Final FOC Step 1 and Step 2, as available, OSED

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Abstract

This OSED mainly focuses and describes Business Trajectory Management (including Free Route and AFUA) in the context of Step 1 and Step 2, as available, of the SESAR V&V Storyboard viewed from the FOC system and airspace user's perspective.
It focuses on the transition steps towards the target business trajectory concept implementation, with specific attention to apply the business trajectory life cycle through all ATM planning phases - including the execution phase.
In addition to Business Trajectory Management this document as well reflects UDPP and AIM/MET processes from the FOC system and airspace user's perspective.

Note: This OSED is in accordance with SESAR Integrated Roadmap DS16.

Authoring & Approval

Prepared By - *Authors of the document.*		
Name & Company	Position & Title	Date
Olaf Belzer/ Sabre	Program Director	08/09/2016
Saskia Tomes/Sabre	Research Engineer	04/08/2016
Max HOFFMANN / Lufthansa Systems	Research Engineer SESAR	08/09/2016
Marcus HANTSCHKE/Lufthansa Systems	Senior Research Engineer SESAR	08/09/2016
Urban Weisshaar/ Lufthansa Systems	Contribution Manager	
Régis BATTEUX/Airbus	Project Manager 11.01.02	26/08/2016
Matej Papp/Honeywell	Contribution Manager 11.01	05/08/2016

Reviewed By - *Reviewers internal to the project.*		
Name & Company	Position & Title	Date
Marcus HANTSCHKE/Lufthansa Systems	Senior Research Engineer SESAR	12/09/2016
Max HOFFMANN/ Lufthansa Systems	Research Engineer SESAR	12/09/2016
Régis BATTEUX/Airbus	Project Manager 11.01.02	12/09/2016
Urban WEISSHAAR / Lufthansa Systems	Project Manager 11.01.03	
Olaf BELZER / Sabre	Project Manager 11.01.04	12/09/2016
Joseph ABO ROMMAN / Airbus	Project Manager 11.01.05	12/09/2016

Reviewed By - *Other SESAR projects, Airspace Users, staff association, military, Industrial Support, other organisations.*		
Name & Company	Position & Title	Date
Christophe PLUSKOTA / DHL	11.01 Airspace User	08/08/2016
Peter HICKISCH / DHL	11.01 Airspace User	08/08/2016
Gerd MATTES / Lufthansa German Airlines	11.01 Airspace User	08/08/2016
Jürgen MIES/ AOPA	11.01 Airspace User	08/08/2016
Nigel FREE / BA	11.01 Airspace User	08/08/2016
Sigmund LOCKERT / EHA	11.01 Airspace User	08/08/2016
Fulya Hulya ONCE / TURKISH AIRLINES	11.01 Airspace User	08/08/2016
Alon LAVI / EL AL	11.01 Airspace User	08/08/2016
Amos ALDAAG / EL AL	11.01 Airspace User	08/08/2016
Jacqueline COQUEL / Air France	7.6.2 Airspace User	08/08/2016
Pascal COLLES / Air France	Airspace User	08/08/2016
Jean-Philippe RAMU / EBAA	11.01 Airspace User	08/08/2016
Jürgen MIES / AOPA	11.01 Airspace User	08/08/2016
Nick RHODES / ELFAA	11.01 Airspace User	08/08/2016
Manfred MOHR / IATA	11.01 Airspace User	08/08/2016
Stefano PROLAS / IATA	11.01 Airspace User	08/08/2016
Manfred LINDHOLM / IATA	11.01 Airspace User	08/08/2016
Peter SANDGREN / Novair	11.01 Airspace User	08/08/2016
Russell OLIVIER / Air France Hop	11.01 Airspace User	08/08/2016
Tobin MILLER / AA	11.01 Airspace User	08/08/2016

Approved for submission to the SJU By - *Representatives of the company involved in the project.*		
Name & Company	Position & Title	Date
Régis BATTEUX/Airbus	Project Manager 11.01.02	31/08/2016
Martina Stehlikova	Honeywell Program Manager	31/08/2016

Rejected By - *Representatives of the company involved in the project.*		
Name & Company	Position & Title	Date
<Name / Company>	<Position / Title>	<DD/MM/YYYY>

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Intellectual Property Rights (foreground)

This deliverable consists of SJU foreground.

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Executive summary

This OSED describes Business Trajectory Management in the context of Step 1 and Step 2, as available, viewed from the FOC system and airspace user's perspective.

It focuses on the transition steps towards the target business trajectory concept implementation, with specific attention to apply the business trajectory life cycle through all ATM planning phases - including the execution phase.

As Step 3 has been formally cancelled and only limited material is available for Step 2, this OSED will be limited to the requirements related to Step 1 and Step 2 as available.

This OSED will be the final document from WP11.1 and builds on the progress done during SESAR 1, especially the definition of an extended flight plan for the exchange of trajectory information between airspace users and ATM. The exchange of trajectory information needs to be recognized as "the" key enabler providing all relevant information in order support multiple concepts such as UDPP, Free Route, AFUA and AIM, covered in this document as well.

Several background documents have either been not updated (DOD Step 1, DOD Step 2 and 3 as available) or cancelled (ConOps Step 2), or have been produced in parallel (Transition ConOps) to the development of this document. For this reason full traceability cannot be guaranteed throughout the entire document. To ensure a smooth transition from the SESAR 1 work programme to the SESAR2020 programme it was decided to directly use the content of the Integrated Roadmap DS16 as basis for all descriptions. This is also done - as the fly4D consortium is abolished with the end of the SESAR 1 work programme – to ensure that the work on airspace user related aspects can start right from the beginning without major need to update such definitions and requirements.

The structure of this document was decided to be OFA centric and has a strong focus on complementing SESAR federating concepts reflecting the Airspace Users point of view.

Detailed operating methods, use-cases and requirements have been developed in close coordination with AU`s, other work packages (mainly WP7) and several working groups e.g.: ICAO ATMRPP and FAA NextGen.

Special attention has been given to transversal aspects as fly4D representing the FOC is only one player in an extremely complex environment, consisting out of multiple equal partners representing the AU, ATM, Airport community.

In summary this document shall be used as a reference document for future projects e.g. SESAR 2020, providing the complete list of business requirements and processes for the FOC identified in SESAR 1, supporting the SESAR solutions:

- #31 (Advanced Flexible Use of Airspace)
- #33 (Free Routing)
- #37 (Extended Flight Plan)
- #57 (User Driven Prioritization Process)

1 Introduction

1.1 Purpose of the document

The Operational Service and Environment Definition (OSED) 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 DOD 11.1.1-2c produced by the federating OPS project P11.01.01. It also contains refinement of the DOD 7.2 (refer to [22] and [23]) requirements produced by the federating OPS project P7.2. And finally, 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.

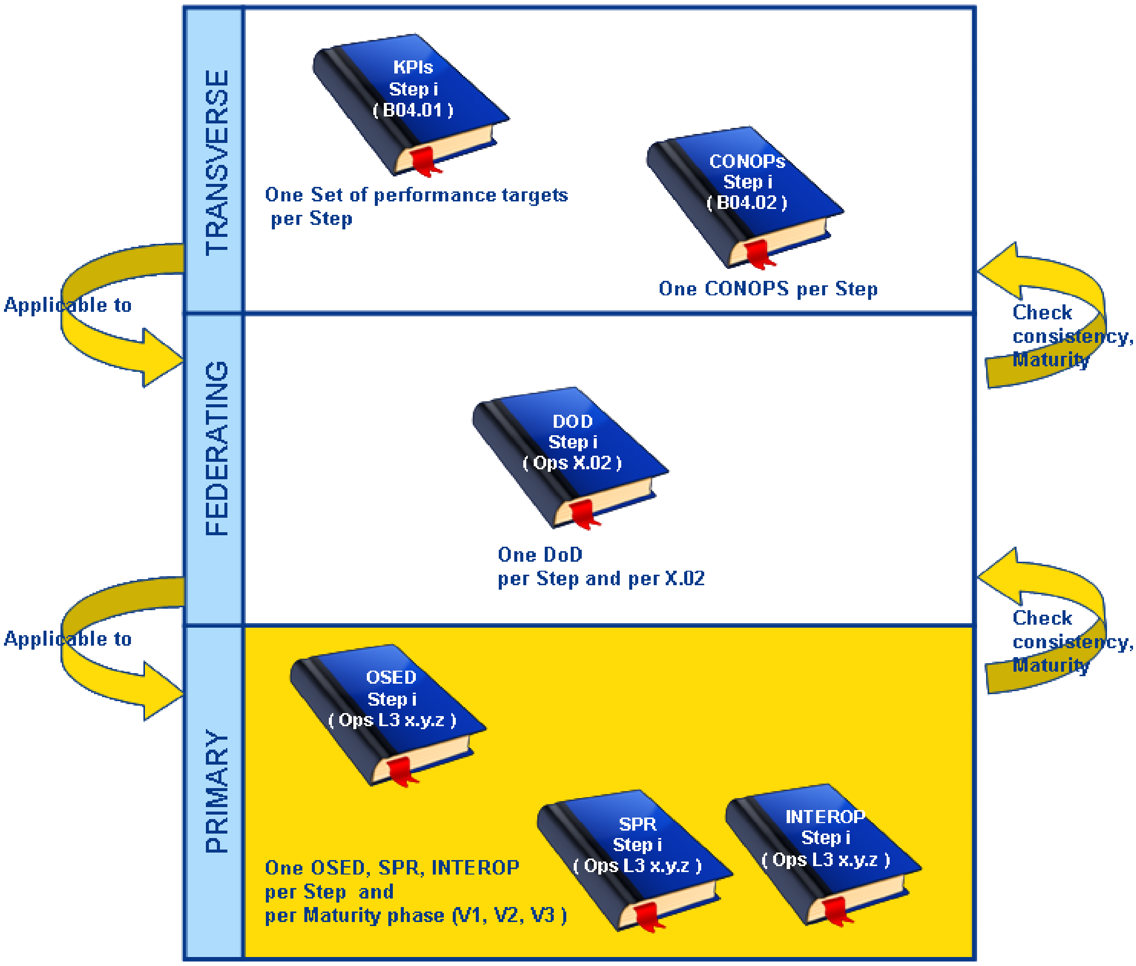


Figure 1: OSED document with regards to other SESAR deliverables

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 <relevant> project execution phase.

1.2 Scope

This document is structured in an OFA centric way in order to be in line with the general tendency to re-group certain aspects of the programme in a more efficient way.

The first part of the OSED details the operational concept for the Operational Focus Area (OFA) 03.01.01 Trajectory Management Framework and 03.01.04 Business and Mission Trajectory. Within this document both OFAs are taken together under the header Business Trajectory (including Trajectory Management Framework). This document will only address the lifecycle of the Business Trajectory from the AU/ FOC perspective for SESAR Step 1 and SESAR Step 2 as available, the Mission Trajectory is out of scope for this document.

The document will define the processes integrated in the FOC and services provided by the FOC that are needed to contribute in the Trajectory Management. Furthermore the respective actors and roles will be described that use or perform the single processes and services.

Operational Focus Areas

- Business and Mission Trajectory (including Trajectory Management Framework)
- Free Routing
- System Interoperability with air and ground data sharing (SWIM)
- Airspace Management and AFUA
- UDPP
- Aeronautical Information Management and Meteorology

As the MET requirements have not been addressed since the beginning of the WP11.1, and no dedicated V&V activity has been performed on the subject, these requirements should be identified at maturity level not more than V1 and consequently should not be considered in the core of the document. However, taking into consideration the outcomes data obtained, it has been decided to include these requirements in an annex (Appendix D Future MET requirements).

1.3 Intended readership

This document is intended first:

- to WP11.01 and other relevant primary projects addressing the same OFAs and/or with dependencies to network management;
- as well as to transversal projects such as B4.2, B4.1 and WP16;
- all federating Projects (X.2) and 7.5.3, 7.6.2, 9.1, 9.2, 9.3 for cross WP integrated validation;
- outside SESAR: to all ATM Stakeholders (including Airspace Users) to ensure early awareness and buy-in to the Concept;
- as federating document for documents produced by P11.01.03.

1.4 Structure of the document

The document is structure in the way suggested by the OSED template. Within each section the structure is OFA centric which allows an easy and intuitive browsing through the individual sections.

1.5 Background

Two previous FOC OSED versions were issued before this final version :

- D11.2.2-1 OSED V04.doc - Step 1 - V01.04 – 23/11/2012 :
  - Not updated since 2012
  - All requirements of this version are deleted in Appendix C of this final OSED version
- D11.01.02-2c-OSED-Ed 02.00.00.doc - Step 2and 3 as available – V02.00.00 – 15/11/2013 :
  - No requirements identified in this document
  - Step 3 canceled

Several background documents have either been not updated (DOD Step 2) or cancelled (ConOps Step 2), or have been produced in parallel (Transition ConOps) to the development of this document.

As a project dedicated to FOC will no longer exist after the closure of SESAR 1, major revisions for the processes and requirements outlined in this document will be made in the dedicated SESAR2020 projects.

This OSED Document will be the final WP11.01 FOC version and might be used as a document supporting the transition to SESAR2020.

1.6 Glossary of terms

Glossary and definition of terms can be found in the "SESAR Lexicon" [4].

For a better readability, terms that are used frequently in this document are explained again below.

Term	Definition	Source
Advanced Flexible Use of Airspace	An airspace management concept in which airspace is managed as a single entity and in which there are no fixed structures and airspace reservations for special airspace activity are allocated in real time.	SESAR Consortium (2007) CONOPS Acronyms and Definitions, Task 2.2.2 - Milestone 3
Airspace Configuration	Is a pre-defined and coordinated organisation of routes and /or terminal routes and their associated airspace structures (including temporary airspace reservations, of appropriate) and ATC sectorisation,	ASM Handbook EUROCONTROL - GUID – 140
Airspace Constraint	An Airspace Constraint is a reservation of airspace for activities not linked to a mission trajectory. Examples include ground-to-air or ground-to-ground gunnery sessions. As for any ARES, the activity inside an Airspace Constraint is not shared.	Project 07.05.02
Airspace Management	The process by which airspace options are selected and applied to meet the needs of the ATM community.	ICAO, Doc 9882 Manual on Air Traffic Management System Requirements 2008, 1st ed., p. F-1
Airspace Restriction	1. A defined volume of airspace temporarily reserved for exclusive or specific use by categories of users (TSA, TRA, CBA) and Airspace Restriction designates Danger, Restricted and Prohibited Areas. *2.* A defined volume of airspace temporarily reserved for exclusive or specific use by categories of users. These airspace reservations may be stationary, like an "ad-hoc" TSA, or moving along with the flight path to facilitate aerial operations like en-route Air to Air Refuelling.	ATM Lexicon

Term	Definition	Source
Airspace User	An Airspace User is an organization operating aircraft (in terms of: aerial vehicle). The organization includes the pilots of the aircraft. Airspace Users include: • Civil airspace users: airlines (i.e. those engaged in commercial air transport like passenger, mail and cargo services), aerial work, air taxi operators, business aviation, private air transport, sporting and recreational aviation etc.; • Military airspace users: military forces that operate under the sole authority of a state government. Two classifications of flight operations are considered: • ICAO-compliant manned or unmanned flight operations; • ICAO non-compliant manned or unmanned flight operations. ICAO-compliant flight operations are those conducted in accordance with ICAO provisions (e.g. SARPs, PANS). Civil airspace users realise ICAO-compliant manned or unmanned flight operations whereas military airspace users realise usually ICAO non-compliant manned or unmanned flight operations. Military airspace users realise ICAO-compliant manned or unmanned flight operations when they operate State aircraft using civil air traffic rules.	WP11.1
Briefing Package	The briefing package includes the operational flight plan used to brief the flight crews in regard to the intended flight execution. The briefing package includes • The whole trajectory that shall be flown • The filed ATS - FPL • The NOTAM information related to the flight • The Weather information related to the flight • The estimated fuel masses	WP11.1
Cross Border Area	An airspace restriction established over international borders for specific operational requirements. This may take the form of a Temporary Segregated Area (TSA) or Temporary Reserved Area (TRA).	Eurocontrol ATM Lexicon
Cross Border Operation	Cross Border Operations encompasses activities conducted by one or more States within an area established across international borders or entirely within the airspace under the jurisdiction of one State.	Advanced Flexible Use of Airspace-OSED Step2 V1
Digital NOTAM (D-NOTAM)	A data set made available through digital services containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to systems and automated equipment used by personnel concerned with flight operations.	OSED 13.02.02

Term	Definition	Source
Direct Routing	The shortest connection close to the great circle between 2 published waypoints consisting of a succession of Direct Segments and ATS route segments.	Derived from SJU Free Route Task Force final report
Direct Routing Airspace	Airspace defined laterally and vertically with a set of entry/exit conditions where published direct routings are available. Within this airspace, flights remain subject to air traffic control.	SJU Free Route Task Force final report
Dynamic Mobile Area	A constraint placed on a trajectory with the purpose of avoiding an area with military or other similar activity. The owner of the trajectory decides how to satisfy the constraint with the most appropriate change. The high precision of 4D navigation allows properly equipped aircraft to avoid the temporary trajectory exclusion volumes with minimum business trajectory disruption.	Eurocontrol ATM Lexicon
Early Flight Intents	Early flight intents are a set of data provided by an Airspace User to express its intentions to use the airspace. This set of data includes a first level of trajectory description.	P07.06.02
ECAC Domestic	This term is used to name flights that are departing and arriving within the ECAC area. This traffic can be separated into traffic which is flying a trajectory that is completely located in the ECAC area (e.g. traffic between Brussels and Frankfurt/ Main), called *ECAC Domestic Type 1*, and traffic that is flying a trajectory which touches partially airspaces outside the ECAC area (e.g. traffic between Roma and the Canary Islands), called *ECAC Domestic Type 2*.	WP11.1
ECAC-International	This term is used to name flights that are departing in the ECAC area but not flying to any airport within the ECAC area and traffic departing outside the ECAC area and flying to any airport in the ECAC area.	
Extended Flight Plan	Includes the ICAO Flight Plan and the 4D trajectory computed by the Flight Operation Centre (FOC).	ATM Lexicon
ETOPS	Extended Range Twin Engine Operation: Extended range operations by aircraft with two turbine power units (ETOPS or EROPS) are flights where the flight time at the one power-unit inoperative cruise speed (in ISA and still air conditions), from a point on the route to an adequate alternate aerodrome, is greater than the threshold time approved by the State of the Operator. (ICAO Vocabulary).	ICAO
EROPS	See ETOPS	ICAO
Flight Operation Centre (FOC)	Flight Operation Centre is a part (department, employee) of an Airspace User or a system used by an Airspace User providing services and support like operational control, flight planning, pre-flight briefing, in-flight support and post-flight analysed in accordance to AU's Operational Manual and Standard Operational Procedures.	WP11.1
Free Route	Operational concept consisting of the two sub-concepts Direct Routing and Free Routing.	Derived from 4.7.2 Free Route OSED Step 1
Free Routing	The ability for Airspace User to plan/re-plan a route according to the User defined segments.	SJU Free Route Task Force final report

Term	Definition	Source
Free Routing Airspace (FRA)	Airspace defined laterally and vertically, allowing Free Routing with a set of entry/exit features. Within this airspace, flights remain subject to air traffic control.	SJU Free Route Task Force final report
	A specified airspace within which users may freely plan a route between a defined entry point and a defined exit point, with the possibility to route via intermediate (published or unpublished) way points, without reference to the ATS route network, subject to airspace availability. Within this airspace, flights remain subject to air traffic control. *(Note: In the ERNIP Part 1, the term used is Free Route Airspace instead of Free Routing Airspace)*	ERNIP Part 1
Network Management Function	An integrated ATM activity with the aim of ensuring optimised Network Operations and ATM service provision meeting the Network performance targets. It encapsulates: • Collaborative layered planning and execution processes, including the facilitation of business/mission trajectories. • Airspace organisation and management processes. • Demand and Capacity Balancing processes through all planning and execution phases to ensure the most efficient use of airspace resources, to anticipate and solve workload/complexity issues and to minimize the effects of ATM constraints. • The enabling of UDPP process. • The provision and maintenance of Operation Plans covering the range of activity, i.e. Network to Local. • The provision of relevant complexity resolution advice to ATC operations.	ATM Lexicon
Network Manager Operation Centre	A Eurocontrol Sub-Division being the operational component of the Network Management Directorate, established in accordance with the ICAO Centralised ATFCM Organisation to provide the ATFCM Service, on behalf of the participant States, in a specified part of the EUR Region. The NMOC comprises among others the Network Management Cell (NMC) and the Integrated Initial Flight Planning Processing System (IFPS). For ASM purposes, the NMOC is also entrusted with the Centralised Airspace Data Function (CADF). (Source: ernip-part-3-asm-handbook)	P07.06.02

Term	Definition	Source
Network Operations Plan	1. The plan, including its supporting tools, developed by the Network Manager in coordination with the operational stakeholders to organise its operational activities in the short and medium term in accordance with the guiding principles of the Network Strategic Plan. For the European route network design- specific part of the Network Operations Plan, it includes the European Route Network Improvement Plan. 2. A set of information and actions derived and reached collaboratively both relevant to, and serving as a reference for, the management of the Pan-European network in different timeframes for all ATM stakeholders, which includes, but is not limited to, targets, objectives, how to achieve them, anticipated impact.	ATM Lexicon
Shared Business Trajectory	The trajectory published by the Airspace User that is available for collaborative ATM planning purposes. The refinement of the SBT/SMT is an iterative process. The final form of the SBT/SMT becomes the Reference Business or Mission Trajectory (RBT/RMT) and is part of the filed flight plan.	ATM Lexicon
Temporary Segregated Area	A defined volume of airspace normally under the jurisdiction of one aviation authority and temporarily segregated, by common agreement, for the exclusive use by another aviation authority and through which other traffic will not be allowed to transit.	Eurocontrol ATM Lexicon
User Driven Prioritisation Process	A process during periods of reduced capacity in which the service provider declares the available capacity and users, interacting collaboratively and collectively with the provider, propose specific flights to fill it.	P07.06.02

