it should be limited to a few configurations: ATCO would need adequate training to work in many different configured sectors as well as a knowledge of the related operational procedures. Training is a very important aspect of the concept to ensure safe operations in DAC environment.*

- reduce load to an acceptable level by using STAM management and the DCB/CDM process.

At this stage the choice of selecting a DCM measures should be evaluated by the local INAP actor(s) based on the information provided by the toolset: in practice a comparison is necessary between the amount of flights subject to measurements, and the possible re-shaping of the sectors concerned in the adopted configuration.

In this regard, indicators should be identified that can direct the choice towards one of the two solution:

- maximum number of flights/flows (perhaps a range based on complexity) to select DCB measure,
- notification time before a change of configuration is considered acceptable by ATCOs,
- sector changes should be avoided when workload is high.

3.3.2.4.2.1 Alignment on Granularity

Integrating DAC and INAP concepts implies having the same semantic meaning for their proposed solutions. All these solutions show one key aspect to the integration: granularity.

DAC granularity refers to the level of detail of the proposed sector design and configuration (e.g. basic volumes, basic sectors, etc.). On the other hand, INAP concept understands granularity as the level of detail with which a measure is designed and implemented (e.g. traffic flow, individual flight, etc.). Understanding the differences and finding their common ground is key for the integration of INAP and DAC processes.

3.3.2.4.2.2 Defining Criteria to pick the most appropriate measure(s)

In order to support the identification of the best measure(s) for a specific set of conditions, such as the most efficient and effective measure(s) for a specific DAC proposed sector configuration, the selection criteria should be established and validated.

In previous SESAR Operating Method, DAC was always prioritized with respect to DCB Measures, in order to avoid as much as possible the modification in the airspace user trajectory. In new SESAR Operating Method this criterion is no longer valid, and the different options have the same importance. This means that the election of DAC, DAC in combination of DCB or just DCB Measures depends exclusively in the specific conditions that lead to the imbalance and the advice given by indicators.

In view of this, the criteria to select a measure by INAP actors is based on the following:

- **Imbalance condition and granularity:** including Entry Counts (EC) and Occupancy Counts (OCC); Complexity Values (CPLX); type of spot; and applicability to a flight, flow, sector or group of sectors,
- **Time remaining to the occurrence of the imbalance:** depending on the remaining time, the cost of the implementation of a solution may vary, since it is not the same to apply a DAC solution -2H than -20’ before. In the latter case, the cost will be probably higher than implementing a DCB solution even though this implies changes AUs trajectory,

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Another issue is identified in the requirement to recalculate in a very short time the “new” capacity of the sector modified by the algorithm.

- **Human Resources:** referring to the availability of air traffic controllers in order to determine whether a DAC solution could be implemented or not, even though it is the optimum solution. Human Resources conditionate all applicable solutions,
- **Previous DCB Measures:** The existence of previous DCB Measures affecting the flight, flow or area of applicability of the new solution identified should also be taken into account,
- **Predicted impact of DCB Measures:** sometimes two light demand measures in combination of a capacity measure could lead to lower impacts on ATFM delay and/or trajectories,
- **Uncertainty:** The indication of uncertainty on each proposed solution should be accounted as one of the parameter to be taken into account for decision-making, (see also §3.3.2.1.2.2)
- **Other Indicators:** Indicators on Safety and Cost-Efficiency should be taken into account besides the indicators of capacity and human performance. (see §3.3.2.10)

To complement this section on the criteria applicable for the selection of a measure to solve an imbalance within INAP timeframe, Table 1011 reflects all possible measures, its granularity and the timeframe of application.

MEASURE	GRANULARITY	SEVERITY			TIME HORIZON			
		H	M	L	-6H to -3H	-3H to -2H	-2H to -40'	-40' to -20'
Dynamic Airspace Configuration	Group of sectors							
CTOT	Individual Flights							
Ground Level Capping (A/C ON GROUND)	Flows/Individual Flights							
Re-routing/ Re-filing (FPL Modification)	Flows/Individual Flights							
Ground Delay	Individual Flights							
Take-Off Not Before	Individual Flights							
Take-Off Not After	Individual Flights							
MDI/ ADI	Flows							
TTA	Individual Flights							
TTO	Individual Flights							
MIT	Flows							
Air Level Capping (A/C ON AIR)	Individual Flights							
DPI Sequence	Individual Flights							
Speed Regulation/ TTL/ TTG/Holding	Individual Flights							
tTTA	Individual Flights							
tTTo	Individual Flights							

Table 10: Summary of the possible measures to be applied by INAP actors (in isolation or in a combination of two or more) in relation to its granularity, the severity of the spot affected (being High and Medium severity referred to Hotspots and Low severity to OptiSpot) and the time horizon of application.

3.3.2.4.2.3 Complexity Assessment during the Tactical Phase (D)

During the day of operations, and in particular within the INAP timeframe [6h-20min], the DCB actors will make use of the local complexity information provided by the Imbalance Prediction and Monitoring Service to assess the traffic situation, detect imbalances, declare (hot)spots and prepare DCB measures for resolution within their Area of Responsibility. During this phase, DCB actors will work in close collaboration with the Network Manager to alleviate complexity issues across the network. In particular:

- The LTM, by means of the sector configuration tool, will refine the sector configuration plan establish at D-1 considering a more reliable complexity information. At this stage, the sector optimisation algorithm could assign a highest weight to the resolution of complexity peaks, since more accurate date is expected to be available,
- The LTM and EAP will consider in the first place the local complexity assessment to fine tune the ATFCM measures prepared in the Pre-Tactical phase. Particular attention will be given to ATFCM Regulations established in the Pre-Tactical phase. If the local complexity assessment determines that an ATFCM Regulation is no longer applicable as it was defined in the previous phase, then the LTM/EAP shall cancel it or refine its time window or regulation rate,
- The LTM and EAP will monitor the complexity curves for each Traffic Volume under their Area of Responsibility and compare them against the established monitoring values in order to assess possible peaks of complexity that could not be resolved in the Pre-Tactical phase and that will require the declaration of a hotspot, its analysis, and consequently, the elaboration of a DCB measure to resolve it (e.g. sectorisation change, ATFCM scenario, STAM measures, ATFCM Regulations, etc.),
    - The LTM/EAP will evaluate the complexity input provided for hotspots resolution tools at different levels of granularity. The objective is to select the most effective measure with the least possible impact on traffic demand. In order to do so, it is important that LTM and EAP count with detailed complexity information (e.g. complexity per flight and complexity per flow with the distribution of their complexity contributing factors.). Having complexity defined at flight level is of paramount importance in order to apply STAM cherry-picking or flow measures. For this kind of measures, the LTM/EAP needs to select the most appropriate candidate flights based on the highest possible level of situational awareness. If the measure has to be finally implemented by an ATCO to alleviate a downstream hotspot, the EAP will monitor the corresponding ATCO workload to avoid a potential mental overload.
- The LTM and EAP will provide advice to the ATSU Supervisor on the refinement of the sector opening scheme. In particular, they will consider complexity assessment as input to propose the best moment in time to split and collapse sectors,
- If because of the nature or severity of imbalance detected the (hot)spot cannot be resolved with capacity or demand measures such as ATFCM scenarios or STAMs, the LTM will evaluate the application of an ATFCM Regulation taking into consideration the complexity information to select the regulation time window and regulation rate.

3.3.2.4.3 Assessment and monitoring of the retained solution

INAP actors continuously monitor DCB imbalances to maintain the situational awareness of the situation and take decisions with appropriate information. This monitoring is carried out through automated support.

INAP actors monitoring depends not only on information availability but also on information certainty. Uncertainty grows with the prediction horizon, thus, monitoring indicators are always the same within the INAP timeframe but with different Indexes, accounting for the Uncertainty computed at each time.

Monitoring of the DAC/INAP proposed solutions is based on the use of dynamically defined monitoring values. This will permit to monitor not only existing sectors, but also newly designed sectors that not readily have assigned monitoring values. The areas in which is expected to have indicators are (see also 3.3.2.10):

- Capacity,
- Safety,
- Human Performance,
- Cost-Efficiency.

These newly defined indicators will be added to those previously used by INAP actors, which include:

- ATFCM situation, weather, military activity, airport status and staffing are items always under monitorization,
- Hourly Entry Counts (HEC) in traffic volumes are the entries in periods of 60 minutes and more appropriate from -6H to -40',
- Occupancy (OC) in traffic volumes in periods of 10' are always under monitorization from 6H to 2H is low,
- Complexity (CPLX) in traffic volumes is monitored from 2H to 15' being more useful as long as time is close to execution,
- The ATC Workload seems appropriate its monitorization closer to execution (from -40 to -15'),
- The focus on the flight lists is appropriate from -2H to 15' where most flight plans are already available.

INAP HMI should be defined to accommodate all this information, taking into account the preferences of each ANSP.

3.3.2.5 Post-Ops process

3.3.2.5.1 Complexity Assessment during the Post-Operations Phase

At this stage, the ATFCM unit of each ANSP shall use their Post-Ops Analysis Service, which may or may not be included within the Imbalance Prediction and Monitoring Service) to analyse the effectiveness of the sectorisation and DCB measures taken on the day of operations from the local complexity perspective to provide advice to LTMs, EAPs, and ATSU Supervisors on the most effective configurations and measures for the alleviation of traffic complexity. The post-ops analysis will also provide input to airspace designers in case complexity peaks in certain parts of the airspace or flows require a change in the airspace definition. This post-ops analysis should lead to an optimisation of the ANSP local ATSUs and hence, the optimisation of the network.

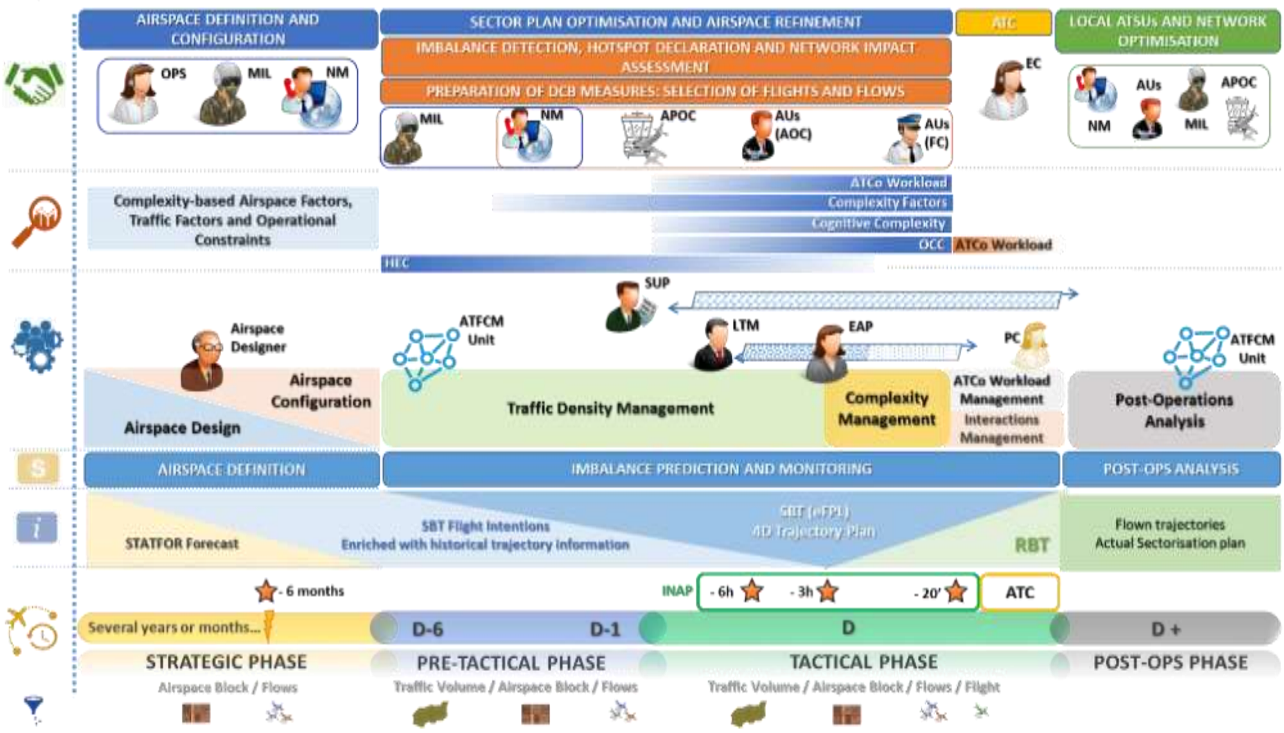

Figure 21. Local Complexity Assessment Operating Method - Summary

Figure 2121 encompasses the usage of local complexity assessment during the entire DCB process, summarising the complexity operating method (from the bottom to the top of the figure) in terms of timeline and granularity, information requested/available, involved services, process and involved actors, complexity metrics, and CDM processes that are supported by the use of complexity, including the interactions with the corresponding actors.

3.3.2.6 INAP role detailed tasks and responsibilities

The INAP role is a collection of two responsibilities: Local Traffic Manager and Extended ATC Planning

3.3.2.6.1 The Local Traffic Manager Responsibilities

- Monitoring the demand and the capacity,
    - Monitor forecast demand against declared capacity,
    - Assess the impact of different sector configurations on the traffic flows,
    - Assess sectors workloads.

- Providing information about predicted imbalance,
    - Provide advance notice of demand that peaks above capacity,
    - Provide advance notice of sector workloads,
    - Provide advance notice of peaks in traffic complexity,

- Designing, assessing and Coordinating actions with other actors to manage imbalances,
    - Coordinate with the ATSU Supervisor any reduction in declared capacity,
    - Advise the ATSU Supervisor on sector opening/closing and staffing to meet the demand,

- Devise and coordinate appropriate action to resolve any imbalances in co-ordination with the ATSU Supervisor,
- Optimise ATC/ATFM system performance including the instigation and coordination of remedial action with any ATS provider, aircraft operator or aerodrome to ensure maximum system performance.

- Monitoring in real time the local consequences of measures applied in adjacent airspace,
  - Monitor the impact of departure, en-route and arrival management systems on traffic in the area of interest,
  - Monitor the impact of traffic in neighbouring areas on his/her area of interest.
- Managing unusual situations.
  - Manage demand when impacted by weather or following an incident or unusual occurrence,
  - Provide information on, and solutions for unexpected increases in demand.

- Tasks included in the scope of the LTM (Local Traffic Manager):
  - Day of execution.

- Monitor the balance of sector configuration and ensure consistency with the Count Forecast (potentially enriched with flight lists and profiles),
- Identify complexity situation,
- Find solutions to solve imbalances between demand and capacity thanks to:

1: Airspace organization and management,

- Negotiation with military partners to shift or cancel reservation of airspace,
- alternative sector configuration,
- Use of the flexible division of flight level.

2: ATFCM measures (CDM with AU, FM, other LTMs, NM…),

- ATFCM scenarios,
- Regulations (CTOT) ,
- Increase of the potential regulation rate thanks to a complexity assessment performed through flight lists analysis,
- .Short term ATFCM (on ground or on airborne flights).
  - FL Capping,
  - Rerouting,
  - Minimum Departure Interval.

3: Assessment and improvement of the ATFCM measures:

- Assess network effects,
- Monitor the impact and the efficiency of the measures,
- Exclude non pertinent A/C from regulation,
- Force A/C to average delay in case of high delay identification,
- Elaborate through a CDM process with the EAP function DCB measures to be applied on airborne a/c …

3.3.2.6.2 The Extended ATC Planning (EAP) responsibilities

- EAP works in the short-term planning/execution ATFCM phase in cooperation with the LTM function and under the authority of the ATSU Supervisor, acting on flights (until approximately

30 min before the effective problem to solve[4]), co-monitoring hotspots evolution and elaborating measures to be applied through a CDM process with the LTM. EAP is in charge of identifying all possible improvements to the traffic situation at ATSU level, in order to best cope with the real time operational situation,

- Once an optimized strategy has been led by LTM, the EAP selects the individual flights on which to perform the predefined ATFCM or ATC actions and propose them to the relevant sector team planning controller (PC),
- The EAP role is responsible for the management of the real time complexity by inter alia managing number of potential strategic conflicts through a dedicated tool,
- EAP is responsible for selecting best-fit actions from a list of pre-defined scenarios/resolution strategies in coordination with the LTM, which will provide better use of actual capacity, by balancing capacity/workload to the benefit of their multi sector area of responsibility (EAP Area):
    - Cherry picking best candidate flights in case of bunch phenomenon to redistribute the traffic to less loaded sectors or to solve complexity within the Hotspot,
    - Early descent, late descent, or delayed climb to avoid a specific sector (in the EAP Area),
    - FL balancing to distribute traffic load between layers of airspace,
    - Use of flexible division of Flight level, which can be associated with the dynamic FL allocation scheme ,
    - Horizontal Rerouting, in order to balance the workload between sectors in nominal situations or taking in consideration specific weather conditions or unexpected military activity (or non-activity). This implies a coordination with LTM, as it has a network effect beyond the EAP Area,
    - Target Times in order to absorb delay and/or better distribute traffic in case of a 'bunching' situation, especially in link with early management of arrivals. These Target Times can either be translated into a "CTOT + TTO" measure for aircraft with sufficient look ahead time before EOBT, or into speed reduction advisories transmitted via ATC,
- EAP can also contribute to the implementation of miles in trail procedures. This also implies coordination with the LTM, as it has a network effect beyond the EAP Area. (reserved/restricted areas, CDR …),
- Within their time horizon of work and their multi-sectors overview in their area of interest, EAP takes into account the existing TTA/TTO instructions),
- EAP role has the ability to directly interact with the control sectors via an asynchronous and bidirectional communication tool (to not cause interruption or disturbance of core ATCO tasks). This tool allows sharing the measures requested for DCB purposes, their status, and any kind of information relevant to improve shared situation awareness between CWPs and INAP Working Position,
- EAP is responsible to act on request from any sector in their given EAP Area,
    - when a specific sector or area encounters adverse weather situation (CBs building up, turbulence appearing) the EAP help may be asked to act to facilitate the transition

[4] This figure would depend on local specificities and is provided in this document to give a rough idea on the timeframe.

towards a situation where accurate ATFCM measures will come into effect. When En-route holding patterns are activated, the EAP may be asked to assist to coordinate speed reduction with upstream sectors and further to coordinate stack exit levels especially in case of multiple layers.

- The EAP will be able to answer specific and real time requests from users, expressed either by the Flight Crew through RT or through any other communication tool by the FOC Operations,
- Some new tasks devoted to EAP should pop up with the application of Dynamic Airspace Configurations, for instance, in the context of activation of Free Route Airspace:
    - The EAP will need a tool which gives a probability of strategic conflicts based on the uncertainty (of the trajectory prediction at least). (this is also useful in fixed route environment but deemed mandatory in free route),
    - Moreover, as it is more complex to solve conflicts for a sector team in a Free Route environment, the EAP could in some cases, choose to make a strategic deconfliction with a slight change on the trajectory in a smoother way thanks to a trajectory editor at the ATSU level.

Similarly to the Planning Controller and Tactical Controller tasks, EAP activities will need to cope with:

- Free Route operations: in case of Short crossings at boundaries of sectors in FRA, EAP should pay a particular attention to these areas, up to circa 30’ before they become complex,

- Conflicts identified (with or without a conflict detection tool) at the boundary of two sectors: this ambiguous situation can become a safety issue if the responsibility for solving the conflict is not clearly allocated early enough. Thanks to its view of the traffic extended at the ATSU level, the EAP will be in the best position to determine the most suitable sector team for resolution of the conflict. A dedicated tool may be used to share information about the conflicts with the most suitable sector team(s).

Intricate conflicts which share the same crossing point or interfere with one another in the same area, with sufficient level of anticipation and certainty: as the EAP is not subject to the same time pressure as the sector team, they can have more time to think about a resolution. The EAP will be able to analyse and share relevant information about the conflicts well in advance, also choosing relevant recipients for this information, allowing sector team(s) to better anticipate and potentially coordinate their analysis when several sectors are involved. Anticipated resolution of complex conflicts involving several sectors will also be facilitated, with more time for coordination and fewer last minute actions.

3.3.2.6.3 RASCI Matrixes

The following tables presents the RASCI Matrixes between INAP roles in tactical timeframes.

R stands for Responsible, A for Accountable, S for Support, C for Consulted and I for Informed

It has initially been developed within PJ09.02 W1 solution and updated within solution 44.

For every role (LTM, EAP, PC (implementer), ATSU Supervisor (SUP)), the following **RASCI** matrix will be used for identifying their responsibilities when performing tasks:

R: Responsible - owns the problem / project / action
A: to whom "R" is Accountable - who must sign off (Approve) on work before it is effective
S: Supportive - can provide resources or can play a supporting role in implementation
C: to be Consulted/Coordinated - has information and/or capability necessary to complete the work
I: to be Informed - must be notified of results, but need not be consulted
The NM, FOC/FC and EC (implementer) Roles, although they are not part of INAP, are included to detect the interactions with them and their RASCI responsabilities in the related tasks. APOC is also included ((D) makes reference to the case when INAP has delegated (full/partial) to APOC)

ROLES, RESPONSIBILITIES & TASKS	H-6h to H-2h							
	NM	LTM	EAP	SUP	PC	EC	APOC	FOC
Monitor demand and capacity to detect DCB imbalances								
Monitor Entry Counts	S	R		A				
Monitor Occupancy Counts	S	R		A				
Monitor Complexity	S	R		A				
Monitor the weather situation		R		A				
Monitor the military activity situation		R		A				
Monitor ATFCM Situation		R		A				
Monitor ATCO workload		R		A				
Check Flight List		R		A				
Check flows for potential interactions within the area of responsibility		R		A				
Monitor the airport status (runways, reactionary delay, etc)		R		A			C	
Identify imbalances								

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ROLES, RESPONSIBILITIES & TASKS	H-6h to H-2h							
	NM	LTM	EAP	SUP	PC	EC	APOC	FOC
Identification of the imbalance	S	R		A			S	
Declare the hotspot								
Declaration of the hotspot to the NOP	I	R		A			C	
Analysis of the hotspot, preparation and coordination of DBC Measures								
Identification of the existing target times (TTO) that need to be taken into account	S	R		A				
Identification of the established AMAN sequence that need to be taken into account		R		A			S	
ATFCM Scenarios								
Preparation of ATFCM Scenarios	S	R	C (S)	A				C
Refinement of ATFCM Scenarios	S	R	C (S)	A				C
Capacity Measures (DAC)								
Proposal of sector configuration changes (split/collapse) according to expected traffic load		R	C (S)	A				
Proposal of airspace volume configuration change (SAM reassignment) according to expected traffic load		R	C (S)	A				
Negotiation with military partners to shift or cancel reservation of airspace		R		A				
Airspace optimisation when the status of a CDR or a military area changes		R		A				
Demand Measures								
Selection of the individual flights/flows for DCB measure application		R	C (S)	A			C	
Exclusion of non pertinent A/C from regulation/STAM measures		R	C(S)	A			C	
Demand Measures- CASA Regulations								
Regulation Proposal	I	R	C (S)	A			C	
Propose to increase of the potential regulation rate	I	R	C (S)	A			C	
Demand Measures- STAM-Cherry Picking								
Level Capping (Ground)	I	R	C (S)	A				I

ROLES, RESPONSIBILITIES & TASKS	H-6h to H-2h							
	NM	LTM	EAP	SUP	PC	EC	APOC	FOC
Level Capping (Airborne)	I	R	C (S)	A				I
Re-Routing (Re-filing)	I	R	C (S)	A				I
Re-Routing	I	R	C (S)	A				I
Ground Delay		R	C (S)	A			C	I
Speed regulation (Time to Lose, Time to Gain)		R	C (S)	A				
Take Off Not Before		R		A			C	
Take Off Not After		R		A			C	
Demand Measures- STAM-Flow Measures								
Level Capping (Ground)		R	C (S)	A				I
Level Capping (Airborne)		R	C (S)	A				I
Re-Routing (Re-filling)		R	C (S)	A				I
Re-Routing		R	C (S)	A				I
Ground Delay		R	C (S)	A				I
Miles in Trail (MIT)		R	C (S)	A				
DPI Sequence								
Minimum Departure Interval (MDI), ADI		R	C (S)	A			C	
Demand Measures- Target Time								
TTA prepared in the Elaboration and refinement of the SBT	S	R		A			C	I
TTO prepared in the Elaboration and refinement of the SBT	S	R		A				I
TTA prepared in the RBT Revision (tTTA)	S	R	C (S)	A			C	I
TTO prepared in the RBT Revision (tTTO)	S	R	C (S)	A				I
Local Impact Assessment								
Execute the local impact assessment (What-if)		R	C	A			C	
Network Impact Assessment								
Execute the network impact assessment	R	I		A				

ROLES, RESPONSIBILITIES & TASKS	H-6h to H-2h							
	NM	LTM	EAP	SUP	PC	EC	APOC	FOC
Consolidate and reconciliate DCB measures	R	I		A				
DCB Measures Implementation Trigger								
Trigger DCB Measure implementation		R		A				
DCB Measures Implementation (meaning also execution of the action)								
ATFCM Scenarios								
Implement/Refine ATFCM Scenario	S	C		A				R
Capacity Measures (DAC)								
Implement sector configuration changes (split/collapse)	I	R		A				
Implement airspace volume configuration change (SAM reassignment)	I	R		A				
Implement capacity measure related to the use of military areas or CDR	I	R		A				
Demand Measures								
Demand Measures- CASA Regulations								
Implement CASA Regulation	R	C		A				
Demand Measures- STAM-Cherry Picking								
Level Capping (Ground)	S	S		A				R
Level Capping (Airborne)	S	S		A		R		I
Re-Routing (Re-filling)	S	S		A				R
Re-Routing	S	S		A		R		I
Ground Delay	R	S		A			I	I
Speed regulation (Time to Lose, Time to Gain)	S	S		A		R		I
Take Off Not Before	S	S		A			R	I
Take Off Not After	S	S		A			R	I
Demand Measures- STAM-Flow Measures								
Level Capping (Ground)	S	S		A				R
Level Capping (Airborne)	S	S		A		R		I

ROLES, RESPONSIBILITIES & TASKS	H-6h to H-2h							
	NM	**LTM**	**EAP**	**SUP**	**PC**	**EC**	**APOC**	**FOC**
Re-Routing (Re-filling)	S	S		A				R
Re-Routing	S	S		A		R		I
Ground Delay	R	S		A				I
Miles in Trail (MIT)	S	S		A			R	I
Minimum Departure Interval (MDI), ADI	S	S		A			R	I
Demand Measures- Target Time								
TTA prepared in the Elaboration and refinement of the SBT	S	S		A			S	R
TTO prepared in the Elaboration and refinement of the SBT	S	S		A			S	R
TTA prepared in the RBT Revision (tTTA)	S	S	C (S)	A		R	S	
TTO prepared in the RBT Revision (tTTO)	S	S	C (S)	A		R	S	
Monitor hotspot status resolution								
Monitor hotspots status (monitor efficiency of the measures applied)	S	R	C (S)	A				S
Identification of hotspot resolution deviations	S	R	C (S)	A			I/C	S
Identification of the need to re-assess hotspot resolution measures	S	R	C (S)	A			I/C	S
Evaluation of the DCB measures needed to resolve the hotpost resolution deviation	S	R	C (S)	A				S

Table 11: RASCI Matrix - 6hrs to 2hrs timeframe

ROLES, RESPONSIBILITIES & TASKS	H-2h to H-40min							
	NM	**LTM**	**EAP**	**SUP**	**PC**	**EC**	**APOC**	**FOC/FC**
Monitor demand and capacity to detect DCB imbalances								
Monitor Entry Counts	S	R		A				

ROLES, RESPONSIBILITIES & TASKS	H-2h to H-40min							
	NM	LTM	EAP	SUP	PC	EC	APOC	FOC/FC
Monitor Occupancy Counts	S	R		A				
Monitor Complexity		R		A				
Monitor the weather situation		R		A				
Monitor the military activity situation		R		A				
Monitor ATFCM Situation		R		A				
Monitor ATCO workload		R		A				
Check Flight List		R		A				
Check flows for potential interactions within the area of responsibility		R		A				
Monitor the airport status (runways, reactionary delay, etc)		R		A			C	
Identify imbalances								
Identification of the imbalance	S	R		A			S	
Declare the hotspot								
Declaration of the hotspot to the NOP	I	R		A			C	
Analysis of the hotspot, preparation and coordination of DBC Measures								
Identification of the existing target times (TTO) that need to be taken into account	S	R		A				
Identification of the established AMAN sequence that need to be taken into account		R		A			S	
Identification of the established E-AMAN sequence that need to be taken into account		R		A			S	
ATFCM Scenarios								
Preparation of ATFCM Scenarios		R		A				
Refinement of ATFCM Scenarios		R		A				
Capacity Measures (DAC)								
Proposal of sector configuration changes (split/collapse) according to expected traffic load		R		A				

ROLES, RESPONSIBILITIES & TASKS	H-2h to H-40min							
	NM	LTM	EAP	SUP	PC	EC	APOC	FOC/FC
Proposal of airspace volume configuration change (SAM reassignment) according to expected traffic load		R		A				
Negotiation with military partners to shift or cancel reservation of airspace		R		A				
Airspace optimisation when the status of a CDR or a military area changes		R		A				
Demand Measures								
Selection of the individual flights/flows for DCB measure application		R		A			C (D)	
Exclusion of non pertinent A/C from regulation/STAM measures		R		A			C (D)	
Demand Measures- CASA Regulations								
Regulation Proposal	S	R	A					
Propose to increase of the potential regulation rate	S	R	A					
Demand Measures- STAM-Cherry Picking								
Level Capping (Ground)		R		A				
Level Capping (Airborne)		R		A				
Re-Routing (Re-filling)		R	A					
Re-Routing		R		A				
Ground Delay		R	A					
Speed regulation (Time to Lose, Time to Gain)	S	R	A					
Take Off Not Before	S	R	A			S		
Take Off Not After	S	R	A			S		
Demand Measures- STAM-Flow Measures								
Level Capping (Ground)		R		A				
Level Capping (Airborne)		R		A				
Re-Routing (Re-filing)		R	A					
Re-Routing		R		A				
Ground Delay		R	A					

ROLES, RESPONSIBILITIES & TASKS	H-2h to H-40min							
	NM	LTM	EAP	SUP	PC	EC	APOC	FOC/FC
Miles in Trail (MIT)		R	A					
DPI Sequence		R		A				
Minimum Departure Interval (MDI), ADI		S	A			R		
Demand Measures- Target Time								
TTO prepared in the Elaboration and refinement of the SBT	S	R		A				
TTA prepared in the RBT Revision (tTTA)	S	R		A			C	
TTO prepared in the RBT Revision (tTTO)	S	R		A			C	
Local Impact Assessment								
Execute the local impact assessment (What-if)		R		A				
Network Impact Assessment								
Execute the network impact assessment	R	I		A				
Consolidate and reconciliate DCB measures	R	I		A				
DCB Measures Implementation Trigger								
Trigger DCB Measure implementation		R		A				
DCB Measures Implementation (meaning also execution of the action)								
ATFCM Scenarios								
Implement/Refine ATFCM Scenario	S	C		A				R
Capacity Measures (DAC)								
Implement sector configuration changes (split/collapse)	I	R		A				
Implement airspace volume configuration change (SAM reassignment)	I	R		A				
Implement capacity measure related to the use of military areas or CDR	I	R		A				
Demand Measures								
Demand Measures- CASA Regulations								
Implement CASA Regulation	R	C		A				
Demand Measures- STAM-Cherry Picking								

ROLES, RESPONSIBILITIES & TASKS	H-2h to H-40min							
	NM	**LTM**	**EAP**	**SUP**	**PC**	**EC**	**APOC**	**FOC/FC**
Level Capping (Ground)	S	S		A				R
Level Capping (Airborne)	I	S		A	R			I
Re-Routing (Re-filling)	I	S		A		R		R
Re-Routing	I	S		A	R			I
Ground Delay	I	S		A			R	I
Speed regulation (Time to Lose, Time to Gain)		S		A		R		
Take Off Not Before	S	R	A			S	I	
Take Off Not After	S	R	A			S	I	
Demand Measures- STAM-Flow Measures								
Level Capping (Ground)		R		A				
Level Capping (Airborne)		R		A				
Re-Routing		R		A				
DPI Sequence		R		A				
Demand Measures- Target Time								
TTA prepared in the RBT Revision (tTTA)	S	S		A	R		S	S
TTO prepared in the RBT Revision (tTTO)	S	S	S	A	R	R		I
Monitor hotspot status resolution								
Monitor hotspots status (monitor efficiency of the measures applied)		R		A				
Identification of hotspot resolution deviations	S	R		A			I/C	
Identification of the need to re-assess hotspot resolution measures		R		A			I/C	
Evaluation of the DCB measures needed to resolve the hotpost resolution deviation		R		A				

Table 12: RASCI Matrix - 2hrs-40' timeframe

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ROLES, RESPONSIBILITIES & TASKS	H-40min to H-15min							
	NM	LTM	EAP	SUP	PC	EC	APOC	FC
Monitor demand and capacity to detect DCB imbalances								
Monitor Entry Counts	S	S	R	A				
Monitor Occupancy Counts	S	S	R	A				
Monitor Complexity		S	R	A				
Monitor the weather situation		S	R	A				
Monitor the military activity situation		S	R	A				
Monitor ATFCM Situation		S	R	A				
Monitor ATCO workload			R	A	C	C		
Check Flight List			R	A				
Check flows for potential interactions within the area of responsibility			R	A				
Monitor the airport status (runways, reactionary delay, etc)			R	A			C	
Identify imbalances								
Identification of the imbalance	C	S	R	A			S	
Declare the hotspot								
Declaration of the hotspot to the NOP	I	S/R	R	A			C	
Analysis of the hotspot, preparation and coordination of DBC Measures								
Identification of the existing target times (TTO) that need to be taken into account	S	S	R	A				
Identification of the established AMAN sequence that need to be taken into account			R	A			S	
Identification of the established E-AMAN sequence that need to be taken into account			R	A			S	
Capacity Measures (DAC)								
Proposal of sector configuration changes (split/collapse) according to expected traffic load		S	R	A	S			
Proposal of airspace volume configuration change (SAM reassignment) according to expected traffic load		S	R	A	S			

ROLES, RESPONSIBILITIES & TASKS	H-40min to H-15min							
	NM	LTM	EAP	SUP	PC	EC	APOC	FC
Negotiation with military partners to shift or cancel reservation of airspace		S	R	A				
Airspace optimisation when the status of a CDR or a military area changes		S	R	A	S			
Demand Measures								
Selection of the individual flights/flows for DCB measure application		S	R	A			C	
Exclusion of non pertinent A/C from regulation/STAM measures		S	R	A			C	
Demand Measures- STAM-Cherry Picking								
Level Capping (Ground)			R	A	C			
Level Capping (Airborne)			R	A	C			
Re-Routing (Re-filing)			R	A	C			
Re-Routing			R	A	C			
Ground Delay			R	A	C			
Speed regulation (Time to Lose, Time to Gain)			R	A	C			
Take Off Not Before			R	A	C			
Take Off Not After			R	A	C			
Demand Measures- STAM-Flow Measures								
Level Capping (Ground)			R	A	C			
Level Capping (Airborne)			R	A	C			
Re-Routing (Re-filling)			R	A	C			
Re-Routing			R	A	C			
Ground Delay			R	A	C			
Miles in Trail (MIT)			R	A	C			
DPI Sequence			R	A			C	
Minimum Departure Interval (MDI), ADI			R	A			C	
Demand Measures- Target Time								
TTA prepared in the RBT Revision (tTTA)	S		R	A	C		C	

ROLES, RESPONSIBILITIES & TASKS	H-40min to H-15min							
	NM	LTM	EAP	SUP	PC	EC	APOC	FC
TTO prepared in the RBT Revision (tTTO)	S		S	A	C			
Local Impact Assessment								
Execute the local impact assessment (What-if)			R	A				
Network Impact Assessment								
Execute the network impact assessment	R	S	I	A				
Consolidate and reconciliate DCB measures	R	S	I	A				
DCB Measures Implementation Trigger								
Trigger DCB Measure implementation		S	R	A	C			
DCB Measures Implementation (meaning also execution of the action)								
Capacity Measures (DAC)								
Implement sector configuration changes (split/collapse)	I	C	R	A	S			
Implement airspace volume configuration change (SAM reassignment)	I	C	R	A	S			
Implement capacity measure related to the use of military areas or CDR	I	C	R	A	S			
Demand Measures								
Demand Measures- STAM-Cherry Picking								
Level Capping (Airborne)			S	A	R			S
Re-Routing			S	A	R			S
Speed regulation (Time to Lose, Time to Gain)			S	A	R			S
Demand Measures- STAM-Flow Measures								
Level Capping (Airborne)			S	A	R			S
Re-Routing			S	A	R			S
Miles in Trail (MIT)			S	A	R			S
DPI Sequence			S	A	R		S	S
Demand Measures- Target Time								

ROLES, RESPONSIBILITIES & TASKS	H-40min to H-15min							
	NM	LTM	EAP	SUP	PC	EC	APOC	FC
TTA prepared in the RBT Revision (tTTA)	S	S		A	R		S	S
TTO prepared in the RBT Revision (tTTO)	S	S		A	R			S
Monitor hotspot status resolution								
Monitor hotspots status (monitor efficiency of the measures applied)		S	R	A				
Identification of hotspot resolution deviations	S	S	R	A			I/C	
Identification of the need to re-assess hotspot resolution measures		S	R	A			I/C	
Evaluation of the DCB measures needed to resolve the hotpost resolution deviation		S	R	A				

Table 13: RASCI Matrix - 40'-15' timeframe

3.3.2.7 Collaborative Decision-Making Process

This concept foresees the move from collaborative processes to ASM merged with DCB into fully integrated ASM/ATFCM/ATS CDM layered process. ASM-ATFCM-ATS based CDM process consistent from local to sub-regional to regional levels, which is triggered either by local or network performance requirements, depending of a specific situation in time and place.

Main objective of the CDM process is to support seamless provision of such DCB service that ensures delivery of ATM service at optimum level at any moment of time (within acceptable deviation from the optimum) via proper combination of Capacity and Flow (Demand) measures.

The optimum is defined **at strategic level** and is based on performance-based approach, i.e. definition at local (or sub-regional) and Network levels of strategic optimal point of trade-off between two or more local/network KPAs/KPIs. One example of that can be, for instance, a level of optimum Delay (KPI) at National level. That optimum becomes a target to be cascaded down to pre-tactical and tactical levels as the target being a function of the traffic demand.

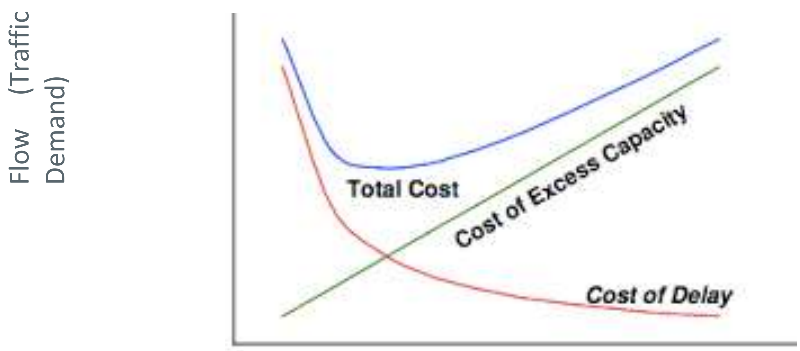


Figure 22. Graph showing cost of excess capacity and cost of delay and the optimum curve to define the balance

The graph shows that the optimum (the lowest point of the blue curve) would be achieved when there is a balance between delay and capacity and not the lowest point of the red curve.

At pre-tactical level integrated ASM/ATFCM/ATS process to be executed by coexisting Models A (top down approach) and Models B (bottom up approach) of capacity (DAC) management process (refer to §2.6). Proper conditions and timing to be defined for the application of either Model, and/or dynamic switch between them in order to achieve the best performance results.

As it can be seen from the graph above an optimum can be achieved only via combination of Flow (Demand) measures and Capacity measures that is why it should executed by ANSP ATFCM Unit at regional and level and NM at Network level in pre-tactical phase, and by LTM in tactical phase..

Within scope of this OSED, Capacity measures comprise initial DAC levels, i.e. combination of non-predefined sectors configurations and some limited sectors boundary adjustments (thanks to SAMs), plus DMAs allocation parameters management. The latter is especially important for achieving Flight Efficiency and Environment KPAs/KPIs targets.

At pre-tactical level, Flow measures includes pre-tactical ATFM measures, i.e. slots allocation process, dynamic RAD…

At tactical level the process is not bound by time anymore, but rather by data uncertainty parameters. (refer also to §3.3.2.4)

3.3.2.8 Cross Border Airspace Configurations / Cooperation between ACC / Delegation of ATC responsibility

Cross border DAC relies on services and enablers to be delivered by Solution PJ10-W2-93 and PJ32-W3.

Cross-border Airspace Configurations enables additional level of dynamicity allowing not to be bound by either ACC or national or sub-regional boundaries and providing possibility for cross border (thus more efficient) use of Capacity adjustment measures.

Following combinations of Cross Border DAC levels and scenarios can be foreseen:

- Cross border sectorisation amongst neighbouring ACCs belonging to the same ANSPs,

- Cross border sectorisation amongst neighbouring ACCs belonging to two different ANSP.

Further details will have to be elaborated in coordination with Solution PJ10-W2-93 and PJ32-W3.

3.3.2.9 Network Operations Plan (DCB-NOP link)

Network Operations Plan (NOP) is playing two-fold role within the scope of the DAC concept, and in particular the integration into DCB:

- Performance targets management process,
- Promulgation of strategic, pre-tactical and tactical DCB measures.

Network operations are driven by enhanced stakeholders' participation in a rolling cooperative process with several layers over time.

- By continuously sharing latest flight intentions resulting in demand and available capacity,
- By defining measures in the Network Operations Plan (EDAC on NOP),
- By considering network performances as a target by all actors,
- By taking into account operational updates - evaluating operations against performance targets and updating the plan.

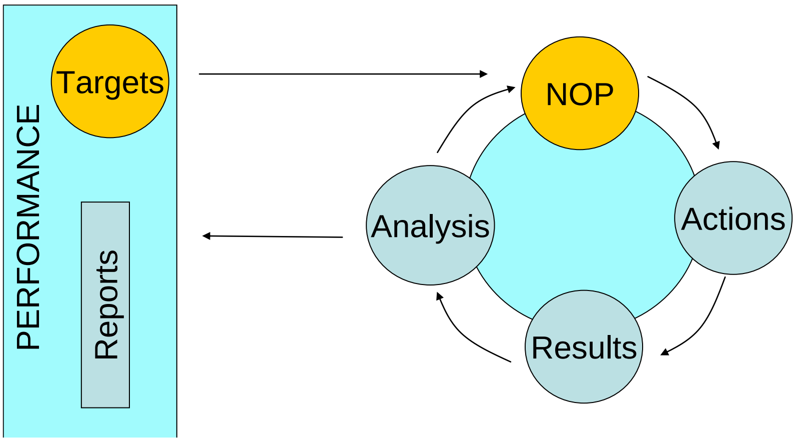


Figure 23. NOP cycle and network performance monitoring

Overall network performance will be closely monitored and managed, including monitoring of the performance targets for the main actors in aviation. This enables Member States and Stakeholders to enhance their local performance from a network perspective. All partners operate with a high level of transparency, through intensive information sharing, allowing dynamic management of available resources responding to the airspace/airport user needs.

The agreed sets of DCB measures will be published in the Cooperative NOP as EDAC (European DAC) and will be transparent to all the parties involved.

In the tactical phase, it will be extremely important to continue the local DCB processes and to integrate its tactically evolving results as inputs in the NOP via the Collaborative NOP mechanisms.

3.3.2.10 DCB KPA/KPI Assessment Criteria

As part of DCB process, basically the same indicators supporting DCB will be supporting DAC performance assessment, thus ensuring that the whole DCB contributes to a reference performance scheme. This is an important point to ensure that the operators understand the measures and actions that will be taken. We will rely more on automation; this implies a stronger need for transparency and understanding of decision-making

KPA impact assessment allows the identification of those areas that need to be considered during the whole DCB process by the different roles and actors. From that point on, representative indicators of those latter areas need to be defined to analyse DCB effectiveness and refine implementation process accordingly.

In order to ensure the continuity and the coherence throughout the whole DCB process, the use of the same KPIs to assess and refine DCB outcome is recommended. In other words, those indicators must support the different actors of DCB during the airspace design process, from the airspace designer in the strategic phase to EAP/LTM in the tactical phase using the What-if functionality (refer to §3.3.2.1.4).

However, because there are differences between the starting points depending on the timeframe, that is, the complete airspace design in the strategic and the refinement of that one in the tactical, some specific indicators should be defined to support the understanding of the KPI and the algorithm outcome.

Mainly, the KPAs that are impacted by DCB operational concept and need to be considered during the airspace design are: capacity, human performance, safety and cost effectiveness. Although, as it will be mentioned below, as the operation day gets closer, areas close linked to the traffic demand gains relevance (e.g. flight efficiency). Therefore, those indicators need to be considered not just from capacity measures point of view, but for the whole DCB process.

3.3.2.10.1 Capacity (CAP)[5]

The impact on capacity due to the airspace design and configuration process is a direct consequence of gaining flexibility by redesigning the airspace in order to optimise the airspace use. It is important to bear in mind that, currently, capacity is measured in hourly entry count (HEC) and in 15-minutes look ahead when closer to the time of operations. Therefore, capacity represents, basically, the number of flights per hour that an ATCO can control in an operational sector.

Regarding the definition, the time granularity of the capacity needs to be redefined according to the flexibility and dynamicity provided by capacity measures. On the other hand, according to DAC operational concept, capacity indicator should go beyond the number of operations that can be managed by an operational sector. A capacity threshold for the whole airspace under the designing process needs to be assessed as a representative indicator of the airspace design result together with the capacity of the operational sectors arising from the process.

Besides, as capacity is defined for an operational sector, capacity is close related to the airspace configuration process. In other words, capacity definition only makes sense within the sector configuration process. Once the airspace design process is defined and DCB process gets into the sector configuration process, the weight of the variable involved in the capacity calculus varies until the operation day.

During the first sector configuration process, the parameters involved in the capacity calculus are based on HEC and predicted workload due to the nature of traffic demand input, which is SBT flight intentions enriched by historical trajectory information. Because of the volatility of the complexity concept, the latter gains importance, as the operation day gets closer, at the expense of HEC importance.

Therefore, from the paragraphs above, it can be deduced that capacity threshold is mainly based on Human Performance (HP) indicators. Those HP indicators that are used for CAP calculus can also be defined as indicators to support the capacity result and get a better understanding of that indicator.

To sum up and regarding capacity indicator, the main considerations are:

- Representative indicator from the operational point of view,
- Time granularity according to DAC operational concept,
- Threshold definition to monitor and identify imbalances,

[5] For this and the rest of KPA to be assessed, the calculation metric to be used should be defined as in the case of Capacity, by using HEC

- In order to support the airspace design process, the indicator should consider a relevant airspace size (e.g. several operational sectors),
- Capacity threshold is based on HP indicators.

3.3.2.10.2 Human Performance (HP)

Capacity measures within DCB process have a direct impact on operational procedures and ATCO licences because of the flexibility and dynamicity increase that is implicit to the operational concept.

Regarding the airspace design process and within Human Performance Area, a usability indicator could be used. The latter indicator is focused on the usability of the airspace volumes and elements (SAB, SAM, ES) to work as such. As we are referring to design elements, usability parameters linked to them should be based on forecasts and/or historical traffic. Complexity of the traffic flows contained by the airspace volumes and elements, parameters related to the complexity of the element shapes or relational aspects between them both might be good candidate factors to compute a metric for that indicator. Each type of airspace structure will require different considerations but, for example, an elementary sector shall usually be within of certain range of number of flows contained. Density of those flows according to historical data, number/complexity of crossing points, convexity of its boundaries, size, number of flight levels, number of short-crossing or alignment between flows and sector boundaries are some good examples as well.

As the flight information gains certainty, different parameters should be weighted in order to calculate the human performance indicator, as occurred to capacity indicators (e.g. HEC), occupancies or traffic complexity.

On the other hand, and considering the implementation of the sector configuration changes, the impact of the latter one on human performance indicator needs to be considered within DAC algorithm, specifically in the sector configuration algorithm. According to that, the concept of usability can be translated into the usability of the configuration plan, that is, usability throughout the configuration plan, as an indicator to combine demand and capacity measures.

3.3.2.10.3 Safety

The impact on human performance and operational roles and functions means a Safety impact too. From the airspace design process and implementation point of view, the main point to ensure safety is to maintain the situational awareness.

3.3.2.10.4 Cost effectiveness

The impact on both capacity and human performance areas translate into an impact on ATCO productivity.

The monetization of the use of human resources gains a significant importance within DCB context, especially regarding airspace design and capacity measures. As the importance of the cost effectiveness indicator lies, in the DCB process, on the human productivity, cost effectiveness is closely related to human performance calculus.

Finally, an indicator that allows the identification of unused capacity, based on the capacity threshold is recommended in order to achieve DCB objective, that is, to find the optimum point between demand and capacity measures.

3.3.2.10.5 Flight efficiency (FEFF), Punctuality (PUN) and Predictability (PRD)

As it has been said above, the impact on the areas that mainly affect traffic demand gains importance as the operation day get closer. In fact, flight efficiency, punctuality and predictability indicators are both part of capacity & demand trade-off.

The calculus of FEFF, PUN and PRD can be assessed in the first stage, that is, during the airspace design and configuration process. However, because of the traffic nature and the inability of action on demand measures in the long-term, those measures cannot support the airspace design process until hours before the operation day.

3.3.2.11 Use Cases

In order to establish the list of UCs, a storyboard has been developed by the solution. It is presented in this document in **Error! Reference source not found. Error! Reference source not found.** as it provides an accurate and exhaustive view of the concept mechanisms on INAP timeframe:

- Storyboard at tactical level, focused on INAP timeframe.

The list of Use Cases is the following:

ID	Current Title
UC-00	Coordination and publication of Optimal Network DCB scenario
UC-01	Airspace Design
UC-02	Optimised Configuration
UC-03	Imbalance Detection and Spot Declaration during the tactical phase
UC-04	Spot Analysis
UC-05	How to choose a DCB measure
UC-06	Spot Resolution & monitoring
UC-07	What-if Flight exclusion tool
UC-08a	ATC in an integrated DAC-DCB environment - hotspot
UC-08b	ATC in an integrated DAC-DCB environment - optispot
UC-09	Target flow CASA
UC-10	Change of DCB plan and its publication update
UC-11	Optimal ARES (DMA) allocation in DAC Pre-Tactical Level

3.3.2.11.1 DCB-UC-00: Coordination and publication of Optimal Network DCB scenario

3.3.2.11.1.1 Scope

This use case is identified to describe the coordination process on D-1 and D of operations more than approx. 4-6h in advance triggered when inconsistencies are detected between DCB reference scenario proposed by NM and local KPIs (i.e. local KPIs are not met).

Two main flows of actions are described in this UC – main flow depicts CDM process triggered and led by LTM, while alternative flow describes CDM process triggered by NM. In both processes/flows final decision remains with local LTM.

3.3.2.11.1.2 Level

User Level

3.3.2.11.1.3 Summary

Following simulations with configurations proposed by NM and WOC agreed ARESs, local performance target are evaluated. When inconsistencies are detected, coordination threads are triggered as following:

- LTM -NM-other LTM/LCM for ARESes coordination,
- LTM -NM-other LTM/LCM for sector configuration and flow measures coordination,
- LTM -WOC – for ARESes modifications.

Once the agreement is reached, the DAC/DCB measures plan publish/update process is triggered.

3.3.2.11.1.4 Actors

3.3.2.11.1.4.1 Primary Actors

- LTM: its main goal is to define optimal sector configurations in short term phase when inconsistencies are identified,
- Network Manager (NM): facilitates the CDM process between DACs. In alternative flow, role of Network Manager (NM) is also to identify Reference Network Scenario, i.e. the one most optimal DAC plan from Network perspective for entire network,
- WOC: involved in the CDM process with DAC solving imbalances by modifying ARESes.

3.3.2.11.1.4.2 Supporting Actors

Other LTM: involved through the NM-CDM process defined to resolve imbalances. In particular, they are involved in the definition of delegation aspects.

3.3.2.11.1.4.3 Off Stage Actors

FOC: Their interest in the process is to be informed and verify that their flight intentions are not heavily modified.

3.3.2.11.1.5 Preconditions

- ATCOs, CWP availability and internal KPIs are known,
- FBT and MBT are available with low uncertainty,
- ARESes requests are shared.

3.3.2.11.1.6 Post conditions

None

3.3.2.11.1.7 Success end state

Optimal DCB measures are defined and there is no remaining imbalance, or a compromise of airspace configuration is found through CDM.

DCB plan in EDAC format publication process is triggered.

3.3.2.11.1.8 Failure end state

Sectorisation and airspace plan is not optimal at network level. Network KPIs are not met.

3.3.2.11.1.9 Notes

None

3.3.2.11.1.10 Trigger

This use case starts when performance target issues are identified on the local level following simulations with sector configuration proposed by NM versus ARESes received from WOC.

3.3.2.11.1.11 Flows

3.3.2.11.1.11.1 Main flow

1. Performance Targets check,
    1. LTM evaluate previously defined (or default) local DCB Plan, i.e. optimum combination of ASM and DCB measures, versus local Performance Targets defined in strategic phase by:
        - inputs the following parameters into the local DAC Tool:
            - FBTs,
            - Strategic and early pre-tactical military reservations/military requirements,
            - KPIs targets.
    2. LTM assesses local DCB Plan, military requirements, and Network performances targets against Local KPIs using a DAC Tool.
2. Identification of Impact assessment and optimum DCB Plan publication:
    1. In case LTM identifies that the local performance targets are not met, LTM performs tuning actions by running simulations with ARES flexible parameters and/or alternative sector configurations, as well as DCB measures,
    2. LTM selects the most optimum combinations of Capacity and Flow measures allowing the adherence to performance targets,
    3. LTM triggers the DCB Plan coordination with NM. NM involves the other LTMs being impacted by the coordination, if required,
    4. If an agreement is reached and Network Performances targets are achieved, the LTM:
        i. sends the optimum DCB plan to the NM for publication,

ii. sends confirmation to the WOC. WOC generates MT relative to the coordinated ARESes, if required.

