Operational Service and Environment Definition (OSED)

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Abstract

This Operational Service and Environment Definition address User Preferred Routing operations in STEP1.

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1 Introduction

1.1 Purpose of the document

The Operational Service and Environment Definition (OSED) document describes the operational concept defined in the Detailed Operational Description (DOD) in the scope of its Operational Focus Area (OFA).

It defines the operational services, their environment, use cases and requirements.

The OSED is used as the basis for assessing and establishing operational, safety, performance and interoperability requirements for the related systems further detailed in the Safety and Performance Requirements (SPR) document. The OSED identifies the operational services supported by several entities within the ATM community and includes the operational expectations of the related systems.

This OSED is a top-down refinement of the User Preferred Route DOD produced by the federating OPS 7.2 project. It also contains additional information which should be consolidated back into the higher level SESAR concepts using a “bottom up” approach.

The figure below presents the location of the OSED within the hierarchy of SESAR concept documents, together with the SESAR Work Package or Project responsible for their maintenance.

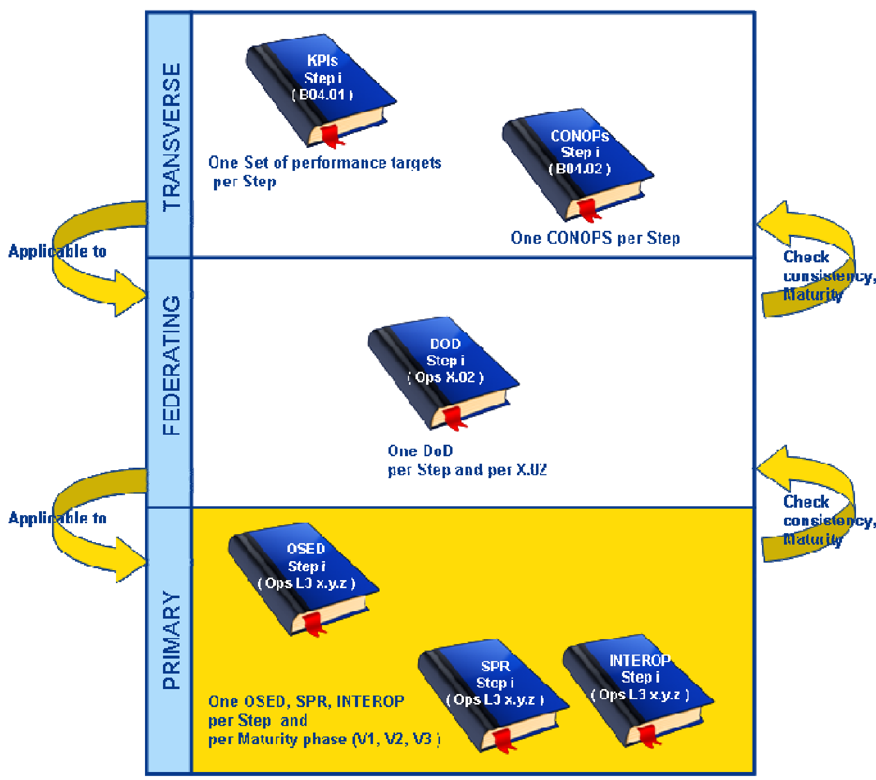

Figure 1: OSED document with regards to other SESAR deliverables

In Figure 1, the Steps are driven by the OI Steps addressed by the project in the Integrated Roadmap document [13].

It is expected that many updates to this OSED will be produced during the lifecycle of the 7.5.3 project execution phase.

1.2 Scope

This OSED details the operational concept as described in the following table:

Operational Package	Operational Sub-Package	Operational Focus Area (OFA)
Moving From Airspace to Trajectory Management (PAC03)	4D Trajectory Management	Free Routing

Table 1: Addressed Operational Focus Area.

It is intended that in future editions, this OSED will be expanded to be linked to the processes and services set out in the SWP7.2 DOD when that is available.

This document describes the principles behind User Preferred Routing. The principal aim is to allow Airspace Users to fly their preferred business trajectories without the need to adhere to a predefined route structure. There are several on-going Free Route initiatives across Europe, and some states and/or FABs have already implemented (e.g. Sweden, Portugal, Ireland …) or plan to implement (e.g. Maastricht UAC, Norway …) Free Route operations within their airspace.

Each implementation has different traffic characteristics and operational objectives. Different capacity, efficiency and safety objectives are appropriate to quiet and busy periods.

This document presents a range of options, aligned with the SESAR concept, which may allow the transition from route-network-based to User Preferred Route operations in different airspaces, at different times.

This document takes account of SESAR Step 1 limitations in respect of operational system capabilities for data exchange, trajectory prediction and flight planning procedures.

1.3 Intended readership

Primary projects:

- WP7: P7.5.2, P7.5.4, P7.6.2

Federating projects:

- 4.2, 5.2 and 7.2 for consolidation
- 7.3.1 and 7.3.2 for cross WP integrated validation

Transversal project:

- WP16 for relevant assessment in transversal areas

1.4 Structure of the document

This document follows the SESAR OSED template.

1.5 Background

In today's organised route structure in the ECAC area, many flights are recleared to a more direct route by ATC for tactical reasons. Indeed, most radar-equipped ATC units offer direct routes as standard practice, subject to traffic volume and complexity. However, this practice is not without its drawbacks: it produces a discrepancy between the flight-plan route and the route flown, making network-wide planning difficult, and, as airlines cannot plan these shortcuts, they are obliged to carry extra fuel and so cannot reap the full benefit from these direct clearances.

Major changes to European airspace can be expected in the near future with the creation of Functional Airspace Blocks. In this context, a harmonised approach will be needed for the successful development of User Preferred Routing. Free-route airspace initiatives have already been adopted by some States—Sweden, Portugal, Ireland, Finland—while others are being actively planned—Maastricht UAC, Norway, Danube FAB, NEFAB.

Recognising both the benefits and potential problems of user-preferred routing, the matter has been addressed directly by the SESAR Concept of Operations (ConOps). According to the ConOps, in managed airspace, particularly in the cruising level regime, user-preferred routing will apply without the need to adhere to a fixed route structure. Route structures will, however, be available for operations that require such support. In either case, the user will share a trajectory whose execution is subject to an appropriate clearance.

The ConOps goes on to say that it recognises that in especially congested airspace, the trade-off between flight efficiency and capacity will require that a fixed route structure will be used to enable the required capacity. Fixed route procedures will be suspended when traffic density no longer requires their use.

Existing free-route airspace systems allow a smooth transition to organised route structures. As the implementation of user-preferred routing is widened, achieving the predictability required for the same smooth transition to route structures in high-density areas will present a major challenge.

1.6 Acronyms and Terminology

Term	Definition
4D	Four-Dimension
ACC	Air Traffic Control Centre
A-CDM	Airport CDM
ADD	Architecture Definition Document
AFUA	Advanced Flexible Use of Airspace
AMC	Airspace Management Cell
ANSP	Air Navigation Service Provider
AO	Aircraft Operator
ASM	Airspace Management
ATC	Air Traffic Control
ATCO	Air Traffic Controller
ATFCM	Air Traffic Flow and Capacity Management
ATFM	Air Traffic Flow Management
ATM	Air Traffic Management
ATSU	Air Traffic Services Unit
AU	Airspace User
BM/T	Business/Mission Trajectory
BT	Business Trajectory (whether shared SBT or reference RBT)
CAA/JAA	Civil Aviation Authority/Joint Aviation Authorities
CDM	Collaborative Decision Making
CDR	Conditional Route
CFMU	Central Flow Management Unit
CONOPS	Concept of Operations
DCB	Demand and Capacity Balancing
DMEAN	Dynamic Management of the European Airspace Network
DOD	Detailed Operational Description
E-ATMS	European Air Traffic Management System
ECAC	European Civil Aviation Conference

E-OCVM	European Operational Concept Validation Methodology
FAB	Functional Airspace Block
FDPS	Flight Data Processing System
FL	Flight Level
FMD	Flow Management Division
FMP	Flow Management Position
FPL	Flight Plan
FUA	Flexible Use of Airspace
IBP	Industrial Based/Pre-Operational Validation & Verification Platform
ICAO	International Civil Aviation Organization
INTEROP	Interoperability Requirements
IP	Implementation Package
IRS	Interface Requirements Specification
KPA	Key Performance Area
KPI	Key Performance Indicator
MSP	Multi-Sector Planner
MUAC	Maastricht Upper Area Control Centre
NM	Network Manager
NOP	Network Operation Plan
OCD	Operational Concept Description
OFA	Operational Focus Areas
OI	Operational Improvement
OSED	Operational Service and Environment Description
R&D	Research & Development
RBT	Reference Business Trajectory
RFL	Request Flight Level
RNP	Required Navigation Performance
RNAV	Area Navigation
RPL	Repetitive Flight Plan
SBT	Shared Business Trajectory
SESAR	Single European Sky ATM Research
SJU	SESAR Joint Undertaking
SPR	Safety and Performance Requirements
SWIM	System Wide Information Management
SWP	Sub-Work Package
TAD	Technical Architecture Description
TMA	Terminal control Area
TS	Technical Specification
UDPP	User Driven Prioritisation Process
UPR	User Preferred Routing
WP	Work Package

2 Summary of Operational Concept from DOD

This OSED details the operational concept of User Preferred Routing (i.e. Free Route) in Step 1 V3. With the on-going implementation of Free Route operations across Europe, a bottom up approached has been adopted in this step.

2.1 Mapping tables

This section contains the link with the relevant DOD, scenarios and use cases, environment, processes and services relevant for this particular OSED.

The following tables shall be coherent with the related DOD Ops 7.2: iterations with OPS 7.2 may be necessary in relation with the consolidation activities.

Table 2 lists the Operational Improvement steps (OIs from the definition phase or new OIs), within the associated Operational Focus Area addressed by the OSED.

Each OIs should in general be allocated to a single OSED, but the possibility of having multiple OSEDs for the same OIs may occur. In this case, the OSED is either the 'Master' (M) or 'Contributing' (C) for the OIs.

Note that the OIs from the definition phase may not be sufficient to represent the concept, raising the need for a new formulation or even new OIs. In the case new OIs are defined (second column), they shall be agreed with B4.2 and Ops 7.2.

Relevant OI Steps ref. (From the definition phase)	Any new / changed OI step (textual form)	Operational Focus Area name	Story Board Step	Master or Contributing (M or C)	Contribution to the OIs short description
AOM-403 (A/B/C)	Pre-defined ATS routes only when and where required within FRA.	Free Routing	Concept Storyboard **Step 1/2/3**	M	Within Free Route Airspace, operational constraints may, locally and on an ad hoc basis, lead to temporarily activate a limited predefined route network. This network solution could be required to enable a more efficient management of traffic situation of too high complexity
AOM-501	Use of Free Routing for Flight in cruise and vertically evolving, inside FAB above a	Free Routing	Concept Storyboard **Step 1**	M	To allow for user preferred trajectory planning, without reference to a fixed route network for flights in cruise inside a defined Free Route Airspace. This may be

	certain level, within low to medium traffic complexity areas.				achieved with either "Direct routing" between established entry/exit way points or by using any intermediate published or not way points.
AOM-502	Use of Free Routing (H24) for Flight in cruise and vertically evolving, through FABs above a certain level, extended to high traffic complexity areas.	Free Routing	Concept Storyboard **Step 2**	M	In step 2, Free Route operation are plannable at a multi FAB level and implemented H24 and extended to high traffic complexity areas.
AOM-503	Use of free routing from Terminal Area Operations exit to Terminal Area Operations entry	Free Routing	Concept Storyboard **Step 3**	M	

Table 2: List of relevant OIs within the OFA.

Table 3: List of relevant DOD Scenarios and Use Cases, identifies the link with the applicable scenarios and use cases of the DOD.

Scenario identification	Use Case Identification	Reference to DOD section
Medium/Short Term: Forecast and Plan Network Demand	UC-NP-01: Submission of iSBT/SMT UC-NP-02: Update iSBT/SMT	DOD Section 4.2.2.1
Medium/Short Term: Elaborate iSBT/SMT	UC-NP-03: Process 4D Trajectory UC-NP-04: Validation of iSBT/SMT UC-NP-08: Submission of OAT Flight Plans (OAT FPL):	DOD Section 4.2.2.1

Table 3: List of relevant DOD Scenarios and Use Cases.

The identified above list of Use Cases applies to trajectory management in general and not specifically to user Preferred Routing. Those Use Cases will not be addressed by the 7.5.3 project but a specific list of Uses Cases enriching them will be defined and developed in section 5 of the document.

Table 4: List of the relevant DOD Processes and Services, identifies the link with the applicable Operational Processes and Services defined in the DOD.

DOD Process / Service Title	Process/ Service identification	Process/ Service short description	Reference to DOD section where it is described
Submit and Update iSBT/SMT	A20	Airspace Users have to provide any data available related to a particular flight in order to create an initial trajectory and further update it with additional information.	DOD Section 5.2.1.1
Submit and update long term exercise schedules and recurrent training plans	A22	When longer term flight intention is known, the related information/data have to be submitted to the System and progressively updated.	DOD Section 5.2.1.1
Check and Validate iSBT/SMT	A70	The planned trajectory has to be checked for compliance.	DOD Section 5.2.1.1

Table 4: List of the relevant DOD Processes and Services.

Table 5: List of the relevant DOD Requirements, summarizes the Requirements including Performance (KPA related) requirements relevant of the OSED. This table supports defining the performance objectives in the scope of the addressed OFA. The DOD performance requirements are structured to respond to Key Performance Indicators (PI) targets / decomposed PIs, so this table will support traceability to the performance framework.

DOD Requirement Identification	DOD requirement title	Reference to DOD section
OPERATIONAL		
REQ-07.02.00-DOD-0001.0002	Enabling free route inside a FAB	Section 6.1 p 111
REQ-07.02.00-DOD-0001.0003	CWP supporting free route airspace	Section 6.1 p 111
REQ-07.02.00-DOD-0001.0004	Complexity and Workload assessment tools supporting free route	Section 6.1 p 111
ENVIRONMENT		
REQ-07.02.00-DOD-0001.0013	Reduction in fuel burn for Step 1	Section 6.1 p 115
COST EFFECTIVENESS		
REQ-07.02.00-DOD-0001.0014	Reduction in cost per flight for Step 1	Section 6.1 p 116

Table 5: List of the relevant DOD Requirements.

2.2 Operational Concept Description

2.2.1 General

Today, in order to guarantee the safety in the European sky and to protect controllers from situations that would be too complex to manage, aircraft trajectories are constrained in both space (required routes) and time (takeoff delays). The European airspace is organised around the use of fixed volumes, mostly constrained by national boundaries and rigid route structures, leading to a fragmented airspace. This results in aircraft operators being unable to fly their most efficient trajectories.

The SESAR ATM Concept of Operations for 2020 represents a paradigm shift from an airspace-based environment to a trajectory-based environment. These trajectory-based operations are the foundation of the whole SESAR concept, in which the trajectory represents the business/mission intention of the airspace users. En-Route and airports constraints will be integrated and agreed for each flight, resulting in trajectories that users agree to fly and the airspace providers (ANSP) and airports agree to facilitate.

Trajectory-based operations imply a new approach to airspace design and management to avoid, whenever possible, airspace becoming a constraint on the trajectories. It will ensure that airspace users fly their trajectories as close as possible to their intents. The route network will evolve to fewer pre-defined routes thanks to new aircraft navigation capabilities, such as required navigation performance (RNP) and area navigation (RNAV) standards, and generalisation of FABs not constrained by FIR boundaries.

At the time of full implementation of the SESAR concept, User Preferred Routing will apply without the need to adhere to a fixed route structure. However it is recognised that in especially congested airspace, the trade off between flight efficiency and capacity will require that a fixed route structure will be used to enable the required capacity. Fixed route procedures will be suspended when traffic density no longer requires their use.

The User Preferred Routing deployment sequence, within ECAC geographical area, will be implemented along the following related Operational Improvement (OI) steps:

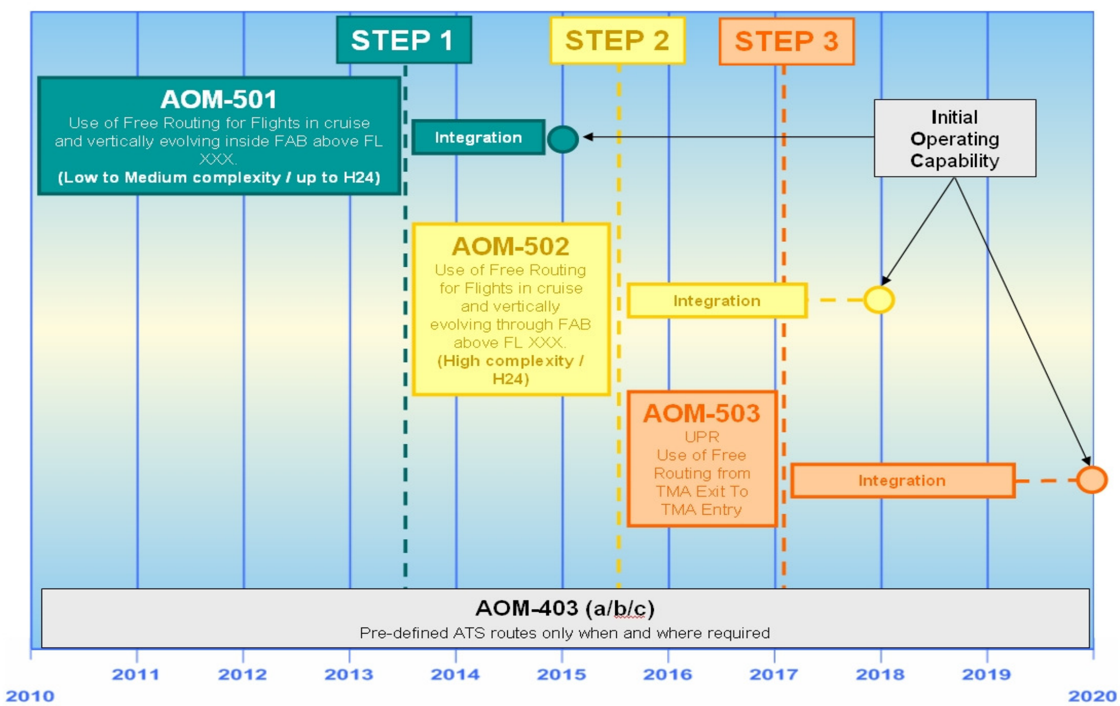

Figure 2: User Preferred Routing OI Steps.

In the SESAR Step 1 timeframe, User Preferred Routing operations will be allowed thanks to the expansion[1] and availability of Free Route Airspace (FRA) which allows an Airspace user to flight plan their preferred routes.

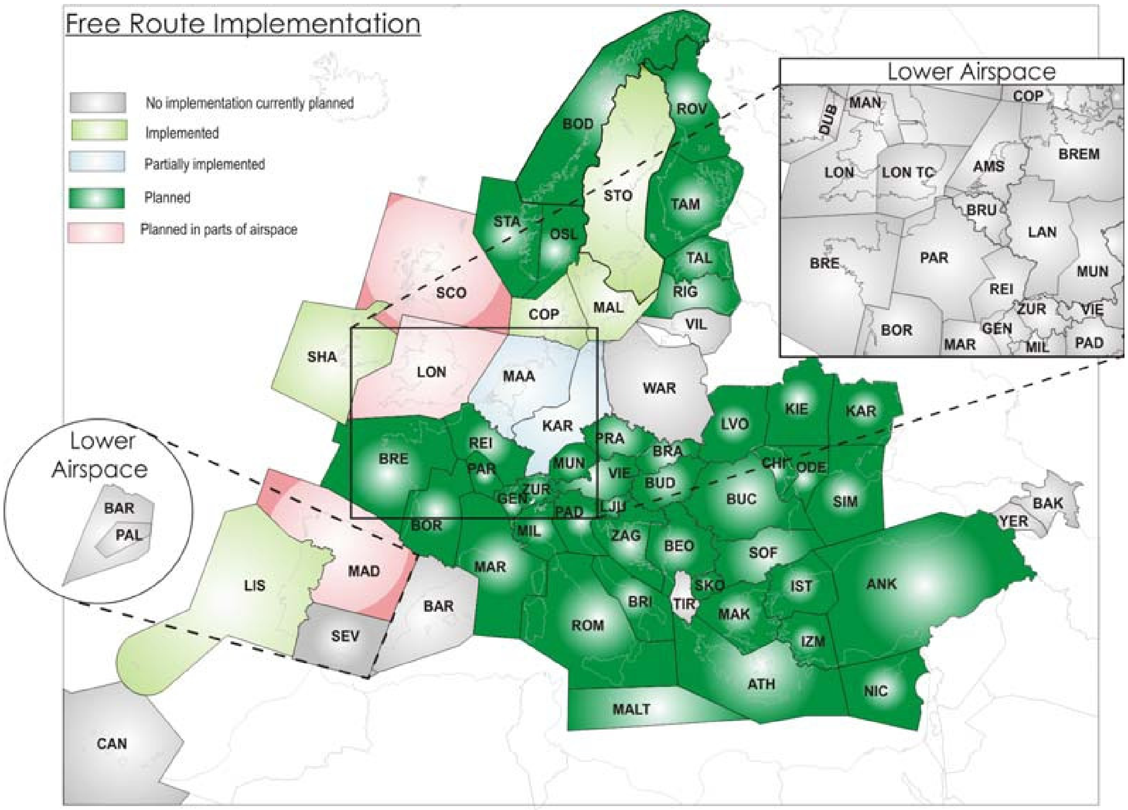

Figure 3: Planned FRA initiatives

Free/User Preferred Route operations are performed at a FAB level and made available to the maximum extent (up to H24 when and where possible) depending on the complexity (low to medium) of the airspace and the traffic demand.

Within a FAB, Free Route operations availability is driven by the local traffic situation (i.e. low to medium) allowing controllers (EC, PC, MSP, LTM) to be able to perform conflict detection and resolution, thanks to automation support and while still being fully in the loop (E.g. to be able to anticipate and reduce any ATM system overloading).

The sectorisation may need to be reviewed to accommodate the changes in traffic flows (according to the expected traffic flows with larger sector sizes supporting operational improvements).

A harmonized lower limit (base FL) is defined in order to guarantee a manageable situation with a sufficient capacity (at least equivalent to the one which could be offered by a fixed route network).

Airspace Reservation/Restriction will remain and all airspace users will have equal access to Free Route Operations airspace. The harmonised application of AFUA (Advanced Flexible Use of Airspace) concept and civil/military coordination will ensure harmonised procedures and service provision.

Free Route Airspace extends laterally to the outer limits of the FAB. This airspace is an integral part of the overall European ATM Network, interfacing horizontally and vertically with adjacent fixed route operations airspace.

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[1] Currently, Free Route operations expand across Europe and there is an increasing number of States and ANSPs or FABs that have already implemented or plan to implement Free Route operation within their airspace.

