Episode 3

Single European Sky Implementation support through Validation

Document information	
Programme	Sixth framework programme Priority 1.4 Aeronautics and Space
Project title	Episode 3
Project N°	037106
Project Coordinator	EUROCONTROL Experimental Centre
Deliverable Name	Detailed Operational Description - Medium/Short Term Network Planning - M2
Deliverable ID	D2.2-043
Version	2.00
Owner	
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Contributing partners	

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Version history

Version	Date	Status	Author(s)	Justification - Could be a reference to a review form or a comment sheet
1.00	17/12/2009	Approved	Sönke Mahlich Serge Manchon	Approval of the document by the Episode 3 Consortium.
2.00	14/04/2010	Approved	Ros Eveleigh	Full alignment with ATM Process Model Approval of the Episode 3 consortium

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EXECUTIVE SUMMARY

The SESAR Detailed Operational Description breaks down into nine main documents. Each document is mapped on:

- A specific operational phase:
  - Long-term planning;
  - Medium/Short-term planning;
  - Execution.
- A specific operational layer:
  - Network management: sub-regional and regional;
  - Airspace management: civil/military;
  - Airport airside operations: runway, apron and taxiway management;
  - Conflict management: terminal and en-route airspace;
  - Airspace user operations: trajectory management.

The Detailed Operational Description addressed by the present document focuses on:

- The operating principles relevant to the Medium/Short-term Planning Phase for:
  - Network management;
  - Airspace management;
  - Airspace user operations, when interacting with the network management function.
- The operating structures relevant to all ATM phases:
  - **The Regional Level**, i.e. the entire network;
  - **The Sub-Regional Level**, i.e. a part of the network;
  - The Airspace Volume Level, i.e. **the Local Level** that is included in the Sub-Regional Level. Usually actions taken at the Local Level should not have, by definition, any impact on the network at the Regional Level.

Airport operations in the mid/short-term are covered by a separate document, Collaborative Airport Planning (M1). Airports are nonetheless scoped by this DOD when regarded as network nodes and not as local resources to manage.

From the perspective of an individual flight, the Medium/Short-term Planning Phase:

- Begins when the Airspace User declares flight intentions;
- Terminates with the instantiation of the flight RBT.

In-between, short-term planning approximately starts three hours before departure, when flight intentions are known in the form of a Shared Business Trajectory (SBT), with the required quality and accuracy levels.

The objective of the Medium/Short-term Planning Phase is to progressively come to an agreement on the Shared Business Trajectory or on the Mission Trajectory that will be flown by the Airspace User and facilitated by the Air Navigation Service Providers and Airports. To come to that agreement, network planning is of most importance. It has to consider the maturing SB/MTs in relation to each other and make sure that, once agreed, trajectories will be flown so that the target performance levels are met. On the day of operation, the

Reference Business Trajectories (RBTs) already agreed are taken into account by network planning.

The objective of military training during the Medium/Short-term Planning Phase is slightly different:

- It starts when the Military Airspace User request a segregated airspace volume;
- It terminates with the activation, or the cancellation of a segregated airspace volume.

Network operations are entrusted with a three-pronged task: plan demand (inc. traffic and airspace requirements); plan capacity (at airspace level from a network perspective); balance planned demand and capacity (at airspace, “airport-in-the-network” from a network perspective). This task is a work of continuous refinement since it depends on the quality and accuracy of the data progressively shared during the planning phase:

- Traffic and airspace requirements are planned on the basis of flight intentions (inc. SBTs) complemented by archived data and forecast/statistics;
- In parallel, ATM resources are planned and allocated in coordination with the Civil/Military Airspace Manager to match the demand at best;
- In the event of a predicted imbalance, DCB Solutions are implemented by the Sub-Regional Network Manager and the Regional Network Manager. To rebalance demand and capacity, capacity adjustments take precedence over demand adjustments.

Airspace users are fully involved in the collaborative demand and capacity balancing processes:

- Either during the agreements on how traffic demand or individual trajectories will be adjusted if ANSP and Airports cannot provide sufficient capacity;
- Or in the UDPP process designed to prioritise traffic queues caused by unexpected significant capacity shortfalls.

1 INTRODUCTION

1.1 PURPOSE OF THE DOCUMENT

This document provides a refined description of the SESAR concept of operations regarding operational processes taking place at the airspace and network levels during the medium/short-term planning phase. Referred as "Medium/Short-term Network Planning – M2", this document is part of a set of Detailed Operational Description (DOD) documents which refine and clarify the high level SESAR ConOps concept description in order to support the Episode 3 exercises, which have the objective of developing a better understanding of the SESAR Concept. This set of DODs can be considered as step 0.2 of E-OCVM [1] - i.e. the description of the ATM Operational Concept(s). The DOD document structure and content is derived from that of the Operational Service and Environment Definition (OSED) described by the ED-78A guidelines [2]. According to the ED-78A: "*the OSED identifies the Air Traffic Services supported by data communications and their intended operational environment and includes the operational performances expectations, functions and selected technologies of the related CNS/ATM system*". The structure of the DOD has been defined considering the level of details that can be provided at this stage – i.e. the nature and maturity of the concept areas being developed.

The complete detailed description of the mode of operations is composed of 10 documents according to the main phases defined by SESAR – i.e. Long-term Planning phase, Medium/Short-term Planning and Execution Phase (the complete set of documents is available from the Episode 3 portal home page [3]):

- The General DOD (G DOD) [4];
- The Long-term Network Planning DOD (L DOD) [5];
- The Collaborative Airport Planning DOD (M1 DOD) [6];
- The Medium & Short-term Network Planning DOD (M2 DOD), this document;
- The Runway Management DOD (E1 DOD) [8];
- The Apron & Taxiways Management DOD (E2/3 DOD) [9];
- The Network Management in the Execution Phase DOD (E4 DOD) [10];
- The Conflict Management in Arrival & Departure High & Medium/Low Density Operations DOD (E5 DOD) [11];
- The Conflict Management in En-Route High & Medium/Low Density operations DOD (E6 DOD) [12];
- The Episode 3 Lexicon (Glossary of Terms and Definitions) [13].

1.2 INTENDED AUDIENCE

The intended audience includes:

- Episode 3 partners;
- The SESAR community.

1.3 DOCUMENT STRUCTURE

The structure of the document is as follows:

- §2 of this document provides an overview of the functions addressed in this document;

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- §3 provides a description of how today's operation will be changed with the implementation of the concept area under analysis;
- §4 gives a description of the future operating principles. It details the benefits, the constraints, the human factors aspects, the enablers, the actors and the operating methods;
- §5 gives environment constraints of interest to the DOD (a general document provides this information at the global level);
- §6 lists roles and responsibilities applicable to this concept area;
- Annex A provides the list of the various scenarios relevant to this document;
- Annex B provides the summary of the Use Cases defined in this document;
- Annex C contains the traceability table of the SESAR Operational Improvement (OI) steps addressed by this document.

1.4 BACKGROUND

The Episode 3 project, also called "Single European Sky Implementation Support Through Validation", was signed on 18th April 2007 between the European Community and EUROCONTROL under the contract N° TREN/07/FP6AE/S07.70057/037106. The European Community has agreed to grant a financial contribution to this project equivalent to about 50% of the cost of the project.

The project is carried out by a consortium composed of EUROCONTROL, Entidad Publica Empresarial Aeropuertos Espanõles y Navegacion Aérea (AENA); AIRBUS France SAS (Airbus); DFS Deutsche Flugsicherung GmbH (DFS); NATS (EN Route) Public Limited Company (NERL); Deutsches Zentrum für Luft und Raumfahrt e.V.(DLR); Stichting Nationaal Lucht en Ruimtevaartlaboratorium (NLR); The Ministère des Transports, de l'Equipement, du Tourisme et de la Mer de la République Française represented by the Direction des Services de la Navigation Aérienne (DSNA); ENAV S.p.A. (ENAV); Ingenieria y Economia del Transporte S.A (INECO) ISA Software Ltd(ISA); Ingeneria de Sistemas para la Defensa de Espana S.A (Isdefe); Luftfartsverket (LFV); Sistemi Innovativi per il Controllo del Traffico Aereo (SICTA); THALES Avionics SA (THAV); THALES AIR SYSTEMS S.A (TR6); Queen's University of Belfast (QUB); The Air Traffic Management Bureau of the General Administration of Civil Aviation of China (ATMB); The Center of Aviation Safety Technology of General Administration of Civil Aviation of China (CAST); Austro Control (ACG); Luchtverkeersleiding Nederland (LVNL). This consortium works under the co-ordination of EUROCONTROL.

With a view to supporting SESAR Development Phase activities whilst ensuring preparation for partners SESAR JU activities, Episode 3 focuses on:

- Detailing key concept elements in SESAR;
- Initial operability through focussed prototyping exercises and performance assessment of those key concepts;
- Initial supporting technical needs impact assessment;
- Analysis of the available tools and gaps for SESAR concept validation; and
- Reporting on the validation methodology used in assessing the concept.

The main SESAR inputs to this work are:

- The SESAR Concept of Operations (ConOps): T222 [77];
- The description of scenarios developed: T223 [78] & [79];

- The list of Operational Improvements allowing to transition to the final concept: T224 [83];
- The definition of the implementation packages: T333 [82] & [83];
- The list of performance assessments exercises to be carried out to validate that the concept delivers the required level of performance: T232 [86];
- The ATM performance framework, the list of Key Performance Indicators, and an initial set of performance targets: T212 [80].

The objective of detailing the operational concept [75] is achieved through the development of the DODs. These documents are available for the SESAR development phase and are produced through the System Consistency work package of Episode 3. The life cycle of the DOD documents is defined through three main steps:

- Initial DODs provided as the first inputs to the Episode 3 project;
- Interim DODs containing first refinement and consolidation from Episode 3 partners aligned to the prototyping/evaluation work, provided by mid-project duration;
- Final DODs updated by the findings and reports produced by the prototyping/evaluation activities, provided at the end of the project.

1.5 Glossary of Terms

The Episode 3 Lexicon contains lists of agreed acronyms and definitions [13].

2 OPERATING CONCEPT-CONTEXT AND SCOPE

2.1 SESAR CONCEPT FOR MEDIUM/SHORT-TERM NETWORK PLANNING

The SESAR Operational Concept envisions the reorganisation of the current ATM planning process into a trajectory based collaborative layered planning. This reorganisation together with the particular emphasis put on trajectory-based operations and on collaborative planning has led to adopt the following requisites for the ATM medium/short-term planning process of SESAR.

The concept emphasises the role of trajectory management as a means of evolving current ATM services. Trajectory management entails the systematic exchange of aircraft trajectory data between the various participants in the ATM planning process (Shared Business Trajectories, Mission Trajectories), so as to ensure a common understanding of a flight, all along the planning spectrum. Trajectory management also states that the business / mission trajectory is fully owned by the airspace user and that when some constraints are needed, the solution shall be chosen by the user whenever possible.

Demand and Capacity Balancing (DCB) is a SESAR Operational Concept Element which echoes to the corresponding ICAO Operational Concept Component. DCB strongly relies on capacity management which will be much more flexible than today and will strive to match the predicted demand, to keep to a minimum the restrictions limiting access to the ECAC airspace.

The concept clearly states that DCB primarily aims at capacity management. In the event that enough capacity cannot be provided, users will be asked to amend their trajectories to respect capacity constraints in a collaborative planning process.

The emphasis for the ATM planning process shall thus be put on managing the balance of Capacity and Demand firstly planned in the long-term and then continuously refined all over the medium / short-term planning phases. In addition, ATM planning shall be organised in such a way that Collaborative Decision Making (CDM) processes are achieved between all ATM Stakeholders. CDM is conditional upon common information sharing throughout the entire planning spectrum. This will enable the various organisations to continuously adjust their own actions based on an enlightened and up-to-date knowledge of DCB events from the long-term planning down to the execution phase. In this context, the military community is considered as a true CDM partner, and the military requirements are fully addressed in this document.

Effort shall be put on implementing all the appropriate CDM enablers, including the Network Operations Planner (NOPLA). NOPLA will be the set of collaborative applications providing access to NOP. The aim of NOPLA is to facilitate the processes needed to reach agreements on demand and capacity.

The ATM planning process in SESAR is a process of maturation, possibly starting many years in advance, to end with execution on the day of operations. In-between, network operations are planned in two phases, the Long-term Planning Phase and the Medium/Short-term Planning Phase. Planning activities do not change radically from one phase to the other, since it is a work of continuous refinement relying on a number of core principles (Plan Traffic and Airspace Demand, Plan ATM Resources Capacity, Balance Demand and Capacity). However those processes are managed quite differently in the two phases: they do not obey the same operating principles, do not exactly involve the same actors (or with roles and responsibilities specific to each phase) and are not triggered by the same events. Furthermore, the quality of the data, such as information type or granularity level, available in the NOP and feeding these processes improves from Long-term to Medium/Short-term.

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Medium/short-term network planning, overseen by the network management function, will be founded on a number of key improvements:

- CDM (Collaborative Decision Making), enabled by common information sharing, including airspace volume requests, will be enlarged throughout the planning phase;
- Shared Business/Mission Trajectories will be the focus of decision-making during the whole planning phase. It will contain high-quality data and more information than the current flight plan. It expresses the specific needs of Airspace Users: "*The trajectories represent the business/mission intentions of the airspace users… Airlines, Business, General Aviation and the military all have 'business' or 'mission' intentions, even if the terminology is different and their specific trajectories have different characteristics. The trajectory is always associated with all the other data needed to describe the flight.*
- SBTs will be managed uniquely through a common operational object, the Network Operations Plan, accessible to all ATM Stakeholders via SWIM. Protection of secure and sensitive military data will be assured.

NOP is the cornerstone of network planning activities. The NOP provides visibility of the demand and capacity situation, the agreements reached, detailed business / mission trajectory information, resource planning information as well as access to simulation tools for scenario modelling. It draws on the latest available information being shared in the system. It includes scenarios (that are predefined most of the time) to assist in managing diverse events that may threaten the network in order to restore stability of operations as quickly as possible. In SESAR, the NOP is a dynamic rolling plan for continuous operations rather than a series of discrete daily plans.

The NOPLA is the set of interactive and collaborative applications providing access to the NOP. All ATM Stakeholders will be users, while stakeholders will use the NOP as the single portal for access to ATM information.

The NOP evolves continually from the planning phase until the execution phase through iterative and collaborative processes. During this evolution, for example:

- Airspace Users will declare their intentions through Shared Business Trajectories possibly including the requirement for airspace reservations;
- Agreements, changes to resources, change proposals for trajectories etc. are entered via the appropriate NOP applications and are accessible to all ATM Stakeholders;
- Network Management, working with ANSP and Airport Operators will assess the resource situation with regard to potential demand. Network Management will facilitate dialogue and negotiation to resolve demand/capacity imbalances in a collaborative manner. Dedicated tools will be used to assess network efficiency.

If after all possible demand / capacity balancing measures have been taken, there is still an excess of demand, Network Management will work in close collaboration with individual Airspace Users, Airports, and ANSPs to decide if the potential level of delay is acceptable or if and how the demand and the capacity shortfall will be managed. In case of significant capacity shortfall, a specific process called "User Driven Priority Process, UDPP (please go to 4.2.4.4) can be triggered by the Regional Network Manager at Airspace Users or/and at Airport requests, most of the time.

During the execution phase, the NOP will continue to reflect updated information, including data from aircraft, ensuring access to the most up to date situation.

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2.2 SCOPE OF THE DOCUMENT

The document addresses the network planning processes relevant to the Medium/Short-term Planning Phase, in relation to the operational improvements targeted by SESAR for 2020, hence addressing OI steps with an Initial Operational Capability of 2020. For those processes, the document describes what the improvements will change to the current operating method, what will enable those changes, what are the expected benefits/anticipated constraints/transition issues and how the improvements, through the processes, will influence the SESAR performance framework.

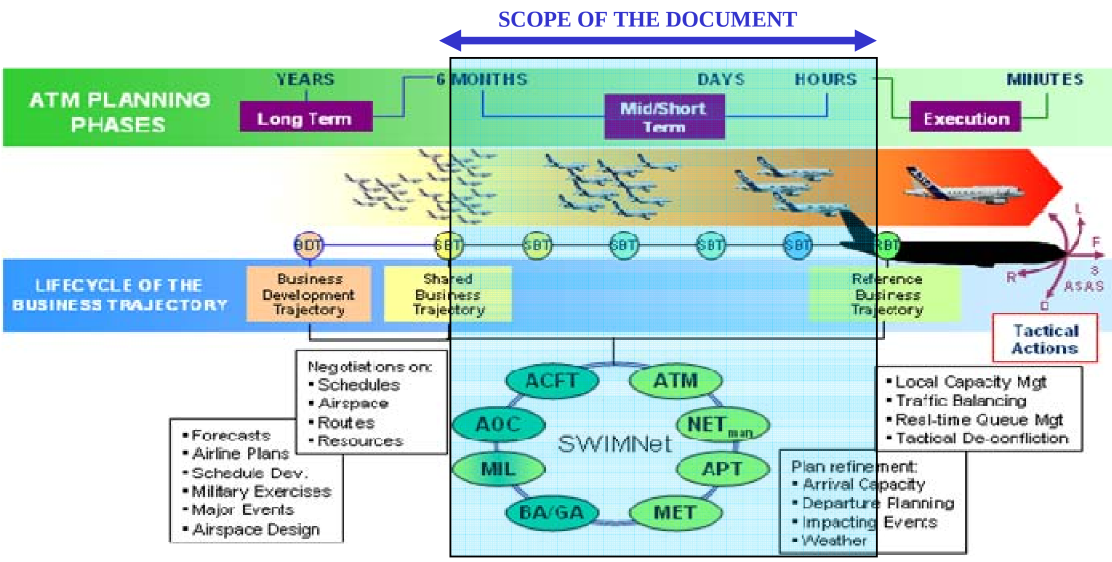


Figure 1: Collaborative Layered Planning (SESAR ConOps)

The document is entitled Medium/Short-term Network Planning (M2). Indeed, it endeavours to detail the operational description of the Medium/Short-term Planning Phase at network level, as well as airspace level. Airport processes are addressed in a separate document, Collaborative Airport Planning (M1) [6], unless they are network-related.

Medium/Short-term Planning succeeds to Long-term Planning, addressed in a single document: Long-term Planning (L) [5].

Long-term Planning starts years in advance and includes infrastructure changes, traffic growth previsions, capacity enhancement plans etc… In parallel, Airspace Users internally develop their business plans for the day of operation. Network planning mainly relies on statistics and forecast.

This DOD addresses on sequence the Medium-term, and then the Short-term Planning Phase:

Medium-term Planning starts some six months in advance and revises the long-term plans on the basis of declared flight intentions, initially known at seasonal level. Identified situations of imbalance are collaboratively worked out (selection, modification, elaboration of predefined DCB solutions) so as to prepare the short-term planning phase;

Short-term Planning starts on the day of operation: the information is almost fully available with a high level of quality and accuracy, i.e. a few hours (around 3h) before departure for each flight - i.e. when a SBT is available with the required quality and accuracy level. Short-term Planning works on a mixed picture: on the one hand, a small part of the traffic demand is still missing while on the other hand some flights are already in execution. It is worth noting that the short-term planning and the execution phases are interlaced.

The information contained within this DOD shall be used within Episode 3 to provide information suitable for the conduct of the validation/clarification exercises and aims to fulfil a number of requirements:

- Refine the relevant part of the SESAR concept;
- Document the operational processes that are envisaged to implement the concept;
- Identify the actors involved and potential working procedures.

2.3 ATM PROCESSES DESCRIBED IN THE DOCUMENT

The SESAR Concept of Operations is process orientated. Each process is triggered by a particular situation and has a goal to achieve, in interaction with its environment and with other processes. Each SESAR phase is structured around a number of processes and is carried out through their implementation.

Medium/Short-term Network Planning includes:

- Demand and Capacity Planning activities, i.e. the network-wide evaluation of the available capacity (allocation of ATM resources) and anticipated demand (determination of traffic and special use airspace requirements e.g. Military airspace requests);
- Demand and Capacity Balancing wherever and whenever an imbalance is foreseen, to optimise network operations well in advance and only leave to Dynamic DCB[1] those situations which are known at very short notice.

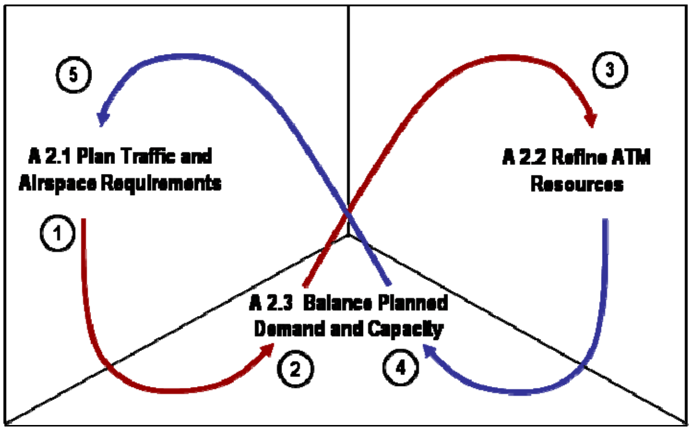
Both activities run in parallel and are interdependent. Demand and Capacity Balancing is conditional upon Demand and Capacity Planning and in return adjusts Demand and Capacity.