5. When the coordination process, as the previously described, succeeds and delivers an agreed DCB Plan, LTM computes (and stores) the KPIs values corresponding to Network performance targets using the Sector configuration and ARESes,
6. NM / ASM receives the agreed ARESs for D-OPS,
7. NM / DCB receives the final local situation (sector configurations, DCB measures and remaining hotspots). Using this information, NM-ATFM builds the expected network performance indicators,
8. NM / DCB publishes the information using EDAC format and makes it available to all actors through the NOP,
9. WOC acknowledges the final ARESes allocation sent by LTM,
10. FOC receives the published information (ARESes allocation and activations, remaining hotspots and DCB measures),
11. FOC reviews the SBTs, if needed.

3.3.2.11.1.11.2 Alternative flows

This alternative flow of actions describes CDM process triggered by NM and runs with support of local LTM. The main goal of this process is a definition of optimal DAC configurations plan starting from Network perspective first, i.e. creating Initial Ideal DAC configurations called Reference Network Scenario and then going down to local levels for further local optimisation, fine-tuning and amendments if/when necessary.

This flow describes how Initial Ideal DAC configurations is identified and Reference Network Scenario is built. As in CDM process described in Main flow of this UC, final decision always remains with local LTM.

1 As soon as NM receives information from all local LTMs on maximum available sectors or by defined time deadline depending what happened earlier NM starts definition of optimum Reference network scenario, i.e. optimal combination of ASM and ATFCM measures.

2 NM identifies early demand/capacity imbalances,

3. NM defines best optimal ASM/ATFCM Network scenario taking into account local resources available and Network constraints,

34. NM advises local LTMs of proposed "ATC volumes" and/or “ideal” modification of ARESes requests received to be coordinated,

5. NM advises local LTM on the optimal Network scenario identified,

6. LTM/ receives Optimum Network scenario suggested by NM and check its consistency vs local performance targets,

7. Further actions to be performed by all DCB CDM process actors/roles as described in Main flow of this UC, starting from the step 1.

3.3.2.11.1.11.3 Failure flows

In case of failure of both Main and Alternative flows of this UC, for the actions should be undertaken refer to UC UC-11 -Definition of Local DAC/DCB Plan”

3.3.2.11.2 DCB-UC-01: Airspace Design

3.3.2.11.2.1 Scope

This use case is identified to describe the workflow and the assessment process of an Airspace Design that allows better distribution of ATCO workload using the DAC Toolbox in the Strategic and Post-operations phases and that provides ANSP with different options to manage capacity and facilitate trajectories in their airspace through varying degrees of sector dynamicity and automation.

3.3.2.11.2.2 Level

User level

3.3.2.11.2.3 Summary

This use case addresses the process at local and regional levels for the design of the elementary pieces of airspace to enable efficient combinations and enough flexibility for better accommodating traffic flows, taking into account seasonality specificities, traffic patterns, Free Route Airspace, and enabling a well-balanced workload. The DAC Toolbox should support the design of the airspace modules, sectors and blocks in the Strategic and Post-operations phases. Using modular design techniques sectors must be adaptable in shape and size in response to demand and airspace availability variations.

The Elementary Sectors (ES) and Airspace Blocks (AB), the creation of which is the prerogative of the Design tool, must be designed according to the assessment of a Traffic sample and Traffic complexity taking also into account organisational constraints and agreements. These elementary pieces are the ones used to build sector configuration of the airspace as described in UC DCB-UC-02: Sector Configuration.

3.3.2.11.2.4 Actors

3.3.2.11.2.4.1 Primary Actors

NM: to obtain Traffic sample and its geographic and time distribution (major traffic flows)

Local ATC expert: to use DAC toolbox and to analyse the Traffic sample and the nature of traffic (e.g. overflying traffic, evolving traffic, Aircraft performance, flight level distribution etc.)

Local Airspace Designers: to implement airspace design process, designing the elementary pieces of the airspace more adapted to the traffic sample and any specific condition of the geographic area considered relevant for the airspace design (e.g. regulatory framework related to airspace organisation, military constraints, etc.)

HLAPB: sets up high level Principle, Rules and priorities of DCB design process at local level and required local, and Network performances (together with NM)

3.3.2.11.2.4.2 Supporting Actors

ATFCM Unit to support a close coordination between all the capacity aspects involved in the process.

Environmental specialist and Operational Controllers to optimize the flight profile.

3.3.2.11.2.4.3 Off Stage Actors
N/A (at this time)

3.3.2.11.2.5 Preconditions

Preconditions are primarily seen as relating to the information required to run the process:

-Knowledge of the local reference scenario (e.g. current layout of Airspace structures, Airspace reservations, ATC sectorisation) and how the traffic is managed within the airspace and in relation to surrounding airspace,

-Capability to assess the complexity and workload using DAC toolbox.

3.3.2.11.2.6 Post conditions

After the implementation of the Airspace change, the system needs to be monitored to determine whether the local strategic objectives are achieved.

Airspace Design result can provide several types of Airspace Structures, namely Elementary Sector (ES), Sharable Airspace Block (SAB), Sharable Airspace Module (SAM), etc. Different consolidation of these airspace structures will enrich Configured Sectors in an ample set of possible sector configurations to be analysed in UC DCB-UC-02.

3.3.2.11.2.7 Success end state

Handling over an airspace in terms of meeting performance criteria, allowing operators to choose from several strategically designed pieces based on the KPI objectives in response to variations in demand and airspace availability.

Among the high level criteria we list the ATC operational feasibility (reasonable number and frequency of changes of configurations, decrease of "problematic flights", as re-entering flights, boundaries flights, conflicts across several sectors, etc., and local and regional ATFCM performances.

3.3.2.11.2.8 Failure end state

The DAC toolbox is not able to suggest an optimal sectorisation and airspace design.

3.3.2.11.2.9 Notes

The performance criteria, assumptions, enablers and constraints are established before the design phase is undertaken (e.g. military requirements, agreement with adjacent unit etc.).

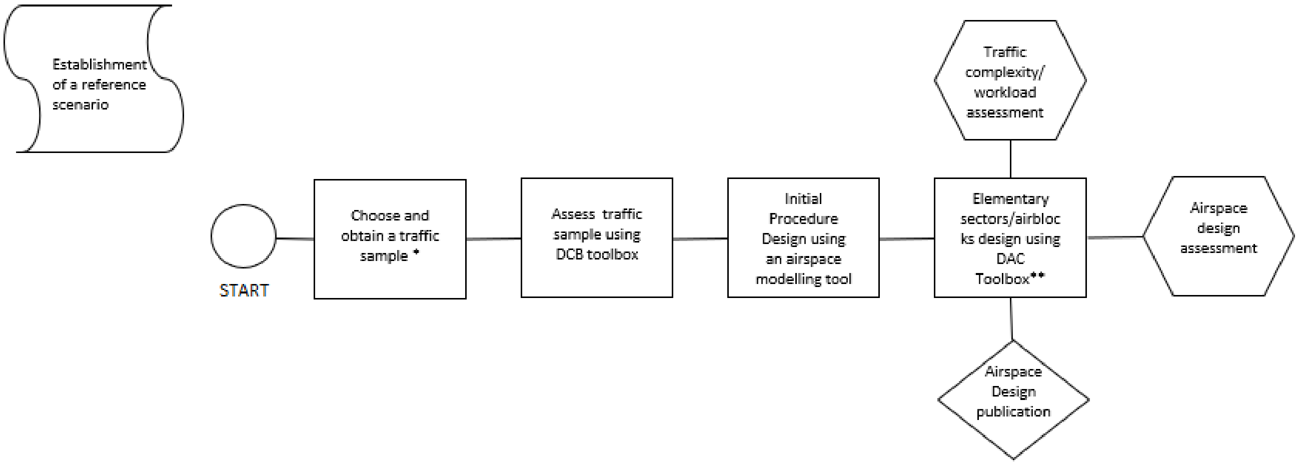
The traffic sample to be used in the initial scoping of Airspace Design will be based on the Network manager traffic data and/ or local ATC Unit so to combine statistical analysis with ATC experience. The sample is considered representative of the traffic to use the airspace which is object to redesign (e.g. traffic distribution by traffic flows, city pairs etc.)

3.3.2.11.2.10 Trigger

This use case starts as soon as there is an operational requirement to define or to update the ACC sector design in order to dynamically combine the elementary pieces of airspace to build feasible and efficient sequences of airspace configurations to meet the traffic distribution (see DCB-UC-002).

3.3.2.11.2.11 Flows

3.3.2.11.2.11.1 Main flow



* Traffic sample:

- Day/month/year,
- Traffic distribution,
- Traffic demand.

** Airspace design criteria:

- principle traffic flows and orientation,
- minimising sector and ACC re-entry,
- minimising short transits through sectors,
- civil/military coordination aspects.

1. Traffic complexity The DCB airspace designer crosses the forecasted traffic with historical data and other parameters (e.g. uncertainty) to create the traffic sample for the design process,
2. The airspace designer identifies the airspace design criteria that should be taken into account (including the principles specified by the HLAPB) to guarantee airspace sectors usability,
    a. POSSIBLE CRITERIA:
        i. Maximum Number of airspace volumes to be created,
        ii. Maximum Number of layers (FLs per sector) (very related to the first one),
        iii. Size and shape of airspace volumes (e.g. sectors not too big, avoid short crossings, border angles),
        iv. Distance to potential conflict points),
        v. Coherence between the upper and lower FLs (e.g. standard FL cut),
        vi. Minimize Number of flows cuts ,
        vii. Minimize re-entries,
        viii. Minimize short crossings,
        ix. Minimize number of entry conflicts.
3. The airspace designer analyses the traffic complexity and other performance related indicators (e.g. CPLX, OCCUPANCY; EC; Flow visualization, KPI values, TMV, flow interaction),
4. The airspace designer creates the airspace volumes with the help of a DCB airspace design tool,
5. The airspace designer analyses the new airspace design in respect of the traffic sample and compared to the previous airspace design. Airspace volume in a 2D/3D map.; Flows; TMVs, EC,

Occ., conflict points categorized as entry or inner, CPX per airspace volume and Usability parameters might be subject to assessment,

6. The airspace designer refines the potential airspace design,
7. New airspace design is analysed to identify how they will be combined (under which traffic conditions) to consolidate Configured Sectors in DCB-UC-2 Sector Configuration Process (for example those containing same or interacting flows will be easily integrated) and the declared capacity for each of Configured Sector option,
8. Operational Procedures, coordination rules for transfer shall be analysed for the new configured sectors,
9. CDM at local/regional level, between the involved ATC units, to refine airspace volumes design
10. Once the present airspace design is accepted and fully characterised, it is published.

•

3.3.2.11.2.11.2 Alternative flows

N/A (at this time)

3.3.2.11.2.11.3 Failure flows

N/A (at this time)

3.3.2.11.3 DCB-UC-02: Optimised configurations

3.3.2.11.3.1 Scope

This use case is identified to describe the workflow process at local/sub-regional level for the different sector configurations to support the accommodation of traffic demand/complexity in the most efficient way, during tactical phase. This accommodation is performed according to a chain of systems, reference datasets and expert rules. The goal is to provide the LTM and ATSU Supervisor of one or several ATSUs in a coordinated approach, with optimized solutions, which might be depending on the timeline; either a new configuration and/or demand capacity balancing measures (e.g. cherry picking, regulations, flight level capping) and/or re-allocation of the ops staff in order to optimize the full efficiency of the ATFCM chain.

The new system will be able to balance the expected workload of a traffic volume/group of traffic volumes by an optimized airspace configuration, with elementary and/or collapsed sectors, based on available OPS staff. The proposed new configuration(s) shall aim to reduce the need of DCB measures, hence the impact on the network. The selected configuration will be shared at network level with NM.

3.3.2.11.3.2 Level

User Level

3.3.2.11.3.3 Summary

This use case describes how the incoming traffic can be managed thanks to an optimized configuration and/or re-allocation of staff[6]. The "configuration tool" will take into account both traffic counts (e.g. occupancy/entry counts) and ATCOs availability in order to propose the most suitable configuration(s) considering these inputs. The ATSU SUP will have the possibility to re-arrange breaks of ATCOs with

[6] Assumption is that the tool is common to all ATSU involved.

the aim at freeing more resources. The tool will identify within the thousands of possible configurations the most adapted one (in terms of OPS staff usage and lowering the need of ATFCM measures), which also permits to extract from the habit of selecting commonly used/customary templates' configurations. Once identified, the optimized configuration will be proposed and displayed to LTM and ATSU SUP to acknowledge or reject the solution. If acknowledged, the configuration will be sent automatically to NM.

If this new configuration does not prevent a hotspot from occurring (i.e. given the current conditions, there is no configuration which can overcome the hotspot), the tool will propose adapted and coordinated DCB measures. However, only the first phase, considering optimized configurations will be described in this use case. The identification, choice and implementation of DCB measures are to be detailed in UC-05 How to choose a DCB measure.

This use case represents an illustration of a sector opening scheme optimization within one ATSU (main flow) and across ATSUs (alternative flow). A strategy could be, for instance, to use a number of ATCOs below the maximum at a given time of the day in order to keep the maximum number of ATCOs available a little bit later (for instance half an hour later when a peak of traffic is foreseen). In this way, it could be necessary at time T to implement DCB measures in order to allow reduction of the number of sectors opened and at time T+1 to avoid to set a regulation/harsher DCB measures since a surplus of ATCOs was created and an additional sector could be opened.

The tool will integrate artificial intelligence to compute optimized sector configurations taking into account human resources in the aim to decrease ATFCM delay for the whole day, i.e. look ahead time ~6 hours.

Analysis and Decision Making are done by local actors, taking into account global ATFCM situation awareness and NM impact assessment, so that the local view benefits from a larger perspective. The criteria for decision making will/should be based on performance indicators, shared and transparent at network level among all actors, namely NM, AUs and Airports

3.3.2.11.3.4 Actors

3.3.2.11.3.4.1 Primary Actors

ATSU Supervisor(s) and/or LTM(s) from concerned ATSU(s)

Their roles are:

- to analyse the configuration proposals from the tool in regards with the situation, assess their potential impact and coordinate at network level (between local levels and with Regional NM)
- to acknowledge or reject the solution,
- to re-arrange ATCO allocation time to accommodate traffic demand (occupancy/entry counts, complexity and uncertainty indicators) to decide if additional DCB measures are needed or to be preferred.

3.3.2.11.3.4.2 Supporting Actors

NM, AUs, Airports through the NOP

3.3.2.11.3.4.3 Off Stage Actors

Roster/Staff planning team

3.3.2.11.3.5 Preconditions

Sectors and the various possible configurations have been designed beforehand, in the strategic phase (see Use Case DCB-UC-01).
LTMs/ATSU SUPs are trained, confident and familiar with the tools and support proposed by the system.
Procedures and responsibilities between the local (sub regional) roles and the regional roles are clearly defined, well understood and shared.

As this tool aims at being used every day as a support tool to ATSU SUPs/LTMs for an optimized allocation of staff, it will not require specific preconditions.
However, the tool can also be used when the ATSU SUPs/LTMs detects a hotspot or an optispot (detected on an elementary sector or on collapsed sectors and identified on the local LTM specific tool) and decides to use the tool.

3.3.2.11.3.6 Post conditions

Decision for a DCB measure if necessary.

3.3.2.11.3.7 Success end state

An airspace configuration will be proposed to the ATSU SUP/LTM, satisfying operational and performance criteria (that will be integrated into the tool):
- operationally feasible,
- optimizing ATSU resources (airspace and staff) in regards with the demand,
- reducing DCB imbalances (at local, sub regional and/or regional levels) and reducing ATFCM delay,
- shared at NM level, and therefore between partners.

3.3.2.11.3.8 Failure end state

The following are considered failure states:

- proposed configuration is not relevant (either not feasible, or leading to further DCB measures and/or under-efficient use of operational staff),
- no suitable configuration is proposed by the system in the relevant time frame,
- the indicators do not support decision making, the analysis and solution selection are complex,
- the proposal is not operationally feasible,
- the proposal does not meet local performance criteria,
- the proposal does not meet regional performance criteria.

3.3.2.11.3.9 Notes

None

3.3.2.11.3.10 Trigger

This use case starts as soon as there is an overload on a traffic volume (detected automatically by the system, notified to the user) and an action from the ATSU SUP/LTM is necessary. However, in real life, the trigger could be any event anticipated by ATSU SUP/LTM in the next hours (for example, no overload but a possibility to relieve some staff and therefore a need to re-optimize configuration without any impact on traffic flows but with impact on sector opening scheme).

This use case will be triggered on human intervention.

3.3.2.11.3.11 Flows

3.3.2.11.3.11.1 Main flow

1. The ATSU SUP/LTM wants to:
    a. anticipate allocation of staff (e.g., check possibility to relieve some staff; re-compute the configurations due to sickness/last-minute non-availability of ATCO; check potential new schemes when new airspace sectorisation has been introduced; etc.),
    b. or investigate any DCB issue.
        i. Depending on the tool, the ATSU SUP/LTM may define their performance objective (what is the DCB issue to be solved? What is the goal to be obtained by the proposed configuration? And how will the users feed the tool with this operational goal, so that the different options can be selected and ranked?).
2. The ATSU SUP/LTM selects the "what-if configuration" exploration window. The what-if window will display the proposed configurations with associated performance indicators to support impact assessment and decision making,
3. Based on this window, the what-if tool will propose the most optimized configuration (and/or a list of suitable ones) for the next 6 hours, in respect of the goal(s) to be obtained, as decided by ATSU SUP/LTM,
4. The what-if window will display occupancy/entry counts curves of the sectors in the new configuration,
5. Other indicators for analysis and decision making can be displayed (complexity, uncertainty, delays, at local level and sub-regional level with ATSUs),
6. After coordination with LTM, the ATSU SUP decides to implement the new configuration,
7. The future configuration is shared at network level to NM.

3.3.2.11.3.11.2 Alternative flow: cross-border sector configuration

1. The SUPs/LTMs of two adjacent ATSUs want to:
    a. anticipate and optimize allocation of staff (e.g. check potential new schemes when new airspace sectorisation has been introduced),
    b. or investigate any common/shared DCB issue.
        i. Depending on the tool, the ATSU SUP/LTM may define their performance objective (what is the DCB issue to be solved? What is the goal to be obtained by the proposed configuration? And how will the users feed the tool with this operational goal, so that the different options can be selected and ranked?)

2. The ATSUs SUPs/LTMs select the "what-if configuration" exploration window. The what-if window will display the proposed configurations for both ATSUs with associated performance indicators to support impact assessment and decision making,
3. Based on this window, the what-if tool will propose the most optimized configuration for both ATSUs (and/or a list of suitable ones) for the next 6 hours, in respect of the goal(s) to be obtained, as decided by ATSUs SUPs/LTMs,
4. The what-if window will display occupancy/entry counts curves of the sectors in the new configurations,
5. NM impact assessment can provide a more global view of the impact of the solution on the global network,
6. Other indicators for analysis and decision making can be displayed (complexity, uncertainty, delays, at local level and sub-regional level with ATSUs),
7. ATSUs SUPs and LTMs coordinate[7] together for the most appropriate configuration[8] to select,
8. The ATSUs SUPs select and validate the new configuration to be implemented,
9. The future configuration is shared at network level to NM.

Failure states for cross borders cases:

- coordination between ATSUs is not feasible,
- no agreement between the ATSUs on the best solution to choose.

3.3.2.11.3.11.3 Failure flows

Link to DCB-UC-06 Spot Resolution and monitoring

3.3.2.11.4 DCB-UC-03: Imbalance Detection and Spot Declaration during the Tactical Phase

3.3.2.11.4.1 Scope

The scope of this use case is limited to the detection of imbalances and declaration of spots during the Tactical Phase.

3.3.2.11.4.2 Level

User Level.

3.3.2.11.4.3 Summary

This use case describes the local process of detecting an imbalance and declaring, if needed, the appropriate kind of spot (hotspot or optispot).

3.3.2.11.4.4 Actors

[7] Coordination means are not developed within this UC (this remark is valid for all UCs, except where clearly explicated otherwise). It is assumed to be similar with current operating method.

[8] Configuration here is to be understood as configuration over the two concerned ATSUs.

3.3.2.11.4.4.1 Primary Actors

The primary actors are the LTM and the EAP.

3.3.2.11.4.4.2 Supporting Actors

The supporting actors are the ATSU Supervisor and the Network Manager.

AU, Airports through the NOP

3.3.2.11.4.4.3 Off Stage Actors

No Off-Stage Actors have been identified.

3.3.2.11.4.5 Preconditions

Traffic demand for the D-day (Tactical Phase) is available, allowing the Imbalance Monitoring and Prediction Service to calculate all the imbalance methodologies outputs.

Optimised configurations have been planned for the ATSU.

3.3.2.11.4.6 Post conditions

Once the imbalance is detected and the appropriate kind of spot declared, the LTM/EAP shall analyse the spot and make decisions on the DCB measures (demand and capacity measures) to be taken.

3.3.2.11.4.7 Success end state

The imbalance is detected and the appropriate spot is declared (hotspot or optispot, depending on the nature of the imbalance).

3.3.2.11.4.8 Failure end state

Due to uncertain information, missing information or information corrupted:

- The imbalance, considering that it exists, is not detected. Therefore, the spot is not declared, which can lead to an overload situation,
- An imbalance is detected but does not match with what will happen in reality: either the nature of the imbalance, or its scale is wrongly assessed. This might lead to unnecessary or even counter-productive measures (creating imbalances or worsening existing imbalance).

3.3.2.11.4.9 Notes

None

3.3.2.11.4.10 Trigger

The imbalance detection may be triggered by:

- an alert on the Traffic Volume capacity threshold violation,
- an alert on the Occupancy Traffic Monitoring Values violation,
- an alert on the Complexity Monitoring Values violation,
- an alert on the ATCO Workload Monitoring Values violation,
- an alert on the Performance Monitoring Values violation.

3.3.2.11.4.11 Flows

3.3.2.11.4.11.1 Main flow

- For each Traffic Volume under the Area of Responsibility of the LTM/EAP, the Traffic Counts (Hourly Entry Counts and Occupancy Counts), Complexity and ATCO Workload are displayed to the LTM/EAP, based on the Configurations plan built and updated tactically as in DCB-UC-02,
- For each Traffic Volume, the LTM/EAP analyses the information provided by the Imbalance Prediction and Monitoring Service,
- If some of the local monitoring values established for a particular Traffic Volume are violated (capacity, occupancy, complexity, ATCO workload, performance), an alert is displayed to the LTM/EAP,
- The LTM/EAP analyses the alert issued by the system and decides, based on the nature of the imbalance, the declaration of the appropriate spot.
    - If the spot is safety-critical and reflects opportunity for resource optimization, the LTM/EAP declares a hotspot and publish it into the NOP,
    - If the spot is not safety-critical, the LTM/EAP declares an optispot and publishes it into the NOP.

3.3.2.11.4.11.2 Alternative flow

- The NM monitors the network status and identifies a local imbalance through its own Imbalance Prediction and Monitoring Service,
- The NM communicates to the local ATSUs involved the possible imbalance and the need to declare a spot,
- The ATSU Supervisor notifies to the LTM/EAP the imbalance detected by the NM,
- The LTM/EAP assesses the imbalance identified by the NM and depending on the nature declares a hotpsot or an optispot.

3.3.2.11.4.11.3 Failure flows

If the failure end state occurs, and there is indeed an imbalance that may lead to a safety issue, then the hotspot shall be resolved by the Planner Controller and Executive controller taking actions on the impacted flights.

3.3.2.11.5 DCB-UC-04: Spot analysis

3.3.2.11.5.1 Scope

Investigation within the INAP phase of a demand/capacity imbalance already identified as a spot at local level and published for wider visibility via the NOP. The investigation sets out to understand the nature of the spot and establishes the subsequent course of action for resolution using the best combination of capacity and/or demand intervention to meet performance targets.

3.3.2.11.5.2 Level

User level

3.3.2.11.5.3 Summary

3.3.2.11.5.3.1 Identify demand-capacity imbalance

The aim here is to verify the earlier declaration of a spot in the NOP within the AoR as a ‘true’ hotspot, and provide information to the users to enable them to prioritise hotspot assessment.

Users are able to identify declared demand-capacity imbalances (hotspots) within the AoR (and potentially within the wider network as well). Where there are multiple hotspots, users are able to establish an order for further investigation. Such an order will be driven by, e.g. severity of overload, the KPI(s) overloaded, time to go before execution or decision milestone. Such prioritisation not only ensures the most important spots are dealt with first, but also delivers workload efficiencies for INAP actors.

The default position is that action will be required to resolve the hotspot – but the assessment process that starts here will define the possibilities and options for such action – and may include simply monitoring with no direct action yet. Such monitoring-only will require re-investigation at defined milestones as demand data matures.

The LTM/EAP will need to have access to all the hotspots published in the AoR, and the LTM/EAP will need to have sufficient information to identify a priority order for spot investigation. LTM/EAP will ideally also have visibility of spots outside their AoR to ensure a joined-up network approach.

The assessment criteria for imbalance uses relevant KPIs – Entry, Occupancy, Complexity & workload in addition to any local performance KPIs.

3.3.2.11.5.3.2 Consult Capacity data

LTM/EAP will be able to select the area and adjacent areas to know the status of available capacity. Users need to understand not only what sector configuration is planned around the time of the hotspot, but also what alternative options are available/feasible. This directly links into, e.g. ATCO resource numbers and validations, together with operational practicalities of transition time needed to move from one configuration to another.

In parallel, users need to understand the airspace configuration planned for the time around the hotspot, e.g. ARES activity. As with the sector configuration options, they need to understand what alternative options are available in terms of revising the ARES activity.

The LTM/EAP will need to have access to capacity related information options (in addition to those currently planned) to allow what-if activity on demand data and identify an appropriate capacity measure.

Consultation of capacity and demand data (below) does not entail action to implement, it is the activity that sets the context for the crucial what-if activity that follows.

3.3.2.11.5.3.3 Consult demand data

Consultation of accurate demand in order to gain a more detailed understanding of the traffic in order to identify potential demand-led solutions to test using what-if capability.

This consultation effort incorporates a check on demand prediction, and therefore the extrapolated workload and complexity indications, are in line with the user's expectations and experience. Assumption is that such demand data will be accurate in profiling of flights in 4-D, capable of taking into any modification via revisions.

3.3.2.11.5.3.4 What-if activity

What-if activity comprises running the demand data through different (viable) sector/airspace configurations to find the best option to resolve the imbalance, together with any demand intervention to fine tune the demand using, e.g. Regulation/STAM.

What-if capability is able to operate holistically and is able to identify the optimal solution that best meets performance targets with minimal negative impact on stakeholders.

The impact of both demand and capacity measures is accurately modelled for both system-led and manual assessment as to suitability, with capability to allow rerun with modifications where users identify the need for modification.

3.3.2.11.5.4 Actors

3.3.2.11.5.4.1 Primary Actors
LTM, EAP and ATSU Supervisor.

3.3.2.11.5.4.2 Supporting Actors
None.

3.3.2.11.5.4.3 Off Stage Actors
None.

3.3.2.11.5.5 Preconditions

Preconditions are primarily seen as relating to the information required to run the process.

A spot (hotspot or optispot) is detected, declared and published in the NOP, and the LTM/EAP wants to understand the conditions of the spot in order to establish a plan to resolve it.

3.3.2.11.5.6 Post conditions

Output from the identify-consult-what-if activities within this UC is taken to the CDM process for:

- Assessment by those required to implement the action,
- revision (where required),
- agreement,
- implementation.

3.3.2.11.5.7 Success end state

A plan is identified to resolve the spot efficiently and effectively, and can be taken by the user for CDM and implementation in the next stage.

3.3.2.11.5.8 Failure end state

Failure to understand and interpret the Demand/Capacity data will result in an inefficient solution to resolve the published spot, potentially leading to reactive and more penalising measures closer to execution.

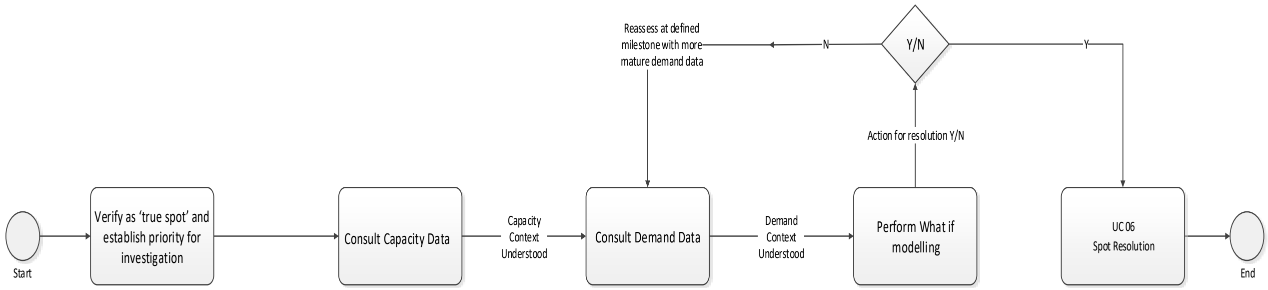
3.3.2.11.5.9 Notes

3.3.2.11.5.10 Trigger

Publication of the spot at local level (and in the NOP).

3.3.2.11.5.11 Flows

3.3.2.11.5.11.1 Main flow



3.3.2.11.5.11.2 Alternative flows

None

3.3.2.11.5.11.3 Failure flows

None

3.3.2.11.6 DCB-UC-05 How to choose a DCB measure

3.3.2.11.6.1 Scope

This Use Case is identified to describe the local workflow to choose the most appropriate DCB measure, both DAC and/or ATFM, at the right level of granularity (high certainty), included the assessment and resolution of local complex situations (e.g. hotspots), making the best use of the ATM resources.

The granularity and uncertainty at which the local complexity information is needed to allow an efficient DCB decision-making process varies from the strategic to the tactical phase, in order to provide appropriate inputs for airspace design, sector configuration optimisation and, in the broader context, DCB measures elaboration. They relate also to the number of factors or elements that the user or system considers when determining complexity, considering both airspace and time horizon. Additional elements will lead to finer resolution of the complexity model. Depending on the timeframe and related uncertainties, different imbalance prediction approaches are proposed to manage the different granularities and nature of demand-capacity imbalances. During the pre-tactical and execution phases, the variability and uncertainty of traffic demand make that the correct granularity coefficient, chosen at least among the three basic elements (traffic volume, flow and flight), is to be considered as the essential key to solve the imbalance and apply the ATFM measure to the correct candidate(s).

According to the flight plans introduced in the system, any critical situation is identified through an estimation of the complexity/workload (through the local complexity assessment methodology implemented by the ANSP) in terms of a value of complexity per each volume both per flight, and per group of flights. If the evaluated complexity is detected as being inside the thresholds, the related complexity situation will be marked as non-critical (acceptable situation); if it is detected as being outside the thresholds, the related complexity situation will be marked as critical (non-acceptable situation). The choice of a DAC or ATFM measures will be evaluated at local level based on the available information about the possible re-shaping of the sectors concerned in the adopted configuration and on some other criteria as the amount of flights subject to performance criteria/indicators measurements and the "quality" of the measurements (e.g. ranking in terms of business objectives:

penalty for Airlines, etc.). As mentioned above, the evaluation process will use indicators, e.g. the ranges of complexity values, which can direct the final choice.

3.3.2.11.6.2 Level

User level.

3.3.2.11.6.3 Summary

This Use Case addresses the process at local level to assess and resolve local complex situations (e.g. hotspots), capacity shortfalls and any kind of DCB imbalances. The assessment and resolution are provided through a continuous monitoring of traffic situation and evaluation of opportunities, to identify and apply the best performing DCB management measures, with the lowest impact on traffic. These solutions will be evaluated (through impact assessment at local levels) and coordinated with the relevant partners before their implementation. The selection of the DCB measures to be implemented will be made according to the operational situation (timeframe, stakeholders involved, nature of the problem and the objectives).

Depending on the timeframe and related uncertainties, different imbalance prediction approaches are proposed to manage the different granularities and nature of demand-capacity imbalances. During the pre-tactical and execution phases the variability and uncertainty of traffic demand make that the correct granularity coefficient chosen at least among the three basic elements (traffic volume, flow and flight) is to be considered as the essential key to solve the imbalance and apply the ATFM measure to the correct candidate(s).

The solution may rely on capacity measures, and trigger for example a need for airspace re-configuration to fit with the new picture of the traffic distribution, as well as on demand measures, including regulations and/or STAM measure(s). Airspace configuration management and demand measures need to be processed in an integrated way, rather than two completely different processes, as both can have an impact on each other. As an illustration, STAMs like level capping measures may lead to change the sectors configuration to balance the CWPs' workload and facilitate their implementation by ATCOs.

When DAC process reaches its limit, Demand balancing will be performed through ATFM measures (Level Capping, horizontal rerouting, Mandatory Cherry Pick regulation (MCP)/Ground Delay, airborne delay absorption).

The continuous assessment of evolving traffic situation will be done using appropriate indicators (Entry Counts and Occupancy Counts; Complexity Values; type of spot; applicability to a flight or flow), business objectives of companies, airports, performance indicators…

The NM role consolidates the local actions (problem notification, planned solution) and provides Network View through NM impact assessment.

3.3.2.11.6.4 Actors

3.3.2.11.6.4.1 Primary Actors

SUP, LTM and EAP: Evaluate different solutions to solve imbalances and optimize performance of the network while keeping ATC load to an acceptable level by using DCB management.

NM: Consolidate the local planned solutions in order to provide a Network View.

3.3.2.11.6.4.2 Supporting Actors

ATFCM Unit to support a close coordination between all the capacity aspects involved in the process.

Environmental specialist and Operational Controllers to optimize the flight profile.

Airspace Users: the customers who have shared their performance expectations and business objectives and can be affected by the implemented measures.

3.3.2.11.6.4.3 Off Stage Actors

None.

3.3.2.11.6.5 Preconditions

Preconditions are primarily related to the operational situation at the time (timeframe, stakeholders involved, nature of the problem and the objectives).

- Local configuration plan has been optimized taking into account traffic demand and performance objectives shared via the NOP,

- ATFCM situation has evolved and an imbalance is identified at local level. The nature and scale of the imbalance is assessed at local level, type of spot is declared for common situation awareness.

3.3.2.11.6.6 Post conditions

After the implementation of the DCB measure the system will support the monitoring of the situation to determine whether strategic objectives are achieved.

3.3.2.11.6.7 Success end state

The implemented DCB measure(s) resolve(s) the identified imbalance: the solution impact is assessed by monitoring the evolution of the implemented measure and the resolution of the imbalance identified, along the performance objectives shared by partners (e.g. AUs, NM, ANSPs).

3.3.2.11.6.8 Failure end state

The implemented DCB solution does not solve the identified imbalance.

In case of failure, reiterate to identify a new solution to solve possible new imbalances detected.

3.3.2.11.6.9 Notes

N/A

3.3.2.11.6.10 Trigger

This use case starts as soon as a local complex situation is detected (e.g. hotspot declared).

3.3.2.11.6.11 Flows

3.3.2.11.6.11.1 Main flow

The process followed by LTM/ EAP actor in the selection of measure(s) to solve an imbalance situation is composed of the following (general) steps:

1. Detect the imbalance based on traffic situation and looking at HEC, OC and complexity values (through the local complexity assessment methodology implemented by the ANSP and in terms of a value of complexity per each volume both per flight, and per group of flights). If the

evaluated complexity is detected as being outside the thresholds, the related complexity situation will be marked as critical (non-acceptable situation),

2. Identify possible solution(s) based on automation support provided by What-If and the indicators values. The selection of the DCB measures (DAC or ATFM) to be implemented will be made according to the operational situation (timeframe, stakeholders involved, nature of the problem and the objectives) and the choice will be evaluated at local level based on the available information about the possible re-shaping of the sectors concerned in the adopted configuration and on some other criteria as the amount of flights subject to performance criteria/indicators measurements and the "quality" of the measurements (e.g. ranking in terms of business objectives: penalty for Airlines, etc.). When the solution relies on capacity measures, it could trigger for example a need for airspace re-configuration to fit with the new picture of the traffic distribution. When DAC process reaches its limit, Demand balancing will be performed through ATFM measures, including regulations and/or STAM measure(s) (Level Capping, horizontal rerouting, Mandatory Cherry Pick regulation/Ground Delay, airborne delay absorption). Airspace configuration management and demand measures need to be processed in an integrated way, rather than two completely different processes, as both can have an impact on each other. As an illustration, STAMs like level capping measures may lead to change the sectors configuration to balance the CWPs' workload and facilitate their implementation by ATCOs,
3. Coordinate the DCB Measure with all involved actors, including NM, Airports and AUs affected,
4. Implement the selected measure,
5. Assess solution impact by monitoring the evolution of the implemented measure and the resolution of the imbalance identified.

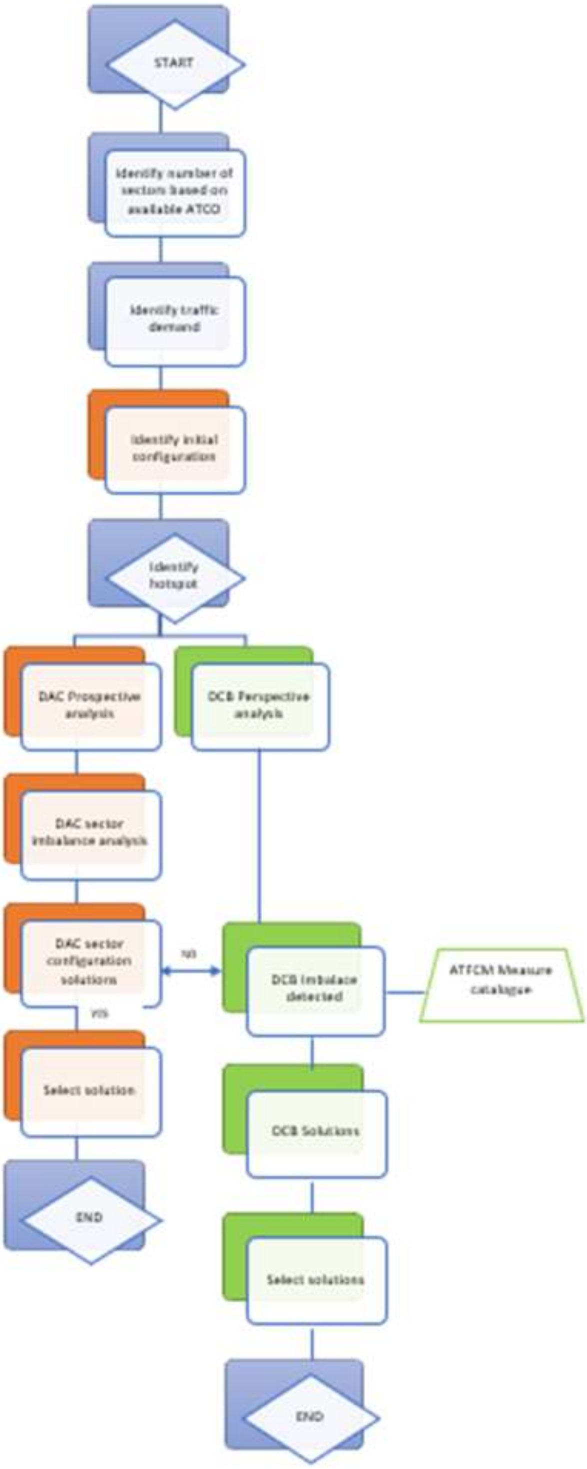


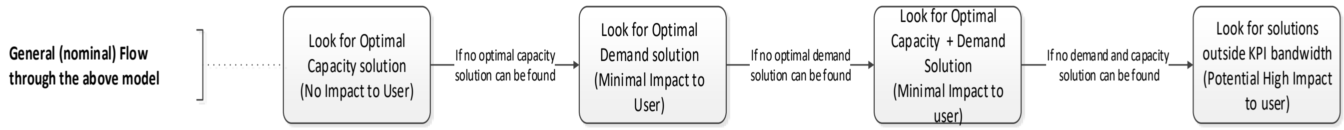
Figure 24. Flow applied to choose a DCB measure.

3.3.2.11.6.11.2 Alternative flows

None.

3.3.2.11.6.11.3 Failure flows

In case of failure, reiterate to identify a new solution to solve the detected imbalance.



Note: this flow is simplified to highlight the priority given to resolution via capacity measures. A capacity solution will implicitly take in the demand and will have compatibility with options to intervene later in the INAP process to fine-tune (e.g. with STAM) if the spot requires further attention.

3.3.2.11.7 DCB-UC-06: Spot Resolution and monitoring

3.3.2.11.7.1 Scope

Identification within the early/mid-INAP phases of a local demand/capacity imbalance, with subsequent resolution able to take into account:

- new sectorisation options,
- ARES options,
- demand intervention.

to arrive at an optimised plan for progression into the latter stages of INAP processes.

3.3.2.11.7.2 Level

User level

3.3.2.11.7.3 Summary

Planning as input to INAP process at t-6 hrs:

Optimal configurations are defined by Pre-tactical planners using forecast demand data at D-1 and updated early on D-0 to set the baseline capacity for the tactical operation. This agreed capacity plan will contain relevant data for the area of responsibility/interest:

- Sector Configuration plan – Optimised to forecast demand and available resource,
- Airspace booking plan (i.e. ARES) - Optimised to Mil demand and forecast GAT demand and available resource.

The planning process will identify *potential* hotspots with assessed and modelled actions to best resolve them if they do appear later in the planning process. They are not applied now as confidence in their appearance is too low at this stage.

Planning from t-6 hrs:

The DCB tool notifies users where demand (as measured using the primary KPIs Entry/Occupancy/Workload and Complexity) exceeds the capacity of the current configuration plan.

Entry per hr KPI at t-6 hrs is likely to be the main reference KPI due to the relatively low maturity and variability of demand data at this early stage. However, as the timeline progresses closer to t-0, other KPIs (specifically Occupancy and Workload/Complexity/Uncertainty) take greater prominence in identification and subsequent assessment and resolution of a hotspot.

Resolution:

Resolution of an imbalance is likely to require elements of both capacity and demand to ensure the compatibility with performance needs. However, the priority at ANSP level is likely to favour capacity solutions wherever possible due to the influence of regulatory performance targets. However even here, the choice of a capacity solution will be influenced by its compatibility with a demand intervention strategy for subsequent fine-tuning.

Using the new DAC capability tool (together with the DCB tool), INAP will be able to identify optimal options to revise the capacity among the following:

a. Resectorise:

   On D-0, feasible sectorisations are open to flexible management available at local level, including using new vertically-defined sectors where introduced. (Link to DCB-UC02-Optimised Configurations).

b. Reconfigure ARES activity:

   Revise activity within the parameters available (e.g. time/location/volume) for local adjustment – defined to provide flexibility without negatively impacting the ARES users' needs.

c. (a) and (b) in combination:

   An optimised sectorisation configuration is designed to utilise ATCO resource in the best way to meet demand whilst intervening to manage demand only by exception.

   An optimised location and time slot for ARES is designed to accommodate segregated activity with the least negative impact to capacity. Note it is possible to optimise to other KPIs where capacity is not a factor, e.g. measure of local environmental performance.

   However, as DAC sets out to integrate both sectorisation and airspace, it is essential that output from a sector configuration optimiser using the new sectors can take into account the output from an ARES optimiser function (and vice versa) in order to provide an overall capacity solution to a hotspot/imbalance.

   Integration of any intervention to fine-tune demand into these optimised configurations is a necessity.

d. Revise MV:

   This is a formalisation of the current process INAP users already adopt after assessing an apparent imbalance and deciding the ATCO team can manage it without further action. Capture of this decision to effectively raise the capacity for this occurrence within the system provides transparency to other users

What-Else modelling is relatively immature at this iteration of the UC, but is expected to be a part of any decision-making process in planning. It aims to reduce some of the inconsistencies in the current operation from human subjectivity and varying experience, utilising historic data with ML/AI.

CDM is an integral element of spot-resolution to ensure the applied action is compatible with the needs of stakeholders whose requirements are not modelled in the optimisation what-if/else process.

Resolution monitoring:

After applying the resolution to solve a spot, further monitoring is needed to ensure that the implemented capacity and demand intervention plan is working as required.

Monitoring is expected to identify whether additional measures are needed, or whether the ones applied can be relaxed to reduce their negative impact on users.

Once satisfied the resolution is a success, specific monitoring of an ex-spot ceases, and any subsequent imbalance is identified via DCB monitoring.

3.3.2.11.7.4 Actors

INAP roles encompass LTM, ATSU Supervisor, and EAP.

3.3.2.11.7.4.1 Primary Actors

LTM / EAP, ATSU Supervisor

3.3.2.11.7.4.2 Supporting Actors

FOC, NM, airports, AUs via the NOP

Note: CDM will be performed where required I non-nominal situations only, as it is expected that the nominal situations will be sufficiently covered with planning and revisions processes.

3.3.2.11.7.4.3 Off Stage Actors

None

3.3.2.11.7.5 Preconditions

Preconditions are primarily seen as relating to the information required to run the process.

A baseline Sector and ARES configuration is known going into the INAP phase, alongside any baseline plan to manage the operation (including the potential for hotspots and pre-modelled resolution). Staff availability and deployment is known.

Rules for sector configurations are defined, as are the decision-points for ARES allocation.

3.3.2.11.7.6 Post conditions

Handing over a stable plan (in terms of meeting performance criteria) with identified spots resolved and specific monitoring ended, with the plan viable for the roles within the later INAP timeline to continue working with - without imposing undue workload on them to manage unresolved issues that should have been managed at early/mid INAP timeframe.

3.3.2.11.7.7 Success end state

Handing over a viable plan to be implement at ATC level

3.3.2.11.7.8 Failure end state

Sectorisation and airspace plan is not optimal, requiring reactive demand measures that are overly penal. From a user perspective, failure is inability to carry out activity within the framework rules or even cancellation.

3.3.2.11.7.9 Notes

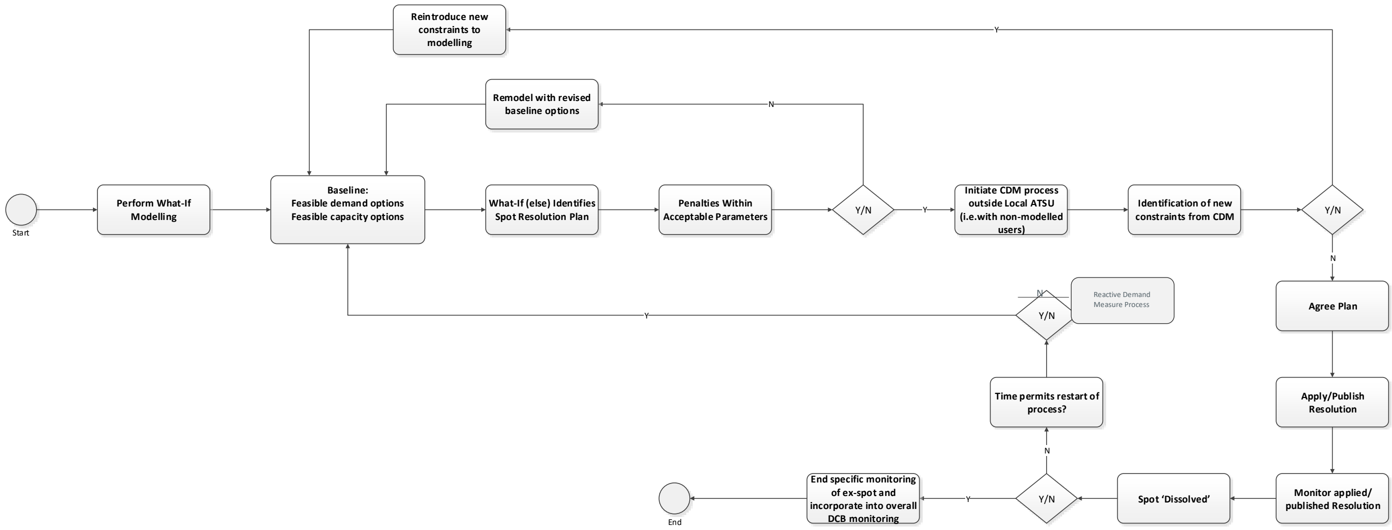
None

3.3.2.11.7.10 Trigger

Imbalance detected against KPI (relevant performance target being measured).

3.3.2.11.7.11 Flows

3.3.2.11.7.11.1 Main flow (see appendix D for a better visibility)



Perform What-if modelling:

Where available, this incorporates system driven what-else. Input to modelling is in terms of feasible capacity options (i.e. DAC), and feasible demand-intervention options. Modelling capability delivers accuracy for local factors, but may not be able to incorporate external users needs, hence need for LTM/EAP to engage in CDM (see below)

LTM/EAP use the output from the modelling – an optimised solution – as the basis for their decision-making, and assess the output in terms of acceptable penalty for users and feasibility for the ATCO team to implement. The LTM/EAP will take the modelled solution, with any necessary modification made by them, to CDM

CDM:

The LTM will jointly agree a preferred resolution to the spot that best resolves the spot itself whilst not impacting on local performance needs for the whole ATSU.

The LTM will take the locally-optimised resolution to other affected users, directly and/or via NM. As their precise needs are not known, there is expectation for some modification. If the need for revision is significant, the LTM will reopen CDM at local level for reassessment.

Agreement and resolution publication:

Following agreement amongst key users, resolution is enacted, with the measures to modify demand and capacity published via local and NM systems.

Monitoring:

The LTM will monitor regularly or will be automatically advised by the tool if a threshold is crossed on the timeframe the LTM has already worked on.

If a threshold is crossed again on this timeframe, the LTM will take other DCB measures to manage the hotspot and this use case will start again from the beginning.

3.3.2.11.7.11.2 Alternative flows

N/A (at this time).

3.3.2.11.7.11.3 Failure flows

N/A (at this time).

3.3.2.11.8 DCB-UC-07: What-if Flight exclusion tool

3.3.2.11.8.1 Scope

This use case is identified to describe the workflow and the computation process to support the assessment of a set of STAMs to solve a local hotspot in short term to execution phases. This analysis is based on machine learning functionalities and/or expert rules. The goal is to determine if the ATC workload of a traffic volume can be reduced by removing a number of eligible flights. If a regulation is still necessary, those flights will be excluded and be targeted with specific measures in coordination with the adjacent ACC that would be impacted by those measures. This would reduce the impact of the regulation on the network.

3.3.2.11.8.2 Level

User Level

3.3.2.11.8.3 Summary

This use case describes first how to identify flights that can “lower/reduce” an overload on a sector using a “what-if exclusion tool”. Once they are identified, the “what-if exclusion” tool will display occupancy curves of the on-loaded and offloaded sectors. Depending on the results given by the tool, DCB measures may be implemented with a cross border coordination to assess their impact and maximize their effects.

3.3.2.11.8.4 Actors

3.3.2.11.8.4.1 Primary Actors

LTM, EAP and/or ATSU Supervisor.

Their role

- to select a timeframe where a hotspot is detected. The what-if exclusion tool will work on this timeframe,

- to assess the curves of the offloaded and on-loaded sector to decide if other measures are needed,

- to assess the impact of the measures in relation to performance indicators.

3.3.2.11.8.4.2 Supporting Actors

None.

3.3.2.11.8.4.3 Off Stage Actors

None.

3.3.2.11.8.5 Preconditions

A hotspot on an elementary sector or on collapsed sectors is detected and identified on the local LTM/EAP specific tool. The overload is relatively small, and STAMs on a few candidate flights to remove them from the overloaded Traffic volume seems to be the optimal resolution option. Performance indicators have been shared among partners (NM, AUs, airports and ANSPs).

3.3.2.11.8.6 Post conditions

STAMs are ready for sharing and implementation.

3.3.2.11.8.7 Success end state

A list of corresponding flights are proposed to the user.

3.3.2.11.8.8 Failure end state

Proposed Flights are not relevant.

3.3.2.11.8.9 Notes

None.

3.3.2.11.8.10 Trigger

This use case starts as soon as there is limited overload on a traffic volume and an action from the user is necessary.

3.3.2.11.8.11 Flows

3.3.2.11.8.11.1 Main flow

1) The user is alerted by an automatic detection or wants to anticipate or investigate A small overload in a TV,
    a. The user selects and validates an exploration window (for this specific TV on a specific timeframe, corresponding to the hotspot).
2) Based on this window, the what-if exclusion tool will propose a list of flights to exclude,

3) The what-if exclusion tool will display occupancy curves of the on-loaded and offloaded sector and other performance indicators,
4) The workload of the on-loaded sector seems acceptable, the user will propose the associated STAMs for implementation by ATC,
5) The LTM/EAP will coordinate with the adjacent ACC LTM to assess the impact of these measures on the adjacent ACC.

3.3.2.11.8.11.2 Alternative flows

This workflow starts at step 4 of the nominal flow:

4) b. If the workload of the onloaded sector is not acceptable, the user will look for other DCB/DAC measures.

4) c. If the offloaded sector workload is still too high, the user will look for additional DCB/DAC measures.

The workflow continues then to 4)a of the nominal flow or to the failure end state.

3.3.2.11.8.11.3 Failure flows

N/A

3.3.2.11.9 DCB-UC-08a: Air Traffic Control in an integrated DAC-DCB environment - hotspot

3.3.2.11.9.1 Scope

This use case is identified to describe how the integrated DCB-DAC environment and processes impact the ATCO workload to solve an identified hotspot.

The case of an optispot is described in a dedicated UC.

3.3.2.11.9.2 Level

User Level,

3.3.2.11.9.3 Summary

In Execution phase, DAC elements are to be deployed/activated according to the plan, i.e. EDAC and its updates.

On the D of Ops, in the frame of an integrated DCB-DAC environment, the LTM will continuously monitor the demand in real time and manage the available capacity through both capacity and demand measures. The ATCO, in addition to its ATC services tasks, will have to implement these measures.

Though changes of sectorisation and periodical ARES activations/deactivations during the Day of Operations is not new element introduced by DAC and DCB concepts and they occur under current baseline ATC Modus Operandi, the new integrated DAC-DCB environment will make those changes more dynamic, requiring adhoc communications and tools to support the new processes.