The Airspace User is the owner of the Business Trajectory and has primary responsibility over its operation. The RBT/RMT adherence principle remains the same within FRA. As far as possible the modifications of the RBT during the execution phase have to be limited to face unforeseen events (e.g. separation provision, failure, constraining weather conditions…).

Every Airspace User defines its user preferred trajectory according to its business intentions, which may strongly differ according to the operator type and business model (e.g. low cost airline or business aviation company) , and even according to the air link for a same operator (e.g. market competition & cost index, route charges, yield management).

According to the situation, the performance target and the associated design criterion will not be the same:

- Time efficiency
- Distance flown reduction,
- Fuel consumption reduction,
- Cost effectiveness,
- Weather avoidance preferences (e.g. Turbulence, Cb's, icing conditions),
- Yield management (e.g. hub management, flight crew turnover).

For transition purposes between FRA and fixed ATS route network environment, overfly of a published entry and a published exit way points is mandatory. Between those points Airspace users can freely define additional intermediate waypoints, by using Latitude/longitude coordinates (i.e. a user preferred route definition inside a FRA may be entirely defined via non published waypoints).

The mandatory Entry and Exit points are defined in order to ensure a safe transition (i.e. lateral and/or vertical) between FRA and adjacent/subjacent conventional ATS Route Network airspace. This can be also facilitated via ARN design refinement.

Inside FRA, User-Preferred Route operation will

- Not be limited to direct routing between an entry and an exit point, but the aircraft is supposed to fly direct between any intermediate (published or not) way points specified by the airspace user.

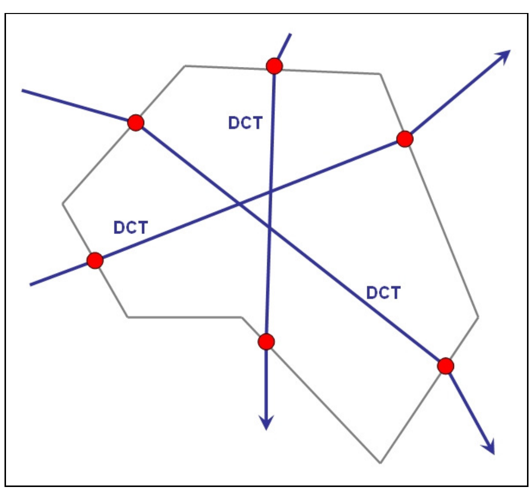

Figure 4: User Preferred Route using direct routing between Entry/Exit points.

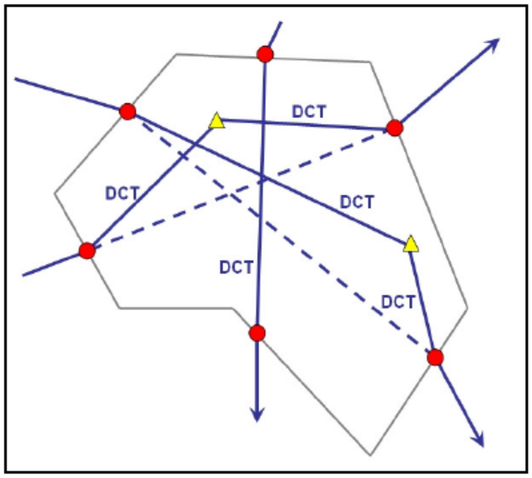

Figure 5: User Preferred Route using intermediate way point between Entry/Exit points.

- Concern cruising and vertically evolving (i.e. climbing/descending) flights.

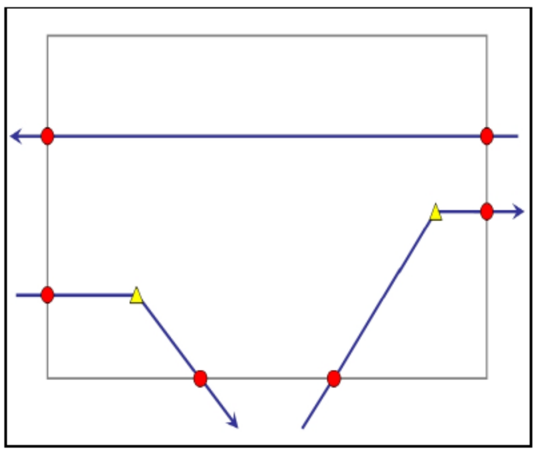

Figure 6: Vertical evolution of flights in Free Route airspace.

2.2.2 Expected Operational Improvements and Benefits

The following table presents the identified operational improvements and potential expected benefits due to the introduction of User Preferred Routing operations.

KPA	Operational Improvement(s)	Expected Benefit(s)
CAPACITY	By allowing Airspace Users to fly their user preferred routes, the need for controllers tactical interventions altering significantly the flight trajectory is expected to be reduced.	Potential negative impact on airspace capacity is expected due to the increase in trajectory crossing points across the whole airspace.
EFFICIENCY	Airspace Users file and fly a trajectory closer to their preferred routing.	• Improved time efficiency • Improved fuel efficiency

		• Improved missions effectiveness
FLEXIBILITY	User Preferred Routing gives airspace users multiple options when planning their flight, which improves business/mission flexibility.	• Business Trajectory update flexibility for scheduled and non-scheduled flights • Flexible access-on-demand for non-scheduled flights • Suitability for military requirements of ARES
PREDICTABILITY	When planned versus executed trajectory becomes more similar.	Improved estimated time of arrival.
ENVIRONMENT		Reduction in distance and flight time will induce a reduction in fuel burnt and associated emissions (CO_2, NOx, H_2O, …).

Table 6: Operational Improvements and expected benefits.

2.3 Processes and Services (P&S)

2.3.1 Processes

This section presents the processes listed in the network DOD and being in the scope of P7.5.3.

2.3.1.1 Process: Submit and Update iSBT/SMT

An operator is to input to a central database any data available related to a particular flight as early as possible to create an initial trajectory, and then progressively update that trajectory with better and more complete data as it becomes available (UC-NP-01/02/06).

2.3.1.2 Process: Submit and update long term exercise schedules and recurrent training plans

When the long term intention to carry out either a mission or training exercise is known, the parameters are to be input into a central database and then progressively updated as alterations or more complete data becomes available. (UC-NP-06).

2.3.1.3 Process: Check and Validate iSBT/SMT

A planned trajectory will be checked within the Network Management environment, initially for syntax, then for compliance with any airspace requirements and limitations that may exist. Then ultimately validated when correct.(UC-NP-04).

2.3.2 Services

No services are defined yet either by B4.2 or 7.2.

3 Detailed Operating Method

3.1 Previous Operating Method

Today, the role of ATM is to deliver air navigation services (through ANSPs) directly to airspace users in the form of en-route and airport Air Traffic Control (ATC) services. This is done using procedures, people and engineering systems located mainly within en-route ATC centres and airports.
Over time, the ATM system has evolved and maintained this basic concept and introduced improvements to it to supply capacity whilst maintaining safe operation.
The following sections describe the fixed route network based operating method and the recent evolutions introduced by the development in Europe of Free Route operation capabilities offered by ANSPs to airspace users.

3.1.1 Fixed Route Network Based Operating Method

Today in Europe, flights are operated through a pre-established ATS route network (ARN) essentially anchored on ground based navigational aids.

ATC sectors and the ATS Route Network are interdependent in both their design and use. “Modus Operandi” are the “operational instructions’ for its use. The purpose of the Modus Operandi will be to provide all the pre-planned links between the route network, sectorisation and segregated airspace so that an automated system (IFPS/NM) and/or the ATS providers and/or the AOs will be able to use the airspace to its optimum.

Current Modus Operandi comprises:

- The availability, in terms of time and FL, of route segments (including the direct route segments) in line with the constraints imposed by segregated airspace.

- The links between network and sectorisation - conditions for availability of certain route segments and their dependence on the configuration of ATC sectors to match traffic demand.

- Routeing scenarios – including all pre-planned alternate routeings to compensate for the temporary unavailability of certain airspace structures.

- Structural constraints – notified constraints, such as, the activation of segregated airspace, sector capacity restrictions, specialised routes for specific traffic flows, profile constraints to skip sectors in a given configuration and modifying capacity depending on the sector configuration.

- Recommended practices – proposals derived from operational experience including the process for selecting sector configurations.

A list of Fixed Route Network Based Operating Method and limitations follows:

- The pre-established ATS route network (ARN) is regularly reviewed and adapted according to the evolution of air traffic demand but is relatively inflexible geographically due to the correspondence of operational sector borders to the FIR boundary instead of desirable operational boundary, showing limitations in exploiting more airspace capacity.

- A number of versions of ARN have been introduced, each one improving on the existing airspace structure: Version 3 made best use of RNAV in route network design and Version 4 was planned to get the utmost benefit from RVSM. After this version, the Route Network Development Sub-Group (RNDSG) decided that the successive versions of the ARN would be based on the new approach of the “Advanced Airspace scheme”, designed to complement the general principles and criteria for ARN Versions 3 and 4 with a radical view of the overall airspace structure, both ATC sectors and ATS routes. These include the need for airspace planning to take account of the requirements of both civil and military users and the principle that when building overall route proposals, the major traffic flows should be accommodated whilst reducing the airspace structure complexity and balancing ATC workload.

The objective of the ARN version 7, the last one to be released, is the enhancement of European ATM capacity, flight efficiency and environmental performance through the development and implementation of an improved ATS route network and TMA systems structures supported by corresponding improvements to the airspace structure and the optimal utilisation rules of both in the ECAC area.

Offering more alternative routings and more direct route alignments closer to the user preferred routes whilst keeping the internal operational consistency of the European airspace organisation requires to take into account the need for a coherent interface with the remainder of the ICAO European and North Atlantic Region and other relevant ICAO regions.

- A pre-established ATS route network (ARN) essentially anchored on ground based navigational aids requires high setting up and maintenance costs to ANSPs.

- Current Airspace Management based on fixed route network gives information to aircraft operators on which routes are available.

- The current airspace design process, which starts from airspace volumes based on national borders, then sub-divides into sectors through which ATS routes are channelled, has proved to be restrictive and does not offer the operators their optimal route profile.

- The organisation of the ATM system in the ECAC region on a national basis leads to a fragmented airspace that, in turn, produces flight inefficiencies.

- Airspace capacity is designed to meet projected demand patterns using fixed routes and sectors, with controllers validated against these structures to handle the traffic. Differing configurations of these structures can be used on the day of operation, but these are also limited to certain pre-defined options and procedures, and this design process is reaching the limits of performance.

- In the current organised route structure, with aircraft unable to fly their most efficient trajectories, to keep the air traffic network safe, aircraft trajectories must be constrained in both space and time by means of an organised route structure, flight-level constraints and take-off delays.

- The strategic organisation of traffic flows is currently executed through the Route Availability Document (RAD) providing a single fully integrated and co-ordinated list of routing restrictions and requirements for the CFMU area.

  The diagram below gives a flow presentation of the process of creation of the RAD, starting with the box on the top left and working through until Publication.

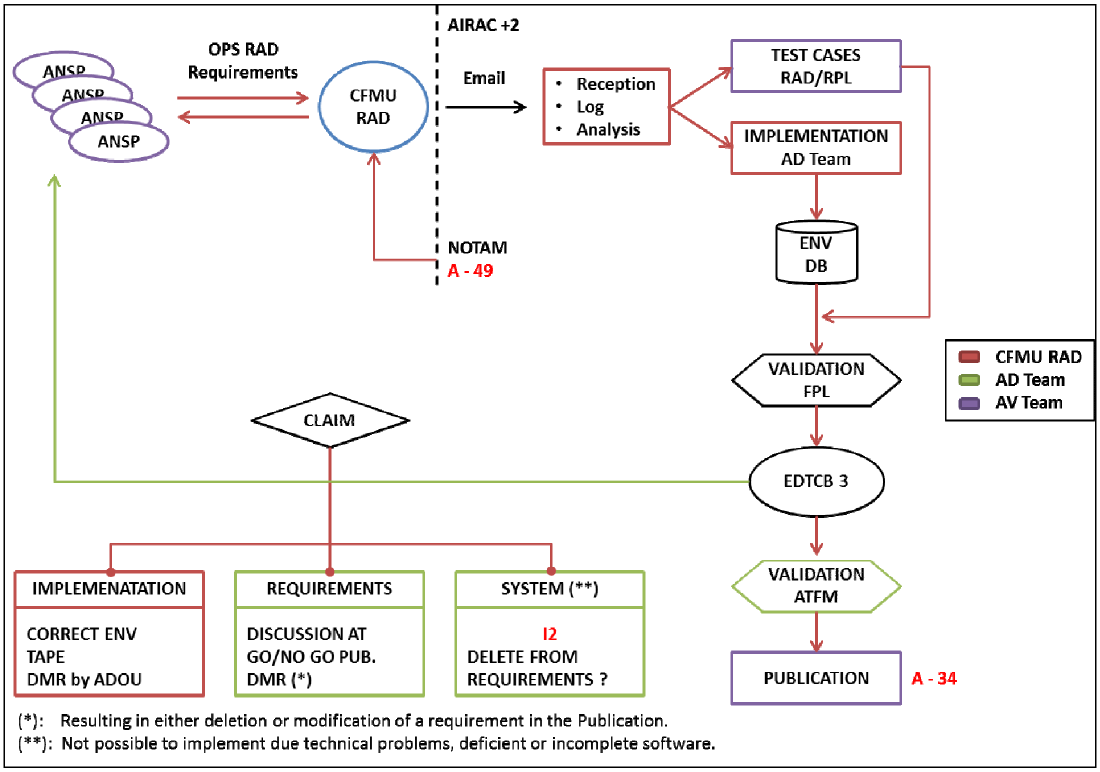

Figure 7: Creation of the RAD.

- Transfer procedures and restrictions are currently stipulated in the Letters of Agreement between the concerned ATS units, reflecting any changes to the applicable procedures in the airspace where ATS is delegated.

- With the increase of flights every year, the airspace routes are becoming more crowded especially over the intersections creating problems for ATC for conflict detection and resolution.

- Many flights are re-cleared to a more direct route by ATC for tactical reasons. This produces a discrepancy between the flight-plan route and the route flown, making network-wide planning difficult.

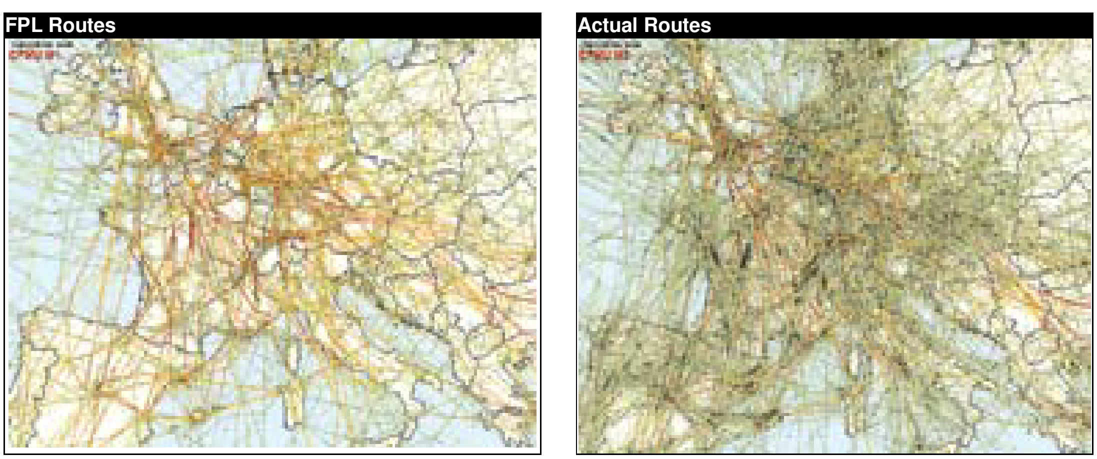

Figure 8: The Network impact.

Use of DCT, while often desirable, can be the cause of sector overloads - due to flights entering sectors earlier or indeed entering a sector which had not anticipated this traffic -, approach sequencing problems and timing issues for ground handling.

- Today sectors are not aligned as far as possible so that the number of flights with short transit times is reduced to a minimum and sector/ATC unit re-entry of flights is not avoided, with such traffic still considered from NM traffic counts.

  The location of crossing points, in relation to the sector boundaries, are not placed close to the entry border of the sector, in order to leave sufficient time for the controller to resolve possible conflicts.

  The use of 'balconies' to allow for direct co-ordination between upper adjacent lower sectors (including cross border) is considered (see example below: the left hand diagram indicates a lateral view of a simplified four sector boundary. The ideal flight profile creates unnecessary co-ordination for sector S1 which would be resolved by introducing level constraints, indicated by the dashed line. However by creating a balcony, as shown in the right hand diagram the co-ordination would be made directly between S2 and S3).

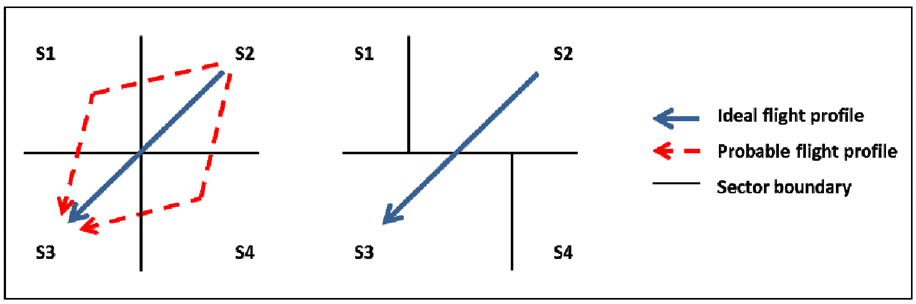

Figure 9: Use of "balconies in sector design".

- Another limitation of current pre-established ATS route network is represented by the "Special Use Airspace", the airspace of defined dimensions for the exclusive use of specific users, including TRA, TSA, D, R, P, Areas and any specially activated areas.

- Active Special Use Airspace is crossed or avoided depending on the degree of civil/military co-ordination and the status of the activity in the areas. In areas where civil/military coordination procedures and airspace conditions permit, the airspace users are permitted to flight plan through Special Use Airspace. In some cases, tactical re-routing will be given if airspace is not available for civil operations. The expected maximum length of tactical re-routings is promulgated through national AIS publications.

- Procedures are developed between the NM and all interested parties to ensure a harmonised application of avoidance of Special Use Airspace.

3.1.2 Recent Evolutions on FRA

From a recent past, Aircraft Operators and other stakeholders are subject to very demanding economic and environmental pressures. To respond to this, an increasing number of States and ANSPs started to implement Free Route operations within their airspace with the will to offer, to the greatest possible extent, user preferred trajectories without the need to rely on a fixed route network.

Current implementations of Free Route Airspace (FRA) have been done through the following options:

- Complete Free Route airspace above a certain FL within one State/FIR
- Complete Free Route airspace above a certain FL within several State/FIR
- Free Route airspace above a certain FL limited to cruising flights

Sweden, Portugal, Ireland and MUAC have started FRA implementation. Other States/ANSPs, individually or through FAB initiatives plan to implement Free Route operations within their airspace. The following paragraphs provide a summary of these initiatives.

3.1.2.1 Today's operational FRA initiatives

3.1.2.1.1 SWEDEN

The Free Route Airspace Sweden (FRAS) initiative is intended to develop Free Route operation in Sweden and allow airspace users to flight plan direct routes across Swedish UIR.

The project has been phased in five steps as following:

Phase	Description	Status
1	To allow free route flight path for traffic over flying Sweden UIR **above FL285**, North of **61st** parallel.	Implemented. April 2009.
2	To allow free route flight path for traffic over flying Sweden UIR **above FL285**.	Implemented. May 2010.
3	To allow free route flight path for **ARR**/**DEP** to/from Sweden and adjacent airports, **North** of latitude **61°N** with a planned trajectory above **FL285**.	Implemented. December 2010.
4	To allow free route flight path for traffic over flying Swedish FIR **above FL285,** including ARR/DEP to/from Sweden and adjacent airports, **South** of latitude **61°N** with a planned trajectory above **FL285**.	Implemented. May 2011.
5	Implementation of free-route airspace within the Denmark/Sweden FAB. A number of 5LNCs were introduced to be used for flight planning in free-route airspace when TSA, restricted and danger areas are active.	Implemented November 2011.

Table 7: Sweden FRA implementation plan.

All five phases of the project that specifically concern Sweden were implemented between April 2009 and May 2011. Expansion of the concept with neighbouring Denmark was implemented in November 2011.

3.1.2.1.2 PORTUGAL

Portugal has implemented Free Route operations above FL245 in Lisboa FIR since May 2009.

The FRA is characterised as below:

- Inside Lisbon FIR above FL245, all route network removed
- A contingency route network remains in operation as well as a route network below FL245
- Overflying and evolving traffic fully benefits from Free Route operations.

- Allows direct flights between entry/exit points or via intermediate published points or lat/long points.
- Arriving/departing traffic to/from Portugal is allowed to proceed direct; and revised SID/STARs have been implemented to ensure appropriate links with the free route airspace.
- Cross border DCTs are not allowed so interim waypoints have been added to the airspace design.
- Specific DCTs created in co-operation with Spain to address some portions of airspace where ATS delegation agreements exist between Portugal and Spain.
- No extra flight planning requirements.
- Flight planning allowed through military airspace, but flights can be tactically rerouted following military request.
- Extra-mileage due to re-routing between 5-15 NM.

3.1.2.1.3 IRELAND

The Free Route Airspace Ireland initiative is intended to develop the implementation of direct routes which can be planned (i.e. Free Route Airspace) within the Shannon UTA, Northern Oceanic Transition Area (NOTA) and the Shannon Oceanic Transition Area (SOTA).
The project has been phased and implemented in five steps as following:

Phase	Description	Status
1	To introduce Free Route Airspace above **FL245** within **Shannon UTA**, Northern Oceanic Transition Area (**NOTA**) and Shannon Oceanic Transition area (**SOTA**).	Implemented. December 2009.
2	To remove all upper ATS routes whilst maintaining the current lower ATS route structure below FL245.	
3	To permit airspace users to flight plan direct routing “DCT” between any of the published waypoints or nav aids within the area *(except for some limited RAD Appendix 4 restrictions to prevent aircraft flying along common boundaries etc)*.	
4	To implement a number of new waypoints.	
5	To withdraw a significant number of waypoints	

Table 8: Ireland FRA implementation plan.

The FRA is characterised as below:

- Free Route Airspace above FL245 within Shannon UTA, Northern Oceanic Transition Area (NOTA) and Shannon Oceanic Transition area (SOTA).
- The route network above FL245 was replaced with a series of waypoints marking the airspace boundary with additional points at 14W, around SNN and DUB.
- No contingency route network above FL245.
- The route network below FL245 remains in existence.
- Overflying and evolving traffic fully benefits from Free Route operations, except as required to remain clear of Active Danger areas.