Network planning works on the following high-level processes:

- A2.1: Plan Traffic and Airspace Requirements;
- A2.2: Refine ATM Resources;
- A2.3: Balance Planned Demand and Capacity.

Note that process A2.4 – Prepare Flight for Departure – is a short-term airport process addressed by Collaborative Airport Planning (M1). It is triggered when network planning is over with respect to that particular flight: the SBT is validated a last time to become the RBT, and uploaded into the FMS, the a/c is sequenced in pre-departure and preparing for departure.

[1] Refer to Network Management during the Execution Phase (E4 DOD [10]).



1. Top-left, traffic demand and airspace requirements are refined;
2. At bottom-centre, a first Demand & Capacity Balancing is performed;
3. Top-right represents available ATM capacity optimisation;
4. At bottom-centre, a new DCB is performed according to the evolving airspace Users requests (top-left) and to ATM resources optimisation.

Figure 2: Principles of Medium-Term/Short-Term Network Planning

This very high-level Figure 2 is not only a simple presentation of the DCB loop. It can be applied to make it easier understanding the synopsis of the "Medium/Short-Tem planning process (Figure 3).

Medium/Short-term Network Planning is presented in details on Figure 3 to show the interactions between the three Services (Plan Traffic and Airspace Requirements, Refine ATM Resources, Balance Planned Demand and Capacity). They are provided through a number of key processes related to Airspace User Operations (in blue), Airspace Organisation and Management (in green), Demand and Capacity Balancing (in orange). Those processes operate as follows:

- Airspace Users declare their flight intentions and optimise their trajectory through SBTs (A2.1.2.2 and A2.1.2.3), in accordance with their business model – the NOP being visible to them at all times;
- The airspace is organised so as to respect their preferences and provide enough capacity (A2.2.1.2, A2.2.1.3 and A2.2.2.2), taking into account airspace requirements (A2.1.1);
- The planned traffic and airspace demand (A2.1.2.4 and A2.1.1) and the planned capacity (A2.2.3.2) are evaluated by the Network Management function, so as to detect potential imbalances (A2.3.1.2);
- In case of imbalance, a DCB Solution is selected in the Catalogue or elaborated with possible network impact assessment (A2.3.2.2.1, dotted arrow);
- The solution is then applied (A2.3.2.2.2), resulting in capacity adjustments (triggering A2.2.1.2, A2.2.1.3 and A2.2.2.2) and possibly demand adjustments if advisories are notified or constraints are necessary (triggering A2.1.2.2). Airspace reservations are also optimised accordingly, if possible (triggering A2.1.1). UDPP is exceptionally triggered to prioritise flights (A2.1.3, dotted arrow);
- The foreseen ATM picture is reassessed after implementation of the DCB Solution (A2.1.2.4, A2.2.3.2 and A2.3.1.2) etc.

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The DCB loop runs iteratively during the medium and short-term planning phases so that demand and capacity are approximately balanced when SBTs become stable: the execution of RBTs can start, being served by the optimal Capacity Plan and the optimal Airspace Use Plan (broad arrows).

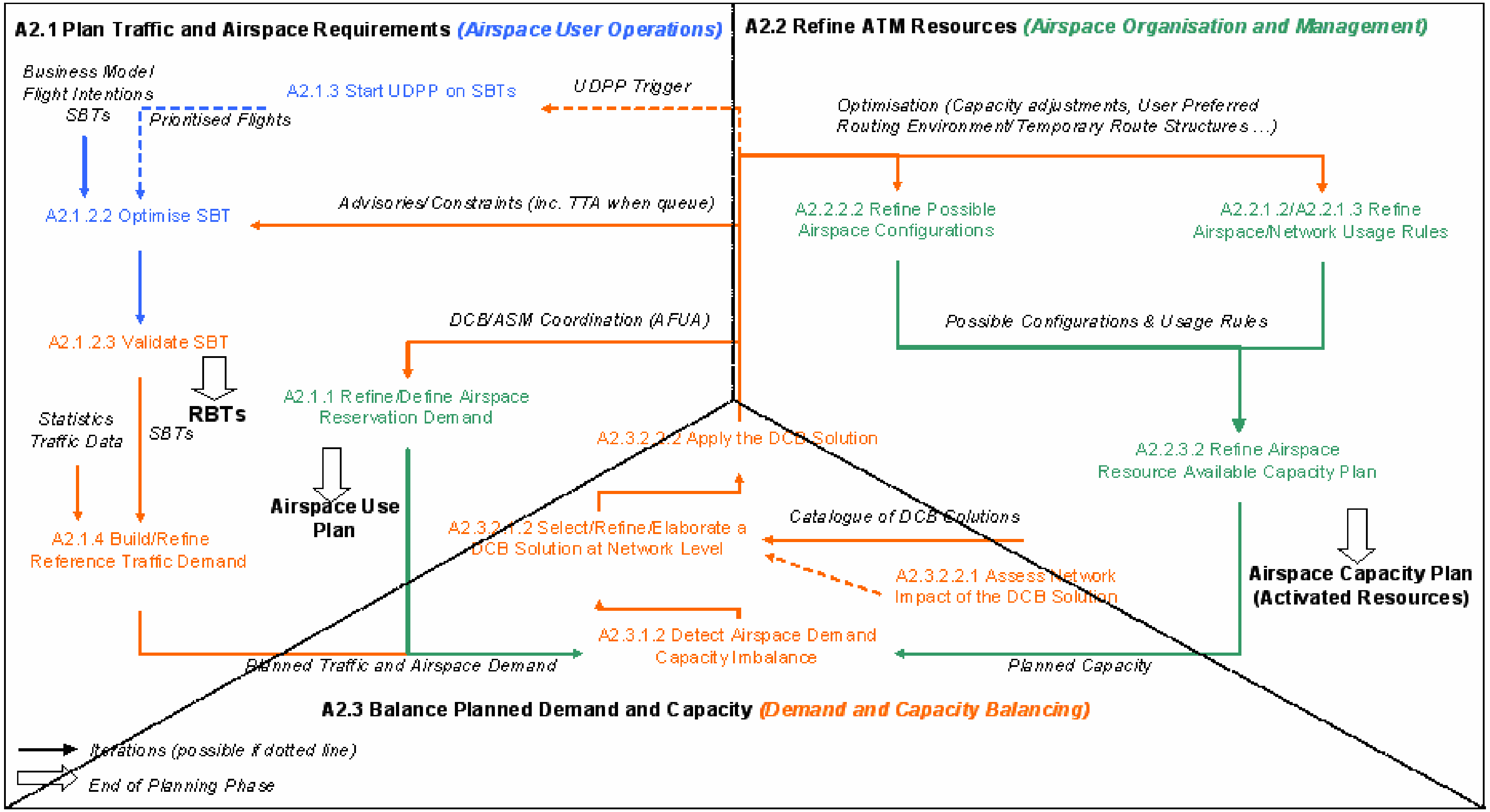

Figure 3: Synopsis of Medium/Short-term Network Planning

To complement the synopsis, the distinction is made hereunder between the medium-term and the short-term objectives assigned to each Service:

- A2.1: Plan Traffic and Airspace Requirements.

  Medium (Short)[2] Term Objectives: Refine the long-term airspace requirements (yearly plan) with new or more detailed requests[3], consistent with the resource available capacity plan and the related DCB solutions, when implemented. Refine the long-term user traffic demand with archived data and flight intentions (inc. available SBTs) to complement forecast and build the reference traffic demand.

  (Medium)[4] Short-term Objectives: Optimise SBT in conformance with airspace requirements and the constraints laid by DCB solutions. Manage UDPP and "append" UDPP results to SBTs, if need be.

- A2.2: Refine ATM Resources.

  Medium-term Objectives: Refine the long-term resource available capacity plan at airspace and network level through the refinement of usage rules and possible configurations.

  Short-term Objectives: Adjust the capacity plan (inc. changes in usage rules and configurations) in accordance with airspace requirements and DCB solutions implemented at short notice.

- A2.3: Balance Planned Demand and Capacity.

  Medium-term Objectives: Balance demand and capacity at airspace and sub-regional network level and check consistency with DCB at airport level, as well as DCB at regional network level (network impact assessment).

  Short-term Objectives: React to short-term situations of imbalance through the implementation of appropriate DCB Solutions (inc. queue management measures) and trigger UDPP if need be.

Each process involves different actors:

- Airspace Users, to declare their intentions through the Shared Business Trajectories;
- Civil/Military Airspace Managers, to handle airspace requirements and assign airspace resources;
- Sub-Regional Network Managers, to optimise airspace resources and balance demand and capacity;

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[2] In brackets to indicate that the missions are mainly completed in the medium-term.

[3] The yearly plan contains the planned exercises in terms of airspace impact (international, national, regional, altitude, managed and/or unmanaged airspace, etc). Generally, the size of these exercises both in terms of airspace and of participants, but also the logistics make exercise re-negotiation in time or space, impossible once the requirements have been agreed. It is assumed that 100% of the large scale exercises, whether civil or MIL are part of the yearly plan 6 months before operations.

Smaller scale and size exercises requirements are continuously updated through the NOP during the medium / short-term planning phases and the impact on airspace users assessed.

It is assumed that 90% (TBV) of the airspace requirements are known 2 days (TBV) before operations. It is also assumed that the remaining 10% (available 2 h or less before execution) deal with quick response alerts or such and as a consequence are not planned by definition and necessity of training relevance (train as you fight).

[4] In brackets to indicate that the missions are mainly completed in the short-term.

- The Regional Network Manager, to consolidate and coordinate medium/short-term planning activities so that the network can be operated as smoothly as possible.

The Network Operations Plan (NOP) is the focal point for all actors and all network planning activities.

Each process breaks down to the lowest level into processes which are covered either by airport planning (DOD M1 [6]) or by network (inc. airspace) planning activity (DOD M2).

Mid-level processes, when present, usually encapsulate low-level processes supported jointly by the airport and airspace/network planning.

The low-level processes addressed in this document are listed in Table 1 below.

Code[5]	ATM Process	Description	SESAR ConOps References
A2.1.1	Refine/Define Airspace Reservation Demand	This process allows the long-term airspace requirements to be refined with more detailed requests, e.g. military reservations, most of them being large scale exercises. But it also allows defining new airspace reservation demand during the medium/short-term planning phase.	F.2.6.6, F.3.7
A2.1.2.2	Optimise SBT	Through this process, SBTs are filed/refined and optimised to the best outcome for the user. This process is mainly a short-term process.	F.1, F.2, F.2.1, F.2.2, F.2.3, F.2.6.2, F.2.6.3, F.2.6.4, F.2.6.6, F.3.1, F.3.2, F.4.1
A2.1.2.3	Validate SBT	SBT Validation is the latest process before integration of the updated SBT inside the NOP.	F.1, F.2, F.2.1, F.2.2, F.2.3, F.2.3.2, F.2.6.2, F.2.6.4, F.2.6.6, F.3.1, F.3.2
A2.1.3	Start UDPP on SBTs	This is an AOC process dealing with activities related specifically to UDPP process. However, SBT revisions are still effectively processed through "Optimise SBT" while UDPP Results should usually consist of a prioritised flight list.	F.2.3, F.2.3.2, F.2.6.5.3
A2.1.4	Build/Refine Reference Traffic Demand	The Reference Traffic Demand is elaborated and used during the Medium-term Planning Phase. The reference planned traffic demand, built in a first step with only some SBTs in medium-term, is continuously refined as soon as more SBTs are available or optimised.	F.2.6.2, F.2.6.4, F.3.1, F.3.2
A2.2.1.2	Refine Airspace Usage Rules	In this process, airspace volume (including military areas) and route (route crossing military areas, SIDs, STARs, routes that can be activated in high density areas …) usage rules are refined if required.	F.2.6.3, F.3

[5] This refers to the code associated to the process in the ATM Process Model SADT diagrams.

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Code[5]	ATM Process	Description	SESAR ConOps References
A2.2.1.3	Refine Network Usage Rules	This process produces network usage rules as a consistent check of refined Airspace Usage Rules and refined Airport Usage Rules.	F.2.6.2, F.2.6.3, F.2.6.5.3
A2.2.2.2	Refine Possible Airspace Configurations	The possible airspace configurations refinement process aims at refining the possible configurations established in the long-term planning phase. For each airspace resource, times of use are specified, e.g. per day type - i.e. week day, week-end, holiday, special event day.	F.2.6.2, F.2.6.3, F.2.6.4, F.3
A2.2.3.2	Refine Airspace Resource Available Capacity Plan	Airspace Available Resource Capacity Planning gathers for each Airspace Configuration the available capacity, taking into account human resources plans, enhancement plans, etc.	F.2.6.3, F.2.6.4, F.2.6.5.2, F.3
A2.3.1.2	Detect Airspace Demand Capacity Imbalance	This process aims at balancing demand and capacity for each Airspace Volume. For each day of operation, flights are scheduled over time periods according to scheduled available capacity. Then, resources scheduling are consolidated in order to detect demand capacity imbalance.	F.2.6, F.2.6.5, F.2.6.5.2, F.3
A2.3.2.1.2	Select/Refine/Elaborate a DCB Solution at Network Level	This process allows the selection/refinement/elaboration of a DCB Solution at the Airspace level. Taking into account the detected Demand/Capacity Imbalance, the resulting Airspace DCB Solution is provided with an associated cost. Note: Solution acceptance depends on the related KPIs that are part of the target performance objectives defined and agreed by all Actors during the long-term planning phase.	F.2.6.3, F.2.6.4, F.3
A2.3.2.2.1	Assess Network Impact of the DCB Solution	This process describes respectively how the Sub-Regional and Regional Network Manager assesses the local/network impact of a DCB solution (possibly made of several DCB measures). Network impact assessment must be performed the more as DCB solutions will be defined most of the time at local level. Distant network impact cannot be detected at sub-regional/local level.	F.2.6.2, F.2.6.3, F.2.6.4

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Code[5]	ATM Process	Description	SESAR ConOps References
A2.3.2.2.2	Apply the DCB Solution	This process describes how the Sub-Regional Network Manager or APOC Staff may send a GO for implementation concerning the DCB solutions that have been activated in the NOP locally and require Network Impact assessment. Not all DCB solutions will require Network Impact assessment: those having sub-regional/local impact only (this being determined during the long-term planning phase) will not need network impact assessment in order to be published in the NOP (default GO for implementation).	F.2.6.2, F.2.6.3, F.2.6.4

Table 1: Low-level processes scoped by M2

2.4 Related SESAR Operational Improvements (OIs)

A table listing the SESAR Operational Improvements steps that are relevant to this DOD, and the associated processes, is provided in Annex C (refer to §11).

2.5 Related SESAR Performance Requirements

SESAR has defined several Key Performance Areas (KPAs) and Performance Requirements (objectives, indicators and targets) which are defining system wide effectiveness and thus, for most of them, affect the various components of the future 2020 ATM target system. The table below shows a list of those Key Performance Indicators (KPIs) which are directly or indirectly affected by Network Planning [76]. The KPIs are organised by KPA and performance requirements as defined by SESAR:

Key Performance Area (KPA)	Description
Access & Equity	Access: This Focus Area covers the segregation issue: whether or not access rights to airspace and airports are solely based on the class of airspace user. In other words, is shared use by classes of airspace user allowed, and how much advance notice of this accessibility is provided. Shared use of airspace by different classes of airspace users should be significantly improved (classes defined by type of user, type of aircraft, type of flight rule). Where shared use is conflicting with other performance expectations (safety, security, capacity, etc.), viable airspace alternatives will be provided to satisfy the airspace users' needs, in consultation with all affected stakeholder. No indicators defined yet. Equity: The scope covers the subject of equitable access, i.e. the prioritisation issue: under shared use conditions (i.e. access is possible), to what extent is access priority based on the class of airspace user. No indicators defined yet.
Capacity	This KPA addresses the ability of the ATM system to cope with air traffic demand (in number and distribution through time and space). The challenge in terms of capacity in the airspace environment is to meet the traffic growth demand and to limit the en-route delay. The strategy aims at widening the current notion of Traffic Flow and Capacity Management from the mere allocation of slots to the optimisation of traffic patterns and capacity management with the emphasis on optimising the network capacity through collaborative decision-making processes. KPIs affected by Network Planning: • Annual growth rate for the number of IFR flights that can be accommodated in Europe **CAP.3.OBJ1.IND2** • Annual number of IFR flights that can be accommodated in Europe **CAP.3.OBJ1.IND1** • Daily number of IFR flights that can be accommodated in Europe **CAP.3.OBJ1.IND3** • Daily number of IFR movements (departures plus arrivals) **CAP.2.OBJ1.IND2** • Hourly number of IFR movements (departures plus arrivals) **CAP.2.OBJ1.IND1** • Annual number of IFR flights able to enter the airspace volume **CAP.1.OBJ1.IND2** • Hourly number of IFR flights able to enter the airspace volume **CAP.1.OBJ1.IND1**

<table>
<tr><th>Key Performance Area (KPA)</th><th>Description</th></tr>
<tr><td>Cost Effectiveness</td><td>This KPA addresses the cost of gate-to-gate ATM in relation to the volume of air traffic that is managed.

In line with the political vision and goal, the working assumption for Cost Effectiveness design target is to halve the total direct European gate-to-gate ATM costs from 800 €/flight to 400 €/flight, in 2020 (2005 Euros).

KPIs affected by Network Planning:
• Average cost per flight, at European annual level CEF.1.1.OBJ1.IND1
• Average indirect cost per flight, at European annual level (The scope covers the extra costs incurred by airspace users through non-optimum performance in the Efficiency, Flexibility and Predictability KPAs) CEF.2.OBJ1.IND1</td></tr>
<tr><td>Efficiency</td><td>This KPA addresses the actually flown 4D trajectories of aircraft in relationship to their initial Shared Business Trajectory

The efficiency of individual flight operations has to be improved such that:
• At least 98% of flights depart on time (punctuality with respect to a 3 minutes tolerance window around off-block departure), the average departure delay of delayed flights does not exceed 10 minutes;
• The flight duration is “normal” (with respect to a 3 minutes tolerance window around block-to-block time) more than 95% of the time, the average flight duration extension of flights does not exceed 10 minutes;
• Less than 5% of flights suffer additional fuel consumption of more than 2.5%, for flights suffering additional fuel consumption of more than 2.5%, the average fuel consumption does not exceed 5%.

KPIs affected by Network Planning:

<u>Fuel Efficiency:</u> Conform to the recalculated Initial Shared Business Trajectory (= initial SBT corrected for actual weather) Fuel consumption to the greatest extent :
• Occurrence: % of flights with additional fuel consumption of more than 2.5% of intended consumption EFF.2.OBJ1.IND1
• Severity: Average fuel deviation of deviated flights EFF.2.OBJ1.IND2

<u>Mission efficiency:</u> Following military trajectory models focus is to reflect the economic impact of transit times associated with military training activities.
• Impact of Airspace Location on Training EFF.3.OBJ2.IND1 (Provides a measurement of the time spent actually in the designated operating area, achieving the mission training objectives, compared with the total time airborne)
• Economic impact of Transit EFF.3.OBJ1.IND1
(Provides a measurement of the economic cost of the time spent by aircraft flying from their bases into their designated operating area and returning at the end of the exercise).