3.3.2.11.9.4 Actors

3.3.2.11.9.4.1 Primary Actors

- ATCO: Executive and Planning ATCOs providing ATC in DAC environment,
- ATSU SUP,

- LTM/EAP.

3.3.2.11.9.4.2 Supporting Actors

NM (for collaborative management of capacity and demand).

3.3.2.11.9.4.3 Off Stage Actors

Aircraft crews.

3.3.2.11.9.5 Preconditions

- Latest /updated EDAC is successfully implemented,
- Short Term ATFCM situation and associated complexity is planned and monitored by LTM,
- ATCOs situation awareness in their area of responsibility is ensured,
- A hotspot occurs.

3.3.2.11.9.6 Post conditions

None.

3.3.2.11.9.7 Success end state

- De-confliction and airspace usage optimisation are ensured in safe and effective manner,
- ATCOs situation awareness allow to provide ATC service and implement DAC-DCB measures,
- ATFCM actors (LTM/EAP, ATSU SUP) have a good awareness of current ops room configuration and complexity,
- Hotspot is solved.

3.3.2.11.9.8 Failure end state

- De-confliction and/or airspace usage optimisation are not ensured or possible in safe and effective manner,
- Hotspot cannot be solved by local DAC-DCB measures (e.g. a regulation or a scenario is required).

3.3.2.11.9.9 Notes

None.

3.3.2.11.9.10 Trigger

This use case starts as soon as new DAC is implemented according to latest published/updated EDAC and a hotspot occurs.

3.3.2.11.9.11 Flows

3.3.2.11.9.11.1 Main flow

1) The LTM takes into account a hotspot,
2) The LTM checks planned DAC-DCB measures, i.e. upcoming configuration change, planned short-term ATFCM measures on involved sectors and applies one of the following,
    a. No DAC-DCB measures are planned : LTM assesses with ad-hoc tools the solutions to solve the hotspot and effects on traffic to identify the best options, using his/her demand and capacity measures catalogue and the workflow continues to step 3 alternative flow,

   b. A configuration change is planned: LTM evaluates with ad-hoc tools effect of the planned actions on the traffic as it may allow to solve the new hotspot.
      i. If the configuration change planned allow to solve the hotspot in the most optimal manner, then the LTM do not plan any new action and the workflow continues to step 3, nominal flow,
      ii. If the hotspot is not solved or LTM detects potentials for better solution, the LTM evaluates the new solution to solve the hotspot while not degrading the overall situation awareness with use of complementary DAC-DCB measures and the workflow continues to step 3, alternative flow.

3) The LTM coordinates to ATSU SUP. Each ATCO's pair involved in the configuration change gets aware of their future area of responsibility as soon as upcoming DAC is displayed on the HMI (but not activated yet), i.e. as from a minima 10 min, or more, before new DAC activation time,

4) ATCO communicates with the receiving ATCO that are about to take in charge (part of) their area of responsibility during the upcoming sectorisation change in order to get situation awareness,

5) The receiving ATCO shall confirm they are ready to accept the DAC sectorisation change before starting its implementation. The change is made when both teams are ready (i.e. no immediate ATC actions are due within the time lapse of the transfer),

6) As soon as new DAC is activated and displayed on the ATC system, ATCO starts provision of ATC service in their new area of responsibility,

7) ATCO takes into account and integrates the aircraft that are about to enter their new area of responsibility. CWP tools shall present to the controller the flight/s that need to be transferred or assumed during a DAC sectorisation change. CWP tools shall provide the controller the TFLs of the aircraft that are about to exit to their area of responsibility,

8) ATCO communicates to aircraft the frequency of new following sectors that are going to assume control over the flight. In order to do that sector frequency shall be shown to the ATCO at the later, after 60 seconds before the aircraft crosses sector boundary. Alternatively, Sector frequency might be automatically sent to the pilot after a transfer control action,

9) ATCO identify conflict between aircrafts and issue necessary instructions to concerned aircrews in order to solve the conflicts. In order to do so ATCO should be supported by CD/R tools, tuned to allow a proper use on the current and upcoming DAC sectorisation, in the relevant timeframe,

10) ATCO should monitor conflict avoidance by aircrew active ARES and issue instructions if and when required. ATCO should be supported by adequate Monitoring aids that takes into account time and volume of ARES activations and both current sectorisation,

11) Planner ATCO needs to detect future conflict risk taking into account upcoming DAC sectorisation. An ATCO needs to be supported by a CWP system that properly reports conflicts taking into account upcoming DAC sectorisation changes,

12) At the end of the configuration change, LTM monitors the traffic situation and ensures the complete solving of the hotspot.

3.3.2.11.9.11.2 Alternative flows

3BIS) Hotspot is identified. The LTM assesses solution to solve the hotspot through DAC and/or DCB measures in the most efficient manner,

4) The LTM picks a solution (integrating ATFCM measures in the DAC environment) and coordinates with relevant actors (among which ATSU SUP, implementing ATCO, upstream and/or downstream LTM) to apply measures,

5) In case of short-term ATFCM measures, the implementing ATCO receives the measures to be implemented and applies whenever possible. Coordination between implementing, onloaded and off loaded sectors, within the ATSU and with other concerned ATSUs should be asynchronous and supported by automation to avoid additional workload. The workflow continues to step 3 – Nominal Flow.

3.3.2.11.9.11.3 Failure flows

13) The solution applied does not allow to solve the hotspot. The LTM has to find a new DAC/DCB solution. The workflow returns to Nominal Flow, step 2,

13bis) the implementing ATCO cannot implement the measure. Several reasons can cause this flow:

- implementing ATCO has not been aware of the request to implement the measure with sufficient lookahead time,

- the measure was not feasible due to traffic (creating a conflict),

- the ATCO was already under excessive workload,

- the on loaded sector is unexpectedly busy and cannot accept additional traffic.

3.3.2.11.10 DCB-UC-08b: Air Traffic Control in an integrated DAC-DCB environment - optispot

3.3.2.11.10.1 Scope

This use case is identified to describe how the integrated DCB-DAC environment and processes impact the ATCO workload to address optispots.

The case of a hotspot is described in a dedicated UC.

3.3.2.11.10.2 Level

User Level.

3.3.2.11.10.3 Summary

In Execution phase, DAC elements are to be deployed/activated according to the plan, i.e. EDAC and its updates.

On the D of Ops, in the frame of an integrated DCB-DAC environment, the LTM will continuously monitor the demand in real time and manage the available capacity through both capacity and demand measures. The ATCO, in addition to its ATC services tasks, will have to implement these measures.

Though changes of sectorisation and periodical ARES activations/deactivations during the Day of Operations are not new element introduced by DAC and DCB concepts and they already occur in current baseline ATC Modus Operandi, the new DAC-DCB environment will make those changes more dynamic, and the global workflow of detection-analysis and resolution will rely on both DAC and DCB processes, closely intertwined and not only in sequence, requiring adhoc communications and tools to support the new processes.

3.3.2.11.10.4 Actors

3.3.2.11.10.4.1 Primary Actors

- ATCO: Executive and Planning ATCOs providing ATC in DAC environment,
- ATSU SUP,
- LTM/EAP.

3.3.2.11.10.4.2 Supporting Actors

NM and NOP.

3.3.2.11.10.4.3 Off Stage Actors

- Aircraft crews,
- AOs dispatch/CFSP.

3.3.2.11.10.5 Preconditions

- Latest /updated EDAC is successfully implemented,
- Short Term ATFCM situation and associated complexity is planned and monitored by LTM,
- ATCOs situation awareness in their area of responsibility is ensured,
- An optispot is identified.

3.3.2.11.10.6 Post conditions

None.

3.3.2.11.10.7 Success end state

- De-confliction and airspace usage optimisation are ensured in safe and effective manner,
- Aircraft trajectories are optimised in respect of AUs business needs,
- ATCOs situation awareness allow to provide ATC service and implement DAC-DCB measures,
- ATFCM actors (LTM/EAP, ATSU SUP) have a good awareness of current ops room configuration and complexity.

3.3.2.11.10.8 Failure end state

Airspace usage optimisation is not ensured or possible in safe and effective manner:

- The optispot cannot be addressed without degrading global situation awareness,
- AOs cannot optimize their trajectories and benefit from the optispot.

3.3.2.11.10.9 Notes

None.

3.3.2.11.10.10 Trigger

This use case starts as soon as new DAC is implemented according to latest published/updated EDAC and an optispot is identified (there is room for more traffic to be handled, e.g. because of an anticipated release of ARES, or increase in ATSU capacity…).

3.3.2.11.10.11 Flows

3.3.2.11.10.11.1 Main flow

1) The LTM detects and shares an optispot,
2) The LTM checks planned DAC-DCB measures, i.e. upcoming configuration change, planned short-term ATFCM measures on involved sectors and applies one of the following,
    a. No DAC-DCB measures are planned: LTM assesses with ad-hoc tools the solutions to address the optispot and effects on traffic, using his/her demand and capacity measures catalogue and the workflow continues to step 3 alternative flow,
    b. A configuration change is planned: LTM evaluates with ad-hoc tools effect of the planned actions on the traffic as it may allow to optimise the network performance,
        i. If the planned configuration change allows to address the optispot in the most optimal manner, then the LTM do not plan any new action and the workflow continues to step 3, nominal flow,
        ii. If the optispot is not addressed or LTM detects potentials for better solution, the LTM evaluates the new solution to optimise the airspace while not degrading the overall situation awareness with use of complementary DAC-DCB measures and the workflow continues to step 3, alternative flow.
    c. A measure was already planned on traffic demand (e.g. regulation, MCP, STAM…), which is no longer needed (as identified by the optispot detection). After analysis, coordination with relevant actors (e.g. other LTMs) and agreement of SUP, the LTM can cancel/release all or part of the constraint on the traffic, allowing aircraft to fly closer to their business needs. Continues to step 17 a).

3) Once the optispot is published, the concerned airspace will become available for AOs to optimize their trajectories planning (ie to avoid a saturated area and related ATFCM delays, shorten their route) and fly closer to their business needs. NM will make proposals to AOs through the NOP, associated with impact assessment to support coordination with partners and decision making (NM AOWIR),

4) Modification of flight planning,
    a. Nominal flow: Successful coordination between partners: impact is assessed as acceptable for the on loaded LTM, which can take additional traffic while respecting the sectors capacity. AOWIR shows the added value of the proposed trajectory to AOs and planning modification is facilitated by B2B services without any penalty (like Late Updater status). Some AOs take the opportunity for rerouting/ optimisation of their trajectories and change their flight plans along NM proposals (via RRP B2B services).

5) The on loaded LTM and SUP analyse the additional demand and evaluate its impact on ATC workload,
    a. Nominal flow: optispot is solved (no unused capacity) and the planned airspace configuration remains valid,
    b. Alternative flow: optispot is solved (no unused capacity) but the planned airspace configuration needs to be updated to better adapt to the new demand.

6) LTM analyses and coordinates with SUP the required change in configuration. After successful coordination, new plan of configuration is shared in the ops room,

7) Each ATCO's pair involved in the configuration change gets aware of their future area of responsibility as soon as upcoming DAC is displayed on the HMI (but not activated yet), i.e. as from a minima 10 min, or more, before new DAC activation time,

8) ATCO communicates with the receiving ATCO that are about to take in charge (part of) their area of responsibility during the upcoming sectorisation change in order to get situation awareness,

9) The receiving ATCO shall confirm they are ready to accept the DAC sectorisation change before starting its implementation. The change is made when both teams are ready (i.e. no immediate ATC actions are due within the time lapse of the transfer),

10) As soon as new DAC is activated and displayed on the ATC system, ATCO starts provision of ATC service in their new area of responsibility,

11) ATCO takes into account and integrates the aircraft that are about to enter their new area of responsibility. CWP tools shall present to the controller the flight/s that need to be transferred or assumed during a DAC sectorisation change. CWP tools shall provide the controller the TFLs of the aircraft that are about to exit to their area of responsibility,

12) ATCO communicates to aircraft the frequency of new following sectors that are going to assume control over the flight. In order to do that sector frequency shall be shown to the ATCO at the later, after 60 seconds before the aircraft crosses sector boundary. Alternatively, Sector frequency might be automatically sent to the pilot after a transfer control action,

13) ATCO identify conflict between aircrafts and issue necessary instructions to concerned aircrews in order to solve the conflicts. In order to do so ATCO should be supported by CD/R tools, tuned to allow a proper use on the current DAC sectorisation,

14) ATCO should monitor conflict avoidance by aircrew active ARES and issue instructions if and when required. ATCO should be supported by adequate Monitoring aids that takes into account time and volume of ARES activations and both current sectorisation,

15) Planner ATCO needs to detect future conflict risk taking into account upcoming DAC sectorisation. An ATCO needs to be supported by a CWP system that properly reports conflicts taking into account upcoming DAC sectorisation changes,

16) At the end of the configuration change, LTM monitors the traffic situation and assesses the optimisation of the situation through dedicated indicators, such as complexity.

3.3.2.11.10.11.2 Alternative flows

1) The LTM assesses solution to address the optispot through DAC and/or DCB measures in the most efficient manner,
2) The LTM picks a solution and coordinates with ATSU SUP and implemented ATCO to apply measures,

3) In case of short-term ATFCM measures, the implemented ATCO integrates the measures and applies whenever possible. He coordinates when required to off-loaded and on-loaded sectors. The workflow continues to step 3 – Nominal Flow.

3.3.2.11.10.11.3 Failure flows

Numbers refer to nominal flow steps.

13) The solution applied do not has effect on the indicators related to complexity. The LTM has to find a new DAC/DCB solution. The workflow returns to Nominal Flow, step 2.

OR

17) b. no proposal is accepted by AOs, and the optispot remains, meaning unused available capacity.

a. as the added value compared to the initial trajectory is limited,
b. as the dispatchers don't have time to process the proposal (proposal was received too late),
c. as dispatchers workload is too high and the optimization of the flights is not top priority compared to other actions.

3.3.2.11.11 DCB-UC-09: Target flow CASA

3.3.2.11.11.1 Scope

This use case describes the application of a new type of regulation to a specific flow of aircraft. This regulation, called Target Flow CASA, is applied to reduce the number of flights impacted by a traditional regulation.

3.3.2.11.11.2 Level

User Level

3.3.2.11.11.3 Summary

Targeted CASA regulations are a DCB measure that mitigates the impact of current CASA regulations and thus reduces the number of minutes of delay at Traffic Volume and Network level, as well as the number of flights affected by the measures applied.

It includes workflows required for ACC LTMs to electronically coordinate CASA regulations, which are limited to specific flows, with the NM. The NMOC performs a network impact assessment before approving the regulation request. The NM infrastructure is used for the coordination (B2B service) mechanism and to distribute the resulting flight planning updates across the network.

To setup a Targeted CASA regulation, six steps are required:

1. Identify the imbalance,
2. Assess the impact,
3. Select the most proper option,
4. Assess the Network impact,
5. Implement,
6. Monitor.

3.3.2.11.11.4 Actors

3.3.2.11.11.4.1 Primary Actors

INAP Actors: LTM and or EAP

3.3.2.11.11.4.2 Supporting Actors

- NM,
- AUs.

3.3.2.11.11.4.3 Off Stage Actors

None.

3.3.2.11.11.5 Preconditions

An identified Demand / Capacity imbalance (due to an entry or occupancy TMV violation) requires an action by the INAP actor to resolve it. The imbalance (or hotspot) is characterised in terms of its location (geographically and time wise), as well as its severity.

3.3.2.11.11.6 Post conditions

Targeted CASA Flow regulation is declared and marked for implementation.

3.3.2.11.11.7 Success end state

Declared hotspot is resolved.

3.3.2.11.11.8 Failure end state

Declared hotspot is **not** resolved.

3.3.2.11.11.9 Notes

None.

3.3.2.11.11.10 Trigger

Hotspot declared.

3.3.2.11.11.11 Flows

3.3.2.11.11.11.1 Main flow

Step 1: Simulate and compare

1) Based on the identified hotspot, the INAP support tool identifies the flows that go through the identified hotspot. Then it graphically displays them,
    a) Optionally, the System might propose flows that impact the area although they do not necessarily go through it,
    b) The System provides a Filter to enable FLOW selection.
        i) Timeframe,
        ii) Waypoints,
        iii) Origin / Destination.
2) INAP considers the information displayed and Selects Flows based on his/her experience,
    a) Optionally the System might propose best flow to have the minimum impact.
3) Using the available hotspot description, the INAP support tool identifies and assembles a general CASA regulation request following the NM B2B simulation service format. The request includes information about:

   a) Location [automatic],
   b) Rate [set by INAP],
   c) Window width / Period [set by INAP].
4) Once it is assembled, the petition is sent to the NM using the B2B simulation service.

Step 2: Assess the impact

5) The NM simulates the impact of the proposed general CASA regulation. Results are provided in terms of:
   a) Number of impacted flights,
   b) Total delay,
   c) Average delay.
6) The local complexity tool uses this information to estimate the resulting complexity,
7) The results are presented to the INAP. The general CASA regulation will be used as the baseline from which all comparisons will be made,
8) Using the information regarding the selected flows and the available imbalance description, the INAP support tool assembles a Targeted CASA flow regulation. The request includes information about:
   a) Location [automatic],
   b) Rate [set by INAP],
   c) Window width / Period [set by INAP],
   d) Flows [selected by INAP].
9) Once it is assembled, the petition is sent to the NM using the B2B simulation service,
   a) If the regulation is assembled manually, then the user will need to approve it,
   b) The NM simulates the impact of the proposed Targeted CASA flow regulation,
   c) The local complexity tool uses this information to re-estimate the resulting complexity.
10) The results are presented to the INAP which uses the information displayed to compare the simulated regulations using the **General CASA regulation** as the baseline. The INAP support tool highlights the best option:
   a) Smaller Number of impacted flights,
   b) Smaller Total delay,
   c) Smaller Average delay,
   d) Lower Complexity.
11) INAP uses the displayed information to assess if proposed regulations are enough to solve the imbalance,
12) If the proposed regulations are not enough, then INAP will refine the initial targeted CASA regulation using the **first and second steps**.

Step 3: Select the most proper option

13) Select the best option,
14) Send proposal to NM,

Step 4: Network impact assessment

15) Performed by the NMOC,

Step 5: Implement

16) Once approved by the NMOC, the INAP actor proceeds to implement the measure,
17) NM infrastructure is used to distribute the results,

Step 6: Monitoring

18) Perform the monitoring.

3.3.2.11.12 DCB-UC-10: Change of DCB plan and its publication update

3.3.2.11.12.1 Scope

This use case is identified to describe the DCB changes assessment and publication.

3.3.2.11.12.2 Level

User Level.

3.3.2.11.12.3 Summary

A change of the already published DCB plan information is allowed at any time after the publication.

The change can be requested due to unexpected events such as weather, staff shortage etc.

The LTM takes in charge the identification of needed changes and the coordination with the involved actors in order to assess the new situation and its impact.

3.3.2.11.12.4 Actors

3.3.2.11.12.4.1 Primary Actors

- LTM: its goal is to provide the appropriate DAC/DCB information to be shared by NM that is in charge of publication/update of the information to concerned actors,
- WOC: its goal is to get agreement on the final ARESs, allowing him to accomplish the mission.

3.3.2.11.12.4.2 Supporting Actors

NM: its goal is to build/maintain and share the agreed DAC/DCB overall information. DAC/DCB information is published once it reaches the agreed level of maturity.

3.3.2.11.12.4.3 Off Stage Actors

AUs: Their interest in the process is to verify the impact of DAC/DCB measures on theirs flight intentions in order to identify better opportunities, to get the situation awareness and to adapt their SBT if needed.

3.3.2.11.12.5 Preconditions

- DCB measures has been calculated (optimized) or coordinated (CDM),
- The network impact assessment has delivered acceptable resulted KPIs.

3.3.2.11.12.6 Post conditions

None.

3.3.2.11.12.7 Success end state

- DCB plan update in EDAC format is published,
- Proposed sector capacities are available to all actors through the EDAC published on NM/NOP.

3.3.2.11.12.8 Failure end state

None.

3.3.2.11.12.9 Notes

None.

3.3.2.11.12.10 Trigger

This use case starts when ARESes update/cancelation request is issued, or ATFCM measures needs to be updated due an unexpected event (staff shortage, weather, etc.).

3.3.2.11.12.11 Flows

3.3.2.11.12.11.1 Main flow

1) The Change of DCB plan can be triggered by:
   - new info on/change of the ASM event,
   - the update of the flow management measures after the identification of sectors' configuration modification and revised DCB measures.
2) LTM starts the assessment of the impact on agreed sector configurations and on DCB measures already in place,
   a) If there is NO impact then:
      - Final optimal DCB plan in EDAC format is published,
      - End of the UC.
   b) Otherwise (an impact is observed).
      i. If the event is an update, then LTM identifies counterproposals and sends them to WOC,
      ii. WOC coordinates the counterproposals with LTM,
      iii. If the counterproposal is accepted by the WOC, then,
      iv. Final optimal DCB plan in EDAC format is published,
      v. End UC.
3) LTM adapts the sector configuration and/or DCB measures,
4) Coordinates with NM(and with the other LTMs through NM) the newly adapted sector configurations and DCB measures,
5) Final optimal DCB plan in EDAC format is published,
6) End of UC.

3.3.2.11.12.11.2 Alternative flows

N/A.

3.3.2.11.12.11.3 Failure flows

N/A.

3.3.2.11.13 DCB-UC 11: Optimal ARES (DMA) allocation in DAC Pre-Tactical Level

3.3.2.11.13.1 Scope

This use case is identified to describe decision-making process in DAC on pre-tactical level to support the optimal ARES/DMA allocation vs local KPIs, traffic demand forecast, ATC volumes and sector configuration. This analysis is performed with support of automated tools and/or expert rules. The goal is to determine if the impact on planned airspace configuration triggered by ARES/DMA allocation can be reduced by the proper coordination process within DAC when inconsistencies are detected.

3.3.2.11.13.2 Level

User Level.

3.3.2.11.13.3 Summary

This use case describes how DAC Impact assessment is being done at local level in order to identify impact on defined KPIs in order to verify up to which extent the planned DAC meet the Local KPIs and military requirements. Following simulations with initial ideal sector configurations and WOC agreed ARES/DMAs allocation, local performance target are evaluated. When inconsistencies are detected, coordination threads are triggered.

A change of the already agreed ARES/DMAs is allowed at any time during CDM process. The change can be requested by all involved Actors due to operational reasons such as unexpected events, staff shortage etc. DAC takes in charge the identification of needed changes and the coordination with the involved actors in order to assess the new situation awareness.

3.3.2.11.13.4 Actors

3.3.2.11.13.4.1 Primary Actors

LTM who:

- performs the analysis to prepare optimal operational performance and assesses several scenarios through the use of DAC tools.
- analyses the traffic sample,
- defines optimal sector configurations in the medium short term phase when inconsistencies are identified,
- if necessary, solves imbalances by modifying ARES/DMAs during the negotiation process.

3.3.2.11.13.4.2 Supporting Actors

None.

3.3.2.11.13.4.3 Off Stage Actors

Military requests for ARES/DMAs.

3.3.2.11.13.5 Preconditions

- Rules and priorities of DAC management CDM process at local level have been defined,
- RSA/DMAs request process,
- Local KPIs, military requirements are defined and shared,
- FM/BTs available with a low uncertainty level,
- RSA/DMAs shared.

3.3.2.11.13.6 Post conditions

None.

3.3.2.11.13.7 Success end state

- The LTM is able to define and satisfies the required local performances: number of maximum available sectors, staffing requirements,
- FBT with associated level of maturity (uncertainty index) is created and can be downloaded by interested actors,
- LTM extracts the data from shared ARES/DMAs dataset,
- Operation Plan verified against local KPIs and military requirements,
- ARES/DMAs and ATC requests are de-conflicted and allocated,
- DAC Plan is verified against Local KPIs and military requirements,
- Airspace configuration is defined and there is no remaining imbalance, or a compromise of airspace configuration is found through CDM.

3.3.2.11.13.8 Failure end state

- The LTM is NOT able to define a Service Strategy that satisfies the required performances,
- FBT is not defined and not available,
- Operation Plan is not verified against Local KPIs and military requirements,
- DAC Plan is not verified against Local KPIs and military requirements,
- The identified Airspace configuration is not able to resolve remaining imbalances or to find an acceptable compromise solution.

3.3.2.11.13.9 Notes

None.

3.3.2.11.13.10 Trigger

- As soon as operational needs are identified LTM receives the ARES/DMAs dataset,
- When performance target issues are identified on the local level following simulations with sector configuration versus received ARES/DMAs,
- At any time, the request for ARES/DMA update/cancelation could be received by LTM due to any unexpected event (staff shortage, new ARES/DMA time schedule).

3.3.2.11.13.11 Flows

3.3.2.11.13.11.1 Main flow

1 FBT is uploaded by actors concerned to be used as input or to trigger next DAC Plan definition and planning processes,
2 LTM receives DMAs datasets,
3 LTM identifies D-OPS local performance targets,
4 LTM creates ATC Volumes (based on ATC requests),
5 LTM evaluates impact of received requests and identifies if there are conflicting,
6 If there are conflicts between requests, LTM solves them by negotiation process,
7 LTM receives final ARES/DMAs and runs simulation with sector configuration proposed vs final ARES/DMAs received in order to check the consistency vs local performance targets,
8 LTM performs tuning actions by running simulations with flexible parameters and/or alternative sector configurations,

9 LTM selects the best configurations proposals and ARES/DMAs allowing the adherence to performance targets,

10 If an agreement is reached and Performances targets are achieved, the LTM confirms allocation of ARES/DMA.

3.3.2.11.13.11.2 Alternative flows

N/A.

3.3.2.11.13.11.3 Failure flows

N/A.

3.3.3 Differences between new and previous Operating Methods

DAC Management

There are following main new elements that characterise New Operating Methods:

- Performance based approach focusing on providing optimal DCB solutions,
- Dynamic Sectors and ARES Design Airspace Configuration based on Sharable Airspace Modules (SAMs) airspace design architecture,
- Non predefined Sectors Configurations: Airspace Configurations are becoming fully dynamic and integrated with the capacity management process into a wider DCB process,
- Cross-border Airspace Configurations within one ANSP and between two ANSPs (to be coordinated with PJ32-01),
- Dynamic Mobile Areas of 2 types: DMA type 1 and 2,
- Move from collaborative processes to ASM merged with DCB into fully integrated ASM/ATFCM/ATS CDM layered process,
- The process is not bound by time anymore, but rather by data uncertainty parameters,
- Enables/support Full Free Route operations.

The Table below provides overview of Differences between new and previous Operating Methods.

The information appearing in SESAR OSED solution 08.01 section 3.3.3 [39] is also applicable in this section.

Local & network Consolidated Predicted Workload

Depending on the timeframe and related uncertainties, different predicted workload methodologies are proposed to manage heterogeneous granularities' issues:

- Traffic density management to ensure there are not too many flights in a traffic volume,
- then traffic complexity management to support keeping an acceptable level of complexity induced by flights in a traffic volume,
- then, local complexity methodology with various indicators, criteria and options.

Spot Management

Regardless the methodology used (HEC, OC, weighted complexity, complexity…), the imbalances are characterized with Traffic Monitoring Values (TMV). These thresholds represent different objectives (safety, rate optimisation, critical & crisis situation ….) and are related to different meanings and different category of Spot:

- HotSpot: Initially introduced in SESAR1 with the peak and sustain thresholds. It aims at preventing excessive ATC workload and to ensure that the traffic delivered to ATC controllers will always be manageable in the safe limits of workload. It represents potential indications in term of controller workload, and implicitly potential non-critical safety risks,

- OptiSpot: It aims at preventing bunch (without safety issue) and to ensure that the traffic delivered to ATC controllers will always be manageable in an organised and smoothed way. It aims also at providing room for better use of spare capacity. It defines the context of an optimisation issues. Thus, an Optispot is triggered by TMV (rate marks) violation,
- NetSpot: The Network Spot (netSpot) is a captured geographical area that includes linked airspace clusters predicted to be in non-nominal or critical states. The netSpot represents a reference for all concerned actors and stakeholders indicating that:

  - a congestion is propagating at the network level moving to a non-nominal or critical situations,

  - a global strategy will be coordinated and implemented to resolve it.

INAP function

The INAP function proposes two functions LTM and EAP working on different timeframes and associated levels of uncertainty and granularity, rendering better service to Airspace Users, in close connection with NM, thanks to shared situational awareness regarding the problems identification, solution means and performance objectives. Local DCB actors and Extended ATC Planning actors work within an INAP platform (Integrated Network and ATC Planning) providing the full capabilities to manage imbalances through assessment of evolving traffic situations and evaluations of opportunities, in order to apply the best performing option between the Dynamic Airspace Configuration, Flow Managements measures (synchronization, sequencing) and Trajectory measures.

Collaborative NOP

Enriched DCB information has been proposed:

- AU Simple preference (refer to solution 38) to indicate a preferred action for a flight in case of DCB constraints (or to be offered opportunities).They will be considered by airports in the process of assigning targeted CASA, within the selection of flights logic and equally they will be considered by LTM/INAP in the process of STAM assignment within the selection of flights logic.
- Imbalance repository service to share at NM level

Activities (in EATMA) that are impacted by the SESAR Solution	Current Operating Method	New Operating Method
Demand capacity balancing (DCB)	Sector configuration changes are determined in a fixed way, thus being more inefficient	Dynamic changes of sector configuration, adapting better the traffic demand

	Optimised sector configurations are only based on capacity measures	Inclusion of demand measures to propose and implement the best possible sector configuration
	External airspace limits correspond to political borders between countries, therefore they restrict sectors' shape making them less useful to allocate traffic demand	Establishment of FABs with more operationally feasible boundaries, improving the effectiveness of sectors design
	DCB (ATFCM) service is limited by various constraints (military activities, local resources availability) and focused mainly on minimising delays only. Configuration options are selected to provide a local benefit. Configuration options cannot be compared to the options of neighbouring ACC (little readjustment by NMC).	Initial performance based approach DAC management provides an opportunity to optimise overall performance and not only capacity at local sub regional and regional level. Decision is made on Network Wide Benefit Numbers of constraints included in DAC and becoming manageable (e.g. ARES place and time) which allows to provide most optimum solution in line with defined strategic objectives Range of airspace solution for capacity management is much wider. Configurations are selected to maximise the overall (network) efficiency, whilst not being "locally" inefficient, nor bringing disbenefit to ANSPs. There may be a variety of local ANSP KPI's and regional (European Commission) targets. Alignment/agreement of theses competing drivers is required as a precursor to this network optimisation.

Prediction of Traffic and Workload	The current ATM environment is not fully compatible with accurate prediction of the traffic and sector predicted workload with which to determine efficient airspace configurations, thus leaving to ACCs to determine the "optimal" airspace configurations, in regard with their staff and equipment, helped by the current ATFCM tools. This occurs every day in Europe and impact resources and cost. Traffic demand is not confirmed until hours (typically 3 hours) before operation / execution.	The process is not bound by time anymore, but rather by data uncertainty parameters. One key element of the SESAR long-term concept is the transition from airspace-based operations to trajectory-based operations. With respect to airspace configurations, a significant expected benefit of trajectory-based operations is the increased predictability of individual aircraft – with a resulting improvement in the accuracy of predictions of emerging traffic demand. Thus the SESAR trajectory-based operations offer the opportunity to improve the optimisation of resources to meet the forecast traffic demand and workload and then optimise the sector configuration. Information on emerging traffic demand will be more certain – as a result of Trajectory Based Operations concept. However it is not known how much more certain (information on emerging traffic demand) will be. (There will therefore be a requirement for a measure of uncertainty). The relationship between actual traffic demand and workload/complexity/capacity is understood.
Network Operations Plan (NOP)	Separate plans at Network level: ATFCM Daily Plan AUP/UUP	Move to combined DCB plan (EDAC) Enhanced network view with enriched DCB information

Improved Decision Making – More efficient use of Resources	Configuration options are limited and not necessarily able to manage the traffic demand efficiently. Currently 10 controllers (for example) may be used (to open a number of sectors) with a particular configuration, but configuration options are limited and not necessarily able to manage the traffic demand efficiently.	Dynamic Sectors and ARES Design Airspace Configuration based on Airspace Building Block and Controlling Building Block airspace design architecture. Airspace configuration will be developed in a smoother and more flexible way (smaller sectors but in a larger number: the ability to combine sectors will be much more efficient), so as to better cope with demand and to plan in advance required resources. Airspace ("Sectors") can better be aligned with the demand. In addition, an optimization of the resources available can highly contribute to a better efficiency of the system. If keeping a sector closed during a period of time leads to some light STAM measures, then some ATCOs can have a rest in order to be prepared for a peak of demand minutes later. And if these ATCOs had not been made available then the measures to be implemented would have had more impacts on global performance indicators.
Predicted Workload	Entry Count, Occupancy Count	Enhanced Local Complexity methodology and assessment, Uncertainty
Hotspot Management	Hotspot	Optispot, NetSpot Spot Resolution Monitoring and concept of NetLoad
INAP function	LTM + EAP	Detailed LTM+EAP (ATCO link)

Table 14: Difference between new and previous Operating Method – Integrated DCB

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

This chapter gathers the requirements relevant for the Solution PJ09-W2-S44 at OSED level (at the start of the V2 Phase). These requirements have been defined using the SESAR Requirements and V&V guidelines [25].

The REQ definition and Trace tables contain:

- The links to the Activities to which the requirement is applied. The links to the Roles and Function Blocks to which the requirement is allocated will be defined in a future version of this SPR-INTEROP / OSED document,
- The Rationale field providing an initial explanation about the requirement formulation. It may include for instance how the requirement will be amended for the need of consolidation or to justify the allocation or a reference to a source document (e.g. Safety Assessment, Operational Assessment Report, etc.). The field may be evolved in the final version of this SPR-INTEROP / OSED document with results integration.

4.1 Naming rules

Requirements identifier follows the following schema:

REQ-S44.W2-SPRINTEROP-UU01.0123

where ‘UU01’ is set to:

For Operational Category

- SPOT for “Spot Management”,
- IPMS for “Imbalance Prediction and Monitoring Service”,
- DCBM for “DCB Catalogue of Measures”,
- WHIF for “What-if Service”,
- WHEL for “What-else feature”,
- CMPL for “Local Complexity Service”,
- STRA for “Strategic Process”,
- PRET for “Pre-Tactical Process”,
- TACT for “Tactical Process”,

- POST for “Post-Ops Process”,
- INAP for “INAP Role”,
- CDMP for “Collaborative Decision Making”,
- XBRD for “Cross Border”,
- KPAI for “DCB KPA/KPI Assessment”.

For Safety Category:

- SAF for “Safety requirements”

For Security Category:

- SEC for “Security requirements”

For Human Performance Category:

- HP for “Human Performance requirements”.

For Interoperability Category:

- IER for “Interoperability requirements”.

And where “0123” is incremented “+10”, starting from “0010” for each category and sub-category

4.2 Functional Requirements

This section provides the functional requirements for the PJ09-W2-S44 project. The section is subdivided in key concepts elements of the solutions, in the same order as presented in section 3.3.2.1, namely:

- Spot Management,
- Imbalance Prediction and monitoring Service,
- DCB Catalogue of measures within INAP timeframe,
- What-if Service,
- What-else feature,
- Local Complexity Service,
- Strategic Process,
- Pre-tactical Process,
- Tactical Process,
- Post Ops Process,

- INAP Role,
- Collaborative Decision Making,
- Cross Border,
- DCB KPA/KPI Assessment.

The set of requirements is built upon requirements established for PJ08.01 and PJ09.02 wave 1 projects (please refer to relative OSED [38] & [39]). The requirements listed in this document focus on new or updated elements developed with the solution 44 and elements from wave 1 with an <in progress> status at the end of the phase.

Terminology: in all requirements below, the term INAP refers to INAP actors.

4.2.1 Spot Management

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SPOT.0010
Title	Spot Category
Requirement	INAP shall manage different type of spot category (Hotspot, Optispot), ensuring the proper planning, implementation and monitoring of the problem resolution.
Status	<validated>
Rationale	INAP manage different type of spot categories (Hotspot, Optispot), ensuring the proper planning, implementation and monitoring of the problem resolution. This requirement comes from Wave 1 : REQ-09.02-OSED-HSPT.0001
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-02
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	Imbalance severity Value
<ALLOCATED_TO>	<Activity>	Evaluate imbalance

<ALLOCATED_TO>	<Role>	INAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Spot management

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SPOT.0020
Title	Type of Traffic Monitoring Values
Requirement	INAP actors shall be able to define different types of Traffic Monitoring Values (TMV). These thresholds represent different objectives (safety, rate optimisation) and are related to different meanings (TMV-safety, TMV-rate, TMV-monitoring)
Status	<validated>
Rationale	INAP actors can define different types of Traffic Monitoring Values (TMV). These thresholds represent different objectives (safety, rate optimisation) and are related to different meanings (TMV-safety, TMV-rate) This requirement comes from Wave 1 : REQ-09.02-OSED-HSPT.0010
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-02
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	Imbalance severity Value
<ALLOCATED_TO>	<Activity>	Evaluate imbalance
<ALLOCATED_TO>	<Role>	INAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Spot management

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SPOT.0030
Title	TMV-safety
Requirement	INAP actors shall be able to define safety thresholds (TMV-safety)
Status	<validated>
Rationale	TMV-safety: Initially introduced in SESAR1 with the peak and sustain thresholds. It aims at preventing excessive ATC workload and to ensure that the traffic delivered to ATC controllers will always be manageable in the safe limits of workload. It represents the acceptable limits in term of controller workload, and implicitly potential safety risks. TMV-safety are defined with two thresholds (peak, sustain). It defines the context of a safety issues in nominal situations marked out by a Hotspot. Thus, a hotspot is triggered by TMV (safety marks) violation. This requirement comes from Wave 1 : REQ-09.02-OSED-HSPT.0011
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-02
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	Imbalance severity Value
<ALLOCATED_TO>	<Activity>	Evaluate imbalance
<ALLOCATED_TO>	<Role>	INAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Spot management

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SPOT.0040
Title	TMV-rate
Requirement	INAP actors shall be able to define a rate thresholds (TMV-rate)

Status	<validated>
Rationale	TMV-rate: It aims at preventing bunch and to ensure that the traffic delivered to ATC controllers will always be manageable in an organised and smoothed way. There is no safety issue. It defines the context of an optimisation issues marked out by an Optispot. Thus, an Optispot is triggered by TMV (rate marks) violation. This requirement comes from Wave 1 : REQ-09.02-OSED-HSPT.0013
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-02
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	Monitoring treshold
<ALLOCATED_TO>	<Activity>	Define monitoring treshold
<ALLOCATED_TO>	<Role>	INAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Spot management

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SPOT.0050
Title	Spot Category Triggering
Requirement	The INAP actors shall be able to trigger different TMV for each category of spot : TMV-safety : Hotspot ; TMV-rate : OptiSpot
Status	<validated>
Rationale	Different type of TMV generate different type of spot category (hotspot, optispot) This requirement comes from Wave 1 : REQ-09.02-OSED-HSPT.0020
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-02
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	Monitoring treshold
<ALLOCATED_TO>	<Activity>	Define monitoring treshold
<ALLOCATED_TO>	<Role>	INAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Spot management

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SPOT.0060
Title	Key-parameters of the potential hotspot/optispot
Requirement	INAP shall be able to select and display for a potential hotspot/optispot, all the different parameters related to its calculation: entry counts, occupancy counts, complexity, uncertainty.
Status	<validated>
Rationale	The user need to know several key-parameters to have a better understanding of the spot, and to analyse, based upon their experience, the incidence of the potential hotspot/optispot. This requirement comes from Wave 1 : REQ-09.02-OSED-HSPT.0160
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<ALLOCATED_TO>	<High Level Operational Requirement>	P09-TLOR-02

<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	Monitoring treshold
<ALLOCATED_TO>	<Activity>	Define monitoring treshold
<ALLOCATED_TO>	<Role>	INAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Spot management

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SPOT.0065
Title	Hotspot/Optispot declaration to NM
Requirement	INAP system shall be able to declare hotspot/optispot to NM.
Status	<validated>
Rationale	In some instances where both the context and the contour conditions are clear, the system should be able to propose automatically a hotspot/optispot. In all cases the spot will need to be confirmed by the user. This requirement comes from Wave 1 : REQ-09.02-OSED-HSPT.0330
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-02
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	Create initial Optispot
<ALLOCATED_TO>	<Activity>	Create initial Hoptspot
<ALLOCATED_TO>	<Role>	INAP

<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Spot management

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SPOT.0070
Title	Hotspot notification to AUs
Requirement	INAP shall be able to notify hotspot to AUs.
Status	<validated>
Rationale	This requirement comes from Wave 1 : REQ-09.02-OSED-HSPT.0340
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-02
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	Optispot
<ALLOCATED_TO>	<Activity>	Share spot with stakeholders
<ALLOCATED_TO>	<Role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Spot management

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SPOT.0080
Title	Hotspot/optispot monitoring

Requirement	INAP shall be able to access the information (key-parameters) of a published hotspot/optispot, in order to assess the impact of the proposed DCB solution by the system.
Status	<validated>
Rationale	The user must know hotspot/optispot key-parameters such as, entry counts or occupancy counts; thus, he or she could assess if the adopted measure has a positive or negative impact. This requirement comes from Wave 1 : REQ-09.02-OSED-HSPT.0350
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-02
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	Spot resolution Alert
<ALLOCATED_TO>	<Activity>	Monitor spot resolution
<ALLOCATED_TO>	<Role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Spot management

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SPOT.0090
Title	Hotspot/optispot attributes
Requirement	INAP shall be able to access the information that defines a published hotspot/optispot. Traffic volume name ; With effect from ; Until ; Reason for decision ; Status
Status	<validated>
Rationale	Any user must be able to view the hotspot/optispot and its defining attributes. This requirement comes from Wave 1 : REQ-09.02-OSED-HSPT.0360

Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-02
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	Spot resolution alert
<ALLOCATED_TO>	<Activity>	Monitor spot
<ALLOCATED_TO>	<Role>	INAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Spot management

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SPOT.0100
Title	Hotspot / Optispot cancellation
Requirement	INAP shall be able to select a hotspot / optispot in proposed or coordinated status, and, after checking that capacity nominal situation has been recovered, cancel it
Status	<validated>
Rationale	If the user decides that a hotspot/optispot is no longer required, he must be able to cancel it as long as the following are met : - The spot is in status proposed or coordinated - The capacity nominal situation is checked and has been recovered This requirement comes from Wave 1 : REQ-09.02-OSED-HSPT.0380 For information on status, please refer to OSED PJ09 Wave 1 [39] - REQ-09.02-OSED-HSPT.0370
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-02
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	Spot resolution alert
<ALLOCATED_TO>	<Activity>	Monitor spot
<ALLOCATED_TO>	<Role>	INAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Spot management

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SPOT.0120
Title	Monitoring Thresholds Notification
Requirement	INAP shall be able to define the Hotspot/Optispot monitoring threshold
Status	<validated>
Rationale	INAP defines the monitoring thresholds so as to monitor the proper resolution of the Hotspot according to the traffic prediction vs these thresholds. (e.g. TMV-rate, TMV-safety, TMV-monitoring) This requirement comes from Wave 1: IER-09.02-OSED-101.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	Monitoring treshold

<ALLOCATED_TO>	<Activity>	Define monitoring treshold
<ALLOCATED_TO>	<Role>	INAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Spot management

4.2.2 Imbalance Prediction and Monitoring Service

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IPMS.0010
Title	TMV-Monitoring
Requirement	INAP shall define TMV-monitoring threshold to monitor any deviation from the DCB solution.
Status	<validated>
Rationale	TMV-monitoring is set to detect deviation from the planned hotspot resolution plan. This requirement comes from Wave 1 : REQ-09.02-OSED-HSPT.0060a
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-02
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	Spot resolution alert
<ALLOCATED_TO>	<Activity>	Monitor spot
<ALLOCATED_TO>	<Role>	INAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Spot management

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IPMS.0020
Title	Alert to monitor solution implementation and efficiency
Requirement	INAP shall be able to monitor the hotspot/optispot and generate alerts should the DCB solution deviate during the execution phase and notify the stakeholders (e.g. NM, AUs, other ANSPs,…)
Status	<validated>
Rationale	Once the solution has been prepared and implemented, the hotspot/optispot shall be monitored to ensure that the DCB solution is properly executed and is not deviating. It will trigger an automatic alert in case of deviations. Such monitoring mainly aims at ensuring that the spot resolution is progressing correctly and to take additional corrective actions if necessary. This requirement comes from Wave 1 : REQ-09.02-OSED-HSPT.0060b
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-02
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	Spot resolution alert
<ALLOCATED_TO>	<Activity>	Monitor spot
<ALLOCATED_TO>	<Role>	INAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Spot management

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IPMS.0030
Title	Information of the Hotspot/Optispot Deviation

Requirement	INAP actors shall be informed of the Hotspot/Optispot Deviation Alert and shall take additional DCB measures if necessary to re-assess the spot resolution
Status	<validated>
Rationale	This requirement comes from Wave 1 : REQ-09.02-OSED-HSPT.0061
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-02
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	Spot resolution alert
<ALLOCATED_TO>	<Activity>	Monitor spot
<ALLOCATED_TO>	<Role>	INAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Spot management

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IPMS.0040
Title	Management of the Hotspot/Optispot Deviation
Requirement	INAP actors shall be able to take additional DCB measures if necessary to re-assess the Hospot resolution
Status	<validated>
Rationale	INAP actors is informed of the Hotspot Deviation Alert and shall take additional DCB measures if necessary to re-assess the Hospot/Optispot resolution This requirement comes from Wave 1 : REQ-09.02-OSED-HSPT.0061
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-02
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	Spot resolution alert
<ALLOCATED_TO>	<Activity>	Monitor spot
<ALLOCATED_TO>	<Role>	INAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Monitor spot

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IPMS.0050
Title	Monitoring forecast in relation to hotspots / optispots
Requirement	INAP shall be able to access workload, demand and complexity predictions to monitor their values and know if there are some deviations or changes from initial conditions, not only for new hotspots/optispots but also for existing ones.
Status	<validated>
Rationale	Hotspots/Optispots can be identified using three different approaches: demand, workload and complexity. Being aware of changes to any of these parameters is key to the provision of spot identification services. This requirement comes from Wave 1 : REQ-09.02-OSED-HSPT.0070
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01

<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	Hotspot resolution monitoring
<ALLOCATED_TO>	<Activity>	Monitor flights
<ALLOCATED_TO>	<Role>	INAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	DCB measures prepared in the SBT elaboration process (execution phase)

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IPMS.0060
Title	Monitoring flight plan deviations in relation to hotspots/optispots
Requirement	The system shall highlight the deviations from initial flight plan to ease the identification of changes, not only for new hotspots/optispots but also for existing ones.
Status	<validated>
Rationale	The estimation of demand, workload and complexity depend strongly on the filed flight plan. Any changes to the flight plan have to be identified as soon as possible (including changes arising from the actual operation of the flight). This requirement comes from Wave 1 : REQ-09.02-OSED-HSPT.0090
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	Hotspot resolution monitoring

<ALLOCATED_TO>	<Activity>	Monitor actual business Trajectory and update RBT accordingly
<ALLOCATED_TO>	<Role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	DCB measures prepared in the SBT elaboration process (execution phase)

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IPMS.0070
Title	Timeframe and airspace monitoring selection
Requirement	INAP shall be able to monitor the traffic situation using different timeframe and airspace, on demand.
Status	<validated>
Rationale	The system must provide the user with the flexibility to choose when and where he/she wants to analyse the traffic situation, with indicators such as traffic demand, workload, and complexity forecasts, as well as flight plan deviations This requirement comes from Wave 1 : REQ-09.02-OSED-HSPT.0100
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	Spot resolution alert
<ALLOCATED_TO>	<Activity>	Monitor spot
<ALLOCATED_TO>	<Role>	INAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

<ALLOCATED_TO>	<Activity View>	Spot management

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IPMS.0080
Title	Hotspot/Optispot status
Requirement	INAP shall be able to access the status information of a published hotspot/optispot.
Status	<validated>
Rationale	The system will provide spot status information. Status can be : Proposed ; Coordinated ; Abandoned ; Implemented ; Cancelled This requirement comes from Wave 1 : REQ-09.02-OSED-HSPT.0370
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	Spot resolution alert
<ALLOCATED_TO>	<Activity>	Monitor spot
<ALLOCATED_TO>	<Role>	INAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Spot management

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IPMS.0090
Title	Uncertainty

Requirement	Uncertainty shall be presented to the DCB actors in the tool used to monitor the evolution of traffic.
Status	<validated>
Rationale	This tool needs to integrate an uncertainty calculator which accounts for the main sources of uncertainty: timeframe, type of spot, trajectory prediction uncertainty, quality of information. Its use is very important in the decision-making process performed in the what-if function. This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<ALLOCATED_TO>	<High Level Operational Requirement>	P09-TLOR-01
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	Confidence index
<ALLOCATED_TO>	<Activity>	Evaluate imbalance
<ALLOCATED_TO>	<Role>	INAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Spot management

4.2.3 DCB Catalogue of Measures

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-DCBM.0010
Title	Definition of potential solution to the hotspot / optispot
Requirement	For each detected hotspot/optispot, INAP shall be able to define and store candidate DCB solutions.
Status	<validated>

Rationale	The solution definition process should be able to define and test as many solutions as required, for each detected spot. To ensure that no information is lost the user should be able to access these candidate solutions at any time. This requirement comes from Wave 1: REQ-09.02-OSED-HSPT_p.0200.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	Agreed DCB measure
<ALLOCATED_TO>	<Activity>	Prepare and implement DCB solution
<ALLOCATED_TO>	<Role>	INAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Spot management

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-DCBM.0020
Title	Edition of potential solution to the hotspot / optispot
Requirement	INAP should be able to further edit the stored DCB candidate solutions or select them as needed, via the hotspot/optispot identifier.
Status	<validated>
Rationale	The solution definition process should be able to define and test as many solutions as required, for each detected spot. To ensure that no information is lost the user should be able to access and edit these candidate solutions at any time. This requirement comes from Wave 1: REQ-09.02-OSED-HSPT_p.0200.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	Hotspot, Optispot
<ALLOCATED_TO>	<Activity>	Update spot
<ALLOCATED_TO>	<Role>	INAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Spot management

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-DCBM.0030
Title	Selection of the solution for hotspot/optispot
Requirement	INAP shall be able to select any solution or combination of solutions from the catalogue of measures.
Status	<validated>
Rationale	After the assessment process has been completed, INAP shall be able to select the best DCB measure or combination of demand and capacity measures. This requirement comes from Wave 1: REQ-09.02-OSED-HSPT.0300.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01

<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	Proposed DCB measure
<ALLOCATED_TO>	<Activity>	Create/Update proposal flight
<ALLOCATED_TO>	<Role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	DCB measures prepared in the SBT elaboration process (execution phase)

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-DCBM.0040
Title	Dynamic Airspace Configuration as a DCB Measure
Requirement	The INAP shall be able to evaluate the efficiency of the DCB measure(s) through all ATM phases against the assigned performance targets.
Status	<validated>
Rationale	Dynamic Airspace Configuration could be applied to a group of sectors during the whole INAP timeframe. This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<ALLOCATED_TO>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02
<ALLOCATED_TO>	<Information Exchange>	Sector count provision
<ALLOCATED_TO>	<Information Flow>	msg_sRegRegCoord
<ALLOCATED_TO>	<Activity>	Advice local DACs and FMPs of ideal sector configurations, proposed ATFM measures for remaining hotspots

<ALLOCATED_TO>	<Role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	[NOV-5] DAC_UC05_Initial Ideal sector configuration and DCB imbalance Identification (Option A)

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-DCBM.0050
Title	DCB measures
Requirement	INAP shall be able to implement any measure or combination of measures (demand and/or capacity measure(s)) to solve a demand capacity imbalance during its timeframe of operation.
Status	<validated>
Rationale	INAP has access to any measure or combination of measure from the list provided in 3.3.2.1.3 DCB Catalogue of measures within INAP timeframe This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	Constraint reconciliation
<ALLOCATED_TO>	<Information Flow>	Implemented DCB measure
<ALLOCATED_TO>	<Activity>	Implement DCB solution
<ALLOCATED_TO>	<Role>	INAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	DCB measures prepared in the SBT elaboration process (planning phase)

4.2.4 What-if Service

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-WHIF.0010
Title	Exclusion of some flights from the hotspot/optispot measure application
Requirement	INAP shall be able to select individual flights to exclude them from the potential DCB measures targeting a set of flights (hotspot/optispot measures).
Status	<validated>
Rationale	This is part of the what-if capabilities required from the system. This also permits the cherry picking flights. This requirement comes from Wave 1: REQ-09.02-OSED-HSPT.0290.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02
<ALLOCATED_TO>	<Information Exchange>	STAM Measures
<ALLOCATED_TO>	<Information Flow>	proposed DCB solution
<ALLOCATED_TO>	<Activity>	What-if identifies resolution plan
<ALLOCATED_TO>	<Role>	Upstream LTM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	What-if flight exclusion

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-WHIF.0020

Title	What-If service as enabler of DCB measures
Requirement	The What-If service shall work in an integrated manner to achieve a seamless DCB process in which the involved actors are able to compare and assess impact and efficiency of different capacity and demand measures proposals for a specific airspace situation
Status	<validated>
Rationale	The What-If Service shall be able to define the most appropriate solution (that could be capacity and/or demand measure (s)) at the right level of granularity and provide performance indicators for comparison purpose between candidates solution. The optimum solution may be a combination of demand and capacity measures, so DAC need to be fully integrated with DCB process. This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	STAM Measures
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	Perform what-if modelling
<ALLOCATED_TO>	<Role>	Upstream LTM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	What-if flight exclusion

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-WHIF.0030
Title	What-If Tool at Strategic & Pre-Tactical levels

Requirement	What-If Tool shall allow at Strategic & Pre-Tactical levels the ANSP ATFCM Unit to find new sectorisation, matching the demand with acceptable level of performance.
Status	<validated>
Rationale	What-If Tool shall allow at Strategic & Pre-Tactical levels the ANSP ATFCM Unit to find new sectorisation, matching the demand with acceptable level of performance, allowing it to coordinate with civil and military airspace users the implementation of priority rules for a specific airspace situation. This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	Perform what-if modelling
<ALLOCATED_TO>	<Role>	Upstream LTM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	What-if flight exclusion

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-WHIF.0040
Title	What-If Service for the INAP environment
Requirement	What-If Service shall allow automated support for imbalance detection and hotspot/optispot resolution, as far as INAP concept is concerned.
Status	<validated>
Rationale	What-If Service shall support INAP environment to find adequate solutions, including demand and capacity measures, maintaining

	acceptable levels of workload/complexity (e.g. : below peak levels) while minimising the impact to the Airspace User.(e.g. : adherence as much as possible to the flight plan) This requirement is a new requirement developed within the solution 44
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	Determine Feasibility of demand capacity options
<ALLOCATED_TO>	<Role>	Upstream LTM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	What-if flight exclusion

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-WHIF.0050
Title	What-If Service exchanges
Requirement	The What-If service should allow the exchange of the actions and measures to be taken with the impacted actors through the appropriate CDM mechanisms.
Status	<validated>
Rationale	Though it does not affect the effectiveness of the what if service per se, the What-If service should be connected to CDM mechanisms for even more efficiency and comes as a complement. This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	Proposed DCB solution
<ALLOCATED_TO>	<Activity>	Coordinate with adjacent LTM
<ALLOCATED_TO>	<Role>	Upstream LTM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	What-if flight exclusion

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-WHIF.0060
Title	What-If Service from Pre-Tactical to Tactical phase
Requirement	The What-If service shall allow the end user to decide, during the different time horizons, from the Pre-Tactical to Tactical Phase (up to a range of value or discretion for each ACC) what are the measures (among both airspace management measures and demand measures) with higher effectiveness and performance with regards to the resolution of a declared hotspot/optispot.
Status	<validated>
Rationale	The What-If service shall incorporate both airspace management measures and demand measures to allow the end user to decide, during the different time horizons, from the Pre-Tactical to Tactical Phase (up to a range of value or discretion for each ACC) what are the measures with higher effectiveness and performance with regards to the resolution of a declared hotspot/optispot. This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	What-if identifies resolution plan
<ALLOCATED_TO>	<Role>	Upstream LTM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	What-if flight exclusion

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-WHIF.0070
Title	What-If Service to support analysis of traffic imbalance.
Requirement	The What-If service shall complement the Imbalance Prediction and Monitoring Service by monitoring available staff, traffic, workload and complexity within defined airspace volumes.
Status	<validated>
Rationale	The What-If service shall support the analysis and resolution to find adequate solutions to complexity situations of traffic. Through various indicators it shall complement the analysis of the traffic imbalances. This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	Hotspot management

<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	What-if identifies resolution plan
<ALLOCATED_TO>	<Role>	Upstream LTM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	What-if flight exclusion

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-WHIF.0071
Title	What-If Service to support resolution of traffic imbalance.
Requirement	The What-If Service should support to avoid overload situations as much as possible by finding adequate solutions to complex issues.
Status	<validated>
Rationale	The What-If service shall support the resolution thanks to proposal of adequate solutions to complex situations of traffic. This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	What-if identifies resolution plan
<ALLOCATED_TO>	<Role>	Upstream LTM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	What-if flight exclusion

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-WHIF.0072
Title	What-If Service integrates DAC into INAP processes.
Requirement	The What-If service outputs shall integrate DAC and INAP processes as a whole process by searching through both demand and capacity measures to solve complex situations.
Status	<validated>
Rationale	The What-If service shall integrate both processes and measures to propose the optimum solutions. This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	What-if identifies resolution plan
<ALLOCATED_TO>	<Role>	Upstream LTM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	What-if flight exclusion

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-WHIF.0080
Title	What-If Service customization
Requirement	The What-If Service shall be suitable customized for each type of DCB measure (capacity or demand) at different time horizons, to answer to the different and specific needs of the operator and/or the ACC in order to assess the performance of the resolution proposal.