- Allows direct flights between entry/exit points or via intermediate published points with a DCT limit of 600 NMs (500NM below).
- Arriving/departing traffic to/from airports located within Shannon FIR to proceed to/from STARs/SIDs or navaids associated with the airport.
- Cross border DCTs are not allowed so interim waypoints have been added to the airspace design.
- Routes above FL245 maintained in areas where ATS delegation agreements exist between Ireland and neighbouring ACCs.
- No extra flight planning requirements.
- Waypoints established at extremities of danger areas to facilitate flight planning when areas are active.
- Operational procedure with CFMU has been agreed when RSA activation.

3.1.2.1.4 MUAC

The Free Route Airspace Maastricht (FRAM) initiative is intended to develop Free Route operations within MUAC Airspace.

The project implementation presents six major steps as following:

Phase	Description	Status
1	Limited Concept implementation - **Core night** 2300/2200 - 0500/0400.	Implemented. February 2011.
2	Concept Implementation expanded to **near Night time** from 0000 - 0400 to 0000 – 0600.	Implemented. June 2011.
3	Concept Implementation: making the current Night FRAM DCTs also available H24 during weekends from Fri 2300 (2200) to Mon 0700 (0600).	Implemented. December 2011.
4	Limited concept implementation: upon agreement, DCTs will be extended into the airspace of adjacent ACCs and UACs.	Proposed. Spring 2012.
5	All DCTs H24/7, depending on the availability of the suitable ASM tools (expected 2012+).	Proposed. 2013.
6	Implementation of the full concept.	Proposed. 2014.

Table 9: MUAC FRA implementation plan.

3.1.2.1.5 GERMANY

The objective is to implement the free-route airspace concept in the Karlsruhe UAC and to:

- Shift and optimise pan-European flows in the Karlsruhe East sectors to offload the Warsaw D sector.
- Optimise operational requirements in the Central sectors.
- Offer significantly shorter routes.
-

The project has four phases as follows:

Phase	Description	Status
1	1. New DCTs (Mainly H24, some weekend DCTs) on axis EPWW-EDUUEDYY (East sectors). 2. New northbound (including DEP EDDM, EDDF, LKPR) and southbound DCT in the East sectors. 3. New H24 (local) DCTs Dest. EBBR via ESAMA. 4. New H24 DCTs Dest EDDV, EDDH via UL604 RUDNO.	Implemented. June 2011.
2	1. Extend the list of RAD DCTs in the East sectors mainly H24 depending on military areas and connected to FRA Sweden, Denmark, MUAC and FRA/night at Praha ACC. 2. Selected new RAD DCTs in the other (complex and high loaded) sectors of Karlsruhe UAC and time extension of existing Night ATS routes or Night DCTs.	Implemented. December 2011.
3	1. Completion of the RAD list in East sectors. 2. Certain new RAD DCTs for overflights in the other complex and high-loaded) sectors of Karlsruhe restricted by time (night/weekend/offpeak) and/ or MIN FL. 3. Use of additional cross-border DCTs after upgrade of OLDI exchange with MUAC. 4. Creation of transit routes to optimize vertical transition to/from FRA, to simplify RAD and to enable unlimited DCTs in FRA Karlsruhe (East sectors).	Proposed. Autumn 2012.
4	1. Update of DCTs after the integration of the Munich upper sectors in Karlsruhe. 2. Implementation of a FRA model according to simulation results and customer preferences, for example: a. complete overlay above a high MIN FL, e.g. FL375 (perhaps with time limitations). b. overlay above e.g. FL375 and another layer with lower MIN FL in the East sectors. c. further application and update of the RAD DCT list instead of introducing simplified but inflexible FRA layer(s).	Proposed. 2013.

Table 10: Karlsruhe FRA implementation plan.

3.1.2.2 Planned FRA initiatives

During this last year the European route network has been affected by important changes and improvements; a large number of night routes, dozens of DCT (night and H24), several new week-end routes and some free route airspace initiatives have significantly increased the flexibility and the efficiency of the pre-existing network.
Free Route initiatives continue to evolve, with projects at various stages of planning in Czech Republic, Romania, Serbia, North European and Mediterranean Area, and others planned within the context of the Functional Airspace Blocks.

3.1.2.2.1 FABEC

In September 2011, FABEC members endorsed an airspace vision and strategy based on a common FABEC concept of operations that includes:

- A Free Route Airspace (FRA) volume over the greatest possible FABEC area ;
- A transition airspace volume in which the transition from free route to fixed route airspace and vice versa will take place, focusing on the harmonised development of airspace to support traffic flows (e.g. arrival and departure management concept and tools) around the Top 5 TMAs (Paris, Frankfurt, Amsterdam, London and Munich);
- A fixed route airspace volume intended to optimise the use of the lower airspace to improve arrival and departure routes.

The FABEC Free Route Concept of Operations, is under development and has been worked out taking into account the Free Route concept developed by RNDSG members (i.e. ARN V7 FRA concept).

3.1.2.2.2 FAB CE (Czech Republic Free Route Initiative)

FAB CE is a joint Initiative of 7 States and ANSPs from Central European area. Participating States are: Austria, Bosnia & Herzegovina, Croatia, Czech Republic, Hungary, Slovakia and Slovenia. Respective participating ANSPs: Austrocontrol, BHDCA, Croatiacontrol, ANS CR, HungaroControl, LPS SK, Sloveniacontrol. EUROCONTROL acts as the facilitator and project manager.
A study is being made on the future evolution of the European night direct route network in the FABCE airspace. More intensive work is expected in the future including the development of concrete airspace proposals.

3.1.2.2.3 DANUBE (Romania/Bulgaria Free Route Initiative)

In the context of DANUBE FAB initiative, a catalogue has been developed covering the short, medium and long term. Proposals take into account the overall European ATS route network evolution but also the implementation of more advanced concepts (Free Route or Free Route-like). A real time simulation took place at the end of 2011.

3.1.2.2.4 Balkan States Free Route Initiative

Serbia is participating in the ISIS (the former SEEFAB) initiative, which was originally planned to be a FAB, but is no longer being taken forward in this form. In this context, a night-time free route initiative in the Beograd UIR is planned for the spring of 2012. In coordination with the Serbian initiative, a similar night-time free route operation in the Sarajevo and Zagreb FIRs is also planned for the spring of 2012.

3.1.2.2.5 NEFAB

NEFAB is one of the operational and technical initiatives that are being undertaken by the North European ATM Providers of Norway, Finland, Estonia, Latvia and Iceland, with the scope of providing harmonised and cost efficient service to customers through the possibility of a North European Functional Airspace Block.

Free Route Airspace within NEFAB area above FL 285 is planned to be implemented by November 2015 to improve the airspace structure.

3.1.2.2.6 BLUEMED

During the "Feasibility study" of BLUE MED Project a relevant number of route network improvements were identified and studied. Different timeframes were assigned to each proposal according to the complexity of the local environment and the a-mount of work expected to be developed for each proposal.

In the first part of the ongoing "Definition Phase" some of those proposals were selected to be implemented within 2010 as possible "Quick Wins" and a number of possible improvements/proposals for a later timeframe (2012-2015-2020) were identified and fixed within an agreed FAB action plan.

Moreover, many national or cross-border projects and RNDSG-RDGE proposals have been defined with different identified stages of maturity. All these proposals needed to be assessed both as a single project and, in some cases, as an overall wider route network design activity, in order to estimate possible gains in terms of Nautical Miles saved by aircraft operators and, as a consequence, in terms of time, fuel and CO2 emissions savings.

Additionally, in order to improve the investigation process and classify properly all the different proposals, two separate catalogues for the BLUEMED area have been established:

1. BLUEMED Route Network Catalogue, already presented under the RNDSG of EUROCONTROL and offering relevant benefits to the whole ATM community and focusing on

an area spanning from the EU Core Area up to the far Eastern EU borders. The abovementioned catalogue will now evolve into a regional Flight Efficiency Plan, which will be periodically reviewed and discussed with the active contribution of airspace users.

2. BLUEMED Night DCT Catalogue, giving special attention to the feasibility of implementing free route airspace during the night in parts of the Blue Med FAB.

The catalogues are considered as living documents; the first version of the catalogues have be-en released on February 2010, and will be updated in October 2010 and every six months as an average reviewing period.

An assessment of potential savings was carried out on each single proposal by EUROCON-TROL using SAAM, which shows the number of potential flights attracted by the new route/network/DCT, the daily distance savings in NM, flight time, fuel and CO_2 emission.

Always in the context of the BLUE MED project, the "Free Route Real Time Simulation" took place in Roma at the ENAV simulation and experimental centre from 22 November to 3 December 2010. The aim of the simulation was to investigate the possible effects of the introduction of the Free Route concept in a realistic working environment.

The Malta ACC air space was chosen as the simulation area because of its geographical area and the considerable air traffic, with the collaboration of the Maltese air traffic controllers involved in this type of activity.

3.2 New SESAR Operating Method

3.2.1 Definition

In alignment with ICAO aviation system block upgrades, (the Framework for global harmonization, working document for GANIS), User Preferred Routing is the ability for an airspace user to plan a flight plan with at least a significant part of the intended route which is not defined according to published route segments but specified by the airspace users.

A user-preferred route is not necessarily a direct route between an entry point and an exit point of a specific airspace, but it's expected that the flight is executed along direct segments between any way-point published and/or specified by the airspace user.

User Preferred Routing operations concern flights in cruise or vertically evolving within a Free Route Airspace (FRA).

Such capabilities are enable thanks to Free Route airspace defined by RNDSG members as follow:

A Free Route Airspace (FRA) is a specified airspace within which users may freely plan a route between a defined entry point and a defined exit point with the possibility to route via intermediate way points without ref. to the ATS route network, subject to airspace availability. The FRA is a fully managed airspace within which flights remain subject to ATC.

3.2.2 Airspace classification

It is assumed that user Preferred Routing capabilities will be allowed, in principle in Class C airspace.

3.2.3 Flight Level orientation

The implementation of User Preferred Route operation does not impact the Flight Level Orientation System (FLOS) applicable. The FLOS applicable within Free Route airspace shall be promulgated through the relevant national AIS publications.

3.2.4 Applicability of FRA airspace and User Preferred Route operation

3.2.4.1 Time limitation

The availability of the Free Route airspace can be limited in time during defined period, depending on traffic complexity. Such limited implementation could facilitate the transition to a full deployment of User Preferred Route operation on a permanent basis.

3.2.4.2 Structure limitation

In complex airspace, the deployment of full implementation of Free Route Airspace and User Preferred Route operations could potentially have a negative impact on capacity. In such a case, ANSPs may decide to structurally limit the User Preferred Route capabilities offered to airspace users, for example by restricting the available set of entry/exit points for certain traffic flows, which could increase predictability and reduce the number of potential conflicts.

3.2.5 Airspace organisation

Reserved airspace for user-preferred route operations will form an integral part of the ECAC ATM network, interfacing vertically or laterally with adjoining fixed-route airspace.

Such Airspace will be defined in terms of both lateral and vertical limits. Special-use airspace, i.e. airspace of defined dimensions for the exclusive use of specific users, mainly military, remain and will be defined in terms of both lateral and vertical limits and identified through a clear unambiguous naming convention.

Flight planning procedures are needed which are understandable and easy to use and are coherent with procedures for the fixed route network.

Principles are outlined for GAT and OAT flight-planning dealing primarily with GAT but will specifically mention OAT requirements where necessary.

3.2.5.1 Applicable airspace

User Preferred Route operations are applicable to any area where Free Route Operations airspace is implemented within the European airspace network.

3.2.5.2 Vertical limits

It will be for each ANSP to decide where and when to implement airspace for user-preferred routings. As no two airspace systems are the same, there is no specific recommendation on the minimum Flight Level of such implementation. Each unique set of dimensions will, however, be published in the national AIS publications.

However, the setting of the lower limit of Free Route airspace shall not adversely impact adjacent areas where Free Route operations airspace is not yet implemented or where only a limited application is in place.

With the goal of a harmonised airspace structure across European network, it's recommended that:

- The lower vertical limit shall be coordinated at European network level to ensure interconnectivity with adjoining airspace and this could vary in different areas or at different times within a particular Free Route Operations Airspace.
- The minimum level should be the lowest feasible, taking into account the complexity of the airspace and the traffic demand.

3.2.5.3 Horizontal limits

In order to gain full benefits from Free Route operation airspace, the horizontal limits should reflect the operational boundaries of the ATC unit, depending on local circumstances. Entry and exit points into and out of the airspace will be clearly defined and promulgated.

In areas where the shape of the User Preferred Route/Free Route airspace is such that direct routings could lead to exiting briefly into adjacent airspace, all efforts will be made to ensure that the applicability of User Preferred Route operations will be organised based on operational requirements and that the appropriate arrangements will be made with the adjacent ATC units or States.

If the Free Route airspace is implemented in adjacent FIR/UIRs, the publication of this airspace will clearly reflect the cross-border application. The publication of entry and exit points on the common FIR/UIR boundary will not be necessary from an operational perspective.

Entry/exit points into/out of Free Route Operations airspace shall take into account adjacent airspace where Free Route Operations airspace is not implemented. Entry/exit points will be defined to allow for a structured transition between the two operational environments, this may not necessarily be at the FIR or ATC unit boundary.

In order to ensure overall European airspace structure interconnectivity, the entry/exit points from/into adjacent non Free Route Airspace shall ensure interconnectivity with the fixed ATS route network.

3.2.5.4 Vertical transition between Free Route Airspace and underlying Fixed ATS route network

The vertical connection between User Preferred/Free Route operations airspace and the underlying fixed ATS route network will take into account the various climbing and descending profiles. This will be done by defining a set of waypoints or a transition layer that adequately reflect these profiles. Such mechanisms will be published in the national AIS publication.

3.2.5.5 Maximising Efficiency of User Preferred/Free Route Airspace

To maximize the efficiency of User Preferred Route operations and to ensure the safe and efficient transition of flights, realignment of the fixed route network will be made where necessary in the adjacent airspace not applying User Preferred/Free Route operation.

Wherever a fixed route network will remain in operation below the UPR airspace, this underlying route network will be refined and coordinated at network level to take account of the needs of UPR operations in the airspace above.

3.2.5.6 Access To/From Terminal Airspace

Access to and from terminal airspace will need to be considered and appropriate refinements to TMA structures initiated, including the definition of additional SIDs and STARs to permit more flexibility.

Where the lower limit of the User Preferred/Free Route airspace is coincident with the upper limit of a TMA, the entry and exit points into and out of Free Route airspace should preferably be the last point of the SID and the first point of the STAR[2]. In some cases a redesign of the SIDs and STARs will be required and, depending on complexity, extensions may need to be investigated to ensure appropriate traffic segregation.

3.2.5.7 Publication of a Contingency ATS Route Network

There is no requirement for a European contingency fixed ATS route network

[2] If for some airports no suitable SID/STAR is available, flight planning through the use of DCT should be facilitated.

3.2.5.8 Maintenance of a Fixed ATS Route Network within User Preferred/Free Route Airspace

Wherever a fixed route network is maintained within airspace where Free Route Operations are implemented, details shall be published in AIS publications.

3.2.5.9 User Preferred Routing availability

User-preferred routings may be suspended when analysis of the pending trajectories determines airspace volumes of high potential complexity, e.g. where an active temporary segregated area would lead to restricted airspace availability with consequent traffic congestion. These volumes will have both geographical and temporal dimensions and will be visible via the Network Operations Plan (NOP), along with the route structures that will be used.

During periods of high complexity, en-route operations will be based primarily on the issuance of 2D clearances on user-preferred routes, supported by shared data from the aircraft and ground-based trajectory prediction and uncertainty calculation. Conflict management support tools will be capable of predicting conflicts with sufficient accuracy and look-ahead time to allow the controller to exploit the benefits of UPR operations.

During periods of medium or low complexity, en-route operations will be based on essentially the same principles as for high-complexity, but the specific high-capacity modes will not be needed. All aircraft will normally be cleared on 2D user-preferred routes, supported by shared trajectory data (for capable aircraft) and ground-based trajectory prediction and uncertainty calculation. Aircraft will be subject to conventional ATC separation or will use ASAS capabilities. Vertical constraints will be used as required and precise longitudinal navigation may be applied, either in absolute terms (CTO) or in relative terms, with the spacing between flights being achieved through controller actions or ASAS, when needed.

3.2.5.10 Airspace reservations / Special-use airspace

Free Route Airspace providing User Preferred routings will take account of the airspace volumes established for the operation of diverse, mainly military, aerial activities. Advanced Flexible Use of Airspace (A-FUA) foresees this trend towards UPRs, so circumnavigation of temporary reserved airspace will be facilitated by the appropriate trajectory-management techniques.

In principle, civil flights should not penetrate prohibited, restricted, temporarily restricted or active temporary segregated areas, except where supported by a procedure. Where a procedure exists for the penetration of special-use airspace, airspace users will be permitted to flight-plan through it.

The UPR concept will incorporate the flexibility to allow for tactical controller routing instructions around active temporarily segregated areas (Figure 9). When and where required, civil-military coordination procedures will be in place to enable the preferred trajectories, without having a negative impact on military operations and training activities.

If tactical rerouting is not allowed, published 5LNC[3] way points will be defined to facilitate flight planning. The promulgation of these points shall be ensured through national AIS publication.

[3] The possibility to use lat/long should be considered.

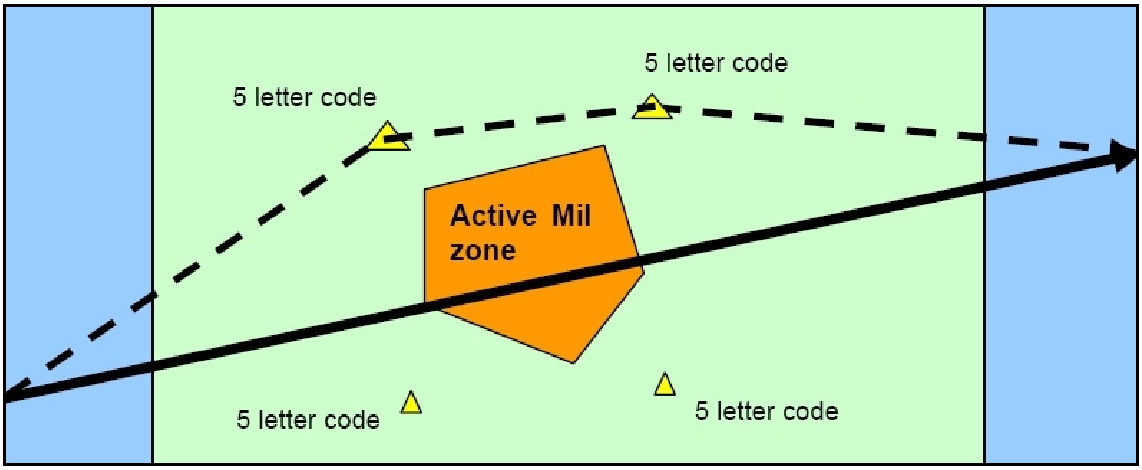

Figure 10: UPR and active military area.

3.2.5.11 Sectorisation

The present sectorisation scheme may need to be restructured to accommodate traffic flows in both the User Preferred/Free Route airspace and the underlying fixed-route network. Instead of having standard traffic flows along the route network crossing at identified points, the traffic will potentially be spread across the whole of a sector.

Sector design will consequently need to be more flexible, i.e. capable of being reconfigured to meet traffic demand.

Inside User Preferred/Free route airspace, sectors should be:

- Unconstrained by FIR/UIR or State boundaries.
- Capable of being reconfigured to meet demand. A structured methodology where sectors are taken from a library of designs already known to the internal and external systems is likely in areas where there are significant fluctuations of traffic flow orientation. Changes to sector definition will need to be notified to the Network Manager and should be transparent to adjacent units.
- If required sectors design should take into account mixed operations

As well, sector design criteria should, at least, take into account:

- The principle traffic flows and orientation;
- Minimizing short transits through sectors;
- Minimizing sector and ACC re-entry;
- Positions of airspace reservations;
- Coherency with adjoining fixed route sectors and link routes to SIDs and STARs;
- Civil / military coordination aspects.

Sectors shall be aligned as far as possible so that the number of flights with short transit times is reduced to a minimum. If this is not feasible such traffic should be exempted from Network Manager traffic demand counts.

More flexibility in defining a larger number of elementary sectors/airspace volumes and sector configurations will need to be explored. Sectors will need to be designed to minimize short transits and to avoid sector/ATC unit re-entry of flights. Operationally designed, cross-border sectors may be needed where User Preferred/Free Route operation Airspace is implemented in adjacent areas.

A more extensive application of cross-border sectors is likely to be required to reflect better variations of traffic patterns. Local FMPs will have to take a more proactive role in the selection of optimum sector configurations. Active sector configurations shall be dynamically communicated to the Network Manager and CIV/MIL ATC units.

3.2.5.12 Sector and Traffic Volumes Capacities/Monitoring Values

Sector capacities shall take into account the more dynamic variations of traffic patterns. Definition of traffic volume capacities/monitoring values shall take into account a minimum transit time. Following advice from the appropriate ATC unit, appropriate procedures shall be put in place by the Network Manager to exempt such flows from sector traffic counts.

3.2.5.13 ATS Delegation

In areas where operational boundaries do not coincide with FIR/UIR boundaries, and delegation of ATS is effective, if one ATC unit has implemented Free Route Airspace but the adjacent one has not, the operational boundaries of FRA shall be published in the national AIS publications of both States. The Letters of Agreement between the concerned ATS units shall be amended accordingly to reflect any changes to the applicable procedures in the airspace where ATS is delegated.

3.2.5.14 Controller actions

Since user-preferred routes will reflect the aircraft operator’s optimum business trajectory, it is anticipated that controllers will not alter the user-preferred route, except for reasons of safety, or when pilots agree to or request a proposed change to their flight plan or, possibly, when military areas are released for civil use.

3.2.6 Airspace Management

3.2.6.1 General

ATC, aircraft operators and the Air Traffic Flow Management organisation should have the same information regarding the intended profile and routing of a flight both regarding the initial flight plan intentions and any subsequent revisions to that information. The development of appropriate tools will indicate real time and future activity status of Segregated Airspace to all users.

The management of managed airspace, allowing user preferred routing operation, will differ from that of the Route Network in that airspace users will no longer be given information on which routes are available, but will need to know which airspace is available.

For the transit period of a given flight through the airspace, Air Traffic Services (ATS) providers and associated organisations such as Air Defence Units and airspace users will need to know and to be updated with the activity of all pertinent segregated airspace areas to enable the selection of a route that will avoid them.

The projected sector demand should also be made available to the airspace users as this too could influence a best route decision.

3.2.6.2 Airspace Information Collection and Distribution

Route selection and flight-plan completion can take place up to the latest possible time prior to flight-plan submission. At the time of route selection, aircraft operators will need the latest available information on the activity of segregated airspace affecting each flight.

In the **medium/short term phase** the current Flexible Use of Airspace arrangements, may be adapted so that planned activation of all Segregated Airspace is delivered by the Airspace Management Cells to CADF for distribution. (In the same way the Airspace Use Plan (AUP) is processed today). States that do not have an Airspace Management Cell (AMC) will need to establish an appropriate arrangement for this task.