<u>Temporal efficiency EFF.1:</u> This Focus Area covers the magnitude and causes of deviations from planned (on-time) departure time and deviations from Shared Business Trajectory durations):
• Occurrence: % of flights with a normal flight duration EFF.1.OBJ2.IND1
• Severity: The average flight duration extension of flights with an extended flight duration EFF.1.OBJ2.IND2

Continually reduce the departure delay due to ATM EFF.1.OBJ1 (Only</td></tr>
</table>

Key Performance Area (KPA)	Description
	primary delay due to ATM in nominal conditions is considered (Flights delayed for non ATM reasons are excluded but would be considered against flexibility performance): • Occurrence (Punctuality): % of flights departing on-time **EFF.1.OBJ1.IND1** • Severity (Delays): The average departure delay of delayed flights **EFF.1.OBJ1.IND2**
Environmental Sustainability	This KPA addresses the role of ATM in the management and control of environmental impacts. The aims are to reduce adverse environmental impacts (average per flight); to ensure that air traffic related environmental constraints are respected; and, that as far as possible new environmentally driven non-optimal operations and constraints are avoided or optimised as far as possible. This focus on environment must take place within a wider "sustainability" scope that takes account of socio-economic effects and the synergies and trade-offs between different sustainability impacts. KPIs affected by Network Planning: • Amount of CO_2, H_2O, NO_x emissions which is attributable to inefficiencies in ATM service provision **ENV.4.OBJ1.IND1-4** • Percentage of cases in which local environmental rules affecting ATM are respected **ENV.3.OBJ1.IND1** • Percentage of cases in which the best alternative solution from a European Sustainability perspective is adopted **ENV.1.OBJ2.IND1** • Percentage of proposed ATM constraints which has been subjected to an environmental/socio-economic assessment **ENV.1.OBJ1.IND1** No indicators on noise emissions yet defined.
Flexibility	This KPA addresses the ability of the ATM system and airports to respond to "sudden" changes in demand and capacity: rapid changes in traffic patterns, last minute notifications or cancellations of flights, changes to the Reference Business Trajectory (pre-departure changes as well as in-flight changes, with or without diversion), late aircraft substitutions, sudden airport capacity changes, late airspace segregation requests, weather, crisis situations, etc. Allow Airspace Users translating in time their Business Trajectory to the greatest extent **FLX.1.OBJ1**: • Flexibility demand: % of flights requesting time translation from initial RBT **FLX.1.OBJ1.IND3** • Frequency: % of Business Trajectory delayed more than 3 minutes as a consequence of a 4D Trajectory time translation **FLX.1.OBJ1.IND1** • Lead time is the time difference between the time request and the earliest time constraint (e.g. gate, de-icing, departure runway, weather…) **FLX.1.OBJ1.IND4** • Severity: Average delay of delayed flights as a consequence of a 4D Trajectory time translation **FLX.1.OBJ1.IND2** Allow Airspace Users updating their Business Trajectory for a full redefinition to the greatest extent : • Flexibility demand: % of flights requesting BT redefinition from initial RBT **FLX.1.OBJ2.IND4**

Key Performance Area (KPA)	Description
	• Frequency: % of Business Trajectory delayed more than 3 minutes as a consequence of the Business Trajectory full re-definition **FLX.1.OBJ2.IND2** • Frequency: % of Business Trajectory update accepted possibly with time penalty as a consequence of the Business Trajectory full re-definition **FLX.1.OBJ2.IND1** • Lead time is the average time difference between the time request and the earliest time constraint (e.g. gate, de-icing, departure runway, weather…) **FLX.1.OBJ2.IND5** • Severity: Average delay of delayed flights as a consequence of the Business Trajectory full re-definition **FLX.1.OBJ2.IND3** Accommodate non-scheduled flight departures **FLX.2.OBJ1:** • % of non-scheduled flights delayed more than 3 minutes **FLX.2.OBJ1.IND1** • Average delay of delayed non-scheduled flights **FLX.2.OBJ1.IND2** Suitability for military requirements **FLX.4** (Focus is to reflect the suitability of the ATM System for military requirements related to the flexibility in the use of airspace and reaction to short-notice changes.) • Be able to increase/decrease the amount of airspace segregation as required **FLX.4.OBJ1** • Adherence to optimum Airspace Dimension **FLX.4.OBJ2.IND1** • Efficient Booking Procedure **FLX.4.OBJ4.IND1**
Participation	At the level of overall ATM performance, the KPA "Participation by the ATM Community" covers quite a diversity of objectives and involvement levels. Participation by the ATM community can be considered in the following dimensions: a) Separate involvement issues and approaches apply for each of the ATM lifecycle phases: planning, development, deployment, operation and evaluation/improvement of the system. b) "Meeting the (sometimes conflicting) expectations of the community" implies that participation and involvement should be explicitly pursued for each of the other Key Performance Areas: access and equity, capacity, cost effectiveness, efficiency, environment, flexibility, global interoperability, predictability, safety, security. c) Involvement should be monitored and managed per segment of the ATM community. The three dimensions serve as a framework for focused tracking of the various participation and involvement initiatives, assessment of the actual level of involvement against the desired level, and identification of weaknesses and improvement opportunities. The aim is to achieve a balanced approach to ATM community involvement. Different methods and levels of involvement are possible: • Informing the community; • Obtaining feedback and advice from the community; • Collaborative decision making; and

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Key Performance Area (KPA)	Description
	• Consensus building. No indicators defined yet.
Predictability	This KPA addresses the ability of the ATM system to ensure a reliable and consistent level of 4D trajectory performance. In other words: across many flights, the ability to control the variability of the deviation between the actually flown 4D trajectories of aircraft in relationship to the Reference Business Trajectory. The predictability of individual flight operations has to be improved such that: • Less than 5% of flights suffer arrival delay of more than 3 minutes; • The average delay of delayed flights (with a delay penalty of more than 3 minutes) will be less than 10 minutes; • Variability of flight duration (block to block) is 0.015 (meaning for a 100-minute flight duration, more than 95% flights arrives on-time, according to arrival punctuality target); • Reactionary delays are reduced by 50% by 2020 compared to 2010 baseline. KPI concerning Knock-on Effect: • Number of cancelled flights **PRD.3.OBJ1.IND2** • Reactionary delay **PRD.3.OBJ1.IND1** KPI concerning On Time Operation: • Arrival punctuality: % of flights with an arrival delay of more than 3 minutes **PRD.1.OBJ1.IND1** • Arrival punctuality : Average arrival delay of delayed flights **PRD.1.OBJ1.IND2** • The coefficient of variation of gate to gate time intervals **PRD.1.OBJ2.IND1** KPI concerning Service Disruption: • Number of cancelled flights per type of disruption **PRD2.OBJ1.IND1** • Number of diverted flights per type of disruption **PRD2.OBJ1.IND2** • Total delay due to disruption per type of disruption **PRD2.OBJ1.IND3**

Key Performance Area (KPA)	Description
Safety	This KPA addresses the risk, the prevention and the occurrence and mitigation of air traffic accidents. The number of ATM induced accidents and serious or risk bearing incidents do not have to increase and, where possible, have to decrease, as a result of the introduction of SESAR. Considering the anticipated increase in the European annual traffic volume, the overall safety level would gradually have to improve, so as to reach an improvement factor 3 in order to meet the safety objective in 2020. This is based on the assumption that safety needs to improve with the square of traffic volume increase, in order to maintain a constant accident rate. KPI concerning Network Planning: • Safety level, Accident probability per operation or flight hour, relative to the 2005 baseline **SAF.1.OBJ1.IND1** • Severe DCB/Complexity issues not detected/unsolved during network planning **SAF.1OBJ1.IND2**
Security	This KPA covers a subset of aviation security. It addresses the risk, the prevention, the occurrence and mitigation of unlawful interference with flight operations of civil aircraft and other critical performance aspects of the ATM system. This includes attempts to use aircraft as weapons and to degrade air transport services. Unlawful interference can occur via direct interference with aircraft, or indirectly through interference with ATM service provision (e.g. via attacks compromising the integrity of ATM data or services). ATM security also includes the prevention of unauthorised access to and disclosure of ATM information. No indicators defined yet.

Table 2: Key Performance Areas scoped by M2

3 CURRENT OPERATING METHOD AND MAIN CHANGES

A number of Operational Improvements (identified by SESAR and listed in section 11) are required if the ATM system is to live up to the expectations of the airspace users by 2020. The implementation of such OIs will by essence reshape the current operating method. Some operating principles will change, some will not.

3.1 ASPECTS OF TODAY'S OPERATIONS THAT WILL REMAIN

Medium-term Planning Phase

- Network planning based on demand planning, capacity planning, demand and capacity balancing;
- Network planning reflected by an operations plan;
- Demand planning reflected by a reference traffic demand and an airspace use plan;
- Coordination between Network Management and Airspace Management before the day of operation;
- Reference traffic demand based on intentions and predictions;
- Capacity planning reflected by a capacity plan;
- Capacity plan based on the definition of ATM resources and the selection of configurations adapted to the demand;
- Some types of DCB Solution already exist, such as predefined scenarios.

Short-term Planning Phase

Short-term DCB Solutions will still be necessary, because:

- A part of the traffic/airspace demand will only be known on the day of operation;
- The predictability of weather and unexpected events will remain limited in the medium-term.

3.2 ASPECTS OF TODAY'S OPERATIONS THAT WILL CHANGE

Medium-term Planning Phase

- Planning decisions will be made as late as possible relative to the time available to affect the outcome;
- Medium-term Network Planning driven by the performance-based approach to ATM: Demand and Capacity are balanced so as to meet the Service Level Agreements[6] on the day of operation;
- Medium-term Network Planning founded on trajectory-based operations: Demand and Capacity are balanced so as to ensure the best possible outcome for as many flights[7] as possible;

[6] SLAs are defined during the Long-term Planning Phase (refer to DOD L). They may define binding objectives for the Provider, such as the Quality of Service expected by the User on delivery.

- Medium-term Network Planning respectful of the trajectory ownership principle: (1) DCB tries not to constrain Airspace Users by providing the capacity needed to accommodate the demand. (2) When imposed by the network, constraints are negotiated with all the interested parties, until agreement or arbitration. (3) Airspace Users decide on how to meet every constraint;
- Medium-term Network Planning achieved through: (1) Common Information Sharing: Airspace Users have access to the NOP at all times; (2) Collaborative Decision Making: Airspace Users are fully involved in the process of DCB;
- Collaborative Layered Planning supported by the NOP: a work of continuous refinement dealing with thinner and thinner granularity levels as the day of operation approaches: more and more data are available to the network, their quality and accuracy increase; and the network permanently respond to it in an appropriate manner;
- Interactive Network Planning supported by the NOP. The NOP is prepared for the Airspace Users and with the Airspace Users;
- The NOP is not a daily operations plan but a dynamic rolling plan;
- Coordination between Network Management and Airspace Management extended to the day of operation;
- Airspace Organisation and Management driven by the preferences of the Airspace Users, as expressed in their Shared Business/Mission Trajectory;
- The Shared Business/Mission Trajectory as the vehicle for flight planning, i.e. the means to declare flight intentions;
- The Shared Business/Mission Trajectory as the vehicle for CDM during network planning, through trajectory revisions (1) initiated by the Airspace User or (2) requested by an ATM Stakeholder.

Short-term Planning Phase

- A major change from current situation: the objective, a TTA/TTO, is set on the congested point. Airspace Users as owner of the STB/RBT decide on how to absorb the delay;
- The Queue Management process as a means to optimise the utilisation of a constrained resource when there is still an excess of traffic demand after all possible measures have been taken to adjust capacity;
- The User Driven Prioritisation Process as a means to prioritise flights when the mismatch between demand and capacity exceeds an agreed threshold (significant capacity shortfall);
- DCB in short-term planning and execution phases viewed as a unique seamless process.

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[7] DCB will not just optimise flows, regardless of the flights they consist of.

3.3 ASPECTS OF TODAY'S OPERATIONS THAT WILL DISAPPEAR

Medium-term Planning Phase

The notion of mandatory constraint (such as mandatory re-routing): DCB solutions are the result of an open negotiation (if time permits) with Airspace Users, taking the form of a CDM process, both during definition and for application during the short-term planning phase.

Short-term Planning Phase

- Replacement of the unique central multi-constraints slot allocation mechanism[8] based on **ground delay assignment** by multi-scoped demand/capacity balancing and queuing processes at regional and sub-regional level. In the current system, a central network service is working out a target time over the most penalising capacity constraint from which:
  - A Target Take-Off Time (*TTOT*) is derived 2 hours before the flight Expected Off-Block Time;
  - The AO calculates its own Target Off-Block Time from the TTOT.
- In the continuity of the previous item, no more ATFM slots frozen around 30' before flight Off-Block Time will exist.
- These rather static processes will be replaced by more dynamic, responsive and user oriented processes.
- Nevertheless, a process assigning Target Take-Off Times will have to remain as a back-up measure for major planning failure and imponderability (e.g. as a default solution during a UDPP process).

[8] Such as Computed Assisted Slot Allocation (CASA) [15].

4 PROPOSED OPERATING PRINCIPLES

4.1 FOREWORD

The processes, sub-processes and use cases described in this DOD are those related to DCB for the Manage Medium/Short-term Planning Phase (refer to the ATM process model [14] in order to have a complete view of the different processes and sub-processes).

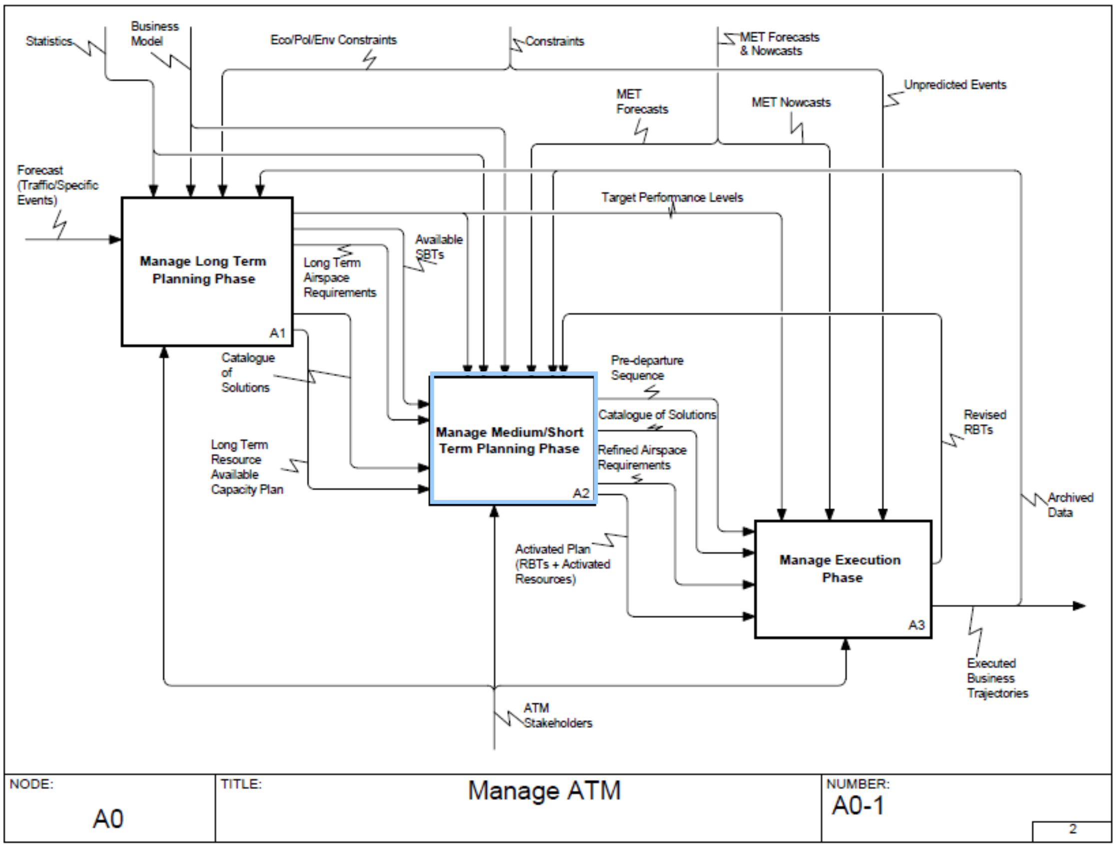

Figure 4: ATM Process Model - High Level SADT diagram

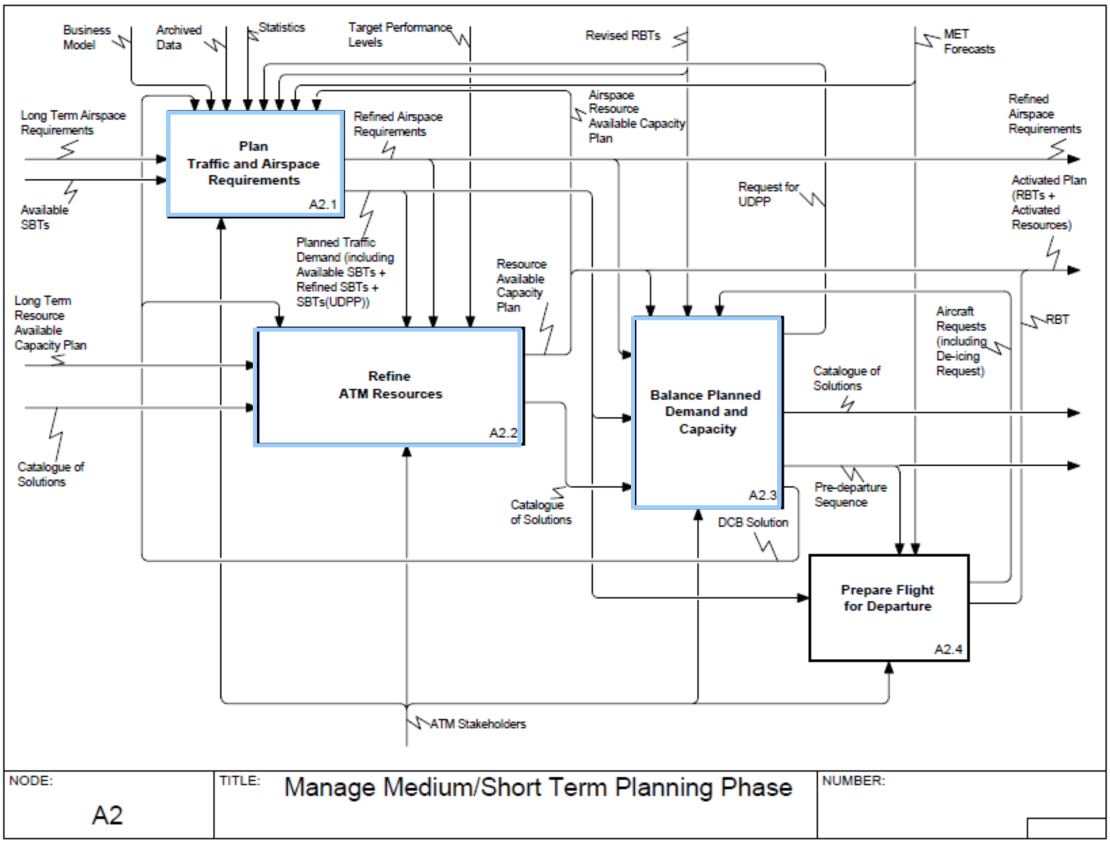

Figure 5: Manage Medium/Short-term Planning Phase High-level processes

4.2 NETWORK SUPPORT TO PLAN TRAFFIC AND AIRSPACE REQUIREMENTS (A2.1)

4.2.1 Scope and Objectives

Since sub-process A.2.1.2.1 "Schedule Flights" and A2.1.2.4 "Schedule Aircraft Operations" are Airport sub-processes of A2.1 "Plan Traffic and Airspace Requirements", it has been agreed that prefix "Network support to…" and prefix "Airport support to…" will be added to process name "Plan Traffic and Airspace Requirements" respectively in DOD M1 and M2. This naming convention applies throughout the documents each time a high-level process involves airport and network aspects.

In the medium-term network planning phase, the demand is planned, meaning that the flight intentions for the day of operation are progressively shared by the Airspace Users and gathered by the Regional Network Manager[9] through the NOP [DCB-0103].

Because a part of the demand is unknown prior to the day of operation, the Regional Network Manager completes the declared flight intentions with archived data. This traffic demand is known as the "Reference Traffic Demand". It is used to build the ATM picture for the day of

[9] The long-term demand is mainly based on forecast and statistics, which are not specific to the day of operation, but relevant to a season or a time period…

operation. These data are offered to Sub-Regional Network Managers, to Airspace Users, to Civil/Military Airspace Managers and to all other concerned actors, through the NOP [DCB-0103].

In the meantime, Civil/Military Airspace Managers (in their function of local ASM and AMC) collect Airspace Requirements[10] from Civil and Military Airspace Users and propose the related Airspace Reservation Plan, in close cooperation with the Sub-Regional Network Manager.

The flexibility of the military airspace structure makes it easier the elaboration of the Airspace Use Plan, through:

- Availability of more Cross Border Operations/Areas [AOM-0204];
- Improvement of the definition of ad-hoc structure depending on Military requests and requirements versus the Civilians needs [AOM-0206];
- Full implementation of military areas able to change according to time [AOM-0208].

The CDM process is achieved through:

- Refinement of available ATM resources, - i.e. plan capacity consistently through the definition of a relevant Airspace Resource Available Capacity Plan (A2.2 Refine ATM Resources process) taking into account MET forecasts [IS-0501], airspace constraints, technical restrictions, airport capabilities, and unexpected events;
- Demand and Capacity Balancing Solutions (A2.3 Balance Planned Demand and Capacity). The Airspace Users, working together with Network Managers and with Airspace Managers, agree on the DCB Solutions to be applied: airspace re-configurations, SBT/Mission Trajectory adjustments [AUO-0204] [AOM-0304], routing advisories, mandatory route scheme when and where required [AOM-0403], otherwise use of a free-route environment [AOM-0501] [AOM-0502].

This CDM process should end with the definition of acceptable Airspace Use Plan and set of DCB Solutions in order to satisfy both Military and Civilian needs - i.e. minimise changes to Airspace Use Plan and traffic demand adjustments.