Status	<validated>
Rationale	The customisation includes mainly the capacity of the service to take into account the various demands from the catalogue (refers also to 3.3.2.1.3 DCB Catalogue of measures within INAP timeframe) with regards to their time horizons but also habits and constraints of the ACC. This requirement allows to ensure the service is correctly tuned to support effectively the ACC in the way of working by providing as much adherence as possible to the operating method. This requirement is a new requirement developed within the solution 44
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	What-if identifies resolution plan
<ALLOCATED_TO>	<Role>	Upstream LTM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	What-if flight exclusion

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-WHIF.0100
Title	What-If service on Capacity Measures
Requirement	The What-if service shall be applicable on the available capacity (predefined acceptable configurations, available configurations based on other constraints, assessment of DAC configurations before their activation on the CWP), by providing the capability of designing a configuration in terms of split, collapse, change of configuration, SAM, flexible boundaries.
Status	<validated>

Rationale	The What-If service, according to the DCB timeline, shall support the INAP to take airspace management measures including both airspace configuration actions (by selecting different airspace volumes defined in the strategic phase, grouping them and defining the outcome airspace volume as operational sector/CAB), and airspace refinement elements (by redefining the vertical and lateral boundaries of the operational sectors/CAB and even of the airspace volume, using flexible boundaries and the definition of VSAMs, in line with gaining flexibility and dynamicity). This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	What-if identifies resolution plan
<ALLOCATED_TO>	<Role>	Upstream LTM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	What-if flight exclusion

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-WHIF.0105
Title	What-If service reassessment
Requirement	After the definition of the new airspace configuration or of the airspace design refinement, the What-if service shall reassess the different performance indicators
Status	<validated>
Rationale	As the What-If service, shall support the INAP to take airspace management measures including both airspace configuration and airspace refinement elements (see requirement REQ-S44.W2-

	SPRINTEROP-WHIF.0100) , it is necessary to provide an actualisation of indicators each time one of these two elements is updated. . Once completed the what-if process, the user shall be able to implement the change from the What-If tool. This requirement is a new requirement developed within the solution 44
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	Remodel with revised baseline options
<ALLOCATED_TO>	<Role>	Upstream LTM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	What-if flight exclusion

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-WHIF.0106
Title	What-If service application
Requirement	Once completed the what-if process, the user shall be able to implement the change directly from the What-If tool to the operational world.
Status	<validated>
Rationale	To be more effective the use of the what-if service and transitions with the operational world shall be as seamless as possible. This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	Publish DCB measure
<ALLOCATED_TO>	<Role>	Upstream LTM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	What-if flight exclusion

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-WHIF.0110
Title	What-If service support for best sector configuration
Requirement	The What-if service shall support LTM, EAP, NM in identifying the best sector configuration at the whole airspace level or at ACC level and, within an ACC, at sector level, to manage the demand.
Status	<validated>
Rationale	The What-If service, according to the DCB timeline, shall support the INAP to take airspace management measures including both airspace configuration actions (by selecting different airspace volumes defined in the strategic phase, grouping them and defining the outcome airspace volume as operational sector/CAB), and airspace refinement elements (by redefining the vertical and lateral boundaries of the operational sectors/CAB and even of the airspace volume, using flexible boundaries and the definition of VSAMs, in line with gaining flexibility and dynamicity). This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier

<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	What-if identifies resolution plan
<ALLOCATED_TO>	<Role>	Upstream LTM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	What-if flight exclusion

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-WHIF.0120
Title	What-If service on Demand Measures
Requirement	The What-If-Service shall be possible on the traffic demand and trajectory measures such as MCP-Ground Delay, Level-Capping, Horizontal Re-Routing (both at flight and flow levels, ground and airborne).
Status	<validated>
Rationale	The What-If service shall allow the INAP to select individual flights from the list and change manually one or more of their trajectory elements in order to simulate and assess the impact on the traffic demand, workload, complexity indicators and/or other kind of performance indicators. Once completed the what-if process, the user shall be able to select a combination of measures on individual flights and/or traffic flows, and he/she shall be able to select both the candidate flow and the DCB measures to be proposed for implementation. This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44

<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	What-if identifies resolution plan
<ALLOCATED_TO>	<Role>	Upstream LTM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	What-if flight exclusion

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-WHIF.0130
Title	What-If service on combination of measures on individual flights and flows
Requirement	Once completed the what-if process, the user shall be able to select a combination of measures on individual flights and/or traffic flows alike.
Status	<validated>
Rationale	The What-If service shall allow the INAP to select measures on flows and individual flights and combine them to propose the best solution. This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	What-if identifies resolution plan
<ALLOCATED_TO>	<Role>	Upstream LTM

<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	What-if flight exclusion

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-WHIF.0140
Title	What-If service on ATFM Scenarios (Level-capping and Horizontal Rerouting)
Requirement	The What-if-service shall allow the application of ATFM scenarios published in the NOP.
Status	<validated>
Rationale	The what-if service shall be as complete as possible when exploring all options and gather all known and defined measures, included the ATFM scenarios. This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	What-if identifies resolution plan
<ALLOCATED_TO>	<Role>	Upstream LTM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	What-if flight exclusion

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-WHIF.0150

Title	What-If service on ATFM Regulation
Requirement	The what-if service shall the application of ATFM Regulations, simulating the impact of different regulation time windows and regulation rates.
Status	<validated>
Rationale	The what-if service shall be as complete as possible when exploring all options and gather all known and defined measures, included the ATFM regulations with modulations on their rates and durations. This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	What-if identifies resolution plan
<ALLOCATED_TO>	<Role>	Upstream LTM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	What-if flight exclusion

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-WHIF.0160
Title	What-If service access through an HMI
Requirement	The What-If services shall be accessible through an HMI, with functionalities allowing their launch, as well as the presentation of their results.
Status	<validated>
Rationale	The What-If shall rely on the service functionalities, closely linked to the HMI, as the INAP shall propose a solution, assess the impact and the

	benefits of that solution in terms of performance indicators and finally, implement it. Therefore, the What-If tool shall display, on one hand, the starting airspace design and on the other hand, the foreseen trajectories and, from that point on, the HMI shall let the user propose the capacity and demand measures according to the DCB timeline. This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	Perform what-if modelling
<ALLOCATED_TO>	<Role>	Upstream LTM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	What-if flight exclusion

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-WHIF.0165
Title	What-If tool displays
Requirement	The What-If tool shall display, on one hand, the starting airspace design and on the other hand, the foreseen trajectories and, from that point on, let the user propose the capacity and/or demand measures according to the DCB timeline.
Status	<validated>
Rationale	Though the requirements included in this OSED aim at defining high level concepts and not go down to tools descriptions, the authors deem that an exception has to be made for the what-if tool. This requirement is thus issued from the brainstorming during the solution work with end-users and appears to be necessary for the proper functioning of the what-

	is service as proposed in this OSED. This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	Perform what-if modelling
<ALLOCATED_TO>	<Role>	Upstream LTM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	What-if flight exclusion

4.2.5 What-else feature

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-WHEL.0010
Title	What-Else service to find potential alternative solutions in case of unsatisfactory solutions obtained with the What-If service
Requirement	To resolve a hotspot/optispot imbalance, the What-Else Service shall allow the INAP actors to ask the system for potential alternative solutions to the ones obtained with the What-If service.
Status	<validated>
Rationale	The What-Else Service should help INAP actors in finding alternative solutions to those analysed through the What-If Service. As the service is built on AI techniques, able to process a huge amount of historic data, it should also contribute to reducing some inconsistencies in the current operation due to human subjectivity and different experience of INAP actors, and should be able to propose DCB strategies

	«hidden» to them. This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	Remodel with revised baseline options
<ALLOCATED_TO>	<Role>	Upstream LTM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	What-if flight exclusion

4.2.6 Local Complexity Service

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-CMPL.0010
Title	Complexity indicator selection
Requirement	The INAP shall be able to select the desired complexity indicator to perform the analysis of the traffic situation, independently of being or not the most appropriate for the timeframe selected.
Status	<in progress>
Rationale	The INAP need to know the complexity value provided for all the available complexity indicators within the system, even if these indicators are not the most appropriate for the timeframe selected. This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
< ALLOCATED_TO >	<Information Exchange>	Information Exchange Identifier
< ALLOCATED_TO >	<Information Flow>	Information Flow Identifier
<ALLOCATED_TO>	<Activity>	Activity Identifier
<ALLOCATED_TO>	<Role>	Role Identifier
<ALLOCATED_TO>	<Sub-Operating Environment>	Sub-Operating Environment Identifier
<ALLOCATED_TO>	<Activity View> Use case as in NOV-5	Activity View Identifier

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-CMPL.0020
Title	Complexity filtering
Requirement	The INAP shall be able to filter complexity information by traffic flows and individual trajectories.
Status	<in progress>
Rationale	The INAP shall be able to manually filter certain traffic flows and individual trajectories to perform accurate complexity assessment. This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
< ALLOCATED_TO >	<Information Exchange>	Information Exchange Identifier
< ALLOCATED_TO >	<Information Flow>	Information Flow Identifier
<ALLOCATED_TO>	<Activity>	Activity Identifier
<ALLOCATED_TO>	<Role>	Role Identifier
<ALLOCATED_TO>	<Sub-Operating Environment>	Sub-Operating Environment Identifier
<ALLOCATED_TO>	<Activity View> Use case as in NOV-5	Activity View Identifier

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-CMPL.0030
Title	Individual flight complexity contribution
Requirement	The INAP shall be able to select specific flights associated to a time interval and airspace volume from the list of flights contributing to complexity to assess the individual contribution of each flight to the global complexity value.
Status	<in progress>
Rationale	The INAP shall be aware of the contribution of each flight to the global complexity value in order to select the appropriate flights over which DCB measures (e.g. STAM) will be applied. This fact will increase the efficiency of the solutions proposed and will improve the decision making process. This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
< ALLOCATED_TO >	<Information Exchange>	Information Exchange Identifier
< ALLOCATED_TO >	<Information Flow>	Information Flow Identifier
<ALLOCATED_TO>	<Activity>	Activity Identifier
<ALLOCATED_TO>	<Role>	Role Identifier
<ALLOCATED_TO>	<Sub-Operating Environment>	Sub-Operating Environment Identifier
<ALLOCATED_TO>	<Activity View> Use case as in NOV-5	Activity View Identifier

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-CMPL.0040
Title	Traffic flow complexity contribution
Requirement	The INAP shall be able to select specific traffic flows associated to a time interval and airspace volume from the list of traffic flows contributing to complexity to assess the individual contribution of each traffic flow to the global complexity value.
Status	<in progress>
Rationale	The INAP shall be aware of the contribution of each traffic flow to the global complexity value in order to select the appropriate flows of traffic over which DCB measures (e.g. STAM) will be applied. This fact will increase the efficiency of the solutions proposed and will improve the decision making process. This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
< ALLOCATED_TO >	<Information Exchange>	Information Exchange Identifier
< ALLOCATED_TO >	<Information Flow>	Information Flow Identifier
<ALLOCATED_TO>	<Activity>	Activity Identifier
<ALLOCATED_TO>	<Role>	Role Identifier
<ALLOCATED_TO>	<Sub-Operating Environment>	Sub-Operating Environment Identifier
<ALLOCATED_TO>	<Activity View> Use case as in NOV-5	Activity View Identifier

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-CMPL.0050
Title	Individual flight complexity contribution within traffic flows
Requirement	The INAP shall be able to select specific flights associated to a traffic flow to assess the individual contribution of each flight to the global traffic flow complexity value.
Status	<in progress>
Rationale	The INAP will be interested in knowing the complexity root cause of the traffic flows contributing to the global complexity. For this reason, the INAP will need the individual contribution of the flights that belong to the traffic flow under analysis to the traffic flow global complexity value This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
< ALLOCATED_TO >	<Information Exchange>	Information Exchange Identifier
< ALLOCATED_TO >	<Information Flow>	Information Flow Identifier
<ALLOCATED_TO>	<Activity>	Activity Identifier
<ALLOCATED_TO>	<Role>	Role Identifier
<ALLOCATED_TO>	<Sub-Operating Environment>	Sub-Operating Environment Identifier
<ALLOCATED_TO>	<Activity View> Use case as in NOV-5	Activity View Identifier

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-CMPL.0060
Title	Identification of the most complex flights
Requirement	The INAP shall have access to an automatic identification of the flights contributing the most to complexity within a specific airspace volume and timeframe (e.g. ranked list).
Status	<in progress>
Rationale	In order to make the decision making process quicker and more efficient, the INAP need to have available an automatic identification of the flights contributing the most to complexity (e.g. by means of a ranked list). This will allow a better identification of the most appropriate flights over which DCB measures should be applied. This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
< ALLOCATED_TO >	<Information Exchange>	Information Exchange Identifier
< ALLOCATED_TO >	<Information Flow>	Information Flow Identifier
<ALLOCATED_TO>	<Activity>	Activity Identifier
<ALLOCATED_TO>	<Role>	Role Identifier
<ALLOCATED_TO>	<Sub-Operating Environment>	Sub-Operating Environment Identifier
<ALLOCATED_TO>	<Activity View> Use case as in NOV-5	Activity View Identifier

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-CMPL.0070
Title	Complexity Contributing Factors
Requirement	The INAP shall have access to a detailed analysis of the complexity factors that contribute to the overall airspace complexity.
Status	<in progress>
Rationale	In order to increase the meaningfulness of the complexity information provided by the INAP tool, the INAP needs to have access to a detailed break-down of the complexity contributing factors. This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
< ALLOCATED_TO >	<Information Exchange>	Information Exchange Identifier
< ALLOCATED_TO >	<Information Flow>	Information Flow Identifier
<ALLOCATED_TO>	<Activity>	Activity Identifier
<ALLOCATED_TO>	<Role>	Role Identifier
<ALLOCATED_TO>	<Sub-Operating Environment>	Sub-Operating Environment Identifier
<ALLOCATED_TO>	<Activity View> Use case as in NOV-5	Activity View Identifier

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-CMPL.0080
Title	Complexity what-if assessment
Requirement	The INAP should be able to perform Demand and/or capacity what-if analysis in support of managing complexity.
Status	<in progress>
Rationale	When proposing a DCB measure, the INAP might be interested in previously assessing the impact in complexity of the measure application. This should be done by means of what-if tools. This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
< ALLOCATED_TO >	<Information Exchange>	Information Exchange Identifier
< ALLOCATED_TO >	<Information Flow>	Information Flow Identifier
<ALLOCATED_TO>	<Activity>	Activity Identifier
<ALLOCATED_TO>	<Role>	Role Identifier
<ALLOCATED_TO>	<Sub-Operating Environment>	Sub-Operating Environment Identifier
<ALLOCATED_TO>	<Activity View> Use case as in NOV-5	Activity View Identifier

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-CMPL.0090
Title	Complexity integration into sector configuration optimisation process.
Requirement	The INAP shall be able to consider complexity assessment within the sector configuration optimisation process.
Status	<in progress>
Rationale	In order to increase the efficiency and granularity of the configuration optimiser solutions proposed, complexity assessment shall be integrated into the INAP sector configuration optimiser. This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
< ALLOCATED_TO >	<Information Exchange>	Information Exchange Identifier
< ALLOCATED_TO >	<Information Flow>	Information Flow Identifier
<ALLOCATED_TO>	<Activity>	Activity Identifier
<ALLOCATED_TO>	<Role>	Role Identifier
<ALLOCATED_TO>	<Sub-Operating Environment>	Sub-Operating Environment Identifier
<ALLOCATED_TO>	<Activity View> Use case as in NOV-5	Activity View Identifier

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-CMPL.0100
Title	Complexity alerts
Requirement	The INAP shall be alerted when the complexity value is above the established thresholds.
Status	<in progress>
Rationale	The INAP awareness of complexity exceeding predefined thresholds needs to be ensured by means of visual alerts displayed in the INAP's complexity management tool. This requirement comes from Wave 1: REQ-09.01-OSED-CPX.0250
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
< ALLOCATED_TO >	<Information Exchange>	Information Exchange Identifier
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<ALLOCATED_TO>	<Activity>	Activity Identifier
<ALLOCATED_TO>	<Role>	Role Identifier
<ALLOCATED_TO>	<Sub-Operating Environment>	Sub-Operating Environment Identifier
<ALLOCATED_TO>	<Activity View> Use case as in NOV-5	Activity View Identifier

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-CMPL.0110
Title	Complexity post analysis data storage
Requirement	Complexity data shall be stored for the day of operation in support of post operational analysis functions.
Status	<in progress>
Rationale	Complexity data needs to be stored for future analysis as an input for complexity or what-if tools. Stored data should include information such as 4D trajectory information, complexity predictions, calculations performed, etc. This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
< ALLOCATED_TO >	<Information Exchange>	Information Exchange Identifier
< ALLOCATED_TO >	<Information Flow>	Information Flow Identifier
<ALLOCATED_TO>	<Activity>	Activity Identifier
<ALLOCATED_TO>	<Role>	Role Identifier
<ALLOCATED_TO>	<Sub-Operating Environment>	Sub-Operating Environment Identifier
<ALLOCATED_TO>	<Activity View> Use case as in NOV-5	Activity View Identifier

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-CMPL.0120
Title	Complexity post-analysis
Requirement	Local DCB actors shall be able to use stored complexity data within post operational analysis functions.
Status	<in progress>
Rationale	Post analysis of DCB/DCB solutions efficiency in terms of complexity is needed to identify best practice and deficiencies as an input for operational and strategic decision making. This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
< ALLOCATED_TO >	<Information Exchange>	Information Exchange Identifier
< ALLOCATED_TO >	<Information Flow>	Information Flow Identifier
<ALLOCATED_TO>	<Activity>	Activity Identifier
<ALLOCATED_TO>	<Role>	Role Identifier
<ALLOCATED_TO>	<Sub-Operating Environment>	Sub-Operating Environment Identifier
<ALLOCATED_TO>	<Activity View> Use case as in NOV-5	Activity View Identifier

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-CMPL.0130
Title	Airspace sectorisation impact in complexity assessment
Requirement	The INAP shall be able to perform capacity what-if assessments for different airspace configurations and airspace granularities in support of managing complexity.
Status	<in progress>
Rationale	The complexity tool shall provide complexity predictions on-request for different sectorisation scenarios, selected by the INAP, before they are operationally applied or scheduled. The human operator may be interested in knowing the complexity prediction of a sector configuration, different from the current one, as it would be active in a specific time period in the future. This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
< ALLOCATED_TO >	<Information Exchange>	Information Exchange Identifier
< ALLOCATED_TO >	<Information Flow>	Information Flow Identifier
<ALLOCATED_TO>	<Activity>	Activity Identifier
<ALLOCATED_TO>	<Role>	Role Identifier
<ALLOCATED_TO>	<Sub-Operating Environment>	Sub-Operating Environment Identifier
<ALLOCATED_TO>	<Activity View> Use case as in NOV-5	Activity View Identifier

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-CMPL.0140
Title	Airspace sectorisation proposal for complexity distribution
Requirement	The INAP shall be able to propose airspace sectorisation changes for the optimisation of complexity distribution.
Status	<in progress>
Rationale	In order to optimize the distribution of complexity across sectors, the INAP shall be able to propose more appropriate sector configurations after performing the adequate complexity what-if analysis. This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
< ALLOCATED_TO >	<Information Exchange>	Information Exchange Identifier
< ALLOCATED_TO >	<Information Flow>	Information Flow Identifier
<ALLOCATED_TO>	<Activity>	Activity Identifier
<ALLOCATED_TO>	<Role>	Role Identifier
<ALLOCATED_TO>	<Sub-Operating Environment>	Sub-Operating Environment Identifier
<ALLOCATED_TO>	<Activity View> Use case as in NOV-5	Activity View Identifier

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-CMPL.0150
Title	Airspace information for complexity assessment
Requirement	The INAP shall have available all the updated information regarding airspace configurations, including airspace availability limitations due to weather or special use of airspace reservations (e.g. events) for complexity assessment purposes.
Status	<in progress>
Rationale	Airspace configuration information and airspace availability limitations are needed so as to obtain accurate complexity estimations (for both predicted/actual complexity values and during what-if assessments). This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
< ALLOCATED_TO >	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
< ALLOCATED_TO >	<Information Exchange>	Information Exchange Identifier
< ALLOCATED_TO >	<Information Flow>	Information Flow Identifier
<ALLOCATED_TO>	<Activity>	Activity Identifier
<ALLOCATED_TO>	<Role>	Role Identifier
<ALLOCATED_TO>	<Sub-Operating Environment>	Sub-Operating Environment Identifier
<ALLOCATED_TO>	<Activity View> Use case as in NOV-5	Activity View Identifier

4.2.7 Strategic Process

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP- STRA.0200
Title	Sector Design adaptation

Requirement	The Sector design process shall satisfy local characteristics and constraints specific to each local ANSP
Status	<validated>
Rationale	Sector Design process shall adapt Elementary Airspace elements according to local characteristic and constraints to cope with Airspace specificities and controller licenses. Sector Design process shall ensure that all Elementary airspace elements produced shall be manageable by Sector Management Process and be conform to local agreements (LOA, Delegations, ...). This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0250.0050.
Category	<STRA>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	assess perfo
<ALLOCATED_TO>	<Information Flow>	FBT
<ALLOCATED_TO>	<Activity>	Inputs Parameters into Local DAC Tool
<ALLOCATED_TO>	<Role>	local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Coordination and publication of optimlal Network DCB scenario

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-STRA.0010
Title	Minimise large Airspace modification impact
Requirement	DAC tool shall be able to generate stable configuration to minimise large scale airspace reorganisation if not strictly necessary, requiring specific ATCO training.

Status	<validated>
Rationale	Airspace redesign shall be applied on specific areas following the principle of minimizing modifications, aimed at achieving the performance targets. Complete ACC redesign, requiring large validation phase and specific ATCOs training before putting in operation shall be avoided. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0200.0020.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	ATC Volumes
<ALLOCATED_TO>	<Information Flow>	Traffic demand
<ALLOCATED_TO>	<Activity>	KPI assessment
<ALLOCATED_TO>	<Role>	Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	DAC W2 Airspace design

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-STRA.0020
Title	Definition of Local Airspace rules and delegations
Requirement	LTM shall be able to define rules and delegations (if there are any) of the Airspace under its responsibility to be used in Airspace organisation
Status	<validated>
Rationale	To satisfy organisational constraints and agreements, the LTM shall define all the needed data to manage Airspace configurations (Elementary Airspace rules, delegation to neighbourhood, to FAB, to NM).

	This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0210.0010.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	assess perfo
<ALLOCATED_TO>	<Information Flow>	list secor configuration
<ALLOCATED_TO>	<Activity>	Build regional ASP config and compute KPI
<ALLOCATED_TO>	<Role>	Regional ASM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	DAC W2 Airspace Design

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-STRA.0030
Title	Application of Local Airspace rules and delegations
Requirement	LTM shall be able to apply the defined rules and delegations (if there are any) of the Airspace under its responsibility to be used in Airspace organisation
Status	<validated>
Rationale	To satisfy organisational constraints and agreements, the LTM shall apply rules given to him (by delegation on not) to manage Airspace organisation.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	assess perfo
<ALLOCATED_TO>	<Information Flow>	list secor configuration
<ALLOCATED_TO>	<Activity>	DAC-NM coordination
<ALLOCATED_TO>	<Role>	Sub-Regional / Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	DAC W2 Airspace Design

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-STRA.0040
Title	Seamless DAC process along timeline
Requirement	LTM shall be able to deliver a seamless approach to optimise the available capacity with the intention of minimising required deviations by airspace users from optimal flight profiles
Status	<validated>
Rationale	To avoid disruptions on the timeline, DAC process shall manage Airspace configuration in a continuum way from long term planning to execution. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0220.0010
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	assess perfo

<ALLOCATED_TO>	<Information Flow>	DCB plan
<ALLOCATED_TO>	<Activity>	Assess local DCB plan
<ALLOCATED_TO>	<Role>	Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Coordination and publication of optimlal Network DCB scenario

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-STRA.0050
Title	Use of Capacity Optimisation
Requirement	DAC shall be able to optimize the use of available capacity
Status	<validated>
Rationale	One of the main objectives of DAC is to solve Demand/Capacity imbalance (Strategic to tactical phases) by acting on the capacity part of the ATM by analysing if the capacity can be optimised to cope with the level of demand. If no capacity solution is found, best airspace solutions are applied and residual imbalance will be managed by DCB process. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0220.0020.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	assess perfo
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	Select optimal Capacity and Flow Measures
<ALLOCATED_TO>	<Role>	Local ATFCM

<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Coordination and publication of optimlal Network DCB scenario

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-STRA.0060
Title	Sector Design supported by DAC Toolbox
Requirement	DAC Toolbox shall allow the sector design in terms of elementary Airspace elements.
Status	<validated>
Rationale	DAC Toolbox should design Elementary Airspace elements according to the local implementation's levels of Sector Configuration design and all defined constraints of local organisation. The Elementary Airspace elements will be built through a global analysis of the traffic forecast during a long term period. According to the ANSP characteristics and Controller licences, a validation phase (and controller training if necessary) is needed before publishing the new elementary Airspace elements. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0250.0040.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<ALLOCATED_TO>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	assess perfo
<ALLOCATED_TO>	<Information Flow>	performance targets
<ALLOCATED_TO>	<Activity>	run ASM simulations
<ALLOCATED_TO>	<Role>	Sub Regional/ Local ASM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

<ALLOCATED_TO>	<Activity View>	DAC W2 Airspace Design

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-STRA.0070
Title	Sector Configuration Design solution
Requirement	DAC tool shall provide sector configuration design solution for recurrent and/or expected imbalance
Status	<validated>
Rationale	Sector Configuration Design within the DAC tool shall enable the design of the dynamic configurations and allow the planning of the ATM resources that should be made available to respond to the various performance objectives. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0250.0070
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	assess perfo
<ALLOCATED_TO>	<Information Flow>	FBT
<ALLOCATED_TO>	<Activity>	Inputs Parameters into Local DAC Tool
<ALLOCATED_TO>	<Role>	Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Coordination and publication of optimlal Network DCB scenario

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-STRA.0080
Title	NWP predefined scenarios management
Requirement	The NWP shall support the management of predefined scenarios (i.e. Airspace configuration prepared in advance).
Status	<validated>
Rationale	NWP shall support predefined scenarios prepared in advance to face special events or an uncertain situation occurred. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0290.0010.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	assess perfo
<ALLOCATED_TO>	<Information Flow>	Sector configuration
<ALLOCATED_TO>	<Activity>	Build expected network performance indicators
<ALLOCATED_TO>	<Role>	Network manager
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Coordination and publication of optimlal Network DCB scenario

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-STRA.0090
Title	DAC integration of local constraints and parameters in strategic phase
Requirement	DAC solution shall reflect and integrate local constraints typical of the strategic phase.
Status	<validated>

Rationale	DAC process shall be affected by local constraints and parameter typical of strategic phase, e.g. limitations such as external sector boundaries, procedures for maintaining and acquiring ATCO licenses, usability of sector configurations regarding Human Performance to guarantee the ATC resources can perform their tasks in a safe manner. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0300.0010.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	assess perfo
<ALLOCATED_TO>	<Information Flow>	FBT
<ALLOCATED_TO>	<Activity>	Inputs Parameters into Local DAC Tool
<ALLOCATED_TO>	<Role>	Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Coordination and publication of optimlal Network DCB scenario

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-STRA.0100
Title	DAC process compatibility and continuity with INAP
Requirement	Local DAC actor shall act in continuity with INAP Function
Status	<validated>
Rationale	INAP acts in tactical phase anticipation to adapt ATC environment to inbound traffic. Local actors should provide compatible parameters to DAC function to act as a continuum from strategic anticipation to tactical phase

	This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0300.0050.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	DCB plan
<ALLOCATED_TO>	<Activity>	Initiate DCB plan
<ALLOCATED_TO>	<Role>	Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Coordination and publication of optimlal Network DCB scenario

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-STRA.0110
Title	Generic DAC process according to granularity and delegation
Requirement	LTM shall perform DAC activities at Regional, Sub-Regional, or local levels to optimise the available capacity according to granularity and delegations.
Status	<validated>
Rationale	The DAC activities shall be performed at the adequate level of Network granularity (regional, sub regional or local) depending on the delegation put in place and the uncertainty of the forecast demand. Uncertainty and delegation shall be the key of the granularity selection for Airspace management. At local level, Airspace granularity will also be applied to find the adequate Airspace element to manage (Sector, cluster, centre …) This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0310.0010.

Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	assess perfo
<ALLOCATED_TO>	<Information Flow>	FBT
<ALLOCATED_TO>	<Activity>	Inputs Parameters into Local DAC Tool
<ALLOCATED_TO>	<Role>	Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Coordination and publication of optimlal Network DCB scenario

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-STRA.0120
Title	Workload predictability and uncertainty calculation module
Requirement	DAC tool shall support a better anticipation of imbalance through all ATM phases supported by an enhanced Predicted Workload with uncertainty assessment (refer to §3.3.3)
Status	<validated>
Rationale	DAC tool shall support the resolution of imbalances by using the predicted workload methodology for each potential configuration and during all the timeline. From strategic to tactical, DAC tool will provide an optimum solution for Airspace configuration, minimising imbalance at the right level of granularity (Airspace elements) according to uncertainty based on a "Predicted Workload Model" This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0320.0010.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	assess perfo
<ALLOCATED_TO>	<Information Flow>	FBT
<ALLOCATED_TO>	<Activity>	Inputs Parameters into Local DAC Tool
<ALLOCATED_TO>	<Role>	Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Coordination and publication of optimlal Network DCB scenario

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-STRA.0130
Title	Predicted Workload Methodology (PWM)
Requirement	DAC tool shall be able to apply for the Predicted Workload Methodology (refer to §3.3.3) different criteria according to uncertainty: Entry count, Occupancy Count, Traffic Complexity
Status	<validated>
Rationale	Depending on uncertainty (time horizon which the workload prediction is done), Different available criteria shall be used: entry counts (large uncertainty) occupancy counts (less uncertainty) and complexity (defined by ATC) available. Combination of these criterions shall be used to avoid disruption on Predicted Workload indicator over time horizon (uncertainty). This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0320.0020.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<ALLOCATED_TO>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	assess perfo
<ALLOCATED_TO>	<Information Flow>	FBT
<ALLOCATED_TO>	<Activity>	Inputs Parameters into Local DAC Tool
<ALLOCATED_TO>	<Role>	Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Coordination and publication of optimlal Network DCB scenario

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-STRA.0140
Title	WOC coordination with DAC
Requirement	The WOC shall be able to coordinate with local DAC actor to find the most optimal solution on DMAs for achieving mission objectives, in compliance with AUs' local performance targets
Status	<validated>
Rationale	Models A & B process diagram – WOC shares the DMAs in the format of DMA dataset and triggers the assessment process. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0100.0002.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01

<ALLOCATED_TO>	<Information Exchange>	ARES definition
<ALLOCATED_TO>	<Information Flow>	Lmilitary airspace usage
<ALLOCATED_TO>	<Activity>	Assess local DCB plan
<ALLOCATED_TO>	<Role>	Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Coordination and publication of optimlal Network DCB scenario

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-STRA.0160
Title	Integration of DAC tool and local resource management tools
Requirement	DAC tool shall be configurable to allow integration of the constraints related to local resource management within the DAC algorithm
Status	<validated>
Rationale	Integration of DAC tool and local resource management tools may be required in order to ensure correct DAC planning that matches ATCO staff availability This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-1120.0002.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	assess perfo
<ALLOCATED_TO>	<Information Flow>	KPI targets
<ALLOCATED_TO>	<Activity>	Inputs Parameters into Local DAC Tool
<ALLOCATED_TO>	<Role>	Local ATFCM

<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Coordination and publication of optimlal Network DCB scenario

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-STRA.0170
Title	Airspace Configuration Design and Airspace Configuration Management Functions
Requirement	DAC Function shall be structured in two major functions: Sector Configuration Design and Sector Configuration Management.
Status	<validated>
Rationale	The DAC activities shall be decomposed in 2 main functions due to the time adaptation and validation of a new airspace environment and its implications. Airspace Design shall create elementary Airspace elements to be managed dynamically by Sector Management. It uses large scale traffic and need a validation phase according to level of implementation of DAC (linked to local characteristic and ATCO licensing). Airspace Management shall group elementary Airspace elements according to traffic forecast for a specific time period and assume the transition between the different time periods. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0200.0010.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	assess perfo
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	Select optimal Capacity and Flow Measures
<ALLOCATED_TO>	<Role>	Local ATFCM

<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Coordination and publication of optimlal Network DCB scenario

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-STRA.0180
Title	Sector Configuration Management takes into account TMA boundaries constraints
Requirement	The ACC (Supervisor) through the Sector Configuration Management process shall integrate boundaries constraints from TMA.
Status	<validated>
Rationale	Sector Management process should integrate TMA boundaries constraints to propose an adapted sector configuration. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0250.0030.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	assess perfo
<ALLOCATED_TO>	<Information Flow>	FBT
<ALLOCATED_TO>	<Activity>	Inputs Parameters into Local DAC Tool
<ALLOCATED_TO>	<Role>	local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Coordination and publication of optimlal Network DCB scenario

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-STRA.0190
Title	Sector Configuration Design adaptation
Requirement	The ACC (Supervisor) through the Sector configuration design process shall satisfy local characteristics and constraints specific to each local ANSP
Status	<validated>
Rationale	Sector Configuration Design process shall adapt Elementary Airspace elements according to local characteristic and constraints to cope with Airspace specificities and controller licenses. Sector Configuration Design shall ensure that all Elementary airspace elements produced shall be manageable by Sector Configuration Management Process and be conform to local agreements (LOA, Delegations, …). This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0250.0050
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	assess perfo
<ALLOCATED_TO>	<Information Flow>	FBT
<ALLOCATED_TO>	<Activity>	Inputs Parameters into Local DAC Tool
<ALLOCATED_TO>	<Role>	local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Coordination and publication of optimal Network DCB scenario

4.2.8 Pre-Tactical Process

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-PRET.0010
Title	Number of opened sectors
Requirement	When the traffic is mature enough, the local DAC actor shall be able to determine the number of opened sectors (N) for D-OPS and inform NM on this number and the sectors foreseen to be opened.
Status	<validated>
Rationale	Models A & B Input information for DAC process This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0100.0004.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	Local daily performance targets
<ALLOCATED_TO>	<Activity>	Identify number of sectors based on available ATCOs as well as local hotspots
<ALLOCATED_TO>	<Role>	Subregional / Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	DAC_UC_05_Initial ideal sector configuration and DCB imbalance identification

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-PRET.0020
Title	Define ideal sector configuration

Requirement	Local DAC actor shall be able to define the best possible - ideal - sector configuration for his/her airspace, satisfying the requested DMAs and its local performance targets considering his/her number of opened sector.
Status	<validated>
Rationale	With the decentralised Model B, the local DAC actors accommodate the requests of the WOC taking into account local KPIs and changes for the sector configurations in coordination with NM. Nonetheless, there is a common agreement that in isolated cases (e.g. critical traffic flow or meteorological issues, large-scale events with cross border implications etc.) the network requirements shall prevail in configuring the airspace structure at local/ sub-regional levels. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0100.0005.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	Identify initial local/FAB sector configuration matching local/network performance targets
<ALLOCATED_TO>	<Role>	Subregional / Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	DAC_UC_05_Initial ideal sector configuration and DCB imbalance identification

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-PRET.0040

Title	Identify best sector configurations from Network point of view
Requirement	NM shall be able to identify best local/FAB sector configurations matching local performance targets and network performance targets and taking into account the declared number of opened sectors by local DAC actor for every assessment process during planning
Status	<validated>
Rationale	With the centralised model the Network Manager initiates, coordinates and monitors the DAC planning process and the local actors (at national or sub-regional level depending on local organisation) assist NM with local expertise, data and knowledge. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0100.0013.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	reg reg coord
<ALLOCATED_TO>	<Activity>	Receive by NM of ideal sector configuration and ATFCM measures for remaining hotspots
<ALLOCATED_TO>	<Role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	DAC_UC_05_Initial ideal sector configuration and DCB imbalance identification

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-PRET.0060

Title	EDAC production
Requirement	NM shall be able to produce the EDAC
Status	<validated>
Rationale	This is part of the workflow for both DAC Models A & B This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0100.0018.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	reg reg coord
<ALLOCATED_TO>	<Activity>	Advice local DACs and FMPs of ideal sector configurations, proposed ATFM measures for remaining hotspots
<ALLOCATED_TO>	<Role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	DAC_UC_05_Initial ideal sector configuration and DCB imbalance identification

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-PRET.0080
Title	SBT adaptation to EDAC information
Requirement	FOC shall be able to review its SBTs according to EDAC information and modify them if necessary
Status	<validated>

Rationale	This requirement is the core of the solution 44 : DAC integrated within DCB at tactical horizon (D-OPS) This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0100.0021.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	CDM proposal
<ALLOCATED_TO>	<Information Flow>	DCB measure
<ALLOCATED_TO>	<Activity>	Coordinate proposal
<ALLOCATED_TO>	<Role>	WOC
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Change of DCB plan and its publication update

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-PRET.0090
Title	Finalize sector configurations and ATFCM measures for D-OPS
Requirement	DCB shall be able to finalize the sector configuration and consolidate ATFCM measures for the D-OPS.
Status	<validated>
Rationale	This requirement is the core of the solution 44 : DAC integrated within DCB at tactical horizon (D-OPS) This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0100.0030.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	reg reg coord
<ALLOCATED_TO>	<Activity>	Advice NM of local sector configuration and proposed ATFCM measures for remaining hotspots
<ALLOCATED_TO>	<Role>	Sub regional/ Local ASM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	DAC_UC_05_Initial ideal sector configuration and DCB imbalance identification

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-PRET.0110
Title	NOP Support to DAC
Requirement	Local DAC actor shall be able to access and use NOP in support of DAC coordination and data sharing all over the timeline
Status	<validated>
Rationale	NOP shall support coordination and data exchange over the network to satisfy DAC processes This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0230.0010.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44

<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	DCB measure, sector configuration exchange
<ALLOCATED_TO>	<Activity>	Incorporate new configuration/measures
<ALLOCATED_TO>	<Role>	Network Manager
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Change of DCB plan and its publication update

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-PRET.0120
Title	NOP deliver ATM performance for DAC
Requirement	DAC shall be able to access and use NOP performance assessment at all levels (Local, Sub-regional, Regional) in pre-tactical to tactical phase
Status	<validated>
Rationale	In order to evaluate the efficiency of the DAC with regard to demand at all levels of decision making, specific performance targets will be delivered by the NOP. The analysis of the performance achieved is used to adapt constraints and processes to improve the sectorisation processes. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0230.0020.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01

<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	DCB measure, sector configuration exchange
<ALLOCATED_TO>	<Activity>	Incorporate new configuration/measures
<ALLOCATED_TO>	<Role>	Network Manager
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Change of DCB plan and its publication update

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-PRET.0140
Title	NWP support for the publication of Airspace organisation and negotiation
Requirement	Local DAC actor shall be able to cooperate with other FMP, WOC, what-if and data modification publications based on the NM support
Status	<validated>
Rationale	During negotiation, and at the end of the negotiation process, data shall be published to support the cooperation and the awareness of the network situation This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0280.0020.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision

<ALLOCATED_TO>	<Information Flow>	DCB measure, sector configuration exchange
<ALLOCATED_TO>	<Activity>	Incorporate new configuration/measures
<ALLOCATED_TO>	<Role>	Network Manager
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Change of DCB plan and its publication update

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-PRET.0150
Title	Identify overloaded areas
Requirement	Given a sector configuration, Local DAC actor shall be able to identify remaining hotspots/optispots and eligible areas.
Status	<validated>
Rationale	Given a sector configuration, Local DAC actor shall be able to identify remaining hotspots/optispots and eligible areas where indicators (Occupancy Traffic Monitoring Values, Complexity Monitoring Values, ATCo Workload Monitoring Values, Performance Monitoring Values) are close or beyond the established Traffic Volume capacity threshold (DAC Model B.) This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0100.0007.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	nan

<ALLOCATED_TO>	<Activity>	Identify remaining hotspots and/or critical traffic volumes
<ALLOCATED_TO>	<Role>	Sub regional/ Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	dac_UC_05_Initial ideal sector configuration and DCB imbalance identification

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-PRET.0160
Title	Information on planned DAC for the entire D of OPS (or shift)
Requirement	Supervisor shall be able to access the information on the DAC tool for the entire D of OPS: (sectors configurations opening scheme and/or planned DMA activations, including geographical location, vertical FLs band, and time.
Status	<validated>
Rationale	Information on planned DAC for the entire D of OPS (or shift) may be requested by Supervisor to obtain an overview on DAC elements. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-1110.0034.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	regreg coord
<ALLOCATED_TO>	<Activity>	Advice NM of local sector configuration and proposed

		ATFCM measures for remaining hotspots
<ALLOCATED_TO>	<Role>	Sub regional/ Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	daC_UC_05_Initial ideal sector configuration and DCB imbalance identification

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-PRET.0170
Title	Supervisor notification of updated DAC/EDAC
Requirement	The supervisor shall be notified as soon as/when the latest DAC/EDAC is updated.
Status	<validated>
Rationale	The supervisor has to be notified about the planned/updated DACs as soon as latest EDAC is updated. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-1130.0002.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	Sector configuration exchange
<ALLOCATED_TO>	<Activity>	Publish DCB plan
<ALLOCATED_TO>	<Role>	Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

<ALLOCATED_TO>	<Activity View>	Change of DCB plan and its publication update

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-PRET.0180
Title	Supervisor access to updated DAC/EDAC
Requirement	The supervisor shall be able to access to the updated planned DAC/EDAC after an update.
Status	<validated>
Rationale	The supervisor has to be able to assess the changes. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-1130.0002.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	Sector configuration exchange
<ALLOCATED_TO>	<Activity>	Publish DCB plan
<ALLOCATED_TO>	<Role>	Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Change of DCB plan and its publication update

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-PRET.0190

Title	DAC tool interface with NWP
Requirement	DAC tool shall be able to exchange/receive information from the Network Working Position (NWP) in support of DAC processes at any time of pre-tactical to tactical phase
Status	<validated>
Rationale	DAC and DCB will be run by the same actor, an integrated interface will be developed. As the use of airspace configuration is part of the DCB solution to provide optimised capacity, the NM working position shall enable to work simultaneously on demand aspects and airspace management aspects. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0220.0070.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	performance targets
<ALLOCATED_TO>	<Activity>	Coordinate with Local DAC in case of conflicting performance targets
<ALLOCATED_TO>	<Role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Performance target definition

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-PRET.0200
Title	Airspace Configuration and Traffic Prediction

Requirement	DAC tool shall be able to produce Airspace Configuration all along the timeline considering/taking into account the Traffic Prediction
Status	<validated>
Rationale	With NOP Traffic planning data and Traffic projections, a Traffic Prediction with uncertainty indicators shall be provided (by DCB or BT management) This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0220.0030.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	performance targets
<ALLOCATED_TO>	<Activity>	Coordinate with Local DAC in case of conflicting performance targets
<ALLOCATED_TO>	<Role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Performance target definition

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-PRET.0210
Title	DAC tool and hotspot/optispot detection
Requirement	The DAC tool shall automatically detect a hotspot/optispot window by comparison between available staff resources and estimated required staff resources
Status	<validated>

Rationale	An hotspot / optispot is linked to the capacity provided by the ACC, thus the comparison between estimated staff vs available staff is to be included in the DAC tool for automatic detection This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-1120.0032.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	Identify remaining hotspots and/or critical traffic volumes
<ALLOCATED_TO>	<Role>	Subregional / Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	dac_UC_05_Initial ideal sector configuration and DCB imbalance identification

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-PRET.0220
Title	DAC tool and hotspot/optispot time period
Requirement	The DAC tool user shall have the possibility to adapt the time period of the hotspot/optispot window.
Status	<validated>
Rationale	Workflow - Need for DAC tool user to adapt the time period where he wants to use the decision support tool. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-1120.0042.

Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	Identify remaining hotspots and/or critical traffic volumes
<ALLOCATED_TO>	<Role>	Subregional / Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	dac_UC_05_Initial ideal sector configuration and DCB imbalance identification

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-PRET.0230
Title	DAC tool and exploration window
Requirement	The DAC shall be able to select a time framed and geographical window on which to apply DAC tool functionalities to perform his/her analysis and support to decision-making.
Status	<validated>
Rationale	The DAC does not usually need to apply DAC tool on the overall area under his/her responsibility and needs to restrain the analysis on a geographical area within a given time frame. He/she thus shall be able to select a defined window (geographically and timestamped) where he/she wants to use the decision-making support tool. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-1120.0052.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	Identify remaining hotspots and/or critical traffic volumes
<ALLOCATED_TO>	<Role>	Subregional / Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	dac_UC_05_Initial ideal sector configuration and DCB imbalance identification

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-PRET.0240
Title	DAC tool and support functions
Requirement	The DAC tool shall offer several functionalities (such as traffic counts, flight lists, ATC workload indicators) to provide efficient decision support in various situations.
Status	<validated>
Rationale	Workflow - The DAC tool is only a decision support tool and to do that it offers a large number of support function such as elements of new configuration (traffic counts, flight list, ATC workload indicators…), popularity, feedback from previous use of the configuration, tendency, intermediate steps to reach the new configuration, access to configurations with N-x and N+x sectors. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-1120.0072.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	Identify remaining hotspots and/or critical traffic volumes
<ALLOCATED_TO>	<Role>	Subregional / Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	dac_UC_05_Initial ideal sector configuration and DCB imbalance identification

4.2.9 Tactical Process

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-TACT.0010
Title	ATSU Supervisor/LTM DAC support tool
Requirement	The ATSU Supervisor/LTM shall be able with the support tool (DAC tool) to ensure that DAC sectorisations are compliant with resource management rules proposed while maintaining DAC performance improvements.
Status	<validated>
Rationale	DAC tool is regularly required to support ATSU supervisor/LTM in monitoring of DAC situation and ease decision making process. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-1120.0003.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	ATC Volumes
<ALLOCATED_TO>	<Information Flow>	list sector configuration
<ALLOCATED_TO>	<Activity>	run ASM simulations
<ALLOCATED_TO>	<Role>	Subregional/local ASM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	DAC W2 Airspace Design

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-TACT.0020
Title	Adaptation of sector configuration and/or ATFCM measures to unexpected/new/updated events
Requirement	DCB shall be able to adapt a sector configuration and/or ATFCM measures in order to deal with unexpected/new/updated events.
Status	<validated>
Rationale	Models A & B This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0100.0032.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01

<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	Identify remaining hotspots and/or critical traffic volumes
<ALLOCATED_TO>	<Role>	Subregional / Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	dac_UC_05_Initial ideal sector configuration and DCB imbalance identification

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-TACT.0030
Title	DAC react on imbalanced situations from DCB
Requirement	DCB shall be able to support the resolution of imbalance detected proposing new Airspace configuration if Airspace saturation is not reached
Status	<validated>
Rationale	DCB shall integrate the Imbalance detection and propose new Airspace configuration to fulfil the demand or the best organisation if Airspace is saturated. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0220.0090.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision

<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	Identify remaining hotspots and/or critical traffic volumes
<ALLOCATED_TO>	<Role>	Subregional / Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	dac_UC_05_Initial ideal sector configuration and DCB imbalance identification

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-TACT.0040
Title	Sector Configuration Management function
Requirement	The ACC (Supervisor) shall be able to group elementary Airspace elements according to traffic and constraints using the Sector Management process. (refer to [39])
Status	<validated>
Rationale	Sector Management function requires to group elementary Airspace elements according to traffic and constraint from AFUA, FRA and TMA. It uses Traffic forecast (FBTs) and Predicted Workload model on a particular time window to propose an optimum organization balancing airspace elementary block on Controller Working Positions. It integrates all constraints to generate an optimum sector configuration for Controller Working Position. If all the constraints could not be matched, capacity constraints could be negotiated (military and/or delegation) and if not enough DAC shall generate the best Airspace organisation face the predicted traffic (FBT) and constraints. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0250.0010.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01

<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	Identify remaining hotspots and/or critical traffic volumes
<ALLOCATED_TO>	<Role>	Subregional / Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	dac_UC_05_Initial ideal sector configuration and DCB imbalance identification

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-TACT.0050
Title	Sector Management local adaptation
Requirement	The ACC (Supervisor) shall satisfy local characteristics and constraints specific to each local ANSP by using the Sector Management process. (refer to [39])
Status	<validated>
Rationale	Sector Management process shall be adapted to each local ANSP to cope with local characteristic and constraints. Sector Management shall ensure that all local agreements and constraints (LOA, Delegations, …) and Local ANSP organisation is taken into account. Local ANSP shall define all relevant data according local organisation to cope with Airspace management. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0250.0020.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01

<ALLOCATED_TO>	<Information Exchange>	ATC Volumes
<ALLOCATED_TO>	<Information Flow>	list sector configuration
<ALLOCATED_TO>	<Activity>	run ASM simulations
<ALLOCATED_TO>	<Role>	Subregional / Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	DAC W2 Airspace Design

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-TACT.0060
Title	DAC view of Network Situation through FBTs
Requirement	The Local DAC actor shall be able to access the three different views of the Network Situation, i.e. the view of the actual demand with implemented DCB measures; the view taking into account the DCB for implementations; the view taking into account all DCB measures proposed, in order to perform analysis
Status	<validated>
Rationale	DCB process shall derive the analysis of the solutions according to 3 types of views: the view of the actual demand with implemented DCB measures; the view taking into account the DCB for implementations; the view taking into account all DCB measures proposed. The 3 views provide DCB with views of the actual traffic, and the possibly impacted traffic. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0260.0020.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision

<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	Impact assessment
<ALLOCATED_TO>	<Role>	Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Change of DCB plan and its publication update

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-TACT.0070
Title	Automatic sector configuration
Requirement	DAC actor shall be able to create automatically new sector configuration for the detected imbalances according to data and rules put in place by the local actors
Status	<validated>
Rationale	Dynamic Airspace Configuration shall use the detected imbalance as a trigger to initiate the process of capacity adjustment (trigger data parameters shall be defined by Local DAC/DCB actor). This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0270.0010.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	Identify remaining hotspots and/or critical traffic volumes
<ALLOCATED_TO>	<Role>	Subregional / Local ATFCM

<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	dac_UC_05_Initial ideal sector configuration and DCB imbalance identification

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-TACT.0080
Title	Automatic new configuration proposal
Requirement	The DAC automation module (refer to [39]) shall be able to automatically propose a new configuration
Status	<validated>
Rationale	According to variation of traffic, input airspace elements, local parameters including trigger values, the automation module shall select automatic action to be performed and generate orders actions for Sector Configuration (or sector design module for Level 4 implementation), and record actions on supervision timeline management. When new Airspace Configuration is generated, if all constraints are matched, and if parameters indicate the possibility of automation with no Human intervention, a new configuration is automatically proposed and put in place after the supervisor check and approval. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0270.0011.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	Sector configuration exchange
<ALLOCATED_TO>	<Activity>	adapt sector configuration / DCB measures

<ALLOCATED_TO>	<Role>	Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Change of DCB plan and its publication update

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-TACT.0090
Title	Adaptation to real-time events
Requirement	On D-OPS, the DCB shall be able to identify sector configuration modification and/or revised ATFCM measures in order to deal with unexpected events (weather, staff, …) or new DMA requests (or modification/cancellation of existing requests) taking into account its local performance targets
Status	<validated>
Rationale	Adaptation of DAC concept at tactical level, for both models A & B This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0100.0012.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	Sector configuration exchange
<ALLOCATED_TO>	<Activity>	adapt sector configuration / DCB measures
<ALLOCATED_TO>	<Role>	Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

<ALLOCATED_TO>	<Activity View>	Change of DCB plan and its publication update

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-TACT.0100
Title	EDAC modification
Requirement	On D-OPS, the NM shall be able to produce EDAC following modification of sector configuration, DMAs and/or ATC volumes
Status	<validated>
Rationale	Adaptation of the DAC concept at tactical level, for both Models A & B; This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0100.0019.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	Sector configuration exchange
<ALLOCATED_TO>	<Activity>	Publish DCB plan
<ALLOCATED_TO>	<Role>	Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Change of DCB plan and its publication update

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-TACT.0110

Title	Network consolidation of sector configurations, ATFCM measures and DMAs
Requirement	NM shall be able to collect and consolidate all sector configurations, ATFCM measures and DMAs sent by local DAC
Status	<validated>
Rationale	Models A & B ; This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0100.0031.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	regreg coord
<ALLOCATED_TO>	<Activity>	Receive by NM of ideal sector configuration and ATFCM measures for remaining hotspots
<ALLOCATED_TO>	<Role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	DAC _UC_05_Initial ideal sector configuration and DCB imbalance identification

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-TACT.0120
Title	DAC and local performance degradation below acceptable level and associated problems

Requirement	DAC shall be able to detect local situations that lead to local performance degradation below acceptable level and associated problems.
Status	<validated>
Rationale	DAC needs to detect local situations that lead to local performance degradation below acceptable level and associated problems. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0400.0250
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	regreg coord
<ALLOCATED_TO>	<Information Flow>	Performance
<ALLOCATED_TO>	<Activity>	Assess wether conflicts exist between regional and subregional / localperformance targets
<ALLOCATED_TO>	<Role>	Subregional / Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Performance target definition

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-TACT.0130
Title	NWP support to the integration of DCB activities
Requirement	The NWP shall be able to support the integration of DCB activities
Status	<validated>
Rationale	As the use of airspace configuration is part of the DCB solution to provide optimised capacity, the NM working position shall enable to work simultaneously on demand aspects and airspace management aspects

	This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0220.0080.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	agreed DCB measure
<ALLOCATED_TO>	<Activity>	Consolidate DCB measure
<ALLOCATED_TO>	<Role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	DCB_UC_03 Spot management

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-TACT.0140
Title	Automatic action records
Requirement	DAC tool shall be able to automatically record performed actions on the supervision timeline management.
Status	<validated>
Rationale	When new Airspace Configuration is generated, if all constraints are matched, and if parameters indicate the possibility of automation with no Human intervention, a new configuration is automatically put in place. Automatic actions are recorded on Actions supervision functions. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0270.0012.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	Perform what-if modellinf
<ALLOCATED_TO>	<Role>	Upstreal LTM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	what-if flight exclusion

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-TACT.0150
Title	Next waypoint visualization on the CWP
Requirement	CWP shall inform the ATCOs about the next waypoint out of the FIR under their responsibility
Status	<validated>
Rationale	Visualization of the next waypoint out of the FIR under ATCO responsibility shall be shown to enable an adequate trajectory visualization This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-1110.0036.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	ATC situation awareness

<ALLOCATED_TO>	<Information Flow>	revised RBT
<ALLOCATED_TO>	<Activity>	implement EAP DCB measure
<ALLOCATED_TO>	<Role>	ATC
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	EAP hotspot mangement in full autonomy

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-TACT.0160
Title	DAC adaptation
Requirement	DAC HMI integrated into NWP shall allow the application of actions or constraints on selected geographical area
Status	<validated>
Rationale	To tune DAC processes, and adapt it to new situation/event, DAC HMI (NWP) allows to apply new constraints or change parameters on selected area. (e.g. in case of decrease capacity on area due to weather condition). This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0300.0020.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	Perform what-if modellinf
<ALLOCATED_TO>	<Role>	Upstreal LTM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

<ALLOCATED_TO>	<Activity View>	what-if flight exclusion

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-TACT.0170
Title	DAC monitoring of Airspace configurations
Requirement	Local DAC actor shall be able to monitor Airspace configurations deployed as a result of strategic phase, taking into account Network and local performance targets
Status	<validated>
Rationale	The local DAC actor will need to have the ability to continually monitor the planned airspace configurations throughout the timeline (including strategic). This will enable the local DAC actor to assess if the configuration is still fit for purpose as the timeline progresses. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0400.0240.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	spot resolution alert
<ALLOCATED_TO>	<Activity>	Monitor spot
<ALLOCATED_TO>	<Role>	INAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	DCB_UC_03 Spot management

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-TACT.0180
Title	CWP visual aids to indicate horizontal limits of the sector
Requirement	CWP visual aids to indicate horizontal limits of the sector under control shall allow the controller easily and unequivocally identify their horizontal area of responsibility as per the upcoming sector configuration.
Status	<validated>
Rationale	CWP visual aids shall indicate horizontal limits of the sector under control to ensure ATCO clear and unambiguous awareness of his/her Area of responsibility at any time as per the upcoming sector configuration. ; This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-1110.0003.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	ATC situation awareness
<ALLOCATED_TO>	<Information Flow>	revised RBT
<ALLOCATED_TO>	<Activity>	implement EAP DCB measure
<ALLOCATED_TO>	<Role>	ATC
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	EAP hotspot mangement in full autonomy

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-TACT.0190
Title	CWP visual aids to indicate vertical limits of the sector

Requirement	CWP visual aids to indicate vertical limits of the sector under control shall allow the controller to easily and unequivocally identify their vertical area of responsibility as per the upcoming sector configuration.
Status	<validated>
Rationale	CWP visual aids shall indicate vertical limits of the sector under control to ensure ATCO clear and unambiguous awareness of his/her Area of responsibility at any time as per the upcoming sector configuration. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-1110.0004
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	ATC situation awareness
<ALLOCATED_TO>	<Information Flow>	revised RBT
<ALLOCATED_TO>	<Activity>	implement EAP DCB measure
<ALLOCATED_TO>	<Role>	ATC
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	EAP hotspot mangement in full autonomy

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-TACT.0200
Title	CWP visual aids to identify the aircraft entering to their area of responsibility
Requirement	CWP visual aids shall allow the controller to identify the aircraft that are about to enter to their area of responsibility.
Status	<validated>

Rationale	CWP visual aids shall support ATCOs to help them to identify the aircraft that are about to enter to their area of responsibility. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-1110.0005.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	ATC situation awareness
<ALLOCATED_TO>	<Information Flow>	revised RBT
<ALLOCATED_TO>	<Activity>	implement EAP DCB measure
<ALLOCATED_TO>	<Role>	ATC
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	EAP hotspot mangement in full autonomy

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-TACT.0210
Title	CWP visual aids to identify the aircraft exiting their area of responsibility
Requirement	CWP visual aids shall allow the controller to identify the aircraft that are about to exit from their area of responsibility.
Status	<validated>
Rationale	CWP visual aids shall support ATCO to help them to identify the aircraft that are about to exit their area of responsibility. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-1110.0006.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	ATC situation awareness
<ALLOCATED_TO>	<Information Flow>	revised RBT
<ALLOCATED_TO>	<Activity>	implement EAP DCB measure
<ALLOCATED_TO>	<Role>	ATC
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	EAP hotspot mangement in full autonomy

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-TACT.0220
Title	CWP aids to provide the controller the TFLs of the aircraft that are about to exit to their area of responsibility.
Requirement	The CWP shall support ATCO with the provision of all the strategic constraints through the display of the TFL/XFL.
Status	<validated>
Rationale	CWP aids shall support ATCO for facilitation of control transfer procedures. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-1110.0007.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	ATC situation awareness

<ALLOCATED_TO>	<Information Flow>	revised RBT
<ALLOCATED_TO>	<Activity>	implement EAP DCB measure
<ALLOCATED_TO>	<Role>	ATC
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	EAP hotspot mangement in full autonomy

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-TACT.0230
Title	CWP to present the flight/s that need to be transferred or assumed by ATCO
Requirement	CWP aids shall be able to present to the controller the flight/s that need to be transferred or assumed during a DAC sectorisation change.
Status	<validated>
Rationale	ATC system has to ensure and help to maintain ATCO traffic situation awareness during DAC sectorisation change. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-1110.0010.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	ATC situation awareness
<ALLOCATED_TO>	<Information Flow>	revised RBT
<ALLOCATED_TO>	<Activity>	implement EAP DCB measure
<ALLOCATED_TO>	<Role>	ATC
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

<ALLOCATED_TO>	<Activity View>	EAP hotspot mangement in full autonomy

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-TACT.0240
Title	CWP aids to present to the controller the status of the aircraft that need to be transferred or assumed during DAC sectorisation change
Requirement	CWP aids shall be able to present to the controller the status of the aircraft that need to be transferred or assumed during a DAC sectorisation change, indicating whether the aircraft is already under the correct frequency and has already been accepted by the concerned controller in the new DAC sectorisation.
Status	<validated>
Rationale	ATC system has to ensure and help to maintain ATCO traffic situation awareness during DAC sectorisation change ; This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-1110.0011.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	ATC situation awareness
<ALLOCATED_TO>	<Information Flow>	revised RBT
<ALLOCATED_TO>	<Activity>	implement EAP DCB measure
<ALLOCATED_TO>	<Role>	ATC
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	EAP hotspot mangement in full autonomy

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-TACT.0250
Title	EDAC modification publication
Requirement	On D-OPS, the NM shall be able to publish on the NOP EDAC following modification of sector configuration, DMAs and/or ATC volumes valid until the next EDAC publication
Status	<validated>
Rationale	Adaptation of the DAC concept at tactical level for both Models A & B . The need is for all stakeholders to receive the latest updates on EDAC This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0100.0036.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	Hotspot management
<ALLOCATED_TO>	<Information Flow>	hotspot
<ALLOCATED_TO>	<Activity>	Publish EDAC information
<ALLOCATED_TO>	<Role>	Network manager
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Coordination and publication of optimlal Network DCB scenario

4.2.10Post Ops Process

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-POST.0010
Title	NOP updated up to the post-operations phase.

Requirement	The NOP, e.g. the set of information and actions derived and reached collaboratively from the ATM stakeholders from the strategic to the tactical phases, shall be updated up to the post-operations phase
Status	<validated>
Rationale	In order to support the post ops phase and serve as the reference, the NOP should be updated until then and be used as a reference for the continuous improvement This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	publish ASP design
<ALLOCATED_TO>	<Role>	Regional ASM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Airspace design

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-POST.0020
Title	Local information and reached actions updated up to the post-operations phase.
Requirement	Local information and actions derived and reached collaboratively from the ATM stakeholders from the strategic to the tactical phases, shall be updated up to the post-operations phase.
Status	<validated>

Rationale	In order to support the post ops phase and serve as the reference, the local information should be updated until then and be used as a reference at local level for the continuous improvement This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	traffic demand
<ALLOCATED_TO>	<Activity>	Strategic demand forecast
<ALLOCATED_TO>	<Role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Airspace design

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-POST.0030
Title	Lessons learnt on integrated DCB processes
Requirement	Post Operational Analysis processes shall review the efficiency of the previous processes in the integrated DCB timelines (e.g. Strategic and pre-tactical, INAP Time Horizon, Tactical) and make recommendations for change (if necessary).
Status	<validated>
Rationale	In order to support a continuous improvement process. This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	traffic demand
<ALLOCATED_TO>	<Activity>	Strategic demand forecast
<ALLOCATED_TO>	<Role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Airspace design

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-POST.0040
Title	Workload assessment methodologies used in post-ops analysis
Requirement	The workload assessment methodologies based on empirical data collection (performance, physiological and subjective measures) shall be used for post-ops analysis.
Status	<validated>
Rationale	In order to support the continuous improvement process This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision

<ALLOCATED_TO>	<Information Flow>	traffic demand
<ALLOCATED_TO>	<Activity>	KPI assessment
<ALLOCATED_TO>	<Role>	Sub Regional / Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Airspace design

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-POST.0050
Title	AI/ML techniques for DCB measures definition
Requirement	Post-operational analysis feedback shall provide feedback for DCB measures definitions months before the day of operation to enable refinement.
Status	<validated>
Rationale	The post-operational analysis shall produce a good feedback loop. This will also permit in supporting big data and machine learning techniques, if used, in determining months before the day of operation a group of relevant and appropriate candidate demand and capacity measures to solve potential issues. This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	traffic demand
<ALLOCATED_TO>	<Activity>	run ASM simulations
<ALLOCATED_TO>	<Role>	Sub Regional / Local ATFCM

<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Airspace design

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-POST.0080
Title	Post Ops airspace design
Requirement	The DAC Toolbox shall facilitate the design of the airspace modules, sectors and blocks in the Post-Operations phase by providing decision making indicators, such as resulting capacity or configuration scheme.
Status	<validated>
Rationale	The aim is to provide first levels of automatization to allow coping with more and more complex situation, beyond human usual capacities. This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	traffic demand
<ALLOCATED_TO>	<Activity>	run ASM simulations
<ALLOCATED_TO>	<Role>	Sub Regional / Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Airspace design

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-POST.0090

Title	Post-Operations Analysis of the General and Targeted CASA regulations comparison simulation results
Requirement	The Post-Operations phase shall analyse the simulation results of the General and Targeted CASA regulations comparison.
Status	<validated>
Rationale	This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	CASA regulation proposal
<ALLOCATED_TO>	<Activity>	Perform Network impact assessment
<ALLOCATED_TO>	<Role>	Network manager
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Target Flow CASA

4.2.11INAP Role

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-INAP.0010
Title	DAC into DCB roles and working methods
Requirement	The DAC tool shall support INAP and NM in determining the sector configuration (or capacity plan) for their respective timeframes and area of interest.
Status	<validated>

Rationale	In order to have the commitment of the involved actors to the DAC tool This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-1120.0012.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	Identify initial local/FAB sector configuration matching local/network performance targets
<ALLOCATED_TO>	<Role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	dac_UC_05_Initial ideal sector configuration and DCB imbalance identification

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-INAP.0020
Title	DAC into DCB procedures
Requirement	The DAC tool shall enable differentiation of different roles/profiles of DAC tool users with defined associated procedures
Status	<validated>
Rationale	the DAC user perimeter has to be well defined This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-1120.0022.

Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	nan
<ALLOCATED_TO>	<Role>	nan
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	nan

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-INAP.0030
Title	DAC into DCB plan validation by Supervisor
Requirement	The ATSU supervisor/LTM shall be able to request, validate and activate DAC for the Day of Operation.
Status	<validated>
Rationale	ATSU Supervisor/LTM has to be able to validate DAC planned for the shift ; This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-1130.0001.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44

<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	performance
<ALLOCATED_TO>	<Activity>	Coordinate with regional ATFCM in case of conflicting performance targets
<ALLOCATED_TO>	<Role>	subregional / local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Performance target definition

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-INAP.0040
Title	DCB roles within INAP
Requirement	En-route local DCB actor shall manage the activities linked to DCB roles inside the INAP (Integrated Network ATC Planning) function.
Status	<validated>
Rationale	Regardless of staffing strategy and local organization, the operating methods, roles, procedures and relevant automation support shall be made available and consistent for the En Route DCB actor(s) (be it the ATSU SUP, LTM, EAP(s), etc..) to be able to perform the whole range of activities linked to DCB roles in ATFCM tactical phase (short-term planning to execution phase). The INAP function shall provide the relevant level of consistency between the roles and their respective methods, procedures and tools. This requirement comes from Wave 1: REQ-09.02-OSED-INAP.0020.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44

<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	Proposed DCB measure
<ALLOCATED_TO>	<Activity>	Prepare EAP DCB solution
<ALLOCATED_TO>	<Role>	INAP EAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	EAP resolution of local hotspots with LTM delegation

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-INAP.0050
Title	Responsibility for local DCB imbalances
Requirement	INAP actors shall be responsible for the identification of local DCB solutions to solve local imbalances.
Status	<validated>
Rationale	Local imbalances have to be solved by local actors with their catalogue of measures. This requirement comes from Wave 1: REQ-09.02-OSED-INAP.0050.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	Proposed DCB measure
<ALLOCATED_TO>	<Activity>	Prepare EAP DCB solution

<ALLOCATED_TO>	<Role>	INAP EAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	EAP resolution of local hotspots with LTM delegation

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-INAP.0060
Title	Access to local situations
Requirement	The INAP shall have direct access to information linked to local complex situations within the INAP area of responsibility.
Status	<validated>
Rationale	This requirement covers local complex situations and contributing factors for both LTM and EAP ; each role using the information within its own timeframe and granularity. This requirement comes from Wave 1: REQ-09.02-OSED-INAP.0070.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	4D trajectory situation awareness
<ALLOCATED_TO>	<Activity>	Monitor DCB imbalance
<ALLOCATED_TO>	<Role>	Trajectory situation awareness
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Hotspot management in full autonomy

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-INAP.0065
Title	Identification to complexity
Requirement	The INAP shall be able to identify what the complexity consists in: which flights create complexity in the hotspot, from a list proposed by the system.
Status	<validated>
Rationale	This requirement covers local complex situations and contributing factors for both LTM and EAP ; each role using the information within its own timeframe and granularity. This requirement comes from Wave 1: REQ-09.02-OSED-INAP.0070.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	4D trajectory situation awareness
<ALLOCATED_TO>	<Activity>	Monitor DCB imbalance
<ALLOCATED_TO>	<Role>	Trajectory situation awareness
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Hotspot management in full autonomy

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-INAP.0070
Title	Airspace type

Requirement	The INAP shall be able to work in the following airspace type: Free Routing, and Fixed Route.
Status	<validated>
Rationale	This requirement comes from Wave 1: REQ-09.02-OSED-INAP.0110.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	nan
<ALLOCATED_TO>	<Role>	INAP EAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	nan

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-INAP.0080
Title	EAP – LTM Collaboration
Requirement	The Extended ATC Planner (EAP), if implemented, shall work in close collaboration with the Local Traffic Manager (LTM).
Status	<validated>
Rationale	The INAP encompass the 'standard' local DCB actor(s) and a possibly new one in charge of Extended ATC Planning, if implemented as a distinct actor. Both these actors will need to work in collaboration for efficient INAP function. This implies a consistent set of closely coordinated working methods, procedures and tool support. This requirement comes from Wave 1: REQ-09.02-OSED-INAP.0140.

Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	hotspot
<ALLOCATED_TO>	<Activity>	Analyse delegated hotspot and associated proposed measures
<ALLOCATED_TO>	<Role>	INAP EAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	EAP resolution of local hotspots with LTM delegation

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-INAP.0090
Title	INAP Awareness of existing DCB measures on a flight
Requirement	The INAP shall be informed of any other DCB measures impacting a flight over his/her area of responsibility.
Status	<validated>
Rationale	This requirement comes from Wave 1: REQ-09.02-OSED-INAP.0290.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44

<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	DCB impact assessment
<ALLOCATED_TO>	<Activity>	Coordinate EAP / DCB solution
<ALLOCATED_TO>	<Role>	INAP EAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	EAP resolution of local hotspots with LTM delegation

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-INAP.0100
Title	Pre-requisite for Synchronization
Requirement	The INAP shall be able to assess the compatibility of DCB Measures under preparation with any other DCB measure impacting the candidate flight(s)
Status	<validated>
Rationale	This requirement comes from Wave 1: REQ-09.02-OSED-INAP.0300.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	Proposed DCB solution
<ALLOCATED_TO>	<Activity>	Analyse EAP DCB solution

<ALLOCATED_TO>	<Role>	EAP INAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	EAP resolution of local hotspots with LTM delegation

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-INAP.0110
Title	EAP and ATC collaboration
Requirement	The INAP shall be able to assess the compatibility of DCB Measures under preparation with any other DCB measure impacting the candidate flight(s)
Status	<validated>
Rationale	This requirement comes from Wave 1: REQ-09.02-OSED-INAP.0400.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	ATC situation awareness
<ALLOCATED_TO>	<Information Flow>	revised RBT
<ALLOCATED_TO>	<Activity>	implement EAP DCB measure
<ALLOCATED_TO>	<Role>	ATC
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	EAP hotspot mangement in full autonomy

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-INAP.0120
Title	Planning Controllers' role in Short-Term ATFCM Measures process
Requirement	The PC shall be able to handle the Short-Term ATFCM Measures to solve local complex situations sent by EAP (or LTM if EAP is not implemented) within the TFV under their responsibility
Status	<validated>
Rationale	This requirement comes from Wave 1: REQ-09.02-OSED-INAP.0410.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	ATC situation awareness
<ALLOCATED_TO>	<Information Flow>	revised RBT
<ALLOCATED_TO>	<Activity>	implement EAP DCB measure
<ALLOCATED_TO>	<Role>	ATC
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	EAP hotspot mangement in full autonomy

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-INAP.0130
Title	DCB information for INAP
Requirement	The INAP shall be able to access pre-planned DCB and DCB measures for hotspots/optispots resolution, assess their impact, and when operationally relevant, implement them as a potential solution.
Status	<validated>
Rationale	This requirement comes from Wave 1: REQ-09.02-OSED-CORS.0050b.

Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	Proposed DCB solution
<ALLOCATED_TO>	<Activity>	Trigger implementation of EAP DCB solution
<ALLOCATED_TO>	<Role>	INAP EAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	EAP resolution of local hotspots with LTM delegation

4.2.12Collaborative Decision Making Process

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-CDMP.0010
Title	Strategic CDM
Requirement	INAP shall integrate the Collaborative decision making process from local to regional levels at strategic phase based on performance approach
Status	<validated>
Rationale	Performance approach could be in defining strategic optimal point of trade-off between two or more local/network KPAs/KPIs (cost, delay, capacity). That optimum becomes a target to be cascaded down to pre-tactical and tactical levels as the target being a function of the traffic demand. This requirement is a new requirement developed within the solution 44.

Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	FBT
<ALLOCATED_TO>	<Activity>	Inputs Parameters into Local DAC Tool
<ALLOCATED_TO>	<Role>	Local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	Coordination and publication of optimlal Network DCB scenario

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-CDMP.0020
Title	Pre-Tactical CDM
Requirement	INAP shall execute the Collaborative decision making process at pre-tactical phase by using combination of capacity and demand measures from the DCB catalogue eg. Model A, model B, combination of non predefined sectors configuration, regulation…
Status	<validated>
Rationale	This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier

<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	regreg coord
<ALLOCATED_TO>	<Activity>	Advice NM of local sector configuration and proposed ATFCM measures for remaining hotspots
<ALLOCATED_TO>	<Role>	Subregional / local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	dac_UC_05_Initial ideal sector configuration and DCB imbalance identification

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-CDMP.0030
Title	Tactical CDM
Requirement	INAP shall execute the Collaborative decision making process at tactical phase by using combination of capacity and demand measures from the DCB catalogue and taking into account uncertainty, time horizon, severity and granularity.
Status	<validated>
Rationale	At tactical level the process is not bound by time anymore, but rather by data uncertainty parameters. This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44

<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	regreg coord
<ALLOCATED_TO>	<Activity>	Advice NM of local sector configuration and proposed ATFCM measures for remaining hotspots
<ALLOCATED_TO>	<Role>	Subregional / local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	dac_UC_05_Initial ideal sector configuration and DCB imbalance identification

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-CDMP.0040
Title	CDM responsibility at tactical phase
Requirement	At tactical phase, the LTM shall be responsible for the CDM process
Status	<validated>
Rationale	This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	regreg coord

<ALLOCATED_TO>	<Activity>	Advice NM of local sector configuration and proposed ATFCM measures for remaining hotspots
<ALLOCATED_TO>	<Role>	Subregional / local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	dac_UC_05_Initial ideal sector configuration and DCB imbalance identification

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-CDMP.0050
Title	CDM responsibility at pre-tactical phase
Requirement	At pre-tactical phase, the ANSP ATFCM unit shall be responsible for the CDM process
Status	<validated>
Rationale	This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	regreg coord
<ALLOCATED_TO>	<Activity>	Advice NM of local sector configuration and proposed ATFCM measures for remaining hotspots
<ALLOCATED_TO>	<Role>	Subregional / local ATFCM

<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	dac_UC_05_Initial ideal sector configuration and DCB imbalance identification

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-CDMP.0060
Title	CDM responsibility at strategic phase
Requirement	At strategic phase, the ANSP ATFCM unit shall be responsible for the CDM process
Status	<validated>
Rationale	This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	regreg coord
<ALLOCATED_TO>	<Activity>	Advice NM of local sector configuration and proposed ATFCM measures for remaining hotspots
<ALLOCATED_TO>	<Role>	Subregional / local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	dac_UC_05_Initial ideal sector configuration and DCB imbalance identification

4.2.13Cross Border

The following requirements have been developed within solution 44 and should be reviewed to ensure consistency with related solutions, namely SESAR Wave 2 Solution 93 and SESAR Wave 3 PJ32, which will be recipient of DAC principles, especially cross border operations.

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-XBRD.0010
Title	Cross Border delegation volumes
Requirement	Cross Border airspace volumes eligible to be transferred shall be pre-defined.
Status	<validated>
Rationale	The ATCO from both ACC shall be trained with the airspace, the adaptation data charged in both systems, and the set of procedures needed in the sectors outside their nominal area of operations, but not the whole neighbouring ACC. This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	nan
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	nan
<ALLOCATED_TO>	<Role>	ATC
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	nan

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-XBRD.0020
Title	Definition of Local Airspace rules and delegations
Requirement	Rules for Cross Border sectors and delegation of airspace concerning other ATSU (same or different ANSP) shall be defined.
Status	<validated>
Rationale	Rules for delegating, such as low traffic density, type of traffic (en Route, APP), availability of licensed ATCOs, etc. shall be clearly explicated and known by actors This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	nan
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	nan
<ALLOCATED_TO>	<Role>	ATC
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	nan

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-XBRD.0030
Title	CNS interoperability between delegating ATSUs
Requirement	Cross Border airspace configuration shall require cross border CNS interoperability and/or integration of transnational systems.
Status	<validated>
Rationale	Need of systems that could operate side by side and guarantee information interchange is done in an effectively and in a safe manner.

	Interoperability will be achieved through syntactic interoperability (common data formats and communication protocols), as well as semantic (common information exchange reference model that helps to produce useful results). This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	nan
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	nan
<ALLOCATED_TO>	<Role>	nan
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	nan

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-XBRD.0040
Title	What-if and complexity to assess cross-border solutions
Requirement	The LTM shall be able to perform DCB within predefined Cross Border configuration using the different tools available, such as what-if and complexity.
Status	<validated>
Rationale	The LTM may decide to propose Cross Border delegation of airspace volumes to the neighbouring ACC/ATSU as a solution to a DCB imbalance. This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	What-if identifies resolution plan
<ALLOCATED_TO>	<Role>	Upstream LTM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	What-if flight exclusion tool

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-XBRD.0050
Title	Coordinate best fit sector configuration taking into account Cross Border sectors
Requirement	INAP shall be able to coordinate with neighbouring INAPs the proposals of Cross Border sector configurations.
Status	<validated>
Rationale	INAPs affected (from both the receiving and delegating ACCs) by a delegation proposals shall agree and coordinate the sector configuration to be implemented in order to ensure situational awareness as well as to assure the performance assessment of the involved ACCs/ATSU. This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01

<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	proposed DCB measure
<ALLOCATED_TO>	<Activity>	Prepare DCB solution
<ALLOCATED_TO>	<Role>	INAP EAP
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	DCB measures prepared in the SBT elaboration process (planning phase)

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-XBRD.0060
Title	Communicate to the NM that a Cross Border sector configuration will be implemented
Requirement	The Network Manager shall be aware that a Cross Border operations will take place. Where Cross Border DAC takes place, the NM shall be informed of the configuration and to whom the sectors are delegated.
Status	<validated>
Rationale	INAPs affected by delegation proposals shall communicate to the NM the new delegation of airspace due to the implementation of a Cross Border sector configuration. This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	nan
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	nan

<ALLOCATED_TO>	<Role>	ATC
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	nan

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-XBRD.0070
Title	Define best fit sector configuration taking into account Cross Border sectors
Requirement	Local DAC actor shall be able to design the best possible - best fit - configuration, satisfying the complexity and local performance targets considering the number of opened sector and possibility to open Cross Border sectors.
Status	<validated>
Rationale	Sector configuration at Cross Border level shall be able to provide benefits not only at local level but considering complexity and performance at regional or sub-regional levels. This requirement is a new requirement developed within the solution 44.
Category	<Operational><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	nan
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	nan
<ALLOCATED_TO>	<Role>	ATC
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	nan

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-XBRD.0080
Title	Cross Border delegation procedures
Requirement	Operational procedures shall ensure the safe implementation of the delegation of airspace from one ACC to another ACC.
Status	<validated>
Rationale	Airspace from one ACC can be transferred to another ACC and operational procedures are needed to ensure the safe implementation of the delegation. It is worth mentioning to avoid ambiguities that operational procedures are not provided in this OSED but should be defined by local actors implementing the solution 44, considering local constraints, usages, regulations,... This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	nan
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	nan
<ALLOCATED_TO>	<Role>	nan
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	nan

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-XBRD.0090
Title	Cross Border delegation procedures for delegation
Requirement	INAP and ATCO operational procedures for delegation shall be defined.

Status	<validated>
Rationale	Airspace from one ACC can be transferred to another ACC and operational procedures are needed to ensure the safe implementation of the delegation at all levels. It is worth mentioning to avoid ambiguities that, even if mandatory to be able to implement cross-border operations, operational procedures are not provided in this OSED but should be defined by local actors implementing the solution 44, considering local constraints, usages, regulations,... This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	nan
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	nan
<ALLOCATED_TO>	<Role>	nan
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	nan

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-XBRD.0100
Title	Cross Border supporting tools
Requirement	INAP and ATCO supporting tools shall be able to comply with the working methods described in cross border procedures.
Status	<validated>
Rationale	Visualization and Communication in CWP and supporting tool of Cross Border sectors and flights affected by new sectorisation with the cross

	border sector. This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	nan
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	nan
<ALLOCATED_TO>	<Role>	nan
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	nan

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-XBRD.0110
Title	Supervisor coordination of cross-border delegation timeframe
Requirement	The supervisor of the delegating ATSU shall be able to coordinate with the supervisor of the receiving ATSU the most appropriate timeframe for the airspace delegation
Status	<validated>
Rationale	In order to ensure a non-disruptive transition of cross-border sector configurations, the supervisors concerned by the change should be in close coordination between themselves and their corresponding ATCO teams. This will ensure the efficiency of the sector configuration change and will avoid unnecessary ATCO workload peaks. This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	nan
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	nan
<ALLOCATED_TO>	<Role>	nan
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	nan

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-XBRD.0120
Title	ATCO team coordination during cross-border sector configuration changes
Requirement	The PC and EC of the delegating ATSU shall be able to establish textual or verbal coordination with the PC and EC of the receiving ATSU during the cross-border airspace delegation transition period.
Status	<validated>
Rationale	The coordination between ATCOs during the cross-border sector configuration change is essential to ensure a sufficient level of situational awareness and to keep seamless operations with regards to the aircraft on frequency (avoiding clearances repetitions, unnecessary ATCO-pilot exchanges, etc.). This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01

<ALLOCATED_TO>	<Information Exchange>	nan
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	nan
<ALLOCATED_TO>	<Role>	nan
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	nan

4.2.14DCB KPA/KPI Assessment

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-KPAI.0010
Title	DCB within ATM performance data from NOP
Requirement	The INAP shall be able to evaluate the efficiency of the DCB measures through all ATM phases against the assigned performance targets
Status	<validated>
Rationale	In order to evaluate the efficiency of the Dynamic Airspace Configuration to the traffic at all levels of decision making, specific performance targets will be defined and used, delivered by the NOP. The analysis of the performance is used to adapt constraints and processes to improve the sectorisation processes and take decisions. This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision

<ALLOCATED_TO>	<Information Flow>	performance
<ALLOCATED_TO>	<Activity>	produce local daily performance taget plan
<ALLOCATED_TO>	<Role>	subregional / local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	performance target definition

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-KPAI.0020
Title	Performance Indicators from NOP
Requirement	The INAP shall assess airspace solutions according to the Performance Indicators from NOP and as a trade-off between the benefits and costs for the different actors
Status	<validated>
Rationale	As capacity measures impact flights/airspace configuration, the solution shall be a fair trade-off between the benefits and costs of the airspace solution and the benefits and costs for the Airspace users and the wider community. Either benefits or costs are defined according to both global performance criteria and local criteria and are converted in KPIs. Capacity measures basically avoid the trajectory penalization for the airspace users (i.e. demand measures), but the cost of a Capacity measure could be higher than the cost of the problem itself. To compare efficiency of possible solutions capacity and demand measures need to apply performance analysis within DCB context. This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision

<ALLOCATED_TO>	<Information Flow>	performance
<ALLOCATED_TO>	<Activity>	produce local daily performance taget plan
<ALLOCATED_TO>	<Role>	subregional / local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	performance target definition

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-KPAI.0040
Title	Performance Indicator for What-If and negotiation
Requirement	The INAP shall be able to consider the relevant performance KPIs negotiated with involved actors.
Status	<validated>
Rationale	As DCB measures are to be selected based on performance driven criteria, specific KPIs and supporting tools shall be provided to the INAP to enable performance impact assessment considering both global and local perspective. This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	performance
<ALLOCATED_TO>	<Activity>	Receive D-ops regional ATFCM performance targets
<ALLOCATED_TO>	<Role>	sub-regional / local ATFCM

<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	performance target definition

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-KPAI.0050
Title	NM support performance Indicator
Requirement	The INAP shall take into account the performance targets and indicators supported by a what-if function from the Network Performance Impact Assessment.
Status	<validated>
Rationale	The NM shall provide a Network Performance Assessment tool in order to assess the impact of DCB measures on the performance at network level but also for the individual actors (Centre, Cluster, Sector …) This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	performance
<ALLOCATED_TO>	<Activity>	inform local DAC of D-ops regional ATFCM performance targets
<ALLOCATED_TO>	<Role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	performance target definition

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-KPAI.0060
Title	Local performance data parameters
Requirement	The INAP shall be able to define and assess their local appropriate performance indicators and metrics.
Status	<validated>
Rationale	DCB process shall be associated to specific performance indicators and metrics to be integrated in the performance framework. Private (local) indicator shall stay private and only available for local Actor. This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	performance
<ALLOCATED_TO>	<Activity>	produce local daily performance taget plan
<ALLOCATED_TO>	<Role>	sub-regional / local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	performance target definition

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-KPAI.0070
Title	NM and Fuel Efficiency KPI
Requirement	The INAP shall be able to consider fuel efficiency during the decision-making process.
Status	<validated>

Rationale	NM measures the Fuel Efficiency to be available when the INAP assesses the measures to be taken according to the benefit and cost analysis for the different actors. Fuel efficiency is especially relevant when considering demand measures, since capacity measures are transparent for the Airspace Users. This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	performance
<ALLOCATED_TO>	<Activity>	produce network daily performance target plan
<ALLOCATED_TO>	<Role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	performance target definition

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-KPAI.0080
Title	Predictability KPI at NM Level availability for INAP
Requirement	The INAP shall be able to consider Predictability (Flight duration variability) during the decision-making process.
Status	<validated>
Rationale	Predictability (i.e. Flight duration variability, against RBT) measured at NM level shall be available when the INAP assesses the measures to be taken according to the benefit and cost analysis for the different actors. Predictability is especially relevant when considering demand measures,

	since capacity measures are transparent for the Airspace Users. This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	Monitor actual business Trajectory and update RBT accordingly
<ALLOCATED_TO>	<Role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	DCB measures prepared in the RBT revision process

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-KPAI.0090
Title	Punctuality KPI at NM level availability for INAP
Requirement	The INAP shall be able to consider Punctuality during the decision-making process.
Status	<validated>
Rationale	Punctuality (i.e. % AOBT within +/- 3 minutes of SOBT) measured by NM shall be available when the INAP assesses the measures to be taken according to the benefit and cost analysis for the different actors. Punctuality is especially relevant when considering demand measures, since capacity measures are transparent for the Airspace Users. This requirement is a new requirement developed within the solution 44.

Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	nan
<ALLOCATED_TO>	<Activity>	Monitor actual business Trajectory and update RBT accordingly
<ALLOCATED_TO>	<Role>	Regional ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	DCB measures prepared in the RBT revision process

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-KPAI.0100
Title	KPIs to assess Local Performance targets
Requirement	The INAP shall be able to consider the KPIs corresponding to daily Local Performance Targets for a given sector configuration and list of DCB measures.
Status	<validated>
Rationale	To ensure that the DCB solution is compliant with daily local performance targets, the corresponding KPIs associated to the solution shall be evaluated. This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	performance
<ALLOCATED_TO>	<Activity>	produce local daily performance taget plan
<ALLOCATED_TO>	<Role>	subregional / local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	performance target definition

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-KPAI.0110
Title	KPIs to assess Network Performance targets
Requirement	The INAP shall be able to consider the KPIs corresponding to daily Network Performance Targets provided by the NM and given a set of sector configurations and a list of DCB measures.
Status	<validated>
Rationale	To ensure that the DCB solution is compliant with daily network performance targets, the corresponding KPIs associated to the solution shall be evaluated. This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01

<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	performance
<ALLOCATED_TO>	<Activity>	produce local daily performance taget plan
<ALLOCATED_TO>	<Role>	subregional / local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	performance target definition

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-KPAI.0120
Title	Produce daily network performance targets
Requirement	NM shall be able to produce daily network performance targets from the Network Operations Performance Plan
Status	<validated>
Rationale	The daily network performance targets are derived from the periodical global performance targets and the performances already accomplished since the beginning of the period. This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	performance
<ALLOCATED_TO>	<Activity>	produce local daily performance taget plan

<ALLOCATED_TO>	<Role>	subregional / local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	performance target definition

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-KPAI.0130
Title	Produce daily local performance targets
Requirement	Local manager shall be able to produce daily local performance targets from the periodical high level performance targets defined by the HLAPB
Status	<validated>
Rationale	The local network performance targets are derived from the periodical global performance targets and the performances already accomplished since the beginning of the period. This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	performance
<ALLOCATED_TO>	<Activity>	produce local daily performance taget plan
<ALLOCATED_TO>	<Role>	subregional / local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	performance target definition

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-KPAI.0140
Title	DCB solutions compliant with performance targets
Requirement	The INAP shall be able to plan and develop Dynamic Airspace Configurations that meet defined Network and Local operational performance targets
Status	<validated>
Rationale	DAC solutions proposed by Local DACs shall be compliant with daily performance targets. This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	performance
<ALLOCATED_TO>	<Activity>	Receive D-ops regional ATFCM performance targets
<ALLOCATED_TO>	<Role>	sub-regional / local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	performance target definition

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-KPAI.0150
Title	Performance monitoring
Requirement	The INAP shall monitor Airspace configurations deployed as a result of strategic phase (taking into account Network and local performance)
Status	<validated>

Rationale	The daily local performance targets shall be monitored (to detect deviations) and recorded for post-ops analysis This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	performance
<ALLOCATED_TO>	<Activity>	produce local daily performance taget plan
<ALLOCATED_TO>	<Role>	subregional / local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	performance target definition

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-KPAI.0160
Title	Evaluate sector configuration
Requirement	The INAP shall be able to evaluate the impact of sector configuration(s) (i.e. capacity measures) and/or ATFM measures (i.e. demand measures) and check their consistency with its local performance targets
Status	<validated>
Rationale	The INAP need to be able to understand if the capacity plan is still valid or if action is required to modify/update the capacity plan based on better information and that the capacity plan still meets the local performance targets. This requirement is a new requirement developed within the solution 44.
Category	<Operational>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<SATISFIES>	<High Level Operational Requirement>	P09-TLOR-01, P09-TLOR-02, S44-HLOR-01
<ALLOCATED_TO>	<Information Exchange>	sector configuration and capabilities provision
<ALLOCATED_TO>	<Information Flow>	performance
<ALLOCATED_TO>	<Activity>	produce local daily performance taget plan
<ALLOCATED_TO>	<Role>	subregional / local ATFCM
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network
<ALLOCATED_TO>	<Activity View>	performance target definition

4.3 Safety Requirements

The following requirements are issued from the SAR.

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SAF.0010
Title	Alert in case of loss of status
Requirement	The LTM/EAP shall be alerted in case of the loss of the Impacted hotspot resolution status functionality
Status	<validated>
Rationale	It is necessary in the SOL 44 SAR to mitigate Hz 03: ATFM measures not designed or not implemented or implemented partially by Local ATFCM This requirement comes from Wave 1 : REQ-09.01-OSED-SAF.0010
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-73
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SAF.0020
Title	Training of the LTM/EAP – TMV values
Requirement	Training of the LTM/EAP shall consider the selection / modification of the TMV values
Status	<validated>
Rationale	It is necessary to mitigate "Incorrect Traffic monitoring value with regard to complexity/workload" as cause of Hz 03 This requirement comes from Wave 1 : REQ-09.01-OSED-SAF.0003
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-74
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SAF.0040
Title	Information on the complexity calculation status
Requirement	The LTM/EAP shall have an access to the information whether complexity calculation is in progress or done
Status	<validated>
Rationale	It is necessary to mitigate "Incorrect Traffic monitoring value with regard to complexity/workload" as cause of Hz 03 This requirement comes from Wave 1 : REQ-09.01-OSED-CPX.0340
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-75
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SAF.0050
Title	Training of the LTM/EAP – imbalance severities and confidence index
Requirement	Training of the LTM/EAP shall consider the evaluation of imbalance severities and/or confidence indexes in view of hotspot identification
Status	<validated>
Rationale	It is necessary to mitigate "Local LTM or NM fails to identify and declare hotspot" as cause of Hz 03 This requirement comes from Wave 1 : REQ-09.01-OSED-SAF.0004
Category	<Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-76
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

4.4 Security Requirements

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SEC.0010
Title	Authentication
Requirement	Each entity connected to the Local Network Management / Airspace Management Demand & Capacity Balancing system (i.e., the requestor, the provider, and the broker when applicable) shall be authenticated.

Status	<validated>
Rationale	Protection against spoofing, cyber intrusion and unauthorized actions
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-77
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SEC.0020
Title	Authorization
Requirement	The Local Network Management / Airspace Management Demand & Capacity Balancing system shall define different levels of authorization to the users.
Status	<validated>
Rationale	Protection against unauthorized actions
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-78
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SEC.0030
Title	Network Monitoring System

Requirement	The Local Network Management / Airspace Management Demand & Capacity Balancing system shall be protected by a real time Network Monitoring System.
Status	<validated>
Rationale	Protection against spoofing and cyber intrusions
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-79
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SEC.0040
Title	Data encryption
Requirement	The Local Network Management / Airspace Management Demand & Capacity Balancing system shall encrypt data on transit.
Status	<validated>
Rationale	Protection against spoofing and unauthorized actions
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-80
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SEC.0050

Title	System configuration
Requirement	The Local Network Management / Airspace Management Demand & Capacity Balancing system infrastructure shall be securely configured (e.g., reduce attack surface, use secure protocols, etc.).
Status	<validated>
Rationale	Protection against spoofing, cyber intrusions and unauthorized actions
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-81
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SEC.0060
Title	Physical security
Requirement	The Local Network Management / Airspace Management Demand & Capacity Balancing system shall be secured physically.
Status	<validated>
Rationale	Protection against unauthorized actions
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-82
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SEC.0070
Title	Security awareness
Requirement	Security Awareness and Education about Security Risk shall be provided to users of the Local Network Management / Airspace Management Demand & Capacity Balancing system.
Status	<validated>
Rationale	Protection against phishing and disclosure of sensitive information via electronic means
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-83
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SEC.0080
Title	Security oversight
Requirement	Disciplinary process shall be created for employees who have committed an information security breach in the Local Network Management / Airspace Management Demand & Capacity Balancing system.
Status	<validated>
Rationale	Protection against phishing
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-84
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SEC.0090
Title	Redundancy
Requirement	The Local Network Management / Airspace Management Demand & Capacity Balancing system shall be designed with a redundant architecture.
Status	<validated>
Rationale	Protection against potential denials of service
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-85
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SEC.0100
Title	Capacity Monitoring System
Requirement	The Local Network Management / Airspace Management Demand & Capacity Balancing system shall be protected by a real time Capacity Monitoring System.
Status	<validated>
Rationale	Protection against potential tampering with configuration
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-86
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SEC.0110
Title	Change Management System
Requirement	The Local Network Management / Airspace Management Demand & Capacity Balancing system shall implement a Change Management System.
Status	<validated>
Rationale	Protection against potential tampering with software
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-87
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SEC.0120
Title	Data quality check
Requirement	The Local Network Management / Airspace Management Demand & Capacity Balancing system shall implement quality checks on the input/output data.
Status	<validated>
Rationale	Protection against the potential corruption of data
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-88

<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-SEC.0130
Title	Information classification protocols
Requirement	The Local Network Management / Airspace Management Demand & Capacity Balancing system shall implement protocols for the classification of the information exchanged between the different entities.
Status	<validated>
Rationale	Protection against the disclosure of sensitive information via electronic means
Category	<Security>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-89
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

4.5 Human Performance Requirements

[REQ]

Identifier	REQ_PJ.09-W2-44-V3-001
Title	System design
Requirement	The DAC algorithm shall integrate operational criteria when defining new sector shapes.
Status	<To be analysed>
Rationale	Requirement based on operational staff's feedback.
Category	<Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-44
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ_PJ.09-W2-44-V3-002
Title	Formation
Requirement	Knowledge, skill and experience requirements shall be identified before the implementation of the concept.
Status	<To be analysed>
Rationale	Requirement based on deployment needs and HP reference material
Category	<Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-45
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ_PJ.09-W2-44-V3-003
Title	Training
Requirement	Training requirements per actor group shall be identified before the implementation of the concept.
Status	<To be analysed>
Rationale	Requirement based on deployment needs and HP reference material
Category	<Human Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-46
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

4.6 Interoperability Requirements

The following requirements have been retrieved from wave 1, PJ08.01 and PJ09.02 and completed with new requirements developed for PJ09-W2-S44.

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IER.0010
Title	EDAC retrieval by FOC
Requirement	FOC shall be able to retrieve EDAC information from the NOP
Status	<validated>
Rationale	This requirement supports coordination in both Models A & B This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0100.0020.
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-47
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IER.0020
Title	Airspace status visibility for Airspace Users
Requirement	Airspace Users shall be able to access the integrated Airspace Status View in order to evaluate the current situation concerning their traffic.
Status	<validated>

Rationale	AU shall have access to all information related to imbalance and hotspot through the integrated Airport/Network view in order to anticipate DCB measure and react to imbalances, to better satisfy their own business needs. This "natural" reaction of AUs to imbalance prediction is the first step after Capacity adjustment to solve DCB problems. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0220.0060.
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-48
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IER.0030
Title	Airspace Network Status available from NOP
Requirement	NOP shall give access to the Airspace configuration status (DAC)
Status	<validated>
Rationale	NOP should support negotiation and data exchange between WOCs and DACs. In this frame, NOP should give access to the Airspace Network status to WOC to help him best organise activity periods and anticipate impact on civil activity. WOC need to understand possible civil request for negotiation on airspace booking and for that need to have access the status of the airspace and the imbalances. In other words military should be in the decision loop for Airspace negotiations. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0240.0010.
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-49

<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IER.0040
Title	EDAC publication
Requirement	NM shall be able to publish the EDAC on the NOP at any moment of pre-tactical to tactical phase valid until the next EDAC publication
Status	<validated>
Rationale	This requirement is required in both Models A & B This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0100.0035.
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-50
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IER.0050
Title	Inform on ideal sector configuration
Requirement	INAP shall be able to inform NM about its ideal sector configuration and proposed ATFCM measures (associated to remaining hotspots - if any) in medium to short term planning phase as soon as the assessment is done
Status	<validated>
Rationale	This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0100.0006.
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-51
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IER.0060
Title	Inform on final sector configuration, DMAs and ATFCM measures
Requirement	ATFCM Actors shall be able to inform NM on the final sector configuration, DMAs, ATFCM measures and remaining hotspots for D-OPS after coordination with WOC and NM after every assessment process during planning
Status	<validated>
Rationale	This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0100.0011.
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-52
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IER.0070
Title	Inform local INAP on best sector configurations
Requirement	NM shall be able to inform INAP on the best sector configuration allowing to satisfy local and network performance targets according to the declared number of opened sectors after every assessment process during planning
Status	<validated>
Rationale	Model B. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0100.0014.

Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-53
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IER.0080
Title	Inform local INAP on overloaded areas
Requirement	NM shall be able to inform INAP on identified "ATC volumes" and on proposed modifications of DMAs requests taking into account these ATC volumes after every assessment process during pre-tactical to tactical phases
Status	<validated>
Rationale	This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0100.0016.
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-54
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IER.0100
Title	Airspace Configuration and Traffic Prediction
Requirement	INAP shall be able to produce Airspace Configuration all along the timeline considering/taking into account the Traffic Prediction

Status	<validated>
Rationale	With NOP Traffic planning data and Traffic projections, a Traffic Prediction with uncertainty indicators and confidence Index shall be provided (by DCB or BT management). This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0220.0030.
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-55
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IER.0130
Title	DCB supported by the DCB NWF tool
Requirement	INAP shall be able to exchange/receive information from the Network Working Position (NWP) in support of DCB processes at any time in pre-tactical and tactical phases
Status	<validated>
Rationale	DCB will be run through an integrated interface. As the use of airspace configuration is part of the DCB solution to provide optimised capacity, the NM working position shall enable to work simultaneously on demand aspects and airspace management aspects. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0220.0070.
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-56
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IER.0170
Title	Automatic action records
Requirement	DAC shall be able to automatically record performed actions on the supervision timeline management.
Status	<validated>
Rationale	When new Airspace Configuration is generated, if all constraints are matched, and if parameters indicate the possibility of automation with no Human intervention, a new configuration is automatically put in place. Automatic actions are recorded on Actions supervision functions. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0270.0012.
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-57
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IER.0180
Title	DAC and En-route Airspace capacity KPI
Requirement	DAC shall be able to receive from NM and extract the relevant KPIs to measure En-Route DCB delay
Status	<validated>
Rationale	DAC measures the En-Route Airspace Capacity – Throughput / airspace volume & time. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0400.0170.
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-58
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IER.0190
Title	Network Manager's KPIs
Requirement	DCB actors shall be able to receive from NM and extract the Network Manager's KPIs corresponding to daily Network Performance Targets based on a set of sector configurations, list of demand measures and DMAs
Status	<validated>
Rationale	DCB actors use the Network Manager's KPIs corresponding to daily Network Performance Targets based on a set of sector configurations, list of ATFCM measures and DMAs. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0400.0210.
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-59
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IER.0200
Title	Network performance targets
Requirement	DCB actors shall be able to receive from NM and extract the Network Manager's daily network performance targets in pre-tactical and tactical phases

Status	<validated>
Rationale	DCB actors use Network Performance Targets based on a set of sector configurations, list of ATFCM measures and DMAs. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0400.0220.
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-60
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IER.0210
Title	Spot Sharing
Requirement	NM actor shall be able to disseminate the Hotspot/Optispot information
Status	<validated>
Rationale	NM disseminates the Hotspot and Optispot information (time, severity) to NMf actors. This request is the first step for the spot sharing with stakeholders. This requirement comes from Wave 1: IER-09.02-OSED-102.
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-61
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IER.0220

Title	Spot Resolution Status Update
Requirement	NM shall be able to monitor the proper resolution of the Hotspot/Optispot in the execution phase and to send alert to NMF actors in case of deviations.
Status	<validated>
Rationale	NM monitors the Spot resolution, informs INAP about the spot resolution status and alerts it in case of any resolution deviation is detected. Model B This requirement comes from Wave 1: IER-09.02-OSED-103.
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-62
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IER.0230
Title	Spot Resolution Status Update
Requirement	INAP shall be able to monitor the proper resolution of the Hotspot/Optispot in the execution phase and to send alert to NM in case of deviations.
Status	<validated>
Rationale	NM monitors the Spot resolution, informs INAP about the spot resolution status and alerts it in case of any resolution deviation is detected. Model A This requirement comes from Wave 1: IER-09.02-OSED-103.
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-63

<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IER.0240
Title	DCB Measure Proposal
Requirement	INAP shall be able to send DCB measures proposal to NM
Status	<validated>
Rationale	INAP elaborates a solution to resolve the Hotspot/Optispot based on DCB measures. INAP sends the proposed DCB Measures to the NM system. This requirement comes from Wave 1: IER-09.02-OSED-200.
Category	<IER><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-64
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IER.0250
Title	DCB Measure Update
Requirement	After receiving updates from INAP actors, NM shall be able to send updates of DCB measures to NMF actors
Status	<validated>
Rationale	Updated DCB Measure information (such as regulation rate or concerned flights,...) is sent to the NM system. NM sends the agreed DCB Measures information to the NMF and AU actors. This requirement comes from Wave 1: IER-09.02-OSED-201.
Category	<IER><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-65
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IER.0260
Title	DCB Measure Implementation
Requirement	INAP shall be able to inform NM about the implementation of DCB Measures
Status	<validated>
Rationale	INAP informs NM about the implementation of the DCB Measure along with the Revised RBT after having sent the DCB measures to ATC for implementation. This requirement comes from Wave 1: IER-09.02-OSED-202.
Category	<IER><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-66
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IER.0280
Title	Req Available Sector Configs
Requirement	Local DAC shall be able to request available sector configurations of the adjacent Local Airspaces
Status	<validated>
Rationale	During the ASP design, the local DAC need the available sector configurations of the adjacent Airspaces. The information is requested to NM that is providing it to allowed users. This requirement is a new requirement developed within the solution 44.

Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-67
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IER.0290
Title	Send Available Sector Configs
Requirement	DAC shall send the locally agreed optimized configuration to the Regional ATFCM
Status	<validated>
Rationale	During the ASP design phase, the available sector configuration are made available through the NM system that is in charge of providing them to allowed users. This requirement is a new requirement developed within the solution 44.
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-68
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IER.0300
Title	Send Optim Sector Config
Requirement	Local DAC shall be able to send the locally agreed optimized configuration to the Regional DAC

Status	<validated>
Rationale	During the tactical phase, the Local DAC shall send the locally agreed optimized configuration to the Regional DAC. This requirement is a new requirement developed within the solution 44.
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-69
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IER.0310
Title	Rec Optim Sector Config
Requirement	Regional DAC shall be able to receive the locally agreed optimized configuration from the Local DAC
Status	<validated>
Rationale	During the tactical phase, the Regional DAC shall receive the locally agreed optimized configuration from the Local DAC. The Regional DAC updates the general picture. This requirement is a new requirement developed within the solution 44.
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-70
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IER.0320

Title	HotSpot and OptiSpot status to AU
Requirement	NM shall disseminate HotSpot and OptiSpot status to AU as soon as they are updated (Creation, cancellation)
Status	<validated>
Rationale	Based on this dissemination, AUs could take the appropriate actions (Cancellation, rerouting of flights, …) This requirement is a new requirement developed within the solution 44.
Category	<IER><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-71
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

[REQ]

Identifier	REQ-S44.W2-SPRINTEROP-IER.090
Title	Airspace Design and Airspace Management Functions and data
Requirement	DAC tool shall be able to serve to and process two major functions, Sector Design and Sector Management, and the associated data
Status	<validated>
Rationale	The DAC activities shall be decomposed in 2 main functions due to the time adaptation and validation of a new airspace environment and its implications. Airspace Design shall create elementary Airspace elements to be managed dynamically by Sector Management. It uses large scale traffic and need a validation phase according to level of implementation of DAC (linked to local characteristic and ATCO licensing). Airspace Management shall group elementary Airspace elements according to traffic forecast for a specific time period and assume the transition between the different time periods. This requirement comes from Wave 1: REQ-08.01-SPRINTEROP-0200.0010.
Category	<IER>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ.09-W2-72
<ALLOCATED_TO>	<Sub-Operating Environment>	Network/network

5 References and Applicable Documents

5.1 Applicable Documents

Content Integration

[1] B.04.01 D138 EATMA Guidance Material

[2] EATMA Community pages

[3] SESAR ATM Lexicon

Content Development

[4] PJ19 - D2.5 : SESAR 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] B.04.01 D108 SESAR 2020 Transition Performance Framework

[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]

System Engineering

[25]SESAR 2020 Requirements and Validation Guidelines

Safety

[26]SESAR, Safety Reference Material, Edition 4.0, April 2016

[27]SESAR, Guidance to Apply the Safety Reference Material, Edition 3.0, April 2016

[28]SESAR, Final Guidance Material to Execute Proof of Concept, Ed00.04.00, August 2015

[29]SESAR, Resilience Engineering Guidance, May 2016

Human Performance

[30]16.06.05 D 27 HP Reference Material D27

[31]16.04.02 D04 e-HP Repository - Release note

Environment Assessment

[32]SESAR, Environment Reference Material, alias, “Environmental impact assessment as part of the global SESAR validation”, Project 16.06.03, Deliverable D26, 2014.

[33]ICAO CAEP – “Guidance on Environmental Assessment of Proposed Air Traffic Management Operational Changes” document, Doc 10031.

Security

[34]16.06.02 D103 SESAR Security Ref Material Level

[35]16.06.02 D137 Minimum Set of Security Controls (MSSCs).

[36]16.06.02 D131 Security Database Application (CTRL_S)

5.2 Reference Documents

[37]ED-78A GUIDELINES FOR APPROVAL OF THE PROVISION AND USE OF AIR TRAFFIC SERVICES SUPPORTED BY DATA COMMUNICATIONS.[9]

[38]D4.1.023 V2 Final OSED Sol PJ09.03, June 2019, Edition 00.02.01

[39]D2.1.020 SESAR Solution 08.01 SPR-INTEROP-OSED for V2, July 2019, Edition 03.00.01

[40]D3.1.070 PJ09-02 V2 VALR, September 2019, Edition 01.02.00

[41]D1.2 PJ09 Final Project Report, November 2019, Edition 01.00.00

[42]PJ08 VALR

[43]PJ08 FPR

[44]*STEP1 V3 Final Complexity Management OSED,*" October 10, 2016

[45]COTTON consortium, H2020 project Grant Agreement 783222, "D4.2 Validation Report", 2019

[46]COTTON consortium, H2020 project Grant Agreement 783222, "D2.2 - Innovative complexity and workload assessment to support future Capacity Management processes in TBO" 2019

9

Appendix A Cost and Benefit Mechanisms

A.1 Stakeholders identification and Expectations

This section describes the stakeholders involved in PJ09-W2-S44.

Stakeholder	Involvement	Why it matters to stakeholder
ANSPs	To implement the DCB	○ Expect to significantly improve quality of service through the integration of dynamic airspace configuration and trajectory constraint management. ○ Expect to optimised the use of airspace capacity and reduce delays through a better planning. ○ Expect to integrate the INAP function as a link between what's done at local and network level in the DCB process. ○ Expect to increase capacity, predictability and punctuality thanks to more reliable prediction of the demand/workload using complexity indicators. ○ Expect to improve cost efficiency through an optimum use of available human resources and residual capacity. ○ Expect to maintain or increase the level of safety. ○ Expect to gain interaction with Airspace Users taking into account their Preferences and Priorities in the DCB process. ○ Expect to gain situational awareness through a collaborative planning with all stakeholders.
Airport Operators	To request DCB solutions for the airports	○ Expect to improve quality of service by fully integration of the Airports in the DCB process at local and network level. ○ Expect to achieve a between situational awareness through the integration in the INAP process. ○ Expect to achieve a better resource planning through its integration as an INAP actor.
Airspace Users: Airlines, Business Aviation, Military, General Aviation	End User	○ Expect to obtain evidence of improved predictability by considering airspace users preferences when selecting optimum DCB solutions. ○ Expect to obtain a significant efficiency improvement thanks to the management of the airspace configurations and the residual capacity to meet users' expectations. ○ Expect to obtain evidence of the improvement on punctuality, with an increased adherence to arrival and departure times. ○ Expect to achieve a balance between AUs needs and other DCB actors when selecting a DCB measure. ○ Expect to have a reduction on the average fuel burnt through the decrease of trajectory changes ○ Expect to achieve an improved participation in the process of deriving an appropriate measure

Airspace Users ops staff: Pilots, Flight Crew, Flight dispatchers	End User	○ Expect to experience a decrease in workload through the adoption of DCB measures that result in less trajectory changes. ○ Expect to make a better use of the available ATM resources ○ Expect to maintain the level of safety
Network Manager	To assess, approve and implement network DCB solutions.	○ Expect to optimise network usage through better exchange of information between actors. ○ Expect to significantly improve predictability through the integration of dynamic airspace configuration and trajectory constraint management. ○ Expect to increase capacity, predictability and punctuality thanks to more reliable prediction of the demand/workload using complexity indicators, thanks to a better integration of Network Management measures with extended ATC planning activities and thanks to the involvement of airspace users in the DCB process. ○ Expect to improve cost efficiency through an optimum use of available human resources and residual capacity. ○ Expect to increase situation awareness in order to assess the best solutions both at local and network level.
Industry	To provide trial platforms.	○ Expect to generate and assess technical requirements to help mature and prove the validation concepts. ○ Expect to gather evidence to help them decide on continued investments and/or concept implementation ○ Expect to promote the benefits of the concept. ○ Expect to achieve the integration with other systems and tools.
SJU	Programme coordinator	○ Ensure the concept definition and validation activities comply with the general SJU approach. ○ Expect to gather evidence that support the achievements obtained with the validation of the concept. ○ Expect to gather evidence of the positive, negative or neutral benefits obtained with the concept.
European Commission	Participation through SJU	○ Expect to increase economic power and position of Europe in the air-traffic sector. ○ Expect to increase capacity and efficiency. ○ Support for the implementation of the SES.

Table 15: Stakeholder's expectations for Solution PJ09-W2-S44

A.2 Benefits mechanisms

This chapter provides description of PJ09.W2-S44 DAC Solution benefit mechanism.

It is based on work performed by the solution members through dedicated exchanges and workshops for each OI covered by the solution.

The following Legend describes the meaning of the symbols reported in the Benefit and Input Mechanism:

Column Title	Box Shape	Column Description
Feature	Feature	Introduces one of the new features that the project is bringing to the world of ATM
Impact Area	Impact Area A	Sub categories used to group indicators and positive/negative impacts to help orient the reader (may not always be necessary)
Indicators	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 measured in the validation exercises
Positive or Negative Impacts	Impact 1	Describes the expected positive or negative impacts
KPA	KPA 1	KPAs linked to the positive or negative impacts

Table 16: Benefit Mechanism Syntax - Columns

The boxes in these columns are linked by numbered arrows which represent the mechanisms.

1	The numbers provide links to the mechanism descriptions in the text.

Table 17: Benefit Mechanism Syntax – Mechanisms

The arrows associated with the Indicators and the Positive or Negative Impacts are:

	A beneficial decrease e.g. a reduction in CO_2 emissions (indicator) or a reduction in controller workload (positive impact)
	A detrimental increase e.g. an increase in CO_2 emissions (indicator) or an increase in controller workload (negative impact)
	A beneficial increase e.g. an increase in no. of movements (indicator) or an increase in safety (positive impact)
	A detrimental decrease e.g. a reduction in no. of movements (indicator) or a reduction in safety (negative impact)

⇨	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.

Table 18: Benefit Mechanism Syntax – Coloured Arrows

Collaborative Airspace Configuration – AOM-0805

Description

Airspace configurations are activated through integrated collaborative decision-making processes at national, sub-regional and regional levels. Procedures and system support tools shall be defined to enable to manage the airspace configurations as a continuum to meet the users' expectations.

Rationale

Procedures and system support tools will allow civil and military airspace managers, flow managers to assess and compare different local airspace configurations (FMPs and FABs level), identifying mutual network impact, through a continuous CDM process aiming at providing the best airspace configurations at network level from planning to execution phases, making optimum use of the available airspace and human resources to meet the users' expectations.

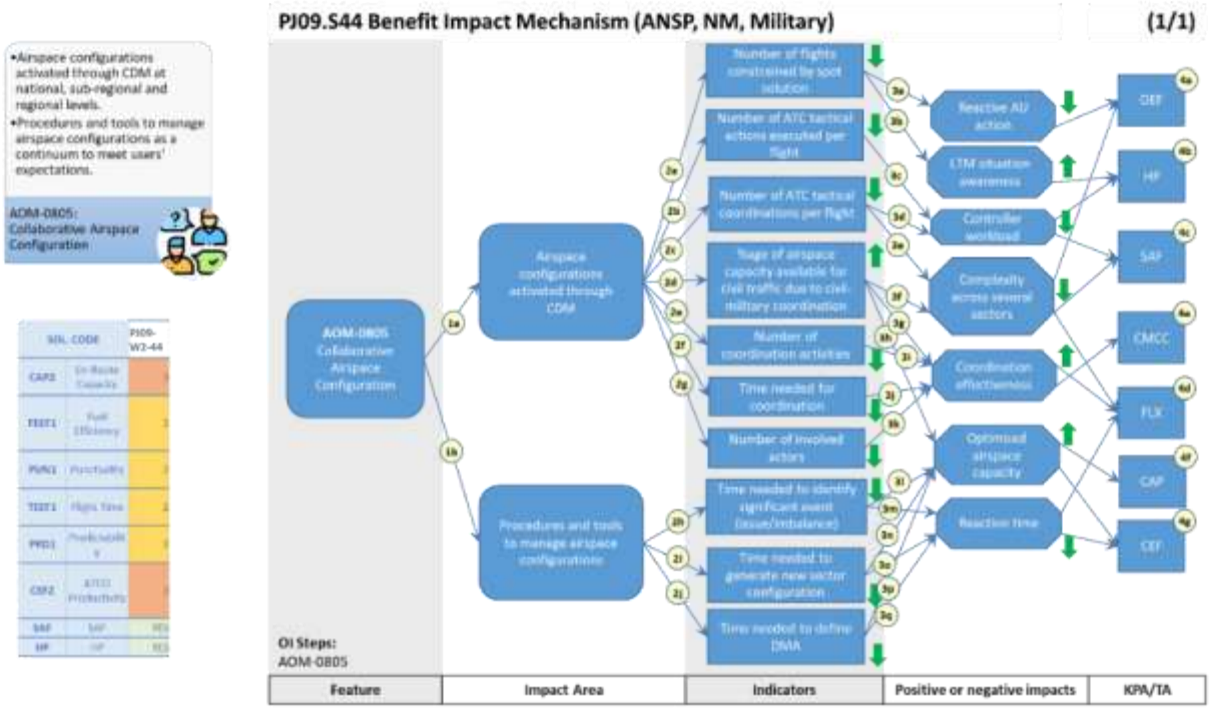

Figure 25. BIM_AOM-0805

Impact Areas

(1a) Airspace configurations activated through CDM: Collaborative Airspace Configuration will result in airspace configurations activated through CDM at national, sub-regional and regional levels.

(1b) Procedures and tools to manage airspace configurations: Collaborative Airspace Configuration will result in procedures and tools to manage airspace configurations as a continuum to meet users' expectations.

Indicators

(2a) Number of flights constrained by spot solution: The CDM will reduce the number of constrained flights by finding a better solution.

(2b) Number of ATC tactical actions executed per flight: Finding a better solution through CDM will reduce the number of ATC tactical actions per flight.

(2c) Number of ATC tactical coordination per flight: Finding a better solution through CDM will reduce the number of ATC tactical coordination.

(2d) percentage of airspace capacity available for civil traffic due to civil-military coordination: Due to an efficient civil-military CDM, a higher percentage of airspace capacity will be available for civil traffic.

(2e) Number of coordination activities: Due to an efficient CDM the number of coordination activities will be reduced.

(2f) Time needed for coordination: Due to an efficient CDM the time taken for coordination will be reduced.

(2g) Number of involved actors: Due to an efficient CDM the number of involved actors will be reduced.

(2h) Time needed to identify significant event (issue/imbalance): Procedures and tools will reduce the time taken to identify imbalances or any other issues.

(2i) Time needed to generate new sector configuration: Tools with automatic algorithms will reduce the time taken to generate new sector configurations.

(2j) Time needed to define DMA: Procedures and supportive tools will reduce the time taken for DMA definition.

Positive or negative impacts

(3a) Reactive AU action: There will be a positive reduction of reactive AU actions due to the decrease in the number of flights constrained by the spot solution.

(3b) LTM situation awareness: Situational awareness will be positively impacted due to a reduction of workload.

(3c) (3d) Controller workload: There will be a positive reduction of the controller workload due to the reduction of tactical actions and coordinations executed per flight.

(3e) (3f) Complexity across several sectors: A reduction of the tactical coordinations per flight and an improvement in the availability of airspace capacity will result in a positive reduction of complexity across several sectors.

(3g) (3i) (3j) (3k) Coordination effectiveness: An efficient CDM process will improve the coordination effectiveness.

(3h) (3l) (3n) (3p) Optimised airspace capacity: There will be a positive increase in the optimised used of airspace capacity due to the inclusion of capacity measures that will result in less parts of the airspace not efficiently used and less trajectory changes.

(3m) (3o) (3q) Reaction time: A decrease in the reaction time will be achieved due to procedures and tools that reduce the time of identification of events, generation of new sector configurations and definition of DMAs.

Key Performance Areas

(4a) Operational Efficiency (OEF): Operational Efficiency KPA will be positively impacted by the reduction of reactive AU actions and complexity across several sectors.

(4b) Human Performance (HP): The reduction of controller workload as well as the increase in LTM situation awareness results in a positive effect in the Human Performance KPA.

(4c) Safety (SAF): The reduction of controller workload and complexity across several sectors will positively impact the Safety KPA.

(4d) Civil-Military Cooperation and Coordination (CMCC): The increase in coordination effectiveness results in an improvement of the Civil-Military Cooperation and Coordination KPA.

(4e) Flexibility (FLX): The reduction of complexity across several sectors and reaction time as well as the increase in coordination effectiveness will have a positive impact in the Flexibility KPA.

(4f) Capacity (CAP): Capacity KPA will be positively affected by the integration of capacity measures due to the optimisation of capacity usage.

(4g) Cost Efficiency (CEF): An optimisation of the capacity usage and the reduction of reaction time will positively impact the Cost Efficiency KPA.

Initial SD&C Unconstrained by Predetermined Boundaries – AOM-0809-A

Description

En-route ATC sectors design principles based on dynamic definition and delineation of volumes of airspace vertically and/or horizontally in addition to traditional ATC sectors that enable more flexible and more dynamic approach for airspace configurations from planning to execution phases, which leads to increasing of the Network capability to continuously adapt to demand pattern changes and traffic flows volatility induced by an extensive implementation of free route operations

Rationale

In continuation of "Modular Sectorisation adapted to traffic Flows" AOM-0802, more flexibility is allowed in defining a larger number of elementary sectors/airspace blocks. Consequently, en-route ATC sectors configurations are aimed to adapt to both fixed and dynamic elements, (i.e. fixed and flexible routing, reserved/restricted airspace (ARES, CBA, CBO, DMA), meeting civil and military preferred trajectories and responding to performance driven strategic objective at all levels.

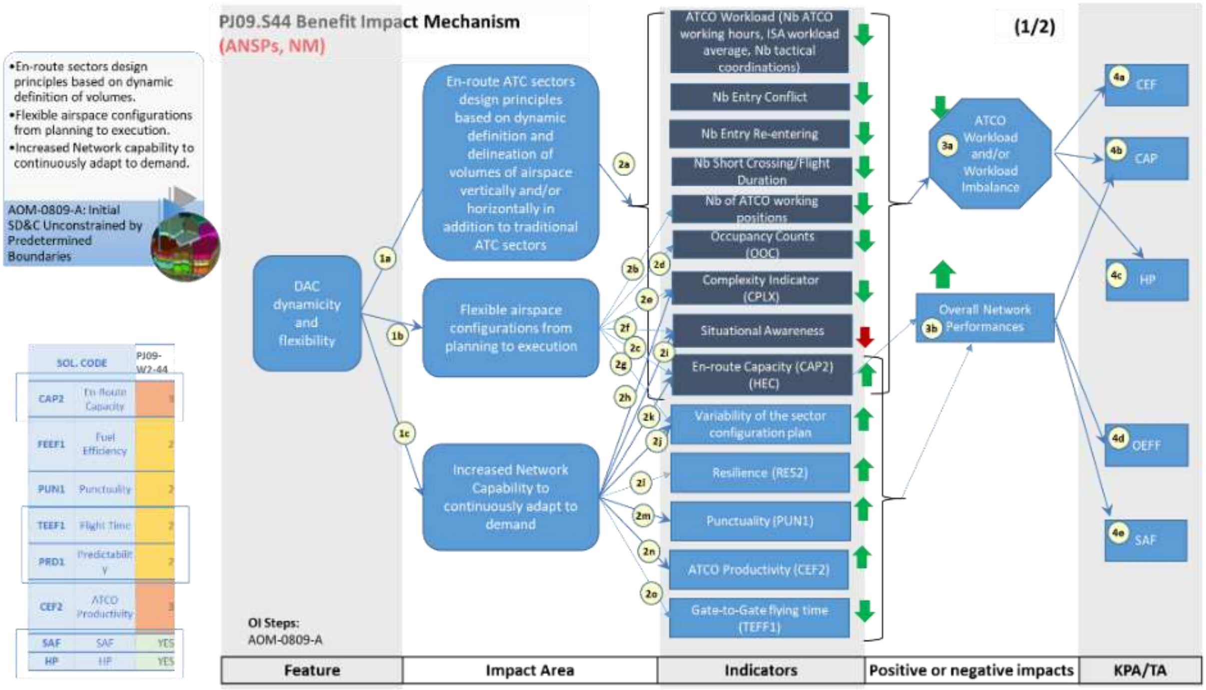

Figure 26. BIM_AOM-0809-A_ ANSP & NM Point of View

Feature

(1) DAC dynamicity and flexibility is the capability to deploy the most optimum solution at all levels (Long, Medium and Short phase) thanks to the possibility to play with different capacity elements and constraints in order to adapt the solution to any changes (e.g. Workload imbalance, predicted demand, weather, unexpected events).

Impact Areas

(1a): An optimised airspace will ensure vertical and horizontal correlation along with alignment of ATC sectors with traffic flows to support adaptable sector configurations.

(1b): Introducing a more flexible and dynamic approach to sector configuration helps to match airspace capacity with traffic demand in order to build optimal configurations from planning to execution.

(1c): Free route operations produces a larger number of trajectory options and traffic flows, and the dynamicity and flexibility of the DAC process will allow increased network capability to optimally adapt to the demand pattern changes. Indicators measured at a local level can be aggregated to the overall network results.

Indicators

(2a)-(2e), (2h): A reduction in certain indicators can signify a reduction of ATCO Workload and/or Workload imbalance and include the following:

- Workload (Nb. of controller hours) (ATCO ISA perceived workload average, Nb. of tactical coordinations),
- Nb. of entry conflicts,
- Nb. of entry, re-entering,
- Nb. Short Crossing/Flight Duration,
- Nb. of ATCO working positions,
- En-route Capacity (CAP2): (Hourly Entry Counts – HEC, Occupancy Counts - OOC),
- Complexity Indicator (CPLX),
- A dynamic delineation of ATC sectors and the flexible airspace configuration to dynamically adapt to traffic demand will positively impact on these indicators.

(2a) (2f) (2i): Situational Awareness: Depending on the traffic situation, ATCO have to build up a mental picture following any sector configuration/DMA change and multiple sectorisation changes and their timing may lead to a decrease in SA.

(2g) (2j): The variability of the sector configuration plan increases the number of available options to adapt to the network demand.

(2K): En-route Capacity (CAP2) will be increased as a consequences do the improved network capability to adapt to demand, thus reducing the need for regulations or unused capacity.

(2l): Resilience (RES2): In case of critical weather events or infrastructure degradation such as technical failures, strikes or accidents, the modularized airspace can be dynamically reconfigured to solve the imbalances (totally or partially) and this ability to re-adapt means a loss of capacity will be avoided.

(2m): Punctuality (PUN1): The optimised sectorisation and dynamic approach means that flights can depart without delay.

(2n): ATCO Productivity (CEF2): The optimised solution reduces workload for each flight which in turn increases the no. of flights to be handled per ATCO hour.

(2o): Gate-to-Gate flying time (TEFF1): A reduction in delay and distance/time flown means less G2G flight time

Positive or negative impacts

(3a) Workload/workload imbalance: The seamless integration of pre-tactical and tactical DAC and the implementation of optimised configurations will have a positive impact on workload.

(3b) Overall network performance: The dynamicity and flexibility of the airspace will have a positive impact on overall network performance.

Key Performance Areas

(4a) Cost Efficiency: Due to smaller granularity of airspace building blocks, it is possible to adjust existing sector configurations without increasing the number of sectors (reducing workload imbalance), thus ATCO numbers, which will allow "not to overreact" to the situation and to manage the demand with minimal operational cost.

(4b) Capacity: The possibility to recombine elementary airspace elements in order to form new sectors and/or configurations to best fit the traffic pattern characteristics (in particular in free route environment) raises the number of flights that an individual controller can handle safely with the same workload.

(4c) Human Performance: A better distribution of ATCO workload among sectors results in a positive impact on HP. Multiple sectorisation changes and timing of sectorisation changes and activation may have a negative impact on situation awareness.

(4d) Operational Efficiency: The optimal solution will have a positive impact on time efficiency and punctuality.

(4e) Safety: Limited impact in safety as ATCOs are trained to multiple sector changes and those changes occur during low workload.

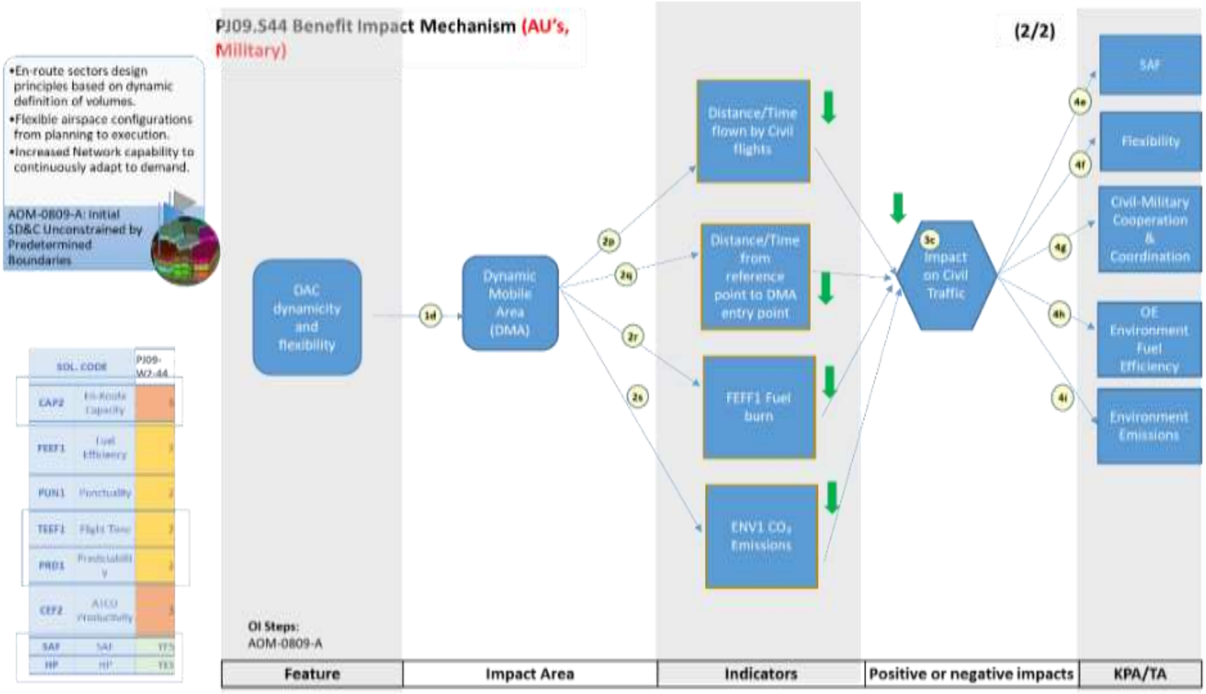

Figure 27. BIM_AOM-0809-A_ AU & Military Point of View

Feature

(1) DAC dynamicity and flexibility is the capability to deploy the most optimum solution at all levels (Long, Medium and Short phase) thanks to the possibility to play with different capacity elements and constraints in order to adapt the solution to any changes (e.g. Workload imbalance, predicted demand, weather, unexpected events).

Impact Areas

(1d): Dynamic Mobile Areas to be integrated in this environment will found more flexibility to satisfy their operational needs thanks to the greater capability of the airspace to be adapted to the flows impacted by the presence of DMAs

Indicators

(2p): Distance/Time flown by civil flights: The flexible location of DMA allows reserved volume of airspace to be moved reducing the number of civil flights circumnavigating the ARES which leads to a reduction of distance/time flown by civil flights. It also accommodates planned and unplanned changes in the air traffic leading to the reduction of which leads to a reduction in the average delay for scheduled civil/military flights with change request and non-scheduled / late flight plan.

(2q): Distance/Time from reference point to DMA entry point: The reduction of the distance flown by military flights, the reduction of average delay and the reduction of the distance/time from reference point to DMA entry point contribute to a global reduction of the impact on civil flight without affecting the mission effectiveness.

(2r): Fuel Burn: Environment: The DMA area can be moved away from the main traffic flows reducing the number of flights that have to circumnavigate the military reserved area with a resulting reduction of the amount of fuel burn per flight.

(2s): Co2 Emissions: See fuel burn

Positive or negative impacts

(3c) Impact on civil traffic: The reduction of the distance flown by civil flight, the reduction of average delay and the reduction of the distance/time from reference point to DMA entry point contribute to a global reduction of the impact on civil flight without affecting the mission effectiveness.

Key Performance Areas

(4e) Safety: There will be no negative impact on safety.

(4f) Flexibility: Due to the DMA flexible geographical location, the military reserved area can be re-collocated (also with short notice) in other places without affecting the mission effectiveness and responding to planned and/or unplanned changes in the traffic.

(4g) Civil-Military Cooperation & Coordination: The DMA geographical location offers more opportunity for military to either satisfy their demand (volume and location) or better accommodate short notice requests. The DMA geographical location can be modified during the negotiation process but the mission effectiveness is preserved (the volume of the Airspace is not modified and the DMA distance from a reference point is within military acceptable limit). In addition, the possibility to place the Military reserved area in different locations results in an increased number of available solutions that can be exploited by the ATM system to solve capacity issues.

(4h) Environment - Fuel Efficiency: the optimum solution minimises the impact on the traffic increasing user preferred paths and consequently the Fuel Efficiency.

(4i) Environment emissions: See fuel efficiency

Dynamic Airspace Management based on Complexity – CM-0102-B

Description

Following CM-0102-A supporting Dynamic Sectorisation for the purpose of workload and complexity optimisation at local level, this improvement relates to the Dynamic of Airspace Configuration in a more global approach through wider areas based on better information sharing. The objective is to manage the airspace as a continuum to meet the users' expectations. It encompasses Airspace organisations based on combinations of airspace volumes, interfaces between En Route and TMA, Free route airspace structures, management of Variable Profile Areas, DMAs and Cross Border Areas in order to enable the User Preferred Routing concept and resolution of complexity and DCB issues. Dynamic configurations shall accommodate En- Route and TMA ATC environments at all complexity levels and support new operating methods.
Where automated system provides support for the assessment and comparison of different configurations, for the decision making process, taking into account different kind of parameters, and

for the monitoring of the implemented solutions, in order to make best use of the available airspace and human resources at any given time

Rationale

Integrating Complexity Assessment and Resolution to the DCB process, automated support optimises airspace configuration based on workload and complexity, avoiding inconsistencies and side effects in the activation of airspace structures.

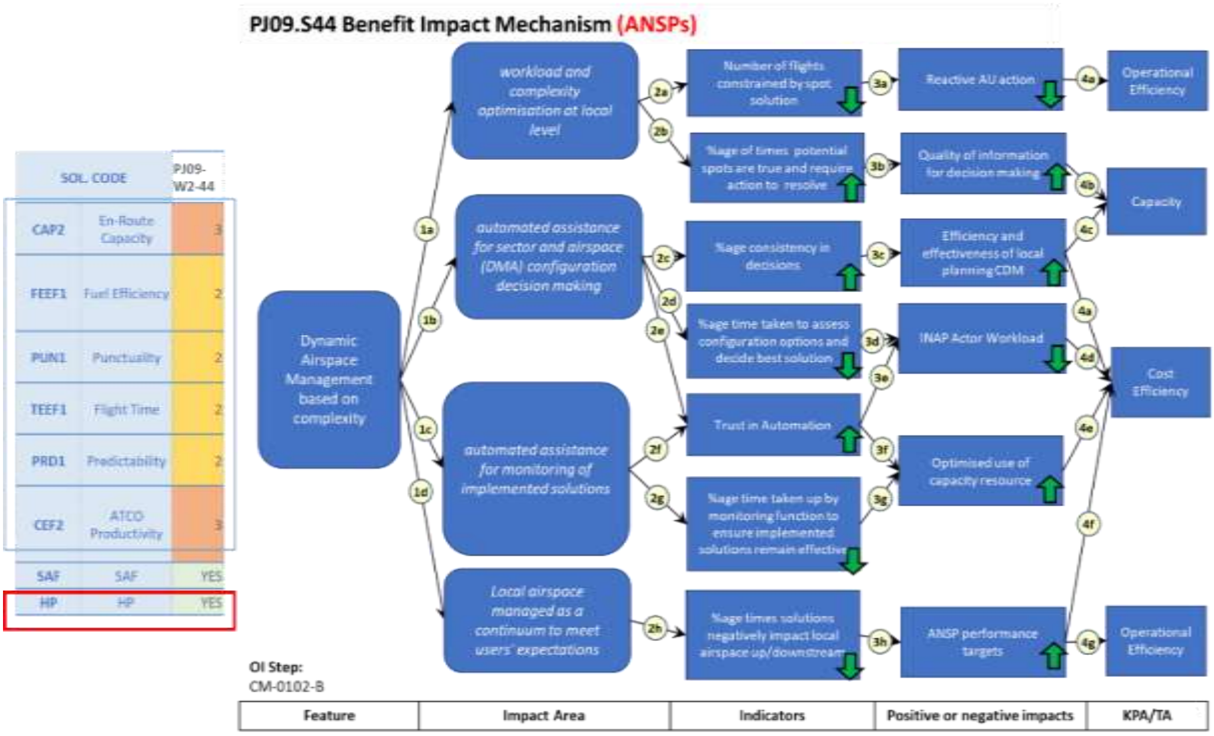

Figure 28. BIM_CM-0102-B

Impact Areas

(1a) Workload and complexity optimisation at local level: Integration of fine-detail variables into an effective workload and complexity calculation results in a capability to better configure sectors and airspace in the INAP timeframe

(1b) Automated assistance for sector and airspace (DMA) configuration decision making: Adoption of automation allows the decision-makers within the INAP timeframe to take into account the increased scope of options available and assess their potential impact

(1c) Automated assistance for monitoring of implemented solutions: Adoption of automation allows the decision-makers within the INAP timeframe to assess the ongoing effectiveness of a measure to ensure it continues to meet the required performance target as the operation moves closer to execution

(1d) Local airspace managed as a continuum to meet users' expectations: The ability to assess the impact of sector and airspace configurations together with DCB measures to resolve individual spots is mirrored by an ability to assess their impact holistically across the ATSU.

Indicators

(2a) Number of flights constrained by spot solution: Use of DAC to address spots together with the ability to target specific flights via STAM to reduce complexity and manage ATCO workload will reduce the reliance on global regulation that will constrain a larger number of flights

(2b) Percentage of time potential spots are true and require action to resolve: DAC Management using complexity as a key KPI will result in a direct correlation to ATCO workload, providing INAP users with an understandable and relatable metric to declare a spot and required action for resolution.

(2c) Percentage consistency in decisions: Automated assistance removes the human from low-level sifting of data, introducing the user to the decision-making process at a higher level. The resultant decision making is more likely to be consistent with less opportunity as the presented data is already sifted for the user to decide the course of action.

(2d) Percentage time taken to assess configuration options and decide best solution: Automation removes the time-consuming effort to initiate data analysis at the lowest level, allowing the user to enter the decision making process at a later stage and utilise their expertise and skill once out of scope of automation

(2e) Trust in Automation: User trust will increase where automaton is able to prove it can consistently highlight complexity and present data for decision making in an unambiguous way

(2f) Trust in Automation: Where the user is content to allow automation to remove the need to continually monitor an implemented action, confident that the automation will alert them where the action is no longer meeting performance requirements

(2g) Percentage time taken up by monitoring function to ensure implemented solutions remain effective: Automation is able to reduce the requirement for the user to continually monitor an implemented solution, thereby freeing them to carry out other tasks and increasing their efficiency

(2h) Percentage times solutions negatively impact local airspace up/downstream: the ability for the local ATSU to integrate solutions into the needs of the whole operation, and not just individual spot resolution, means negative unintended consequences are avoided at this level.

Positive or negative impacts

(3a) Reactive AU action: as a consequence of fewer flights captured in a global regulation and constrained, there will be a reduction in reactive AU response as they seek to find a non-constrained alternative.

(3b) Quality of information for decision making: With a reduction in false spots to distract users, they are able to focus on assessment of true spots, utilising the better data from complexity and workload.

(3c) Efficiency and effectiveness of local planning CDM : Efficiency and effectiveness increases as a consequence of a more stable and evidence-based environment, where user skill and expertise is used at the most effective level, and is largely removed from low-level data sifting.

(3d) INAP actor workload: The workload task across the INAP timeframe is necessarily reduced compared to today as the task is expanded to include greater responsibility for DAC as well as DCB, and in the context of a significantly increased palette of options for consideration.

(3e) INAP actor workload: Automation assistance is a direct contributor to the necessary reduction in INAP actor workload

(3f) Optimised use of capacity resource: Automation and capability to assess complexity and workload sees direct correlation to the efficient and effective use of both airspace and ATCO resource

(3g) Optimised use of capacity resource: Workload involved after application of a spot resolution measure can more demanding in a developing traffic scenario, so early indication via automated assistance that the solution is no longer viable results is more seamless and less reactive revision to the resource plan

(3h) ANSP performance targets: Such targets are traditionally based on attributable delay within the local AoR, and a holistic approach to both individual and multiple spot resolution is able to deliver an overall solution capable of meeting both ANSP targets and performance targets of other stakeholders

Key Performance Areas

(4a) Operational efficiency and specifically, Network predictability: The potential for 'snowballing' of DCB measures, where AUs response to an initial DCB measure is met with additional constraints – and further refiling…. Is reduced, delivering a more stable demand picture for management.

(4b) Capacity: Capacity at local level is increased as a consequence of good decision-making using direct relevant data in a format users can readily translate to the tactical operation. This reduces the need for large capacity buffers to account for unknowns.

(4c) Capacity: Capacity is increased at local level through a better planning environment that is able to retain flexibility, but also remove the need for over-resourcing to mitigate late and unexpected and poorly planned action.

(4d) Cost Efficiency: As ATCO expertise is key to the INAP process, the involvement and increased use of effective automated assistance delivers a greater ATCO productivity from these actors.

(4e) & (4F) Cost Efficiency: ATCOs are an expensive and key capacity resource, so an improved capability that reduces the need for an ANSP to over-resource to take into account potential unknowns results in the ATCO resource being utilised more efficiently.

(4g) Operational efficiency in terms of Punctuality: Where ANSPs are better able to manage their capacity resource at both spot resolution level and cross-ATSU simultaneously, the targeted solutions to manage flights via DAC or STAM delay rather than global regulation results in AU punctuality increasing as fewer CTOTs are applied at point of departure.

Automatic Support for Traffic Complexity Assessment – CM-0103-B

Description

Automated tools adapted to trajectory based operations (planning and execution): including user preferred trajectory and 4D data, continuously monitor and evaluate traffic workload and complexity in defined airspace volumes according to predefined parameters. These tools will provide accurate and timely prediction on upcoming congestions and appropriate input to tools handling hotspots/ complexity resolution.

Rationale

The objective is to design advanced tools for both Network Management function (planning and execution phases) and extended ATC planning to monitor and assess ATC workload/complexity and to provide input to complexity resolution tools. ATC Workload/complexity assessment : Analysing aircraft trajectories using SBT/RBT and other demand information, added with the use of validated complexity metrics, allows prediction of complexity coupled with demand to evaluate predicted ATC workload. In medium to short term planning phase, DCB (through CDM) operates with look ahead times in which information on traffic and airspace organisation might be still at the level of intentions. Because of this uncertainty, complexity and workload assessment may need to be evaluated in a different way than in short term to execution phase, where it can be done with more accurate data. ATC Workload/complexity resolution: The workload/complexity assessment is used by resolution tools in order to support them in finding solutions to hotspots/complex situation at different level of accuracy of the prediction data.

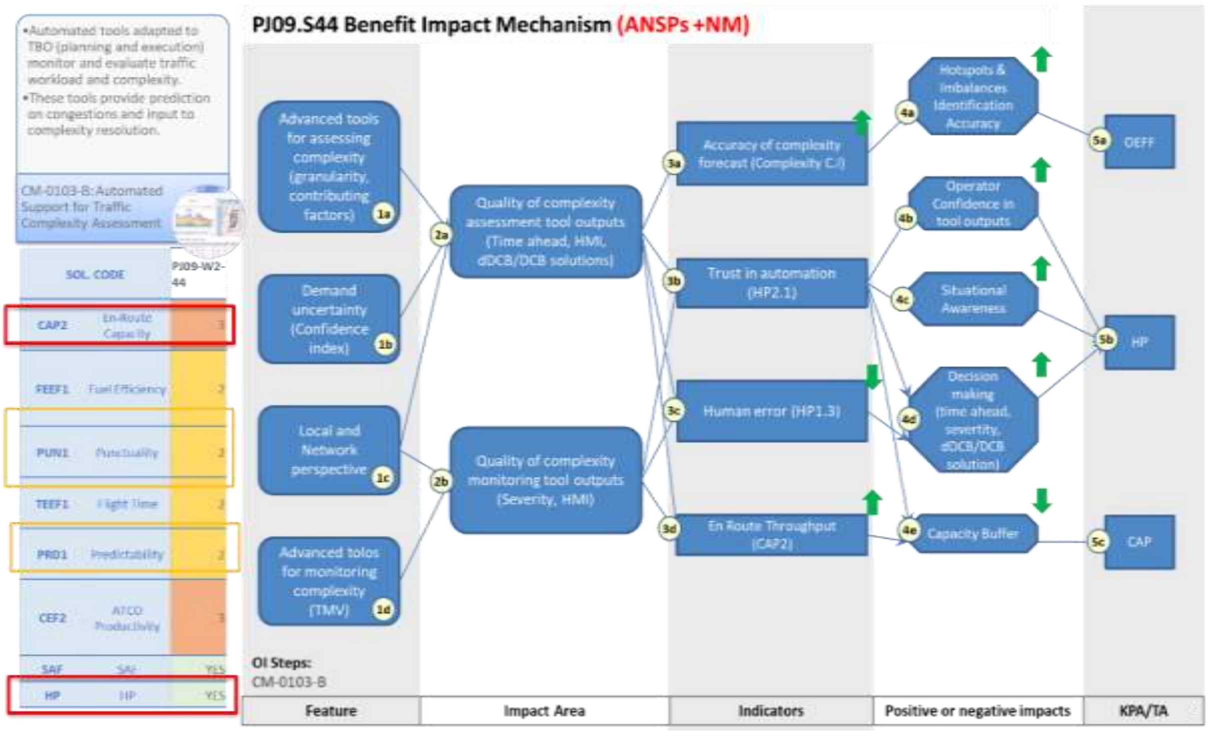

Figure 29. BIM_CM-0103-B

Features

(1a) Advanced tools for assessing complexity (granularity, contributing factors): The design of advanced tools for assessing complexity will provide automated support for both NM and ANSPs to assess traffic complexity within a defined airspace volume, and to provide inputs to complexity resolution tools in finding solutions to hotspots/complex situations.

These advanced tools will be influenced by:

- The granularity in which complexity is assessed, related to the number of factors or elements that the user/system takes into account when determining complexity, considering both airspace and time horizon. Depending on the timeframe and related uncertainties, different DCB filters and methodologies will be applied to manage different granularity of issues,
- Different contributing factors, such as the characteristics of the flights contributing to the imbalance (number of interactions, ascending/descending flights…).

(1b) Demand uncertainty (Confidence index): Demand uncertainty (Confidence Index) means that the way in which ATC complexity is evaluated may change depending on the traffic demand information accuracy (e.g. in medium to short term planning phase, traffic and airspace organisation information might be still at level of intentions; whereas in short term to execution phase the information should be more accurate). This feature will take as an input the OI DCB-0211 Traffic and Demand Forecast in 4D Trajectory Management Context.

(1c) Advanced tools for monitoring complexity (TMV): The design of advanced tools for monitoring complexity will provide automated support for both NM and ANSPs to monitor traffic complexity within a defined airspace volume, and to provide inputs to complexity resolution tools in finding solutions to hotspots/complex situations.

Based on a set of Traffic Monitoring Values (TMV), these tools will allow the identification of nominal, critical and crisis situations, as well as hotspots and optispots.

(1d) Local & Network perspective: This feature means that both local and network actors will have an accurate vision of hotspots and imbalances at local and regional levels

Impact Areas

(2a) Quality of complexity assessment tool outputs (Time ahead, HMI, DCB/DCB solutions):

- The design, refinement and optimisation of advanced and automated tools for assessing traffic complexity will increase the quality of the complexity assessment outputs for the different imbalances and hotspots granularity selected. This granularity, which varies in terms of time horizon and airspace volume will be selected accordingly, based on the time the information is received,

- The tool also provides a level of detail that allows the involved actors to see the characteristics of an airspace volume and specific flights, to help him making a decision (DAC and DCB solutions),

- Furthermore, the HMI will also have influence on the quality of assessment. The display of information is essential for all the presented features in order for the actors involved to be well informed of the situation, and to act accordingly,

- The demand uncertainty (confidence index) will impact on the quality of the complexity assessment outputs, since the use of more accurate traffic demand information will improve the representativeness of the complexity metric/indicator values. This will also determine the way in which complexity should be assessed (metric/indicator to be used),

- Depending on the vision of how complexity is calculated (local or network level) the quality of complexity assessment tool outputs will be impacted. Moreover, the involved actors are aware of the effect of their actions both at local and regional levels.

(2b) Quality of complexity monitoring tool outputs (Severity, HMI):

- The design, refinement and optimisation of advanced and automated tools for monitoring traffic complexity will increase the quality of the complexity monitoring tool outputs,
- In particular, the tool will impact on the quality of complexity monitoring related to the severity of the situation, which is determined by the Traffic Monitoring Values,
- The HMI will also have influence on the quality of complexity monitoring. The display of information is essential for all the presented features in order for the actors involved to be well informed of the situation and to act accordingly,
- Depending on the vision of how complexity is calculated (local or network level), the quality of complexity monitoring tool outputs will be impacted. Moreover, the involved actors are aware of the effect of their actions both at local and regional levels.

Indicators

(3a) Accuracy of complexity forecast (Complexity C.I): The improvement of the quality complexity assessment tool outputs, by reducing the uncertainty of the assessment, will increase the accuracy of complexity forecast (Complexity Confidence Index)

(3b) Trust in automation (HP 2.1): The improvement of the quality complexity assessment/monitoring tool outputs, by reducing the uncertainty of the assessment/monitoring, will increase the involved actors’ trust in automation.

(3c) Human error (HP 1.3): The improvement of the quality complexity assessment/monitoring tool outputs, by reducing the uncertainty of the assessment/monitoring, will lead to a reduction in the human errors committed by the operators involved in terms of decision making processes, as the complexity information available will be more accurate.

(3d) En-Route Throughput (CAP2): The improvement of the quality complexity assessment/monitoring tool outputs will increase the airspace capacity, since it will allow the reduction of the capacity buffer declared.

Positive or negative impacts

(4a) Hotspots & Imbalances identification accuracy: The increase of the complexity forecast accuracy will lead to an increase of the hotspots and imbalances identification accuracy.

(4b) Operator confidence in tool outputs: The increase of the operators’ confidence in automation will increase the operators’ confidence in the tool outputs, that is, the traffic complexity values predicted.

(4c) Situational awareness: The increase of the operators’ confidence in automation due to the improvement on the quality of complexity tool outputs will increase the situational awareness of the actors involved, since they will have more support in their tasks as well as a better understanding of the traffic complexity within a defined airspace volume.

(4d) Decision making (time ahead, severity, DCB/DCB solution): The increase of the operators' trust in automation and the reduction in the number of human errors committed will lead to a more efficient and accurate decision making process, improving the quality and effectiveness of the DCB/DCB solutions proposed. In particular, the decision making process will be improved regarding:

- Selection of solution – Time ahead: The determination of the granularity via the time and methodology to use will help the actors involved in making a decision,
- Selection of solution – Severity: The determination of the severity of the situation via the thresholds (critical, crisis, hotspot, optispot) will help the actors involved in making a decision,
- Selection of solution – DCB/DAC solution: The increase of trust in automation will improve the selection of the appropriate DCB/DAC solution by improving decision making processes. Moreover, it will minimise the impacted flights: the determination of the individual flights that have an impact on complexity will help the actors involved to limit his actions on a limited number of flights rather than on a large number of flights.

(4e) Capacity buffer: The increase of operators' trust in automation will allow a reduction of the capacity buffer declared and used to protect air traffic controllers, since the traffic complexity information will be more accurate.

Key Performance Areas

(5a) Punctuality & Predictability: Predictability, not as defined in SESAR but as the consequence of a better detection of hotspots, allows the actors involved to act in advance.

(5b) Human Performance: The increase of operator confidence in complexity tool outputs, situational awareness and decision making, will have a positive impact on Human Performance KPA.

(5c) Capacity**:** The reduction of the capacity buffer declared will have a positive impact on Capacity KPA, by increasing the nominal declared capacity.

Automatic Support to INAP function – CM-0104-C

Description

INAP (Integrated Network Management and Extended ATC Planning) roles, namely LTM and EAP, are supported by an automated system enabling the detection, management and monitoring of local complex situations. The system will provide assessment of evolving traffic situation and will support INAP actors in the evaluation of opportunities for smoothing flows and de-conflicting flights across INAP AoR, in order to identify and manage the best performing option between Dynamic Airspace Configuration measures and STAM measures (flow management and trajectory measures) to solve the identified hotspots.

This OI includes the set-up of an automated interface and related procedures between INAP function and NM function, to optimize the ATM resources management and improve the effectiveness of complexity resolution measures through a collaborative decision-making process that involves all the relevant actors.

In addition, in the timeframe close to the time of occurrence of the hotspot situations, the INAP function is assisted in alleviating traffic complexity thanks to:

- finer ATFCM measures which allows for more reliable and efficient analysis and better focused measures, which are more likely to have the desired impact without unwanted side effect,
- support to ATCos on CWPs to facilitate decision making process and implementation of the ATFCM measures (on the basis of Best Effort principle).

Rationale

Support for INAP stretches from around 6 hours to 15 minutes before entry in the sector.

The major objective of INAP function is to optimize ATC team's workload and solve complexity situations (e.g. hotspots). By providing automated support, the situational awareness of INAP actors will be improved when selecting the most appropriate DCB solution with best performance effects in terms of service and use of resources, considering that INAP function will operate within a dynamic airspace management environment.

The automated support will help the Extended ATC Planner on assessing the need for revision of individual trajectories along the (collaboratively) prepared and coordinated DCB plan using advanced planning tools and consequently reducing complexity in his extended planning horizon (across several units), around 45 to 15 min before sector entry.

In addition, ATCos on CWPs will benefit from a shared ATFCM situational awareness (awareness of hotspots in their Area of Interest for ATFCM, but also the planned resolution strategy, and their potential role to contribute to its implementation/ update), as well as support for implementation of the ATFCM measures for flights already airborne.

The tools that assist INAP actors in resolving complexity issues should include a “What-If” capabilities, where resolution strategies can be assessed before implementation, and may provide assistance in identifying the trajectory or trajectories that are causing complexity peaks.

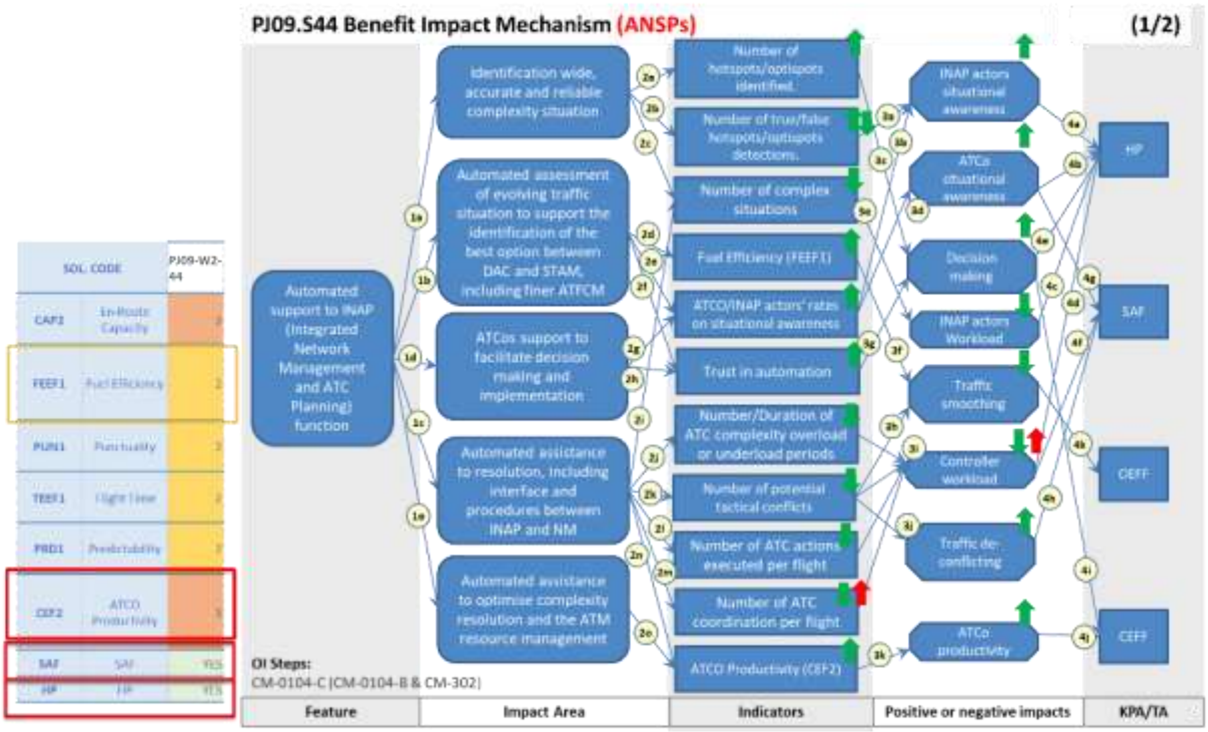

Figure 30. BIM_CM-0104-C – ANSP point of view

Feature

There is a single feature for the stakeholder (ANSPs) affected by the aim of this OI step.