In the **execution phase**, changes to the planned activation will need to be communicated as soon as they occur. A real-time airspace database will be necessary to deliver or make available real-time updates on airspace constraints to:

- Aircraft operators (Civil and Military)
- NM
- Area Control Centers (ACCs) (Civil and Military)
- Airspace Management Cells (AMCs)
- Air Defence Units

The Real-Time Database may be a dedicated, centralised or distributed system, or may be incorporated into current or planned systems. States will decide which part of their system will provide the tactical input to this database.

The overall structure must ensure that there is consistency between the pre-tactical and tactical processing.

3.2.6.3 Publication of UPR data

National AIS publications will have to publish:

- The vertical and horizontal limits of UPR/Free Route airspace.
- Entry and exit points into and out of UPR/Free Route airspace.
- Details of any cross-FIR/UIR implementation.
- Definition of any transition layer or set of waypoints that will be used in the interconnection of UPR/Free Route airspace and fixed-route airspace.
- Details of the maintenance of a fixed-route network within airspace where UPR/Free Route airspace is implemented.
- Waypoints defined for navigating around active special-use airspace and conditions for their use.

The role, format and applicability of the Route Availability Document (RAD) will need to be reconsidered within UPR/Free Route airspace, especially for large-scale implementations. The strategic organisation of traffic flows currently executed through the RAD will require a complete review.

3.2.6.4 Letters of agreement and coordination procedures

Letters of agreement will need to be adapted to reflect the specificities of User Preferred/Free Route operations in regard to transfer points, flexible changes in sectorisation, links with the fixed route network, high fluctuations in traffic flows and the possibility to enter or exit the airspace at random points.

Appropriate mentioning of ATS delegation in areas involving UPR/FRA shall be fully considered.

The automatic exchange of flight data between ACCs will need to consider the possibility of transfer at random points.

Transfer procedures: Appropriate procedures shall be defined to reflect these new provisions.

3.2.7 Flight Planning

ATC, Airspace users and the Network Manager will have the same information regarding the intended profile and routing of a flight, both the initial flight plan and any subsequent revisions to that information. The development of appropriate tools will indicate real-time and future activity status of special-use airspace to all users.

With User preferred Routing, there will be no limitation on the use of direct routings, other than those recommended by ICAO.

Airspace users will have the possibility to flight-plan the portion of their routings contained within the airspace volume designated for UPR operation. This will be in the form of a direct routing between, at a minimum, an entry point and an exit point (see Figure 10), both situated at or close to the UPR's lateral boundary. Entry and exit points must assure transparency with adjacent ATC centres.

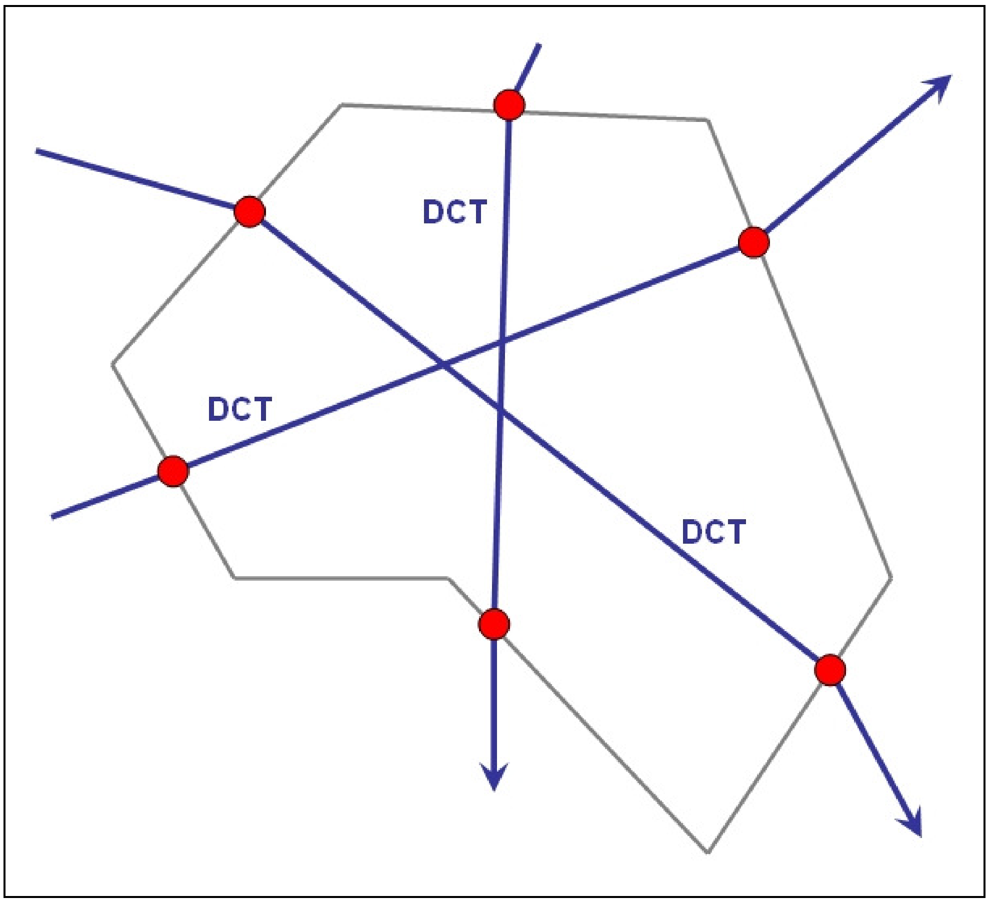

Figure 11: Direct routing between Entry/Exit points.

Operators will also have the possibility to file multiple segments via one or more intermediate points within the User Preferred/Free Route airspace volume (Figure 11), allowing dog-leg segments to provide optimisation as regards the operators' assessments of routing considerations other than those strictly related to distance.

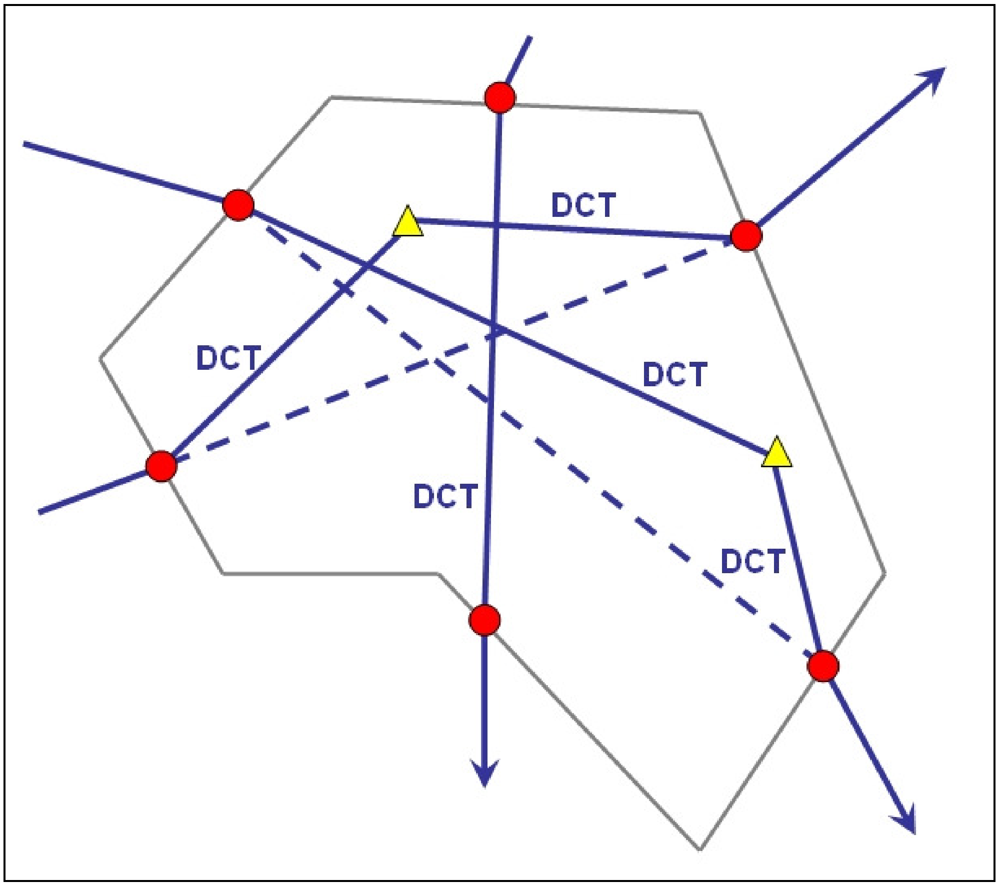

Figure 12: UPR with intermediate points

For safety and capacity reasons, the user-preferred routing should not cause major disturbances to the traffic flow. Therefore, limitations on flight planning possibilities between entry and exit points may be necessary. Ultimately, the amount of freedom in flight planning will depend on, inter alia, the availability of AMC manageable areas, location of traffic flows and ATC capacity.

The Initial Flight Plan Processing System (IFPS) will be modified to enable flight-plan processing and checking in the context of variable lower levels of user-preferred routing operations. Similarly, the IFPS will enable appropriate flight-plan processing and checking for the transition from UPR airspace to fixed-route airspace whenever UPR operations will be implemented for limited time periods, e.g. during night time only.

3.2.7.1 Flight planning routings through Airspace reservations

Airspace users will need information about all pertinent segregated airspace to enable the update of their user preferred trajectory. The update and the selection of a route to avoid the segregated airspace shall be based on the 5LNC formally published to this effect.
When and where required, civil-military coordination procedures will be in place to enable the execution of user-preferred routing trajectories, without having a negative impact on military operations and training activities. Tactical re-routing could be expected, in such cases the expected length of tactical re-routings, the Network Manager shall ensure an overall estimation of the total extra length required for a particular flight.

3.2.7.2 Flight Plan Format

No change is envisaged to the ICAO flight-plan format in respect of User Preferred Routing Operations. OAT flight plans shall continue to comply with national regulations.

3.2.7.3 Route Description

FRA entry/exit points, intermediate waypoints and significant points will be described using the standard ICAO format by:

- 5LNC points or,
- Lat/Long or,
- Range and bearing from a Navigational Aid.

Route portions between waypoints or Lat/Long shall be indicated by means of DCT.

3.2.7.4 Flight Planning Facilitation through the use of DCTs

The use of published DCTs might be required in certain cases to facilitate flight planning in User Preferred/Free Route Operations airspace. This is especially valid in the case where only a limited combination of entry/exit points will be initially permitted within User Preferred/Free Route Operations airspace. Similarly, a number of DCTs might not be allowed for use by the airspace users.
A harmonized approach for the publication of these DCTs will be ensured at network level. This approach shall ensure the respect of the status of airspace within various FIRs (e.g min/max FLs, avoiding penetration of uncontrolled airspace, etc.).

3.2.7.5 Requested FL Change

The airspace users may use any significant point or Lat/Long for indicating changes to the RFL. The airspace users shall observe the Flight Level Orientation System applicable within the respective User Preferred/Free Route airspace.

3.2.7.6 Flight Plan Submission

GAT flight-plans will be submitted to the network Manager/IFPS within the appropriate time-parameter. RPLs may continue to be submitted for flights that will transit User Preferred/Free Route Airspace, but they might not have the full benefit of optimum route selection derived from precise information on airspace availability.
They will continue to be checked by Network Manager/IFPS following normal procedures for proposing alternative routes when necessary.
Flight plan filing limitations shall be promulgated for areas where User Preferred/Free Route Airspace Operations is structurally limited – i.e. only a limited combination of entry/exit points are permitted.

3.2.7.7 Flight Plan Checking and Correction

In addition to the normal flight plan validation rules, the flight-planned route through User Preferred/Free Route Operations airspace shall be considered invalid if it:

- Fails to comply with published entry/exit requirements
- Infringes an airspace reservation
- Fails to maintain the prescribed minimum lateral and vertical distances from an airspace reservation;
- Fails to maintain the published FLOS.

In proposing alternative routes, Network Manager/IFPS will not be able to consider all the varying AO criteria for route selection.
In case of time-limited application of User Preferred/Free Route Operations, Network Manager/IFPS shall check the flight plan to ensure that it complies with the time parameters of the User Preferred/Free Route Operations.

3.2.7.8 Flight Plan Distribution

Real time updates to airspace availability should lead to a recalculation of the submitted flight profile before it's distributed. To ensure that subsequent route corrections can be offered for affected flights, an appropriate distribution time parameter will need to be set. Once this parameter has passed and Flight plans are distributed, further route updates will not be processed.

Flight Plans shall be distributed to appropriate ATS providers, relevant military organisations and other authorised parties decided by National Authorities. The Network Manager/IFPS shall ensure the appropriate calculation of the flight profile to enable a correct distribution of the flight plan to all interested parties.
For large scale applications of free route airspace, the flight plan distribution will need to be ensured to the appropriate ATC units and sectors, hence the importance of having updated information on active sector configurations. In addition, the ATC units, the airspace users and Network Manager will need access to exactly the same information, both for the initial flight plan and subsequent updates. The importance of completely up-to-date information on the status of airspace reservations is to be again underlined.

3.2.7.9 DCT Limits

Existing limitations on the DCTs (in distance and for cross border DCTs) will need to be reviewed.
The current DCT limits are applicable to an administrative airspace (FIR/UIR/NAS) which does not always coincide with the operational airspace boundaries. In case of ATS delegation, this prevents the creation of a DCT covering the complete operational airspace.
The possibility of flight planning DCT across two or more FIR/UIR boundaries shall be considered. This will require the Network Manager/IFPS to compute and communicate to all ACC units entry/exit positions for their area of responsibility.

3.2.7.10 Promulgation of extra mileage

An indication on the maximum extra mileage that could be imposed on an individual flight will be required.

3.2.8 Demand and Capacity Balancing management

Airspace users shall comply with normal Demand and Capacity Balancing (DCB) procedures both within and outside airspace allowing user preferred routing operation.
The implementation of user preferred routing operation at a large scale will generate a large variation of trajectories. Traffic situation awareness with real-time updates will be required in order to provide the most updated DCB situation at local/network levels.

3.2.8.1 Sector configuration management

It is foreseen that in a user preferred routing context, with the induce traffic flow volatility, the use of a large number of elementary sectors and sector configurations associated to a more flexible adaptation to traffic conditions, will be required.
This subject will be addressed by the SESAR P7.5.4 project.

3.2.8.2 Sector and Traffic Volumes capacities/monitoring values

In managed airspace, allowing user preferred routing operations, the use of traffic volumes and exclusion will need to be considered as large variations in traffic pattern will occur with large scale implementation of user preferred routing or when two adjacent ATC units allow user preferred routing operations.

3.2.8.3 Letters of Agreement Restrictions

A number of restrictions currently stipulated in the existing Letters of Agreement and implemented by the Network Manager for flight planning or DCB purposes may no longer be applicable in a user preferred routing environment. Such provisions will need to be reviewed.

3.2.8.4 Re-routing proposals

The possibility for the Network Manager/IFPS to propose alternate/optimum routes to airspace users, taking into account the best operating conditions within a user preferred routing context, shall be considered. New procedures will have to be defined and System support will be required to facilitate this task.

3.2.8.5 DCB procedures

The deployment of user preferred routing operations in Europe will impact the existing DCB/ATFCM procedures and will require a comprehensive re-evaluation of the existing procedures following the different planning phases (i.e. strategic, pre-tactical, tactical).

3.2.8.6 ASM/DCB scenarios management

TBD.

3.3 Differences between new and previous Operating Methods

Previous operating method	New SESAR operating method
Route network	
Although regularly reviewed and adapted according to the evolution of traffic demand, the fixed ATS route network is relatively inflexible due to the alignment of sector boundaries to FIR boundaries.	To ensure the efficiency of UPR operations and the safe and efficient transition of flights, realignment of the fixed route network may be necessary in the adjacent airspace not applying UPR.
SIDs and STARs connect to a fixed route network. Sectors are designed around these connections.	Where the lower limit of UPR airspace coincides with the upper limit of a TMA, the entry and exit points into and out of UPR airspace should be the last point of the SID and the first point of the STAR. A redesign of the SIDs and STARs may be required, with extensions, to ensure proper traffic segregation.
Many flights are recleared to a more direct route by ATC for tactical reasons, producing a discrepancy between the flight-plan route and the route flown.	As UPR reflects an aircraft operator's optimum business trajectory, it is anticipated that controllers will not alter the UPR, except for reasons of safety or when pilots agree to or request a change to their flight plan or, possibly, when military areas are released for civil use.
Airspace management	
Special-use airspace of defined dimensions is reserved for the exclusive use of specific users.	Special-use airspace will remain but will be defined in terms of both lateral and vertical limits and identified through a clear unambiguous naming convention.
	Airspace reserved for UPR will be defined in terms of both lateral and vertical limits and will form an integral part of the ECAC ATM network, interfacing vertically or laterally with adjoining fixed-route airspace.
Constraints	
For safety reasons, flight profiles are constrained in both space and time by means of an organised route structure, level constraints and take-off delays.	Instead of having regular traffic flows along the route network crossing at known points, the traffic in UPR airspace will potentially be spread across the whole of a sector.
Sectors	
Sectors and the route network are interdependent in both their design and use.	Sector design will be more flexible, i.e. capable of being reconfigured to meet fluctuating demand.
Airspace design process starts from airspace volumes based on national borders, then sub-	If UPR airspace is implemented in adjacent FIR/UIRs, the publication of this airspace will

Previous operating method	New SESAR operating method
divides into sectors, through which ATS routes are channelled.	clearly reflect the cross-border application.
	In the context of UPR and its traffic flow volatility, the use of a large number of elementary sectors and sector configurations, suitable for a more flexible adaptation to traffic conditions, will be required.
Coordination – civil/civil and civil/military	
Transfer procedures and restrictions are currently stipulated in Letters of Agreement between the relevant ATS units.	Letters of agreement will be adapted to reflect the specificities of UPR operations in regard to transfer points, flexible changes in sectorisation, links with the fixed route network, high fluctuations in traffic flows and the possibility to enter or exit the airspace at random points.
Active special-use airspace is crossed or avoided, depending on the degree of civil/military co-ordination and the status of the activity in the areas. In areas where civil/military coordination procedures and airspace conditions permit, the airspace users are permitted to flight plan through special-use airspace.	UPRs will take account of the airspace volumes established for the operation of military activities. AFUA will facilitate the circumnavigation of temporary reserved airspace by the appropriate trajectory-management techniques.
	Airspace users will need information about all pertinent segregated airspace to enable the update of their user-preferred trajectory.
	In the tactical phase, changes to the planned activation will be communicated as soon as they occur. A real-time airspace database will be necessary to deliver or make available real-time updates on airspace constraints to: • Aircraft operators (Civil and Military) • Network Manager • Area Control Centers (Civil and Military) • Airspace Management Cells • Air Defence Units
Flight planning	
The strategic organisation of traffic flows is currently executed through the Route Availability Document (RAD).	The role, format and applicability of the RAD will need to be reconsidered within UPR airspace, especially for large-scale implementations. The strategic organisation of traffic flows currently executed through the RAD will require a complete review.
	The management of managed airspace, allowing UPR operation, will differ from that of the route network in that airspace users will no longer be given information on which routes are available, but will know which airspace is available.
	UPR permits an aircraft operator to flight plan its preferred route without reference to the ATS route network within a managed airspace, between a defined entry point and a defined exit point and, subject to airspace availability, via intermediate points (published or not).
	National AIS publications will publish: • The vertical/horizontal limits of UPR airspace. • Entry/exit points into/out of UPR airspace. • Details of any cross-FIR/UIR implementation.

Previous operating method	New SESAR operating method
	• Definition of any transition layer or set of waypoints that will be used to connect UPR airspace and fixed-route airspace. • Details of the retention of a fixed-route network within airspace where UPR is implemented. • Waypoints defined for navigating around active special-use airspace and conditions for their use. The development of appropriate tools will indicate real-time and future activity status of special-use airspace to all users. The projected sector demand will also be made available to the airspace users, as this could influence a best route decision.
ATFCM	
ATFCM measures are designed to meet projected demand patterns using fixed routes and sectors.	Airspace users shall comply with normal Demand and Capacity Balancing (DCB) procedures both within and outside airspace allowing user preferred routing operation. The implementation of user preferred routing operation on a large scale will generate a large variation of trajectories. Traffic situation awareness with real-time updates will be required in order to provide the most updated DCB situation at local/network levels.
	In managed airspace, allowing user preferred routing operations, the use of traffic volumes and exclusion will need to be considered as large variations in traffic pattern will occur with large scale implementation of user preferred routing or when two adjacent ATC units allow user preferred routing operations.
	The possibility for IFPS to propose alternate and/or optimum routes to airspace users, taking into account the best operating conditions within a user preferred routing context, shall be considered.

Table 11: Differences between new and previous Operating Methods.

4 Detailed Operational Environment

4.1 Operational Characteristics

This section is described in the DOD 7.2. The following paragraphs add elements related to User Preferred Routing in a SESAR context.

4.1.1 Airspace

Airspace management in a SESAR context will differ, airspace will be designated in 2 categories organised in a service oriented approach:

- Managed, where traffic information is shared and the service provider is the predetermined separator (may be delegated to the flight crew with pre-defined rules);
- Unmanaged, where traffic may not share information and the predetermined separator is the airspace user.

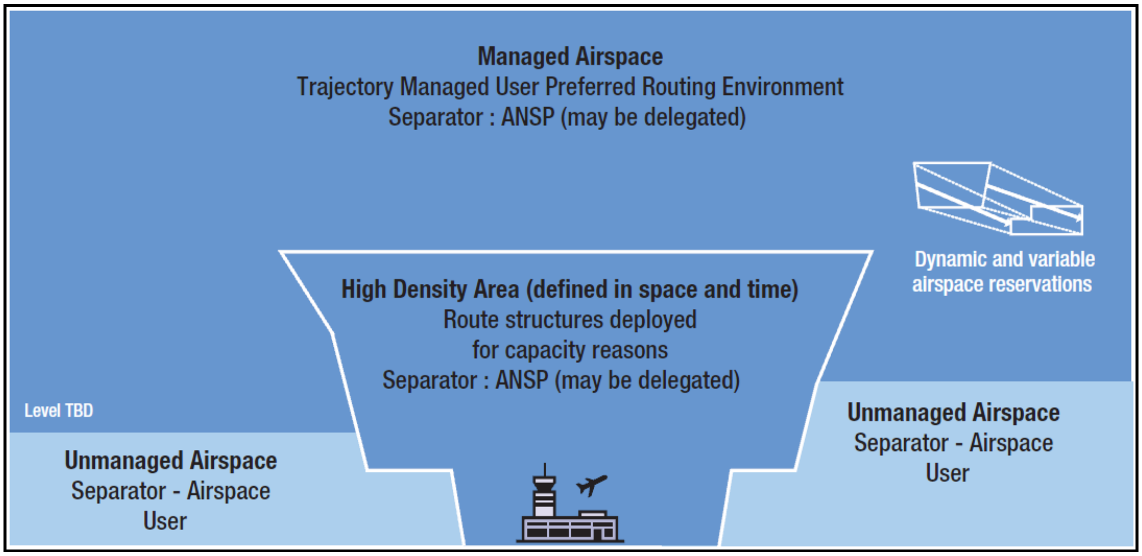

Figure 13: SESAR airspace structure.