1.7 Acronyms and Terminology

Term	Definition
4D	Four Dimensional
4DT	Four Dimensional Trajectory
A/G	Air-Ground
A/C	Aircraft
AA2A	ATC Area to Avoid
ACARS	Airline Communication and Reporting System
A-CDM	Airport Collaborative Decision Making
ACK	Acknowledgement message

Term	Definition
ADD	Architecture Definition Document
ADEP	Aerodrome of Departure
ADES	Aerodrome of Destination
AFUA	Advanced Flexible Use of Airspace
AIBT	Actual In Block Time
AIM	Aeronautical Information Management
AIP	Aeronautical Information Publication
AIREP	Aircraft Report
AIS	Aeronautical Information Services
AIXM	Aeronautical Information Exchange Model
ALDT	Actual Landing Time
AMAN	Arrival Manager
AMDAR	Aircraft Meteorological Data Relay
ANSP	Air Navigation Service Provider
AO	Aircraft Operators
AOBT	Actual Off Block Time
AP / APT	Airport
APOC	Airport Operations Centre
ARES	Airspace Reservation/Restriction
ARINC	Aeronautical Radio Incorporated
ARO	Aerodrome Reporting Office (ICAO acronym)
ASM	Airspace Management
ATCO	Air Traffic Controller
ATC	Air Traffic Control
ATFCM	Air Traffic Flow & Capacity Management
ATFM	Air Traffic Flow Management
ATIS	Automatic Terminal Information Service

Term	Definition
ATM	Air Traffic Management
ATMS	Air Traffic Management System
ATOT	Actual Take Off Time
ATSU	Air Traffic Services Unit
AU	Airspace User
AUP	Airspace Use Plan
BGA	Business and General Aviation
BIRDTAM	Bird Notice to Airmen
BMT	Business/Mission Trajectory
B2B	Business to Business (B2B)
BT	Business Trajectory
CCS	Capacity Constraint Situation
CDM	Collaborative Decision Making
CHG	FPL Change message
CI	Confidence Index
COTS	Commercial-off-the-shelf
CPDLC	Controller-Pilot Data Link Communications
CTA	Controlled Time of Arrival
CTO	Controlled Time Over
CTOT	Calculated Take-off Time
D-ATIS	Digital Air Traffic Information Service
DCB	Demand Capacity Balancing
D-NOTAM	Digital NOTAM
D-MET	Digital Meteorological Information
D-METAR	Digital METAR
D-TAF	Digital TAF
DCT	Direct

Term	Definition
DMA	Dynamic Mobile Area
D-MET	Digital Meteorological Information
D-NOTAM	Digital NOTAM
DOC	Direct Operating Cost
DOD	Detailed Operational Description
DOF	Date of Flight
DRA	Direct Routing Airspace
D-VOLMET	Digital Meteorological Information for Aircraft in Flight
E-ATMS	European Air Traffic Management System
EAUP	European Airspace Use Plan
ECAC	European Civil Aviation Conference
ECHG	Modification message of the Extended FPL
ECNL	Extended CNL (Cancel) message
EDLA	Extended DLA (Delay) message
EFB	Electronic Flight Bag
EFPL	Extended Flight Plan
EFPM	Extended Flight Plan Message
EIBT	Estimated In Block Time
EID	Electronic Information Device
ENB	Enabler
EOBT	Estimated off-block time
ERNIP	European Route Network Improvement Plan
ETA	Estimated Time of Arrival
EUUP	European Updated Airspace Use Plan
FAA	Federal Aviation Authority
FAB	Functional Airspace Block
FB	Functional Block

Term	Definition
FC	Flight Crew
FDA	Fleet Delay Apportionment
FF-ICE	Flight and Flow Information in a Collaborative Environment
FIBT	Forecasted In Block Time
FIXM	Flight Information eXchange Model
FIXM 4D	FIXM 4D Flight Plan Message
FL	Flight Level
FMS	Flight Management System
FOBT	Forecasted Off Block Time
FOC	Flight Operations Centre
FOO	Flight Operations Officer
FPL	Flight Plan
FSPD	Flight Specific Performance Data
GAMET	General Aviation Meteorological Information
GEWF	Global Ensemble Weather Forecast
GAT	General Aviation Traffic
GUFI	Global Unique Flight Identifier
HSPT	HOT SPOT
IBT	In-Block Time
ICAO	International Civil Aviation Organization
ICAO FIXM	ICAO flight plan in FIXM format
ICAO FPL	ICAO flight plan
ICAO XML	ICAO flight plan in Eurocontrol XML format
ICAO TXT	ICAO flight plan in text format
ID	Identifier
IEI	Imbedded Element Identifier
IER	Information Exchange Requirements

Term	Definition
IFPS	Integrated Initial Flight Plan Processing System
INTEROP	Interoperability Requirements
iRBT	Initial Reference Business Trajectory
IRS	Interface Requirements Specification
IRSM	Information Service Reference Model
iSBT	Initial Shared Business Trajectory
ITCZ	Intertropical Convergence Zone
i4D	Initial 4D trajectory
KPA	Key Performance Area
KPI	Key Performance Indicator
Lat	Latitude
LOA	Letter of Agreement
Long	Longitude
LROPS	Long Range Operations
MCDU	Multifunction Control Display Unit
MEL/CDL	Minimum Equipment List / Configuration Deviation List
MET-GATE	A functional component of the 4DWxCube serving tailored MET Information and services to ATM systems through SWIM compliant webservices.
METAR	Meteorological Aviation Routine Weather Report
NM	Network Manager
NMF	Network Manager Function
NMOC	Network Manager Operations Centre
NOP	Network Operations Plan
NOTAM	Notice to Airmen
NPR	Nominal Preferred Route
OBJ	OBJECTIVE
OBT	OFF BLOCK TIME

Term	Definition
OC	OPERATING CREDIT
OEM	Original Equipment Manufacturer
OFA	Operational Focus Area
OFP	Operational Flight Plan
OI	Operational Improvement or OPERATING INDEX
OIS	On Board Information Service
OR	Operational Requirements
OSED	Operational Service and Environment Definition
PANS	Procedures of Air Navigation Services
PANS-ATM	Procedures of Air Navigation Services – Air Traffic Management
PCS	Process
PDS	Pre-Departure Sequence
PIB	Pre-flight Information Bulletin
PIBT	Published In Block Time
POBT	Published Off Block Time
PTR	Profile Tuning Restrictions
PWI	Predicted Wind Information Message
RAD	Route Availability Document
RBT	Reference Business Trajectory
REJ	Reject Message
REQPWI	Request for Predicted Wind Information Message
RMAN	Runways Manager (first Airport process to organise departure)
RNP	Required Navigation Performance
RPAS	Remotely Piloted Aircraft Systems
RSA	Restricted Airspace
RTA	Required Time of Arrival
RTS	Real Time Simulation

Term	Definition
RTSA	Real Time Status of Airspace
SARPs	Standards and Recommended Practices
SBT	Shared Business Trajectory
SCN	Scenario
SESAR	Single European Sky ATM Research Programme
SESAR Programme	The programme which defines the Research and Development activities and Projects for the SJU.
SIGMET	Significant Meteorological Information
SFP	Selective Flight Protection
SFP OC	SFP Operating Credit
SFP OI	SFP Operating Index
SIBT	Scheduled In Block Time (initial Airline schedule)
SITA	Société Internationale de Télécommunication Aéronautique
SJU	SESAR Joint Undertaking (Agency of the European Commission)
SJU Work Programme	The programme which addresses all activities of the SESAR Joint Undertaking Agency.
SOA	Service Oriented Architecture
SOBT	Scheduled Off Block Time (initial Airline schedule)
SPECI	Special METAR forecast
SPR	Safety and Performance Requirements
STAM	Short-Term ATFCM Measures
STD	Scheduled Time of Departure
SUUP	Special UUP
SVC	Service
SWIM	System Wide Information Management
TAD	Technical Architecture Description
TAS	True Air Speed
TMA	Terminal Manoeuvring Area

Term	Definition
TOD	Top of Descent
TR	Technical Requirements
TS	Technical Specification
TSAT	Target Start-up Approval Time
TT	Target Time
TTA	Target Time of Arrival
TTO	Target Time Over
TTOT	Target Take-off Time
TW	Target Window
TXT	Text
UDPP	User Driven Prioritisation Process
UIBT	User In Block Time (prioritisation given by User)
UOBT	User Off Block Time (prioritisation given by User)
UUP	Updated Airspace Use Plan
VALP	Validation Plan
VALR	Validation Report
VPA	Variable Profile Area
WOC	Wing Operations Centre
WP	Work Package
WX	Weather
WXXM	Weather Information Exchange Model
XML	Extensible Markup Language

2 Summary of Operational Concept from DOD

From the operational concept as developed in D11.1.1-2c this OSED will concentrate on limited number of OFAs:

- Business and Mission Trajectory (including Trajectory Management Framework)
- Free Routing
- Aeronautical Information Management (AIM) / METeorology
- Airspace Management and Advanced Flexible Use of Airspace
- User Driven Prioritization Process

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 D11.1.1-2c

Each OI 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 DOD D11.1.1-2c.

2.1.1 Business Trajectory (including Trajectory Management Framework)

Relevant OI Steps ref. (coming from the Integrated Roadmap)	Operational Focus Area name / identifier	Story Board Step	Master or Contributing (M or C)	Contribution to the OIs short description
AOM-0202-A — Automated Support for strategic, pre-tactical and tactical Civil-Military Coordination in Airspace Management (ASM).	OFA05.03.01 Airspace Management and AFUA	Step 1	C	Real time ASM data will dynamically change the boundary conditions that are used to plan a trajectory. Such information can offer opportunities to plan more efficient trajectories but also lead to an invalidation of an already planned trajectory that has been planned by the AU. The AU has to monitor all ASM data and assess whether it impacts the trajectory of a particular flight and initiate actions to plan a trajectory in accordance with the particular information.

Relevant OI Steps ref. (coming from the Integrated Roadmap)	Operational Focus Area name / identifier	Story Board Step	Master or Contributing (M or C)	Contribution to the OIs short description
AOM-0206-A: Flexible and modular ARES in accordance with the VPA design principle	OFA05.03.01 Airspace Management and AFUA	Step 1	C	This OI-Step will not change any process on AU side in principle. Anyhow the implementation of the VPA design principle might decrease the negative impact of any airspace closure caused by military airspace use as the blocked volume should be as minimal as possible. That might lead to more efficient trajectories in case of military airspace use.
AOM-0404: Optimised Route Network using Advanced RNP	OFA02.01.01 Optimised 2D/3D Routes	Step 1	C	An optimised route network that considers advanced RNP capabilities can lead to more efficient trajectories as the airspace can be facilitated much more efficient. But this also requires the consideration of the advanced RNP capabilities during the trajectory calculation. This especially includes the consideration of the aircraft RNP capabilities as well as the RNP options that are supported by the airspace in which the trajectory is planned.
AOM-0500: Direct Routing for flights both in cruise and vertically evolving for cross ACC borders and in high complexity environments.	OFA03.01.03 Free Routing	Step 1	C	The direct routing initiative will not change processes in the AU domain as this is already implemented and used on AU side.
AOM-0501: Free Routing for Flights both in cruise and vertically evolving within low to medium complexity environments	OFA03.01.03 Free Routing	Step 1	C	The free routing in general will offer the airspace user the possibility to plan more efficient and robust trajectories compared to any fixed route network system. Trajectories can now be planned in accordance with the AUs needs and capabilities. For the trajectory planning on AU side the airspace complexity does not matter. But the application of different approaches and requirements with regard to the free route planning options in different airspaces might increase the planning effort on AU side and reduce the efficiency of any trajectory.

Relevant OI Steps ref. (coming from the Integrated Roadmap)	Operational Focus Area name / identifier	Story Board Step	Master or Contributing (M or C)	Contribution to the OIs short description
AUO-0101-A: Enhanced ATFM Slot Swapping	OFA05.03.06 UDPP	Step 1	C	The ATFM slot swapping will influence the AUs' flight operations in two different ways. A slot swap – especially at the two airports relating to a flight, will have impact on the overall flight schedule of an AU. Besides that any swap of a slot is changing the boundary conditions of the trajectory calculation and might lead to the need of calculating a new trajectory. Hence the Enhanced ATFM slot swapping will directly impact the trajectory of any concerned flight.
AUO-0103: UDPP Departure	OFA05.03.06 UDPP	Step 1	C	This OI allows the AU to change the priority of its flights at the airport of departure. That will result in the application of a slot that might be earlier or later. However, this will not change the trajectory planning in general but might lead to more optimal slot times at an airport of departure and hence might have positive effect on the overall flight operations of an airspace user.
AUO-0108: Most Penalizing Delay based on reconciliation between DCB and Airport CDM	OFA05.03.06 UDPP	Step 1	C	The application of the most penalizing delay principle will not change the trajectory planning at all as the principle of considering slots (delayed or not) is already part of the trajectory planning on airspace user side. But this most penalizing delay principle will increase the transparency with regard to the root cause of a delay for the airspace user. The airspace user will now have the opportunity to more efficiently coop with any delay as a trajectory can now be planned to efficiently deal with the constraint situation instead of only considering a delay at the ADEP (via CTOT).

Relevant OI Steps ref. (coming from the Integrated Roadmap)	Operational Focus Area name / identifier	Story Board Step	Master or Contributing (M or C)	Contribution to the OIs short description
AUO-0203: EFPL in NM processes	OFA03.01.04 – Business and Mission Trajectory	Step 1	M	In accordance with ICAO recommendations and regulations the AU is obliged to file a valid flight plan to each impacted ANSPs. In Europe this is done via EUROCONTROL acting as Network Manager. The flight plan represents the trajectory as it is intended to be flown by the airspace user. As the airspace user has the most information available that has to be considered in the trajectory planning and as the AU is the entity conducting the flight, its trajectory has to be considered and respected by all ATM stakeholders that shall only check for compliance with all regulations and restrictions but should not change the trajectory without involving the flight plan originator, which is the airspace user. The flight plan filing is currently done with the ICAO flight plan which has been assessed has having many limitation with regard to the capability to exchange trajectory information in a 4D trajectory enabled environment. For that reason the EFPL has been developed with the purpose to extend the information that is given in the ICAO FPL. It will additionally include a 4D trajectory that reflects the trajectory planned by the AU best and can optionally include flight specific performance data that can be used by the ATM stakeholder in case that any trajectory prediction is required internally. The AU will with the implementation be able to more accurately inform the NM about the intended flight. The generation of the EFPL requires the use of a flight planning system (FOC system).

Relevant OI Steps ref. (coming from the Integrated Roadmap)	Operational Focus Area name / identifier	Story Board Step	Master or Contributing (M or C)	Contribution to the OIs short description
AUO-0205-A: ATC-ATC, ATC/Aircraft and ATC/NM Update and Revision of the Initial Reference Business/Mission Trajectory (iRBT/iRMT)	ENB03.01.01 – Trajectory Management Framework	Step 1	C	This OI-Step will only allow a minimal involvement of the AU in the iRBT revision process. The only direct involvement of the AU is organized via the flight crew, which might be forced – especially in case of medium- and long-haul flights – to request support from the FOC in a conventional way (e.g. via telex). The FOC will only be informed about the result of an iRBT revision process. In the worst case the FOC – after assessing the change – will inform the flight crew about any inability to comply with the revised iRBT and propose appropriate actions. In those cases the flight crew will be required to initiate actions to revise the iRBT again.
AUO-0223: Harmonised and improved integration of airspace and ATC constraints/procedures in trajectories calculated by FOCs and NM.	OFA03.01.04 Business and Mission Trajectory	Step 1	C	This OI-Step deals with the standardization and harmonization of ATC constraints and shall define how they will be published and shall be considered in a 4D trajectory. This will also include the consideration of restrictions that are not yet systematically considered during the trajectory planning, like LOAs and PTRs. Once all restrictions and their handling is standardized and harmonized the AUs will be able to more accurately plan trajectory that better reflect the trajectory as it will be flown with a very high certainty. This is a key element of the implementation of the RBT concept that is based on the use a single trajectory being reference throughout all involved ATM actors systems.

Relevant OI Steps ref. (coming from the Integrated Roadmap)	Operational Focus Area name / identifier	Story Board Step	Master or Contributing (M or C)	Contribution to the OIs short description
AUO-0224: Nominal Preferred Routes within iSBT	OFA03.01.04 – Business and Mission Trajectory	Step 1	M	This concept is not supported by the airspace users due to several reasons: - The systematic planning of trajectories in the medium term phase is not possible due to the low reliability of e.g. the meteorological forecast, - Would increase the effort on AU side (trajectories have to be planned much earlier as today/ statistically recorded etc.) without increasing the flight efficiency, - The provision of NPRs in the medium term phase, especially in free route environments and is regulated by dynamic constraints is not really possible as the number of trajectory options would be much higher compared to the ATS-route network with static /RAD)-restrictions that is used nowadays. From this perspective the AUs do not foresee any contribution for this OI-Step.
AUO-0225: Agreed iRBT to provide target time to ATM systems	OFA03.01.04 Business and Mission Trajectory	Step 1	C	The AU, as the flight plan originator, will provide the information included in the iSBT as well as in the iRBT and furthermore will trigger the transformation from iSBT to iRBT.The contribution of the FOC to this OI-Step ends with the provision of/ agreement on the iRBT and the start of the flight execution.

Relevant OI Steps ref. (coming from the Integrated Roadmap)	Operational Focus Area name / identifier	Story Board Step	Master or Contributing (M or C)	Contribution to the OIs short description
DCB-0103-A: Collaborative NOP for Step 1	OFA05.03.07 Network Operations Planning	Step1	C	The Network Operations Plan (NOP) is in fact a 4 dimensional real time virtual representation of the European ATM environment. It is a unique, dynamic; rolling picture (rather than a series of discrete daily plans) that provides a relational image of the state of the ATM environment for past, present and future. ATM stakeholders, via the appropriate applications, have visibility of the demand and capacity situation, the agreements reached, detailed business/mission trajectory information, resource planning information as well as access to simulation tools for scenario modelling. The NOP draws on the latest available information being shared in the system. It includes scenarios to assist in managing diverse events that may threaten the network in order to restore stability of operation as quickly as possible.
IS-0303-A: Downlink of on-board 4D trajectory data to enhance ATM ground system performance: initial and time based implementation	ENB03.01.01 TMF Trajectory Management Framework and System Interoperability with air and ground data sharing	Step1	C	Update of the ground system by the predicted trajectory computed on board, following a download on request (i4D includes the downlink of the arrival portion of the trajectory in Step 1). This will be supported on the airborne side by e.g. ADS-C EPP provided at AMAN horizon in the context of i4D operations.
AUO-0205-B: ATC-ATC, ATC/Aircraft and ATC/NM Update and Revision of the Reference Business/Mission Trajectory (RBT/RMT)	ENB03.01.01 – Trajectory Management Framework	Step 2	C	The AU will have the capabilities to trigger a revision of the RBT if it would like to fly another trajectory or can participate in the revision of the RBT in case it cannot be facilitated by the ATM stakeholders anymore. With SESAR Step 2 the AU has the opportunity to participate in an RBT revision throughout the whole lifecycle of the RBT.

Relevant OI Steps ref. (coming from the Integrated Roadmap)	Operational Focus Area name / identifier	Story Board Step	Master or Contributing (M or C)	Contribution to the OIs short description
AUO-0206: FOC Management of the Reference Business Trajectory	ENB03.01.01 – Trajectory Management Framework	Step 2	M	The FOC will manage the RBT throughout the whole lifecycle of it. This includes the RBT adherence monitoring as well as the evaluation of the impact of any change of the boundary conditions of a flight. It also includes the ability to support the flight crews throughout the whole flight execution and the participating in and starting of RBT revision processes. This also includes the planning of new trajectories in accordance with the current position of the aircraft as well as the assessment of the usability of any proposed trajectory) last but not lease it also includes triggering of the RBT..
AUO-0207: SBT including user preferences associated to meteo	OFA03.01.04 – Business and Mission Trajectory	Step 2	M	The FOC will plan trajectories under consideration of meteorological information. This is not a new concept but represents the state of the art. The trajectories will be provided to the NM for the purpose of negotiation with the target to get an agreement with all ANSPs that shall accommodate the trajectory. The information provided in the SBT and the procedures used to provide SBT will be in accordance with the provisions of FF-ICE.
AUO-0208: SBT including user preferences and trajectory information for DCB processes	OFA03.01.04 – Business and Mission Trajectory	Step 2	M	The trajectories planned by the FOC will be provided to the NM for the purpose demand and capacity balancing. This collaborative process will be implemented as iterative process that aims the negotiation of trajectories with all concerned ATM stakeholders. SWIM will link the FOC with all ATM stakeholders.
AUO-0209: FOC agreement on RBT	OFA03.01.04 – Business and Mission Trajectory	Step 2	M	After the trajectory has been negotiated through the iterative refinement of the SBT information the AU will trigger the switch from SBT and RBT.

Relevant OI Steps ref. (coming from the Integrated Roadmap)	Operational Focus Area name / identifier	Story Board Step	Master or Contributing (M or C)	Contribution to the OIs short description
AUO-0217: Constraint uncertainty assessment	OFA03.01.04 – Business and Mission Trajectory	Step 2	C	The FOC has to consider trajectories in accordance with all constraints. In this case the constraints are linked with a probabilistic dimension that expresses the likelihood that it is applied in execution or not. This will required new processes on AU side to take the impact of such type of restrictions into account.
AUO-0218: SBT including User preferences associated to meteo scenario and DCB scenario	OFA03.01.04 – Business and Mission Trajectory	Step 2	M	This OI-Step seems to have the same purpose as the OI-Steps AUO-0207 and AUO-0208. The same type of contribution as described for them would be required for this OI-Step.
AUO-0219: Use of all NOP information (DCB, ASM, weather), to compute optimal trajectory	OFA03.01.04 – Business and Mission Trajectory	Step 2	M	A key of the trajectory management concept is the agreement on the RBT used as single reference throughout all ATM actors. This requires an alignment and transparency with regard to the boundary conditions of a flight as DCB, ASM and weather conditions. This is facilitated through the NOP where all this information will be made available to the AU. The AUs will use this information to enrich the set of information that is used for the trajectory planning.