- Automated support to INAP (Integrated Network Management and ATC Planning): The use of automated tools and procedures between Local NM function and ATC Planning in order to optimize the ATM resource management and improve the effectiveness of complexity resolutions.

Impact Areas

Regarding this OI, four impact areas have been identified.

(1a) Identification of a wider, more accurate and reliable scope of local complex situations: hotspots (occupancy, complexity) & optispots: The INAP provides tools and accurate data to identify a wider scope of situations, based not only on occupancy peaks but also on complexity criteria. An adequate granularity of the information provided as well as the greater reliability of the complexity methods and tools will allow a better traffic complexity management process. These tools will assist and help the INAP actors in understanding the root cause of a given local complex situation.

(1b) Automated assessment of evolving traffic situation to support the identification of the best option between DAC and STAM, including finer ATFCM: The INAP provides a large set of automated tools to assist INAP actors in their decision to solve a given situation with DCB measures thanks to accurate indicators and shared information with all stakeholders. Automated support will allow the assessment of complexity situations taking into account what-if complexity assessment of the solutions

(1c) Automated assistance to resolution, including interface and procedures between INAP and NM : The INAP provides assessment tool to be used at LTM timeframe to assist him/her in the resolution, which helps to choose the most suitable solution between measures, this support includes facilitation of the procedures to coordinate with NM.

(1d) ATCos support to facilitate decision making and implementation: The INAP actors' terminal provides automated tools to share information towards ATCo regarding the measures that need to be applied. This will make more efficient and smooth the processes of measures acceptance/refusal/analysis between INAP actors and ATCos. In order to assure situational awareness and the safe implementation of the DAC capacity measures implementation (sector configuration changes), proper support is incorporated in the ATCo position.

(1e) Automated assistance to optimize complexity resolution and the ATM resource management: INAP is integrated with the resource management process in order to support DCB decision making with the due information to optimize resource management as well as account for resource management constraints and rules.

Indicators

(2a) Number of hotspots/optispots identified: As the identification covers a wider scope of local complex situations, the number of identified hotspots and optispots will increase.

(2b) Number of true/false hotspots/optispots detections: there will be not only an improvement in hotspots/optispots identification, but also a decrease in the number of false detections.

(2c) Number of complex situations: Thanks to a better identification of the local complex situations, and the application of resolution strategies in a prior timeframe, the number of complex situations will be reduced.

(2d) Fuel Efficiency: the automated support for the assessment of demand and capacity measures will allow the selection of the measures with fewer impact on flight trajectories, facilitating the selection of capacity measures when possible. It will improve fuel efficiency.

(2e) (2g) ATCO/INAP actors' rates on situational awareness: The improvement of the traffic complexity management process due to the use of automated tools will increase the INAP actors' rates on situational awareness because of earlier, finer and more reliable identification of the root cause of a local complex situation. ATCo support to coordinate and implement the measures will improve their situational awareness.

(2f) (2h) Trust in Automation: The automated assistance to flow analysis, to resolution, and the sharing of local ATFCM information between actors, will allow improving the quality of the complexity assessment and resolution, and it will increase the involved actors' trust in automation.

(2i) Number/Duration of ATC complexity overload or underload periods: The use of automated assistance to solve complexity situations will allow to reduce the number and duration of ATC complexity overload or underload periods because of the better understanding and managing of these complex situations.

(2j) Number of potential tactical conflicts: The use of automated assistance to solve complexity will contribute to the de-confliction of traffic and the reduction of conflicts in the tactical phase.

(2k) Number of ATC actions executed per flight: The use of automated assistance to solve complexity situations will allow reducing the number of ATC actions executed per flight.

(2l) Number of ATC coordinations per flight: The implementation of the complexity resolution measures might increase the need for ATC coordinations, which is expected to be mitigated by aumation. The use of automated assistance to solve complexity situations will allow reducing the number of ATC coordinations per flight.

(2n)(2o) ATCO Productivity: The assistance in the complexity resolution as well as its integration with resource management will result in the implementation of more cost-efficient solutions, which will improve ATCO productivity.

Positive or negative impacts

(3a) (3b) INAP actors' situational awareness: The reduction of the number of complex situations due to the improvement on the identification (2a) and the resolution of complex situations supported by automation (2e) will increase the situational awareness of the actors involved, since they will have more support in their tasks as well as a better understanding of the complex situations, which will reflect in a better INAP actors' rate on situational awareness.

(3d) ATCo's situational awareness: According to the ATCo's perception, the ATCo's situational awareness will be improved due to the improved automation support.

(3g)(3c) Decision making: The increase of the actor' trust in automation and the availability of a more reliable hotspot/optispot identification will lead to a more efficient and accurate decision making process.

(3e) INAP actors' workload: The INAP actors' workload will be smoothed and reduced because of a decrease of the number of complex situations.

(3i) Controller Workload: The ATCo workload will decrease because of the reduction of the number of ATC actions per flight. The decrease in the number/duration of the ATC complexity overload and underload periods will contribute to maintaining controllers' workload within the optimal levels (not too overloaded, nor underloaded). The workload implied by the implementation of the complexity resolution measures due to the extra need for coordination will need to be evaluated (see 2l).

(3k) ATCo's productivity: The productivity of the air traffic controllers will be increased because of the better distribution of complexity amongst controllers.

(3h)(3f) Traffic smoothing: A reduction in the number of potential tactical conflicts and the increase of fuel efficiency will lead to smoother traffic flows

(3j) Traffic de-conflicting: A reduction in the number of potential tactical conflicts will lead to a more efficient traffic de-conflicting process.

Key Performance Areas

Human Performance (HP): Human Performance will be impacted by the increase of the actors' situational awareness **(4a)(4b),** the reduction their workload **(4c)(4d),** the improvement in the decision making **(4e)** process.

Safety (SAF): Safety will be impacted by ensuring an adequate level of ATCO workload which avoids underload and overload **(4f)** and the improvement of the controller situational awareness **(4g).** Safety will be impacted by a positive impact on traffic de-conflicting **(4h).**

Cost Efficiency (CEFF): Cost Efficiency will be impacted because of an increase of the air traffic controller productivity **(4i)** by reducing the unforeseen ATCo underload periods and a better decision making **(4j).**

Operational Efficiency (OEFF) will be impacted as a consequence of the smoother traffic flows **(4k)**.

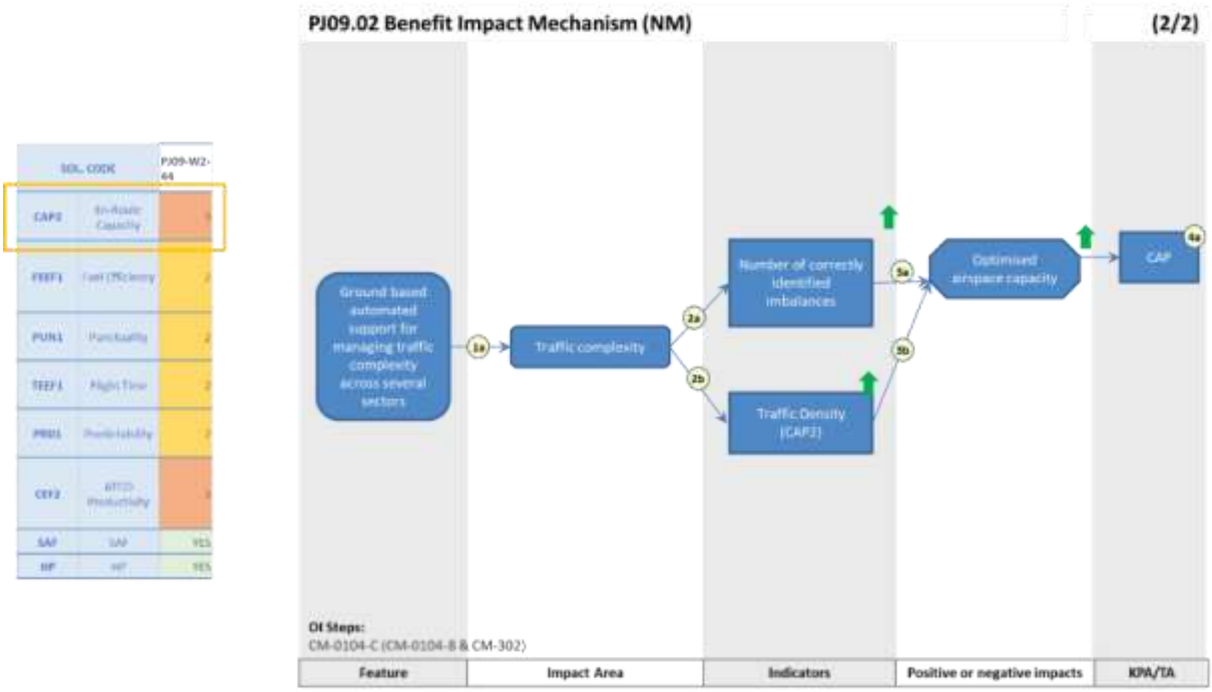

Figure 31. BIM_CM-0104-C – NM point of view

Impact Areas

From this network perspective, the BIM is focused on the air traffic system capacity.

(1a) Traffic complexity: The use of automated ground based tools by the NM actor will allow a better traffic complexity management process. These tools will assist and help the NM actor in understanding the root cause of a given network complex situation by providing them with earlier, finer, and more reliable information.

Indicators

(2a) Number of correctly identified imbalances: The use of automated tools for traffic complexity management will lead to a better identification of the root cause of a network complex situation and, consequently, this will increase the accuracy of the imbalances identification process by the NM actor (earlier, finer and more reliable complexity information).

(2b) Traffic Density (En-Route Throughput): The use of automated tools for traffic complexity management will allow an increase of the traffic density at network level because of the better complexity alleviating process that can be performed at local level.

Positive or negative impacts

(3a) (3b) Optimised airspace capacity: The airspace capacity use will be optimised because of an increase of the number of correctly identified imbalances and an increase of the traffic density.

Key Performance Areas

(4a) Capacity (CAP): The optimisation of the airspace capacity will positively impact on airspace capacity.

Full integration of Dynamic Airspace Configurations into DCB – DCB-0210

Description

The aim of this OIs is to elaborate the complete DCB solution that includes Dynamic Airspace Configurations combined with 4D constraints to optimally adapt the capacity to the demand and minimise demand adjustments.
Integrated Airspace/4D constraints solutions are obtained through an iterative optimisation and CDM processes involving local, sub-regional and regional levels.
ATM resource (including airspace and ground resources) management efficiency will be improved through a seamless integration of Airspace Management functions and Dynamic Airspace Configurations (DAC) into the advanced DCB and ATC planning processes.

Rationale

The definition of full integrated airspace/4D constraints solution will enable a seamless and coordinated approach from planning to execution phases.
It requires the development of a new timeline (strategic, pre-tactical, tactical) to adjust the capacity with a better anticipation based on new operating method, role and responsibility.
Integrated workflow and new tools will be designed for the iNWP (Integrated Network Working Position): airspace configuration optimizer, what-if, messaging, to support CDM processes, as well as local actors, AUs and NM activities.

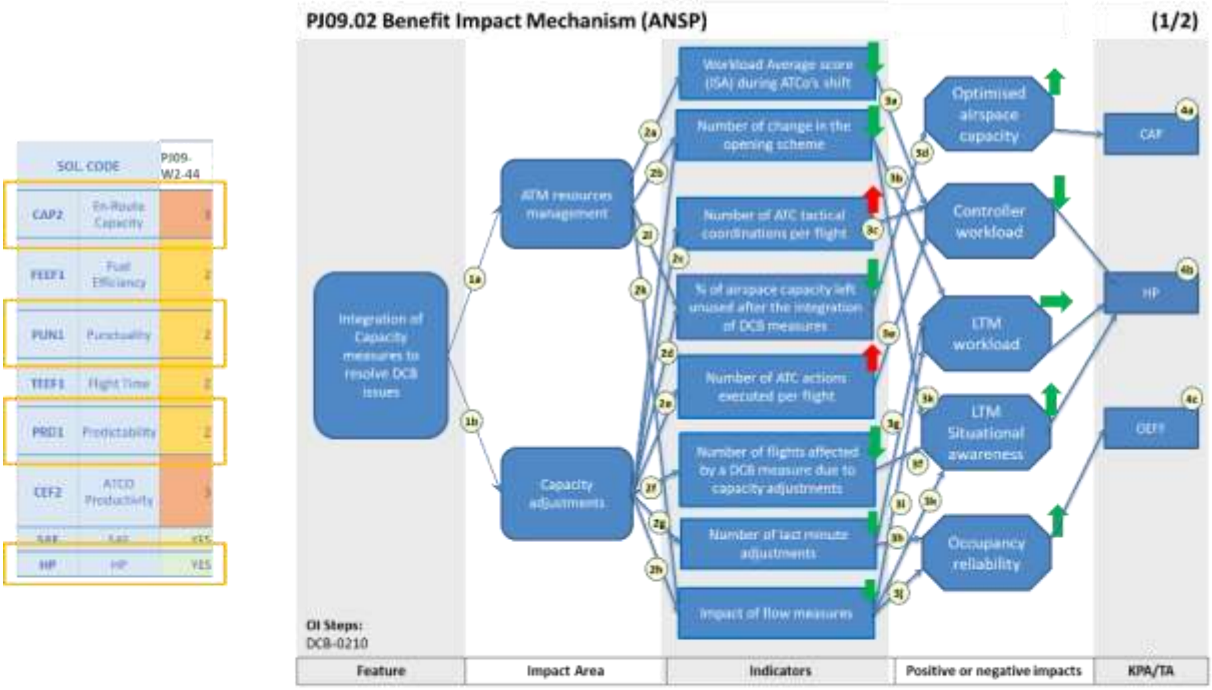

Figure 32. BIM_DCB-0210 – ANSP point of view

Impact Areas

(1a) ATM resource management: Integration of capacity measures into DCB process will result in a smoother ATM resource management, understanding ATM resources as airspace capacity and controllers workforce.

(1b) Capacity adjustments: The integration of capacity measures into DCB will result in a better balance between capacity and demand adjustments and therefore the number of aircraft affected by trajectory changes will decrease.

Indicators

(2a) Workload Average score (ISA) during ATCo's shift: A smoother resource management will allow a better distribution of traffic overtime and between positions leading thus to less peaks and underloads for ATCOs.

(2b) Number of change in the opening scheme: A higher level of automatisation in configuration management will optimize opening scheme and reduce the number of changes.

(2c) Number of ATC tactical coordinations per flight: Controllers will perform more tactical coordinations per flight due to the increase in capacity adjustments in order to ensure the transference of flights between sectors.

(2d) (2i) Percentage of airspace capacity left unused after the integration of capacity measures: The improvements in the management of airspace capacity due to the integration of capacity measures and resource management into DCB will result in reducing the percentage of airspace left unused.

(2e) Number of ATC actions executed per flight: with the integration of capacity measures, controllers will execute a higher number of actions per flight in order to assure a correct transference of flights.

(2f) Number of flights affected by an DCB measure due to capacity adjustments: The integration of capacity measures into DCB will result in a better balance between capacity and demand adjustments and therefore the number of aircraft affected by trajectory changes will decrease.

(2g) Number of last minute adjustments: A better automatisation will allow for a better forecast of the situation, thus less last minute changes.

(2h) Number of flow measures: Due to capacity measures integration into DCB, flow measures will be less needed and will be replaced by specific measures on targeted flights.

(2k) Impact of flow measures: thanks to optimized resource management throughout the day, impact of flow measures will be reduced (optimized configurations so that optimum number of ATCOs are present when peaks are predicted). Impact refers here to both measurements number of flow measures and amount of ATFCM delay.

Positive or negative impacts

(3d) Optimised airspace capacity: There will be a positive increase in the optimised used of airspace capacity due to the inclusion of capacity measures that will result in less parts of the airspace not efficiently used and less trajectory changes.

(3a)(3c)(3e) Controller workload: The inclusion of capacity measures will increase the controller workload (actions per flight and number of coordinations) but at the same time reduce the overall workload on the sector. Hence, it will have a positive impact.

(3b)(3g)(3i) LTM workload: The use of specific measures on targeted flights will be time consuming but the better optimisation in sector configuration will compensate this workload.

(3f)(3k) LTM situation awareness: Situational awareness will be positively impacted due to a better forecast of the situation.

(3h)(3j) Occupancy reliability: Due to less generated delay on flows, the network stability will be improved and the occupancy curves will be less volatile.

Key Performance Areas

(4a) Capacity (CAP2): Capacity KPA will be positively affected by the integration of capacity measures due to the optimisation of capacity usage.

(4b) Human Performance (HP): The impact on controller and LTM workload and situation awareness results in a positive effect in the Human Performance KPA.

(4c) Operational efficiency:

- Predictability (PRD1): The integration of capacity measures into DCB will influence positively predictability,
- Punctuality (PUN1): The integration of capacity measures into DCB process will influence positively punctuality.

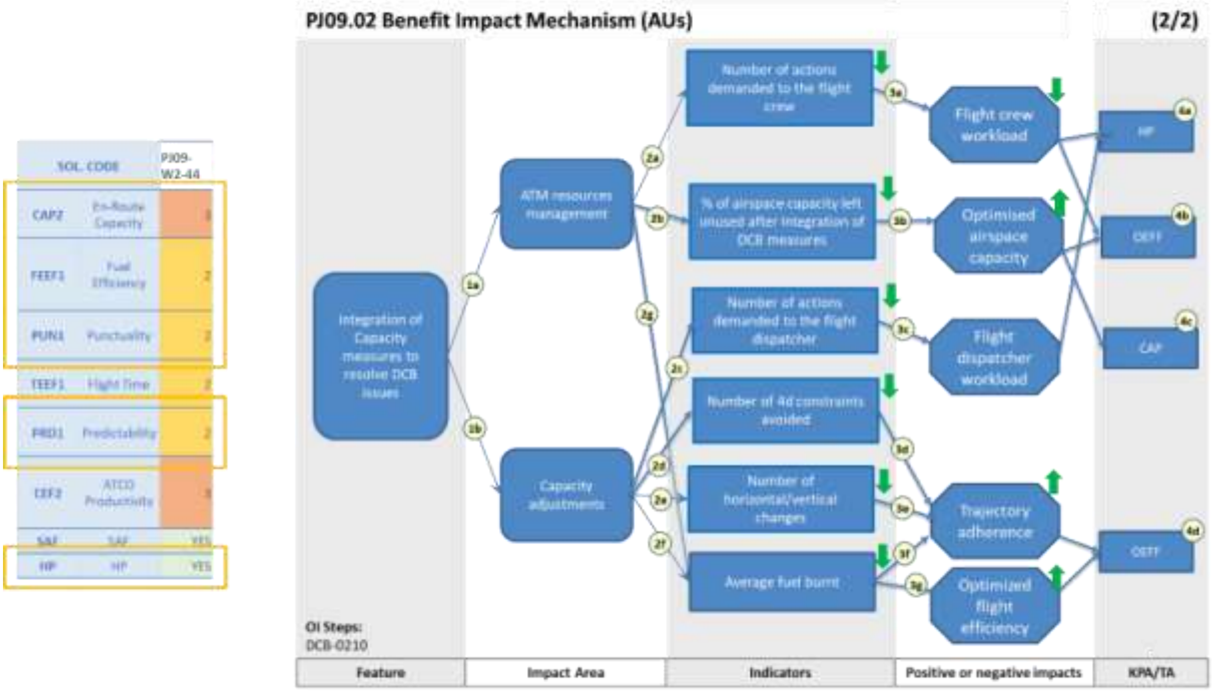

Figure 33. BIM_DCB-0210 – AU point of view

Impact Areas

(1a) ATM resource management: The integration of capacity measures into DCB will result in an improved ATM resource management, understanding ATM resources as airspace capacity and controllers workforce as well as flight crew and flight dispatcher workload.

(1b) Demand adjustments: The integration of capacity measures into DCB will result in capacity adjustments rather than demand adjustments and therefore the number of aircraft affected by trajectory changes will decrease.

Indicators

(2a) Number of actions demanded to the flight crew: The integration of capacity measures will reduce the number of actions demanded to the crew since more adjustments will be performed in the capacity rather than in the demand.

(2b) Percentage of airspace capacity left unused after the integration of capacity measures: The improvements in the management of airspace capacity due to the integration of capacity measures into DCB will result in reducing the percentage of airspace left unused.

(2c) Number of actions demanded to the flight dispatcher: The integration of capacity measures will reduce the number of actions demanded to the flight dispatcher since more adjustments will be performed in the capacity rather than in the demand.

(2d) Number of 4D constraints avoided: Flights will be affected by less 4D constraints due to the capacity adjustments.

(2e) Number of horizontal/vertical changes: Flights will be affected by less horizontal and/or vertical changes due to the capacity adjustments.

(2f) (2g) Average fuel burnt: The impact of capacity adjustments and ATM resource management measures will lead to increased capacity, and therefore better flight efficiency (less fuel, less emissions, less costs for AUs)

Positive or negative impacts

(3a) Flight crew workload: Fewer actions will be demanded to the flight crew due to the reduction in the number of trajectory changes.

(3b) Optimised airspace capacity: The integration of capacity measures will make possible the increase in the number of aircraft flying through the sky, due to an optimisation of airspace capacity.

(3c) Flight dispatcher workload: Fewer actions will be demanded to the flight dispatcher due to the reduction in the number of flow measures.

(3d)(3e)(3f) Trajectory changes: Aircraft will suffer less trajectory changes due to the capacity adjustments.

(3g) Optimised flight efficiency: Aircraft will suffer less trajectory changes due to the capacity adjustments.

Key Performance Areas

(4a) Human Performance (HP): The impact on crew workload results in an impact in the Human Performance KPA.

(4b) Operational Efficiency: Punctuality (PUN1), The impact on crew workload will affect punctuality KPA, increasing the adherence to the expected arrival and departure times.

(4c) Capacity (CAP): capacity measures integration allows more aircraft to fly through the sky thanks to the optimised use of airspace capacity, affecting Capacity KPA.

(4d) Operational efficiency (OEFF):

- Predictability (PRD): Predictability will be impacted as a consequence of the reduction in trajectory changes,
- Fuel Efficiency (FEFF1): Given the reduction of trajectory changes there will be a non-defined impact in the average fuel burnt, which can be either positive or negative.

Appendix B Storyboard

Authors suggest to zoom up to 190% to properly read this diagram on computer.

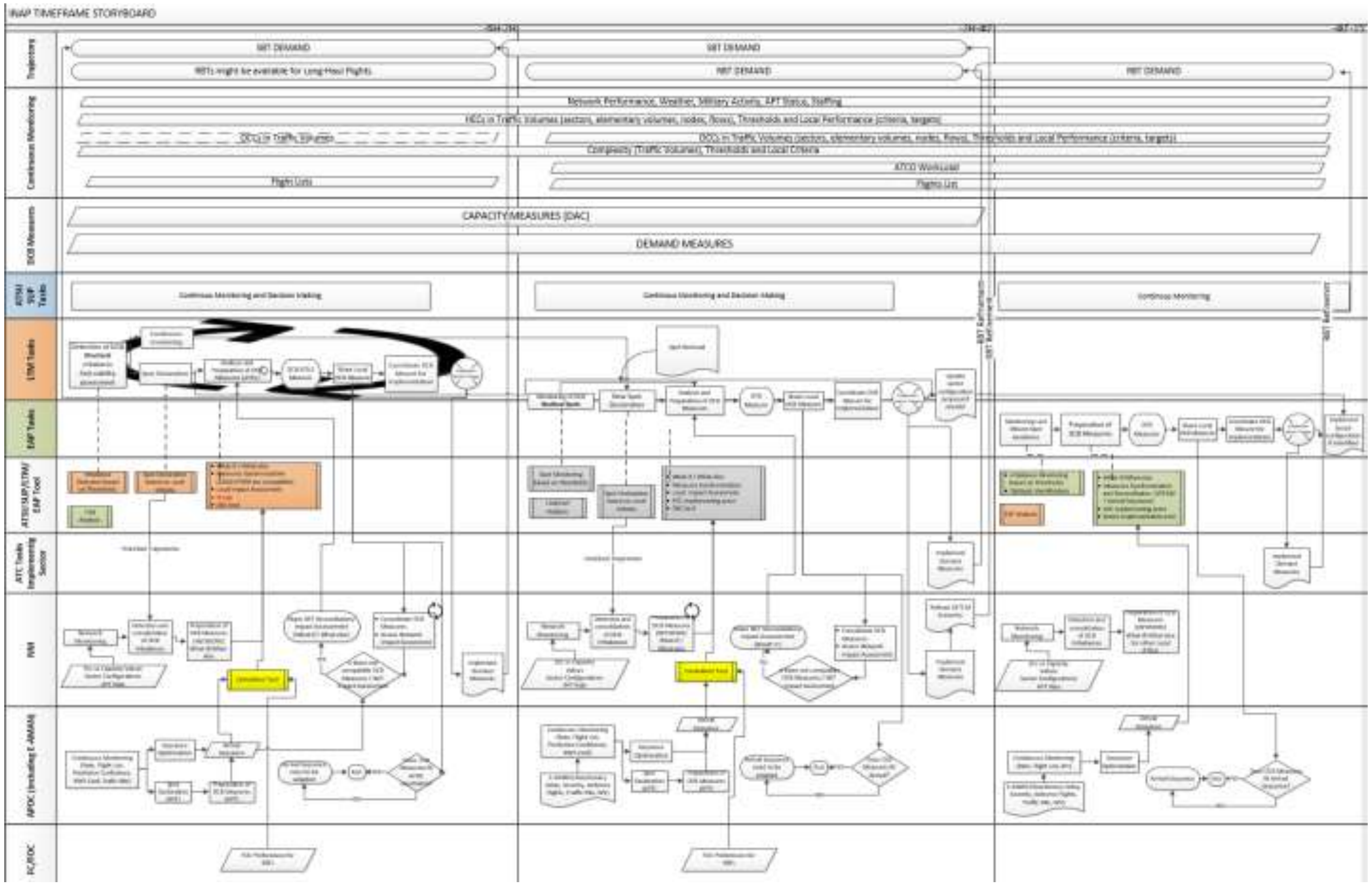

Figure 34 - INAP Storyboard

Co-funded by the European Union

Appendix C MEGA models

The main purpose of the S44 is to define new concepts and to continue developing already existing features when needed, to reach the target of developing a DAC INAP integrated into a CDM process.

Overlaps with the operational Use Cases of the W1 PJ09 and PJ08 baseline projects have been observed. In the same way, W1 MEGA models should be reused and enriched. New MEGA models have been built in order to fill the gaps when needed.

The table below summarizes W2 S44 operational Use Cases and their corresponding MEGA models.

Operational Use Case	Description	Covering MEGA models
DCB-UC-01: Airspace Design	Describes the workflow and the assessment process of an Airspace Design that allows better distribution of ATCO workload using the DAC Toolbox that provides ANSP with different options to manage capacity and facilitate trajectories in their airspace through varying degrees of sector dynamicity and automation.	[NOV-5] DAC W2 Airspace_Design
DCB-UC-02: Optimised configurations	Describes the workflow from the proposing of an ACC optimized sector configuration to the decision process to implement it in tactical phase. The optimization is performed according to multiple predefined performance criteria.	[NOV-5] DAC_ Initial Ideal sector configuration and DCB imbalance Identification (Option A) [NOV-5] DAC_UC04_Performance Target definition
DCB-UC-02: Optimised configurations	Describes the workflow process to support the accommodation of traffic demand/complexity in the most efficient way, in tactical phase.	[NOV-5] DAC_Initial Ideal sector configuration and DCB imbalance Identification (Option B) [NOV-5] DAC_UC04_Performance Target definition
DCB-UC-03: Imbalance Detection and Spot Declaration during the Tactical Phase	Detects imbalances and declaration of spots during the Tactical Phase	[NOV-5] Spot Management
DCB-UC-06: Spot Resolution and monitoring	Identification within the early/mid-INAP phases of a demand/capacity imbalance,	[NOV-5] Spot Management

	with subsequent resolution able to take into account: new sectorisation options; ARES options; and demand intervention to arrive at an optimised plan for progression into the latter stages of INAP processes.	[NOV-5] DCB Measures prepared in the RBT Revision process [NOV-5] DCB Measures prepared in the SBT Elaboration process (Planning Phase)
DCB-UC-07: what if Flight exclusion tool	Describes the workflow and the computation process to support the analysis of a hotspot on capacity sector in short term to execution phases based on machine learning and/or expert rules analysis.	[NOV-5] What-if Flight Exclusion
DCB-UC-09:Targeted CASA	New DCB measures using enhanced CASA processing tool	[NOV-5] Target Flow CASA
DCB-UC-00 Coordination and publication of optimal Network DCB scenario	Describes the coordination process on D-1 and D of operations, more than 4-6h in advance when inconsistencies are detected between DAC/DCB reference scenario proposed by NM and local KPIs	[NOV-5] Coordination and publication of optimal Network DCB scenario
DCB-UC-xx Change of DAC/DCB plan and its publication update	Describes the DAC/DCB changes assessment and publication	[NOV-5] Change of DCB Plan and its Publication Update

Figure 35: S44 Operational Use cases

10 Note that DCB Models are not yet completed thus "TBD" is stated to inform that correspondence with Solution 44 Operational Use Case is not available yet. They shall be integrated in the final issue by December 22.

The table below, summarizes the W2 MEGA operational models covering the scope of the S44.

NOV5 diagram	Description
[NOV-5] DAC W2 Airspace_Design	The overall process of the Airspace Design, from the Strategic Demand Forecast to NOP publication
[NOV-5] DAC_UC03_Initial ASM Request	
[NOV-5] DAC_UC05_Initial Ideal sector configuration and DCB imbalance Identification (Option A)	In conjunction with the "[NOV-5] DAC_UC04_Performance Target definition" models the "DCB-UC-02: Optimised configurations" use-case
[NOV-5] DAC_UC05_Initial Ideal sector configuration and DCB imbalance Identification (Option B)	In conjunction with the "[NOV-5] DAC_UC04_Performance Target definition" models the "DCB-UC-02: Optimised configurations" use-case
[NOV-5] DAC_UC04_Performance Target definition	Set-up the performance targets

[NOV-5] Spot Management	At any time in the D-1 to 20 min timeframe, NM and INAP actors can create, modify, cancel and delegate a hotspot (to elaborate and revise DCB Measures). The hotspot is notified with some attributes (reference location, status, start/end time, criticality…).
[NOV-5] EAP Hotspot Management in Full Autonomy	Specific case of spot management in Full Autonomy mode (to EAP)
[NOV-5] EAP Resolution of Downstream Hotspot with LTM delegation	Specific case of spot management in delegation mode (to LTM in EAP)
[NOV-5] EAP Resolution of Local Hotspot with LTM delegation	Local Hotspot Resolution during LTM delegation
[NOV-5] DCB Measures prepared in the RBT Revision process	Preparation of DCB Measures (RBT revision phase).
[NOV-5] DCB Measures prepared in the SBT Elaboration process (Execution Phase)	Preparation of DCB Measures during execution phase.
[NOV-5] DCB Measures prepared in the SBT Elaboration process (Planning Phase)	Preparation of DCB Measures during planning phase (SBT revision).
[NOV-5] DAC_UC06_ATC Volumes vs ARES assessment (Option A)	ATC volumes with respect to ARES Assessment
[NOV-5] DAC_UC06_ATC Volumes vs ARES assessment (Option B)	ATC volumes with respect to ARES Assessment
[NOV-5] UC-05 How to choose a DCB measure	How to choose a DCB measure
[NOV-5] Change of DCB Plan and its Publication Update	Change of DCB Plan and its Publication Update
[NOV-5] Coordination and publication of optimal Network DCB scenario	Coordination and publication of optimal Network DCB scenario
[NOV-5] Preparation of E-R DCB solutions taking into account Airport flight impact severity indicator	Preparation of E-R DCB solutions taking into account Airport flight impact severity indicator
[NOV-5] Target Flow CASA	Target Flow CASA
[NOV-5] What-if Flight Exclusion	What-if Flight Exclusion

Figure 36: MEGA operational models for W2 S44

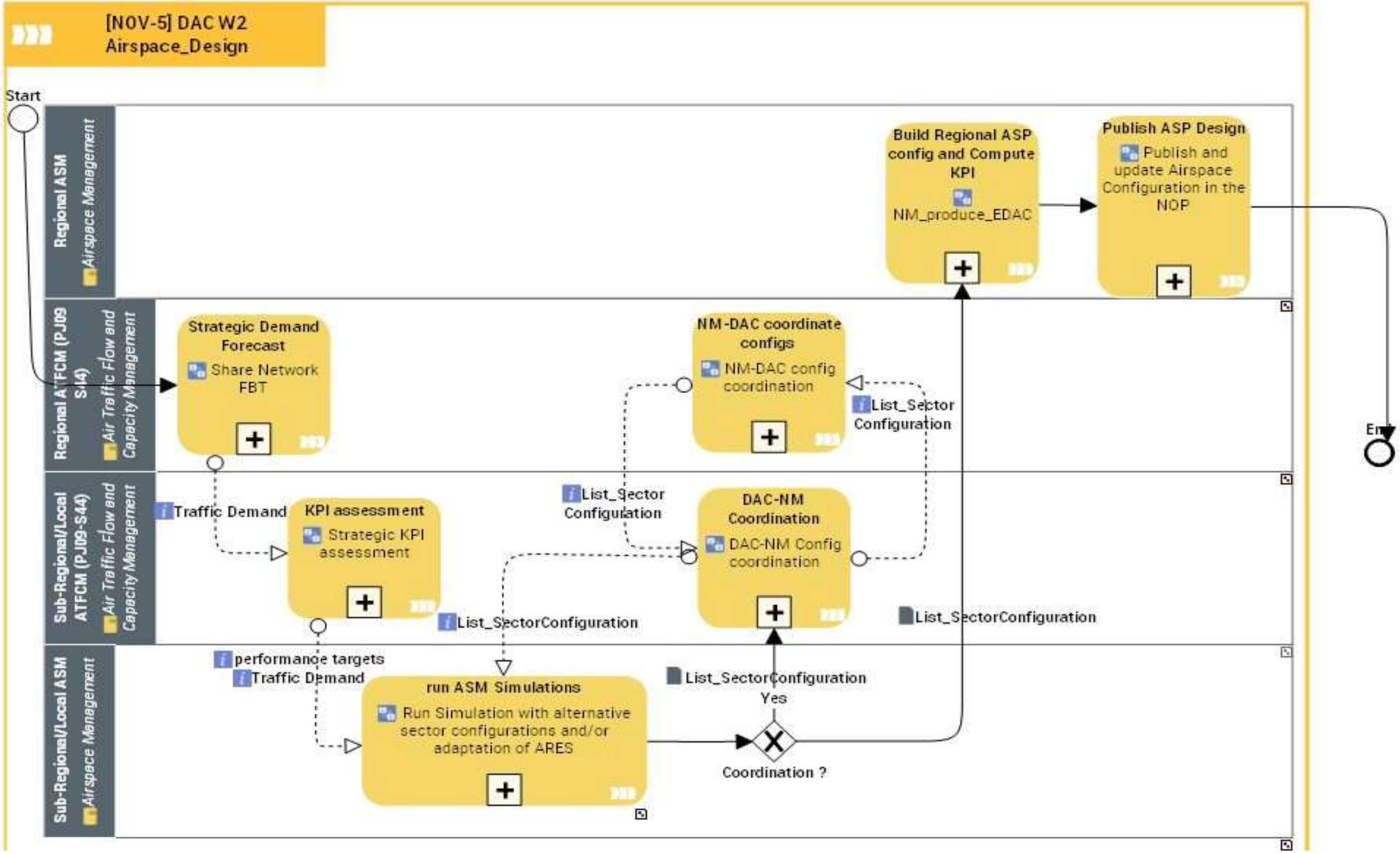

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Figure 37 - DAC W2 Airspace Design

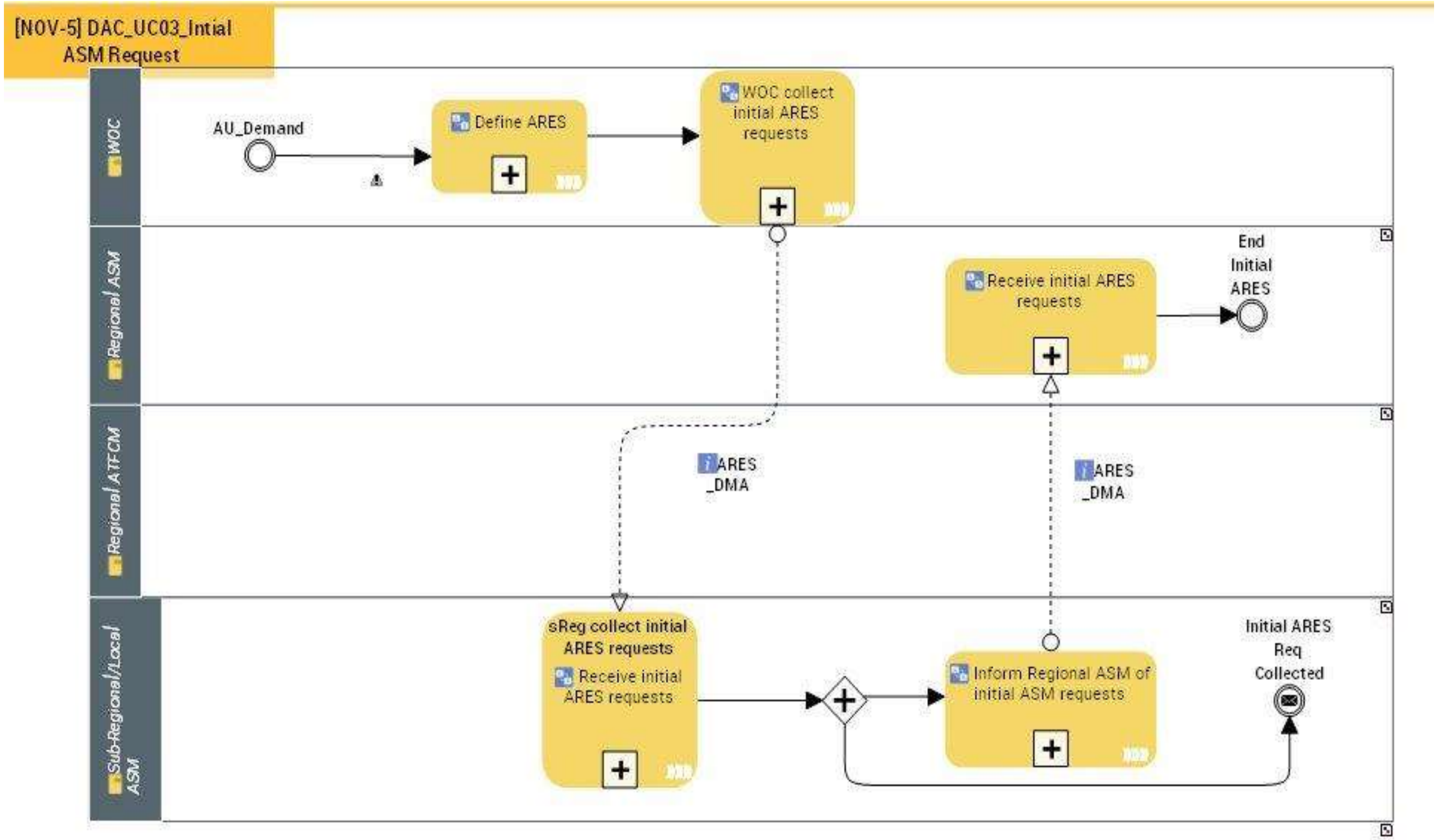

Figure 38 - DAC-UC-03 Initial ASM request

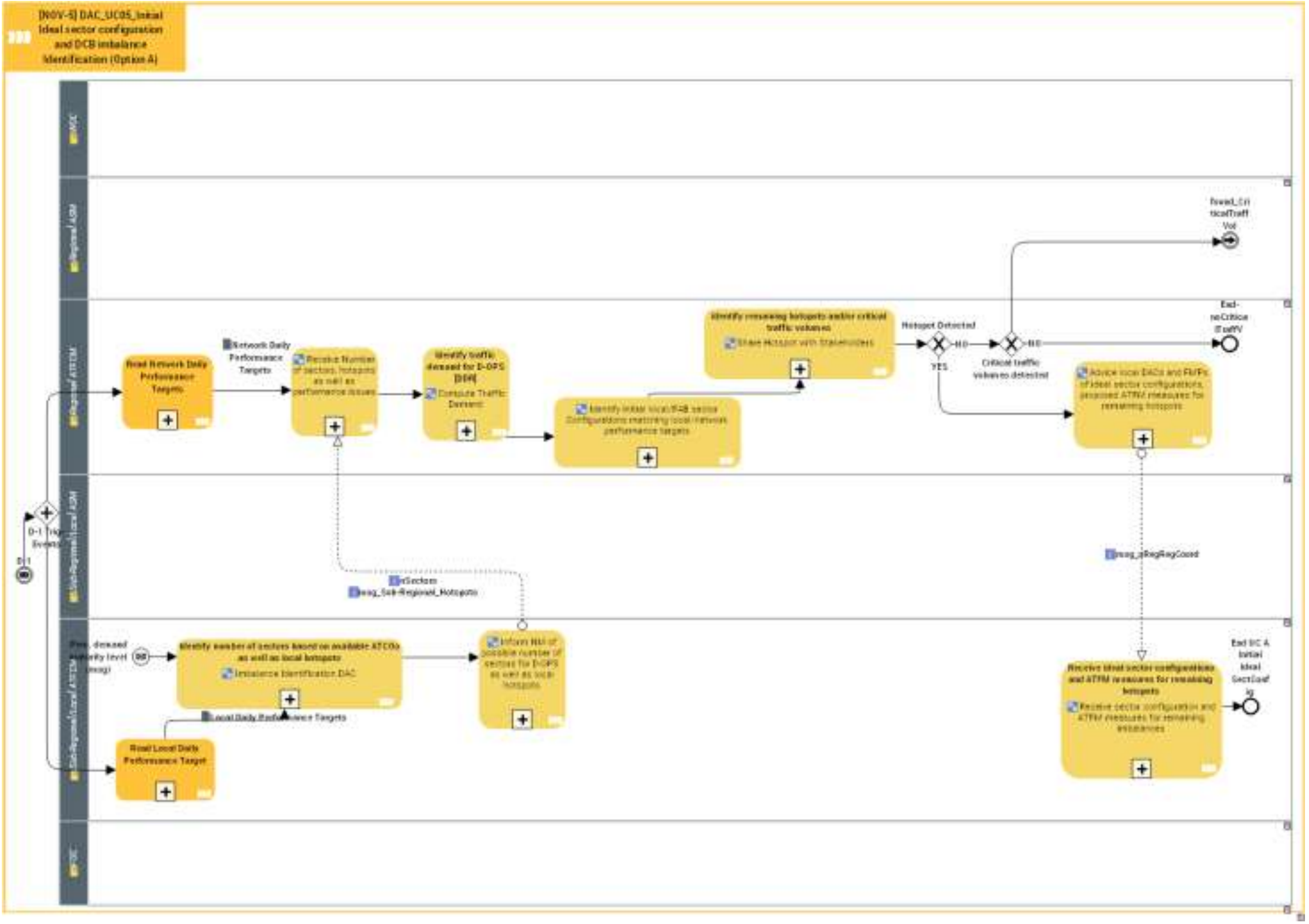

Figure 39: DAC_UC05_Initial Ideal sector configuration and DCB imbalance identification (Option A)

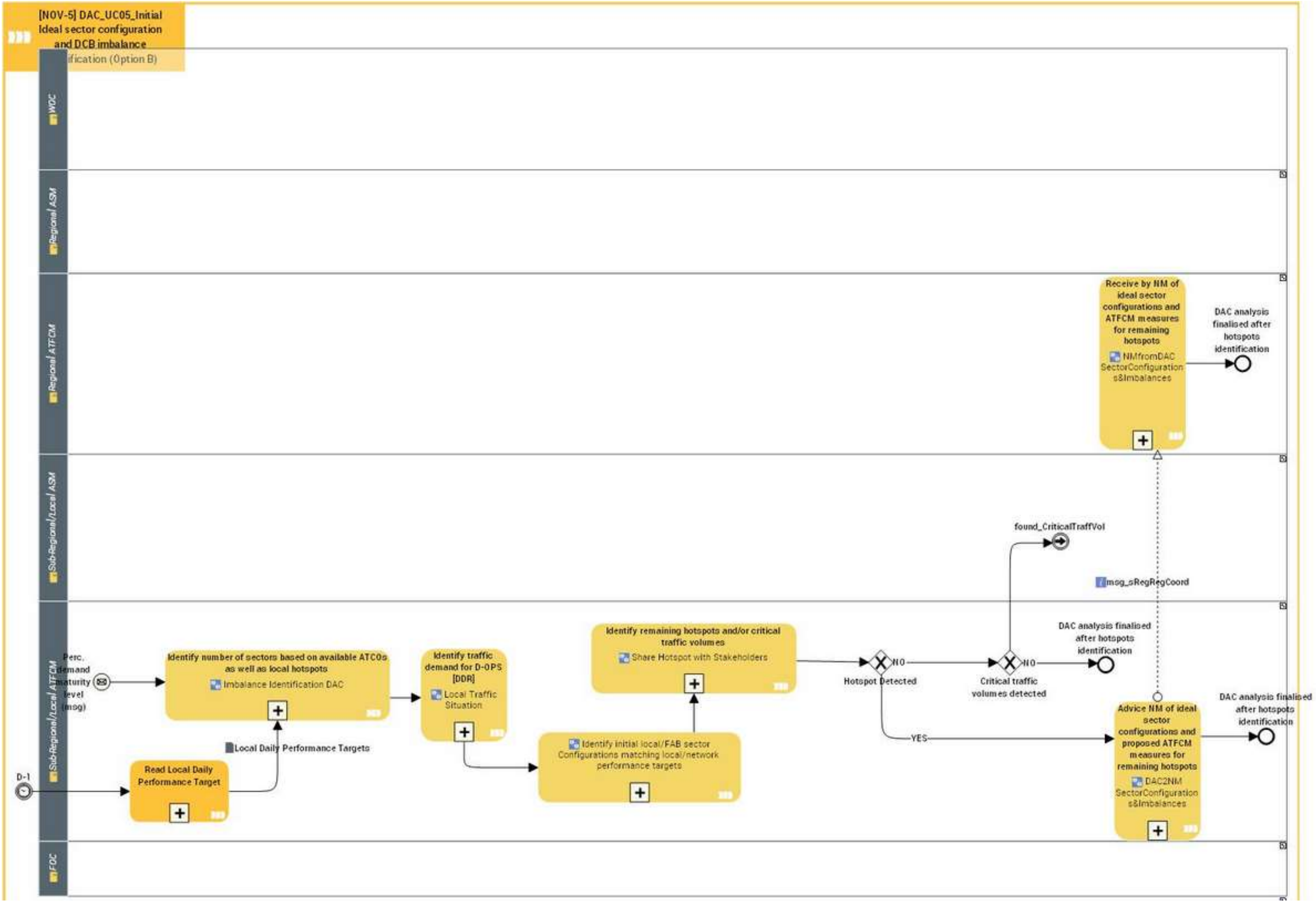

Figure 40: DAC_UC05_Initial Ideal sector configuration and DCB imbalance identification (Option B)

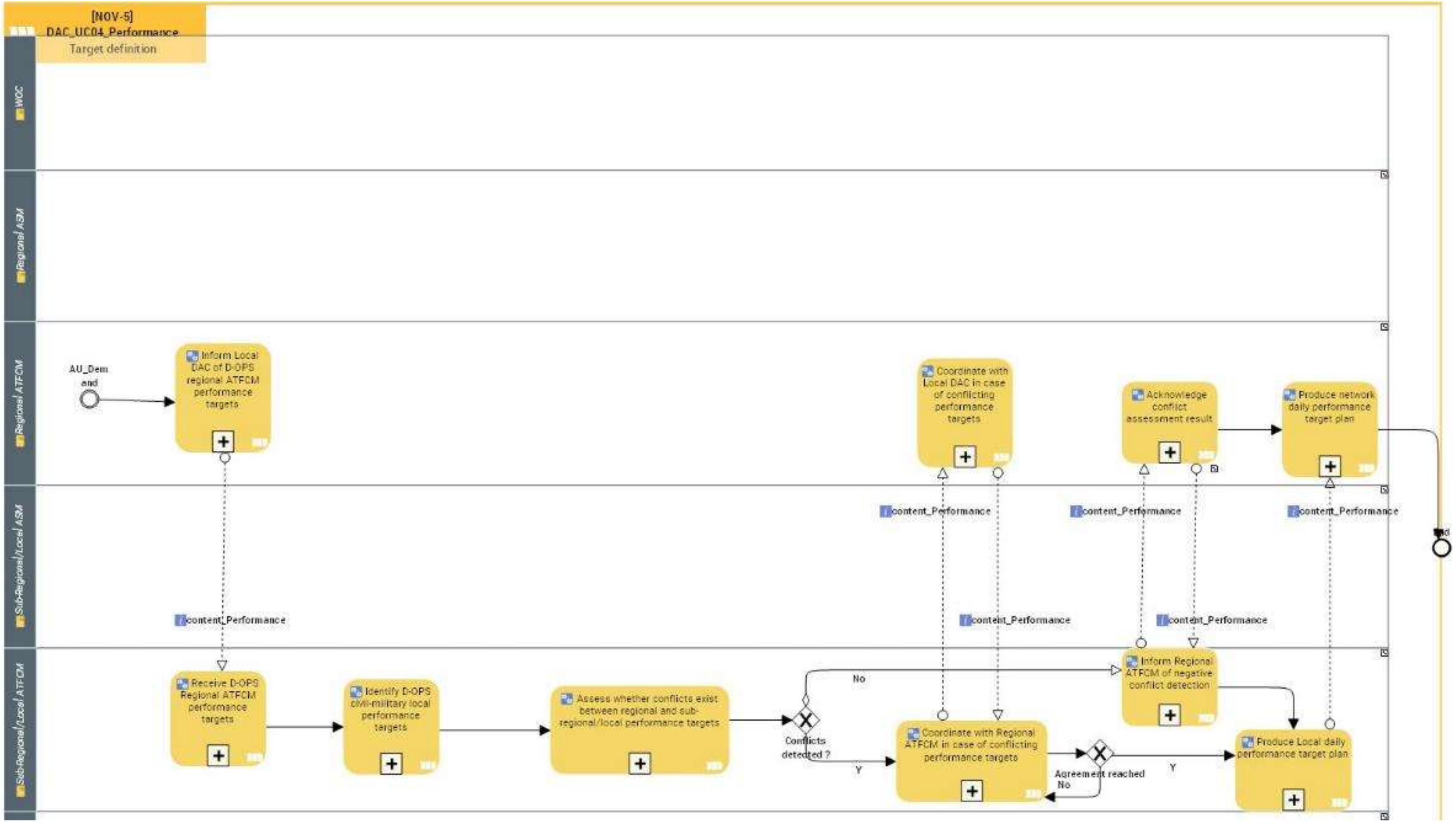

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Figure 41: DAC_UC04_Performance Target definition