In managed airspace, the User Preferred Routing concept will be characterised by the absence of a reference to the ATS route network (i.e. Free Route Airspace), but it will still be an integral part of the overall airspace organisation. Free Route airspace, providing User Preferred Route capabilities will be seamlessly connected with non-Free Route airspace.

AMC manageable airspace structures will remain and all suitably equipped airspace users will have equal access to User Preferred Route airspace.

In medium to high-density airspace or when the nature and density of the traffic will be sufficiently complex, an unrestricted User Preferred/Free Route airspace is not envisaged. This is because flight profiles will be no longer aligned to routes and, therefore, will produce a greater number of random crossing points as illustrated below.

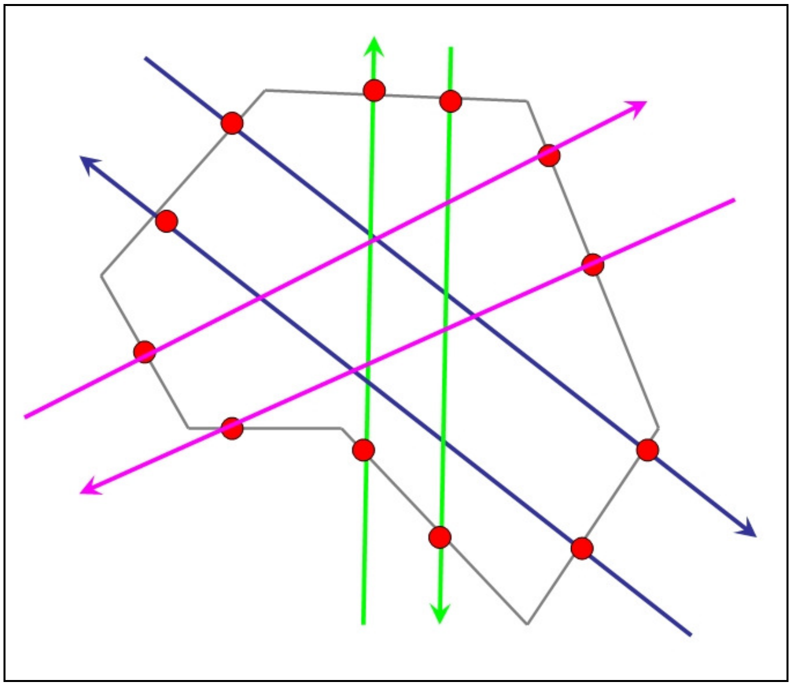

Figure 14: Random crossing points due to Free Route.

4.1.2 Sectorisation

In the case where the implementation of user-preferred routing operations will provoke significant changes in the traffic profiles, a new sectors design of the local airspace or an implementation of more dynamic sectorisation of the local sectors will have to be considered. It will have also to be borne in mind that some sectors could be working in mixed-mode operations.

4.1.3 Military Operations

Military aviation has a vital role to play in the security of each State. Therefore, it is a fundamental requirement that each State is able to operate its military forces to enable them to discharge their responsibilities for security and defense. The user-preferred routing concept will support the level of military effectiveness required by each State.

4.2 Roles and Responsibilities

The roles and responsibilities listed here are not exhaustive and apply only to the User Preferred Routing concept. See WP7.2 DOD Step 1 Role and Responsibilities sections for complementary roles description.

4.2.1 Aircraft Operator

There are four relevant categories of aircraft operators:

The scheduled aircraft operator’s aim is to sell their capacity to the public and to gain the greatest possible share in the transport market. They seek to plan according to demand and to fly according to schedule in an expeditious and cost-effective manner.

Low-cost operators are interested in having the greatest possible flexibility in operations and are acutely sensitive to service costs.

Executive charter operators are also concerned with service costs but, more importantly, their business is built on transporting their clients when and where they want to go. They seek maximum flexibility of operations.

Military aviation operates transport aircraft able to conform to GAT rules, as well as fighter and other aircraft with limited equipment operating as OAT. The latter category needs special handling and assistance from ATC and/or air-defence units, according to national regulations.

The responsibilities of aircraft operators include:

- Performing route planning, taking account of weather, en-route charges, fuel consumption, route and airspace availability/restrictions and capacity restrictions.
- Checking NOTAMs and AMC airspace plans.
- Submission of flight plans to the Network Manager (NM).
- Replanning of routes to cater for changes in airspace availability, actual or forecast traffic congestion and observed or forecast poor weather conditions.
- Coordination of special-use airspace, e.g. for supersonic flights, air-to-air refuelling.

4.2.2 Air Traffic Control

4.2.2.1 Planning Controller

The planning controller (PC) is part of the sector team responsible for a designated volume of airspace, typically one sector. His/her principal task is to check the planned trajectory of aircraft intending to enter the sector for a potential separation risks and to coordinate entry and exit conditions leading to conflict-free trajectories.

The tasks of the planning controller are not likely to change too much. However, the way in which they are performed may well change. The move away from an organised route network will remove the structure that the planning controller uses to solve potential conflicts in the medium term. The tasks of monitoring and conflict detection may increase, although the actual number of conflicts is expected to decrease.

The responsibilities of the planning controller include:

- Evaluating trajectory and flight-plan data according to the airspace status.
- Determining any action needed from the sector team to meet requirements in the trajectory.
- Using automated tools, evaluating the accuracy of detected conflicts and highlighting those requiring action by the EC.
- Coordinating a conflict-free entry and exit for traffic approaching or about to leave the sector with the adjacent sector's PC or EC as appropriate.
- Maintaining and monitoring traffic conflict tools on the sector display.
- Modifying trajectory and flight-plan data according to the local airspace status and planned actions.
- Monitoring the status of automated coordination between sectors.
- Issuing non-system-based clearances to adjacent units where no automated coordination exists.
- Determining expected sector and EC workload by general estimation of potential traffic conflicts.
- Advising the EC about any potential action.

- Monitoring airspace status and adverse weather situations.
- Monitoring aircraft equipment status and informing the EC of any anomalies if necessary.
- Inputting modifications of route and planned flight levels into the flight-data processing system.

4.2.2.2 Executive Controller

The executive controller (EC) is part of the sector team responsible for a designated volume of airspace, typically one sector. S/he is responsible for the safe and expeditious flow of all flights operating within the area of responsibility. His/her principal tasks are to separate and sequence known flights operating within the sector and to issue instructions to pilots for conflict resolution. Additionally, s/he monitors the trajectories (4D and 3D) of aircraft according to the clearance they have received. S/he is assisted in these tasks by automated tools for conflict detection and resolution and trajectory monitoring.

The task of the EC in solving short-term problems is unlikely to change. However, in the context of user-preferred routings, potential conflicts will no longer occur at known points, but will be widely dispersed among numerous random points. In the high traffic-density areas, the impact of removing the ATS route network could have significant impact on the controller's working practice.

The executive controller's responsibilities are:

- Identify conflict risks between aircraft.
- Provide separation between controlled flights.
- Provide sequencing between controlled flights.
- Provide flight information to all known flights.
- Provide information on observed but unknown flights that may constitute traffic for known aircraft.
- Monitor flights regarding adherence to its trajectory or flight plan.
- Communicate with pilots by means of R/T or data link.
- Monitor information on airspace status, e.g. activation or deactivation of segregated/reserved areas.
- Input data into the flight data processing system regarding tactical route modification, modification of flight level, etc.
- Monitor the weather situation.
- Relay to pilots SIGMETS that may affect the route of a flight.
- Reroute flights to avoid bad weather areas if so requested.
- Monitor aircraft equipment status according to information provided by the system.
- Coordinate with PC or MSP (inter-sector) and adjacent sector executive controllers.
- Coordinate with the PC about planned conflict resolution strategies based on system-derived solution proposals.
- Coordinate the implementation of system-derived conflict resolutions with the PC.
- Apply appropriate separation to all controlled flights exiting his/her area of responsibility.
- Transfer control of aircraft to the appropriate EC when clear of traffic within his/her sector.

4.2.2.3 Executive Air Defence Controller

Executive Air Defence Controller's main responsibility is to contribute to the safe realisation of a mission inside or outside an ARES.

He's responsible for:

- Maintaining the assets inside the ARES (when the mission takes place in an ARES)
- Issuing instructions to pilots for conflict resolution vis-a-vis external traffic and or within the mission assets
- Issuing instructions to pilots for mission completion/realisation
- Providing situation awareness
- Triggering alert in case of emergency
- Providing any information related to weather forecast, airfield status, etc

He is assisted for:

- Preparing and executing hand over
- Coordinating with other units/controllers
- Monitoring the traffic outside the ARES

4.2.2.4 Air Defence Supervisor

He is responsible for the general management of all activities related to Air defence missions. He decides on staffing in accordance with planning.

He's responsible for coordinating the activation / de activation or any changes of an ARES with the other (civil & military) supervisors impacted by the ARES.

4.3 Constraints

4.3.1 Network Manager

The Network Manager will need the capability to receive, validate and distribute flight plans containing a user-preferred route segment to the relevant ATC centres and to process them for distribution and flow regulation purposes. This process will be dependent on having knowledge of the latest airspace availability information.

Implementation of user-preferred routings will generate a large variation of trajectories. Real-time updates of the airspace situation with respect to both sector configurations and segregated airspace will be required in order to show the current ATFCM situation. New ASM and ATFCM processes might be required to respond to quickly varying traffic demands and patterns.

4.3.2 Flight plan providers

Enhanced or new flight planning systems permitting the computation of a user-preferred route may be necessary for aircraft operators to benefit from the increased flexibility provided by UPR. They should also be able to receive and process real-time data concerning updates of airspace availability.

The implementation of UPR airspace would be formally defined in terms of a publication in all relevant aeronautical publications pertaining to the relevant airspace. New UPR-related agreements with partners, where necessary, will be described in amended Letters of Agreement.

4.3.3 Legal constraints and safety requirements

With the establishment of user-preferred routing, civil flights will no longer be on published ATS routes. This raises the question of priority between civil and military flights: who will have priority over whom and when? The issue will need to be solved on a regulatory and operational basis. A standard rule should be envisaged.

4.3.4 Flight data processing systems

System support will play a major role in enabling Free Route/User-Preferred routing operations to be implemented and in contributing to its efficiency. Flight data processing systems must be able to recognize the complete Free Route environment, i.e. associated waypoints and horizontal/vertical boundaries. They must also be capable of computing the correct sector sequence for all aircraft on preferred routes using only the data associated with the entry/exit points and any other intermediate or user-defined waypoints.

5 Use Cases

5.1 Operational Scenario 1: Planning and Execution of User Preferred Routing

5.1.1 Scenario Summary

The first part of the operational scenario describes a specific flight of a scheduled airline whose routing between the departure airport and the arrival airport transits through UPR airspace as envisaged in SESAR Step 1: Time Based Operations which are focused on the KPAs of flight efficiency, predictability and environment. At the time of filing the flight plan part of the UPR airspace is delegated for military use as a promulgated airspace reservation (ARES). This prevents the airline flying its published UPR for the airspace. Therefore, the flight's route between the entry and exit points of UPR airspace has to avoid the ARES as shown in Figure 1. This scenario describes the interactions between the various actors and the ATM system (Network Management) as the flight progresses. Furthermore, it describes the appropriate interactions in airspace management as a result of airspace availability.

As it is a scheduled flight, the original planning commences in the Long-term Planning phase when the airline is carrying out its business planning, through the Medium/Short-term Planning when schedules are published and flight plans filed. The scenario concludes in the Execution phase as the flight exits UPR airspace. All planning phases of the collaborative layered planning process are therefore included in the scenario.

In the second part of the scenario, multiple tracks are introduced for flights through UPR airspace. Two flights (**Blue 123** and **Noble 345**) are scheduled airlines who have filed their flight intentions for their flights through UPR airspace in the Medium/Short-term Planning phase. The third flight (**Bizjet 007**) is a business flight which has filed its flight plan shortly before the Execution phase. The scenario describes the interactions between the system (Network Management), the ANSP (Controllers) and the Aircraft Operator (Pilot) as the respective flights enter the airspace.

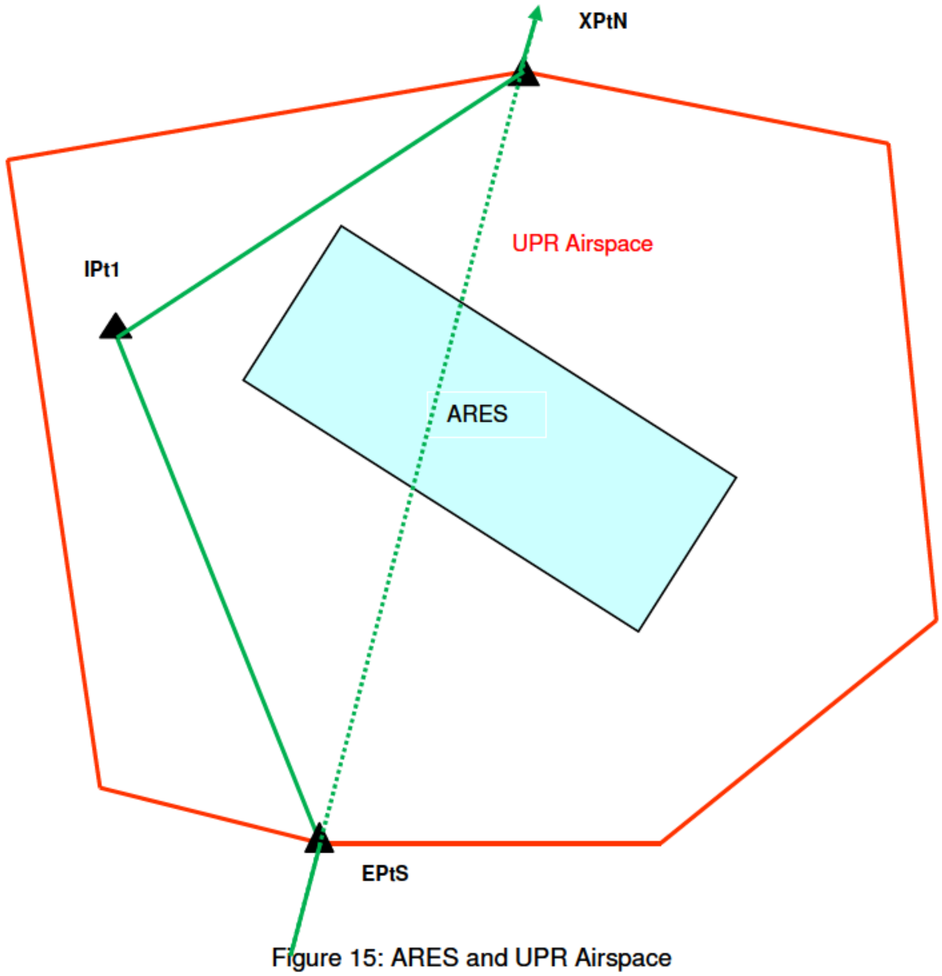

Figure 15: ARES and UPR Airspace

5.1.2 Assumptions and Constraints

- All concerned Operational Improvement Steps for Service Levels 0 and 1 are implemented.
- Regional airspace planning has been carried out and the plans have been coordinated between the AMCs and the network manager, i.e. input has been made into the network operations plan.
- All relevant personnel are aware of the contents of the network operations plan.
- The UPR airspace is contained within one FAB.
- The vertical and horizontal limits and the entry and exit points into and out of the UPR airspace have been published in national AIS publications.
- Within UPR airspace the Flight Crew is responsible for the 2D routing[4] but the Controller is responsible for the vertical element of the trajectory and safe separation.
- Advanced FUA is in operation.

[4] OI CM-0601: Precision Trajectory Clearances (PTC)-2D Based on Pre-defined 2D Routes

- ANSP sector resource management is in effect.
- The Network Management system (IFPS) is aware of the airlines user preferred routings.
- The flight is operating between two major IATA level 3 coordinated airports.
- The flight has been issued with a TTA for the arrival airport and which is back calculated to provide the flight with a CTOT for the departure airport.
- Aircraft equipage:
    - FMS with single RTA/O capability.
    - ATC/Aircraft data link.

5.1.3 Collaborative Layered Planning Process

The goal of collaborative layered planning (see Figure 16) is to balance ATM resources and the airspace user demand. Network Management assures the stability and efficiency of the ATM network. This function exists at both at a regional and sub-regional level. Organisationally, Network Management is independent of users and service providers but will work transparently and collaboratively with both and with the Airports to assure the optimum utilisation of network resources which are a common, public good. A key tool for network management is the Network Operations Plan (NOP) which is accessed through the NOP Portal[5].

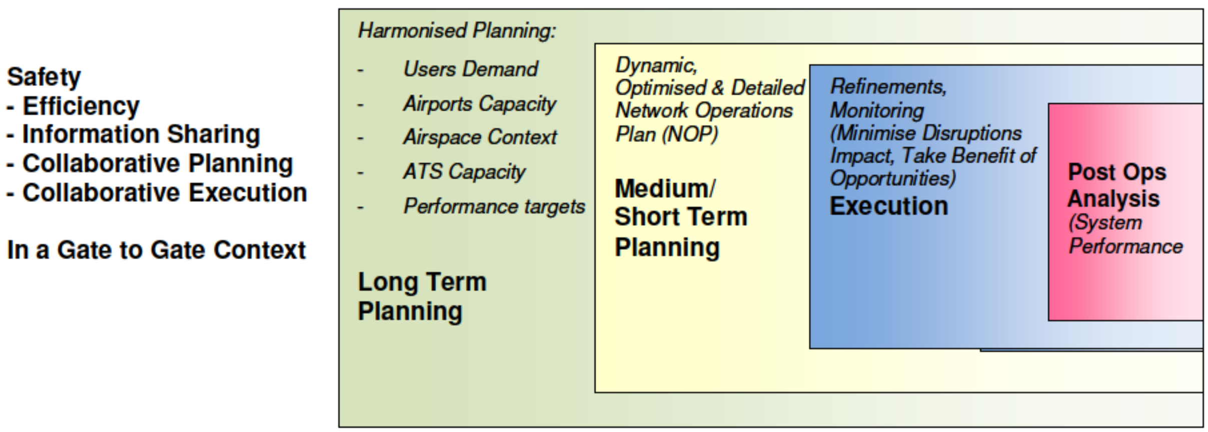

Figure 16: Collaborative Layered Planning Process

In the Long-term Planning phase (see Figure 17), the aircraft operator has determined its business plans and strategic planning. Thus, although no flight plan routings have been declared, airport city pairs, for example, have been determined. An output of this phase will be the airline schedules. Where flights through UPR airspace are planned, the aircraft operator will publish user preferred 3D routes for validation by Network Management. At the same time National Airspace Policy Boards (APB) will have determined and published regional and sub-regional airspace organisations. Based on historical data, the published airline schedules and repetitive flight plans, Network Management will collaboratively agree ATFCM scenarios to resolve DCB shortfalls.

During Medium/Short-term Planning, the aircraft operator will publish through the NOP and Shared Business Trajectory (SBT). The SBT reflects the flight intentions of the airline and enriches the published flight schedule with 3D trajectory information. Network Management uses the NOP to promulgate any ATM constraints (e.g. a revised airspace organisation) the SBT will be updated to reflect the constraint. Thus the SBT becomes an iterative flight plan for the Airline Operator. Network management and airspace management cells (AMC) collaborate and agree airspace management organisations for both regional and sub-regional airspace, including UPR airspace availability. The

[5] OI DCB-0102: Interactive Rolling NOP

output is the Airspace Use Plan (AUP) which is promulgated to all stakeholders via the NOP. A consequence of the Medium/Short-term planning process will be the filed flight plan (FPL).
In the Execution Phase, the network management has to assure the stability of the NOP, reacting to unexpected events, which impact on overall network performance, such as unusual meteorological conditions or a loss of significant assets (e.g. runways), by, for example, activating pre-agreed scenarios that will enable the network management to restore Network stability. A dynamic airspace database repository (DDR), contained within the NOP, delivers and makes available all real-time updates on airspace constraints, such as the activation of a short-notice ARES within UPR airspace. Before departure, the airline operator reacts to any constraints that impact the SBT and updates it accordingly.
When airborne the SBT is instantiated as the initial Reference Trajectory (RBT). The RBT is the trajectory that the airline operator agrees to fly and that the ANSP and Airport agree to facilitate. Any subsequent tactical changes agreed between the Flight Crew and the Controller will result in an RBT revision. Dynamic Demand and Capacity Balancing (dDCB) is implemented, where appropriate, to address any capacity shortfalls as a consequence of non-forecasted changes in demand and/or airspace organisations (see WP7.6 Primary Projects).

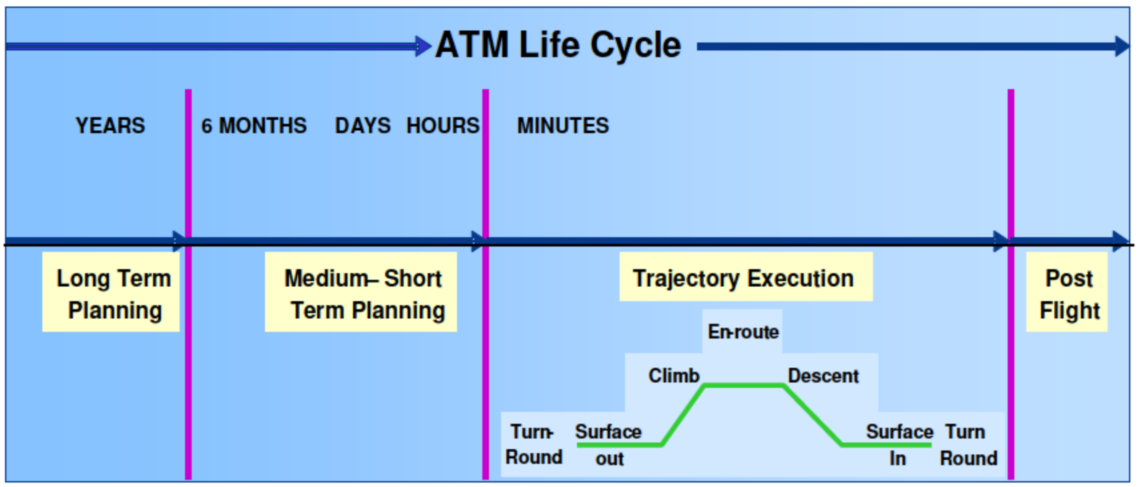

Figure 17 - ATM Phases

5.1.4 ATM Actors

The following organisations and their respective actors are involved in the scenario:

1. National/Sub-regional Airspace Policy Board (APB)
2. Airport Slot Coordinator (ASC)
3. Airport Operator (AOP)
4. Aircraft Operator (AO)
   - Airline Operations Centre (AOC)
   - Flight Crew/Pilot
5. Airspace Management Cell (AMC)
   - Civil Airspace Manager
   - Military Airspace Manager
6. Network Management
   - Network Manager (NM)
   - Flow Manger (FM)

7. Air Navigation Service Provider (ANSP)
    - ACC Supervisor
    - Local Capacity Manager
    - Local Traffic Manager (LTM)[6]
    - Multi-Sector Planner (MSP)/Planning Controller (PC)
    - Executive Controller (EC)[7]
8. Air Defence Organisation

5.1.5 Scenario

5.1.5.1 Long-term Planning Phase

At the end of Long-term Planning, the following events will have been determined and published to the NOP:

National/Sub-regional Airspace Policy Board (APB)

- Has published the geographical and vertical dimensions of the UPR airspace and activated it for the day of use. **[UC-1: Activate UPR Airspace]**

Aircraft Operator:

- Has published its proposed flight schedule for the coming season.
- Has planned a user-preferred route, with alternatives, for each flight and collaboratively agreed these with the Network Manager.