Relevant OI Steps ref. (coming from the Integrated Roadmap)	Operational Focus Area name / identifier	Story Board Step	Master or Contributing (M or C)	Contribution to the OIs short description
AUO-0221: Agreement on RBT (associated to tolerances)	OFA03.01.04 – Business and Mission Trajectory	Step 2	C	The RBT will be based on the trajectory as it is intended by the airspace user to be flown. All impacted ATM stakeholders will have to agree on facilitating this trajectory before it becomes the RBT. With this agreement of the RBT the ATM stakeholders might define the 4D tolerances in which the RBT remains valid. The bigger theses tolerances are this more robust is the trajectory against the influence of the change of environmental changes. The AU will have to assess the tolerances of the RBT and might initiate actions to revise the RBT if the tolerances are too tight to ensure a smooth flight operation.
AOM-0206-B Sharing real time airspace information with the aircraft	OFA05.03.01 Airspace Management and AFUA	Step 2	C	Sharing those data with the aircraft has only limited benefits as the aircraft has no trajectory planning functionality included. Hence this information must be exchanged with the FOC as it uses the information during the trajectory generation process. The exchange of this information with the FOC (despite the aircraft) is furthermore needed to have the same information in both systems.
AOM-0208-B: Dynamic Mobile Areas (DMA) of types 1 and 2	OFA05.03.01 Airspace Management and AFUA	Step 2	C	DMA 1 will only impact the trajectories and the flight planning if they are established and activated. The concept of DMA 1 includes the definition of several military areas at different locations of which only one area will be activated, in best case at an location where the negative impact onto the overall traffic flows is the lowest. The activated area – at a specific location – will be considered during the trajectory planning. Planned trajectories have to be in accordance with such activated DMA 1.

Relevant OI Steps ref. (coming from the Integrated Roadmap)	Operational Focus Area name / identifier	Story Board Step	Master or Contributing (M or C)	Contribution to the OIs short description
AOM-0505: Free Routing for Flights both in cruise and vertically evolving within high -complexity environments in Upper En Route airspace	OFA05.03.01 Airspace Management and AFUA	Step 2	C	The free routing in general will offer the airspace user the possibility to plan more efficient and robust trajectories compared to any fixed route network system. Trajectories can now be planned in accordance with the AUs needs and capabilities. For the trajectory planning on AU side the airspace complexity does not matter. But the application of different approaches and requirements with regard to the free route planning options in different airspaces might increase the planning effort on AU side and reduce the efficiency of any trajectory.
AOM-0506: Free Routing for Flights both in cruise and vertically evolving within high-complexity environments in Lower En Route airspace	OFA05.03.01 Airspace Management and AFUA	Step 2	C	The free routing in general will offer the airspace user the possibility to plan more efficient and robust trajectories compared to any fixed route network system. Trajectories can now be planned in accordance with the AUs needs and capabilities. For the trajectory planning on AU side the airspace complexity does not matter. But the application of different approaches and requirements with regard to the free route planning options in different airspaces might increase the planning effort on AU side and reduce the efficiency of any trajectory.
CM-0102-B: Automated Support for Dynamic Airspace Configuration	OFA05.03.03 Dynamic Airspace Configurations	Step 2	C	The location and configuration has direct effect on the BT. Hence it must be considered within the trajectory generation process. Due to the fact that this information is very dynamic the FOC must be able to automatically gather and consider relevant information in this regard.

Relevant OI Steps ref. (coming from the Integrated Roadmap)	Operational Focus Area name / identifier	Story Board Step	Master or Contributing (M or C)	Contribution to the OIs short description
CM-0103-B: Automated Support for Traffic Complexity Assessment adapted to trajectory based operations	OFA05.03.04 Enhanced ATFCM processes	Step 2	M	The FOC delivers SBT/ RBT data that are used as input for the complexity and workload assessment. For the resolution of hotspots/ complex situations the FOC might deliver trajectory information is part of an what-if/ CDM process. This can be done throughout the short term planning as well as during the flight execution phase. And might also include an earlier assessment of different ATM scenarios in the late medium term phase.
DCB-0103-B: Collaborative NOP for Step 2	OFA05.03.07 Network Operations Planning	Step 2	C	The NOP will be the focal point where trajectories will be feed in and –in the other way around – a main source for input parameter that influence the trajectory (constraints, airspace information etc.)
IS-0305: Automatic RBT Update through TMR	ENB03.01.01 Trajectory Management Framework	Step 2	C	The FOC will use the respective downlinked data to align the FOC BT with the flown BT with the goal to monitor the evolvement of the trajectory.

Table 1: List of relevant OIs within the OFA

2.1.2 Free Route

Relevant OI Steps ref. (coming from the Integrated Roadmap)	Operational Focus Area name / identifier	Story Board Step	Master or Contributing (M or C)	Contribution to the OIs short description
AOM-0500: Direct Routing for flights both in cruise and vertically evolving for cross ACC borders and in high complexity environments.	OFA03.01.03 Free Routing	Step 1	C	For the FOC no change to the previous operating method is resulting from this OI step. In case of the introduction of the “Direct Routing Airspace” concept, the associated information can be mapped to the DCT segments and, therefore, does not constitute a change in the operating method.
AOM-0501: Free Routing for Flights both in cruise and vertically evolving within low to medium complexity environments	OFA03.01.03 Free Routing	Step 1	C	Compared to previous Free Route implementations there will be not much difference. The major difference will be that the dimension of the Free Routing Airspaces will become larger, which enables more and more cross-border segments that could be used.

Relevant OI Steps ref. (coming from the Integrated Roadmap)	Operational Focus Area name / identifier	Story Board Step	Master or Contributing (M or C)	Contribution to the OIs short description
AOM-0505: Free Routing for Flights both in cruise and vertically evolving within high - complexity environments in Upper En Route airspace	OFA03.01.03 Free Routing	Step 2	C	Compared to AOM-0501, there will be no additional changes for the FOC for AOM-0505/0506, as the flight planning is performed for a single flight, not taking traffic and/or airspace complexity into account. The only exception would be, if completely new concepts for traffic regulation are introduced, which will need to be respected in the flight planning.
AOM-0506: Free Routing for Flights both in cruise and vertically evolving within high-complexity environments in Lower En Route airspace	OFA03.01.03 Free Routing	Step 2	C	

Table 2: List of relevant OIs within the Free Route OFA

2.1.3 Aeronautical Information Management / METeorology

Table 3: List of relevant OI Steps within the AIM/MET OFA lists the Operational Improvement steps within the associated Operational Focus Area addressed by the OSED, with reference to the Integrated Roadmap DS-16.

Relevant OI Steps ref. (coming from the Integrated Roadmap)	Operational Focus Area name / identifier	Story Board Step	Master or Contributing (M or C)	Contribution to the OIs short description
IS-0205 Digital Integrated Briefing for pre-flight phase	ENB02.01.02 AIM/MET	Step 1	M	AU's will be able to perform pre-flight briefing on electronic information devices using updated digital information (D-NOTAM/D-MET). Digital data allows enhanced sorting, filtering and graphical displaying of information.
IS-0206 Digital Integrated Briefing during flight execution phase	ENB02.01.02 AIM/MET	Step 2	M	Any update of the airspace status information is transmitted to flight crew via air-ground datalink (SWIM compliant) and displayed on their electronic information devices. The information contains digital data, allowing in-flight updates of AIS, MET and ATFM information.
IS-0901-A SWIM for Step1	ENB02.01.01 SWIM	Step 1	C	Digital data are provided via ground-ground connectivity between the source of D-NOTAM and AU's FOC. Furthermore, it allows connectivity between AU's FOC and aircraft electronic devices, while aircraft is on the ground.
IS-0901-B SWIM for Step2	ENB02.01.01 SWIM	Step 2	C	SWIM Step 2 allows air-ground information exchange. Any update of the airspace status information is transmitted to flight crew via air-ground datalink through common SWIM infrastructure.

Table 3: List of relevant OI Steps within the AIM/MET OFA

2.1.4 Airspace Management and Advanced Flexible Use of Airspace

Relevant OI Steps ref. (coming from the definition phase)	Operational Focus Area name	Story Board Step	Master or Contributing (M or C)	Contribution to the OIs short description
AOM-0202-A: Automated Support for strategic, pre-tactical and tactical Civil-Military Coordination in Airspace Management (ASM).	OFA05.03.01 Airspace Management and AFUA	1	C	The FOC must ensure that it can participate in the automated exchange of ASM (Airspace Management) data.
AOM-0206-A: Flexible and modular ARES in accordance with the VPA design principle	OFA05.03.01 Airspace Management and AFUA	1	C	Changes in the airspace status need to be known to the FOC and – if necessary – reacted to.
AOM 0204 Europe-Wide Shared Use of Military Training Areas	OFA05.03.01 Airspace Management and AFUA	2	C	The concept of sharing training areas shall provide more capacity to the Network. However it shall not impact military training objectives and mission effectiveness. Airborne and ground systems shall be connected through System Wide Information Management (SWIM) and interoperable for sharing the real time airspace status.

Relevant OI Steps ref. (coming from the definition phase)	Operational Focus Area name	Story Board Step	Master or Contributing (M or C)	Contribution to the OIs short description
AOM 0206-B Sharing real time airspace information with the aircraft	OFA05.03.01 Airspace Management and AFUA	2	M	This OI is the continuation of the Flexible Military Airspace Structures Operational Improvement (see AOM-0206-A). It expands the ASM shared situational awareness to include the flight crews (both civil and military). The status of the airspace structures (activated or deactivated) is uplinked and displayed in the aircraft, allowing a shared situational awareness of ASM related information between all ground stakeholders and flight crews. Furthermore, the trajectories will be amended if necessary due to changes in the airspace structures.
AOM-0208-B: Dynamic Mobile Areas (DMA) of types 1 and 2	OFA05.03.01 Airspace Management and AFUA	2	C	Dynamic Mobile Areas (DMA) provide even more flexibility and available airspace for civil airspace users since they can be adapted to a high degree to the different performance objectives. Incorpation of the DMA information in the flight planning will be assessed based on a what-if assessment.

Table 4: List of relevant Operational Focus Areas with linked OI Steps and X.02

Due to the fact that DOD D11.1.1-2c does not contain Use Cases we cannot create a reference here

Scenario identification	Use Case Identification	Reference to DOD section where it is described
N/A		

Table 5: List of relevant DOD Scenarios and Use Cases

Due to the fact that DOD D11.1.1-2c does not specifically outline the environment we cannot create a reference here

Operational Environment	Class of environment	Reference to DOD section where it is described
N/A		

Table 6: List of relevant DOD Environments

Due to the fact that DOD D11.1.1-2c does not specifically outline processes and services we cannot create a reference here

DOD Process / Service Title	Process/ Service identification	Process/ Service short description	Reference to DOD section where it is described
N/A			

Table 7: List of the relevant DOD Processes and Services

The full traceability to the DOD requirements cannot be guaranteed below.

DOD Requirement Identification	DOD requirement title	Reference to DOD section where it is described
REQ-11.01.01-DOD-D001.0001	Sharing of user preferred route information	5.1
REQ-11.01.01-DOD-D001.0002	4D trajectory synchronisation	5.2
REQ-11.01.01-DOD-D001.0003, REQ-11.01.01-DOD-D001.0004	Exchange of Extended flight plan data, XML format for extended FPL	5.2
REQ-11.01.01-DOD-D001.0005	Higher FPL flexibility	5.2
REQ-11.01.01-DOD-D001.0006, REQ-11.01.01-DOD-D001.0007, REQ-11.01.01-DOD-D001.0008	ATM constraints consideration, ATM constraints update, ATM constraints automatic processing	5.3
REQ-11.01.01-DOD-D001.0009	Network demand and capacity information for flight planning	5.3
REQ-11.01.01-DOD-D001.0013, REQ-11.01.01-DOD-D001.0014	Aircraft position update of FOC systems, Off-block, on-block, take-off and landing time information	5.5

Table 8: List of the relevant DOD Requirements

2.1.5 User Driven Prioritization Process

Relevant OI Steps ref. (coming from the Integrated Roadmap)	Operational Focus Area name / identifier	Story Board Step	Master or Contributing (M or C)	Contribution to the OIs short description
AUO-104 Selective Flight Protection (SFP) AUO-105 Fleet Delay Assignment (FDA) Additional Reference as used in the UDPP step2V2 OSED, but superseded (AUO-0102 UDPP)	OFA05.03.06 UDPP	Step 2	C	In case of delays in the planning phase and in execution for flights in the scope of dDCB, Airspace Users can recommend to the network management function and appropriate airport authorities, a priority order request for flights affected by delays on departure, arrival and en route. Changes in the priority order request could be introduced at the request of Airspace Users, the network management function and the relevant airport authority. This process is supported by an Operational Cost Model implemented at the FOC to assist Airspace Users to identify the best candidates for prioritization in the UDPP process In order to validate this operational change, initial business rules for the communication and negotiation between AUs and appropriate Airport authorities have been developed. Further development of the business rules including network management function will be required to fully elaborate the UDPP Principles and Rules and the mechanism for flight prioritisation and consequent negotiation between all stakeholders concerned.

2.2 Operational Concept Description

The following section describes in simple terms and plain language the Operational Concept elements that are elaborated in detail in this document. It covers all 4 ATM planning phases as described in SESAR ConOps:

2.2.1 Business Trajectory (including *Trajectory Management Framework)*

In scope of FOC are functionalities that are used to create the Business Trajectory considering internal and external input parameter. Internal input parameter are related to elements the AU has the capability to influence to a certain degree, as aircraft type, aircraft payload, business rules etc. External input parameters are things influencing the trajectory from outside, as weather data, constraints, airspace information etc. The AU has not the capabilities to influence all those external input parameters.

The FOC is gathering all these input parameter, generates the optimum trajectory matching with these parameters, prepares the briefing information needed to inform the FCs in a way that they are able to safely execute the intended flight and files the flight plan to the ATC authorities. For that reason the generation of a flight trajectory is purely a FOC[1] functionality.

This main principle will remain within SESAR, but will be extended and enriched by the new concepts that are introduced with SESAR Step 1 and Step 2.

Step 1 Operational Concept

In Step 1 the collaborative NOP will be implemented that will be the single interface of the airspace users with the ATM stakeholders (DCB-0103-A). The NOP will provide the AUs with up-to-date information on the network situation as well as available information provided by the airports. The FOC will use this information to enrich the information used for the trajectory planning. This will already lead to a more accurate and dynamic planning of trajectories. The trajectories will be fed back to the NOP in the EFPL format. The data in the EFPL will be used by the NM internally as it describes the trajectory planned by the AU with much more details and will lead to better flight plan validation results and better traffic predictions that might lead to a more optimal facilitation of the airspace (AUO-0203). All constraints that have to be considered will be available in the NOP in a harmonized and standardized way. That will allow to better coping with any constraint during the trajectory planning and will allow the planning of trajectories as close as possible to the trajectory that will be flown in the end (AUO-0223).

The civil-military use of the airspace will become more dynamic with SESAR Step 1. The AU will be provided with real-time ASM data that might lead to opportunities to find a more efficient trajectory, respectively might invalidate a trajectory that has formally been accepted by NM (AOM-0202-A). The negative impact of military airspace use will be reduced by the implementation of modular ARES in accordance with the VPA design principle that would allow military airspace user to only activate those parts of a military airspace that is necessary to accomplish a mission (AOM-0206-A). This minimization of negative impact onto the flight operations of an AU might increase the flight cost efficiency compared to the previous operating method.

Trajectories can be planned on more optimized route networks that are taking benefits of modern navigation capabilities of the aircraft (AOM-0404) through the use of advanced RNP procedures. The route networks will be based on published direct segments that are planned like conventional ATS routes (AOM-0500) or on routes networks that can be defined by the AU itself, called free routing network (AOM-0501). The implementation of free route will in SESAR Step 1 only be done in low to medium complexity airspaces. That will increase the planning effort for a trajectory on AU side as this will lead to versatile requirements with regard to a planned trajectory depending on the airspaces that are passed by the trajectory. Otherwise the implementation of direct route and free route airspaces might increase the flight cost efficiency on AU side if more optimal trajectories can be planned. Instead of getting a CTOT only that indicates that the departure slot has been delayed or fixed by NM more transparency will be given with regard to any penalizing delay that is to be applied onto a trajectory.

With SESAR Step 1 the most penalizing constraint principle will be implemented. With this concept the AU will only get the most penalizing delay including the information to which point of the trajectory this delay relates too (AUO-0108). The AU will have several possibilities to cope with such penalizing delay, which is obviously a most penalizing constraint. On the one hand the AU can plan another trajectory under consideration of such 4D constraint or can try to influence the application of such 4D constraint using the user driven prioritization process. Is the delay caused at the airport of departure the AU will be allowed to change the priority of flights. This can help to avoid or reduce the extent of a delay on a flight or lead to a swap if a slot from one flight to another (AUO-0103). For other delays the

[1] The functionality itself is related to the scope of an FOC and therefore related to the AU. Despite that such functionality might be implemented in other systems providing those FC or AU supporting these functionalities to AU, e.g. 3rd party service provider, NM, ATC etc.

AU can try to swap slots with other flight to avoid or reduce the extent of the delay (AUO-0101-A).The respective processes and procedures can be found in the respective chapters dealing with UDPP.

UDPP will be used to reduce the negative impact of constraints onto the flight operations. However at the end of the process 4D constraints will be established by the NM, the airport or any ANSPs that have to be considered during the trajectory planning. In the other way around every constraint might lead to less flight cost efficient trajectories. Therefore the flight costs of every calculated trajectory have to be considered in the context of UDPP for being able to really evaluate the impact of a constraint and to find appropriate actions to minimize this negative impact onto the overall flight operations.

These processes already suggest that with SESAR Step 1 the trajectories will be collaboratively planned and agreed. But the trajectory management will still not be trajectory based, but time based. Therefore the concept of the iterative planning of trajectory will only initially implement. The trajectory will be provided in the planning phase as iSBT which will be in accordance with FF-ICE (AUO-0224). Once a trajectory has been found that the AU wants to fly and the ATM stakeholder agree to facilitate the AU will trigger the switch from the iSBT to the iRBT. With this trigger the NM will provide the target time windows that relate to the trajectory as planned by the AU (AUO-0225). The target time window will inform the AU about the robustness of the trajectory with regard to any deviation from it. The AU can now check whether the iRBT is robust enough for him to ensure a smooth flight operation. In case they are too tight the AU might plan another trajectory and revise the iRBT. During the flight execution the FOC is not fully involved in any iRBT revision but is informed about any iRBT revisions (AUO-0205-A) performed between the ATM stakeholders and the flight crew. Deviations from the iRBT can always be detected as the aircraft will regularly downlink the 4D trajectory data that can be compared with the iRBT (IS-0303-A) Based on such information the FOC can already assess the situation to best support the flight crew whenever a revision of the iRBT might be required.

Step 2 Operational Concept

SESAR Step 2 will introduce the trajectory based operations. As a consequence thereof the SBT as well as the RBT and related processes to fully manage them throughout all phases will be implemented and offer the airspace user more opportunities to optimize their trajectories whenever required and desired.

The planning of trajectories can be done in an iterative way. For that reason the SBT will be implemented to its maximal extent. This also includes the alignment of meteorological information (AUO-0207) that is used to plan the trajectory published as SBT. The airspace user will plan trajectories in accordance to its needs and under consideration of external requirements and conditions as generally shared among all ATM actors (AUO-0219) through the NOP (DCB-0103-B). Flow constraints that have to be considered while planning a trajectory will – as far as possible – not be static but the result of demand and capacity balancing. That means that the NM will use the SBT provided by the airspace user to check whether it can be facilitated as it is or whether further flow constraints have to be provided as a consequence of any traffic flow regulation (AUO- 0208).

Besides the planning of the SBT, NM will offer possibilities for collaborative decision making. This will include what-if assessment processes that will allow to define DCB scenarios that fit best to the present network situation. That will also allow the airspace user to find the most optimal scenario that best supports flight cost efficiency. For that reason NM will provide uncertainties of certain constraints (AUO-0217). They can be used to define different DCB scenarios that can be used by all ATM actors to assess which DCB scenario is the best trade-off between flight cost efficiency for the airspace user and ATM efficiency ((AUO-0218). This will allow the airspace user to express which trajectories facilitate their business targets in the best way. NM will in this case make the assessment to ensure that those trajectories can be facilitated in the network. To ensure the airspace is used in an optimal way on the one hand and that the airspace users can fly trajectories that support their business goals as best as possible on the other side, several structural improvements will be implemented with SESAR Step 2.

This will include the implementation of Free Route in high complexity airspaces in the upper and lower flight level ranges (AOM-0505; AOM-0506). This will allow airspace users to plan trajectories that are fully complying with their needs and capabilities. Even the civil-military use of the airspace will become more dynamic and will allow the negotiation between civil and military airspace users wherever this is possible. As an example the principle of dynamic mobile areas (DMA) will be implemented (AOM-0208-B) that might allow the airspace users to plan more optimal trajectories that have not to be planned around military airspaces that are closed for civil air traffic. On the one hand the element called DMA Type 1 will be introduced where different locations for a military area are assessed and the location the impacts civil traffic flows in the lowest way will be selected. On the other hand the DMA type 2 will be implemented where complete corridors are blocked by military airspace user but only these parts of the corridor where a mission is done. Such closures will only last as long as the respective mission is done. This will help to limit the times and volumes that are blocked by military airspace users and can help to reduce the negative impact on flight cost efficiency of civil airspace users. Besides this airspace status information will be shared in real time (AOM-0206-B). That means that always the current status of an airspace volume is known. If, for example a military mission is finished earlier as expected and it is possible to release the airspace earlier, this will directly be done and the respective information shared through the NOP. In those situations the airspace user can try to make use of such airspace release and try to plan a more efficient trajectory. This trajectory can be published as new SBT or – if the RBT has already been triggered – lead to a revision of the RBT.