The ATM picture is incrementally refined from the medium-term to the short and progressively approaches reality: more information is now available to all stakeholders via the NOP. This will ensure that the ATM system will be prepared to cope with the majority of events that might disrupt the smooth running of the day of operation.

In the short-term network planning phase, DCB Solutions proceed with:

- Capacity adjustments: (1) accurate weather forecast is now available, and (2) more and more flight intentions are defined/refined [AUO-0204] in the form of SBTs/Mission Trajectories with a high level of detail allowing DCB complexity analysis. Some users' intentions will still not be known (e.g. business aviation) so that predicting traffic demand is still relevant. These are the main network management functions, both as regional and sub-regional levels, that collaborate closely to assure the best possible capacity plan is offered to airspace users;

[10] In fact, Airspace Users requests and related requirements.

- Traffic and airspace demand adjustments: final plans are made for airspace configurations and any associated/complementary DCB constraint. Subsequently, the Network Management function informs the users via the NOP of instances where traffic demand is likely to exceed capacity first and max admissible complexity next. The Airspace Users, working together with the Network and (indirectly) Airspace Managers agree on the DCB Solutions to be applied: airspace re-configurations, SBT/Mission Trajectory adjustments, queue management. In the case of a severe capacity drop, a specific negotiation process called UDPP (User Driven Prioritisation Process) will be triggered by the Regional Network Manager to respect the reduced capacity ATM element (airport or airspace block) [AUO-0102]. The concerned Airspace Users will be responsible to respond in a collaborative manner to the Network Management function with a demand that best matches the available capacity, because of the shift to user trajectory ownership. Airspace Users have to recommend to the Network Management a priority order for flights impacted by the capacity reduction [AUO-0204]. A specific delay management function is implemented at DCB network level to assist Airspace Users in the UDPP process [DCB-0305].

Considering these elements, the local level bodies will first set up the following plans to the Regional Network Manager through the sub-regional network manager and the Civil/Military Airspace Managers:

- The traffic demand of reference;
- The resource available capacity plan that contains the capacity plan, the airspace usage rules, and the airspace resource availability;
- The catalogue of solutions;
- The planned DCB solutions.

This data is continuously evolving as part of the NOP [DCB-0103], but snapshots are needed at certain time horizons in order to co-ordinate the local, the sub-regional and the regional actors, and the Airspace Users, inside every FAB but also between FABs.

The collaborative planning process terminates when the Reference Business Trajectory /Mission Trajectory is published as a Transition from SBT to RBT.

4.2.2 Assumptions

The main assumptions are described below:

- Seasonal schedules have been published when medium/short-term planning starts meaning that initial SBTs (origin, destination, time) are known in the case of scheduled flights;
- The requirements related to large-scale airspace needs are known when medium/short-term planning starts;
- Most of the traffic (90% TBV) is known before the day of operations;
- Most of the airspace requirements (90% TBV) are known before the day of operations;
- The SBT/Mission Trajectory validation process will be performed taking into account network constraints. The process will depend on the constraint category: either static - e.g. resource unavailability, or dynamic - e.g. capacity shortage. It may also depend on the time remaining before RBT publication/flight execution in order to take into account uncertainty. The longer this time, the looser the allowed tolerances (e.g. in terms of adherence to constraints) to provide the system with stability and let airspace users optimise their SBT/Mission Trajectory according to their preferences;

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- UDPP is a short-term process. It is triggered to balance demand and capacity in the event of a “severe” airport capacity shortfall. Severity can be defined initially as a capacity decrease, as a maximal capacity overload (for example 20%) or as a maximal overload during a time period (for example, 3 hours in a row with a 10% capacity overload). Ultimately, the severity should be reflecting the impact of the capacity drop e.g. measured in delay per delayed aircraft;
- Basic User/ANSP data-link and NAV Systems are capable to support dynamic change of airspace usage rules (promulgation of rules, re-programming Nav Systems, conformation of information reception, etc.).

4.2.3 Expected Benefits, Issues and Constraints

The expected benefits are as follows:

- Common traffic picture shared by all actors, including Airspace Users, through the NOP;
- High-fidelity traffic picture thanks to the quality of the flight planning data: SBTs validated by the Network Management Function whenever updated;
- Continuous refinement of the traffic picture from 6 months before operations up to the day of operations;
- Through the NOP: better knowledge and usage by Aircraft Operators of available airspace resources and traffic demand (congested areas), which contributes to a better airspace capacity use;
- Through assistance to flight planning: shared SBTs are of a better quality, which in turn decreases the need for subsequent changes/corrections to incorrect submissions. The service being also a major enabler of increased automatic acceptance rate should lead to major cost reductions - i.e. less manual interventions.

4.2.4 Overview of Operating Method

4.2.4.1 Refine/Define Airspace Reservation Demand (A2.1.1)

This process allows the long-term airspace requirements to be refined with more detailed requests, e.g. military reservations mostly for large-scale exercises. It also allows the definition of new airspace reservation demand during the medium/short-term planning phase.

The main drivers related to this process are the following:

- Inputs:
  - Long-term Airspace Requirements.
- Constraints/Triggers:
  - MET Forecast;
  - Airspace Resource Available Capacity Plan;
  - DCB Solution[11].

[11] Trade-off between civilians and military airspace requirements.

- Human Actors:
  - o Exercise Director;
  - o Civil/Military Airspace Manager[12].
- Outputs:
  - o Refined Airspace Requirements.

The Civil/Military Airspace Manager in close cooperation with the Sub-Regional Network Manager and Regional Network Manager prepares potential airspace reservations (inc. dynamic and moveable areas) according to Civil or Military Airspace User Requirements, through a CDM process.

Airspace Reservations allows an efficient management of special airspace activity, fully integrated into normal operations. To this end:

- However it is still possible to reserve airspace for a particular use. Like SBTs, Airspace Requirements are intentions expressed by the Airspace Users during the planning phase:
  - o Either routinely - e.g. in the form of a monthly airspace reservation schedule, updated on a weekly basis for military training;
  - o Or specifically - e.g. to attend special events such as air shows.
- Reservations may also be made at very short notice and be related to individual needs - e.g. come attached to a Military Mission or Business Trajectory.

Airspace Reservations are requested by the Airspace Users through a detailed set of requirements. Those requirements are handled by the Civil/Military Airspace Managers and satisfied to the greatest possible extent through the implementation of an ad-hoc Airspace Reservation.

In order to offer maximal capacity, the MIL use flexible airspace volumes that are activated and sized according to the mission requirements i.e. Military Variable Profile Areas **MVPA**, Variable Geometry Areas **VGA**, and Dynamic Mobile Areas **DMA**:

- The **MVPA** model constitutes a flexible composition of pre-defined modular portions of airspace;
- The principle of the **VGA** is to have an MIL area that is the core of the segregated airspace considered. Several pre-planned possible extensions (lobes) next to it could be activated by the MIL according to the training requirements and to the GAT traffic in the area at the time;
- **DMA**s are temporary trajectory exclusion volumes. The exclusion volumes will change profile dynamically to be as small as possible at all times, ensuring that the number of impacted business trajectories is as small as possible. The owner of the trajectory decides how to satisfy the constraint. In some cases, an exclusion may be mobile, in order to follow the MIL training activity as it progresses.

The Civil/Military Airspace Manager coordinates with the Sub-Regional Network Manager to take into account the conflicting needs of DCB (capacity plan) and minimise the creation of inefficiencies (trajectory distortions).

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[12] Representing Airspace Users who need a segregated area for a specific activity incompatible with the rest of the traffic (military training, flight test, parajumping, airshow …)

The following Use Case has been identified for Refine/Define Airspace Reservation Demand process:

Use Case	Description
Define/Refine Airspace Reservation Demand	This UC enables the Civil/Military Airspace Manager to formulate a user demand (military or civil) into the system - e.g. reservation of airspace volumes.

Table 3: Use Case for Refine/Define Airspace Reservation Demand

4.2.4.2 Optimise SBT (A2.1.2.2)

Through this process, SBTs/Mission Trajectories are filed/refined and optimised to the best outcome for the user. This process is mainly a short-term process.

The main drivers related to this process are the following:

- Inputs:
  - Available SBTs/Mission Trajectories.
- Constraints/Triggers:
  - Business Model;
  - DCB Solution;
  - Refined Airspace Requirements.
- Human Actors:
  - AOC Staff;
  - Sub-Regional Network Manager;
  - Regional Network Manager.
- Outputs:
  - Refined SBTs (Optimised Route).

The Elaboration of an optimised NOP relies on a good knowledge of the incoming traffic demand. This is achieved by "**Optimise SBT**" and "**Validate SBT**" mechanisms that assist the Airspace Users in their flight planning activities.

The optimisation of SBTs will start from strategic schedules, i.e. from the initial strategic schedule available at the end of the long-term planning phase (A1.5 Publish Seasonal Schedule), or the updated strategic schedule built during the medium/short-term planning phase (A2.1.2 Schedule Flight).

Airspace Users optimise flight trajectories under consideration of their User Preferred Trajectory, the known airspace status at the time of flight. This process should take around five minutes (conclusion from exercise 3.3.2). In those areas where a high-density risk has to be taken into consideration, trajectories amendments may be assessed through a collaborative process between the Airspace User and the Regional Network Manager. The Airspace User may choose not to change the 3D trajectory and adapt cost index based on its business model in order to decide how to absorb delay.

For those Airspace Users who cannot afford adequate tools, or those that may want another degree of assistance based on the complete outsourcing of their 4D trajectories, or those that depart from a non-equipped area, the Regional Network Management function will provide assistance to file/refine SBT.

During the short-term planning phase, the ATM picture is more and more precise, allowing Airspace Users to optimise their SBTs. Most of the time, the flight is planned to depart as expected in the current SBT, when the ATM network is operating normally. Flights may be

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subject to a TTA, usually due to a capacity overload at destination airport, sometimes due to a capacity overload at departure airport, and exceptionally due to an en-route congested area. TTA is allocated through a queue management process.

The following Use Cases have been identified for Optimise SBT process:

Use Case	Description
Optimise Flight Route (By User)	This UC describes how an AOC Staff provides/updates his/her SBT (a 4D flight plan, on the basis of his/her business model and possibly route catalogue). SBT refinement is supported by the use of an operational quality indicator. This indicator is a combination of a passenger quality indicator and an operating cost indicator.
Provide assistance to flight route planning	This UC describes how an AOC Staff can be assisted by the Sub-Regional Network Manager or the Regional Network Manager to plan an efficient SBT on the basis of an ICAO flight plan, a simplified flight plan or a SBT. Those users that cannot afford to invest in tools will have access via SWIM to a standard supporting tool. This tool needs to be agreed, developed, and made available to the ATM community. It will be configurable so that airspace users could customize it depending on their business model.

Table 4: Use Cases for Optimise SBT

4.2.4.3 Validate SBT (A2.1.2.3)

SBT/Mission Trajectory validation is the latest process before integration of the updated SBT/Mission Trajectory inside the NOP. Validating SBT/Mission Trajectory aims at:

- Checking that the declared trajectory is consistent with the a/c type, 3D profile and with any other parameter that may characterise the SBT, when available;
- Verifying that the 4D profile, when available, is compatible with the airspace resources to be activated at the moment the flight will be using it. Nevertheless for long-haul flights this checking will be conducted the following way:
    - If the flight is more than 3 hours (TBV) away from destination airport then the flight/AOC will be simply informed of the planned mismatch (the planned available/unavailable resources may change);
    - If the flight is less than 3 hours (TBV) away from destination airport then the late answer or no answer at all will result in the Regional Network Manager working out an adequate 4D trajectory.
- Finally making sure the SBT/Mission Trajectory has not adverse impact on the network, the SBT/Mission Trajectory will be posted in the NOP.

The main drivers related to this process are the following:

- Inputs:
    - Updated SBTs (Schedule);
    - Refined SBTs (Optimised Route).
- Constraints/Triggers:
    - DCB Solution;
    - Refined Airspace Requirements.

- Human Actors:
  - o Regional Network Manager.
- Outputs:
  - o Refined SBT.

The SBT will be validated every time it is changed by Airspace Users - e.g. to optimise it according to their business model, or every time an affecting static/dynamic constraint is instituted, amended or removed, so that for each flight, there exists only one SBT in the NOP. Iterations will increase in the short-term, as the estimated off-block time approaches and the ATM situation gets more and more precise.

Transition from SBT to RBT

- In a CDM airport, an SBT is agreed to be the RBT for a flight when the event 'Delivery of start up approval' (triggered by the User Request) occurs, if all the prerequisite actions[13] on the SBT are complete including compliance with ATM constraints;
- In a non-CDM airport the equivalent event is the 'Delivery of the departure clearance', following the user's request for a departure clearance.

From the point of view of short-term DCB, the last SBT validation is achieved when the SBT enters the pre-departure sequence. The Airport process A2.3.4: Manage Pre-Departure Sequence, followed by process A2.4 Prepare Flight for Departure that itself includes RBT Publication. This RBT is validated through E4's process "A3.5.1.2 Validate RBT changes".

The following Use Case has been identified for Validate SBT process:

Use Case	Description
Validate SBT	This UC describes how the Regional Network Manager validates a SBT (a 4D flight plan) by checking it against the route/airspace volume usage rules (whether there is a rigid airspace structure or not) in order to be published in the NOP.

Table 5: Use Case for Validate SBT

4.2.4.4 Start UDPP on SBTs (A2.1.3)

This is an AOC process dealing with activities related specifically to UDPP process. However, SBT revisions are still effectively processed through "Optimise SBT" while UDPP Results should consist of a prioritised flight list.

The main drivers related to this process are the following:

- Inputs:
  - o Refined SBTs.
- Constraints/Triggers:

[13] If the departure airport is within the AMAN horizon of the destination airport, a TTA for the IAF will be allocated which may include the allocation of an appropriate pre-defined arrival route. The principle is “first requested, first served”.

    - o Request for UDPP.
- Human Actors:
    - o AOC Staff.
- Outputs:
    - o UDPP Results.

UDPP is by definition applied during the short-term planning phase, i.e. on the day of operation.

The SESAR performance objectives favour the optimisation of ATM resource over the revision of traffic demand, Hence, UDPP is not intended to be used in the long-term and the medium-term planning phases, However, in case of foreseen contingency, UDPP would be the option to involve users in earlier planning phases.

Start UDDP on SBTs is a short-term (i.e. day of operation) process optionally triggered by the application of a DCB Solution – optionally meaning that DCB Solutions will exceptionally call for UDPP.

UDPP will be triggered by the application of a queue management process when a threshold defined during the long-term planning phase[14] is reached. In practical terms, it will happen in the case of severe capacity drop. Validation exercises have revealed that AOC staff get easily overloaded from CDM and UDPP processes and would probably only focus on a limited (most critical) number of flights.

Requests for UDPP can be initiated by the Sub-Regional Network Manager, the APOC Staff or an Airspace Users representative. Request are sent to the Regional Network Manager who:

- Triggers UDPP and informs the Airspace Users involved in the process;
- Arbitrates UDPP in the last resort, i.e. checks that a timely response is provided. Otherwise a default flight list will be published, based on a “first come / first served” strategy and calculated by the Regional Network Manager (cf. 3.3 Aspects of today's operations that will disappear).

In that event, the queue will not be applied as such, but will actively involve all the interested parties in the process of implementation: Airspace Users will decide by themselves which flights are of the highest priority.

There will continue to be flights that have a high priority - e.g. Medical, Government, military operations. The UDPP process will respect this priority and these flights will appear to other users as constraints.

UDPP is:

- Triggered by the Regional Network Manager on request of the APOC or of Airspace Users;
- Made visible to the Regional Network Manager and other interested parties, through the NOP;
- Facilitated by the Regional Network Manager, to speed up the whole process;

[14] Refer to process A1.3.1.3 Define/Refine Network Usage and Prioritisation Rules.

- Ultimately arbitrated by the Regional Network Manager, to come to an acceptable and accepted Solution[15] before time-out[16].

UDPP is first and foremost the business of Airspace Users, with AOC Staff as the primary actors, involving all the layers of operations:

- Flight Operations, to prioritise a flight with possible inclusion of the Flight Crew;
- Airline Operations, to prioritise flights owned by the same Airspace User with possible inclusion of the Airline Station Manager;
- Airspace Users Operations, to prioritise flights owned by different Airspace Users.

Internal prioritisation (Flight and Airline Operations) and most of all external prioritisation (Airspace Users Operations) will require a minimum set of rules, so that it can be achieved in due time:

- Default rules, applicable whatever the context, will regulate the basic functioning of UDPP;
- Specific rules will regulate UDPP in the context of the DCB Solution in application - e.g. they will be part of the modus operandi of a pre-agreed scenario.

Such rules will define[17]:

- How capacity, in the event of a shortfall, is pre-allocated to airspace users;
- How such allowances can be traded or swapped.

For example:

- User A produces a priority list of his/her flights, User B provides a priority list for his/her flights etc. (internal prioritisation);
- The process is collaborative in the sense that all the priority lists are collated by the Network Management function in a transparent act;
- The collaborative negotiation process between users, such as slot trading, slot swapping etc. is performed (external prioritisation) in order for each individual to improve his/her own net return.

The process is permanently monitored by the Network Management function. It monitors the network to detect any adverse side-effect and to make sure that all concerned parties are aware of them. The result of UDPP is a prioritised flight list, which is validated by the Regional Network Manager. This process depends on CDM between the concerned airspace users, which may, after several optimisations and iterations, not come to an agreed solution. If this fails to produce a satisfactory result, the Regional Network Manager arbitrates in order to make sure that an acceptable solution is available in due time.

Those trajectories are then revised in order to meet the constraints attached to the solution: RBT revisions are triggered by the promulgation of UDPP results.

The UDPP process is not part of the execution phase taking into account the difficulty to perform CDM while flights are airborne or close to be. Nevertheless, AOC to AOC negotiation could be carried out e.g. slot swapping at arrival in co-ordination with the Actor APOC and possibly the sub-regional network manager.

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[15] In a sense that the application of the DCB Solution is dependent on the outcome of UDPP.

[16] To be defined, depending on the look-ahead for the application of the DCB Solution.

[17] Limitedly, extensively or in-between.

The following Use Cases have been identified for Start UDPP on SBTs process:

Use Case	Description
Start UDPP on SBTs	This UC describes the UDPP process that enables AOC Staff(s) to assign priorities to their flights. The priority of a flight is an input to queue management. Other possible and complementary actions to the UDPP are: flight plan cancelling, slot swapping, slot trading, SBT or/and RBT refining...
Prioritise SBTs	This UC describes how an AOC Staff assigns a priority to a flight and which priority can be assigned, after a UDPP process has been triggered. This generates an updated SBT.

Table 6: Use Cases for Start UDPP on SBTs

4.2.4.5 Build/Refine Reference Traffic Demand (A2.1.4)

The **reference traffic demand** is elaborated and used during the Medium-term Planning phase.

The reference planned traffic demand, is initially built upon statistical data, scheduled airports slot allocation, and upon some SBTs already available in the medium-term phase.

The reference traffic demand is continuously refined as soon as SBTs are available or optimised.

The main drivers related to this process are the following:

- Inputs:
  - Refined SBTs including UDPP results in case of crisis situation.
- Constraints/Triggers:
  - Statistics;
  - MET forecast;
  - Refined airspace requirements (inc. social events, and special events);
  - Archived Data;
  - DCB Solution.
- Human Actors:
  - Regional Network Manager.
- Outputs:
  - Planned Traffic Demand (including Available SBTs + Refined SBTs + SBTs[UDPP])[18].

Traffic Demand, at the end of the Long-term Planning Phase, is a picture based on forecast derived from statistics (performed according to historical data), as well as first SBTs derived from the seasonal schedules published by airlines. Such a picture is not specific to the day of operation being considered, apart from major features - e.g. high-season/off-season, weekday/weekend.

[18] Each flight being characterised at any time by one of these SBTs.

From that perspective, the Medium/Short Planning Phase starts when Traffic Demand is no longer forecast, but planned, i.e. when the Airspace Users start to declare their intentions for the day of operations and share them with the Regional Network Manager.

Note that “intentions” is herein taken to the broadest sense. “Intentions” may be variable in quality (the nature of the data) and accuracy (the granularity of the data). What matters is that the quality and accuracy of the data increase as time goes by so that the picture gets clearer. This is how the Reference Traffic Demand is built, as a work of continuous refinement intended to improve predictability and offer maximum visibility to all ATM Stakeholders preparing for the day of operation.

Traffic demand planning for scheduled flights may start some 6 months in advance, when airlines release their seasonal plans consecutive to the allocation of airport slots. For instance, the flows of traffic between city pairs served by coordinated airports can be inferred.

Traffic demand planning “ends” on the day of operation, when all trajectories are known, at least in the form of SBTs (some trajectories may already be agreed RBTs).