Airport Operator:

- At the departing and arrival airports have allocated departure and arrival slots to all concerned operators; the slots are agreed at the 6 monthly IATA Slot Conference and allocated by the Airport Slot Coordinator.[8]
- Has developed its seasonal aircraft stand allocation plans.

Network Manager:

- Has assessed the evolution of traffic demand, identified capacity and demand imbalances and identified scenarios for capacity shortfalls, through CDM, with ANSPs, AMC and Aircraft Operators.

5.1.5.2 Medium/Short-term Planning Phase

All outputs of the Medium/Short-tem phase have been uploaded to the NOP, namely:

- The Local Traffic Manager has updated the NOP with ACC capacity capabilities;
- The ACC Supervisor has validated the foreseen airspace use plan (AUP) **[UC-2: Submit an Airspace Availability Plan for Feedback]** for the following day of operation and has updated the NOP;
- The Network Manager has proposed modified routes to the Aircraft Operators, based on their published alternative routes;

[6] May also be known as the Traffic Complexity Manager (TCM)
[7] Sometimes called Tactical Controller (TC)
[8] Current initiatives are looking at which ATFCM slots require coordination with Airport slots. The intention is to have more integration between Airports and Network, It is the result of the implementation of A-CDM in some airports.

- The Aircraft Operator has submitted revised alternative user-preferred routings **[UC-3: File User Preferred Routes]** to the NOP.

- Based on the user-preferred trajectory, the flight plan has been filed with the Integrated Initial Flight Plan Processing System (IFPS) and the NOP has been duly updated;

- ANSP systems (FDPS) have generated 4D trajectories for each flight based on the data in the flight plans[9];

- The Network Manager has identified capacity shortfalls by means of simulation;

- The Network Manager and Local Traffic Managers have coordinated on the adaptation of capacity to meet the expected demand;

- The ACC Supervisor has updated the capacity allocation plan **[UC-4: Update ACC Capacity Allocation Plan];**

- The Local Traffic Manager and Airspace Manager, have adapted local airspace planning and have updated the Regional AUP **[UC-5: Update an Airspace Use Plan]** in the NOP;

- The Network Manager has identified restrictions and rerouting scenarios with Aircraft Operators and Local Traffic Managers in a refinement process;

- The baseline NOP[10] has been declared by the Network Manager 2 hours before the operation.

- The Aircraft Operator has produced the pseudo-FMS 4D trajectory.

5.1.5.3 Execution Phase

5.1.5.3.1 Pre-Departure

Network management (Enhanced Tactical Flow Management System [EFTMS]) issues a calculated take-off time (CTOT) for those flights which go through areas requiring regulation based on the shared business trajectory (SBT) contained within the filed flight plan (FPL). The Pilot receives the pre-flight briefing and checks the latest situation with regard to the portion of the route to be used for UPR vis-a-vis any planned military activation within the UPR airspace. The planned ARES activity for the UPR airspace is still in force. The SBT includes the calculated times and flight levels for the entry and exit points to and from the UPR airspace. The Pilot uploads the SBT into the FMS.

Whilst within the UPR air space, the flight will not normally be subject to any flow measures. However, on re-entry into the organised route structure the Local Traffic Manager checks whether the flight will create any complexity issues due to its diverted route through SUA airspace. For example, the flight may still be in the sector count figure but after coordination with the Multi-Sector Planner or Planning Controller it requires synchronisation to establish a smooth traffic flow. In which case, The Local Traffic Manager may issue an entry time flow measure for regulated airspace.

5.1.5.3.2 Departure

The flight departs in accordance with its CTOT. On becoming airborne the SBT is instantiated as the RBT and the NOP updated by a data link departure message to the ATM system. The Pilot establishes R/T contact with the departure sector Executive Controller and the RBT is down linked by

[9] It is anticipated that the current ICAO flight plan format will be modified in 2012 to allow fields for aircraft performance and capabilities.
[10] Although the NOP is a dynamic, rolling plan, for system performance analysis in the post flight phase, a ‘snapshot’ of the plan is taken before the Execution phase for comparison with the actual plan at the end of the phase. This is the ‘baseline’ NOP.

the Flight Management System (FMS) to the ground ATM system (FDPS). The ground ATM system updates the FPL-based ground trajectory held in the FDPS and the RBT with more accurate flight data such as aircraft mass and revised ETA at the destination airport. The ground system monitors for any deviations from agreed parameters (e.g. time). Any deviations are displayed to the Executive Controller and are coordinated with the Pilot and will result in an automatic update of the RBT. **[UC-6: Revise an initial Reference Business Trajectory]** The RBT update is down linked into the system.

The departure Planning Controller uses the system to confirm the entry conditions into the en route sector. Any changes to the entry conditions are proposed using system supported silent coordination. The departure Executive Controller uses the system (MTCD) to monitor for potential conflicts up to about 15 minutes ahead of the flight. Approaching the en route sector entry point the Executive Controller transfers control, including communications, of the flight to the en route Executive Controller using the system. The Pilot receives a data link message to establish contact with the en route sector.

The flight's systems establish air/ground communications with the next sector; the Pilot uses R/T to establish radio contact with then route Executive Controller who assumes control of the flight using the system.

5.1.5.3.3 En Route and User Preferred Airspace

The Airspace Management Cell notifies the Network Manager using ground/ground communications that the Air Defence Organisation has cancelled_the_ARES in the UPR airspace. The Network Manager enters the information in the Airspace Data Depository (ADR) and publishes it in the NOP. The Airline Operator (AOC) reacts to the information and instructs the Pilot of the flight via the aircraft communications addressing and reporting system (ACARS) to revise the RBT in UPR Airspace to route direct between waypoints NPtN and XPtN with a time saving of 10 minutes. The Pilot enters the new routing in the FMS and the FMS recalculates the estimate for XPtN and down links the revised RBT to the Executive Controller.

As the downstream sector of the UPR airspace exit point (XPtN) is not the current one, the Planning Controller of the current sector proposes the new exit time to the downstream sector Local Traffic Manager/Planning Controller using the system. The system (traffic complexity tool) determines that the revised entry time into the downstream sector will create traffic complexity and proposes a delay of 3 minutes. **[UC-7: Apply a Dynamic ATFCM (STAM) Constraint to a Flight]** The Local Traffic Manager accepts the solution and proposes the eta revision to the current Planning and Executive Controllers using the system **[UC-8: Integrate a Flight from UPR Airspace]**.

The current sector Planning Controller using MTCD determines a potential conflict in the sector if speed control is effected in the current sector. He proposes to the Executive Controller that the delaying action should be carried out in UPR airspace **[UC-9: Delay a flight in UPR Airspace]**. The Executive Controller accepts the proposal and uplinks the revised UPR airspace exit time to the Pilot. The Pilot enters the revised exit time in the FMS which calculates that the revised eta XPtN is within the aircraft's performance parameters. The Pilot acknowledges that the speed control reduction control in UPR airspace is acceptable to the Executive Controller via data link. The Pilot updates the revised RBT and down links it to the Executive Controller via data link who enters it into the system (FDPS). The UPR airspace Planning Controller acknowledges the RBT revision.

The Pilot informs the AOC of the revised Estimated In-Block Time (EIBT) via ACARS. The AOC enters the revised EIBT into the stand planning system which detects a possible stand non-availability due to the early arrival. The AOC prefers an on-ground delay to an airborne one and acknowledges the Pilot's revised EIBT.

The airport arrival manager (AMAN) recalculates the eta Initial Approach Fix (IAF) and resequences the flight into the arrival stream. The arrival runway slot time is within declared parameters for the flight.

The current Executive Controller uses the system to transfer the flight to the UPR airspace Executive Controller. The Executive Controller assumes the flight and clears it through the UPR airspace. The flight transits the airspace in which the Pilot has responsibility for the 2D route but the Executive Controller has responsibility for the vertical dimension and separation from other known traffic. Approaching XPtN the Executive Controller transfers control to the next sector using the system. The downstream sector Executive Controller assumes the flight.

5.2 Operational Scenario 2: Multiple Tracks

5.2.1 Departure - Multiple Tracks

Departure messages for all three flights, Blue123, Noble345 and Bizjet007, have been processed and the ground system (FDPS) activates the FPL of each flight. In the UPR airspace the Local Traffic Manager using the system identifies a potential conflict between Noble345 and Bizjet007; both flights will be at FL330 on converging headings and cross at approximately the same time according to the flight plan estimates (see Fig.4). The Local Traffic Manager informs the Planning Controller using the system. The Planning Controller now aware of the situation decides to wait for the system to determine sector entry times for each flight before reacting.
The Planning Controller uses the system (MTCD) to monitor for any other potential conflicts and notes that although Blue123 will still be in the climb to FL350 its FPL User Preferred Route will keep it clear of the other two tracks.

5.2.2 En Route and User Preferred Airspace – Multiple Tracks

As a scheduled airline Blue123 has followed the collaborative layered planning processes described above. It has not yet reached its cleared cruising level of FL350 and its flight downlinked trajectory and performance, indicates that it will still be in the climb as it enters UPR airspace at point NPtS (Fig.4). About 15 minutes before entering UPR airspace Blue123 receives an ACARS message from the Aircraft Operator that in order to take advantage of airspace availability in a sector downstream of the UPR airspace to revise the 2D routing and route direct XPtW on entering the airspace. Blue123 acknowledges the message and reprogrammes the flight's FMS with the revised route.

Using R/T the Pilot informs the current sector Executive Controller of the revised routing and downlinks the new route (RBT) into the ground system (FDPS) The Executive Controller's (UPR airspace) HMI notifies him of the revised route and uses the system (SYSCO) to re-coordinate the sector entry conditions at XPtW into the next sector.

The HMI of the Planning Controller (UPR) warns him that there is now a potential conflict **[UC-10: Resolve a conflict in UPR airspace]** between Blue123 and Noble345/Bizjet007 if Blue123 has not passed FL340 approaching the Zone of Potential Conflict (Fig.4). The Planning Controller uses the system to manually re-coordinate the sector entry conditions with the Executive Controller (current) and requests a sector entry level of FL340 or above. The Executive Controller uses R/T to request Blue123 to expedite the climb to meet the revised sector entry conditions. The Pilot acknowledges the request via R/T and the Executive Controller (current) enters the new time in the system.

From the updated flight times in the system (FDPS), the system (MTCD) identifies to the Planning Controller (UPR) that there is still a potential conflict between Noble456 and Bizjet007. As Noble345 is a scheduled flight and has published its flight intentions through the layered planning system it is accorded priority over Bizjet007 (a late filer) under the "first filed, first served" principle.[11] Accordingly, the Planning Controller (UPR) decides on a time delay to resolve the conflict and re-coordinates the UPR airspace entry time at NPtSW using the system (SYSCO) with a delay of 2 minutes (not to enter before[12]) to ensure a time-based separation with Noble345.

The Executive Controller (current) uses R/T to confirm with the Pilot that the time lost on route is achievable. The Pilot enters the new waypoint time into the FMS which confirms that the time loss is achievable through speed control and acknowledges the new waypoint time. The Executive Controller enters the new time into the system. All controllers continue to monitor the situation.

[11] The SESAR principle of "best equipped, best served" in which Airline Operators are encouraged to equip with the latest FMS functionality in order to receive a better service (e.g. 4DT Contracts) has yet to be validated and institutionally approved.
[12] This is effectively the application of STAM (Short Term ATFCM Measure) but implemented at ACC level.

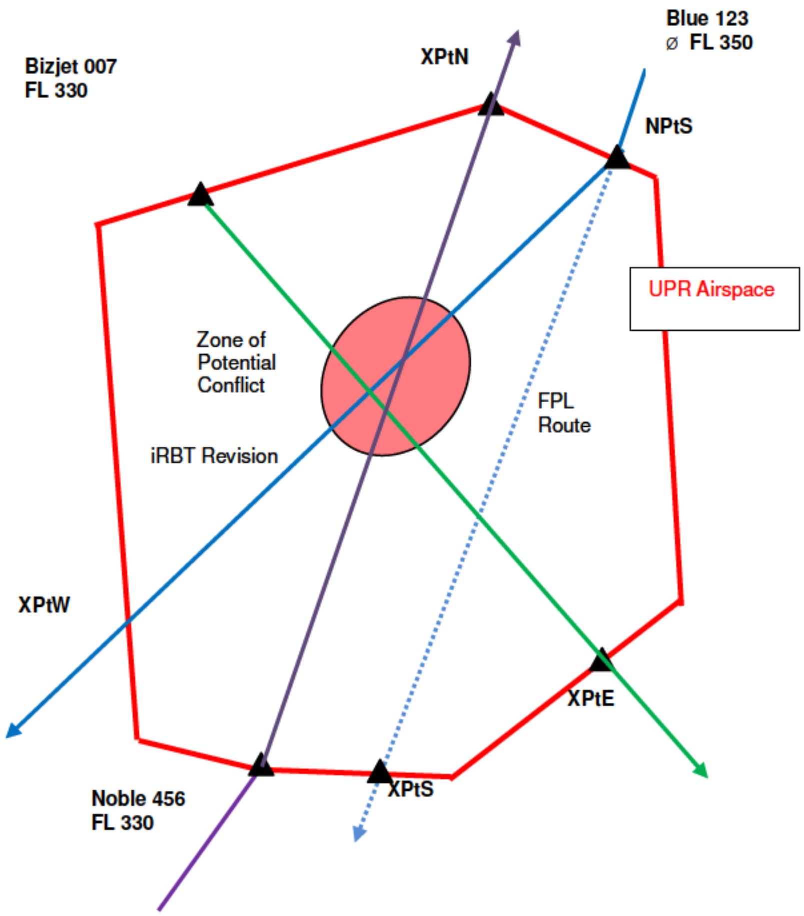

Figure 18: Multiple Tracks in UPR Airspace

5.3 Use cases

The following list of 10 use cases have been identified along the scenarios and are described in the following sections.

1. Activate UPR Airspace
2. Submit an Airspace Use Plan for Validation
3. File User Preferred Routes
4. Update ACC Capacity Allocation Plan
5. Update an Airspace Use Plan
6. Revise an initial Reference Business Trajectory
7. Apply a Dynamic ATFCM (STAM) Constraint to a Flight
8. Integrate a Flight from UPR Airspace
9. Delay a flight in UPR Airspace
10. Resolve a conflict in UPR airspace

5.3.1 Use Case 1 – Activate UPR Airspace

5.3.1.1 Scope

System, black-box. System means a Network Management compliant system.

5.3.1.2 Level

User goal.

5.3.1.3 Summary

The use case describes how the Airspace Manager activates UPR airspace which although promulgated had not been fully available due to military activity. The use case starts when the Air Defence Organisation notifies the Airspace Manager (sub-regional AMC) that military activity in UPR airspace has ceased earlier than promulgated and is now available for civil use. It describes the actions taken by the Network Manager on the availability of the airspace. The use cases finishes when all concerned actors have been informed.

5.3.1.4 Actors

Network Manager (primary) – wants to notify all concerned users of the airspace availability.
Airspace Manager (secondary) – has to completely activate previously promulgated UPR airspace and notify the Network Manager of its availability.
Air Defence Organisation (off-stage) – has to inform the Airspace Manager of the cessation of military activity (ARES) in UPR airspace.
Aircraft Operator (off stage) – has to be informed of UPR airspace availability.

5.3.1.5 Pre-conditions

The geographical and vertical dimensions of both UPR and ARES airspaces have previously been published.
The System is aware of the airspace configurations
The Aircraft Operators have already filed flight plans whose routes take into consideration the ARES and have previously filed user preferred routes through UPR airspace and these are known to the System.

5.3.1.6 Post-conditions

5.3.1.6.1 Success end-state

The UPR airspace has been fully activated and all actors have been made aware. The System records the action taken.

5.3.1.6.2 Failed end state

The ARES has not been deactivated for whatever reason. The System records the action taken.

5.3.1.7 Notes

Although promulgated to cover a specific period, the ARES has been deactivated earlier than planned.

5.3.1.8 Trigger

The use case starts when the Air Defence Organisation notifies the Airspace Manager that the ARES in UPR airspace is now deactivated.

5.3.1.9 Main flow

1. The Air Defence Organisation notifies the System that the ARES will be deactivated at a specified time earlier than promulgated.
2. The System notifies the Airspace Manager of the proposed deactivation and the complete availability of UPR airspace and displays to the Network Manager those flights which are affected.
3. The Network Manager selects the affected flights and enters them into the System.
4. The System notifies the Aircraft Operator that the flight previously affected by the ARES is now able to use the whole of UPR airspace.
5. The Aircraft Operator uses the System to notify the Network Manager that he wants to activate the filed user preferred routing through the airspace.
6. The Network Manager uses the System to select the affected flight and its preferred routing and enters the route revision into the System.
7. The System notifies the Aircraft Operator of the revised routing through the airspace.
8. The use case ends when the System records the changes to the airspace configuration and routing through the UPR airspace.

5.3.1.10 Alternative flows

5.3.1.10.1 [5] The Aircraft Operator has not filed a user preferred route through the airspace

9. The Aircraft Operator notifies the Network Manager through the System that although he has not filed a preferred routing he wishes to take advantage of the situation by routing direct 13.
10. The Network Manager acknowledges the request and notifies the System of the revised route.
11. The use case continues at step [7].

5.3.1.10.2 [5] The Aircraft Operator does not wish to change the flight's route (for whatever reason)

12. The Aircraft Operator notifies the Network Manager through the System he does not wish to activate his user preferred route and that the flight's route will remain unchanged.
13. The use case continues at step [8].

5.3.1.11 Failure Flows

5.3.1.11.1 [1] The Air Defence Organisation does not want to close the ARES earlier than promulgated

14. The use case ends with the non-availability of the whole UPR airspace earlier than planned.

[13] See use case "Revise an RBT".

5.3.2 Use Case 2 – Submit an Airspace Availability Plan for Feedback

5.3.2.1 Scope

System, black-box. System means a Network Management compliant system.

5.3.2.2 Level

User goal.

5.3.2.3 Summary

The goal is to submit an airspace availability plan to network management for feedback to the Airspace Management Cell (AMC) only. The plan is for the area of responsibility of a specific Airspace Management Cell (sub-regional). The plan may be entirely new, or be based on modified previously published, submitted, or saved plans and will include any UPR airspace allocations.

5.3.2.4 Actors

Airspace Manager (primary) - wants to submit airspace availability plan for feedback.

Network Manager (supporting) – has to approve the airspace availability plan prior to consolidation with other AMC's airspace availability plans as the Airspace Use Plan.

5.3.2.5 Pre-conditions

The Airspace Manager's area of responsibility is known by the System.

The System holds all airspace availability plans previously created by the Airspace Manager.

5.3.2.6 Post-conditions

5.3.2.6.1 Success end-state

The airspace availability plan for the area of responsibility of the Airspace Manager's AMC is approved by the Network Manager.

5.3.2.6.2 Failed end state

There is no failed end state. The plan has to be approved through iterations before consolidation with the Airspace Use Plan.

5.3.2.7 Notes

The area of responsibility of the Airspace Manager is the same as the area of responsibility of the AMC to which he belongs.

5.3.2.8 Trigger

Use case begins when Airspace Manager selects to submit an airspace availability plan for feedback.

5.3.2.9 Main flow

1. The use case begins when the Airspace Manager selects an airspace availability plan from the System to submit for feedback from the Network Manager.
2. The System presents a list of previously saved plans for Airspace Manager's area of responsibility that have not been submitted.
3. The Airspace Manager selects to create a new plan, enters the period of the new plan and enters it into the System.
4. The System presents an airspace availability plan of the Airspace Manager's area of responsibility for the given period, where all airspace is free of allocations.
5. The Airspace Manager updates and makes changes to the airspace availability plan and uses the System to submit it to the Network Manager for feedback.
6. The Network Manager uses the System to integrate the airspace availability plan with other sub-regional plans in order to create an Airspace Use Plan (separate use case).
7. The System displays to the Network Manager that the airspace availability plan will integrate with other sub-regional plans.
8. The use case ends when the Network Manager uses the System to notify the Airspace Manager that the plan is approved and the System records that the plan is approved.

5.3.2.10 Alternative flows

5.3.2.10.1 [3] Continue editing a previously saved plan

9. The Airspace Manager selects a previously saved plan from the presented list.
10. The System presents the selected airspace availability plan.
11. The use case continues at step 5.

5.3.2.10.2 [3] Create new plan from copy of an existing plan

12. The Airspace Manager selects to copy an existing plan from the System.
13. The System presents a list of existing airspace availability plans for the Airspace Manager's area of responsibility. The list contains plans already published, plans from previous submissions for feedback, and plans previously saved but not submitted. All plans are for the Airspace Manager's area of responsibility.
14. The Airspace Manager selects an existing plan from the presented list and enters a new period for it.
15. The System validates that the airspace configurations in the selected plan remains the same during the new period.
16. The System presents copy of the selected airspace availability plan, but with the period of each allocation moved by the same amount of time as the plan's new period.
17. The use case continues at step 5.

5.3.2.10.3 [15] Configuration of airspace has changed

18. The System warns that the airspace configuration has changed.
19. The use case continues at step 14.

5.3.2.11 Failure Flows

5.3.3 Use Case 3 – File User Preferred Routes

5.3.3.1 Scope

System, black-box. System means a Network Management compliant system.

5.3.3.2 Level

User goal.

5.3.3.3 Summary

The goal is for the Aircraft Operator to file with network management its preferred routes through UPR airspace. The purpose is to allow the Aircraft Operator to select pre-filed routes according to airspace configurations on the day of operations. The preferred route information contains only 2D information; network management/ANSP still remains responsible for the vertical dimension of the route. The filed preferred routes are complementary to the filed flight plan for an individual flight.

5.3.3.4 Actors

Aircraft Operator (primary) – wants to file user preferred routes.

Safety Regulator[14] (offstage) – wants an audit trail of all filed user preferred route transactions, successful or not.

5.3.3.5 Pre-conditions

The Aircraft Operator and its operating profile, including published schedules, are known to the System.

Planned airspace configurations and route availability are known to the Aircraft Operator.