The RBT will be triggered by the airspace user. The RBT will be a 4D trajectory that completely represents the 4D trajectory as it is intended to be flown by the AU. The implementation of an RBT will be a contract between the airspace user and the ATM stakeholders. The agreement will be based on the following statement: “The RBT is the trajectory the airspace user agrees to fly and the ANSPs and airports agree to facilitate”. As long as the boundary conditions do not change all involved parties are working on the execution of this RBT. Once the switch from SBT to RBT has been triggered NM provides (on behalf of the ANSPs and airports) in the agreement to the RBT the 4D tolerances of the trajectory (AUO-0221). This will offer the airspace user to assess whether the tolerances are too tight to ensure a smooth operations or whether the RBT can be flown as it was agreed (AUO-0209).

The RBT will – after the agreement – be used as reference by all impacted ATM actors. But this RBT is not carved in stone. If there is a need to change the trajectory an RBT revision process can be triggered by any of stakeholders that are part of the agreement. An RBT revision process will always have the target to get an agreement again among all impacted parties. That means the “status” “Trajectory that the airspace user agrees to fly and all ANSPs and airports agree to facilitate” has always be reached again to ensure the stability of the network and flight efficiency. An RBT revision process will be done in three cases (AUO-0205-B).

The first two cases relate to the cleared trajectory[2] itself. In case that a new constraint would prevent any of the ANSPs or airports to facilitate the trajectory a revision of the RBT will be triggered. In case that the release of any type of constraint (or any other changing boundary condition) allows the planning of another trajectory an RBT revision process might be triggered. This case relates to the use of opportunities to increase the flight efficiency. Those cases can in almost all cases only be triggered by the airspace user itself or more concrete by the FOC as they have the complete overview about the airspace user flight operations (AUO-0206).

The third reason requiring an RBT revision is related to the aircraft itself and the question whether it is flying in accordance with the cleared trajectory. For that reason the aircraft will regularly downlink information about its location and with regard to the predicted future flight path (IS-0305). This data will be compared with the reference trajectory and its 4D tolerances. If the aircraft is not flying in accordance with the cleared trajectory an RBT revision will be triggered and appropriate actions will be started to ensure that the aircraft is again following a trajectory that the airspace user agrees to fly and the ANSPs and airports agree to facilitate. An RBT adherence monitoring can be part of the FOC, depending on the complexity of the airspace user flight operations. In the simplest case the flight crew will solely monitor the adherence to the cleared trajectory by following their OFP. The minimum here is that block time adherence is also monitored by the FOC. But the more complex the flight operation becomes (e.g. due to the flight schedule complexity; the airspace complexity or the length of the flight) the more involved the FOC will be. In those cases the flight deck and the FOC will act as direct partners that try to operate the flight as efficient as possible. This will be achieved by a complete

[2] It has to be noted that the design of the RBT as dataset as described in the T-ConOps needs further refinement as it is confusing and besides that not in accordance with the definition of the Reference Business/ Mission Trajectory in the T-ConOps.

linkage of the FOC with all ATM stakeholders and the flight crews via the NOP and via SWIM. This will offer new opportunities of collaborative decision making as well as optimize the flight operations.

2.2.2 Free Route

Free routing is one of the core concepts of SESAR and probably the single most important improvement for airspace users. In SESAR Free Route covers two subconcepts, namely Direct Routing (AOM-0500) and Free Routing (AOM-0501, AOM-0505, AOM-0506).

In SESAR Step 1, in high complexity environments Direct Routing (AOM-0500) is available, whereas Free Routing is available in low/medium complexity environments (AOM-0501). It is to note that both, Direct Routing and Free Routing are also available today, albeit at a smaller, local scale. However, the concepts, which will be explained below, do not differ much conceptually.

Direct Routing means that in addition to the ATS Route Network additional DCT segments are made available, including such that allow cross-border operations. It is also an option to completely remove the ATS Route Network, in which case a Direct Routing Airspace (DRA) is introduced mandatorily (without removal of the ATS Route Network it is optional to introduce a DRA). The usage of the DCT segments might be subject to conditions (like minimum/maximum flight level), which need to be respected in flight planning. The actual benefit that can be achieved by the airspace user is very much dependent on the number and the location of DCT segments introduced in addition to or in replacement of the ATS Route Network.

Free Routing means that the airspace user can plan its trajectory without reference to the ATS Route Network (which can be either maintained or abandoned). By eliminating the need to plan via a fixed route structure, airspace users gain the freedom to route their flights in the most efficient way with the least environmental impact. The geographical area where Free Routing is allowed is given by the Free Routing Airspace (FRA), which also indicates the minimum (and possibly maximum) flight level for Free Route trajectories. For trajectory planning, depending on the implementation, only published point or also user-defined lat/lon points can be used, that can be connected by DCT segments. The usage of published points can be limited by designating points as entry/exit points (for horizontal entry out of / entry into the FRA), arrival/departure points (for vertical entry/exit) or intermediate points (or any combination thereof). In some countries (e.g. Sweden), there are no specific arrival/departure points defined but – due to the low minimum level of the FRA – the Free Route part of the trajectory can start after overflying the last point of predefined departure route. The procedure for arrivals is analogue in the reverse order. The DCT segments between two waypoints can be limited by a minimum and/or maximum segment length. As the restrictions can no longer be attached to the airway segments, new kinds of restrictions (like volume-based restrictions) are needed for traffic management that needs to be respected in flight planning. However, it is important for the airspace user that these restrictions should be as much as needed but as few as possible in order to be able to realize the benefits that can be expected from the Free Route concept. As stated above, the main benefit is an increase of flight efficiency (cost, fuel) due to the more flexible routing options.

In both, the Direct Routing environment and the Free Routing environment the aircraft is subject to air traffic control (in contrast to the Free Flight concept).

In SESAR Step 2, Free Routing is extended to high complexity environments, both in upper airspace (AOM-0505) and lower airspace (AOM-0506). For the airspace user this means that it can expect to be able to plan Free Route trajectories on an ECAC-wide scale. For maximum benefits, it is important that the introduction of the Free Routing Airspaces happens in a synchronized and standardized way, allowing cross-border operations. Except for the fact that with the introduction of Free Route in high complexity environments the airspace user can expect to achieve even higher benefits in terms of flight efficiency, there will be no or only little change in the operating method (for details see section 3.2.2).

2.2.3 Aeronautical Information Management (AIM) / METeorology

Aeronautical and Meteorological Information Management is one of the areas where there are expected new concepts developed within SESAR projects based on newly developed COTS technologies with important role of FOC. One of these new concepts is based on displaying and sharing of Aeronautical and Meteorological Information to all concerned stakeholders.

One of the expected achievements of SESAR concept is to improve the quality and the usability of the aeronautical and meteorological information presented to the Flight Crews, flight dispatchers and air traffic controllers for all phases of flight, through the use of digital aeronautical and MET information.

The core objective of this concept is to provide to Flight Crews and dispatchers the updated and relevant Aeronautical and Meteorological Information in user friendly form for all relevant/non-critical phases of flight (including on ground before the flight), provided with in-flight updates, using on-board information systems.

By providing the flight crews with new cockpit functions using digital information (e.g.: : D-NOTAM, D-METAR, D-TAF, …) uplinked on board of aircraft, their performance will be improved thanks to usage of actualized flight decision support tools and on-board systems.

AIS & MET information is inseparable part of flight crew briefing before each flight, due to the fact that the environment in which air transport is operated is a subject of instant changes. Flight crew has to monitor both short and long term information to manage potential diversions and to react rapidly to the changes.

The current access to NOTAM information is limited to on-ground systems and soon after airborne the information may become obsolete. To acquire recent and up-dated information a communication via voice or text messages with ATC or FOC via radio or datalink respectively is required, thus increasing crew workload. With development and future implementation of SWIM, Flight Crews will have access to more information, enabling more efficient operations. However, there is a risk that the Flight Crews will be overloaded by too much information. This is particularly important for Business and General Aviation Flight Crews, who don´t receive the support of dispatchers (FOC ground support) to filter the information. The requirements described in this document aim at enabling a more efficient access to the information for Business and General Aviation Flight Crews.

This new AIM & MET concept is based on providing updated information to flight crew before and during the flight. To achieve main goal of this concept is expecting uplink of digital information on board of aircraft before and during the flight, to enhance performance of AU´s flight crews. Additionally, the pre-flight briefing is simplified, taking into account the ability of the pilots to later access the information in the aircraft.

Concept architecture is described in the Figure 2: AIM/MET display on board concept architecture. AIM data are shared via G/G SWIM between AIM data provider and FOC system through data server. In application server are the AIM data merged with flight plan data and filtered. A/G data link is used for sharing updated AIM data for particular flight with the aircraft. Updated AIM data are displayed to the crew using electronic information devices.

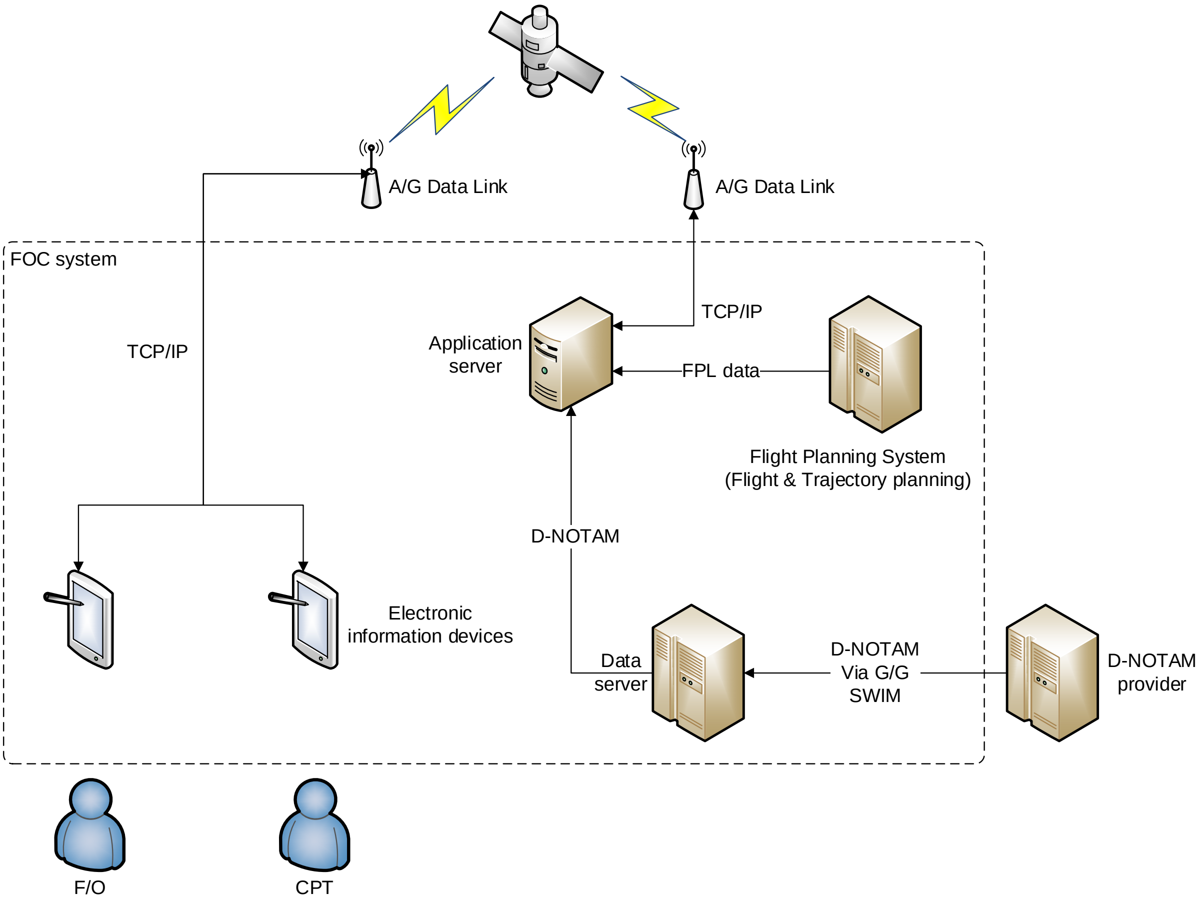


Figure 2: AIM/MET display on board concept architecture

2.2.4 Airspace Management and Advanced Flexible Use of Airspace

Today the airspace has to be shared between two major airspace users - civil and military. Both airspace users are using different business models: civil aviation, operating private Government-owned and commercial aircraft, is primarily focused on world-wide cargo and passenger transportation whereas military aviation, operating State-owned aircraft, reserve airspace for transport, training and defense purposes. Since some military activities will not allow a joint use of airspace between civil and military users, temporarily segregation of airspace is required. Managing limited airspace thus considering both civil and military requirements while ensuring overall safety is the main challenge, which has to be met and comprised in AFUA. Above all, the AFUA concept shall consider and support one of the main objectives of civil airspace users – to meet their planned times of departure and arrivals, to the extent possible, and adhere to their preferred trajectories with minimum constraints. For specific missions, fixed airspace structure remains, including ATS Route, CDR and ARES. In Step 1, the main role of the FOC will be to receive (via B2B) airspace management data automatically and to process this information in the FOC system. This information is used for efficient trajectory planning and to adapt affected trajectories accordingly (both in the planning phase and – using the real time status of airspace – in the execution phase). In case proposed trajectories have been sent by the NMOC, the Airspace User will analyse the proposed trajectories, compare them with trajectories calculated with the FOC system and decide which proposed trajectory matches best considering own business needs and network constraints. Furthermore, in Step 1 a new airspace design principle, Variable Profile Area (VPA), is introduced, based on flexible allocation and management of small fixed predefined modules of airspace The ARES VPA modules are designed to enable multiple airspace allocation solutions suiting best for various mission profiles and facilitate a more efficient allocation of airspace. The VPA modules are requested by the Military Airspace User and negotiated with the Airspace Managers through a CDM process. The best possible ARES configuration is allocated to accommodate both mission requirements and air traffic flow demand. The modular adaption to the operational needs releases more available airspace to the Airspace Users.

The negotiation process between Civil and Military Airspace Users is facilitated. Collaborative Airspace Planning for Cross Border Operations and common situational awareness of data sharing through NOP provide more flexibility to the Stakeholders. The philosophy of CDM enables information-sharing and facilitates decision-making processes by ensuring that all stakeholders are provided with real-time and accurate information essential for planning of their operation.

In the context of SESAR Step 2, the shared use of military training areas will be deployed Europe wide, enabling further benefits for the airspace user. In Step 2, in which the evolution to trajectory management takes place and Free Routing is implemented on a larger scale, there will still be the need for military and civil airspace users to reserve parts of the airspace due to operational reasons. In consequence and to assure safe flight operation for all airspaces users, some trajectories will not be available for flight planning during the airspace reservations. Although mainly military airspace users are involved in airspace reservation to perform military activities in a safe way with lowest possible impact for all other airspace users, it might be also applicable for civil airspace users to reserve some parts of the airspace to enable special flight operation (e.g. check flights). These trajectories will be replaced by ARES (VPA design principle), which ensure, due to their modular composition, high flexibility adapted to the actual needs of the airspace users who have reserved this airspace, and in consequence, more available airspace for other airspace users. The VPA design principle will be extended to Cross Border Area (CBA) and Cross Border Operation (CBO). Dynamic Mobile Areas (DMA) provides even more flexibility and available airspace for civil airspace users since they can be adapted to a high degree to the different performance objectives.

Enhanced situational awareness is an important factor to ensure effective cooperation between all stakeholders. In this context it is essential to provide the FOC constantly with the real time airspace status, to allow in case of changes a fast adaption of affected trajectories under consideration of safety and economical aspects. Also in step 2, the situational awareness in the execution phase is also shared with the flight crew, as the real time airspace information is now also sent to the aircraft and displayed there.

2.2.5 User Driven Prioritization Process

The elaboration of this concept has been done in close coordination of validation exercise EXE-07.06.02-VP-730, recently completed. Detailed information about the full UDPP concept, including requirements for further evaluation and concept development, can be found in the “07.06.02 Final FOC Step 1 and Step 2, as available, OSED” document. To avoid duplication and confusion for readers it has been agreed that the focus of the process description in the WP 11.1 OSED will be limited to the cost analysis part.

AUs do not rationalise their preferred prioritisation based on delay; **the decisions to re-distribute delay are made on basis of consequences on operations and costs.**

From 11.1 overall strategies, UDPP will help to provide AU’s more flexibility in a Capacity Constrained Situation (CCS) by allowing the AUs to adjust their departure, en-route, and arrival schedule to minimize the cost impact of delays imposed as a consequence of the CCS. In order to minimize cost impact during the planning and execution phase an operational cost model has been designed and developed by SABRE Airline solutions as part of the WP11.01 contribution taking all operational relevant factors (e.g.: schedule integrity, passenger connection and welfare, crew rotation, maintenance…..) into account and converting those factors into an AU specific delay cost curve for every individual flight. Based on the delay cost indicated in the FOC, AUs can define and communicate preferences and priorities following the UDPP rules and principles described in the 07.06.02 UDPP OSED document.

To validate the concept and to support the exercise VP730 the cost model was limited using fixed data for a single day for the following factors:

- Passenger misconnect
- Passenger welfare based on EU261
- Missed planned maintenance events
- Night curfew

2.3 Processes and Services (P&S)

2.3.1 Business Trajectory (including Trajectory Management Framework)

With SESAR the development of the business trajectory shall follow an iterative process based on collaborative decision making principles. For that reason the term shared business trajectory has been introduced. While in step 1 of SESAR an initial implementation is foreseen (iSBT) in SESAR step 2 the SBT shall be implemented as single entity including flight information that is steadily refined until the day of flight. If the SBT is mature enough – what means that the AU would agree to fly it while the ANSPs and airports would agree to facilitate it- this SBT will be fixed and agreed among all stakeholders what will make it the reference business trajectory (RBT) of a flight. Now the AU agrees to fly this trajectory and all concerned ANSPs and airports agree to facilitate it. Hence this agreement is already a clearance of this trajectory from ADEP to ADES. The network manager will closely collaborate with the airspace users during planning of the SBT and requests a steady update of information that is included in the SBT (see 07.06.02 OSED Step 2 [20]). EUROCONTROL distinguishes in its document into SBT – Flight Intentions and SBT – Trajectories. This means that NM expects that the airspace user provides flight intention data, like the city pair and schedule data of a flight in an early stage (months in advance) and trajectory data close to the day of operations.

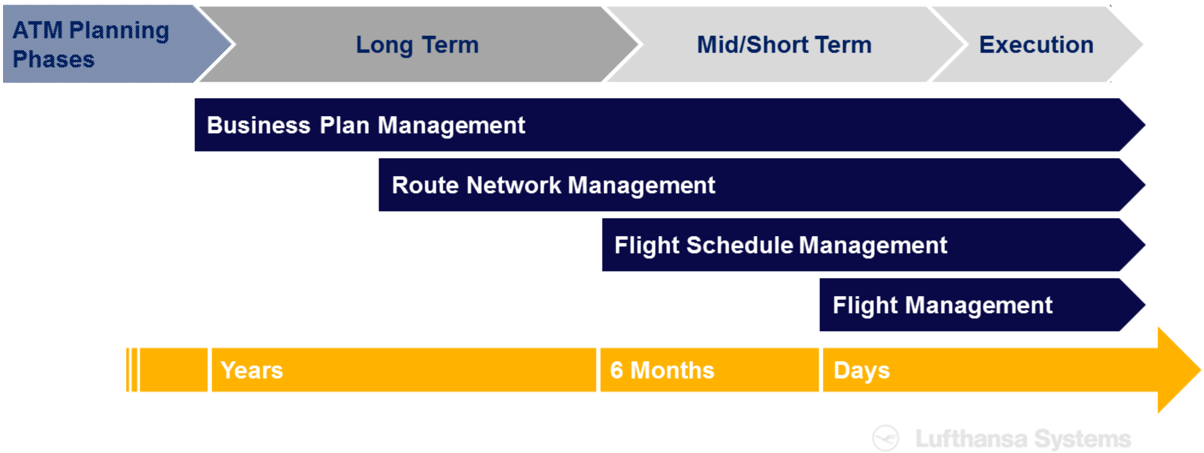


Figure 3 Airspace user activities throughout the ATM planning phases

Figure 3 shows which activities are performed by an airspace user throughout the respective ATM planning phases. It also shows on which data any information (with regard to a flight) can be expected by the NM or any other ATM stakeholder. In the long term planning phase airspace user are starting with the definition of business targets with the purpose to develop a business plan. This business plan is defining the targets that shall be achieved by the airspace user. Based on this business plan the route network is worked out. It includes potential region connections in the beginning and will be refined until it includes a schedule including city pairs and potential block times. During the long term phase the NM could only expect information from these two sources. But most of this information is still immature or confidential and will not be published by the AU. Six months before the day of flight the flight schedule is started to be worked out. In the beginning of this phase – the medium term phase – the AU will start to negotiate airport slots with concerned airports. Hence the airspace user can only provide airport connections, preferred slot times and a frequency of flight. This information – if provided to the NM – could be referred to as SBT Flight Intention data. During this time the airspace user is still not planning individual flights. Therefore the provision of routings or trajectories cannot be expected in this phase. The planning of individual flights might start a few days prior to the day of flight. The planning of individual flights might start with the concrete planning of flight concerned data as flight crew, aircraft etc. and will go to the planning of individual trajectories. In a static environment – as pre-Step 1- the planning of the trajectory is started a few hours prior to departure. With SESAR and the implementation of the iterative planning of the trajectories it could be expected that the trajectory planning might start 2 or 3 days prior to the departure[3].