In-between, the gap (i.e. the missing SBTs) progressively narrows, as Airspace Users progressively share SBTs. However it exists until the day of operation (currently, up to 30% of the demand may still be lacking the day before) and is bridged with some data of reference taken out of archived data, hence the denomination, Reference Traffic Demand.

However, when the day of operations is considered, the related traffic demand is not fully known. Hence, the reference traffic demand is initially the traffic demand of the reference day. The reference day is the latest day (in the past) “bearing strong resemblance” to the day of operation (typically a standard day, same weekday or weekend). In other words, a similar demand pattern is expected for the day of operation.

When new identifiable data become available for the day of operation, the Reference Traffic Demand is updated. For instance, trajectories can be actualised in accordance with weather forecast (winds) and information about flow orientation (like the planned oceanic track i.e. NAT today and extended to other distant origins tomorrow, even if they are not fully ECAC flights). Additional data dealing with already known traffic flows related to special events is also integrated into the traffic demand of reference. This work of refinement will get more intense a week before the day of operation, a day before operation, and finally on the day of operation, during the short-term planning phase of every single flight:

- The Reference Traffic Demand is a source of information;
- The other source of information, which is continuously grown by Airspace Users, is made of SBTs already available in the NOP.

The collation of both sources result in a Reference Traffic Demand (including Available SBTs), laying the foundation for all subsequent DCB activities.

During the short-term Planning Phase (i.e. the day of operation) the predicted traffic demand is continuously enriched with available RBTs and SBTs. In order to improve the DCB monitoring, the traffic demand of reference is also available.

The following Use Case has been identified for Build/Refine Reference Traffic Demand process:

Use Case	Description
Define/Refine Reference Traffic Demand	This UC describes how the Regional Network Manager defines the reference network traffic demand (i.e. the ECAC-wide planned traffic demand built in a first step with only some SBTs in the medium-term phase) and refines it as soon as SBTs are available or any other information like weather forecast, traffic flow re-orientation and traffic growth forecast due to a social event... allow refinement.

Table 7: Use Case for Build/Refine Reference Traffic Demand

4.2.5 Enablers

The main enablers are:

- SWIM-enabled NOP to provide Airspace Users with flight planning information;
- ATM Service Level 3 operations to use flexible military airspace structures.

4.2.6 Transition issues

The main transition issues to be considered are:

- Airspaces Users shall be provided with all the information needed to optimise their SBT according to their preferences, taking into account possible network constraints. In particular, they shall be granted access to all the relevant data in the NOP;
- Implementation of UDPP.

4.3 NETWORK SUPPORT TO REFINE ATM RESOURCES (A2.2)

4.3.1 Scope and Objectives

Through this process, the allocation of ATM resources initiated in the long-term is refined in the medium-term.

This refinement is needed because the planning of the demand is refined as new data become available such as:

- Demand data from process “A2.1 Plan Traffic [AUO-0204] and Airspace Requirements” [DCB-0103];
- ATC staff availability [DCB-0103];
- Technical restrictions [DCB-0103];
- Airport capabilities [DCB-0103];
- Weather [IS-0501];
- Unexpected events [DCB-0103].

In response to the continuous inflow of new information and updates of existing data, the major two outputs available in the NOP [DCB-0103] are:

- The resource available capacity plan;
- The catalogue of pre-defined DCB solutions.

Both may be revised according to traffic demand variation [AUO-0204] and more generally depending on Airspace Users needs, and other unexpected events [IS-0501].

Collaborative airport planning, covered by M1, addresses the allocation of airport resources.

Network planning herein covered, addresses:

- The allocation of airspace resources;
- The allocation of network resources, i.e. the integration of airspace resource allocation and airport resource allocation.

The allocation of airspace and network resources is fine-tuned in three steps:

- Airspace and network usage rules are amended to be commensurate with the agreed Target Performance Levels (notably in terms of capacity and efficiency);

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- Airspace possible configurations are reassessed in light of the planned traffic demand;
- The Resource Available Capacity Plan is updated accordingly to reflect the foreseen network capacity, taking into account the DCB solutions already favoured by DCB processes.

The actors of the process are:

- Civil/Military Airspace Managers, acting both at the local level (local ASM Actor) and at the sub-regional level (AMC) to:
    - Allocate consistently the airspace to the Civil and Military Airspace Users at the local level (local ASM Actor);
    - Integrate the local needs in order to develop the sub-regional Airspace Use Plan (AMC);
    - Disseminate the Airspace Use Plan;
    - Coordinate with their neighbouring counterparts for integration at regional level.
- The sub-regional manager, depending on the organisation working at FAB level (multi-ACC) or ACC level:
    - If the scope of the Sub-Regional Network Manager covers one ACC, only, he/she will act at the local level, like an advanced FMP (local DCB position). Hereby, he/she will have to participate to the refinement of resource usage, the adjustment of traffic demand and military activity, and to coordinate with other DCB Managers as well as adjacent Sub-Regional Network Managers.
    - If the scope of the Sub-Regional Network Manager covers several ACCs (with e.g. the scope of an entire FAB) then he/she will be supplemented by multiple local DCB positions being networked to him/her. He/she will animate CDM sessions internal FAB to collate and analyse local needs versus resources availabilities, and integrate local plans into a coherent network plan. Finally, he/she will participate at CDM sessions at regional network level for consistency check.
- Regional Network Managers, acting at the regional level to:
    - Facilitate coordination between sub-regional network managers;
    - Integrate sub-regional contributions to the NOP.
- Airspace Users, who are notified of the planned resource availability (especially routes) for the day of operations and are consulted during AOM activities.

4.3.2 Assumptions

The main assumptions are:

- The airspace capacity plan defined at the end of the long-term planning phase is consistent with the target airspace capacity, meaning that enough capacity can be provided en-route to cope with the foreseen traffic, taking into account the airspace requirements defined in the long-term;
- The definition of airspace configurations is related to airspace volumes but also route and may combine both of them - e.g. routes to activate depending on sector configuration.

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4.3.3 Expected Benefits, Issues and Constraints

The main benefits expected are:

- More accurate capacity planning induces by a better knowledge of the traffic and airspace demand;
- Capacity planning becomes a full part of the DCB process: capacity is adjusted up to the day of operations to cope with the foreseen demand;
- New ASM solutions (temporary route structures, modular airspace volumes) are available in the Catalogue of Solutions: multiple options exist in terms of airspace configurations and can be selected to adjust capacity and refine the capacity plan in accordance with the foreseen demand (traffic and airspace requirements);
- Coordination between DCB and ASM is enhanced: airspace requirements are taken into account by the capacity planning process up to the day of operations.

4.3.4 Overview of Operating Method

4.3.4.1 Refine Airspace Usage Rules (A2.2.1.2)

In this process, airspace volume (including military areas) and route (route crossing military areas, SIDs, STARs, routes that can be activated in high-density areas …) usage rules are refined if required.

The main drivers related to this process are the following:

- Inputs:
  - Airspace Resource Usage Rules.
- Constraints/Triggers:
  - Refined Airport Resource Usage Rules;
  - Target Performance Levels;
  - Refined Airspace Requirements.
- Human Actors:
  - Civil Airspace Users[19];
  - Civil/Military Airspace Manager[20];
  - Sub-Regional Network Manager;
  - Regional Network Manager.
- Outputs:
  - Refined Airspace Resource Usage Rules.

For each relevant airspace element (airspace volume, area, and route) of his/her area of responsibility, the Civil/Military Airspace Manager defines the usage rules (provisionally) applicable on the day of operation and the time periods during which they shall be applied.

Such rules may be related to:

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[19] Civil airspace users may be represented by an Airline Coordinator (please refer to 7 Hot Topics).

[20] Representing Airspace Users, either civilians or militaries, who need a segregated area for a specific activity incompatible with the rest of the traffic.

- The delineation of airspace volumes;
- The definition of military areas - e.g. Military Variable Profile Areas, Variable Geometry Areas, and Dynamic Mobile Areas;
- The type of route – e.g. predefined, 3D, dynamic.

In the case of concurrent access to resource, equity principle will be applied, possibly based on statistics from long-term to medium-term reservations, to more concrete figures such as:

- Number of impacted SBTs;
- How often a same category of Airspace Users has already been penalized;
- Operational Quality Indicator based on passenger quality, on operating cost, required airspace volume configuration, extra-mileage…

When the military airspace reservation corresponds to a VGA i.e. an ad-hoc military structure usually requested at short notice with dimension flexibility, civil airspace users may be involved as well to provide their preferences such as airspace reservation dimension, shape, and accurate distorted trajectories.

Finding out solutions and assessing them by performing *what-if* is possible and relevant since Network Managers and Civil/Military Airspace Users have access to the same information through the SWIM enable NOP

The following Use Cases have been identified for Refine Airspace Usage Rules process:

Use Case	Description
Refine Airspace Volume Usage Rules	This UC describes how the Sub-Regional Network Manager (in coordination with the Regional Network Manager) refines the planned structure of the airspace from low/medium density areas to high density areas under dynamic sectorisation and route network ruling, the planned military areas, etc. and the way they will be used to match the quality of service agreement objectives.
Refine Military Area Usage Rules	This UC describes how the Civil/Military Airspace Manager (in coordination with the Sub-Regional Network Manager), refines the planned structure of the military airspace (from fixed size areas to dynamic mobile area through variable geometry areas) and the way they will be used (according to the type of Mil. activity) to match the military quality of service agreement objectives.
Refine Route Usage Rules	This UC describes how the Sub-Regional Network Manager and the Civil/Military Airspace Manager (in coordination with the Regional Network Manager) refines the planned structure of the route network and rules to use it - i.e. where and when this structure may be required (temporary high density areas), and how.

Table 8: Use Cases for Refine Airspace Usage Rules

4.3.4.2 Refine Network Usage Rules (A2.2.1.3)

This process produces network usage rules as a consistent check of refined Airspace Usage Rules and refined Airport Usage Rules.

The main drivers related to this process are the following:

- Inputs:
    - Refined Airspace Resource Usage Rules;

  - Refined Airport Resource Usage Rules.
- Constraints/Triggers:
  - Target Performance Levels.
- Human Actors:
  - Civil/Military Airspace Manager;
  - Sub-Regional Network Manager;
  - Regional Network Manager.
- Outputs:
  - Refined Resource Usage Rules.

The refinement of network usage rules builds on the local refinement of airport and airspace rules. All usage rules are collected, validated and published in the NOP by the Regional Network Manager, if they are consistent with each other and compatible with the agreed Target Performance Levels. Otherwise, they are reconciled through the intervention of all Actors and of the Regional Network Manager in particular.

In addition, changing airspace rules cannot be taken in isolation since a number of aircraft are already airborne up to 14 hours prior to their becoming under execution within the ECAC area. Promulgation of rules, re-programming navigation systems, confirmation of information reception are all issues that need being addressed[21].

The following Use Case has been identified for Refine Network Usage Rules process:

Use Case	Description
Refine Network Usage Rules	This UC aims at describing how the Regional Network Manager (in coordination with the Sub-Regional Network Manager and the Civil/Military Airspace Manager) refines the network usage rules.

Table 9: Use Case for Refine Network Usage Rules

4.3.4.3 Refine Possible Airspace Configurations (A2.2.2.2)

The possible airspace configurations refinement process aims at refining the possible configurations that are part of the available capacity plan established in the long-term planning phase. For each airspace resource, times of use are specified, e.g. per day type - i.e. weekday, weekend, holiday, special event day.

The main drivers related to this process are the following:

- Inputs:
  - Possible Airspace Configurations;
  - Catalogue of Solutions.
- Constraints/Triggers:
  - Planned Traffic Demand (including Available SBTs + Refined SBTs + SBTs[UDPP]).
- Human Actors:

[21] There is a need to re-evaluate the legal aspects of insuring the information has been received through data-link.

  - Civil/Military Airspace Manager;
  - Sub-Regional Network Manager;
  - Regional Network Manager.
- Outputs:
  - Refined Possible Airspace Configurations;
  - Catalogue of Solutions.

In this process, the Sub-Regional Network Manager, working closely with the Civil/Military Airspace Manager, proposes, shortlists, retains airspace configurations possibly suitable for the accommodation of the Planned Traffic Demand. The configurations most appropriate are iteratively retained in collaboration with DCB and added to the Catalogue of pre-defined DCB Solutions.

The following Use Cases have been identified for Refine Possible Airspace Configurations process:

Use Case	Description
Refine Possible Route Configurations	This UC refines the possible route configurations - e.g. FL limits, single ways.
Refine Possible Airspace Volume Configurations	This UC refines airspace volume configurations - e.g. airspace restricted or not, airspace size.

Table 10: Use Cases for Refine Possible Airspace Configurations

4.3.4.4 Refine Airspace Resource Available Capacity Plan (A2.2.3.2)

Airspace Available Resource Capacity Planning gathers for each Airspace Configuration the available capacity, taking into account human resources plans, enhancement plans, etc.

The main drivers related to this process are the following:

- Inputs:
  - Long-term Airspace Resource Available Capacity Plan;
  - Refined Airspace Resource Usage Rules;
  - Refined Possible Airspace Configurations.
- Constraints/Triggers:
  - DCB Solution.
- Human Actors:
  - Civil/Military Airspace Manager;
  - Sub-Regional Network Manager (cf. 4.3.1 Scope and Objectives);
  - Regional Network Manager.
- Outputs:
  - Airspace Resource Available Capacity Plan.

In this process, every Sub-Regional Network Manager submits – after coordination with the Civil/Military Airspace Manager – a (provisional) airspace configuration plan for the day of operation. This plan is part of the Airspace Resource Available Capacity Plan. This airspace configuration plan is combined with the applicable airspace usage rules to determine the available capacity:

- For each airspace element of relevance;

- At every time during the day of operation.

Capacity figures are gathered and checked by Regional Network Management, then recorded in the NOP to update the Resource Available Capacity Plan.

The following Use Case has been identified for Refine Airspace Resource Available Capacity Plan process:

Use Case	Description
Refine Airspace Resource Available Capacity Plan	This UC describes how the Sub-Regional Network Manager defines / refines the Airspace Available Capacity Plan. For each airspace configuration, the available capacity is gathered, also taking into account human resources plans, enhancement plans, etc...

Table 11: Use Case for Refine Airspace Resource Available Capacity Plan

4.3.5 Enablers

The main enablers identified are SWIM and the NOP.

4.3.6 Transition issues

A potential transition issue is the deployment of new ASM solutions.

4.4 Network support to balance planned demand and capacity (A2.3)

4.4.1 Scope and Objectives

4.4.1.1 Foreword

The purpose of Network Support to Balance Planned Demand and Capacity is to prepare a Capacity Plan and an Airspace Use Plan in order to maximise the available capacity according to a predicted traffic demand.

This service starts in the long-term planning phase, continues in the medium/short planning phase and, to a lesser extent, can be performed during the execution phase. It relies on an iterative and interactive process conducted in close coordination with Airspace Users, ANSPs, Airports and Airspace Managers. It is based on feedback experience - e.g. post-analysis of implemented DCB solutions, as well as continuous validation of long range forecasts from the NOP [DCB-0103]as more reliable data on traffic demand [AUO-0204]and capacity becomes available.

The service goes on in the Medium-term Planning Phase and continues in the Short-term Planning Phase. The proportion of unknown flights before the day of operations should be lower than today's as more airports should be coordinated or at least schedules facilitated - e.g. it may drop from 10%-40% today down to less that 10% in 2020. Nevertheless, this uncertainty is sufficient to create indeterminacy on the best activation – de-activation times of the planned DCB measures.

On the basis of anticipated demand capacity imbalances, detected at local, sub-regional or regional level, responses will be selected from the pre-defined DCB Solutions Catalogue, and adjusted to planned situation. Those responses will be included in the NOP after a consensus amongst stakeholders has been established.

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These activities will continue until the day of operation.

The recourse to ground delays is expected to be considerably reduced thanks to [DCB-0103]:

- An improved planning starting years ago[22];
- A better planned demand (inc. traffic demand and airspace requirements, A2.1 Plan Traffic and Airspace Requirements);
- A gradually adjusted capacity plan (inc. available resources, resource usage rules and possible configurations, A2.2 Optimise ATM Resources);
- A set of pre-defined DCB solutions elaborated and agreed in the Long-term Planning Phase between every concerned actor, inc. airspace users and military authorities, and continuously refreshed up to the day of operation.

4.4.1.2 Definition of the DCB Solutions

The Catalogue of DCB Solutions consists of:

- Basic DCB/ASM Solutions: configuration inc. military activity, temporary route structure, flight level capping, advisory routing, queue management (inc. UDPP) and Strategic De-confliction measures (only available during the execution phase);
- Pre-defined DCB Solutions made of basic DCB/ASM Solutions, characterised by:
    - The definition of the ATM situation that triggers its application;
    - The expected result (measured through KPIs or lower-level metrics);
    - A modus operandi including:
        - The list of actors that will take part to the negotiation process prior to pre-defined DCB Solution implementation during the Medium-term or Short-term Planning Phase, and their roles;
        - The selected procedures and/or DCB measures, which defines the network use to treat the ATM situation.

Predefined DCB Solutions are agreed between partners through CDM sessions and will be refined during the medium and short-term planning phases, through simulations, just like a contingency plan (predicted de-icing, fog, or snow …) is.

If a particular ATM situation cannot be solved by the application of a predefined DCB Solution, an ad-hoc DCB Solution will be built upon the basic DCB Solutions.

4.4.1.3 Scope of the DCB Solutions

DCB Solutions in the Medium/Short-term are addressed in two DODs:

- DOD M1 addresses the solutions that are manageable at airport level: they may be related to departure management or the level of entry points in the TMA, or required minimal spacing between a/c, or a specific airport configuration. Most of them should need a very weak coordination between actors (the APOC Staff acting as a CDM focal point), having a local impact only, this assumption resulting from knowledge or/and being validated through simulations.
- DOD M2 addresses the solutions related to airspace elements (FAB, ACC, any other airspace volume) but may be applied to help solve an airport imbalance - e.g. in the case of an DCB arrival queue implemented to pre-sequence traffic in

[22] Refer to Long-term Planning (L DOD [5]).

favour of an AMAN or act as a pseudo-AMAN for non-equipped airports. These solution(s), which possibly rely on basic ASM Solutions, can be based on a maximal flow rate, metering between a/c, FL capping, routing advisory (routing proposals), and airspace re-configuration. The required coordination level, which may range from local to regional through sub-regional, depends on the network impact of the DCB solution. It is usually known in the case of predefined DCB solutions, which are already validated and part of the Catalogue. It is usually not known in the case of ad-hoc DCB solutions and will be assessed (through process A2.3.2.2.1) before validation and inclusion in the Catalogue).

4.4.1.4 Process description

Network Demand / Capacity Balancing is a three-stepped process that integrates at all stages the Airspace User:

- The planned traffic demand is confronted to the scheduled capacity to establish the local load plan and detect local imbalances based on an acceptable capacity during the medium-term planning phase down to a maximum permissible density during the last stages of the short-term planning phase. Capacity is also refined according to negotiated military activity;
- DCB Solutions are worked out or reworked at the local/sub-regional or regional network level to resolve detected imbalances;
- DCB Solutions are implemented if they are efficient enough and do not generate an adverse network effect. DCB Solutions will be identified/modified/negotiated at the local/sub-regional level and finally improved for implementation by the regional level. Network solutions can also be identified/modified/negotiated at the regional level and orchestrated by the Regional Network Manager, acting as the honest broker.

The primary actors of the process are:

- The Regional Network Manager, to oversee local actions and make sure that they do not disrupt the stability of the Network. The Regional Network Manager also contributes to the detection and resolution of imbalances;
- The Sub-Regional Network manager, for the detection and resolution of imbalances;
- The Civil/Military Airspace Manager;
- The APOC Staff;
- The Airspace User.

4.4.1.5 DCB Queue management

The next paragraphs attempt to propose basic operating principles for DCB queue management in the context of short-term network planning.

- A DCB queue is a short-term DCB Solution applied when every other capacity optimisation, alone or in combination with others, has been tested and does not solve the imbalance(s). Hence, queue management is a complementary means to guarantee network balance from minor time shifts up to its ultimate of grounding aircraft (e.g. in case of critical events);
- Departure and Arrival sequences are ordered flight lists: **A DCB Queue is NOT!**

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- A DCB queue is defined by a maximum throughput regardless of individual order;
- Flights should be able to depart when they are ready to do so, subject only to any allocated TTA and/or any departure runway capacity constraint[23];
- The **First Come/First Served** principle over a capacity constraint (e.g. a TMA entry point) is applied in the active DCB area whether the flight is airborne or not. When several flights have identical ETA/TTA, then those airborne have priority over those still on the ground. Those having a RBT have priority over those having a SBT;
- A DCB Queue Management process only provides a TTA if the flight has reached a time horizon of 2 h (TBV) before ETA. This DCB Queue active horizon parameter results from a trade-off: the earlier a flight receives a TTA, the better but the more risky it is the ATM situation has changed, and the TTA will have had unnecessarily constrained the flight;
- It is up to the airspace user to decide on how to meet the TTA: 1) By optimising the SBT 2) by revising the RBT.
    - Non-airborne flights may choose to absorb their delay on the ground or in the air;
    - Whether airborne or not, depending on the time to absorb, aircraft may: 1) Adjust speed 2) Change FL if it is not longer optimal[24] 3) Change their 2D route;
    - A tolerance window [-3 min; +3 min] (TBV) is defined around the TTA.
- Once having reached the AMAN active horizon (40 min TBV), the flight does not receive any more TTA from the DCB Queue process, but a CTA from the AMAN.