5.3.3.6 Post-conditions

5.3.3.6.1 Success end-state

User preferred routes are filed and the successful filing is logged by the System.

5.3.3.6.2 Failed end state

The user preferred routes, for whatever reason, are cancelled by the Aircraft Operator and is recorded by the System.

5.3.3.7 Notes

Although the user preferred routing will be 2D, the operator may also propose optimal flight levels commensurate with its business needs. On the day of operation, those flight levels would be consistent with the filed flight plan.

[14] Although not included in the list of OSED Actors, the Safety Regulator is here included as an off-stage actor for accountability reasons in the audit trail.

5.3.3.8 Trigger

The use case starts when the Aircraft Operator informs the System that he wants to file user preferred routes in UPR airspace.

5.3.3.9 Main flow

1. The Aircraft Operator informs the System that he wants to file user preferred 2D trajectories in UPR airspace.
2. The System presents a list to the Aircraft Operator of UPR airspaces and their times of availability according to the Aircraft Operator's operating profile. The list includes the entry/exit points of the airspaces.
3. The Aircraft Operator selects the preferred routes through the airspaces, plus alternatives if appropriate and enters the information into the System.
4. The System validates the route information, verifying that all necessary information has been provided, that all provided information is correct, and that the routes are feasible because there are no conflicts with ATM constraints.
5. The Aircraft Operator confirms to the System the validated user preferred routes for filing.
6. The use case ends when the System records the user preferred routes.

5.3.3.10 Alternative flows

5.3.3.10.1 [4] System finds error(s) in the user preferred routes

7. The System finds error(s) in the filed user preferred trajectories (e.g. availability times) and rejects the filing. The System returns the affected trajectories to the Airspace Operator with the proposed corrections.
8. The Aircraft Operator corrects the error(s) and resubmits the concerned routes to the System.
9. The use case continues at step 4.

5.3.3.10.2 [4] System cannot file validated flight plan

10. The System cannot file the validated user preferred trajectories, for whatever reason. The System logs the filing attempt and notifies the Aircraft Operator that it cannot validate the trajectories for the reason shown.
11. The Aircraft Operator modifies the route in accordance with the reason given and resubmits the route to the System.
12. The use case continues at step 4.

5.3.3.11 Failure Flows

5.3.3.11.1 [Anywhere] – Aircraft Operator wants to cancel the filing of user preferred routes

The Airspace Operator, for whatever reason, wants to cancel the filing of user preferred routes. The use case ends when the System records the cancellation.

5.3.4 Use Case 4 – Update an ACC Capacity Allocation Plan

5.3.4.1 Scope

System, black-box. System means a Network Management compliant system.

5.3.4.2 Level

User goal.

5.3.4.3 Summary

The use case describes how the ACC Supervisor uses the System to update the capacity allocation plan for his ACC for a given period, normally during the Medium/Short-term Planning phase, that best accommodates the demand profile expected during that period as declared in the Network Operations Plan. It may take into account internal ad-hoc constraints that may limit the capacity provision during this period. At the end of the process any change to the ACC capacity allocation plan leads to an update of the Network Operations Plan.

5.3.4.4 Actors

ACC Supervisor (primary) – wants to update a capacity allocation plan for his ACC in the Network Operations Plan.
Network Manager (offstage) – needs to be informed of any capacity shortfalls.
Head of ACC Operations (offstage) - requires that the strategic directives, rules and principles be respected in the elaboration of ACC capacity allocation plans.

5.3.4.5 Pre-conditions

The System knows the ACC's area of responsibility and area of interest within a FAB.
The Network Operations Plan is available, and contains the ACC capacity allocation plan.
The System knows the predefined sector configurations of the ACC.

5.3.4.6 Post-conditions

5.3.4.6.1 Success end-state

An updated ACC capacity allocation plan is stored in the System consistent with the ACC Supervisor's decision.

5.3.4.6.2 Failed end state

The existing ACC capacity allocation plan remains unchanged.

5.3.4.7 Notes

The Local Traffic Manager supports the ACC Supervisor in defining background scenarios relating to sector configurations and traffic flows. These have been previously validated in simulations.
Airspace configurations can be implemented through dynamic sectorisation.

5.3.4.8 Trigger

The use case starts when the ACC Supervisor informs the System that he wants to update the ACC capacity allocation plan for a given period.

5.3.4.9 Main flow

1. The ACC Supervisor informs the System that he wants to update the ACC's capacity allocation plan for a given period.

2. The System displays to the Supervisor an extract of the Network Operations Plan for the given period relating to the ACC's area of interest, including, but not limited to: airspace structure; airspace use; demand forecast; sector capacities; airport capacities; flow measures; and weather forecast. The System also displays the predefined sector configurations for the ACC Supervisor's own area of responsibility
3. The ACC Supervisor specifies updates to the sector capacity to the System. These updates may include changes to sector configurations by other configurations for a specified period of time, or just changes to the attributes of configurations currently in the plan.
4. The ACC Supervisor completes the editing and submits the updated sector capacities to the System for inclusion in the ACC's capacity allocation plan.
5. The System updates the ACC capacity allocation plan and publishes it in the Network Operations Plan.
6. The use case ends when the System records the publication of the updated ACC capacity allocation plan.

5.3.4.10 Alternative flows

5.3.4.10.1 [4] - ACC Supervisor wants to re-enter capacity allocation parameters from the start

7. The ACC Supervisor selects to re-enter into the System the capacity allocation parameters from the start.
8. The System discards all pending ACC capacity planning edits.
9. The flow continues at step 3.

5.3.4.11 Failure Flows

5.3.4.11.1 [2] – Late planning because ACC capacity planning stage is closed

10. The use case ends when the System indicates that the capacity planning stage is closed for the given period.

5.3.4.11.2 [Anywhere] ACC Supervisor no longer wants to update the ACC capacity allocation plan

11. The ACC Supervisor cancels the update process.
12. The use case ends when the System discards all pending ACC capacity planning edits, presents a confirmation to the ACC Supervisor and records the cancellation.

5.3.5 Use Case 5 – Update an Airspace Use Plan

5.3.5.1 Scope

System, black-box. System means a Network Management compliant system.

5.3.5.2 Level

User goal.

5.3.5.3 Summary

The use case describes how the Airspace Manager of an AMC updates an existing Airspace Use plan (AUP) for the day of operations in his area of responsibility. The updated plan (UUP) is published by the Airspace Manager and collected by network management (Central Airspace Data Function [CADF]), consolidated with other AMC's UUPs and published as the network UUP. The Plan includes any update on UPR airspace availability.

5.3.5.4 Actors

Airspace Manager (primary) - wants to update an Airspace Use Plan.
Network Manager (offstage) – needs to be informed of changes to the AUP.

5.3.5.5 Pre-conditions

The Airspace Use Plan is known to the System.
The Airspace Manager's area of responsibility is known by the System.

5.3.5.6 Post-conditions

5.3.5.6.1 Success end-state

The Airspace Use Plan is updated

5.3.5.6.2 Failed end state

The plan is not updated.

5.3.5.7 Notes

The Airspace Use Plan contains published airspace configurations (including UPR airspace) and includes approved requests from users on airspace reservations (ARES) and Conditional Routes (CDR) for the area of responsibility of the AMC.
The Airspace Use Plans published by the AMCs are collected by the CADF that consolidates the information on available Conditional Routes. The CADF in network management compiles a daily Conditional Route Availability Message (CRAM) which indicates the availability of CDRs for flight planning by users.

5.3.5.8 Trigger

The use case begins when the Airspace Manager selects to update the Airspace Use Plan.

5.3.5.9 Main flow

1. The Airspace Manager selects to update the Airspace Use Plan.
2. The System presents to the Airspace Manager the current Airspace Use Plan for his area of responsibility and the current airspace configurations.
3. The Airspace Manager selects the airspace configuration that he wants to update.

4. The System presents the Airspace Manager the current allocations for his selected configuration.
5. The Airspace Manager updates the selected configuration with the new requested airspace allocations.
6. The System validates the new airspace configuration.
7. The use case ends when the System records the update and publishes the Updated Air Space Use Plan to network management.

5.3.5.10 Alternative flows

5.3.5.10.1 [6] – The System is unable to validate the requested update

8. The System notifies the Airspace Manager that it is unable to validate his requested update, for whatever reason, and proposes alternatives.
9. The Airspace Manager selects an alternative and updates the plan with the alternative configuration.
10. The flow continues at step 6.

5.3.5.11 Failure Flows

5.3.5.11.1 [Anywhere] – The Airspace Manager no longer wants to update the plan

11. The Airspace Manager cancels the update process.
12. The use case ends when the System records the cancellation.

5.3.6 Use Case 6 – Revise a Reference Business Trajectory

5.3.6.1 Scope

System, black-box. System means a Network Management compliant system.

5.3.6.2 Level

User goal.

5.3.6.3 Summary

The use case describes how the Executive Controller revises a Reference Business Trajectory (RBT) in UPR airspace. Since both air and ground have already agreed to fly and facilitate the RBT it cannot be changed without the concurrence of both partners, except in emergency.

5.3.6.4 Actors

Executive Controller (primary) – wants to revise the current RBT trajectory.

Flight Crew (secondary) – has to agree to the revision, or propose an alternative revision.

Airline Operations Centre (offstage) – needs to be notified of any revisions.

5.3.6.5 Pre-conditions

The flight is already flying a RBT trajectory.

The proposed route revision will contain the coordinates of any new way points.

5.3.6.6 Post-conditions

5.3.6.6.1 Success end-state

The RBT is successfully revised.

5.3.6.6.2 Failed end state

The current RBT remains unchanged.

5.3.6.7 Notes

SESAR defines the RBT as the trajectory that the Airspace User agrees to fly and the ANSP and Airport agree to facilitate (subject to separation provision).
Within UPR airspace and notwithstanding the RBT definition, controllers may be constrained to a RBT revision only in the vertical and time dimensions, excepting where safety is involved.
SESAR defines two changes to RBT: revision – as a consequence of negotiations between air and ground the trajectory is changed from that previously agreed. This could be a CDM process involving the AOC depending on the time horizon; and, update – the changes to the RBT are automatic as a result of the flown trajectory drifting outside of agreed parameters for Trajectory Management Requirements (TMR) or temporal updates to reconcile the airborne trajectory and the one held in the ground systems.

The ground System will generate a RBT for an aircraft irrespective of the aircraft's System capability to fly within agreed RBT parameters.

5.3.6.8 Trigger

The use case begins when the Executive Controller selects to revise the RBT.

5.3.6.9 Main flow

1. The Executive Controller decides to revise the RBT in order to resolve a potential complexity issue.
2. The Executive Controller uses the System to resolve the complexity issue and selects a route change clearance that will eventually resume the previously agreed RBTand uplinks this to the Flight Crew as a RBT revision.
3. The Flight Crew acknowledges the proposal and enters the RBT revision into the aircraft's system.
4. The aircraft system displays the revised RBT to the Flight Crew, including the point at which the original RBT will be regained.
5. The Flight Crew confirms acceptance of the aircraft system's revision and downlink acceptance of the proposal to the Executive Controller.
6. The use case ends when the Executive Controller confirms acceptance of the RBT revision to the System and the System records the change.

5.3.6.10 Alternative flows

5.3.6.10.1 [3] – The aircraft System is not able to revise the RBT, for whatever reason (e.g. FMS functionality)

7. The aircraft system is not able to comply with the proposed RBT revision; it can be done manually by the Flight Crew.
8. The Flight Crew acknowledges the system non-compliance and downlinks an unable message with reason to the Executive Controller.
9. The Executive Controller acknowledges the unable message and instead uplinks a message to manually fly the RBT revision (e.g. fly heading...) with the point at which it will resume the original RBT.
10. The Flight Crew confirms acceptance.
11. The flow continues at step 6.

5.3.6.10.2 [3] – The Flight Crew are unable to comply with the RBT revision

12. The aircraft system indicates to the Flight Crew that the proposed revision (e.g. climb) is outside of the aircraft's current performance parameters and cannot be flown at all.
13. The Flight Crew acknowledges the system's message and downlinks an unable message with reason to the Executive Controller.
14. The Executive Controller acknowledges the unable message and selects from the System an alternative proposal (e.g. track change) and uplinks the proposal to the Flight Crew.
15. The flow continues at step 3.

5.3.6.11 Failure Flows

5.3.6.11.1 [Anywhere] – The Executive Controller no longer wants to revise the RBT for whatever reason

16. The use case ends with the current RBT unchanged.

5.3.7 Use Case 7 – Apply a Dynamic ATFCM (STAM) Constraint to a Flight

5.3.7.1 Scope

System, black-box. System means a Network Management compliant system.

5.3.7.2 Level

User goal.

5.3.7.3 Summary

The use case describes how the Local Traffic Manager uses the System to decide, collaboratively with other contacted Local Traffic Managers and the Flow Manager, the activation of a traffic complexity reduction scenario incorporating a Short-term ATFCM Measures (STAM) to a flight, or series of flights, that will smooth the flow of traffic and reduce traffic complexity as it exits UPR airspace into his area of responsibility.

5.3.7.4 Actors

Local Traffic Manager (primary) - wants to agree with Contacted Local Traffic Managers and the Flow Manager on a traffic complexity reduction scenario and STAM that will reduce the traffic complexity in his area.
Contacted Local Traffic Manager (support) - has to make sure that the impact of the scenario and STAM can be supported by the controllers in his area of responsibility.
Flow Manager (support) – has to approve the scenario and STAM and implement a solution if the Local Traffic Managers cannot reach an agreement.
ACC Supervisor (offstage) – must provide his agreement to the Local Traffic Manager before any activation of any traffic flow measures involving his ACC.

5.3.7.5 Pre-conditions

A set of traffic complexity scenarios containing STAM has already been collaboratively agreed in the Medium/Short-term Planning phase by network management and is known to the System.
The System identifies to the Local Traffic Manager a potential problem of traffic complexity at a known time and place.

5.3.7.6 Post-conditions

5.3.7.6.1 Success end-state

The traffic complexity reduction scenario with its associated STAM is implemented.

5.3.7.6.2 Failed end state

The System records that the scenario and STAM are not implemented.

5.3.7.7 Notes

The use case may be applied traffic entering UPR airspace in order to smooth traffic flows entering the next sector downstream of the UPR airspace.
The area of responsibility of the Local Traffic Manager could be an ACC or a FAB.
In the event of lack of collaborative agreement between the respective Local Traffic Managers, the problem is escalated to the Network Manager for a decision.

5.3.7.8 Trigger

The use case begins when the Local Traffic Manager is warned by the System of a traffic complexity problem that may develop within his area of responsibility if no action is taken.

5.3.7.9 Main flow

1. The Local Traffic Manager requests from the System the traffic complexity reduction scenarios applicable to the concerned traffic flows.
2. The System presents the related scenarios, together with their associated current traffic complexity diagnosis and proposed STAM for complexity reduction, to the Local Traffic Manager.
3. The Local Traffic Manager selects a scenario showing acceptable traffic complexity with the associated STAM and validates the scenario for approval by the Flow Manager.
4. The System makes the validated scenario available to the Flow Manager who approves the scenario and STAM and submits an implementation plan proposal to the Contacted Local Traffic Managers concerned.
5. The System displays the traffic complexity reduction scenario and associated STAM together with the implementation plan to the Contacted Local Traffic Managers.
6. The Concerned Local Traffic Managers involved agree on the scenario and proposed action plan and confirm their agreement to the Flow Manager via the System.
7. The Use Case ends when the Flow Manager updates the NOP and the System records the approved agreements and the activation of the STAM.

5.3.7.10 Alternative flows

5.3.7.10.1 [3] - The Local Traffic Manager considers that there is no suitable traffic complexity reduction scenario and STAM

8. The Local Traffic Manager elaborates a specific scenario (a separate process) with a STAM and inputs his scenario in the System.
9. The System identifies the actors concerned and presents the list to the Local Traffic Manager.
10. The flow continues at step 4.

5.3.7.10.2 [4, 5, 6] - The Local Traffic Manager wants to change the scenario in the light of current situation evolution

11. The Local Traffic Manager informs the System that he wants to cancel the scenario approval process to propose another scenario.
12. The System informs the contacted Flow Manager and Contacted Local Traffic Managers that the scenario under discussion will change and invalidates the scenario and associated STAM.
13. The flow returns to step 3.

5.3.7.10.3 [6] - A Contacted Local Traffic Manager rejects the implementation plan proposal

14. The Contacted Local Traffic Manager rejects the implementation plan proposal.
15. The System records the rejection and informs the Local Traffic Manager and the Flow Manager of the rejection.
16. The System updates the scenario to take into account the rejection (e.g. actions involving the rejecting ACC are deleted).
17. The flow returns to step 5.

5.3.7.10.4 [6] - A Contacted Local Traffic Manager wants to amend an implementation plan proposal

18. The Contacted Local Traffic Manager inputs to the System the amendment he wants to negotiate.

19. The System determines the changes to the scenario generated by the amendment and sends the proposed amendment together with revised scenario to the Local Traffic Manager and the Flow Manager.
20. The flow returns to step 5.

5.3.7.10.5 [3, 4, 5, 6] - The Local Traffic Manager considers that the problem of traffic complexity no longer exists

21. The Local Traffic Manager selects the “do nothing” option in the System, cancelling the scenario activation process.
22. The System informs the Flow Manager and contacted Local Traffic Managers that the activation of a traffic complexity reduction scenario is no longer necessary and cancels any agreements discussed so far.
23. The use case ends when the System records the ”do-nothing” decision of the Local Traffic Manager.

5.3.7.11 Failure Flows

5.3.7.11.1 [Anywhere] – The Local Traffic Manager is not satisfied with any scenario

24. The Local Traffic Manager informs the System that he wants to cancel the scenario activation process.
25. The System informs the Flow Manager and the Contacted Local Traffic Managers of the scenario activation process cancellation and cancels the implementation plans under discussion.
26. The use case ends when the System records that the resolution of traffic complexity problem has failed.

5.3.8 Use Case 8 – Integrate a Flight from UPR Airspace

5.3.8.1 Scope

System, black-box. System means a Network Management compliant system.

5.3.8.2 Level

User goal.

5.3.8.3 Summary

The use case describes how the Planning Controller uses the System to plan for the re-integration of a flight from UPR airspace into the organised route structure in his area of responsibility (sector).

5.3.8.4 Actors

Planning Controller[15] (Primary) - wants to re-integrate the flight into the organised route structure within his area of responsibility (sector).
Executive Controller (Support) - has to agree to any changes to the original trajectory of the flight.
Sector Controller (UPR airspace) – has to negotiate any change proposals.
Flight Crew (Support) - has to agree to any revisions to the flight's RBT.

5.3.8.5 Pre-conditions

The Systems knows the estimated time and conditions for re-entry into the organised route structure.

5.3.8.6 Post-conditions

5.3.8.6.1 Success end-state

The flight is re-integrated into the organised route structure.

5.3.8.6.2 Failed end state

There is no failed end state. The flight will always be re-integrated into the organised route structure.

5.3.8.7 Notes

The flight's preferred route through UPR airspace forms part of the flight's RBT. For determination of the flight's through UPR airspace, see use case [**Error! Reference source not found.**] File User Preferred Routes.
The planning process may begin as soon as the RBT is published depending on the degree of accuracy on which the RBT can be flown, or when the Planning Controller considers that there is sufficient integrity in the estimated time for re-entry that the process can begin.

5.3.8.8 Trigger

The use case begins when the System displays to the Planning Controller the flight's entry conditions from UPR airspace within agreed parameters.

5.3.8.9 Main flow

1. The System displays to the Planning Controller the flight's entry conditions into his area of responsibility from UPR airspace.
2. The Planning Controller uses the System to search for any potential traffic conflictions or complexity issues at the sector entry point from UPR airspace.

[15] The Actor could also be the Multi-Sector Planner.

3. The System shows no potential conflicts or complexity issues and the Planning Controller validates the flight on the sector entry list for the Executive Controller to assume on transfer of control from UPR airspace.
4. The use case ends when the Executive Controller assumes the flight on entry into the organised route structure.

5.3.8.10 Alternative flows

5.3.8.10.1 [1] The sector entry conditions have changed

5. The System notifies the Planning Controller that the entry conditions into the sector have changed.
6. The Planning Controller uses the System to search for any potential traffic conflictions or complexity issues at the sector entry point from UPR airspace.
7. The System identifies a potential conflict with another flight also entering the sector at the same point.
8. The Planning Controller uses the System to propose new sector entry conditions to resolve the conflict and the System validates the new conditions as being conflict free.
9. The Planning Controller uses the System to propose the new entry conditions to the UPR airspace Sector Controller which involve a change to the flight's RBT.
10. After confirmation of the revision to the RBT (see use case [5.3.6] Revise a RBT) the UPR airspace Sector Controller uses the System to accept the Planning Controller's proposal.
11. The use case continues at step 3.

5.3.8.10.2 [1] – The sector entry point has changed

12. The System notifies the Planning Controller that the sector entry point from UPR airspace has changed due to the flight opting for a filed alternative trajectory through UPR airspace.
13. The Planning Controller uses the System to search for any potential traffic conflictions or complexity issues at the changed sector entry point from UPR airspace.
14. The System identifies a potential conflict with another flight also entering the sector at the same point.
15. The Planning Controller uses the System to propose to the UPR airspace Sector Controller that the flight reverts to the original sector entry point. For operational reasons, the flight wishes to maintain the alternative trajectory and the Flight Crew using the System rejects the proposal.
16. The use case continues at step 8.

5.3.8.11 Failure Flows

There is no failed end state. The flight will always be re-integrated into the organised route structure from UPR airspace.

5.3.9 Use Case 9 – Delay a Flight in UPR Airspace

5.3.9.1 Scope

System, black-box. System means a Network Management compliant system.

5.3.9.2 Level

User goal.

5.3.9.3 Summary

The use case describes how the Executive Controller in UPR airspace has to delay a flight in order to meet a time constraint at the exit point of the airspace. The flight was operating a trajectory to avoid an ARES. The ARES has been deactivated and the flight is now able to route direct on its preferred trajectory to the exit point of UPR airspace and thus will arrive at the airspace exit point well ahead of its planned ETA.

5.3.9.4 Actors

Executive Controller (Primary) – wants to delay the flight through trajectory revision to meet a time constraint.
Flight Crew (Secondary) – has to agree to a trajectory revision to meet the time constraint.
Aircraft Operations Centre (Offstage) – needs to be informed of any delays to the fight.

5.3.9.5 Pre-conditions

Both the flight's current trajectory and its preferred trajectory in UPR airspace are known to the System.
All Actors and the System are aware of the deactivation of the ARES.
The deactivation of the ARES occurs before the flight enters UPR airspace.

5.3.9.6 Post-conditions

5.3.9.6.1 Success end-state

The flight is able to absorb the delay in order to meet the time constraint.

5.3.9.6.2 Failed end state

The flight is unable to absorb the delay.

5.3.9.7 Notes

In UPR airspace the Executive Controller is normally limited to revising the user preferred trajectory by either vertical changes or in time.