The description above describes activities of the airspace user in principle. The times that have been used refer to a scheduled airline that requires the early planning of a flight schedule etc. While of other types of airspace user these activities are also performed, the complexity of their operations might allow performing all of these activities on the last few days prior to the departure. That means that the time windows may vary from one type of airspace user to another.

However airspace user can start to systematically exchange information when they start to work on flight schedules and when they start to work on flight planning. Consequently only the medium/ short term and the execution phases are in scope of this document. Therefore the following processes are only describing the tasks performed in these phases in the context of Business Trajectory (including Trajectory Management Framework).

2.3.1.1 Generation and Sharing of Flight Intent Data Process PCS11.01.02-D08-0001.0010

Based on the definition of the flight schedule the airspace user could provide first input to the ATM stakeholders for demand capacity balancing/ assessment. This data will not include trajectory data but will inform the ATM stakeholders about intended flights and when they are intended to be operated. This data will be published to the NOP and will be treated as SBT information.

This information will include

- Airport of Departure (ADEP)
- Airport of Destination (ADES)
- Date of Flight (DOF)
- Scheduled Time of Departure (STD)
- Aircraft Type (A/C Type) (*optional?*)

This generation and sharing of SBT flight intent data is a process that is steadily performed. The sharing includes the initial sharing of data as well as the update of data that has already been published to the NOP.

2.3.1.2 Generation of Business Trajectory Process PCS11.01.02-D08-0001.0020

The processes used to generate the business trajectory are already implemented within the flight planning systems. These processes will not change in principle, but the data used as input data (especially the planning constraints) will become more dynamic and tailored to a flight. Consequently the generation of a BT will become more iteratively, embedded in a negotiation process with all other ATM stakeholders as NM, ATC and AP.

Hence to trigger (or a combination of these) will be available to start this process:

1. A new BT is planned as the boundary conditions of a flight have changed. This includes two sub-classes of cases:
    a. A change of any of the flight planning boundary conditions is suspending the current BT and requires a new BT;

[3] It has to be noted that some operational figures, like payload, are still not concrete enough to deliver a stable 4D trajectory that will be flown on the day of operations. This aspect has to be analyzed in SESAR 2020 to define the limits of an early trajectory delivery.

b. A change of any of the flight planning boundary conditions offers the opportunity to plan a more optimal BT.

A new BT is planned to address a deviation of the aircraft from the RBT. This process universally used in the Medium/ Short Term Planning as well as in the Execution Phase. As mentioned above the Trajectory Generation Process will not change in SESAR Step 2. It is more the dynamic of the Business Development Scenario that is the change in this process, what means that the Trajectory Generation Process might be perform much more frequently than in the former operations. Furthermore the trigger, leading to the processing of the 'Generation of Business Trajectory – Process', have to be defined very carefully to avoid that the frequency of using this process will decrease the efficiency of the Trajectory Management.

2.3.1.3 Sharing of the Business Trajectory Process PCS11.01.02-D08-0001.0030

If the FOC has generated a BT it might be published to the NOP. With the sharing of the BT the BT will get the status SBT. The sharing of the BT will include the provision of the trajectory to NM (the NOP) and an assessment of the SBT by the NM what will result in an NM reply message. This message will indicate whether the BT can be accepted by NM or not. The sharing of the BT can be done in the ICAO FPL format as well as in the EFPL format that has been developed. This EFPL will be integrated into the ICAO FF-ICE standard to achieve global standardization. The BT will be translated into a flight plan format including the following data:

- The flight plan in the ICAO Flight Plan Format
- The 4D trajectory
- Flight Performance Data (optional)

This data will be transmitted in the EFPL format and will be published as SBT. After the BT has been published and noticed as SBT the 'Sharing of Business Trajectory – Process' will await a reply from the NOP. This reply will include:

- An *'Accept'* indicating that the SBT has been accepted by the ATM world,
- A *'Manual'* indicating that the SBT is still under internal negotiation,
- A *'Reject'* connected with respective 'Reject Reasons'[4] indicating that the SBT can't be facilitated by ATM network.

The sharing of business trajectory process is used for initial SBT trajectory publication as well as for any SBT trajectory update in the NOP.

2.3.1.4 RBT Agreement Process PCS11.01.02-D08-0001.0040

Before the flight is conducted a formal agreement is to be established between all concerned stakeholders. This agreement belongs to the 4D trajectory that is agreed under the given conditions and is some kind of contract between the AU that agrees to fly the 4D Trajectory and the ANSPs and airports that agree to facilitate the 4D trajectory. Hence this agreed 4D trajectory becomes the reference for all involved stakeholders and is therefore called reference business trajectory (RBT). This is not meaning that there cannot be any deviation from the RBT as agreed between the stakeholders. In case of any safety issue or in case of emergency flights a deviation from such RBT might become required, leading to the initiation of a RBT revision process. This would be triggered in the framework of the following process, the RBT adherence monitoring. During the course of the SESAR programme it has not been specified 'how', respectively 'what' triggers this agreement. This is a clear limitation of the whole concept and has to be solved in a very early stage of the SESAR 2020 programme. From an author's perspective it is clear that the RBT agreement process has to be triggered by the AU. This is due to the fact that the AU is planning and conducting the flight while the airports and ANSPs are rather service provide that facilitate the flight. Such trigger might not differ much from the flight plan filing as it is used nowadays and will remain with SESAR Step 1.

[4] At this stage it is unclear how new 'planning constraints' resulting from a DCB process etc. will be negotiated/ provided. Therefore WP11.1 assumes that, as the SBT can't be facilitated as published, the NOP will indicate this with a 'Reject'. This part of the concept is to be refined.

The RBT agreement when triggered by the AU is nevertheless subject to boundary conditions that have to be fulfilled before any of the stakeholders is able to agree on a 4D trajectory. That means that e.g. the ANSPs and airports can define certain conditions (e.g. a time window) in which the RBT agreement can be triggered.

The RBT agreement process could – in accordance with FF-ICE – be initiated without negotiating a trajectory (SBT) before. That could still allow the late filing/ RBT agreement for General Aviation and Business Aviation, but might reduce the probability that the ANSPs and airports agree on the 4D trajectory.

2.3.1.5 RBT Adherence Monitoring Process PCS11.01.02-D08-0001.0050

The trajectory adherence monitoring – in the context of SESAR – is not a standard task of the FOC. The adherence monitoring is regularly performed by the flight crew. However the flight crew has only limited capabilities to assess deviations from the RBT, especially if

- The flight operations of the airspace user consists of complex and big flight schedules with many interdependencies between different flights;
- A medium or long haul flight is performed and the deviation might lead to the non-adherence to any constraint or any other issue further downstream.

From this perspective the cleared trajectory adherence monitoring is a flight crew support function given by the FOC to the flight crew. It is up to the individual airspace user how and to what extent such RBT adherence monitoring is implemented.

A minimal implementation of such RBT adherence monitoring is the assessment whether any deviation from the cleared trajectory endangers any business target to be not achieved. This can for example mean that the FOC assesses whether a delayed time of arrival might lead to missed connections and therefore could lead to reduced flight cost efficiency.

The adherence monitoring could also be supported by the FOC to a maximal extent. That would include the monitoring of the whole flight path and the initiation of actions whenever the aircraft is not adhering anymore to the RBT.

2.3.1.6 Trajectory Reply Service SVC11.01.02-D08-0001.0010

As the FOC system is able to deliver the most accurate BT for a planned flight of an airline it can be used to deliver a matching trajectory to contracted ATM stakeholders as NM, ANSP, ATC etc.

The service and an interface to SWIM will be provided by the FOC provider. Requestor of the service will have to identify the flight (GUFI) for which they need the trajectory and might provide changed constraints (a what-if scenario). The FOC will use this information to generate a new trajectory that will be returned to the originator of the request.

The service will only deliver a trajectory to the originator of the request, if

- The requestor has permission to request such data
- The flight identified in the request is available to the FOC providing the service
- The input data provided by the originator of the request is valid.

If these items are not fulfilled, the request will be rejected by the FOC.

2.3.1.7 Constraint Receive Service SVC11.01.02-D08-0001.0020

This service type is necessary to warrant an efficient trajectory management process. With SESAR Step 2 the configuration and properties will evolve through the lifecycle of the trajectory management. That will lead to cases were a BT has been published to the NOP and was already accepted by all ATM stakeholders but must be adapted at a later time as another constraint was implemented. In such a case there would be the problem that the AU has published a trajectory and assumes that the trajectory is accepted. But the trajectory will be rejected at a later moment, which is not known to the AU. From this perspective a service must be provided by the FOC that is used to provide constraints for a flight or late reply for a flight to the AU.

The service and an interface to SWIM will be provided by the FOC provider. Requestor of the service will have to identify the flight (GUFI) for which they need the trajectory and have to provide the constraints (new/ withdrawn) or late replies matching with the flight.

The FOC will only return whether the information was received. The further processing will be an internal process and is not related to this service.

The service will only accept the "delivery", if

- The requestor has permission to provide data deliveries
- The flight identified in the request is available to the FOC providing the service
- The input data provided by the originator of the request is valid.

If these items are not fulfilled, the request will be rejected by the FOC.

2.3.1.8 Impact Analysis Service SVC11.01.02-D08-0001.0030

This service can be used by ANSPs and NM to analyse the impact of any change in the constraint set before it is published to the NOP (What-if analysis). In this case the requestor of the service will deliver a constraint set and will request the flights of the AU that would be impacted by the new constraint set and/ or a list of flights that can't be constrainted as planned due to critical fuel etc.

The service and the interface to SWIM will be provided by the FOC provider. The requestor of the service has to provide the constraint set.

The FOC will return a list with flights (GUFI) that are affected by the constraint set and an information about the feasibility of a change (whether possible or not) and the expected changed trajectory.

The service will only accept the request, if

- The requestor has permission to provide data deliveries
- The input data provided by the originator of the request is valid.

If these prerequisites are not fulfilled the request will be rejected by the FOC.

2.3.2 Free Route

With regard to Free Route no new processes and services need to be defined.

2.3.3 Aeronautical Information Management (AIM) / METeorology

New processes within AIM/MET will be defined in more details as part of the AIM OFA.

- Interactive flight planning
- Interactive pre-flight briefing
- Automatic In-flight D-NOTAM / D-MET update
- Event triggered In-flight D-NOTAM / D-MET update
- D-NOTAM / D-MET update on Flight Crew demand
- FOC triggered In-flight D-NOTAM / D-MET update

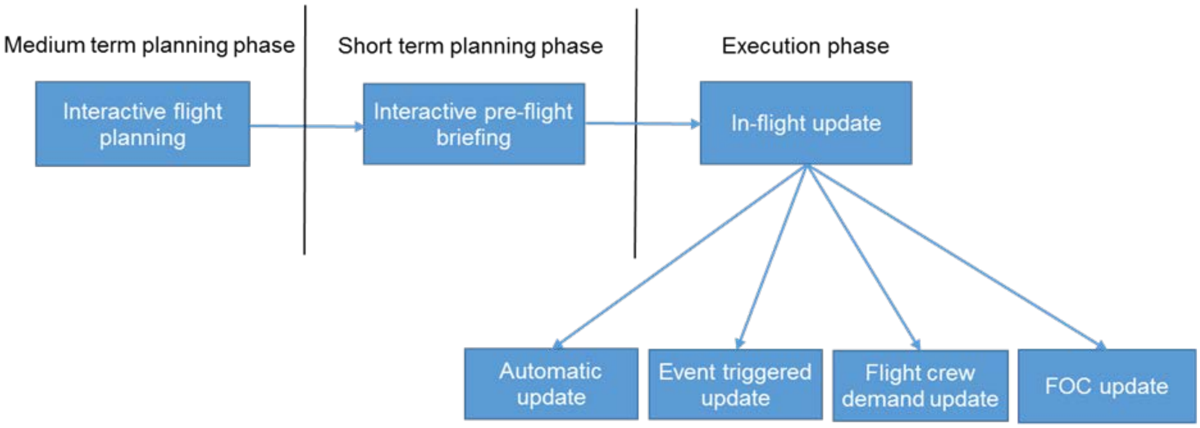


Figure 4: Time flow of new AIM processes

Each of new implemented processes is linked to different flight phase as figured at the Figure 4.

Flight planning is a part of the Medium term flight planning phase, interactive pre-flight briefing is a part of the Short term planning phase and in-flight update (for all cases – automatic update, event triggered update, update on Flight Crew demand and FOC pushed update) is a part of the Execution phase. As the use of AIM data in long term planning phase is based on the AIM data with long term validity and is similar to Medium planning phase, the Long term planning phase process is not mentioned here as a new implemented process.

As there is a significant overlap in the usage of AIM/MET data for different flight phases, the Interactive Flight Planning process is described in more details in chapter 2.3.1 Business Trajectory (including Trajectory Management Framework).

Use of new processes in post-flight phase is not expected as the AIM update from the Aircraft is not assumed yet.

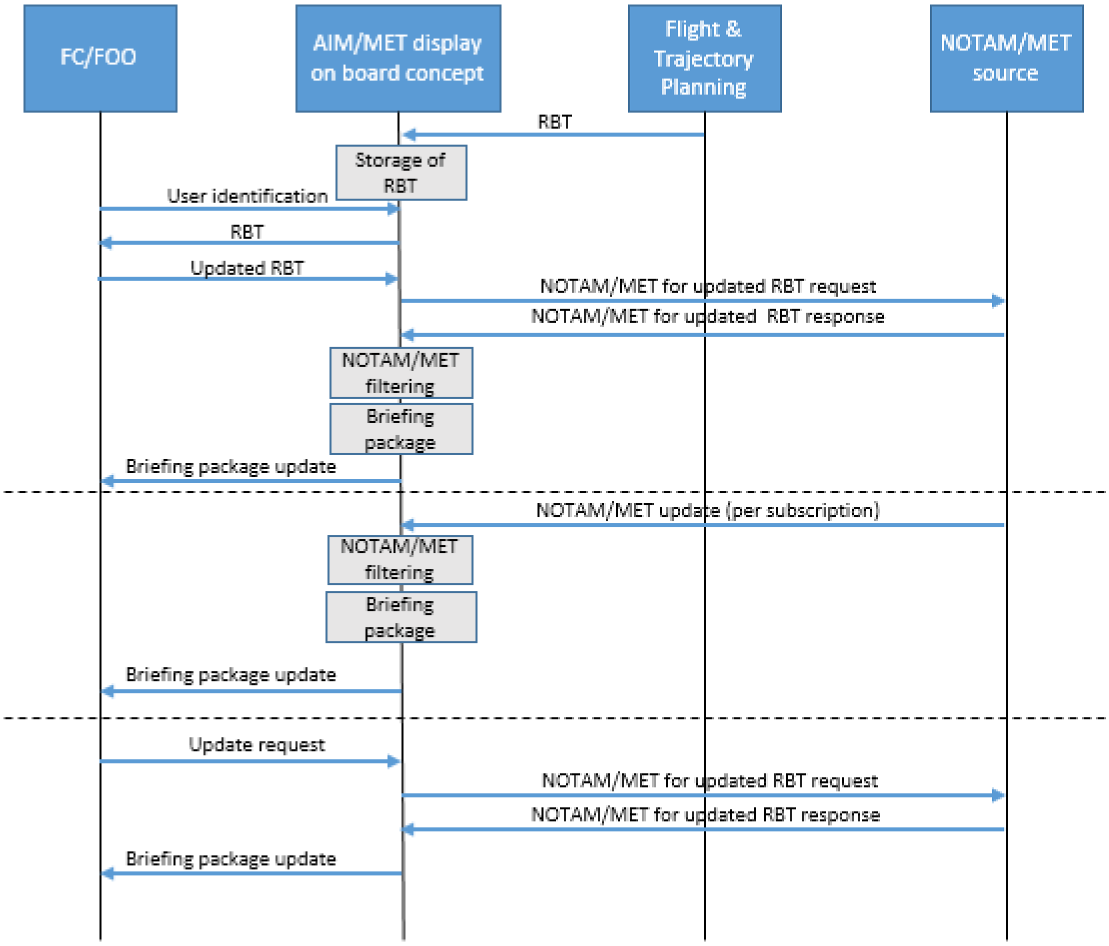


Figure 5: Information flow within new AIM processes

Information flow within new AIM processes is described in the Figure 5. RBT produced by the Flight & Trajectory Planning module of the FOC system is stored by AIM/MET module further processing. Flight crew or Flight Operations Officer is logged to the FOC system for identification and RBT is shared with FC and/or FOO. The following three cases can occur:

1) Update of RBT

This case is based on updated RBT during the flight and enables to the FC or FOO to have the NOTAM/MET for revised RBT.

RBT revised by FC and/or FOO is shared with AIM/MET module, which requests NOTAM/MET for revised RBT from NOTAM/MET source. NOTAM/MET are filtered in Application server of AIM/MET module and new Briefing package is shared with FC and/or FOO.

2) NOTAM//MET update

This case solves the situation when changes in NOTAM//MET package occurs after initial briefing package is generated.

AIM/MET module receives also NOTAM//MET update based on subscription service from NOTAM//MET source. This NOTAM//MET update is filtered in Application server of AIM/MET module and shared with FC and/or FOO.

3) NOTAM//MET update on FC/FOO request

This case means direct FC/FOO request for NOTAM//MET update.

FC and/or FOO sends to AIM/MET module the request for NOTAM//MET update. This request is shared with NOTAM//MET source. Updated briefing package is shared with FC and/or FOO.

2.3.3.1 Interactive flight planning

Please refer to chapter 2.3.1 Business Trajectory (including Trajectory Management Framework).

2.3.3.2 Interactive pre-flight briefing

The access of pre-flight briefing systems to D-NOTAM//D-MET database allows clear and simple visualization of all relevant AIM data during pre-flight briefing phase according to planned trajectory.

Visualization of AIM data is increasing flight safety and reducing pre-flight briefing time. Easy access to D-NOTAM//D-MET database keeps all AIM data updated.

2.3.3.3 Automatic In-flight D-NOTAM update

Air-ground connectivity of FOC system to Electronic information devices such as EFB enables on-going AIM/MET data update in case of any changes in briefed AIM/MET data according to real RBT.

The threshold conditions for the automatic D-NOTAM/D-MET updates have to be set by AU.

2.3.3.4 Event triggered In-flight D-NOTAM//D-MET update

D-NOTAM//D-MET update could also be triggered by the particular event set by AU standard operation procedures e.g. on ETOPS entry point, on ETP points, on TOD, significant WX change, change of RBT, etc.

2.3.3.5 D-NOTAM/D-MET update on Flight Crew demand

A situation when the Flight Crew will require an update of AIM data could also occur. This process is initiated from the board of the aircraft.

2.3.3.6 FOC triggered In-flight D-NOTAM//D-MET update

A similar situation, when the FOC will require that Flight crew to have updated AIM DATA, could occur as well. This process is initiated by the FOC.

2.3.4 Airspace Management and Advanced Flexible Use of Airspace

With regard to Airspace Management and Advanced Flexible Use of Airspace no new processes and services need to be defined.

2.3.5 User Driven Prioritization Process

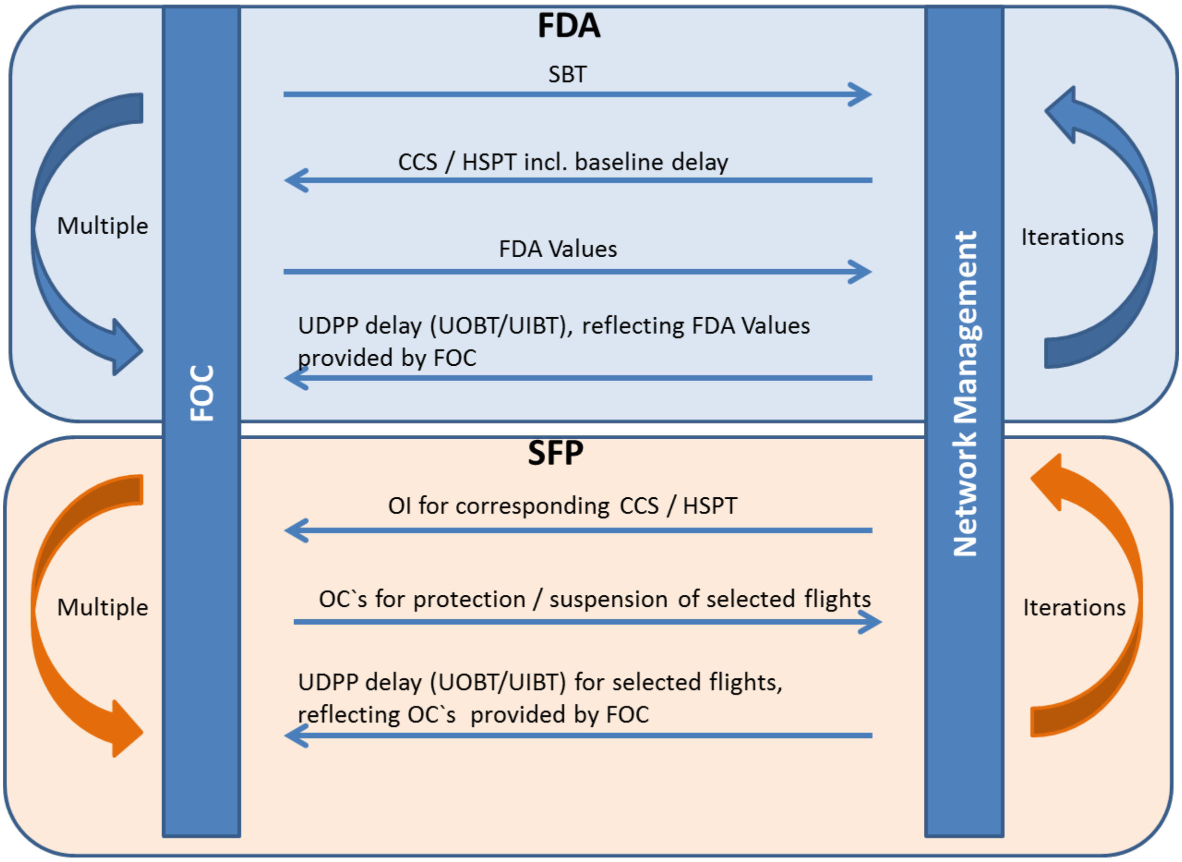
Processes of the UDPP concept from AU / FOC perspective:

In order to enable AUs to perform cost based prioritization of their schedule in case of delays caused by CCS, OI`s and anticipated delays need to be communicated to the FOC from the relevant stakeholders (Network Management Function, Airport) . Based on the values received the FOC will automatically calculate and indicate the cost curve per individual flight and the total cost/delay impact for the information received leading to a so called so “base line” scenario.