4.4.1.5.1 DCB departure queue

DCB departure queues are regarded as airport DCB solutions, addressed in DOD M1 [6].

4.4.1.5.2 DCB arrival queue

DCB arrival queues are regarded as network DCB solutions.

Arrival queues aim:

- Either at preparing flights in order to make it easier sequencing of arrivals during peak periods that cannot be handled by the AMAN alone;
- Or at acting as a basic sequencer for non-AMAN-equipped airfields;
- Or at equity between flights inside or outside the active AMAN horizon. If not DCB arrival queue is implemented then flights outside the AMAN horizon would not be submitted to any pre-sequencing.

Arrival queues are planned by the Sub-Regional Network Manager at the request and in coordination with the APOC Staff.

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[23] When a TTA has been assigned, a tolerance window has to be defined in order to 1) stabilize the network, 2) avoid multiple unnecessary SBT updates with respect to the accuracy of data at this planning stage. The definition of this tolerance window will be a trade-off between planning precision and flexibility aiming at maximising capacity use. It could be of [-3 min, +2 min] for flights being allocated a TTA and of [-5 min, 10 min] for the others. This will be part of the validation exercises.

[24] i.e. if the required speed adjustment is out of a specified window e.g. [-5%;+1%].

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Arrival queue management operates as follows, and involves multiple time horizons, as shown by Figure 6:

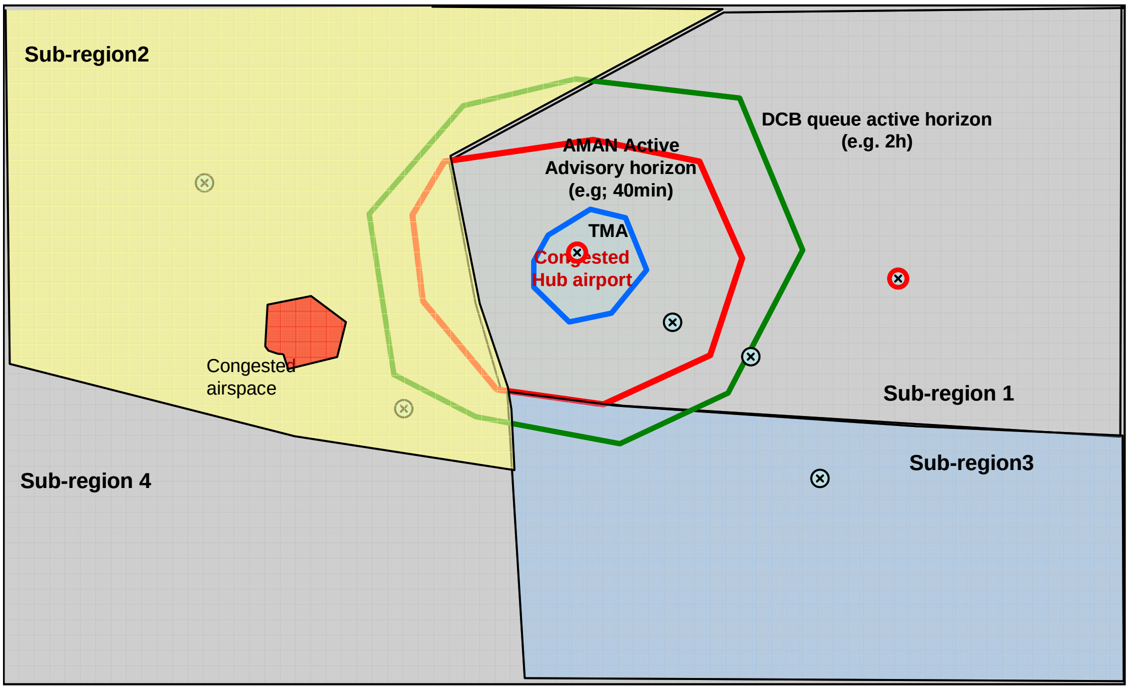

Figure 6: Time horizon of an arrival queue

The APOC Staff decides to plan an arrival queue:

- No active AMAN: the flight is assigned a TTA on the basis of its current SBT/RBT and according to the queue throughput. Flights can be either on the ground or airborne;

Or

- Active AMAN: the flights that are outside the active AMAN active horizon (40mn TBV) are assigned at TTA like in 1). When reaching the AMAN horizon, the TTA turns into a CTA of higher accuracy. The CTA is calculated by the AMAN and is as close as possible to the TTA. The flights that are within the active AMAN horizon are allocated a TTA converted to a CTA as soon as the aircraft departs.

The Airspace User can modify the SBT through a CDM process (Optimise SBT) in order to both achieve the TTA but also maximise the flight revenue according to his/her business model.

For flights also submitted to DMAN, the TTA and the TTOT will be made compatible on the basis of the business trajectory through an iterative process relying on the NOP.

4.4.1.5.3 DCB en-route queue

When exceptionally an en-route high-density area is not anticipated on time, an en-route queue can be requested by the Sub-Regional Network Manager or suggested by the Regional Network Manager. In this case, flights, whether airborne or not, are assigned a TTA

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- i.e. a Target Time of Arrival in the high-density area[25]. The Airspace User modifies the SBT/RBT through a CDM process (Optimise SBT or Revise RBT) in order to both achieve the TTA but also maximise the flight revenue according to its business model. Depending on the high density area location the Airspace User might decide to elaborate a 4D trajectory that matches the TTA but also the planned time of arrival at destination.

4.4.2 Assumptions

The main assumptions are described below:

- A DCB arrival queue can be applied to prepare a traffic demand in favour of an AMAN mainly in the case of an unpredicted capacity shortfall exceeding an agreed threshold (minor imbalances will be solved by Dynamic DCB when trajectories are predictable enough);
- Imbalances at airspace level can be solved during the medium-term planning phase - i.e. short-term DCB solutions at airspace level are only applied to solve imbalances created in the short-term;
- The catalogue of airspace DCB solutions also contains ASM solutions to (re)organise airspace in response to an imbalance, with an integrated view of traffic demand and airspace requirements;
- DCB queues are short-term DCB solutions, applied on the day of operations;
- DCB departure queues are rather managed at airport level[26] (in coordination with network). They are part of airport DCB solutions (refer to DOD M1 [6]);
- DCB arrival queues are rather managed at network level (in coordination with airport). They are part of network DCB solutions.

4.4.3 Expected Benefits, Issues and Constraints

The main expected benefits are:

- Increase of performance/efficiency through the integration of airport and airspace management into a seamless DCB process: DCB solutions involve all concerned actors - e.g. APOC Staff and Sub-Regional Network Manager, depending on the problem to solve;
- Increase of performance/efficiency through the validation of DCB solutions: the impact of DCB solutions on performance is assessed network-wide. In case of adverse network level, compatible solutions are negotiated between concerned actors through CDM at the appropriate level - i.e. from local to regional through sub-regional;
- Increase of performance/efficiency thanks to Dynamic DCB inc. DCB queue management: constraint allocation taking into account the flight status - e.g. airborne or not, flying time to the constraint.

[25] One could consider the TTA as a Target Time Over an entry point (not necessarily a waypoint) in the high-density area, and consequently call it a TTO.

[26] When caused by departure runway capacity limitations or other airport departure constraints. Departure queues due to constraints beyond the airfield (i.e. en-route or at arrival) would be managed at network level.

4.4.4 Overview of Operating Method

4.4.4.1 Detect Airspace Demand Capacity Imbalance (A2.3.1.2)

This process aims at balancing demand and capacity for each Airspace Volume. For each day of operation, flights are scheduled over time periods according to scheduled available capacity. Then, resources scheduling are consolidated in order to detect demand capacity imbalance.

The main drivers related to this process are the following:

- Inputs:
  - None.
- Constraints/Triggers:
  - (Airspace) Resource Available Capacity Plan;
  - Refined Airspace Requirements;
  - Planned Traffic Demand (including Available SBTs + Refined SBTs + SBTs[UDPP]);
  - RBTs.
- Human Actors:
  - Sub-Regional Network Manager;
  - Regional Network Manager.
- Outputs:
  - Detected Imbalance.

The detection of airspace imbalances during the planning phase depends on the accurate prediction of the traffic load foreseen for the day of operation. An airspace imbalance is primarily a local issue, stemming from an identified node in the network, and possibly reverberating around it.

The Network Managers detect the imbalances.

To determine the local traffic load, the network (airspace) is locally meshed[27] with the appropriate granularity. Each node is then loaded, taking into account:

- The solicitation likely to be applied to the node - i.e. the demand, which is twofold:
  - Traffic demand;
  - Airspace Reservation demand.
- The characteristics retained so far for the node - i.e. its capacity (possibly a maximal permissible density to be complemented by DCB complexity as the demand becomes more reliable, TBV), contained in the latest version of the Airspace Resource Available Capacity Plan recorded in the NOP;
- The constraints driving the solicitation of the node (demand) or favouring some characteristics against others (capacity): those are the DCB Solutions selected during the previous DCB rounds and tested by this DCB round to check whether

[27] The mesh may be mapped on the local structure, such as airspace volumes, if it exists.

the Target Performance Levels are met - i.e. whether the right balance is struck between demand and capacity;

- Boundary conditions coming from adjacent areas of responsibility - e.g. DCB solutions implemented elsewhere in the network. Regional Network Management is responsible for the provision of such conditions.

If demand exceeds capacity (according to agreed tolerances), an imbalance is detected. Awareness is raised network-wide by Regional Network Management.

The following Use Case has been identified for Detect Airspace Demand Capacity Imbalance process:

Use Case	Description
Establish/Update Airspace Load Plan	This UC describes how the Sub-Regional Network Manager and the Regional Network Manager monitor the capacity load of every airspace element part of the resource available capacity plan.

Table 12: Use Case for Detect Airspace Demand Capacity Imbalance

4.4.4.2 Select/Refine/Elaborate a DCB Solution at Network Level (A2.3.2.1.2)

This process allows the selection/refinement/elaboration of a DCB Solution to solve an airspace or an airport imbalance from a network perspective. Taking into account the detected Demand/Capacity Imbalance, the proposed DCB Solutions are each associated to a set of performance indicators. All the actors define these indicators during the long-term planning phase.

Note: Solution acceptance depends on the related KPIs that are part of the target performance objectives defined and agreed by all Actors during the long-term planning phase.

In order to avoid that the selected solution has beneficial effects systematically on the same flights, AOC Staff can query archived data in the NOP. Depending on the related DCB solution indicators, and if time permits, (CDM process between AOs) fairness will be aimed at.

The main drivers related to this process are the following:

- Inputs:
  - Catalogue of Solutions.
- Constraints/Triggers:
  - Detected Imbalance;
  - Planned Traffic Demand (including Available SBTs + Refined SBTs + SBTs[UDPP]);
  - Airspace Resource Available Capacity Plan;
  - Target Performance Levels;
  - Cancelled DCB Solution.
- Human Actors:
  - AOC Staff;
  - Civil/Military Airspace Manager;
  - Sub-Regional Network Manager;
  - Regional Network Manager.
- Outputs:

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- o Proposed Network DCB Solution.

In the event of a detected imbalance at airspace level, the resolution is initiated either by the Regional Network Manager or the Sub-Regional Network Manager - e.g. cooperating with the Civil/Military Airspace Manager when usage rules have to be changed. In the event of a detected imbalance at airport level, the resolution is initiated at the request of/after coordination with the APOC Staff acting as a CDM focal point:

- Either a predefined[28] DCB Solution is “fit-for-purpose”: it is selected by the Sub-Regional Network Manager;
- Or an adequate solution is predefined but needs adaptation: it is refined;
- Or an adequate solution is not yet predefined to face that particular situation: an ad-hoc solution is elaborated.

A pre-defined DCB Solution may consist of:

- A DCB Scenario. DCB Scenarios will be predefined most of the time - i.e. “on offer” in the Catalogue. They will be prepared in advance to deal with a number of identified (and possibly recurrent) issues, provide an adapted and efficient response, with a predictable and positive outcome for the user. A DCB Scenario:
    - o Is triggered by a particular situation of imbalance;
    - o Is driven by a modus operandi. The modus operandi coordinates a number of basic DCB solutions;
    - o Results in an expected (and improved) DCB situation.
- A set of basic DCB/ASM solutions. A number of basic DCB/ASM solutions are predefined - i.e. listed in the Catalogue and assembled to build ad-hoc DCB Solutions.

The basic DCB/ASM Solution is the building block of an ad-hoc DCB Solution or of a predefined DCB solution:

- Some of them will rather work on capacity adjustments - e.g. reconfiguration of airspace volumes, activation/deactivation of a route network or activation/deactivation/adaptation of a military area;
- Some of them will rather work on demand adjustments - e.g. strategic de-confliction measures or queue management measures.

DCB Solutions will therefore combine capacity adjustment measures (preferably) with demand adjustment measures (minimally) to rebalance demand and capacity in order to:

- Prevent overloads, if a demand excess is foreseen;
- Avoid capacity waste, if some capacity is likely to be unused.

The resolution of overloads and the use of capacity opportunities are combined to optimise capacity usage.

The “cost of solution” Indicator is a combination of equitable criteria, demand and capacity balance among sectors, workload saturation Indicator of the most suitable airspace organization, workload balance Indicator among sectors of the most suitable airspace organization, total workload Indicator of the most suitable airspace organization.

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[28] I.e. already listed in the Catalogue.

In the short-term, the optimisation of a capacity-constrained resource may be obtained through the implementation of a particular set of DCB Solutions: queue management measures. Queues can be managed at all levels - i.e. by the APOC Staff (Airport DCB Solution), the Sub-Regional Network Manager or the Regional Network Manager (Network DCB Solution). This DOD is focused on the airspace and network aspects of queue management (refer to §4.4.1.5). Airport aspects are covered by Collaborative Airport Planning (M1 DOD [6]).

The following Use Cases have been identified for Select/Refine/Elaborate a DCB Solution at Network Level process:

Use Case	Description
Resolve Network Demand Capacity Imbalance	This UC describes how the Regional Network Manager, in co-ordination with the Sub-Regional Network Manager, the Civil/Military Airspace Manager and the AOC Staff, resolves an overload by selecting/refining/elaborating a DCB solution. This/these solution(s) can be based on a maximal flow rate, metering between a/c, FL capping, rerouting, Airspace re-configuration. Compared to sub-regional/local level, the Network Manager aims at implementing solutions on distant ATM elements (airports, sectors...) for which network impact cannot be guessed at sub-regional/local level.
Use Network Extra Capacity	This UC describes how the Regional Network Manager, in co-ordination with the Sub-Regional Network Manager, the Civil/Military Airspace Manager and the AOC Staff, takes advantage of a capacity opportunity by selecting/refining/elaborating a DCB solution. This/these solution(s) can be based on an extra flow rate due to non military activity, FL capping, rerouting. The solution impact assessment is conducted by the Network Manager.

Table 13: Use Cases for Select/Refine/Elaborate a DCB Solution at Network Level

4.4.4.3 Assess Network Impact of the DCB Solution (A2.3.2.2.1)

This process describes how the Network Management Function assesses the network impact of a DCB solution (possibly made of several DCB measures). Network impact assessment must be performed the more as DCB solutions will be defined most of the time at local level. Distant network impact cannot be detected at sub-regional/local level.

The main drivers related to this process are the following:

- Inputs:
  - Proposed DCB Solution.
- Constraints/Triggers:
  - None.
- Human Actors:
  - Regional Network Manager;
  - Sub-Regional Network Manager.
- Outputs:
  - Cancelled DCB Solution;
  - Validated DCB Solution.

A DCB Solution aims to solve a local issue. Therefore “side effects” should remain local, i.e. restricted to the area of responsibility of the decision-maker (who is the Sub-Regional Network Manager facing the imbalance and preparing to implement a solution, or the

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Regional Network Manager). If a knock-on risk exists, then the network effect of the solution is tested to make sure that it is not adverse:

- In case of neutral effect, the solution is given a "go for implementation". The catalogue is amended;
- In case of adverse effect, the solution is given a "no-go for implementation" and must be reworked through a CDM process involving all concerned actors: coordination takes place at the required level to elaborate compatible DCB solutions. The process stops when an agreement is reached, with the Regional Network Manager possibly playing the role of an honest broker. The solution is then validated and included in the catalogue (back to previous bullet).

The following Use Case has been identified for Assess Network Impact of the DCB Solution process:

Use Case	Description
Assess Network Impact of the DCB Solution	This UC describes how the Regional Network Manager or/and the Sub-Regional Network Manager assesses the network impact of a DCB solution (possibly made of several basic DCB solutions). Network impact assessment must be performed the more as DCB solutions will be defined most of the time at local level. Distant network impact cannot be detected at sub-regional/local level.

Table 14: Use Case for Assess Network Impact of the DCB Solution

4.4.4.4 Apply the DCB Solution (A2.3.2.2.2)

This process describes how the Regional Network Manager, the Sub-Regional Network Manager or APOC Staff may send a GO/NOGO for implementation concerning the DCB solutions that have been activated in the NOP locally and require Network Impact assessment. Not all DCB solutions will require Network Impact assessment: those having sub-regional/local impact only (this being determined during the long-term planning phase) will not need network impact assessment in order to be published in the NOP (default GO for implementation).

The main drivers related to this process are the following:

- Inputs:
  - Validated DCB Solution.
- Constraints/Triggers:
  - None.
- Human Actors:
  - Sub-Regional Network Manager;
  - Regional Network Manager;
  - APOC Staff.
- Outputs:
  - DCB Solution;
  - Request for UDPP.

Only Select/Refine/Elaborate a DCB Solution can trigger a UDPP, which loops back to SBT prioritisation (refer to §4.2.4.4) thus to Optimise SBT (refer to §4.2.4.2).

The following Use Case has been identified for Apply the DCB Solution process:

Use Case	Description
Apply the DCB Solution	This UC describes how the Sub-Regional Network Manager or APOC Staff may send a GO for implementation concerning the DCB solutions that have been activated in the NOP locally and require Network Impact assessment. Not all DCB solutions will require Network Impact assessment: those having sub-regional/local impact only (this being determined during the long-term planning phase) will not need network impact assessment in order to be published in the NOP (default GO for implementation).

Table 15: Use Case for Apply the DCB Solution

4.4.5 Enablers

The main enabler is the availability of the NOP through the SWIM network.

4.4.6 Transition issues

Integration of non-airborne flights (SBT) and airborne flights including non-ECAC flights (RBT).

5 ENVIRONMENT DEFINITION

5.1 AIRSPACE CHARACTERISTICS

This section is covered by the General DOD [4].

5.2 TRAFFIC CHARACTERISTICS

This section is covered by the General DOD [4].

6 ROLES AND RESPONSIBILITIES

The section addresses the roles and responsibilities of organisations and human actors in the context of medium/short-term network planning activities.

6.1 MAIN ROLES AND RESPONSIBILITIES

Four actors are involved in medium/short-term network planning activities:

- Airspace Users;
- Civil/Military Airspace Managers;
- Sub-Regional Network Managers;
- The Regional Network Manager.

They are supported by a fifth actor: the APOC Staff.

The **AOC Staff** are the vehicles through whom the business intentions of the civil airspace users are conveyed and made known to the Network. They become increasingly visible in the medium/short-term planning phase, when their intents are progressively disclosed and disseminated in the NOP via SWIM-enabled NOPLA applications. Business Development Trajectories become Shared Business Trajectories and ultimately Reference Business Trajectories. They manage the trajectory lifecycle and truly are the pivot on which the medium/short-term planning phase turns. In that sense, they are the primary actor of the medium/short-term planning phase.

As trajectory owners, they hold all the information related to their trajectories and contained in the NOP. The information is read-only for all other ATM Stakeholders but is however controlled by the Regional Network Manager (automatically or manually) before inclusion in the NOP.

They drive all the user-centric processes, triggered:

- Either on their own initiative, to declare/change their intentions (in application of their business plans) or adapt their intentions (in reaction to network events);
- Or at the request of an ATM Stakeholder, so that their intentions are compatible with all network constraints.

In the process, they always give their consent before any demand adjustment:

- Either impacting on their trajectories since they file and refine SBTs (under the umbrella of the Regional Network Manager);
- Or impacting on their airspace requirements since they define and refine airspace requirements (under the umbrella of the Civil/Military Airspace Manager).