5.3.9.8 Trigger

The use case begins when the Executive Controller is notified that the flight will route direct in UPR airspace.

5.3.9.9 Main flow

1. The System notifies the Executive Controller that due to the deactivation of the ARES, the flight will now operate its preferred trajectory on entering UPR airspace and route direct to the exit point.
2. The Executive Controller activates the preferred trajectory in the System.

3. The System warns the Executive Controller that due flow measures to smooth traffic flows into the sector downstream of UPR airspace, a time constraint on the flight has been imposed. The flight is not to exit the UPR airspace before a designated time.
4. The Executive Controller uses the System to instruct the Flight Crew not to cross the exit point from UPR airspace before the designated time with the reason for the delay.
5. The Flight Crew enters the new time into the aircraft system.
6. The aircraft system validates the time as achievable within the operating parameters of the flight and confirms the time to the Flight Crew.
7. The Flight Crew use the System to acknowledge the new exit time to the Executive Controller and the System down links the flights revised air speed into the System.
8. The use case ends when the System records that the flight is able to absorb the delay in order to meet the exit time constraint.

5.3.9.10 Alternative flows

5.3.9.10.1 [6] – The flight is unable to absorb the delay flying direct

9. The aircraft system is unable to absorb the delay within the distance to run to the exit point, due to it being outside of the aircraft operating parameters, and notifies the Flight Crew.
10. The Flight Crew uses the System to notify the Executive Controller that it is unable to comply with the instruction flying direct, with the reason.
11. The Executive Controller uses the System to propose a trajectory revision to absorb the delay (see use case 5.3.6).
12. The System validates that the proposed trajectory revision will absorb some of the delay and the Executive Controller uplinks it to the Flight Crew together with a proposal for speed reduction.
13. The Flight Crew enters the trajectory revision into the aircraft system which validates the revision will absorb the delay plus a small speed reduction
14. The Flight Crew down links acceptance of the trajectory revision plus the revised air speed to the Executive Controller
15. The use case continues at step 8.

5.3.9.11 Failure Flows

5.3.9.11.1 [5] – The Flight Crew is unable to absorb the time delay (for whatever reason)

16. The Flight Crew notifies the Executive Controller via the System that it is unable to absorb the time delay[16].
17. The Executive Controller uses the System to inform the downstream sector of the situation and requests over delivery of the flight at the exit point of UPR airspace.
18. The downstream sector accepts the over delivery and the use case ends when the System records the non-compliance with the constraint and the over delivery.

[16] An example could be that the flight is a connecting flight and is already running late and trying to make up time. Any further delay could mean the passengers missing their connection.

5.3.10 Use Case 10 – Resolve a Conflict in UPR Airspace

5.3.10.1 Scope

System, black-box. System means a Network Management compliant system.

5.3.10.2 Level

User goal.

5.3.10.3 Summary

This use case describes how the Multi-Sector Planner uses the System to resolve a potential conflict in his area of responsibility in UPR airspace. The potential conflict arises when one flight takes advantage of the deactivation of an ARES to operate its preferred route through the airspace. Both flights are under the planning authority of the Multi-Sector Planner but it is the Executive Controller's responsibility to issue any instructions concerning conflict resolution.

5.3.10.4 Actors

Multi-Sector Planner (primary) – wants to resolve a potential conflict in his own area of responsibility.

Executive Controller (support) – has to support the Multi-Sector Planner in the resolution of a conflict.

Flight Crew (support) – has to agree to fly the aircraft according to the trajectories issued by the Executive Controller.

5.3.10.5 Pre-conditions

The System knows the filed trajectories in UPR airspace and any filed alternative trajectories.

5.3.10.6 Post-conditions

5.3.10.6.1 Success end-state

The System records that the conflict was resolved.

5.3.10.6.2 Failed end state

The System records that the potential conflict dissolved and the Multi-Sector Planner took no further action.

5.3.10.7 Notes

Although there may be two or more trajectories in conflict, the Multi-Sector Planner will endeavour to resolve the conflict by revising only one trajectory (e.g. level stop off).

5.3.10.8 Trigger

The use case starts when the System detects that some trajectories are in potential conflict in the area of responsibility of the Multi-Sector Planner.

5.3.10.9 Main flow

1. The System detects that some trajectories are in potential conflict in the area of responsibility of the Planning Controller. The System displays to the Planning Controller the trajectories.
2. The Multi-Sector Planner requests resolution advisories from the System to resolve the conflict.

3. The System determines new trajectories that are conflict-free and displays these solutions to the Multi-Sector Planner.
4. The Multi-Sector Planner selects one solution and, by using the System, determines that it is acceptable with respect to current and expected sector traffic and is consistent with the principles of UPR airspace.
5. The Multi-Sector Planner uses the System to propose the revised trajectory to the Executive Controller (see use case 5.3.6).
6. The Executive Controller accepts the proposal and the Multi-Sector Planner updates the System with the revised trajectory, including the point at which the affected trajectory will return to its preferred routing.
7. The use case ends when the System records that the conflict has been resolved.

5.3.10.10 Alternative flows

5.3.10.10.1 [2] - The Multi-Sector Planner knows a possible solution to solve the conflict

8. The Multi-Sector Planner inputs his own trajectory constraints into the System to solve the conflict.
9. The System verifies that the resulting trajectories are conflict-free within the current area of responsibility and notifies the Multi-Sector Planner.
10. The flow continues at step 5.

5.3.10.10.2 [3] – The Multi-Sector Planner wants to modify a System-proposed resolution

11. The Multi-Sector Planner rejects the proposed resolution on the grounds that it is not consistent with user preferred trajectories principles for UPR airspace and modifies the proposed trajectory.
12. The System verifies the modification and that resulting trajectories are conflict-free and notifies the Multi-Sector Planner of the result.
13. The flow returns to step 5.

5.3.10.10.3 [6] – The Executive Controller rejects the proposal

14. The Executive Controller rejects the proposal (for whatever reason) and uses the System to propose his own modification to the trajectory.
15. The System verifies the proposal and that resulting trajectories are conflict-free notifies the Multi-Sector Planner of the result.
16. The use case ends when the System records that the conflict has been resolved.

5.3.10.11 Failure Flows

5.3.10.11.1 [Anywhere] – The conflict situation has ceased to exist

17. The System detects that the extrapolated trajectories are no longer in conflict and notifies the Multi-Sector Planner of the conflict self-resolution.
18. The use case ends when the System records that the potential conflict no longer exists.

6 Requirements

6.1 Operational requirements

The following requirements apply to the Free Routing Operational Focus Area.

[REQ]

Identifier	REQ-07.05.03-OSED-0001.0000
Requirement	The introduction of User Preferred Routing operation shall allow flight efficiency improvement (i.e. in time and fuel) resulting from a reduction in flight plan route distance.
Title	**Flight efficiency improvement**
Status	In Progress
Rationale	Reduction in flight plan route distance will have direct positive impact on : § Environment, through fuel burnt and emissions reduction, § Time & Fuel Efficiency, through the reduction of flight time.
Category	Performance
V&V Method	Real Time Simulation

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
SATISFIES	ATMS Requirement	REQ-07.02.00-DOD-001.0013	FULL
SATISFIES	ATMS Requirement	REQ-07.02.00-DOD-001.0014	FULL

[REQ]

Identifier	REQ-07.05.03-OSED-0001.0001
Requirement	The setting of FRA lower limit shall not adversely impact adjacent non-FRA volume.
Title	**Lower limit of Free Route Airspace**
Status	In Progress
Rationale	A Free Route Airspace will need to facilitate transition to and from non-FRA airspace
Category	Design, Operational
V&V Method	Real Time Simulation/Live Trial

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
SATISFIES	ATMS Requirement	REQ-07.02.00-DOD-001.0002	FULL
SATISFIES	ATMS Requirement	REQ-07.02.00-DOD-001.0014	FULL

[REQ]

Identifier	REQ-07.05.03-OSED-0001.0002
Requirement	The lower level of FRA shall be the lowest possible taking into account airspace and demand complexity
Title	**Harmonisation of lowest level**
Status	In Progress
Rationale	A Free Route Airspace will need to facilitate transition to and from non-FRA airspace The volume of Free Route Airspace shall be as large as possible in order to

	have benefits for: § Environment, through fuel burnt and emissions reduction, § Time & Fuel Efficiency, through the reduction of flight time,
Category	Design, Operational
V&V Method	Real Time Simulation

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
SATISFIES	ATMS Requirement	REQ-07.02.00-DOD-001.0002	FULL
SATISFIES	ATMS Requirement	REQ-07.02.00-DOD-001.0013	FULL
SATISFIES	ATMS Requirement	REQ-07.02.00-DOD-001.0014	FULL

[REQ]

Identifier	REQ-07.05.03-OSED-0001.0003
Requirement	Entry/Exit Points of FRA shall take into account non-FRA adjacent airspace
Title	**Determination of Entry and Exit points**
Status	In Progress
Rationale	A Free Route Airspace will need to facilitate transition to and from non-FRA airspace taking into account the possible effects on: § Controller workload § Flight Planning § Letters of agreement
Category	Design, Operational, Performance
V&V Method	Real Time Simulation

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
SATISFIES	ATMS Requirement	REQ-07.02.00-DOD-001.0002	FULL
SATISFIES	ATMS Requirement	REQ-07.02.00-DOD-001.0013	FULL
SATISFIES	ATMS Requirement	REQ-07.02.00-DOD-001.0014	FULL

[REQ]

Identifier	REQ-07.05.03-OSED-0001.0004
Requirement	The system shall allow the use of cross border DCTs in case of adjacent FRA.
Title	**Free Routing across borders**
Status	In Progress
Rationale	The publication of this airspace will clearly reflect the cross-border application. The publication of entry and exit points on the common FIR/UIR boundary will not be necessary from an operational perspective.
Category	Performance, Design, Interoperability, Operational
V&V Method	Live Trial

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
SATISFIES	ATMS Requirement	REQ-07.02.00-DOD-001.0002	FULL
SATISFIES	ATMS Requirement	REQ-07.02.00-DOD-001.0013	FULL
SATISFIES	ATMS Requirement	REQ-07.02.00-DOD-001.0014	FULL

[REQ]

Identifier	REQ-07.05.03-OSED-0001.0005
Requirement	FRA entry/exit/intermediate waypoints shall use standard ICAO format description
Title	**Standardisation of data**
Status	In Progress

Rationale	All data related to flight planning must conform to current ICAO standards in order to allow exchange between relevant parties
Category	Interoperability, Functional
V&V Method	Expert Group

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
SATISFIES	ATMS Requirement	REQ-07.02.00-DOD-001.0002	FULL
SATISFIES	ATMS Requirement	REQ-07.02.00-DOD-001.0014	FULL

[REQ]

Identifier	REQ-07.05.03-OSED-0001.0006
Requirement	To enable flight planning the system shall allow the use of defined points or grid of points for identification of ARES (segregated airspace or special areas)
Title	**Airspace identification**
Status	In Progress
Rationale	Defined points will provide predictability for airspace users when free routing is not available in certain areas of the airspace These points allow flight plan data to be integrated and distributed throughout the system
Category	Operational, Performance, Safety, Design
V&V Method	Real Time Simulation

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
SATISFIES	ATMS Requirement	REQ-07.02.00-DOD-001.0013	FULL
SATISFIES	ATMS Requirement	REQ-07.02.00-DOD-001.0014	FULL

[REQ]

Identifier	REQ-07.05.03-OSED-0001.0007
Requirement	En-route Business/Mission trajectories shall benefit from FRA capability.
Title	**FRA benefits**
Status	In Progress
Rationale	Implementation of FRA will offer user preferred trajectories without the need to rely on a fixed route network. FRA will allow free route flight path through the following options: § Complete Free Route airspace above a certain FL within one State/FIR; § Complete Free Route airspace above a certain FL within several State/FIR; § Free Route airspace above a certain FL limited to cruising flights Including climbing/descending to/from one State and adjacent airports.
Category	Operating method
V&V Method	Real Time Simulation

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
SATISFIES	ATMS Requirement	REQ-07.02.00-DOD-001.0002	FULL

[REQ]

Identifier	REQ-07.05.03-OSED-0001.0008
Requirement	ANSP, Airspace users and Network manager shall have the same level of information regarding flight profile and routing.
Title	**Information collection and distribution**
Status	In Progress
Rationale	Such information will concern both the initial flight plan intentions and any subsequent revisions to that information. The development of appropriate tools

	will indicate real time and future activity status of Segregated Airspace to all users.
Category	Airspace Management
V&V Method	Real Time Simulation

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
SATISFIES	ATMS Requirement	REQ-07.02.00-DOD-0001.0000	FULL
SATISFIES	ATMS Requirement	REQ-07.02.00-DOD-0001.0001	FULL
SATISFIES	ATMS Requirement	REQ-07.02.00-DOD-0001.0007	FULL
APPLIES TO	ATMS Requirement	REQ-07.02.00-DOD-0001.0008	N/A

[REQ]

Identifier	REQ-07.05.03-OSED-0001.0009
Requirement	The system shall allow the flight planning of DCTs going through special areas in case of tactical re-routing is provided.
Title	**Flight planning of DCTs through special areas in case of tactical re-routing**
Status	In Progress
Rationale	It will allow airspace users to plan DCTs combining any of the published entry/exit waypoints within a Free Route Operations airspace in the event of tactical re-routing when capacity is not constrained. A harmonized approach for the publication of these DCTs will be ensured at network level by sharing the status of airspace within various FIRs (e.g. min/max FLs, avoiding penetration of uncontrolled airspace, etc.).
Category	Flight Planning
V&V Method	Real Time Simulation

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
SATISFIES	ATMS Requirement	REQ-07.02.00-DOD-0001.0003	FULL
SATISFIES	ATMS Requirement	REQ-07.02.00-DOD-0001.0012	FULL

[REQ]

Identifier	REQ-07.05.03-OSED-0001.0010
Requirement	Airspace users shall use the Flight Level Orientation scheme applicable within a FRA.
Title	**Flight Level Orientation scheme**
Status	In Progress
Rationale	Route orientation is one of the conditions of use of an airspace structure that will be used for long term planning and to identify airspace needs, as well as condition of penetration, type of operation, volume description.
Category	Airspace Management
V&V Method	Real Time Simulation

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
SATISFIES	ATMS Requirement		
SATISFIES	ATMS Requirement		

[REQ]

Identifier	REQ-07.05.03-OSED-0001.0011
Requirement	In addition to normal SBT validation rules, the planned route inside a FRA shall be considered invalid if it: § Fails to comply with published entry/exit requirements, § Fails to comply with Special Use Airspace rules (minimum distances, going through)

Title	**SBT validation**
Status	In Progress
Rationale	Validation of SBT is performed by the system checking its syntactic and semantic correctness. Additional constraints are represented by the onboard ability to handle late notice amendments to the SBT as well as enhanced accuracy in the adherence to a time constraint derived from initial 4D operation (e.g.: improved FMS meteorological model, use of more wind/temp data and improved prediction of wind/temp using onboard data, improved RTA algorithm i.e. wider RTA speed range, 10" or 30" selectable RTA tolerance, reliable RTA guidance).
Category	Flight planning
V&V Method	Real Time Simulation

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
SATISFIES	ATMS Requirement	REQ-07.02.00-DOD-0001.0002	FULL

[REQ]

Identifier	REQ-07.05.03-OSED-0001.0012
Requirement	The system shall propose the best routing option to airspace users taking into account the advantage of FRA.
Title	**Best routing option**
Status	In Progress
Rationale	The best routing option will be the path resulting the most cost effective in terms of: § Time/distance flown, § Fuel consumption, § Environmental impact, § Fitting ATC constrains.
Category	Flight Planning
V&V Method	Real Time Simulation

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
APPLIES TO	ATMS Requirement	REQ-07.02.00-DOD-0001.0000	N/A
SATISFIES	ATMS Requirement	REQ-07.02.00-DOD-0001.0002	FULL
APPLIES TO	ATMS Requirement	REQ-07.02.00-DOD-0001.0007	N/A

[REQ]

Identifier	REQ-07.05.03-OSED-0001.0013
Requirement	To enable booking of ARES the system shall allow interface with ASM tools.
Title	**Airspace booking**
Status	In Progress
Rationale	ASM tools will be used by AUs to make their demand and the system shall allow interface with them.
Category	Operational, Performance, Safety, Design
V&V Method	Real Time Simulation

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-07.05.03-OSED-0001.0014
Requirement	The system shall depict the airspace status.
Title	**Airspace activation/deactivation**
Status	In Progress
Rationale	The system shall be able to depict the real time status of the airspace.
Category	Operational, Performance, Safety, Design
V&V Method	Real Time Simulation

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-07.05.03-OSED-0001.0015
Requirement	The system shall be able to manage activation and deactivation fixed route network.
Title	**Activation/Deactivation of Fixed Route network**
Status	In Progress
Rationale	To cope with high complexity traffic situations may be required activation of predefined fixed route network. The system shall be able to manage activation and deactivation such structure.
Category	Flight Planning
V&V Method	Real Time Simulation

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

6.2 Information Exchange Requirements

This section has to be filled in for V2 and refined in V3.

This section shall describe the subset of the operational requirements associated with an information exchange. The information exchange requirements develop the DOD information exchange needs which are applicable to the Operational Focus Area addressed by this OSED (i.e. there is at least an intended addressee of the exchange who is an actor in the OFA).

The OSED defines the requirements, which will be completed with quantitative characterisation in the Safety and Performance document (SPR).

The Information Exchange Requirements address the information to exchange between actors. They are deduced from the interactions between processes or from the services.

The requirements shall be traced with respect to the high level operational requirements identified in the DOD, when available:

- *For Step 1, if the DOD is not available, a provisional description of Information Exchange Requirements shall be provided, based on the description of the Process in the OSED;*
- *For step 2 & 3 where a top down approach is applied, the requirements shall be derived from the DOD and based on the description of the Process in the OSED.*

A coordination shall be done with WP08 to fill out the IER table properly.

In order to enable the import of SE Data in the SESAR SE Repository, the description shall use the layout described in [3]. The layout is illustrated below.

[IER]

Identifier	Name	Issuer	Intended Addressees	Information Element	Involved Operational Activities	Interaction Rules and Policy	Status	Rationale	Satisfied DOD Requirement Identifier	Service Identifier
									DOD Requirement Identifier<Partial>	Service Identifier

Table 12: IER layout

The Identifier field contains the Operational project number, owner of the requirement.

If the information element already exists in the AIRM then provide its name in the AIRM. Else either put the name of the information element and provide the description of the information element using the information element template in Appendix B, or provide the name of the information element and the reference to an external / standard source.

In the fields "Issuer" and "Intended addressees", the use of roles defined by B.04.02 in [12] should be preferred. The syntax of the roles shall be respected, either using B.04.02 roles or using roles defined in the OSED.

If the service portfolio already contains a service which fulfils the Information Exchange Requirement, this last should trace to this service in the field "Service Identifier".

7 References

List of the reference and applicable documents.

This section identifies the documents the OSED has to comply (Applicable documents) or to be used as additional inputs (Reference documents). The generic format is (Name of project, Title of document, Identification number, Edition, Date).

7.1 Applicable Documents

This OSED complies with the requirements set out in the following documents:

[1] Template Toolbox 03.00.00
https://extranet.sesarju.eu/Programme%20Library/SESAR%20Template%20Toolbox.dot

[2] Requirements and V&V Guidelines 03.00.00
https://extranet.sesarju.eu/Programme%20Library/Requirements%20and%20VV%20Guidelines.doc

[3] Templates and Toolbox User Manual 03.00.00
https://extranet.sesarju.eu/Programme%20Library/Templates%20and%20Toolbox%20User%20Manual.doc

[4] EUROCONTROL ATM Lexicon
https://extranet.eurocontrol.int/http://atmlexicon.eurocontrol.int/en/index.php/SESAR

7.2 Reference Documents

The following documents were used to provide input/guidance/further information/other:

The documents mentioned in the template are examples that can be removed

[5] B4.2 High Level Process Models

[6] ED-78A Guidelines for Approval of the provision and use of Air Traffic Services supported by Data Communications

[7] B4.3 Architecture Description Document

[8] ICAO Document 9694

[9] B4.1 [Initial] Baseline Performance Framework (Edition 0) D12.

[10] EUROCONTROL "Point Merge Integration of Arrival Flows Enabling Extensive RNAV Application and Continuous Descent OSED" V2.0, 19/07/10, CND/COE/AT/AO

[11] OATA Operational Scenario and Use Case Guide V1.0

[12] WPB.04.02, SESAR WPB4.2 Actors - Roles and Responsibilities 00.01.05, 11/05/2011

[13] SESAR Safety Reference Material
https://extranet.sesarju.eu/Programme%20Library/Forms/Procedures%20and%20Guidelines.aspx

[14] WPB.01 Integrated Roadmap Latest version

Appendix A Justifications

Please provide in appendix, the material that justifies the requirements allocation.

Appendix B New Information Elements

This section contains a detailed description of the Information Elements that are exchanged by actors within ATM according to Information Exchange Requirements. It has to be used for the Information Elements which are neither in the AIRM nor in an external / standard source document.

The content of this section has been defined within WP08. It will be exploited by WP08 and should be used in the context of AIRM Change Request process.

The description of the Information Element should use the following layout.

Identifier	
Name	
Description	
Properties	
Rules applied	
Comments	

Table 13: Information Element layout

The description of the attributes of the Information Element is:

- *Identifier. The identifier of the Information Element within the Information Exchange Requirement. It should begin with IE- e.g. "IE-01";*
- *Name. The name of the information element;*
- *Description. Explains the meaning of the Information Element. A definition should be clear, explicit, unambiguous, and short;*
- *Properties. Lists the essential characteristics of the information element. Each property is further defined in its own table. Example of properties to include:*
    - *An information element called Aerodrome will have an ICAO location indicator property.*
    - *A Runway will have a length property.*
    - *A Runway is situated at an Aerodrome.*
    - *A Helicopter is a type of Aircraft.*

Rules applied. Details any operational rules that apply to the entity. For example:

An Aerodrome which is defined as of type "Aerodrome" (as opposed to "Heliport") must have at least one Runway.

Comments. Free text to make some remarks or observations you want to be added to your definition.

The description of the property of the Information Element should use the following layout.

Identifier	
Name	
Description	
Value Range	

Table 14: Information Element property layout

The description of the attributes of the property of the Information Element is:

- *Identifier. The identifier of the property within the Information Element. It should begin with PR- e.g. "PR-24"*
- *Name. The name of the property;*
- *Description. Explains the meaning of the property. A definition should be clear, explicit, unambiguous, and short.*
- *Value Range. Details any constraints on the value of a property. For example:*
    - *An ICAO location indicator can only be 4 characters.*

B.1 Information Element for Information Exchange Requirement IER-<Project code>-<Document code>-<Reference code>.<Reference number>

(to be repeated for each Information Element not already defined in the AIRM or another document)

- *Fill in the Information Element table.*
- *Fill in for each Information Element Property, the Information Element Property table.*

-END OF DOCUMENT-