The AU has now the opportunity to optimize this base line scenario based on its own specific strategic requirements by changing the preferences and priorities for individual flights. As soon as the optimization from the AU is completed the correlating values (FDA,OC`s) need to be communicated in order to will receive revised delays for his corresponding flights. The FOC will immediately after receiving the revised information indicate the revised cost curve including the total cost/delay impact as a scenario.

The process allows multiple iterations till the AU is satisfied with the result. To support the process several scenarios can be stored in a “what-if” mode.

The picture below gives a high level indication of the process flow between FOC and NM function.FDA and SFP processes can be applied alone or in combination. However, whilst the FDA process will have an impact on the entire fleet resulting in a revised base line delay for all flights, the SFP process will impact selected flights only.


FDA
SBT
CCS / HSPT incl. baseline delay
FDA Values
UDPP delay (UOBT/UIBT), reflecting FDA Values provided by FOC
Multiple
Iterations
FOC
Network Management
SFP
OI for corresponding CCS / HSPT
OC`s for protection / suspension of selected flights
UDPP delay (UOBT/UIBT) for selected flights, reflecting OC`s provided by FOC
Multiple
Iterations

3 Detailed Operating Method

3.1 Previous Operating Method

3.1.1 Business Trajectory (including Trajectory Management Framework)

The planning of a business trajectory is based is based on a wide range of boundary conditions that lead to a certain 4D trajectory. A 4D trajectory planned for a flight represents the best trade-off between flight costs and benefits under consideration of all boundary conditions. Figure 6 gives a brief overview about factors that have impact on a flight and its trajectory.

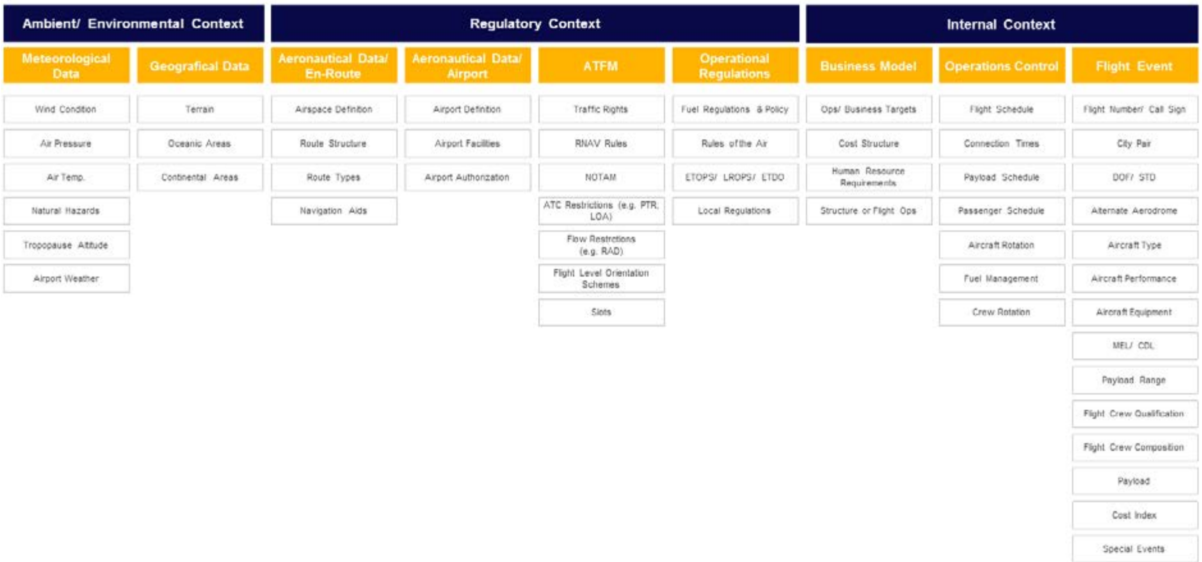


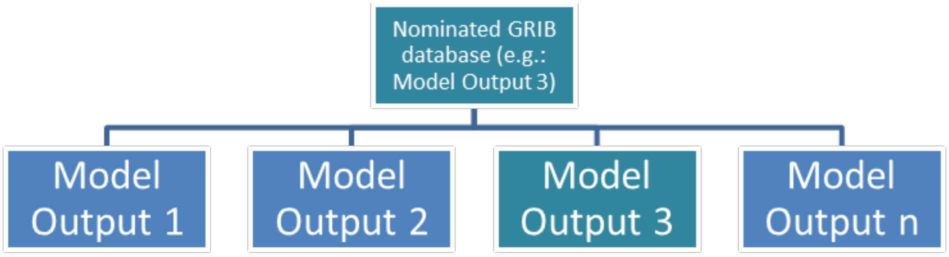
Figure 6 : Factors that influence a flight and its trajectory

If any of these factors changes a new trajectory might be required to ensure that the flight can still be operated in an efficient way. That will not be changed by SESAR. Hence this point remains valid for SESAR Step 1 and Step 2 too.
Before SESAR Step 1 implementation, especially the regulatory context is static over long periods of time. Most information is updated per AIRAC; dynamic publication of constraint is only available for a low number of constraints. Free route and direct route schemes are already implemented but not exhaustive over all types of complexity classes. Besides that the implementation of free route and direct route differs from one country to another leading to many difficulties and increased workload on AU side with regard to the planning of valid and efficient trajectories through such airspaces. A negotiation of business trajectories is not implemented. Instead of that an airspace user is planning trajectories in accordance with all published constraints and requirements and files the flight plan close to STD of a flight. A business trajectory (flight plan) that has been accepted by NM can still be suspended; requiring the AU to re-plan this business trajectory and to file a new trajectory.
In some cases NM delays flights by issuing a CTOT. The root cause of such CTOT is in most cases not known to the airspace user what might lead to situations in which the flight crew might speed up the flight causing the same issue again that was intended to be resolved by the CTOT.

Business trajectories planned by the FOC are converted into the ICAO flight plan format that is used for the flight plan filing. This format only includes minimal information with respect to the planned 4D trajectory and causes inconsistencies between the trajectory planned (and provided to the flight crews) by the FOC and that one used by NM, ANSPs and airports.

3.1.1.1 Usage of Upper Air Data (GRIB) in Trajectory Management

Currently flight planning is done based on a single deterministic upper air weather forecast dataset. A WAFC entity (e.g.: UK Met Office) produces multiple possible weather forecasts using a global model with more or less similar probability. One out of these multiple possible realities one is published as the so-called GRIB database every 6 hours. Each of these upper air databases isvalid for 36h.



Flight operators use these GRIB databases to plan their flights according to the forecast given. Naturally, there is an unquantified uncertainty in the forecasted weather which flight operators have to account for. This is mainly done by carrying additional fuel on the flight called as part of the minimum block fuel. This is called “contingency fuel”. The amount of the contingency fuel is between 3% and 5% depending on the planning variant. Some operators also use statistical fuel from historically planned flights, but the planned fuel deviations covered by this kind of contingency fuel planning mostly covers ATC related uncertainties.

3.1.2 Free Route

As stated above in section 2.2.2, Free Route in its two forms of Direct Routing and Free Routing is already available today in various countries. However, these implementations are most often limited to a single country, except for a few exceptions (e.g. Denmark/Sweden with cross-border operations). Whereas these local FRA initiatives will continue to bring improvements in en-route flight efficiency, SESAR aims at a harmonized implementation in coordination with the European Network Manager. This will ensure interconnectivity between the various initiatives which is vital and has the potential to further optimize the network whilst improving flight efficiency performance.
In terms of operating method, due to the independence of the Free Route operating method form the size of the Free Route implementation, the previous operating method of an airspace user does not differ from the new SESAR operating method. To keep all SESAR operating method descriptions together in one section (Section 3.2), this Free Route operating method is also presented there and not here.

3.1.3 Aeronautical Information Management/ METeorology

Deployment baseline of Aeronautical Information Management was not part of WP11.1 DOD and OSED Step 1. Previous operating method used in AIM/MET is consequently current deployment baseline as there was not introduced any changes for AIM/MET in Step 1.
The provision of pre-flight information services is an ICAO requirement for all IFR flights. This service supports both the provision of the information necessary for flight planning activities and the provision of pre-flight briefing before the start of the flight. One of significant roles of FOC is also enabling the access to the aeronautical and meteorological information for the flights under FOC’s responsibilities.

This service is based on the provision of:

- Baseline aeronautical information (AIP, flight manuals, maps and charts);
- Pre-flight Information Bulletins (PIB), which contain a summary of the NOTAM that might be of interest for a given flight planning or execution, eventually complemented with AIP Supplements;
- Meteorological information presented as maps/charts and standard ICAO messages (METAR, TAF, SIGMET, etc.)

The typical PIB will cover the data along the route and at aerodromes of departure, destination and alternate(s).

Pre-flight briefing packages provided by FOC are usually tailored to the needs of each individual flight crew, taking beside legal aspects company policies into consideration.

In all situations, the summary of the NOTAM in force is filtered to the extent permitted by the current NOTAM format (based on the FIR or airport location and eventually on selected elements of the "Q line" (geographical position/radius of influence, vertical limits, purpose, flight rules). The presentation to the end user in the PIB retains in general the content and format of the original NOTAM messages.

On the MET side, messages (METAR, TAF and their updates) are presented in their encoded format. Significant weather charts, wind and temperature charts and sometimes synthetic views contain the relevant information along the flight route.

Due to the current limited filtering and update capabilities the size of the documents provided is very large and easily exceeds 100 pages, provided either in printed format or PDF. The probability of pilots not being fully aware of important and latest NOTAM/MET information is increasing, as the current operation method does not provide any capabilities for event triggered updates. Any updates to the Pre-flight briefing package are provided on demand.

Overall, the current briefing system no longer satisfies needs for timely and accurate aeronautical and meteorological information updates. NOTAM and MET information are becoming digital in order to respond to the current and future needs, through the application of modern data processing technologies. With Step 1 of the SESAR program the key enabler is an introduction of initial Ground-Ground System Wide Information Management (SWIM). The exchange of information would ensure seamless time-based operations. In previous operating methods the quality and the efficiency of the flight planning and pre-flight briefing and in-flight support are negatively impacted by some legacy aspects of the aeronautical and meteorological information:

- some information necessary for accurate planning is not always available
- NOTAM proliferation
- free text format of NOTAM, MET and other ATM messages, which were originally intended for humans to read
- poor NOTAM management

AIM/MET information for Business and General Aviation Airspace Users are now provided by various parties, depending on the Airspace User business model, and could come from different sources. The digitalization of NOTAM and meteorological reports/forecasts and unification of source would increase the quality of information.

FOC operating AU

FOC systems use interfaces for direct inputs of aeronautical and meteorological information for the flight planning modules, pre-flight briefing modules and in-flight support modules. One data (one for AIM, one for MET information) source ensures consistency in information sharing between different stakeholders within one AU.

Non-FOC operating AU

Non-FOC operating AU use different information sources to ensure all relevant information used for flight planning and in-flight support (if in-flight support is provided) and to fulfil regulatory requirements for pre-flight briefing. Information sources should be integrated on different integration levels into briefing tools based on AU requirements and AIM and MET information provider's capabilities.

3.1.4 Airspace Management and Advanced Flexible Use of Airspace

Today the airspace has to be shared between two major airspace users - civil and military. Both airspace users are using different business models: civil aviation, operating private Government-owned and commercial aircraft, is primarily focused on world-wide cargo and passenger transportation whereas military aviation, operating State-owned aircrafts, reserve airspace for transport, training and defense purposes. Since some military activities will not allow a joint use of airspace between civil and military users, temporarily segregation of airspace is required.

The areas that are restricted for use for that purpose are published within the AIRAC cycle via ARINC 424 format and activated / deactivated via NOTAMs. For the FOC this means that in the flight planning these reserved airspaces have to be respected and it had to be ensured that the planned trajectory does not go through one the reserved airspaces. Exceptions are some military areas (for example in Sweden) that can be planned through as it is ensured that tactical rerouting by the controller is available if required.

3.1.5 User Driven Prioritization Process

The current Operating Method can be characterized as static, i.e., Planning, Sequencing and Flow Management using time-dimensional control to balance Capacity and Demand with only very limited and not formalized input and control by the Airspace User. Any decisions made are solely time based. Non standardized CDM processes are in place at individual airports using individual airport specific processes and tools, focusing on local needs.

3.2 New SESAR Operating Method

3.2.1 Business and Mission Trajectory (including Trajectory Management Framework)

With Step 1 of the SESAR project the Trajectory Management will be introduced in simplified form. Step 1 is focusing on the exchange of more accurate flight data and the introduction of new elements and processes of the Trajectory Management.

With Step 1 the Extended Flight Plan is implemented that allows the exchange of more accurate Business Trajectory information between Airspace User and the other ATM Stakeholder (NM, ATC, AP). With the introduction of the EFPL a paradigm-change will be connected, as with the EFPL the Business Trajectory, as planned by the AU, will be used as the reference trajectory by all ATM stakeholders. That means that no internal modifications of the EFPL reference trajectory will be done by NM, ATCO and airports that are not agreed by the airspace user. That includes especially the modification of the profile by NM using unpublished, internal constraints. In such cases the constraints would be provided to the airspace user, respectively the 4D trajectory calculated by NM would be returned to the AU that can re-plan the business trajectory or accept the trajectory as provided by NM. In consequence the view onto the Business Trajectory will be the same in all the ATM stakeholder's systems.

Furthermore the implementation of the most penalizing delay concept will be done with Step 1 of the SESAR projects. This most penalizing delay will replace the regulation of flight trajectories using a CTOT that is caused by any en-route delay, but later transferred into a departure delay without reference to the original reason for the delay. That means that more transparency with regard to the location of the delay is provided offering the airspace user to more efficiently react on such constraints. This requires that any target time is provided as 4D constraint, especially if located in a Free Routing Airspace.

A Target Time Over will indicate a target time at which a defined volume in the airspace shall be met by the flight. The FOC might use all 4 dimensions (latitude, longitude, altitude and time) to plan in accordance with the respective TTO. That means that the FOC might deliver a BT that meets the volume in the airspace defined by the TTO within the time window that was defined by the TTO, or a BT that circumnavigates the airspace volume defined by the TTO.

A Target Time of Arrival will be used in an almost similar way as TTO. The difference is that the TTA will be linked to an arrival fix defined by the airport. Hence the FOC will not have the same capabilities to circumnavigate this type of target times as only a limited number of approach fixes will be defined for an airport.

Within the Execution Phase the FOC will support the flight crew with updated flight data information, but will not directly be involved in the Trajectory Management process with ATCO. The negotiation with the ATCO will only be done via the flight crew.

With Step 2 of the SESAR programme the Trajectory Management will become an iterative process between all ATM stakeholders – starting in the planning phases and lasting until the aircraft has reached the ADES.

This will include direct connections between all actors via SWIM.

Flight planning will become an iterative process. It will start with the provision of SBT flight intent information, followed by the provision and refinement of SBT trajectory data and will end with the agreement on an RBT. This will be done in the context of iterative collaborative flight planning that will involve all actors, the AU on the one side and NM, ASM, ANSPs and the airports on the other side. SBT data will be published in the NOP and directly validated and assessed by NM. If not acceptable as not in accordance with all constraints it will be rejected, else be accepted by NM. An accepted SBT could become suspended by NM in case that any constraint or restriction is making the SBT invalid. But with SESAR Step 2 an AU will also have the possibility to impact whether any of its flight is getting a constraint or not. This is achieved through collaborative what-if assessment. Such what-if assessment will provide certain information on the location and expected time window of a hotspot. All concerned stakeholders – the AUs on the one side and the ATM stakeholders on the other side – can now try to develop different scenarios that can resolve the hotspot. That can include the increase the priority of a flight (see UDPP) to avoid a suspension of the SBT or the acceptance of any constraint provided by NM that would suspend the SBT and will require the planning and provision of a new trajectory.

In SESAR step 2 the trajectory can be managed by the FOC from the planning phases until the aircraft reaches the airport of destination. That means that all negotiation and CDM process are designed in a way that the FOC can participate in and start any trajectory re-planning throughout all phases of the flight to best support the flight crew and the other ATM stakeholders. This also includes the involvement of the FOC in the RBT revision process as well as in the RBT agreement. Furthermore it also requires and includes FOC capabilities with regard to provide and update up to date briefing information throughout all phases of the flight.

The RBT will be based on a 4D trajectory that is agreed among all actors. That means that the RBT will become a 4D trajectory the AU agrees to fly and the ANSPs and airports agree to facilitate.

Due to the connection of all actors using the SWIM infrastructure full transparency and alignment with regard to all relevant data as meteorological data, constraint data, aircraft position and trajectory predictions is always ensured. This is the backbone of a seamless collaboration and work share among all stakeholders.

3.2.1.1 SBT Flight Intent

The schedule data will consist of:

- Airport of Departure (ADEP)
- Airport of Destination (ADES)
- Date of Flight (DOF)
- Scheduled Time of Departure (STD)
- Aircraft Type (A/C Type) (*optional*)

The data will represent a part the traffic network of the AU. A part means that the AU's will only publish data for flights originating or arriving in the ECAC area. It is not expected that AU's that just overfly the ECAC area will publish schedule data to the NOP.

The data will be available in the beginning of the Medium Term Planning phase. It must be understood that different types of AU will deliver such data at different times. While scheduled airlines might deliver the schedule weeks or even month before the execution of the flight, other AU as GA or BA might only be able to publish those data on the day of operation, maybe only a few hours before departure.

3.2.1.2 SBT Trajectory

The Business Trajectory will represent the trajectory the AU intends to flight. It will be generated by the FOC and will include every route point of the intended route. For every route point several data, depending on the respective FOC system, will be provided. The data that will be published in the NOP and is coded in the EFPL will include:

- Longitude/ latitude
- Altitude
- Time at
- Wind vector
- Gross weight
- Inbound route segment
- Speed
- Minimum altitude
- Maximum altitude

Most FOC systems might generate more data as described above, but this will not be reflected in this document as that data is not in scope of the trajectory management.

The BT will be generated considering all regulatory, safety and commercial requirements known to the AU. The BT will be the basis data used to create the FC briefing documents on the one hand and the EFPL data on the other hand.

The first BT might be delivered by scheduled airlines a few days in advance to the execution of the flight and a few hours in advance for BA and GA.

3.2.1.3 Long Term Planning Phase

In this planning phase the FOC will gather all data that is needed to create the schedule and afterwards the Business Trajectory. The resulting dataset is called Business Development Scenario and will evolve during all Planning Phases and the Execution Phase. Depending on the AU several Operational/ Business Scenarios might be developed that consider different input values as different passenger or cargo load values, different weather scenarios etc.

3.2.1.4 Medium and Short Term Planning Phase

Within the Medium/ Short Term planning phase, after further refinement of the Operational/ Business Scenarios, the AU will start to generate the Schedule. In some cases Schedules for different Operational/ Business Scenarios might be generated to assess the effect on the aircraft allocation, but finally the AU will generate only a single Schedule. Once the Schedule is available and stable the AU will publish this information in the NOP.

Schedule data will be published as SBT Flight Intent data. It is not planned to publish SBT Flight Intent data per individual flight but as schedule of the flight. This corresponds to the provision of a seasonal flight schedule that informs about the city pair connections and frequency of respective flights.

The closer the day of flight comes; the more the boundary conditions of the flight should be defined. The FOC will generate the BT that is the best trade-off between the boundary conditions of the flight and the business targets of the airspace user. This BT will afterwards be published to the NOP to be negotiated with all other ATM stakeholders. This published BT is called Shared Business Trajectory (SBT Trajectory). The AU expects (and the FOC will wait for such a reply) that there will be a message returning from the NOP that will indicate whether the SBT can be flown or even not. If a BT is not accepted the NOP has to indicate the reasons for the reject. In any case the reasons will be constraints that have not been considered by the BT. As not all constraints are known from the beginning the NOP has to indicate whether a known constraint has not been fulfilled by the BT or whether a new constraint was implemented that has to be considered by the BT but was not available to the AU when the BT was generated. That means constraints leading to rejects must be marked to indicate whether that are already existent constraints or whether they have been added as a reaction to the published BT[5]. Therefore it is expected that two different types of messages are used:

- Acknowledge
- Reject

Acknowledge

This type of message will indicate that the SBT was published in the correct format, that the included information is correct and that the BT can be accommodated by the ATM network until further notice. In the early phase of the Trajectory Management this status might only be a temporally status as with the evolving ATFCM situation reasons could rise that would prevent the ATM network to accommodate the SBT. Therefore this message type/ status shall not be confused with the final agreement on the SBT leading to the RBT.