When a UDPP request is sent by the network because it cannot accommodate the full demand properly, the UDPP ensures that the decision on capacity allocation is taken by the Airspace Users: they decide, they choose and prioritise their flights.

The **Airline Coordinator** [29] represents the civil airspace users in collaborative processes as they are a key, active part of these decision making and must convey their preferred

[29] This is a new role proposed by EP3 and is therefore considered as a Hot Topic 7.

trajectories and (non) airspace reservation dimensioning (e.g. geometrical and geographical flexibility).

The associated role does not have a hierarchical position over the individual users but is a supporting role both for the Sub-regional Network Manager and for the airspace users. He/she is a facilitator that ensures explanation of decision taken by the Civil/Military airspace manager/Sub-regional network manager for maintaining safety, network balance and available capacity.

Obviously, he/she is the Airspace Users' facilitator that acts during UDPP.

The main responsibilities are:

- To represent civil airspace users' interests as a user of the ATM System and deals with their problems;
- To be aware of the current ATM process situation, and intervene only when necessary i.e. only if the problem cannot be solved through direct negotiation between users and the Civil/Military airspace manager/Sub-regional network manager couple, which should occur most of the time when a considerable number of users are affected (like UDPP);
- To identify the best solution (equitable, suitable and feasible) for airspace users in close coordination with the sub-regional network manager;
- To analyse with the Civil/Military airspace manager/Sub-regional network manager other ASM/DCB measures before triggering a DCB measure;
- To support the Civil/Military airspace manager/Sub-regional network manager (by having detailed information on the various civil users) in selecting ASM/DCB solutions with respect to equity.

The **Civil/Military Airspace Managers** are distinct but complementary actors collocated in the same organisation/unit – the Airspace Management Cell. They interact permanently to make sure that the airspace resource is consistently allocated, in particular when segregations are needed between civil and military airspace users. They work hand-in-hand with the Sub-Regional Network Manager to meet their contrasting expectations. Ideally, the operational needs of military airspace users are fulfilled, with a minimum impact on the business intents of civil airspace users.

Civil/Military Airspace Managers act both at local level (local ASM Actor) and at sub-regional level (AMC). They work in close co-operation with the Sub-Regional Network Manager and the local DCB Complexity Manager …

In the frame of medium/short-term network planning, Civil/Military ASM are responsible for:

- Acknowledgement of Airspace Users needs, requests and requirements. In the case of a military exercise, the definition of the airspace usage rules for airspace elements part of the reservation is under the responsibility of the Military Authorities;
- Consistent allocation of airspace to the Civil and Military Airspace Users at the local level (local ASM Actor);
- Integration of local needs in order to develop the sub-regional Airspace Use Plan (AMC);
- Dissemination of the Airspace Use Plan;
- Co-ordination with their neighbouring Civil/Military Airspace Managers for integration of the AUP at regional level, through the NOP;
- Co-ordination with the Military Planner (cf. here after);

- Co-ordination during the whole planning phase, up to the day of operation, to handle airspace requirements sent at very short notice;
- Co-ordination with Sub-Regional Network Managers to help solve DCB issues: airspace requirements and airspace usage rules are re-assessed in light of the selected DCB solutions;
- Co-ordination with the neighbouring Civil/Airspace Managers to facilitate cross-border operations.

The focal point for all MIL Actors, including the AMC, is the specific military Actor called the "**Military Planner". He/She** is responsible for scheduling the military needs in terms of airspace reservation and time slot at any time.

In the case of large-scale military exercises planned long time in advance, the Military Planner is a specific Military Actor called the "**Exercise Director**".

Sub-Regional Network Managers are responsible for sub-regional network planning and the resolution of imbalances, whenever it can be done at their level (subsidiarity principle). They:

- Define and refine the airspace available capacity plan, in cooperation with the Civil/Military Airspace Manager;
- Identify imbalances at local / FAB level (possibly advised by the Regional Network Manager);
- Implement DCB Solutions developed at local / FAB level, after regional validation if need be: DCB solutions are developed in cooperation with Civil/Military Airspace Managers to take into account Airspace Requests and Requirements, and find an acceptable trade-off;
- DCB Solutions are also developed in co-operation with Airspace Users, especially when the UDPP is enabled.

The sub-regional network manager works at local/ACC level or at FAB level:

- If the scope of the Sub-Regional Network Manager covers one ACC only, he/she will act at the local level, like an advanced FMP. He/She behaves like a **Local DCB Complexity Manager**;
- Otherwise, the Sub-Regional Network Manager covers several ACCs grouped as a FAB:
  - He/She is supplemented by the local DCB Complexity Managers being networked to him/her;
  - He/she animates CDM sessions internal to FAB to collate, analyse and arbitrates local needs versus resources availability;
  - He/She takes part to any CDM session at sub-regional and regional levels for consistency check;
  - He/She participates at local plans integration into a coherent network plan.

Local DCB Complexity Managers work locally:

- They are the best placed to know the available ACC resources (including roster) and related capacity. They also know which DCB solutions would the best suit (at least, locally) airspace use;
- They participate to refinement of resource usage (including military activity), to the adjustment of traffic demand and military activity, and coordinate with other DCB Managers as well as adjacent Sub-Regional Network Managers;
- They co-ordinate with other local DCB Managers and with local ASM;
- They have to participate to the local solutions integration managed by the Sub-Regional Network Manager.

The **Regional Network Manager** is responsible for ECAC-wide network planning, i.e. for all network aspects beyond the range of Sub-Regional Network Managers. In particular, the network as a whole is entrusted to him/her. He/She envisions it, monitors it, brings it under control and keeps it under control.

The Regional Network Manager:

- Integrates sub-regional contributions to the NOP.

He/She closely cooperates with the Sub-Regional Network Managers, to leverage action and balance demand and capacity at the regional level through:

- Support: Facilitation of co-ordination with the Sub-Regional Network Managers, particularly in the elaboration of network DCB Solutions;
- Validation: Network effect assessment of new and sensitive airspace/airport DCB Solutions;
- Coordination: Integration/synchronisation of a set of airspace/airport DCB Solutions such as queues.

He/She is the recipient of the Airspace Users intentions, validates them and provides assistance to flight planning.

He/She oversees UDPP, but does not interfere with the negotiations: he/she acknowledges UDPP requests, triggers UDPP and brings it to an end if need be.

He/She compiles the NOP, collating all information regarding demand, capacity and DCB Solutions.

The **APOC Staff** support medium/short-term network planning activities insofar as airports are nodes of the network. They notably contribute to DCB through the application of DCB Solutions implemented at the airport level. For a full description of the actor's roles and responsibilities though, please refer to DOD M1 Collaborative Airport Planning [6].

6.2 Actors' Responsibilities in the ATM Process Model

The following table summarizes the main actors and roles contributing to network management in the medium/short term planning phase.

Organisation/Unit	Individual Actor	Related Process(es)	Main Role(s) & Responsibilities
Regional Network Management Unit	**Regional Network Manager**	A2.1.2.2 Optimise SBT A2.1.2.3 Validate SBT A2.1.4 Build/Refine Reference Traffic Demand A2.2.1.2 Refine Airspace Usage Rules A2.2.1.3 Refine Network Usage Rules A2.2.2.2 Refine Possible Airspace Configurations A2.2.3.2 Refine Airspace Resource Available Capacity Plan A2.3.1.2 Detect Airspace Demand Capacity Imbalance A2.3.2.1.2 Select/Refine/Elaborate a DCB Solution at Network Level A2.3.2.2.1 Assess Network Impact of the DCB Solution	The **Regional Network Manager** is responsible for the ECAC-wide network planning, i.e. for all network aspects beyond the range of Sub-Regional Network Managers. In particular, the network as a whole is entrusted to him/her: • Manages the NOP through region-wide actions and through the coordination of sub-region-wide actions; • Permanently monitors the network situation ahead to assess network stability and regain if instabilities develop; • Maximises efficiency and the use of existing capacity, notably when opportunities are created during the medium/short-term planning phase; • Supports DCB solution definition, modification, implementation through the validation and coordination of these DCB Solutions when necessary; • Acts as last-resort decision maker whenever the regional approach is more relevant, in the case the problem is unmanageable sub-regionally (conflict of interest); • Triggers and arbitrates the User Driven Prioritisation Process in case of adverse operational conditions. UDPP depends on CDM between the concerned Airspace Users, which may or may not after several optimisations and iterations come to an agreement. If a relevant solution (i.e. a flight list) that would comply with the capacity constraint (e.g. max number of arrivals at an airport) or if a response is not provided in due time, the Regional Network Manager would arbitrate and propose a resolution to cope with discrepancies between the Business Trajectories demand and the Network capacity constraint(s).

Organisation/Unit	Individual Actor	Related Process(es)	Main Role(s) & Responsibilities
Sub-Regional Network Management Unit	**Sub-Regional Network Manager**	A2.1.2.2 Optimise SBT A2.2.1.2 Refine Airspace Usage Rules A2.2.1.3 Refine Network Usage Rules A2.2.2.2 Refine Possible Airspace Configurations A2.2.3.2 Refine Airspace Resource Available Capacity Plan A2.3.1.2 Detect Airspace Demand Capacity Imbalance A2.3.2.1.2 Select/Refine/Elaborate a DCB Solution at Network Level A2.3.2.2.2 Apply the DCB Solution	The Sub-Regional Network Managers are collectively responsible for the planning and execution of network operations: • During the planning phases, they optimise the capacity use based on the most up-to-date information regarding available resources, predicted traffic demand… The optimisation may be obtained through the adjustment of the resources (e.g. by planning a temporary route structure in terminal airspace during peak operations) or/and the negotiation of traffic assignment when necessary, through CDM processes; • React to the developing situation (short-term planning phase), whenever necessary to correct it or take advantage of it, through Demand Capacity Balancing; • Act as the optimiser of resource use and thereby cooperate with all the actors interested in the resource: the Civil/Military Manager, the AOC Staff, the Regional Network Manager and their neighbouring counterparts, the Complexity Manager, the Planning Controller. The Sub-Regional Network Manager can be envisaged as a **Local DCB Complexity Manager** or as a sub-regional actor, depending on the area of responsibility i.e. local/ACC or FAB. The local activity is more related to resource collection and management, definition of DCB solutions, traffic demand management, while the sub-regional actor works more at providing an integrated plan that will be adjusted through CDM sessions according to the neighbouring sub-regional plans. Considering these elements, the local level bodies will first set up their local "plans" that could contain the following topics: Demand plan 1 Resource plan 2 Capacity plan 3 Scenario plan 4 Airspace Plan 5 Configuration plan. These data will be provided to the Sub Regional level to consolidate all of them.
Airspace Management Cell Civil Military Unit	**Civil/Military Airspace Manager**	A2.1.1 Refine/Define Airspace Reservation Demand A2.2.1.2 Refine Airspace Usage Rules A2.2.1.3 Refine Network Usage Rules A2.2.2.2 Refine	The Civil/Military Airspace Manager is responsible for the management of airspace, that is: • The elaboration, modification and the implementation of the Airspace Use Plan; • The adjustment of Airspace Requirements, when requests are made, changed or removed at the last minute; • The update of the Airspace Use Plan, in accordance with these adjustments; • The notification of these adjustments to the Sub-Regional and Regional Network Managers, so that the possible impact on networks operations can be assessed. E.g. if

Organisation/Unit	Individual Actor	Related Process(es)	Main Role(s) & Responsibilities
		Possible Airspace Configurations A2.2.3.2 Refine Airspace Resource Available Capacity Plan A2.3.2.1.2 Select/Refine/Elaborate a DCB Solution at Network Level	some airspace is released, network management is given the opportunity to use extra capacity and can seize it, if need be, through dynamic resource adjustments and rerouting proposals (in the form of RBT Revisions requests); • The implementation of these adjustments, to adapt operational rules and coordinate the activation or deactivation accordingly; • The management of airspace inc. transitions, with activation and deactivation planning of Airspace Reservations, from Modular Temporary Airspace Structures to Dynamic Mobile Areas through Flexible Military Airspace Structures incl. airspace monitoring inc. conformance monitoring. The Civil/Military Airspace Manager during the Execution Phase cooperates: • Inside ASM - i.e. with their neighbouring counterparts to facilitate cross-border operations, notably in the frame of a shared use of airspace; • Outside ASM, for the purpose of ASM/DCB coordination, with the Exercise Director or the Exercise Planners, the Sub-regional Network Manager and the Regional Network Manager. The Civil Military Airspace Manager can be envisaged as a **local ASM Actor** or as a sub-regional actor, depending on the area of responsibility. The local activity is more related to resource collection and management, while the sub-regional actor works more at providing an integrated Airspace Use Plan through CDM sessions with neighbouring Civil/Military ASM and sub-regional Network Managers. **The Exercise Director** is: • Responsible for scheduling the military needs in terms of airspace reservation and time slot for large-scale exercises; • The focal point for all Military Actors and for the Airspace Management Cell. **The Exercise Planners have similar mission but for small-scale exercises.**
Airline Operations	**AOC Staff**	A2.1.2.2 Optimise SBT	The AOC is an organisational unit of an airspace user and is normally run by a variety of professionals from different areas. It is hosting the roles of Flight Dispatch, TTA/TTO Management

Organisation/Unit	Individual Actor	Related Process(es)	Main Role(s) & Responsibilities
Centre		A2.1.3 Start UDPP on SBTS A2.3.2.1.2 Select/Refine/Elaborate a DCB Solution at Network Level	and Strategic & CDM Management thereby managing the operations of the airspace user and implementing the flight programme. AOC Staff main responsibility is to maintain the integrity of the scheduled Flight Programme and to take during the medium/short-term planning phase and in real time the necessary decisions in order to manage all the flights within the airspace user network. Thereby AOC Staff is responsible for: • Improving airline network performance (integrity); • Optimisation of the SBT (possibly starting during the medium-term planning phase and finishing during the short-term planning phase prior to departure); • Devising solutions for constraints arising from the NOP; • Deciding on the need to create, cancel, delay, reroute flights/passengers and change Aircraft in response to operating needs. Where this affects other stakeholders, the AOC Staff will publish the corresponding data and, where necessary, will negotiate and take decisions via a CDM process; • Request and participate to UDPP; • Developing priority proposals (slot swapping, flight cancelling, slot trading) and negotiating solutions on behalf of the aircraft operator during adverse operational conditions by taking part to the User Delay Prioritization Process.

Organisation/Unit	Individual Actor	Related Process(es)	Main Role(s) & Responsibilities
Airport Operations Centre	**APOC Staff**	A2.3.2.2.2 Apply the DCB Solution	The Airport Operations Centre (APOC) is the central organisational unit responsible for airport airside operations. The APOC Staff has the various roles of Resource Management, Flight Operations Management and Environment Management and is responsible for CDM (CDM focal point) with all relevant stakeholders. Main interactions of the APOC Staff are with the Apron/Ground Controller within the domain of Airport Operations and with Airspace User Operations. In summary, the main tasks of the APOC Staff are to: • Set up Departure Queue; • Manage Airport Resources; • Manage Environmental issues; • Manage Flight Data.

Table 16: Actors' Role & Responsibilities

7 HOT TOPICS

The hot topics come from two sources:

- The review room;
- The expert group sessions following the validation exercises 3.3.2 and 3.3.3, and the expert group 4.3.1.1.1.

Hot topics deal with concept fine-tuning and with incompatible opinions between Experts. In all cases, after analysis of the problem, DOD scribes will take the final decision.

The mentioned exercises confirm a significant number of the assumptions included essentially in DODs M2 "Medium/Short-Term network planning" and E4 "Network Management in the Execution phase"), and also in the operational scenario OS-11 "Non-severe capacity shortfalls impacting arrivals in the Short Term" related to business trajectory management and dynamic DCB in the context of arrival traffic management.

The exercise allowed also refining some elements and identifying open issues to be added in the list of "hot topics":

Border-line between DCB and dynamic DCB

Regarding the planning processes contributing to the management of arrivals in the day of operation, three layers are referred to:

- A DCB layer working uniquely on flights in the planning phase;
- A dynamic DCB layer working with a time horizon ranging from 40 minutes to 2 hours ahead of the congested area and managing both flights in short-term planning phase and execution phase (with a focus on flights in execution phase);
- The "AMAN" process.

The exercise highlighted the fact that the border-line between Dynamic DCB and DCB is not necessarily a "line"! During the simulations, the actors tended to use the possibility to extend the planning horizon of Dynamic DCB in function of the severity of the congestion and thus to overlap significantly with the DCB process, switching from the concept of "border-line" to the concept of "interfacing".

Conclusion from Exercise: The time parameters of 2 hours and 40 min only serve as starting values for process optimisation purposes. The final trigger between the three processes mentioned above will not be a standard fix time parameter but an individual one reflecting local particularities, ground/airport infrastructure, arrival/departure traffic pattern.

Alternative Viewpoint: Some experts expressed the need to have a clear time or distance based process trigger to avoid synchronisation issues.

Transition from SBT to RBT

There were lively discussions on the trigger and time horizon for the transition from SBT to RBT:

Conclusion from the Experts: While elaborating on the operational scenario and refining the simulation platform requirements, experts agreed that the transition from SBT to RBT was in fact defined as:

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- In a CDM airport when the event 'Delivery of start up approval' (triggered by the User's Request) occurs, if all the prerequisite actions[30] on the SBT are complete including compliance with ATM constraints;
- In a non-CDM airport, the equivalent event is the delivery of the departure clearance, following the user's request for a departure clearance.

Alternative Viewpoints: The transition from SBT to RBT takes place as soon as the flight enters the pre-departure sequence (DCB standpoint) or latest at a fixed time trigger such as 5min before push back.

Business Trajectory Management

There were two approaches concerning the business trajectory process sequencing discussed in preparation of the validation exercise.

The Interpretation used in the Exercise: There was consensus amongst ATM service providers that the first proposal for a business trajectory compliant to network constraints should come from the ATM service provider who is best suited to suggest a solution. Then this trajectory would be transmitted to the Airspace User. If the trajectory proves not convenient to the Airspace User, he/she will use the proposal as a baseline for a modification and submit the user preferred 4D trajectory to the network manager for validation and publication. This solution is considered to be the most efficient in conditions of high dependence of multiple constraints.

Note: the gaming exercise with focus on arrival management confirmed the advantages of starting the process with a feasible solution to reduce the number of iterations in the trajectory development process.

Alternative Viewpoint supported by some airlines: The ATM service providers communicate only the constraints subject to the flight and the airspace users in return provide their proposal compliant to the constraints. This solution is considered to be most efficient in conditions of reasonably few interdependent constraints as it is projected by SESAR 2020.

Need for an Airline Coordinator?

When flexibility of a military area is possible i.e. there is flexibility in geometry and in geography, the related airspace reservation should not only be a process limited to the Exercise Director and to the Airspace Manager / Sub-Regional Network Manager couple. Indeed, it should be extended to the Civil Users. Civilians are an active key part of the collaborative process conveying their preferred trajectories and (non-)airspace reservation dimensioning. A new role/function, the Airline Coordinator, representing airspace users' interests has been identified during the validation exercises/expert group sessions.

[30] If the departure airport is within the AMAN horizon of the destination airport, a TTA for the IAF will be allocated which may include the allocation of an appropriate pre-defined arrival route. The principle is "first requested, first served".

The expert group approved the following responsibilities:

- The Airline Coordinator represents civil airspace users' interests as a user of the ATM System and deals with their problems. However:
    - Not all the airspace users may want to be represented by this actor/role.
    - Those that are not represented by the Airline Coordinator may not be treated in the same equitable way and may see the representative as a lobby.
- The Airline Coordinator is a function having not a hierarchical position over the users but that should have a supporting role both for the Sub-regional Network Manager and for the airspace users.
- The Airline Coordinator must always be aware of the current ATM process situation, and should intervene only when necessary i.e. only if the problem cannot be solved through direct negotiation between users and the Civil/Military airspace manager / Sub-regional network manager couple, which should occur most of the time when a considerable number of users are affected (like UDPP).
- The Airline Coordinator works in close coordination with the sub-regional network manager in order to identify the best solution (equitable, suitable and feasible) for airspace users. He/She is a facilitator that ensures explanation of decision taken by the Civil/Military airspace manager / Sub-regional network manager for maintaining safety, network balance and available capacity.
- Before triggering a DCB measure, the Airline Coordinator should analyse with the Civil/Military airspace manager / Sub-regional network manager other ASM/DCB measures.
- Obviously, the Airline Coordinator is the Airspace Users facilitator acting during UDPP.
- The Airline Coordinator will have detailed information on the civil users to support the Civil/Military airspace manager / Sub-regional network manager in selecting ASM/DCB solutions wrt. equity. The equity indicators will consist of historical data (for every airspace user (number of times that each civil airspace user preferred trajectories have been affected and degree of trajectory distortions), trajectory distortions for the day of operations, flight priorities and number of affected trajectories.