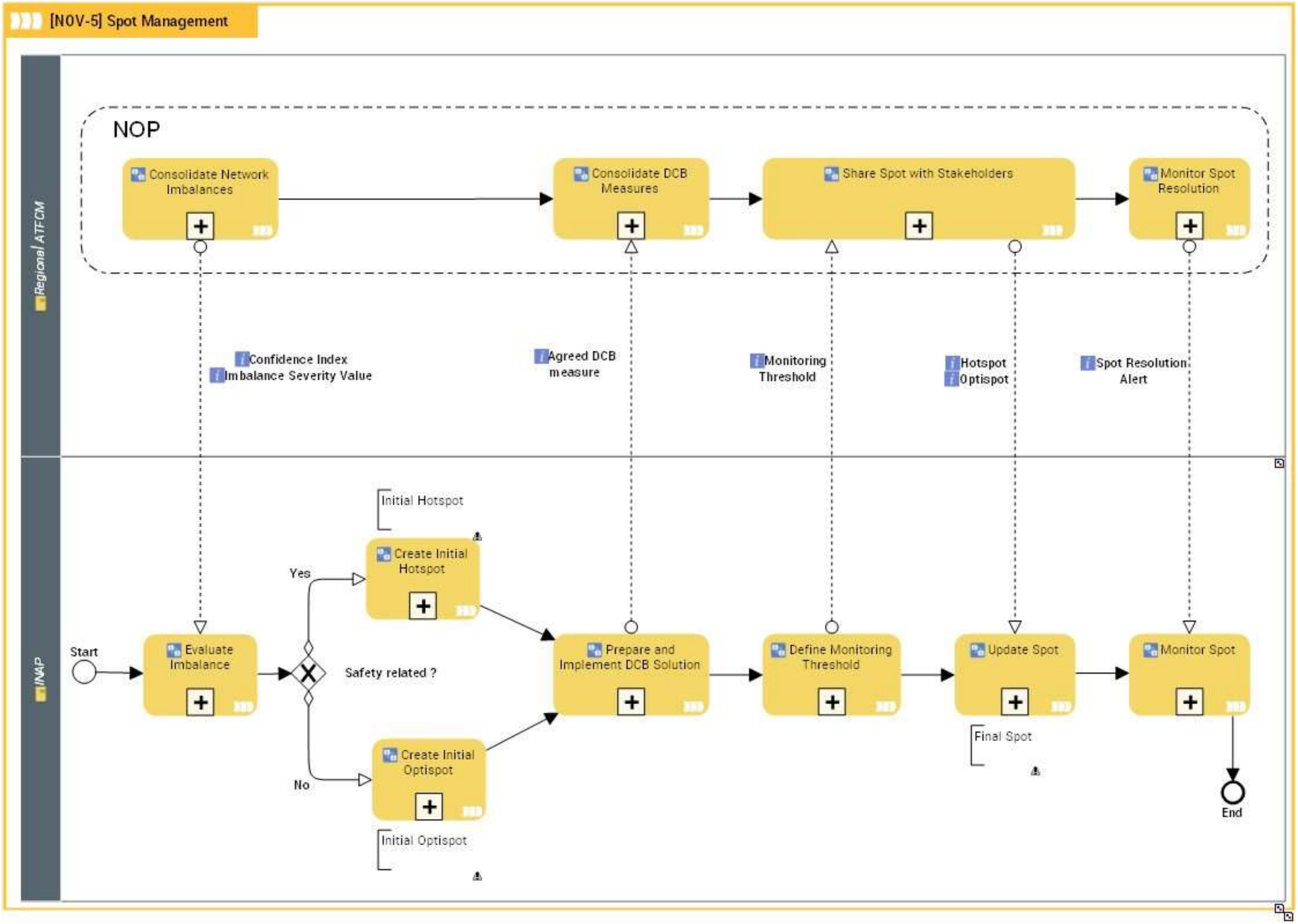
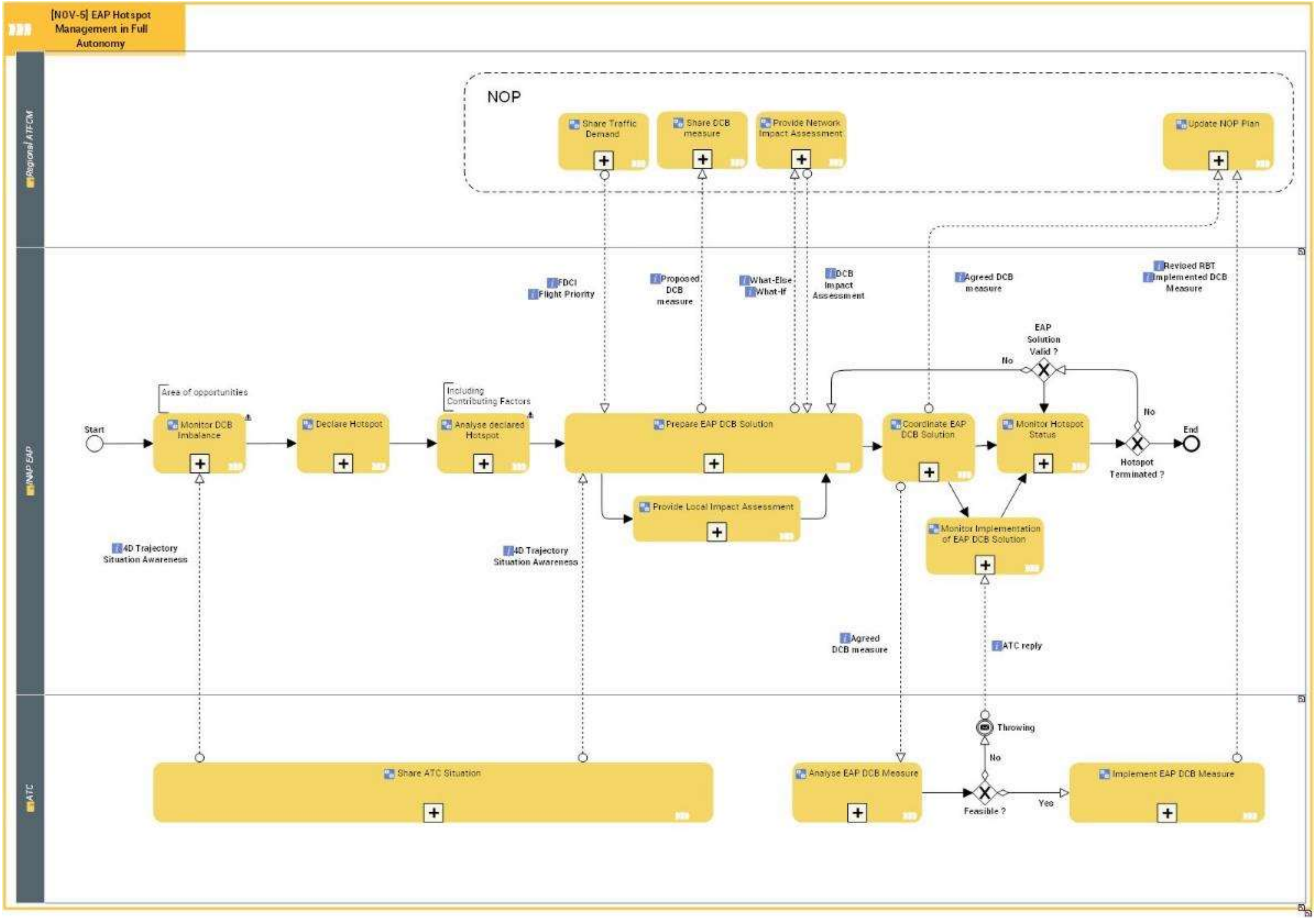


Figure 42: Spot Management



35 **Figure 43: EAP Hotspot Management in full autonomy**

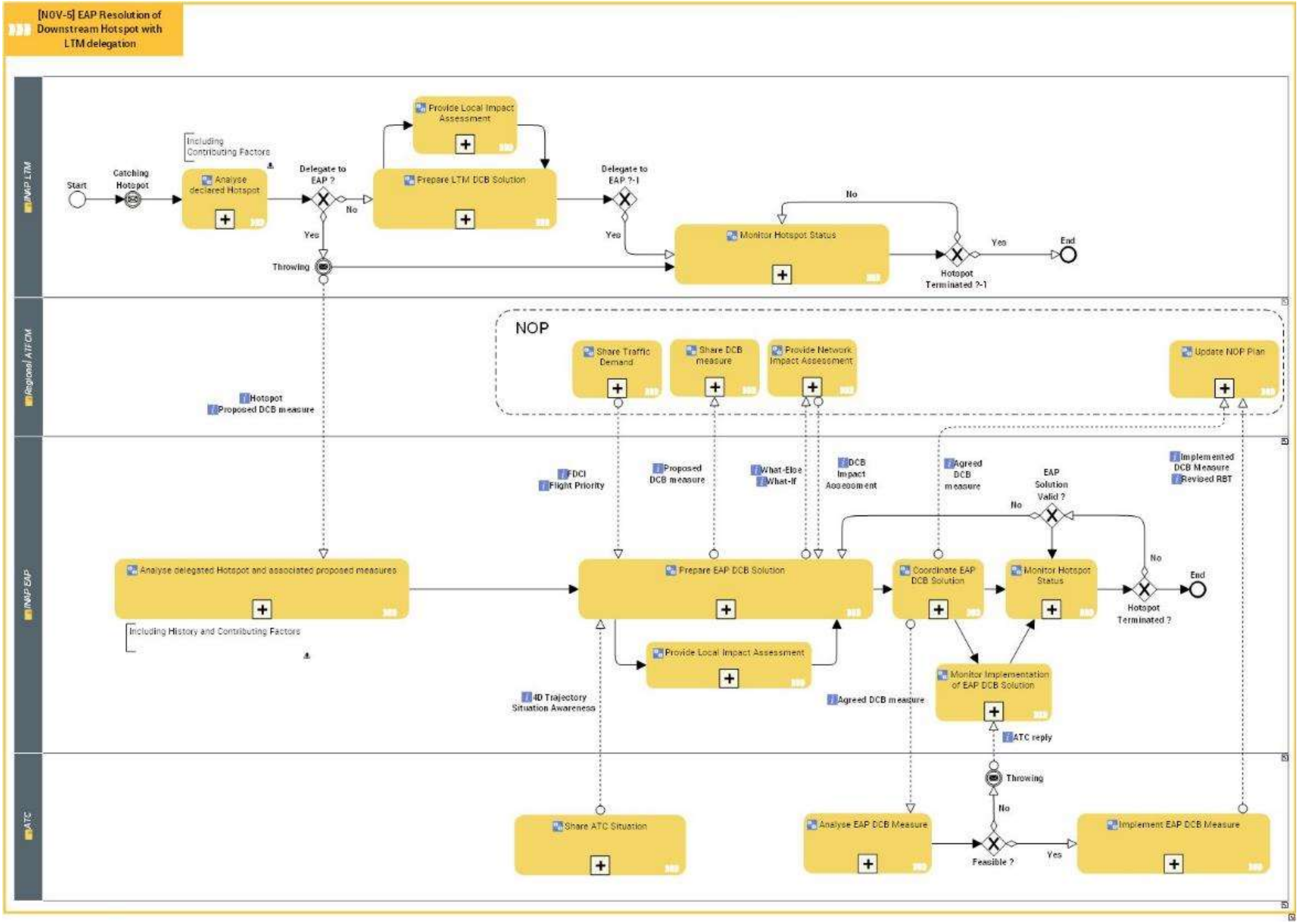


Figure 44: EAP Resolution of Downstream Hotspot with LTM delegation

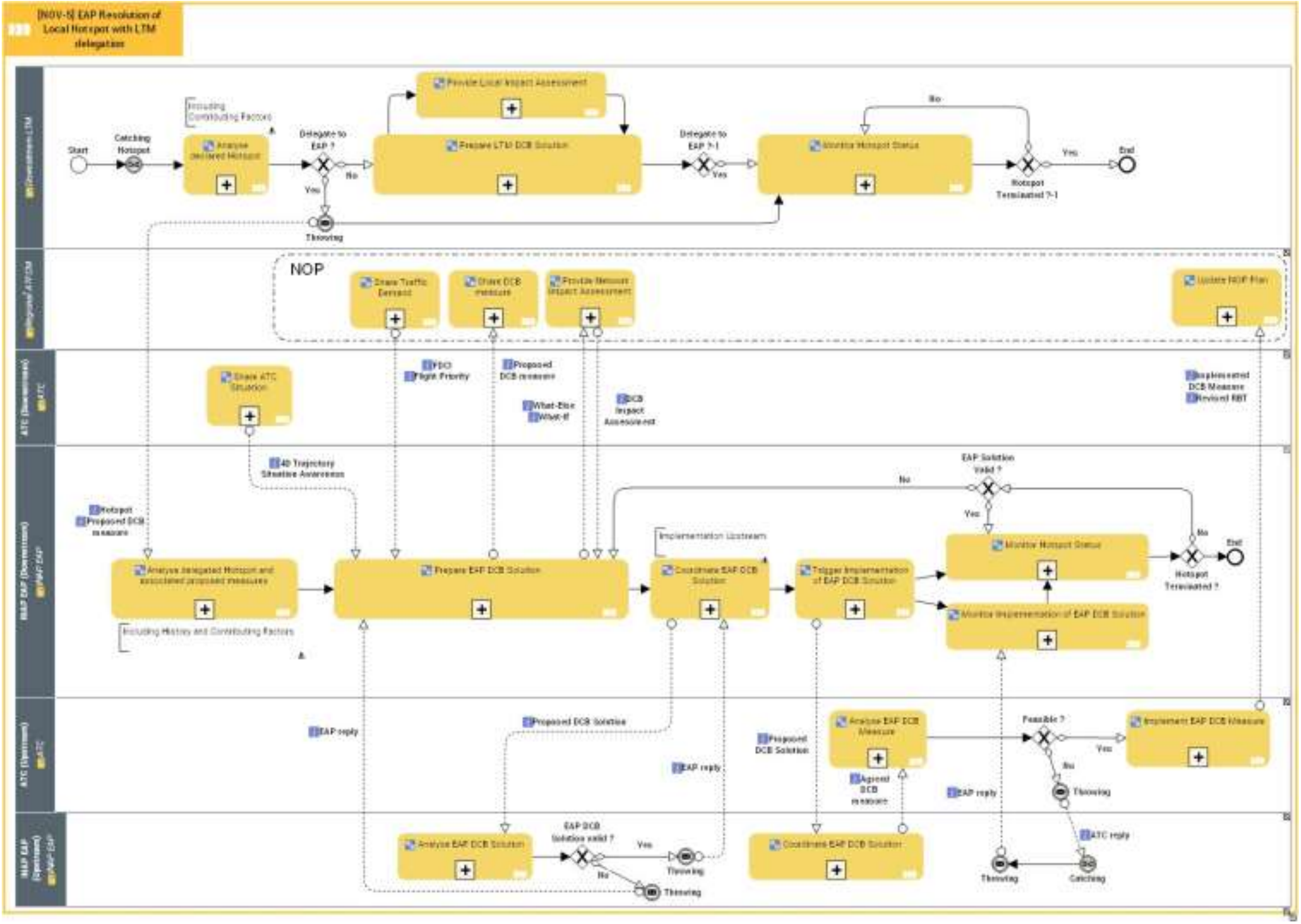


Figure 45 : [NOV-5] EAP Resolution of Local Hotspot with LTM delegation

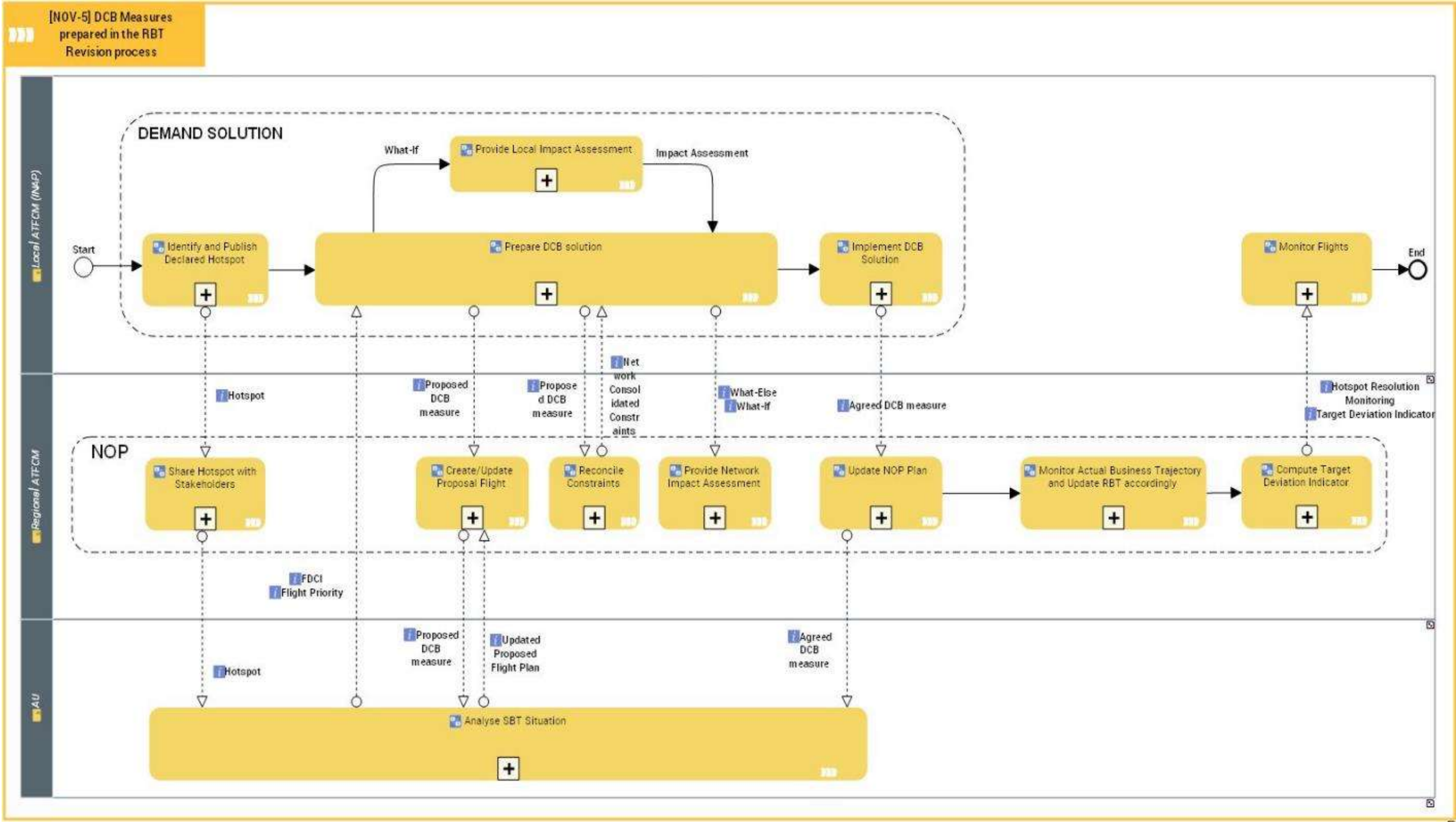


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Figure 46: DCB measures prepared in the RBT Revision process

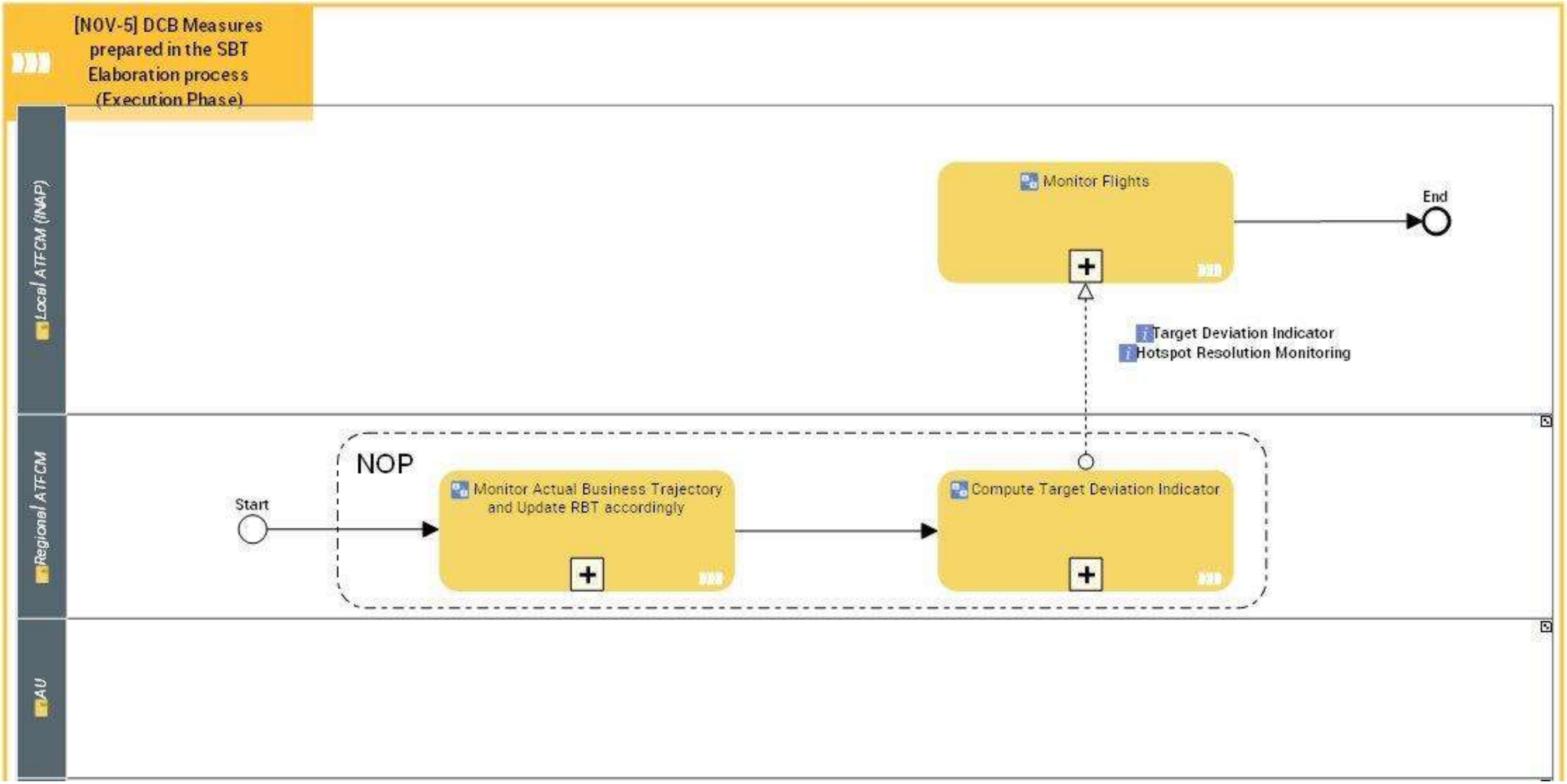

Figure 47: DCB measures prepared in the SBT Elaboration process (Execution Phase)

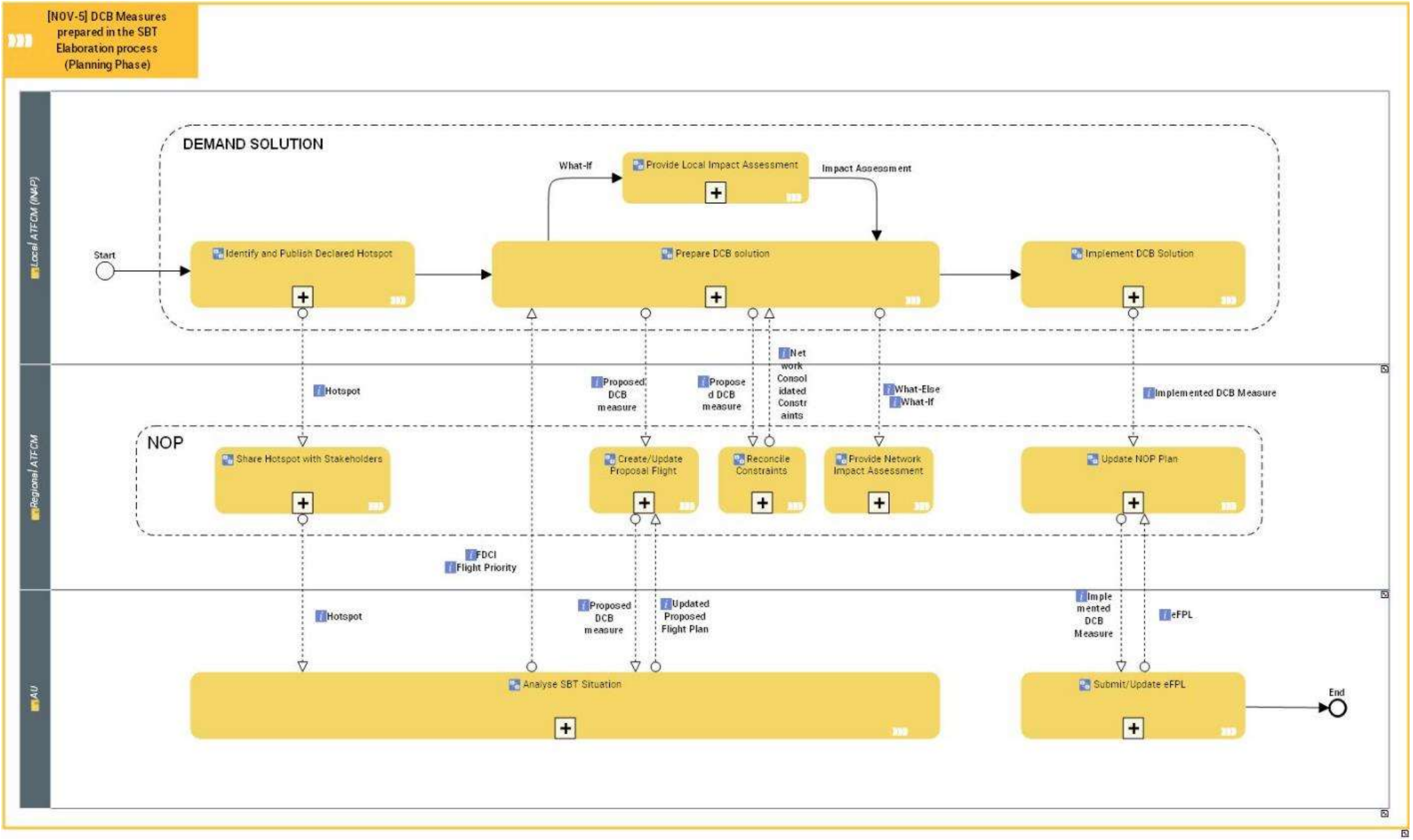

Figure 48: DCB measures prepared in the SBT Elaboration process (Planning phase)

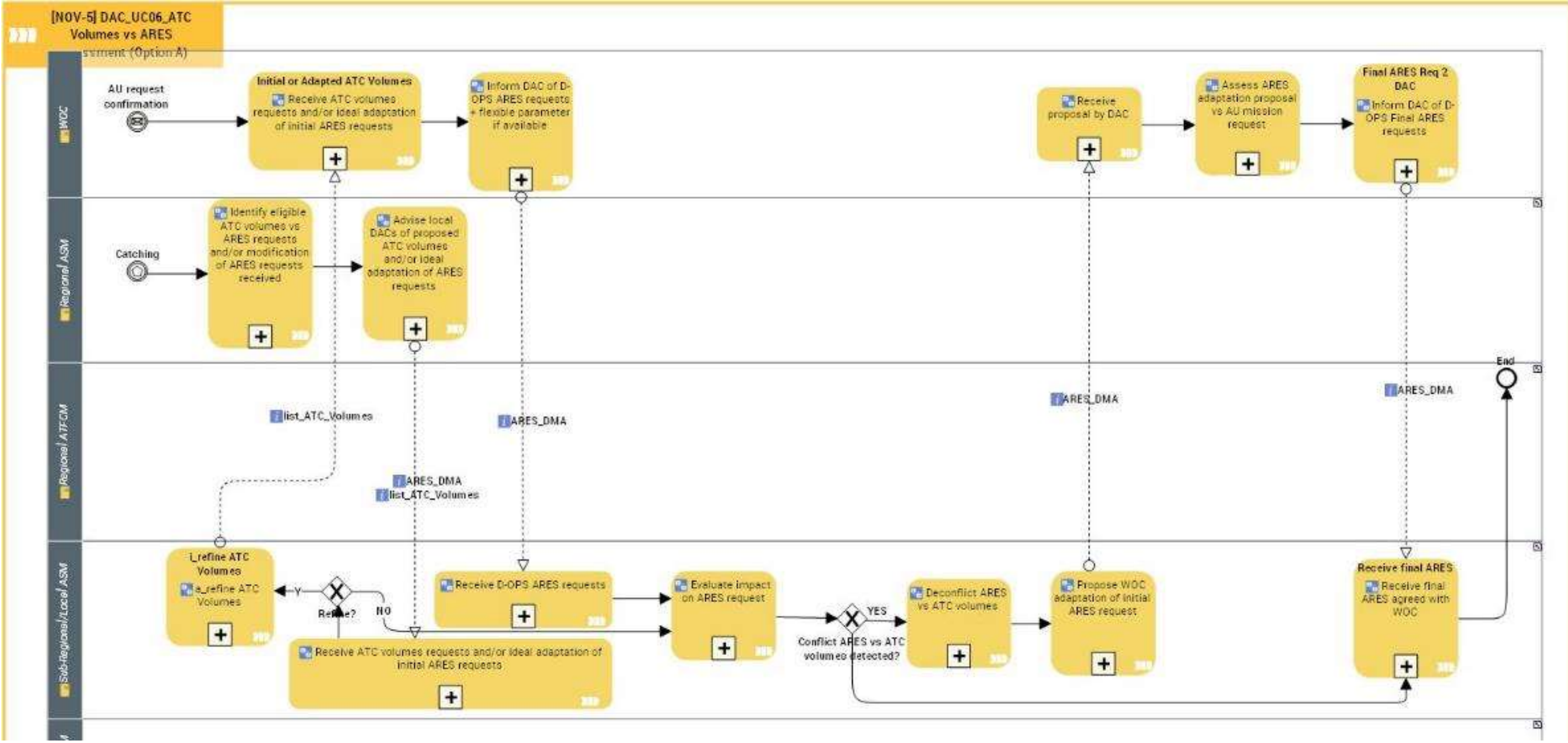

Figure 49: DAC_UC06_ATC Volumes Vs ARES Assessment (Option A)

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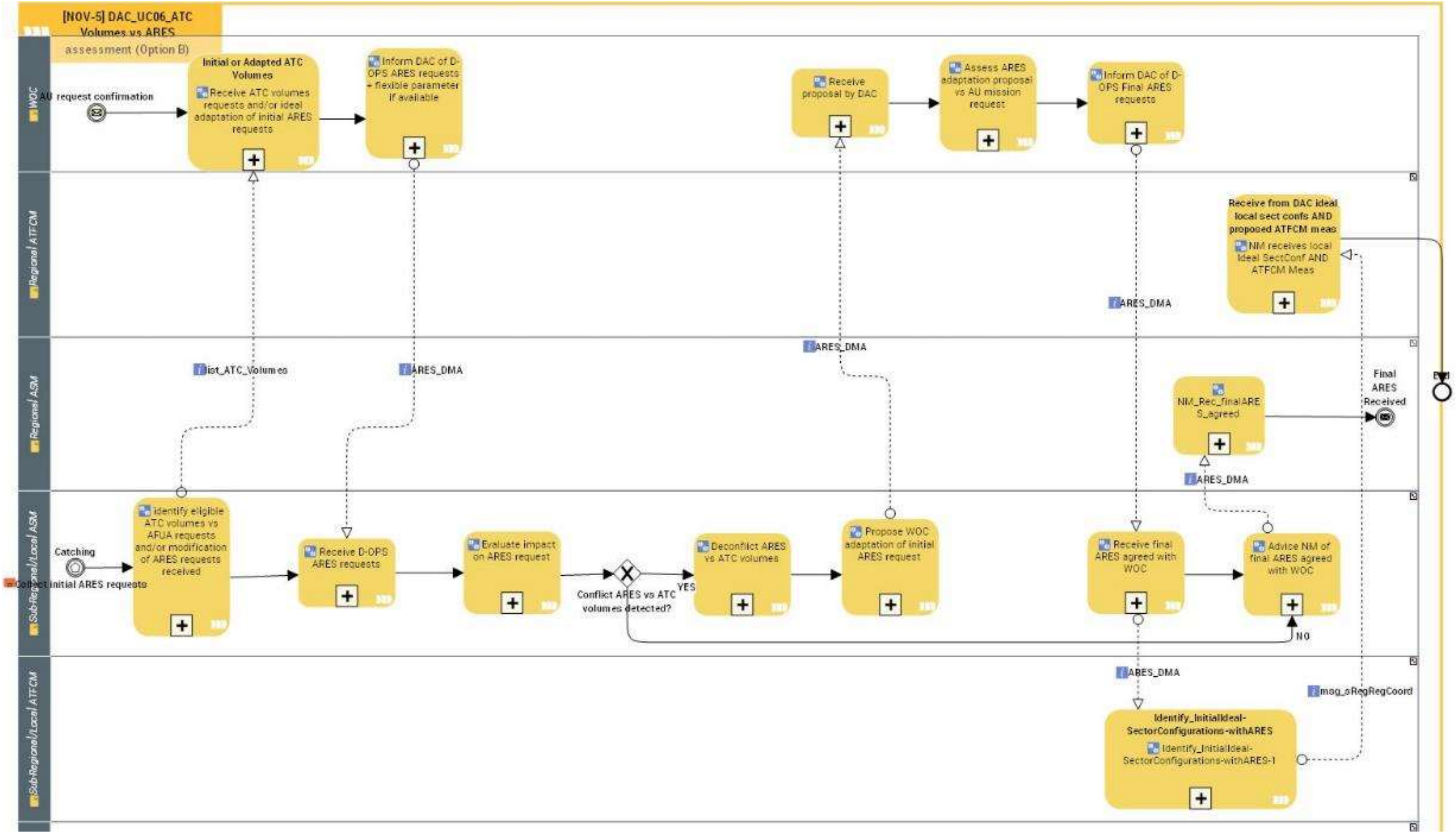

Figure 50: DAC_UC06_ATC Volumes Vs ARES assessment (Option B)

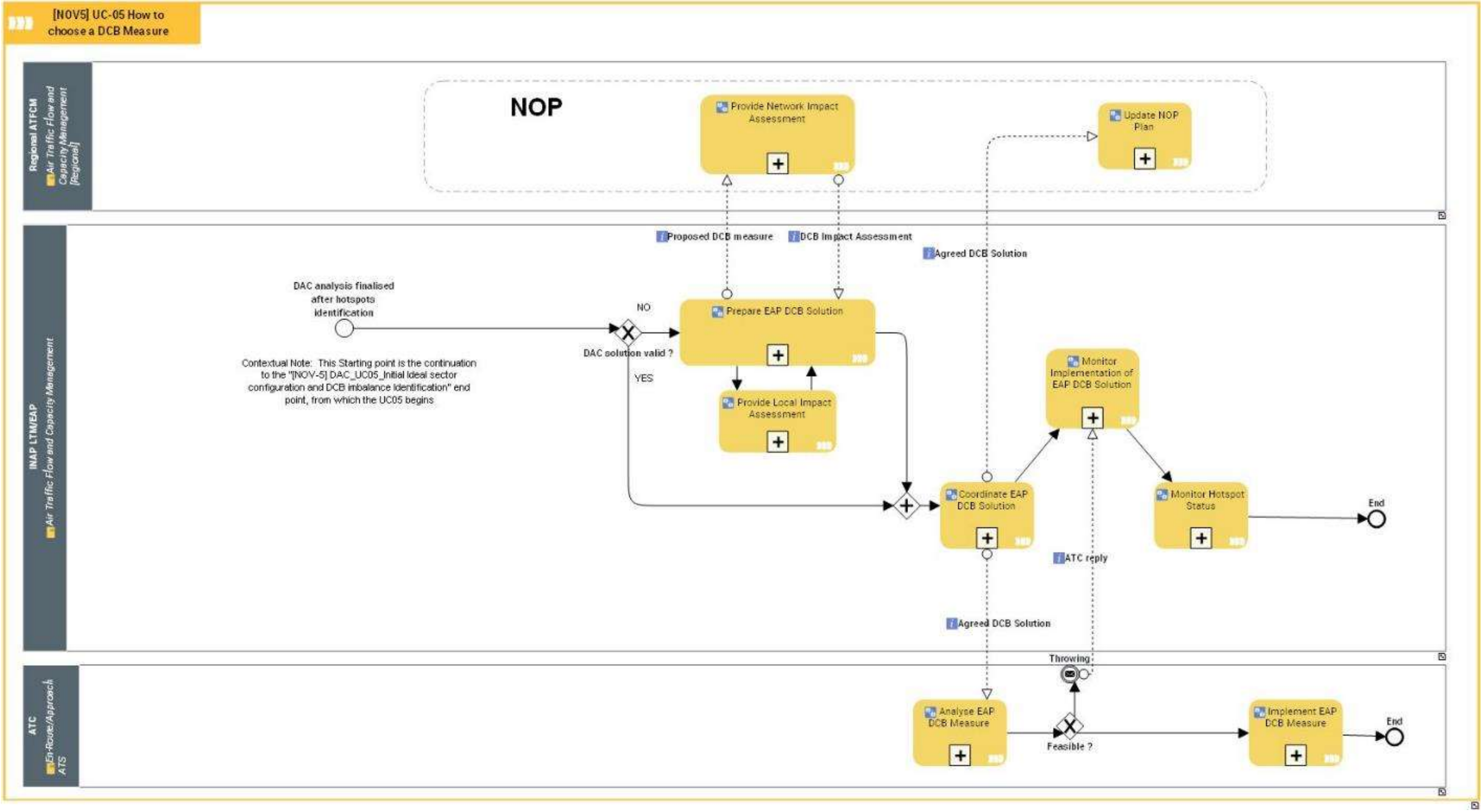

Figure 51: How to choose a DCB measure

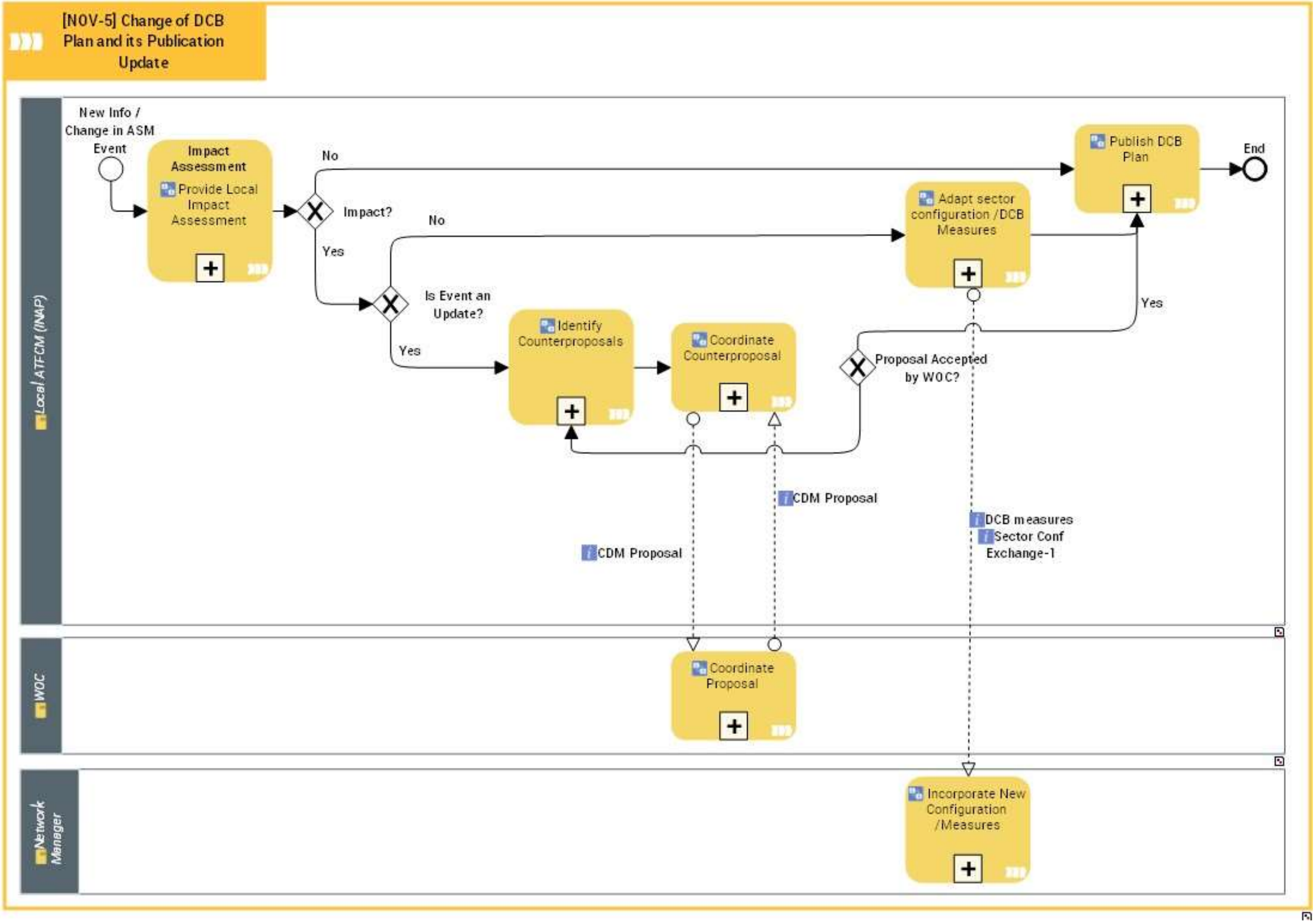

Figure 52 : [NOV-5] Change of DCB Plan and its Publication Update

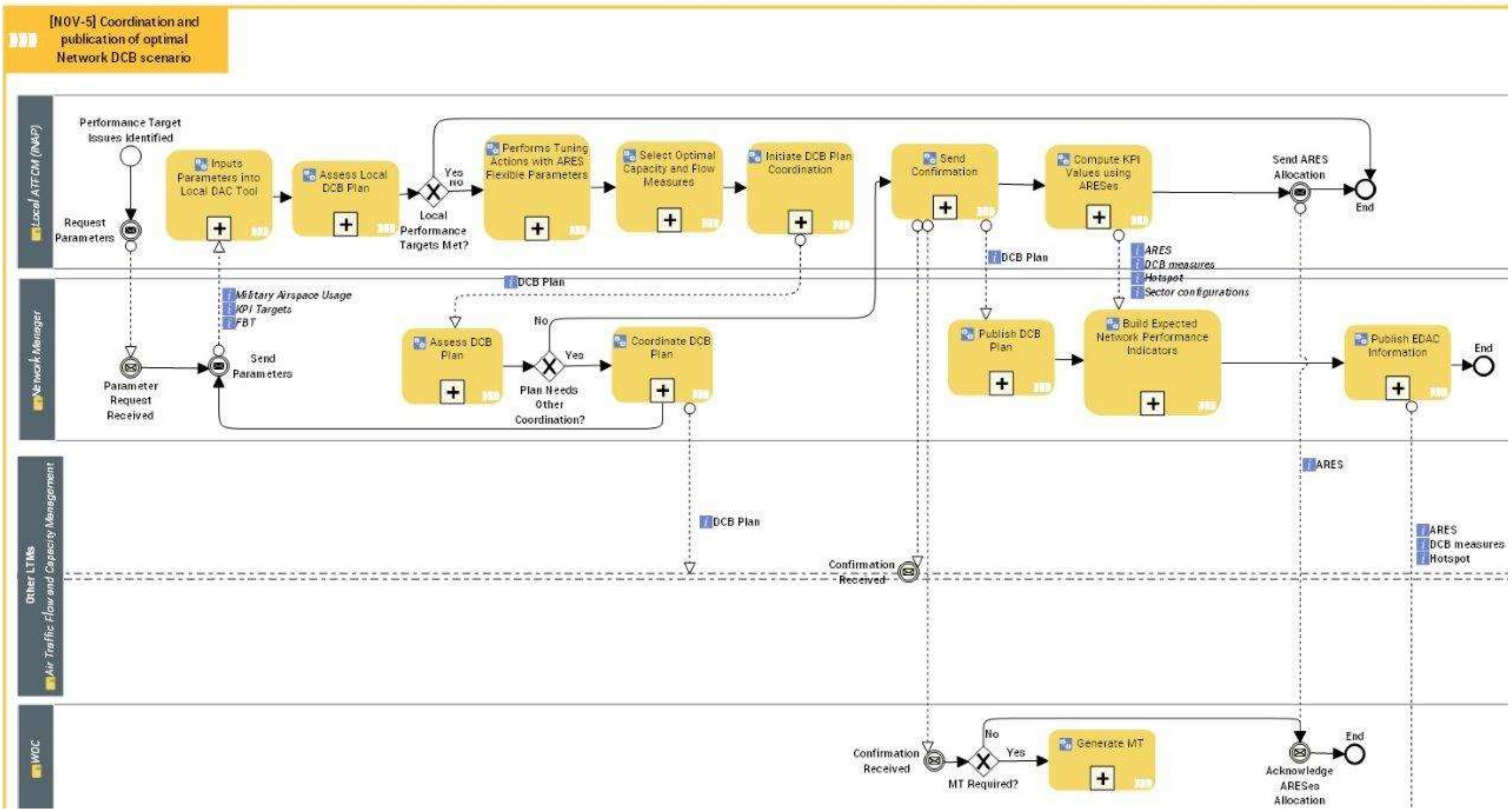

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Figure 53 : [NOV-5] Coordination and publication of optimal Network DCB scenario

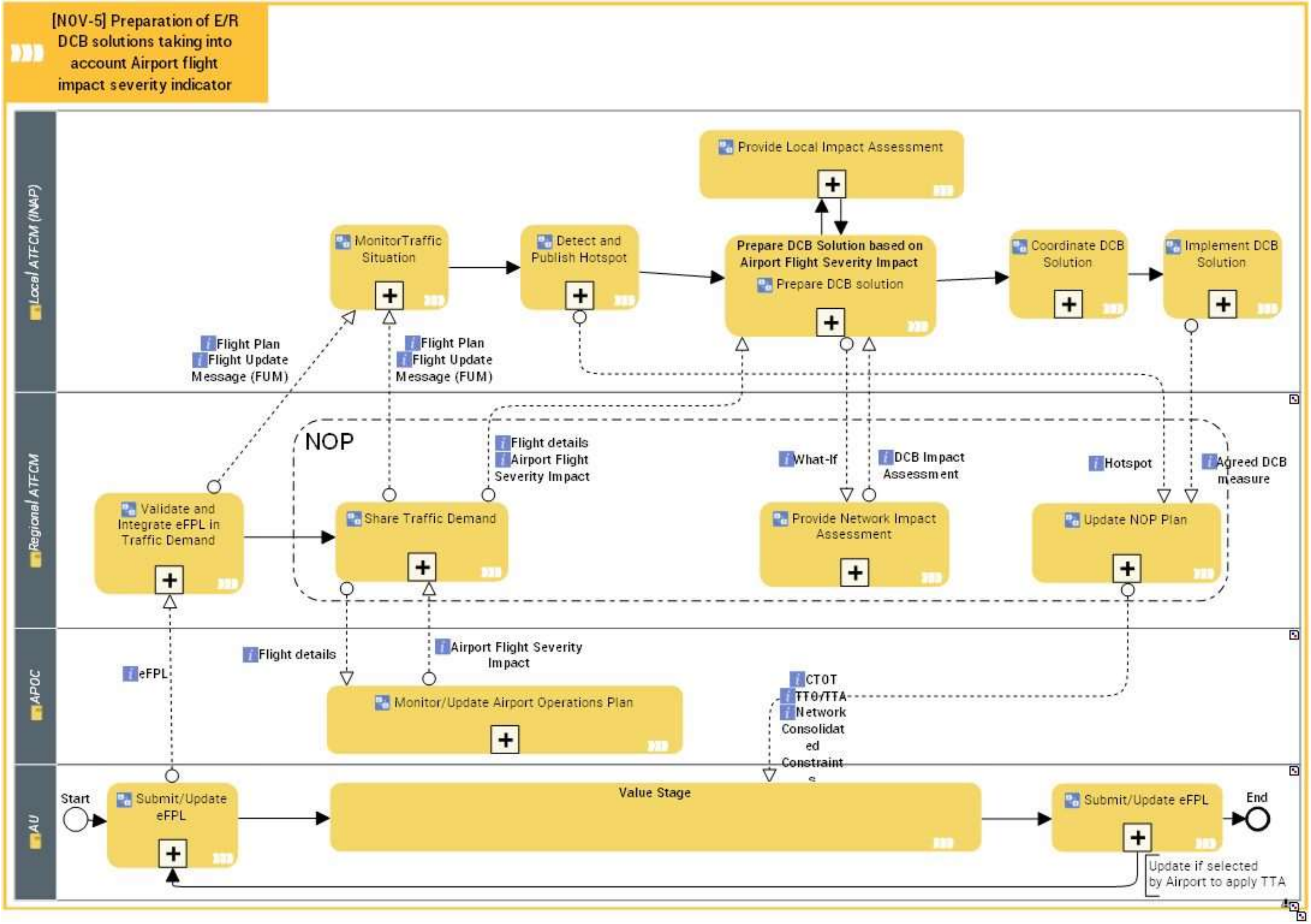

Figure 54 : [NOV-5] Preparation of E-R DCB solutions taking into account Airport flight impact severity indicator

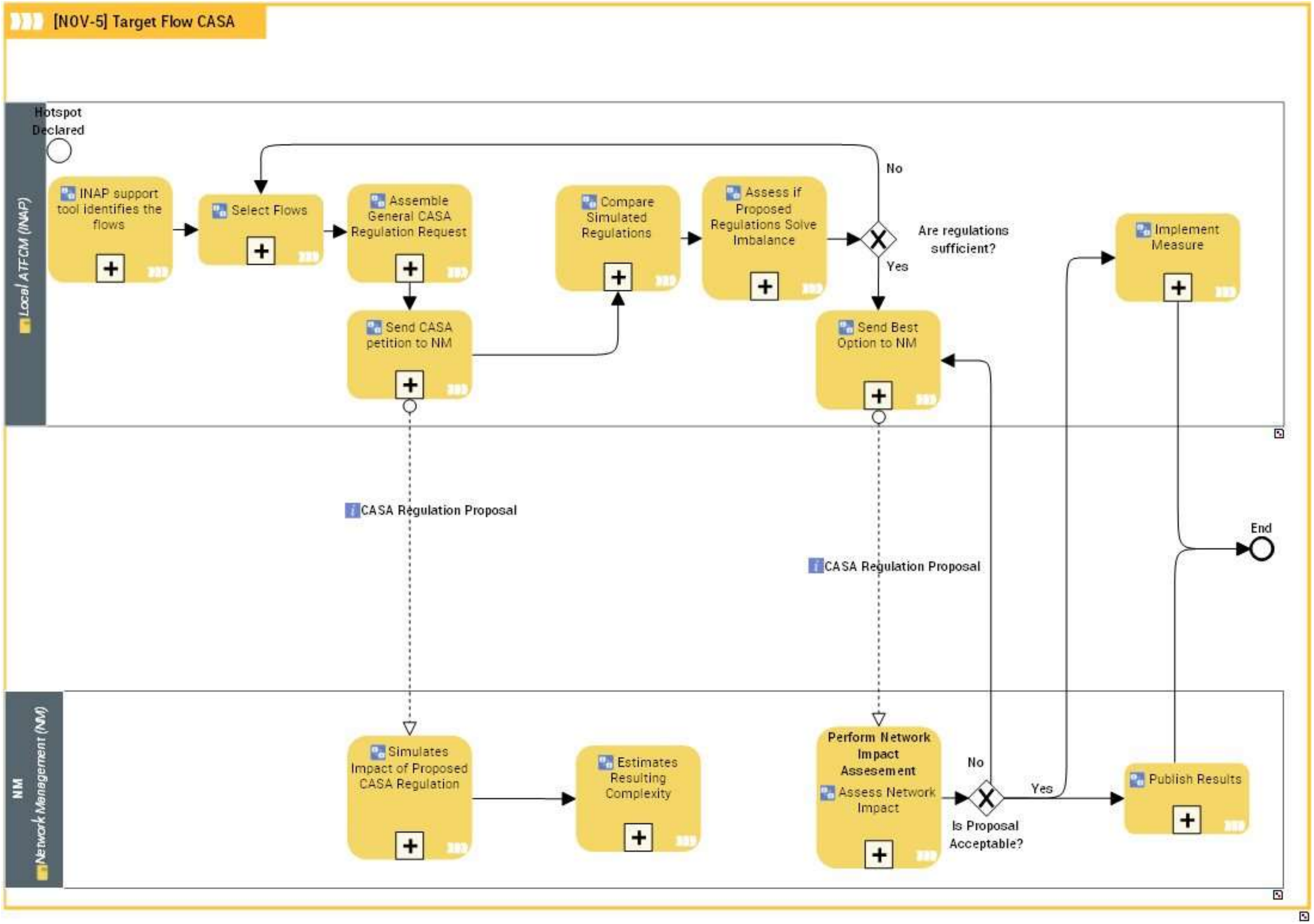

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Figure 55 : [NOV-5] Target Flow CASA

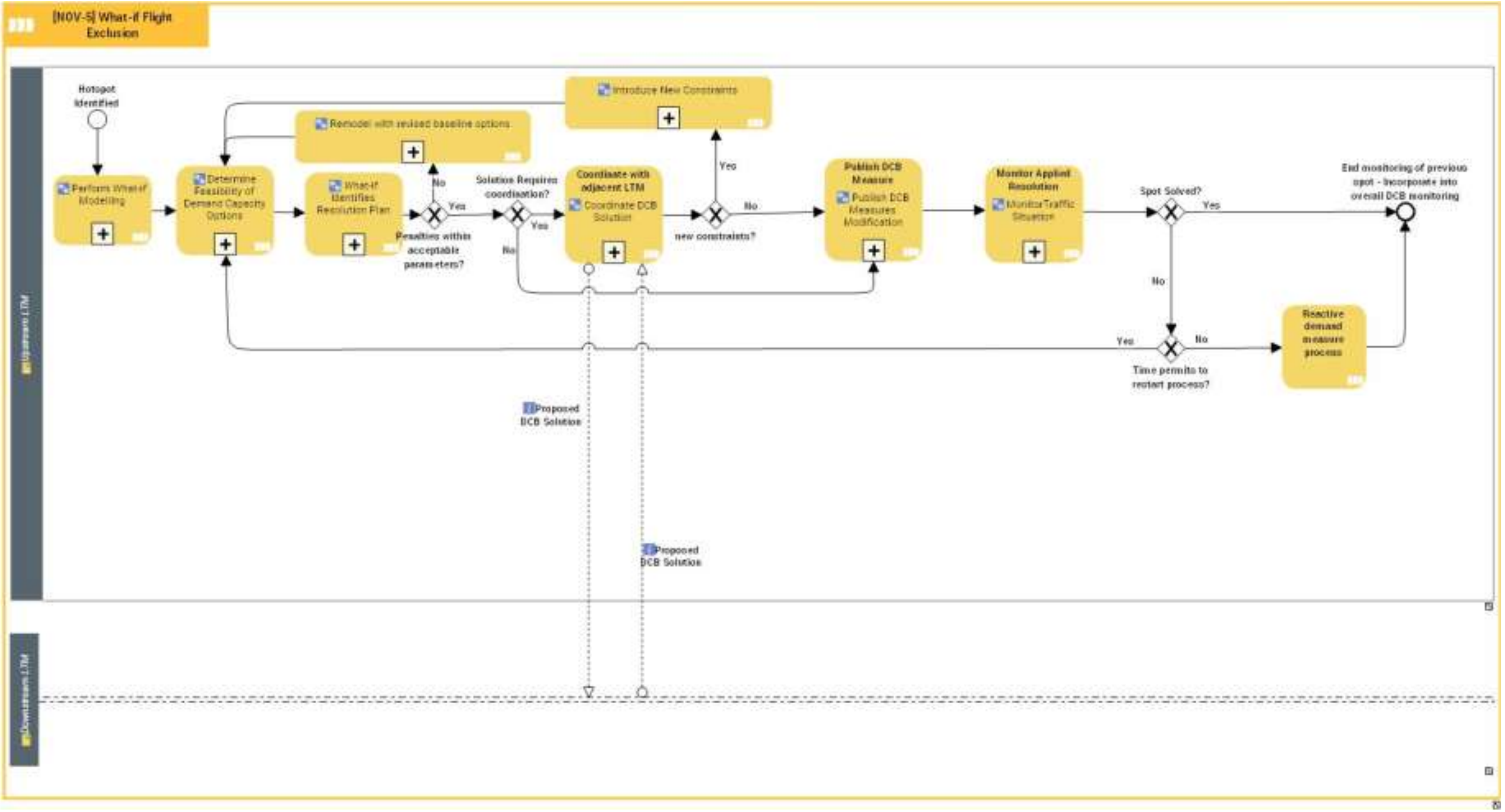

Figure 56 : [NOV-5] What-if Flight Exclusion