Reject

This type of message will indicate that the published SBT is not accepted by the ATM world or the NOP system. There might be several reasons why such a message is return:

1. The syntax of the message is wrong
2. The BT is built in a wrong way
3. The BT is not according to all known constraints, requirements and restrictions

In every of the listed cases the AU expects that the detailed reasons are provided in the reply message.

If new constraints are published upon the publication of a BT, the AU will add them to the set of constraints belonging to a flight and generate a new BT that can be used for publication in the NOP.

This negotiation process will be performed until the <time period> in which the agreement between the AU and the ATM world must be achieved has been reached. Until this moment the AU and the ATM world have to find a BT that is accepted by all stakeholders. Within the <time period> the AU will officially file the SBT. The NOP will return after that accept/ acknowledge. This will be a formal act which ends with an agreement on the SBT. This agreement will include the whole trajectory as planned and all constraints that are interlaced in/ linked with the trajectory. This agreed SBT will represent the BT the AU agrees to fly and the ATM world agrees to facilitate.

Upon this agreement the AU will start to generate the FC briefing package and will start to prepare the execution of the flight.

In the nominal case no changes to the agreed SBT and their BT will be done. If there might be the need to adapt the BT it will be done under the following boundary conditions:

- The change will not have negative influence onto the planned trip fuel
- The change will not have influence onto the briefing package what means that
  - No further weather briefing
  - No further NOTAM briefing is needed

In exceptional cases there might be the need to adapt the BT significantly, what would request the generation of a new briefing package. Such a major revision might only be done in case that the FOC and the FC accept such a change. The acceptance will depend on the capability of the AU to

- Brief the FC accordingly in the remaining time
- To prepare the flight (FC) in the remaining time
- To order fuel in the remaining time.

[5] The concept of marking constraints is introduced by WP11.1 with this document. It must be discussed with the other WP what a concept will be used in this regard (or whether another reply message type is introduced). This concept might be subject of refinement.

The AU expects that only those flights are required to be revised for which an agreed SBT is still not achieved. It is expected that there will be a process on NM/ Airport side deciding which flight will be subject for a revision that is considering the status of the BT.

3.2.1.5 Execution Phase

The Execution Phase will start in the moment when the RBT is triggered. The trigger will be an agreement between the Flight Crew and the ATC controller. Hence the RBT will be triggered by FC and ATCO[6]. Ones the RBT has been triggered the information will be shared with the FOC/ AU via the NOP. The AU/ FOC will take a note and mark the respective BT as RBT.

Upon this trigger the AU will start with the monitoring of the flight and its boundary conditions. This will be – for the majority of flights – and for most of the airlines done by the FOC automatically.

This flight monitoring will cover two aspects:

- The adherence of the aircraft to the RBT;
- The impact of changing boundary conditions onto the flight.

3.2.1.6 Cleared Trajectory adherence monitoring

The FOC will be able to monitor whether the aircraft is flying in accordance with the cleared trajectory and assess impact of deviations or predicted deviations from the RBT. The monitoring will also consider tolerances that are related to any of the trajectory points. Tolerances can be specified in location and time. A deviation from the RBT might trigger the generation of a new 4D trajectory and a revision of the RBT.

While for flights within the ECAC area and on short haul flights the FOC might not continuously monitor the reference trajectory, a continuous flight and trajectory monitoring might be established by the airspace users for long and medium haul flights as well as for flights that are not only flying through the ECAC area. The implementation of such methods – if not regionally regulated by law – will be defined by the individual airspace users.

3.2.1.7 Monitoring of Flight Planning Boundary Conditions

The FOC is able to monitor the conditions that impact a flight. This belongs to the three areas of boundary conditions (as listed in Figure 6 in chapter 3.1.1):

- Ambient/ Environmental Context,
- Regulatory Context, and
- Internal Context.

In these three groups there are different elements that can be seen as being static (like operational regulations like LROPS requirements) and other elements that are rather dynamic (e.g. wind conditions, slots). For dynamic boundary conditions the FOC could be enabled to steadily monitor whether they change and which impact such changes have onto the flight (if they have changed). There are two ways how such changes could impact a flight:

- A change could embarrass the AU to fly in accordance with the cleared trajectory, or
- A change could deliver opportunities to fly a more cost efficient trajectory.

The first type of change require a revision of the cleared trajectory, if the any element of the regulatory context changes. In such a case the monitoring could also be supported by the ANSPs, airports and NM that would inform the FOC about the fact that the cleared trajectory cannot be accommodated

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[6] It is still not defined upon which trigger the SBT/ agreed SBT becomes the RBT. There might be a refinement of this paragraph as a result of the work within the Trajectory Management Framework OFA.

anymore by updating the supporting data within the RBT[7]. The second type of change can only be assessed by the AU itself as only an airspace user can assess the impact of any change of the RBT on the flight cost efficiency.

In any of the described cases an RBT revision could be started to agree on a new RBT if it has been suspended or to agree on a more optimal RBT.

3.2.1.8 RBT Revision Process

The RBT revision process can be triggered by the following stakeholders:

- Airspace User (FOC or flight crew)
- Airport (AP)
- Network Manager (NM)
- Air Traffic Control (ATC)

3.2.1.8.1 RBT Revision Process triggered by the Airspace User

As described above the adherence monitoring of the RBT and the boundary conditions of the flight can be shared between the FOC and the flight crew. While the flight crew might have a more direct look onto the adherence to the cleared trajectory e.g. while monitoring the timings and remaining fuel at certain points of the planned trajectory, the FOC has the more detailed view onto the flight as a whole and in its relation to other flights and the whole flight operations. Hence both instances of the civil AU operations can trigger a RBT revision process.

From the basic principles' perspective the planning of a new trajectory and the negotiation of such trajectory with all other ATM stakeholders is per se an FOC task. From this perspective it depends on the complexity of the flight operations of the airspace user whether the flight crew is able to fully revise an RBT from airspace user perspective and under consideration of the requirements of all concerned ATM stakeholders[8]. From this perspective it has to be stated again that the RBT is the trajectory the AU agrees to fly and the ANSPs and airports agree to facilitate. The RBT and the agreement on it is a contract of a group and hence the agreement of all impacted stakeholders will be a key of efficiency, stability and flight safety. However if e.g. a short haul flight is performed, only a limited number of boundary conditions are impacting the flight directly when changing and only a low number of ANSPs might be impacted be a change of the RBT, the flight crew might be able to manage the whole RBT revision process and hence be able to adopt some of the FOC tasks. In other cases, like long haul flights, with many stakeholders involved and strong connections with other flights it is questionable whether the flight crew can solely revise an RBT up to a maturity level that allows an agreement.[9]

In case of an RBT revision a BT will be calculated, this will be published in the NOP to be negotiated with all other ATM stakeholders. If a negotiated BT can be agreed by all stakeholders the cleared trajectory might be revised.

3.2.1.8.2 RBT Revision Process triggered by the Airport

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[7] This definition of cleared trajectory and supporting data (inter alia) within the RBT (in the T-ConOps) might be reconsidered in the scope of S2020 as it brings some inconsistencies. First this design is not in accordance with the definition of RBT/RMT In the T-ConOps on the other hand the use of the term "cleared trajectory" could be in conflict with ICAO provisions and hence might interfere with FF-ICE.

[8] In many cases the ATM stakeholders can also include non-ECAC states what makes it very difficult to revise the RBT within the SES as regulations and constraints (not known by NM or any European ANSP) have to be taken into consideration too.

[9] This paragraph/ section discuss the RBT revision and not the change of the aircraft trajectory for tactical reasons which will remain to ensure the safety of the flight. A change of the aircraft trajectory might lead a deviation from the RBT what would lead to an RBT revision with the target to achieve agreement again.

The airport operator will only change, add or withdraw constraints that are related to the airport facility or airport operations. The FOC expects that the changed constraints will be published to the NOP and further forwarded to the FOC system. The APOC will typically only directly influence start up time, departure times, taxi time and routing and arrival time.

Once any change to these elements has been made available via the NOP, the FOC will use this as a trigger to generate an updated/ new Business Trajectory. This BT will afterwards be published to the NOP to start the trajectory negotiation process.

If a new BT was agreed by all ATM stakeholders on the ground it will be proposed to FC and ATCO who might agree on the proposed trajectory and use it as RBT.

3.2.1.8.3 RBT Revision Process triggered by Network Manager Function

The Network Manager might publish new constraints, change constraints or withdraw constraints to ensure the stability of the overall network. Those changes in the set of constraints related to a flight will be published via the NOP.

Once any change to these elements has been made available via the NOP, the FOC will use this as a trigger to generate an updated/ new Business Trajectory. This BT will afterwards be published to the NOP to start the trajectory negotiation process.

If it is not possible to change the BT, as a consequence of limited fuel on board, the FOC will publish this information to the NOP to request a revision of the constraints.

If a new BT was agreed by all ATM stakeholders on the ground it will be proposed to FC and ATCO who might agree on the proposed trajectory and revise the cleared trajectory.

3.2.1.8.4 RBT Revision Process triggered by Air Traffic Control

During the execution of the flight ATC might propose a new trajectory or changed constraints set to the FC and the FOC. The FOC will use the delivered information to create a new trajectory upon reception of changed constraints set. If a new trajectory has been defined by the ATCO the FOC will check whether it is feasible to fly the proposed trajectory and whether there would be another more efficient option to fly.

3.2.1.9 Collaborative Decision Making/ What-if Assessment

The planning of a business trajectory that is used for the trajectory negotiation with all ATM stakeholders will be based on ATM constraints that have to be fulfilled by the business trajectory to get it agreed by the ATM stakeholders. But there might be the option - for airspace users - to influence – to a certain degree – whether a flow constraint is assigned to a specific flight or not. The ability to influence the assignment of a flow constraint is directly linked to the complexity of the network situation and might also not be available for every flight that is for example involved in a potential hotspot. The decision about whether the assignment of a flow constraint can be negotiated or not is to be decided by the ATM stakeholders.

However, in cases in which a flow constraint can be negotiated a what-if assessment, respectively collaborative decision making, could be started. In those cases the NM, ANSP or airport will specify when a traffic flow hotspot is predicted to develop. Upon this assessment involved flights – that can still negotiate whether they should avoid the location of the hotspot at a certain time – can participate in the CDM/ what-if assessment process. In such cases the participating airspace users could assess how the hotspot location – especially if transformed into a flow constraint – would impact their flight and which potential options they have to deal with the situation. If a constraint cannot be accepted by the flight – e.g. due to downstream constraints that cannot be met anymore if a new constraint is added – the airspace user could – using UDPP principles – increase the priorities (see UDPP related chapters) of the flight to avoid the constraint. Other AUs might be able to accept a constraint and could provide a new BT to the process that would be assessed by the ATM stakeholders to ensure that it can be facilitated till the airport of arrival. This could lead to a negotiation until a scenario (BTs + constraints) has been found that can be accepted by all concerned actors. If the scenarios are agreed the agreed flow constraints will be published as “mandatory” in the NOP and will suspend the trajectory of the specific flight.

The what-if/ CDM would end with that. The suspension of the trajectory by the new flow constraints will trigger the provision of the BT to the NOP by the airspace user to update the SBT Trajectory information of the flight. This new BT will in usual cases be the same as agreed with the resultant what-if scenario.

If the flight is already in the execution phase the new constraints will suspend the RBT. The AU will provide the new BT that has been agreed in the what-if scenario and upon final agreement of all actors ("Trajectory the AU agrees to fly and the ANSPs and airports agree to facilitate) it will become the new RBT[10].

3.2.1.10 Global Ensemble Weather Forecast

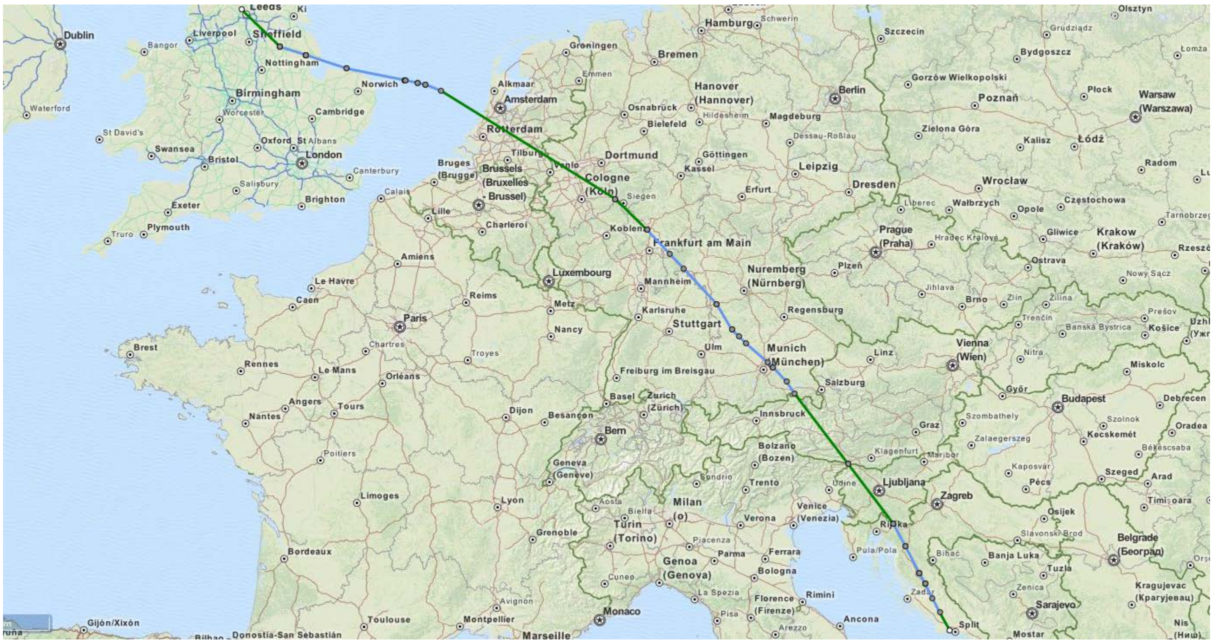
As mentioned in chapter 3.1.1.1 WAFC entities produce a set of upper air forecasts every six hours. Instead of using just one of these forecasts in the flight planning and trajectory management process in the context of the "New SESAR Operating Method" several of these forecasts can be used to generate the optimum trajectory.

While finding the optimum trajectory based on a single upper air database is a deterministic process, the generation of the optimum trajectory based upon several upper air databases is not deterministic but probabilistic. However, quantifying the uncertainty in weather is still a key operational requirement in flight operations.

A set of such upper air databases which are valid all for the same period and time is called Global Ensemble Weather Forecast (GEWF). Using such a GEWF in the trajectory management process allows an operator to quantify the predictability in both trip time and trip fuel aspects for a given flight. In other words, instead of planning a flight with just one forecast, you bring the predictability of the weather into the picture and plan all forecasted realities and use the trajectory ensembles (a set of trajectories for a given flight based upon a GEWF) to make better decisions.

It must be emphasized that quantification of the uncertainty is not only related to the area of operations but must always be derived for a specific flight.

To better explain this let's look at two examples. Example (A) shows a flight from Leeds to Split and example (B) shows a flight from Barcelona to Helsinki.



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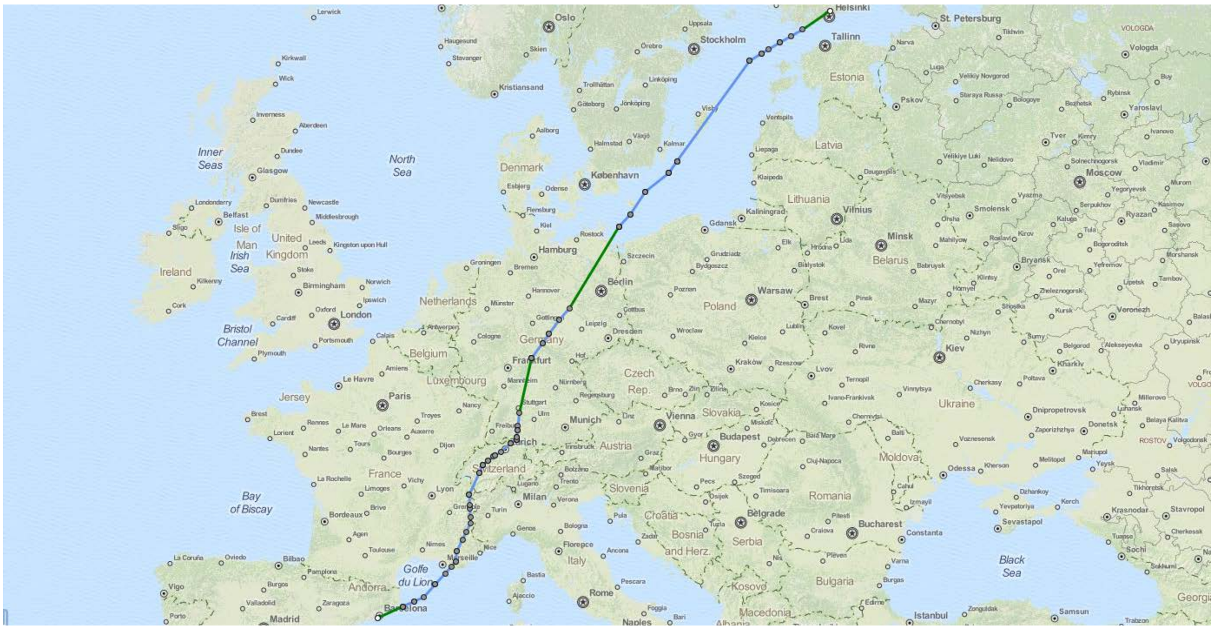
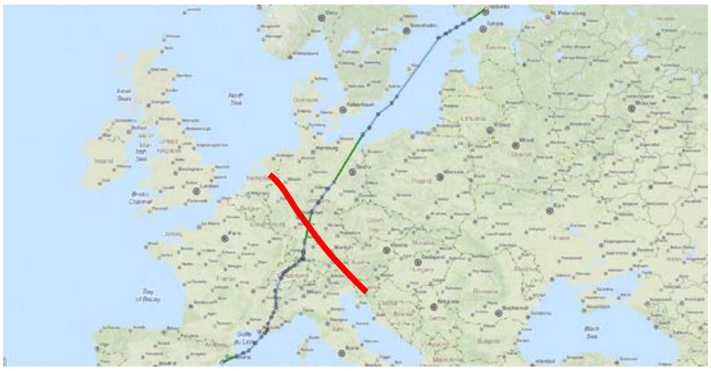
10 This might also include the clearance by the ATCO and the WILCO of the flight crew to fully trigger the RBT execution.



Both flights operate in the same area. One could assume that both flights are subject to similar weather uncertainty. Let's imagine that there is a frontal weather system over central Europe which is aligned with the flightpath of the first flight.

In such a situation the optimum trajectory of the first flight is significantly impacted since the actual location of the strongest winds can vary. Which means that, depending on the weather ensemble member used for the creation of the optimum trajectory, significant differences in the optimum trajectory can be observed. On top of that, the spread in fuel and time of the different optimum trajectories can be considered quite large.



The second flight however will pass the area of strong winds in a more or less 90 degree angle and hence the only variation might be that the aircraft passes the front slightly earlier or later. The spread in fuel and trip time can be considered small with a slight variation in estimated time over in the area around the front.

From an operational standpoint a service that provides a quantification of the uncertainty in weather for a given flight and a given day is considered very beneficial to make the best decisions possible in respect to the lateral route and flight prioritization.

3.2.2 Free Route[11]

As explained in section 2.2.2, Free Routing in terms of SESAR is the overarching concept for both Direct Routing in a Direct Routing Airspace (AOM-0500) and Free Routing in a Free Routing Airspace (AOM-0501, AOM-0505, and AOM-0506).

Free Route through the use of Direct Routing (AOM-0500) constitutes no change compared to today. The ATS Route Network is augmented or replaced (depending on the implementation) by DCT segments allowing more options in flight planning. Although the complete replacement of the ATS Route Network is not practiced today, there is no conceptual difference from a FOC perspective, as DCT segments are in use today in several countries. Even though the possibility of introducing a Direct Routing Airspace is foreseen in the case of the complete elimination of the ATS Route Network, this new kind of airspace will also not lead to a change in the FOC operating method, as all information attached to the airspace could be attached to the segments. Therefore, the remainder of this section will concentrate on the second possibility of implementing Free Route, namely Free Routing in a Free Routing Airspace.

Free routing in a Free Routing Airspace (for simplification abbreviated Free Routing for the remainder of the document) (Step 1: AOM-0501, Step 2: AOM-0505/AOM-0506) is one of the core concepts of SESAR and probably the single most important improvement for airspace users. For Airspace Users, Free Routing is expected to be the default mode of airspace usage in the future. The expectation of Airspace Users is a full and 100% harmonised implementation of this concept. By eliminating the need to plan via a fixed route structure, airspace users gain the freedom to plan their flight trajectories in the most efficient way (in terms of fuel efficiency and business effectiveness) with the least environmental impact considering all regulatory and safety aspects. Without full and 100% harmonised implementation of the Free Routing concept, this goal cannot be achieved.

In general for an airspace user the operating method will not be much different in a Free Routing environment compared to an ATS Route Network environment. Therefore, only the changes will be discussed below. Again, they are not specific to Free Route in SESAR Step 1 as they are already valid for today's implementations of Free Routing Airspaces in Europe, however, the description will be given for reasons of completeness of the operating methods in this document.