Alternative Viewpoint possibly supported by some airlines: Not all the airspace users may want to be represented by an Airline Coordinator being afraid to reveal in total or in part their current business strategy. In addition, denying access to their intentions, those that are not represented by the Airline Coordinator may not be treated in the same efficient way and may see the representative as a lobby driven by the largest AO.

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9 ANNEX A: OPERATIONAL SCENARIOS

The detailed description of those scenarios will be provided through individual files - i.e. one per identified scenario.

The following table summarises the dedicated scenarios for Medium/Short-term Network Planning. This list could be refined according to the specific needs of Medium/Short-term Network Planning exercises.

Some of these scenarios address both the short-term and the execution phases. When it is the case, this is mentioned in the scenario summary header.

Scenario	Summary	Status
Non-Severe (No UDPP) Capacity Shortfalls impacting Arrivals in the Short-Term	Operational scenario OS11 is of interest both for the Medium/Short-term planning phase (DOD M2) and for the execution phase (DOD E4). This OS will be used for the validation of dynamic DCB. Dynamic DCB aims at filling the gap between planning DCB and ATC. This OS describes the resolution of a local imbalance facing a European airport in 2020 on the day of operations that is to say during the short-term planning phase and the execution phase. The imbalance is subsequent to a capacity shortfall resulting from sudden adverse weather conditions. The imbalance, albeit non-critical, is identified at short notice and occurs during a busy time period. Being non-severe, the capacity short-fall can be solved without UDPP during the planning phase (UDPP is not applicable during the execution phase). Severity can be defined as a maximal capacity overload (for example 20%) or as a maximal overload during a time period (for example, 3 hours in a row with a 10% capacity overload), or as a maximal admissible delay per flight. Therefore, actions have to be taken to rebalance the situation at the airport and in the vicinity i.e. terminal airspace. Actions are performed to flights already airborne or not in the DCB arrival queue horizon or not, or in the AMAN horizon or not. Those actions result from the application of predefined DCB Solutions, primarily impacting arrivals and taking the form of a queue management process. Those actions are described, together with the operational events they respond to. The processes relevant to it are addressed in the Detailed Operational Description related to network management on the day of operations.	**Produced (OS-11)**

Scenario	Summary	Status
Severe (UDPP) capacity shortfall impacting arrivals in the short-term	This Scenario describes the resolution of a local imbalance facing a European airport in 2020 on the day of operations. The imbalance is subsequent to a severe capacity shortfall i.e. does trigger application of a User Driven Prioritisation Process. A list of flights is issued by the Airspace Users. It is validated by the Network Management Function. The way the negotiation process between the Airspace Users is performed and the related DCB Queue is applied, are described in the OS.	**Not started**
Non-severe (no UDPP) capacity shortfalls impacting multiple nodes of the network in the short-term	Operational scenario OS36 is of interest both for the Medium/Short-term planning phase (DOD M2) and for the execution phase (DOD E4). This OS will be used for the validation of dynamic DCB. Dynamic DCB aims at filling the gap between planning DCB and ATC. Network stability is also treated. This operational scenario describes the resolution of 3 local imbalances facing 2 European airports and an en-route sector, in 2020 on the day of operations (that is to say during the short-term planning phase and execution phase). Just like for OS11, capacity shortfalls are of an acceptable magnitude i.e. non-severe (please, cf. OS11 here before). The 3 nodes, belonging to the same FAB (Beach FAB), are strongly connected through trajectories. Therefore the resolution of the 3 imbalances is prone to network effect – meaning that a DCB Solution applied on one node may have an impact on another node. As a consequence, local actors have to coordinate at the sub-regional level, so as to find compatible DCB Solutions.	**Produced (OS-36)**
Severe (UDPP) capacity shortfalls impacting multiple nodes of the network in the short-term	This Scenario describes the resolution of 2 local inter-dependent imbalances facing 2 European airports, in 2020 on the day of operations. The 2 interconnected imbalances presented (1 at arrivals, 1 at departures) result from severe capacity shortfalls i.e. do trigger a UDPP. The scenario addresses the assessment of network effect in order to elaborate compatible DCB solutions based on the 2 priority lists, taking into account connected airports too.	**Not started**

Scenario	Summary	Status
Non-Severe (No UDPP) Capacity Shortfalls impacting Departures in the Short-Term	The Operational Scenario describes the processes and interactions among actors for the nominal case of solving a non-severe capacity shortfall impacting departures on the day of operations (short term planning phase and execution phase), within the context of SESAR 2020 concept of operations. The Scenario focuses on how the APOC Staff, the Tower Ground Controller and the ATS Tower Supervisor, in coordination with the Sub-Regional Network Manager, interact with the AOC Staff, the Airline Station Manager and the Ground handling Agents to solve an airport capacity shortfall impacting departures by the activation of a departure queue management process. The Scenario description takes place at one European airport (Riviera Airport), which is strongly connected to a close airport (Sunshine Airport). Actions described by the present scenario at Riviera Airport are triggered by a previous capacity shortfall impacting arrivals at Sunshine Airport resulting from sudden adverse weather conditions (See Scenario “Non-Severe (No UDPP) Capacity Shortfalls impacting Multiple Nodes of the Network in the Short-Term” for further detailed description). The application of a Demand and Capacity Balancing (DCB) queue for arrivals at Sunshine creates an imbalance at Riviera Airport impacting departures. The Scenario starts when the capacity shortfall is triggered at Riviera airport caused by the remote imbalance at Sunshine airport; it covers the processes taken into account at Riviera airport to apply a DCB queue solution for departures, which implies a revision of the departure and pre-departure sequences; continues with the publication of the updated AOP and NOP into the SWIM; and finishes with the implementation of the new pre-departure and departure sequences.	**Produced (OS-26) in DOD M1** “Collaborative Airport Planning”

Scenario	Summary	Status
Severe (UDPP) Capacity Shortfalls impacting Departures in the Short-Term	Prioritisation for departure in the event of reduced capacity is the result of a collaborative process involving all partners. Airspace users among themselves can recommend a priority order for flights affected by delays caused by an unexpected reduction of capacity. This process will be needed in case of disruptions at congested airports. This process leaves room for airspace users to trade slots if they individually agree to do so, based on agreements and rules that are transparent to the other actors but that respect sets of rules agreed by all parties. The process is permanently monitored by the Regional Network Manager in order to make sure that an acceptable solution is available in due time and that all concerned parties are aware of any adverse network wide effects that may develop. This specific scenario is related to the departures during the reduced capacity period and during the recovery time after the capacity shortfall. During those periods there is more departure demand than departure capacity at the airport level without en-route constrictions. Two typical situations can be identified: • During reduced departure capacity which is less than schedule (demand) due to weather conditions or runway restrictions; • Or during recovering from a period of capacity shortfall when several aircrafts exceeding the normal capacity are waiting at the apron for the departure clearance. In both situations, more than one aircraft is requesting the same departing time and new SBTs/RBTs have to be allocated to each flight without the presence of any relevant en-route restriction. Due to the imbalance between the departure demand and capacity, a new AOP has to be built taking into account the possibilities from the network and the needs or preferences from the users following the previously agreed procedures and according to the airport agreed performance targets. The AOP evolution is continuously monitored and the performance indicators are updated accordingly and are forecasted for the next hours. The UDPP process starts as soon as the capacity restriction affects the real time or forecasted performance targets producing an unacceptable result	**Produced (OS-19) in DOD M1** "Collaborative Airport Planning"

Scenario	Summary	Status
Military collaboration in the medium/short-term	Two military collaboration scenarios are addressed: • Military collaboration in the Medium-term; • Military collaboration in the Short-term. The Medium/Short-Term planning phase covers a period from six months to a few hours before the execution of the flight. This planning phase ends with the finalisation of the Reference Business Trajectory (RBT). The SESAR concept does not specify a time or external trigger when the Shared Business Trajectory (SBT) changes to an RBT. When airports and ATM have agreed on the trajectory to be flown, the data will be loaded into the aircraft's avionics. This final pre-flight trajectory generated by the on-board avionics is the RBT. At this stage, the SBT takes the form of a trajectory that the user agrees to fly and the ANSP and Airports agree to facilitate. Those two military collaboration scenarios will be treated through a unique operational scenario starting during the medium-term planning phase up to the short-term planning phase.	**Produced (OS-34)**
Elaboration of pre-defined solutions and optimisation of capacity planning in the Medium Term	This scenario describes the optimisation of the ATM resources by selecting/refining/elaborating a catalogue of DCB solutions, taking into account a more and more precise traffic demand as time is getting closer to operations. By including the airspace users, the CDM process makes ATM resource and SBT optimisations interlaced processes. This scenario spans from the medium term planning phase (-6 month) to the day before operations.	**Not planned within Episode 3**

Table 17: Operational Scenarios identified for Network Management in Execution

10 ANNEX B: DETAILED USE CASE

The detailed description of those Use Cases will be provided through individual files - i.e. one per identified Use Case.

Use Case	Status
Define/Refine Airspace Reservation Demand	**Not Planned within Episode 3**
Optimise Flight Route (By User)	**Not Planned within Episode 3**
Provide assistance to flight route planning	**Not Planned within Episode 3**
Validate SBT	**Not Planned within Episode 3**
Start UDPP on SBTs	**Not Planned within Episode 3**
Prioritise SBTs	**Not Planned within Episode 3**
Define/Refine Reference Traffic Demand	**Not Planned within Episode 3**
Refine Airspace Volume Usage Rules	**Not Planned within Episode 3**
Refine Military Area Usage Rules	**Not Planned within Episode 3**
Refine Route Usage Rules	**Not Planned within Episode 3**
Refine Network Usage Rules	**Not Planned within Episode 3**
Refine Possible Route Configurations	**Not Planned within Episode 3**
Refine Possible Airspace Volume Configurations	**Not Planned within Episode 3**
Refine Airspace Resource Available Capacity Plan	**Not Planned within Episode 3**
Establish/Update Airspace Load Plan	**Not Planned within Episode 3**
Resolve Network Demand Capacity Imbalance	**Not Planned within Episode 3**
Use Network Extra Capacity	**Not Planned within Episode 3**
Assess Network Impact of the DCB Solution	**Not Planned within Episode 3**
Apply the DCB Solution	**Not Planned within Episode 3**

Table 18: Use Case summary

11 ANNEX C: OI STEPS TRACEABILITY TABLE

The following table captures the SESAR Operational Improvements (OIs/OI Steps) addressed by the medium/short-term network planning operations. Although most of the OI Steps should be IP2, some of them might be IP1 (if their implementation is still part of the target system context) or IP3 (if their implementation starts in 2020).

<table>
<tr><th>OI Step</th><th>Description</th><th>Rationale</th><th>Related ATM Model Processes</th></tr>
<tr><td colspan="4">From FUA to Advanced FUA [L02-03]</td></tr>
<tr><td>Europe-wide Shared Use of Military Training Areas
[AOM-0204]</td><td>TSA/TRA sharing concepts - including cross-border operations (CBO) and cross-border areas (CBA) - are extended at European level subject to political endorsement, especially in regard to the dependency on other States (e.g. reciprocity of training opportunities, need to identify and mitigate regulatory and procedural differences).</td><td>This improvement refers mainly to the multilateral/European/FAB dimension. The objective is to overcome existing national fragmentation in view of the Single European Sky implementation, and the expected harmonisation of airspace design and use at European level and to facilitate military-military cooperation between Armed Forces.</td><td rowspan="3">Refine/Define Airspace Reservation Demand (A2.1.1)
Optimise SBT (A2.1.2.2)
Validate SBT (A2.1.2.3)
Refine Airspace Usage Rules (A2.2.1.2)
Refine Network Usage Rules (A2.2.1.3)
Refine Possible Airspace Configurations (A2.2.2.2)
Refine Airspace Resource Available Capacity Plan (A2.2.3.2)
Select/ Refine/ Elaborate a DCB Solution at Network Level (A2.3.2.1.2)</td></tr>
<tr><td>Flexible Military Airspace Structures
[AOM-0206]
IP3</td><td>The possibility for ad-hoc structure delineation at short notice is offered to respond to short-term airspace users' requirements not covered by pre-defined structures and/or scenarios. Changes in the airspace status are uplinked to the pilot by the system.</td><td>The objective is to respond better to military airspace requirements and/or meteorological constraints while giving more freedom to GAT flights to select the preferred route trajectories and to achieve more flexibility from both civil and military partners.</td></tr>
<tr><td>Dynamic Mobile Areas (DMA)
[AOM-0208]</td><td>DMA are temporary mobile airspace exclusion areas. The size and duration of the volumes of airspace will be kept to the absolute minimum required.</td><td>The intent is to limit the impact of airspace exclusion to the minimum while allowing the users to be separated from this moving volume.</td></tr>
</table>

OI Step	Description	Rationale	Related ATM Model Processes
Facilitating OAT Transit [L02-04]			
OAT Trajectories [AOM-0304]	Interfacing Military Mission Trajectories with Business Trajectories		Refine/Define Airspace Reservation Demand (A.2.1.1) Optimise SBT (A2.1.2.2) Refine Airspace Usage Rules (A2.2.1.2)
User Preferred Routing Environment [L02-06]			
Pre-defined ATS Routes Only When and Where Required [AOM-0403] Takes over AOM-0501 and AOM-0502	The route network will evolve to fewer pre-defined routes with the exploitation of advanced navigation capabilities and generalisation of FABs not constrained by FIR boundaries, allowing for more direct routes and free routing. Route constraints are removed along with the development of 4DT based operations. However, it is assumed that some form of route network will be retained to cater for specific requirements (e.g. non capable aircraft, transition of medium complexity operations to/from TMA lower airspace, segregation between managed and unmanaged airspace, military flight planning, etc.).	This OI step is essential in the SESAR Concept of Operations. This is one of the SESAR's basic principles.	Optimise SBT (A2.1.2.2) Refine Airspace Usage Rules (A2.2.1.2) Refine Network Usage Rules (A2.2.1.3) Refine Possible Airspace Configurations (A2.2.2.2) Refine Airspace Resource Available Capacity Plan (A2.2.3.2) Select/ Refine/ Elaborate a DCB Solution at Network Level (A2.3.2.1.2)
Use of Free Routing for Flight in Cruise Inside FAB Above Level XXX [AOM-0501]	The goal is to allow free routing inside FAB independent from route network in cruise above level XXX.	The intent is to alleviate airspace constraints.	
Use of Free Routing from ToC to ToD [AOM-0502]	The free routing is from Top Of Climb to Top Of Descent.	The intent is to alleviate airspace constraints.	

OI Step	Description	Rationale	Related ATM Model Processes
Collaborative Layered Planning Supported by Network Operations Plan [L03-01]			
SWIM enabled NOP [DCB-0103]	The NOP is in fact a 4 dimensional virtual model of the European ATM environment. It is a dynamic, rolling picture that provides a relational image of the state of the ATM environment for past, present and future. The user, via the appropriate applications, is able to view this image, moving the window along the timeline and focusing on any particular aspect or aspects he or she is interested in.	The plan itself is the result of the complex interactions between the trajectories shared into the system, the capacity being offered, the actual and forecast MET conditions, resource availability, etc. and the automatic and manual negotiations that have been carried out. While a user will only need to see the part of the picture he is concerned with together with its broader implications in order to carry out an action on and with the plan, the applications themselves always use the totality of the information available in the SWIM environment.	Define/Refine Airspace Reservation Demand (A.2.1.1) Optimise SBT (A2.1.2.2) Validate SBT (A2.1.2.3) Start UDPP on SBTs (A2.1.3) Define/Refine Reference Traffic Demand (A2.1.4) Refine Airspace Usage (A2.2.1.2) Refine Network Usage Rules (A2.2.1.3) Refine Possible Airspace Configurations (A2.2.2.2) Refine Airspace Resource Available Capacity Plan (A2.2.3.2) Establish/Update Airspace Load Plan (A2.3.1.2) Select/Refine/Elaborate a DCB Solution at Network Level (A.2.3.2.1.2) Assess Network Impact of the DCB Solution (A2.3.2.2.1) Apply the DCB Solution (A2.3.2.2.2)

OI Step	Description	Rationale	Related ATM Model Processes
User Driven Prioritisation Process [L03-02]			
User Driven Prioritisation Process (UDPP) [AUO-0102]	In the absence of any capacity shortfall, reference trajectories are handled on a first come first served basis. Prioritisation for departure in the event of reduced capacity is the result of a collaborative process involving all partners. Airspace users among themselves can recommend to the Network Management a priority order for flights affected by delays caused by an unexpected reduction of capacity. The airspace users will respond in a collaborative manner to the Network Management with a demand that best matches the available capacity.	This process will be needed in case of disruptions of the network and at congested airports. This process leaves room for airspace users to trade slots if they individually agree to do so based on agreements and rules that are transparent to the other actors but that respect sets of rules agreed by all parties. The process is permanently monitored by the Network Management function in order to make sure that an acceptable solution is available in due time and that all concerned parties are aware of any adverse network wide effects that may develop.	Validate SBT (A2.1.2.3) Start UDPP on SBTs (A2.1.3) Select/Refine/Elaborate a DCB Solution at Network Level (A2.3.2.1.2) Assess network impact of the DCB solution (A.2.3.2.2.1)
Planning the Shared Business Trajectory (SBT) [L03-03]			
Agreed Reference Business / Mission Trajectory (RBT) through Collaborative Flight Planning [AUO-0204]	Airspace users can refine the Shared Business / Mission Trajectory (SBT) in a number of iterations taking into account constraints arising from new and more accurate information. They access an up-to-date picture of the traffic situation with the level of detail required for planning (incl. Historical data, forecasted data, already known intentions, MET forecast, current traffic, ASM situation). The collaborative planning process terminates when the Reference Business / Mission Trajectory (RBT) is published.	Refer to SESAR Concept of Operations.	Optimise SBT (A2.1.2.2) Validate SBT (A2.1.2.3)

OI Step	Description	Rationale	Related ATM Model Processes
Improving Network Capacity Management Processes [L04-01]			
Network Management Function In Support of UDPP [DCB-0305]	A delay management function is implemented at ATFCM network level to assist airspace users in the UDPP process.	The Users will make their prioritisation according to the UDPP process. The Network management Function assesses the impact of the UDPP proposal on network stability or calls a CDM process to agree an alternative solution in order to minimise the impact of the Users proposal on the network stability.	Detect Airspace Demand Capacity Imbalance (A2.3.1.2) Select/ Refine/ Elaborate a Airspace DCB Solution at Network Level (A2.3.2.1.2) Assess Network Impact of the DCB Solution (A2.3.2.2.1) Apply the DCB Solution (A2.3.2.2.2)
Airspace User Data to Improve Ground Tools Performance [L01-05]			
Use of Aircraft Derived Data (ADD) to Enhance ATM Ground System Performance [IS-0302]	Continued improvement of ground TP accuracy using ADD (state vector, weight, wind, and then intent data - next N waypoints) subject to quick variations and/or frequent updates.	The objective is to improve ATC decision support tools and especially ground based safety nets performance.	Optimise SBT (A2.1.2.2) Validate SBT (A2.1.2.3) Detect Airspace Demand/Capacity Imbalance (A2.3.1.2) Select/Refine/Elaborate a DCB solution at network level (A2.3.2.1.2) Assess network impact of te DCB solution (A2.3.2.2.1)
Use of Predicted Trajectory (PT) to Enhance ATM Ground System Performance [IS-0303]	The trajectory sharing process is automatic and transparent to the crew and the controller unless the update results in a new interaction for the aircraft. RBT revision is triggered at air or ground initiative when constraints are to be changed (modified by ATC, or cannot be achieved by a/c)	The objective is to improve ground trajectory prediction by use of airborne data.	
Automatic RBT Update through TMR [IS-0305] IP3 Takes over IS-0302 and IS-0303	The event-based Trajectory Management Requirements (TMR) logic is specified by the ground systems on the basis of required time interval and delta of current PT versus previously downlinked PT. TMR parameters can be static/globally defined or dynamic/flight-specific. This process is transparent to ATCOs and pilots (deviation alerts that are relevant for the ATCO should be associated with larger tolerance than	The objective is to improve ground trajectory prediction by use of airborne data while optimising the communication bandwidth. The improvement may be in several steps starting with fixed/pre-defined periodic downlink (possibly varying according to airspace and/or phase of flight), then event-based ground-managed TMR, then static airborne-managed TMR parameters (the detection of deviation	

OI Step	Description	Rationale	Related ATM Model Processes
	ground-managed TMR).	being performed by airborne systems), then dynamic airborne-managed TMR parameters (defined on the ground and uplinked as appropriate).	
Weather Information for ATM Planning and Execution [L01-06]			
Use of Airborne Weather Data by Meteorological Service to Enhance Weather Forecast [IS-0501]	Specified weather data are captured by airborne aircraft and downlinked to the meteorological service in support of forecasting, significant weather reporting and data collection. (This may be "contract" or "event" driven).	The objective is the provision of meteorological products which are more informed and accurate.	All

Table 19: Operational Improvements addressed

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