Flight Planning

For the FOC, the presence of a FRA will be acknowledged. The FOC needs to obtain the information about the Free Routing Airspace dimensions and availability, as well as the applicable rules to file trajectories in this airspace. The planning of the trajectories is then adapted accordingly. Within a single FRA, the trajectory will be built using user-defined segments between any of the designated Entry/Exit or Arrival/Departure points and published and/or user-defined (LAT/LON) Intermediate points. Wherever a fixed route network is maintained within FRA, ATS routes may also be used as described in the AIP. Free Routing Airspace Entry/Exit/Arrival/Departure, Intermediate (LAT/LON or 5LNC) points as well as other significant points are described using the standard ICAO format. In contrast to the current operating method in an ATS route system, it has to be checked for every segment now, whether the newly generated segment is allowed, i.e. compliant with all rules valid in the FRA in question. Examples for such rules could be:

- Limitations on the length of the user-defined segments (both minimum and maximum length)
- For safety and ATC efficiency there might be a requirement for at least one user-defined point in each FIR/FAB due to trajectory prediction accuracy in ground ATC system.
- Segments or points must not be closer than a published distance (AIP) to the FRA boundary if the route does not cross the boundary, to avoid conflict with traffic in non-FRA airspace.

[11] Most parts of this section are identical to the corresponding section in the 04.07.02 Free Route OFA OSED Iteration 2 [21] that has also been provided by WP11.1.

- Exclusion zones, as defined by the ANSP and published by NM thereby providing a single fully integrated and coordinated list in order to strategically manage traffic flows and complexity.

It is expected by the AU that a common set of rules will be defined for Free Routing operations through Europe. Changes to the RFL will be indicated in the flight plan either at a significant point or a LAT/LON point. Due to the possibility of filing numerous relatively short segments defined by LAT/LON points (which need more characters than the usual 5LNC waypoints), there may be a risk of very long route descriptions in FPL field 15. It is expected that the number of LAT/LON described segments, and hence the length of the route description in FRA, will depend on criteria such as: waypoint density, number of ARES activation and the route optimisation process employed by the FOC. It might also depend on the density and complexity of traffic since an ANSP may have certain requirements concerning the strategic de-confliction of traffic flows. Implementing FRA at a large geographical scale may add a further parameter to be reckoned with when considering route description length in field 15.

Even though there will be a homogeneous implementation of a Free Routing Airspace in Europe eventually, there will be multiple operational environments (e.g. FRA, DRA, ARN) that need to be coordinated in the flight planning process. For Short Haul flights, there will be different operational environments in the vertical direction, whereas in addition to that, for long haul flights, there will also be multiple operational environments in the horizontal direction. For each of these environments, the entry/exit conditions must be checked and subsequently obeyed in the flight planning by the FOC.

When filing the flight plan, the airspace users will need to know the latest available information on the planned activity of airspace reservations affecting each flight. In Free Routing Airspace AUs have to make sure to stay out of active ARES, taking into consideration the Flight plan Buffer Zones (FBZ) associated with each area but also the navigation performance of the aircraft. This can be done by use of Intermediate points, LAT/LON or any other published waypoint suitable to avoid the ARES. The totality of the airspace to be avoided shall be notified to the users, for flight planning purposes, by appropriate means of notification (AIP, RAD, NOP or NOTAM). Except in Free Routing Airspaces, where it is published that tactical rerouting will be given (for which additional fuel needs to be carried), the obligation is on the originator of a FPL to submit a routing through Free Routing Airspace that avoids active airspace reservations.

Special care has to be taken to guarantee that a valid flight plan will be generated in a time-limited FRA that is only available at night. If there are time buffers defined, then in most cases no special handling is necessary, as the time buffers guarantee that also flights which are moderately delayed (usual buffer times 0:30h to 1:00h) can use the Free Routing environment as planned in the flight plan. If no time buffer is provided in the respective publications defining the Free Routing Airspace or the flight is heavily delayed, a new trajectory needs to be calculated, usually using the ATS route network. However, this procedure belongs to “trajectory management” and will be described there.

Flight Execution

One point not to be neglected from an airspace user’s perspective is the expected increased stability of the trajectory. It results from the fact that a trajectory that has already been optimized in very high resolution doesn't leave much freedom for further optimization. Therefore DCT instructions given during flight execution will typically not lead to an improvement of an already optimized trajectory anymore and requests for trajectory revisions will only be triggered by scenario changes (e.g. new/cancelled constraints or significant weather changes), not by continued further attempts to improve the trajectory. Furthermore, Shared Business Trajectory (SBT) changes due to Upper wind forecast updates as the departure time is getting closer are also expected to decrease since the trajectory is already very close to the optimum even with slight wind changes and every change in the trajectory requires a batch of tasks to be performed by the flight dispatcher and also changes the crew briefing. The reduced deviations between the executed vs. the planned 4D trajectory leads to two direct beneficial effects on the operations: In the execution phase, the predictability will be much higher for a single flight, which enables the airspace user to anticipate much better e.g. possible missed connections for passengers. In the long term-planning phase, the reduced deviations that can be expected also allow the AU to reduce strategic delays in the flight schedules, enabling the AU to achieve a higher aircraft fleet utilisation.

For non-compliant traffic a structure will be maintained preferably in the form of named waypoints without any fixed route connections in-between. This is expected to accommodate even legacy airspace users as their navigational capability never really required fixed routes. The capability to fly between sufficiently spaced waypoints or navigational aids has always existed. With the rapid introduction of low cost navigation systems even for general aviation, the traffic volume requiring any fixed route structures is expected to decrease rapidly.

Diplomatic Flight

Finally, it is to note, that flight planning in FRA does not affect the requirements for diplomatic clearance. For flights obliged with diplomatic clearance, airspace users have to make sure to file their UPR in areas where the diplomatic clearance is valid, and not to divert from this route. It will be up to the flight crew to keep track of where they are allowed to fly and not.

Difference Step 1 to Step 2

With regard to Free Route in a Free Routing Airspace the difference between step 1 and step 2 is per OI step only the density/complexity of the airspace (AOM-0505/AOM-0506). However, unless there will be new types of traffic flow measurements implemented in a Free Route environment (to be investigated in SESAR 2020 PJ06), this will not cause any change for the FOC.

3.2.3 Aeronautical Information Management (AIM) / METeorology

3.2.3.1 Definition and Impact

As mentioned in chapter 3.1.3 Aeronautical Information Management/ METeorology, the Aeronautical and Meteorological Information Management is an ICAO requirement for flight preparation. The new SESAR Operating method for AIM / MET does not only significantly improve the flight preparation, it enables real time data sharing for all phases of the flights (flight planning, pre-flight briefing and in-flight support).

The objective of the Aeronautical and Meteorological Information Management is to improve the quality and the efficiency of the flight planning, pilot briefing and in-flight support, through the use of digital NOTAM and digital MET data.

The provision of digital aeronautical information and digital meteorological information data using SWIM defined services and information models enables a radical enhancement of the briefing services: easier to understand, better filtered, more tailored pre-flight briefing products and services. Digital NOTAM and digital MET data will also facilitate the in-flight updates.

In addition the use of common format of all aeronautical and meteorological information also facilitates additional information sharing e.g. Airspace User’s internal information called company NOTAMs.

Implementation of digital AIM/MET will provide to all ATM stakeholders the following benefits:

- Constant access to all information necessary for accurate flight planning, pre-flight briefing and in-flight support (PTR, ATM constraints, etc.)
- Reduction of information thanks to vertical, lateral and time filtering features
- Reduction of omission of important information
- Automation of data processing
- Reduction of data misinterpretation
- Data format unification
- Enable information providing to increased number of alternate airports (including adequate and suitable en-route alternate airports)
- Extension of the briefing package on demand during all phases of the flight

3.2.3.2 Extent of Aeronautical and Meteorological Information Management

The Digital NOTAM data will be provided within Step 1 as deployment baseline using Digital NOTAM production tools and Specifications for Digital NOTAM encoding / decoding as main deliverables.

Step 2 will implement provision of digital NOTAM and digital MET data using SWIM defined services and information models and provision of digitally enhanced briefing services / products using following deliverables:

- “to-be” business process and SWIM services
- SWIM connected Digital NOTAM production tools
- SWIM connected digital MET data production tools
- ePIB products/services

Two new operating methods are defined within AIM OFA:

- Implementation of AIXM and WXXM format for AIS and MET data
- SWIM usage for AIS and MET data share

3.2.3.3 Improvements of Aeronautical and Meteorological Information Management

Free text oriented current aeronautical data (NOTAM, AIP) and meteorological data (METAR, TAF SIGMET, PIREP) format is complicated with possible misinterpretation or with need for additional information.

AIXM and WXXM format implementation based on XML graphical representation facilitates data processing. Machine readable format of AIS / MET data bring the digital aeronautical data and digital meteorological data advantages into pre-flight briefing and into the cockpit.

(CA0026/10 NOTAMR CA0027/2009
Q) ENOR/QOBXX/IV/BO/E/000/010/5903N00939E005
A) ENOR
B) 1001012003 C) 1112012359EST
E) OBSTACLE WARNING SYSTEM HAS BEEN INSTALLED IN FRIERFJORDEN BTN SURTEBOGEN AND KJOERRHOLT AND BTN SKJERKOEYA AND FLAUODDEN, PSN 590316N0093848E. WARNING LEVEL 1 IS WHITE FLASHLIGHT ON POWER POLES. LIGHTS ARE TURNED ON IF DIST TO THE ACFT WITH OPR TRANSPONDER IS 3 NM OR LESS AND ALT IS 1500FT AMSL OR LESS. WARNING LEVEL 2 IS ADDITIONALLY A RDO MSG ON FREQ 130.750MHZ, TEXT ATTENTION POWERLINE TRANSMITTED WHEN DIST TO ACFT IS 2NM OR LESS AND ALT 1000FT AMSL OR LESS. APPROACHING EAST, TEXT ATTENTION BRIDGE IS TRANSMITTED. SYSTEM IS ON TEST FM JUNE 2008. LOWER LIMIT: GND UPPER LIMIT: 1000FT AMSL)

Figure 7: Examples of current aeronautical information data

SIGMET:
LZBB BRATISLAVA FIR WS SIGMET 1 VALID 101055/101455 LZIB- LZBB BRATISLAVA FIR MOD TO SEV ICE FCST OVER SW PART OF LZBB BTN FL060/130 MOV W NC=

Figure 8: Examples of current meteorological data

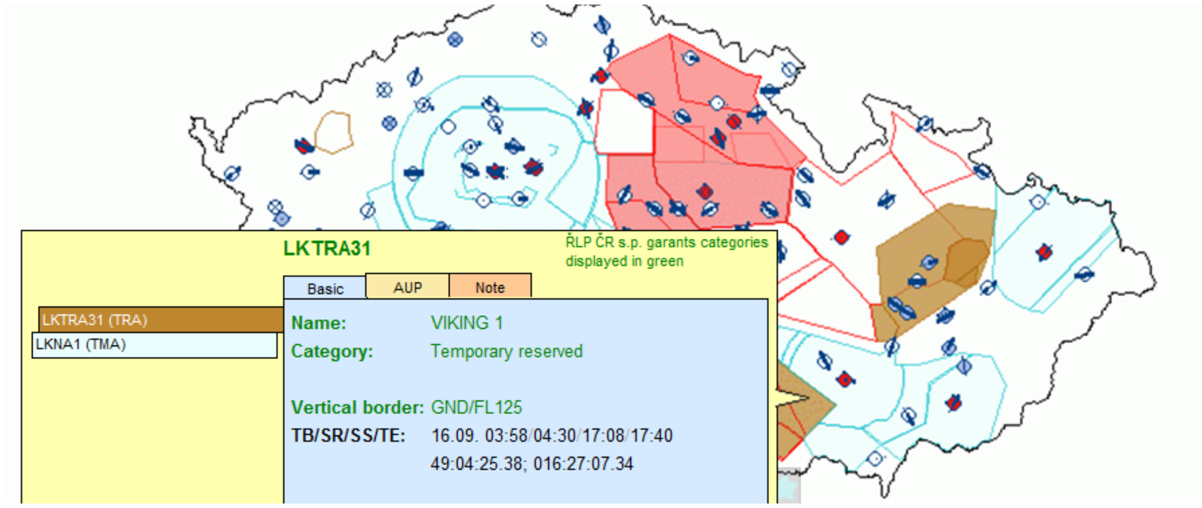


Figure 9: Examples of possible visualization of digital AIS data

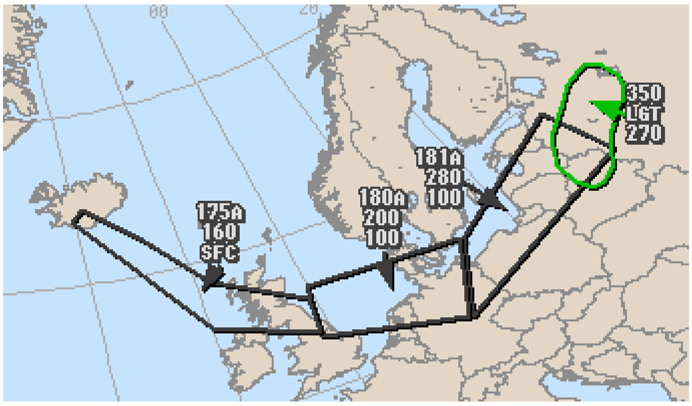


Figure 10: Examples of possible visualization of digital MET data

3.2.3.4 SWIM

SESAR program has included SWIM as the means for managing information. It is advocating that SWIM provides the basis for information exchange between systems based on the principles of a Service Oriented Architecture (SOA). SOA governance is being implemented to ensure that providers and consumers of data act as a community, sharing information among them. The goal is ultimately to provide the benefits of reuse of services and the elimination of duplicative functionality across organizational boundaries, enabling greater agility of the enterprise to adapt to changing business requirements.

SESAR envisions SWIM as an enabler of data sharing between services across the European ATM system. Aeronautical and meteorological data sharing using SWIM will simplify the Air/Ground connectivity. The goal is to improve collaborative decision making and common situational awareness through the provision of quality data to the right people at the right time. SWIM is being addressed by SESAR WPs 8 & 14.

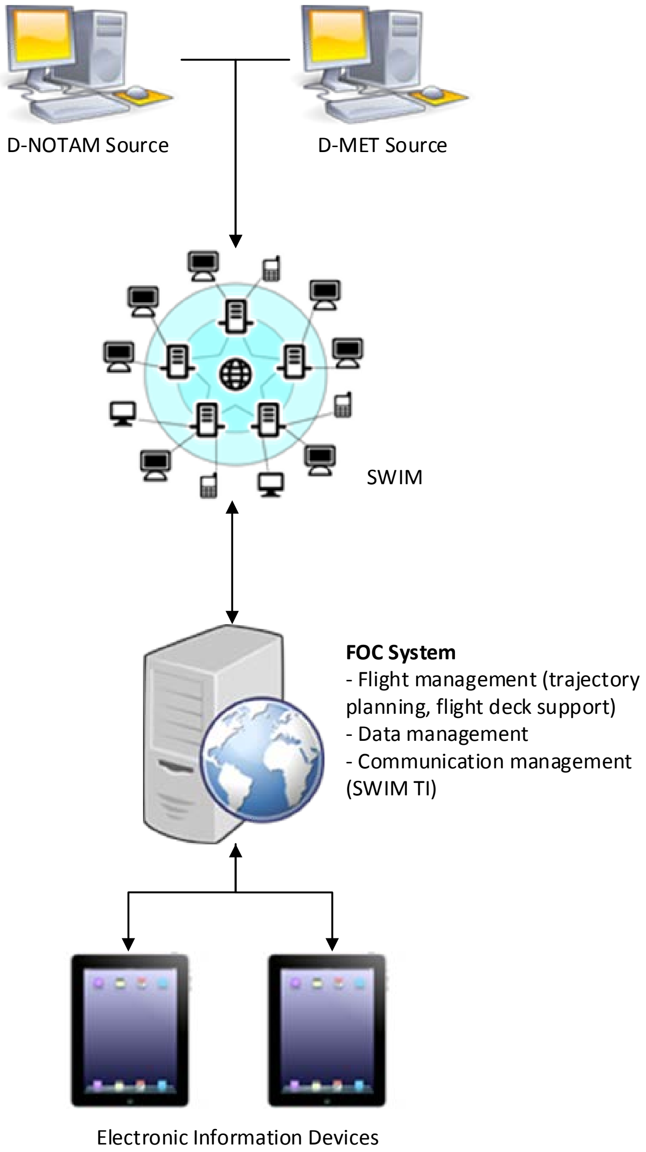


Figure 11: Basic scheme of modules allowing distribution of AIM/MET data via SWIM

3.2.4 Airspace Management and Advanced Flexible Use of Airspace

To ensure safe and efficient flight operation in an environment with increasing complexity it is essential to improve the use of airspace. Although the evolution to trajectory management leads to flight trajectories with a significantly higher accuracy, there will still remain the need of airspace reservation for certain types of flight operation due to safety reasons. To achieve more benefit regarding the use of airspace, improvements have to take place in the long term and medium term planning phase where early flight intents are already known and can be considered when requesting airspace. Airspace Management will elaborate the Airspace Configuration in a continuous process allocating the airspaces in regards to the requirements of airspace users.

In Step 1 the new operating method in SESAR bases on the automated exchange of airspace management data (AOM-0202-A). As before, The FOC system will be able to consider ARES (CBA, CBO) automatically for Flight Planning ensuring, that flights are not planned through an activated ARES. However, now the FOC system is capable of receiving and processing the real-time airspace status information automatically (e.g. via B2B services). It also needs to continuously monitor the release of real time airspace availability information by NM. The information given might support decision making during the flight planning process (both in the planning and in the execution phase) and, subsequently, the trajectories (SBTs/RBTs) can be adapted accordingly. The data can also initiate additional coordination and communication with concerned ATM stakeholders outside the user's organization. From an FOC point of view it is important that the given timeframe to update affected trajectories will still be manageable by the Airspace Users. Furthermore, the VPA design principle is introduced allowing a modular design of ARES (AOM-206-A). This leads to higher benefits for the airspace user but does not constitute a change in the FOC operating method.

Step 2 is introducing new elements supporting the process and a more effective sharing of airspace between all stakeholders. The shared use of military training areas is now extended to be used on Europe-wide scale (AOM-0204). While this does not lead to a change in the FOC operating method, it does allow for higher benefits for the airspace user. This also holds true for the application of the Variable Profile Area (VPA) design principle to Cross Border Operation (CBO) and Cross Border Activities (CBA). The modular composition of these airspaces allows a sizing according to the actual needs of the requestor. In step 2 also Dynamic Mobile Areas (DMA) of type 1 and 2 (AOM-0208-B) need to be considered in flight planning. DMA Type1 minimizes the impact to other traffic due to a short transit time between the ARES and the aerodrome of destination. DMAs Type2 are defined along a trajectory and, therefore, limit the impact on the network due to their variable geographic location. In opposition to the VPAs, which contribute to efficient management of airspace reservation due to their modularity, the DMAs are designed more dynamically and allow keeping the exclusion time of the airspace reservation to a minimum. However, the exact consideration of these Dynamic Mobile Areas in flight planning shall be done by the FOC based on a what-if assessment (see the Business Trajectory (including Trajectory Management Framework sections). Finally in Step 2, changes to the agreed airspace configuration will be directly provided to the flight crew in the aircraft (e.g. via data link) (AOM-0206-B). This also includes the possibility to uplink new trajectories taken into account these changes. For the FOC, this means that it must monitor the evolvement of the trajectory and of related operational constraints throughout all phases of a flight. Furthermore, it must assess the effect of RTSA-induced deviations from previous planning in terms of safety and mission costs. Based on that, the FOC must plan a new trajectory and, subsequently, update and support the flight crews during all phases of a flight. It is to note, that a safety issue has to be considered here. Long haul flights could be affected by a deviation from the agreed airspace configuration, when they are already in flight execution phase. In these cases the flight-planning window has been already closed while the airspace-planning window is still open. If such a deviation leads to a flight disruption resulting in higher fuel consumption this should be further investigated under safety aspects.

3.2.5 User Driven Prioritization Process

UDPP is fundamental shift allowing the AUs to influence the priority and sequence of flights in a schedule-disruptive Capacity Constrained Situation by adapting the relative and absolute priority of their flights involved in a given Capacity Constrained Situation (CCS) according to their business needs. The AU-adjusted priority of these flights will be taken into account in Demand Capacity Balancing processes. Both in situations of manageable delay as well as in situations of significant capacity constraints, i.e., where demand has to be reduced to balance capacity, the adjusted priority of flights will minimise the delay of highly (cost) critical flights by re-distributing delay between all flights for a specific AU. As a consequence the re-distribution of the delay will minimize the overall cost impact of the CCS for a specific AU.

During UDPP prioritisation, the participating AUs will have the capability to manage its own flights within a published hotspot through defined UDPP rules. The output of the UDPP AU prioritisation does not impact the Hotspot itself (same duration) and the list of flights remain the same inside the Hotspot, only a rearrangement of the sequence of the flight list will be performed according to priorities and equity rules.

UDPP (Step 2) has developed 2 mechanisms for the AU to prioritise its flights:

Fleet Delay Apportionment (FDA)
FDA can be utilised by the AU during either the long-term or short-term planning phase to prioritise all flights relative to one another in the AUs flights schedule. The collaborative Demand Capacity Balancing processes take this relative prioritisation into account when recalculating a revised flight list for flights in a manageable or severely Capacity Constrained Situation. With FDA, delay is apportioned according to relative priority, so high FDA value consequentially results in higher delays.

Selective Flight Prioritisation (SFP):
SFP can be utilised in the short-term planning phase for flight prioritisation. When a Capacity Constrained Situation becomes known through publication and the AU has assessed the impact on its flights schedule the AU can reprioritise its flights by giving schedule-critical flights sufficient credit to operate as close as possible to original schedule.
These Operating Credits represent an AU-unique value that can be used to increase flight priority and thus reduce delay for selected flights. The AU-effort to obtain Operating Credits will consist of delaying less important flights to the end of the Hotspot -this may ultimately lead the AU to cancel some of those flights depending on the operational situation.

Detailed description of the FDA and SFP processes including formulas and equity rules are described in section 3.2 of the 07.06.02 Final FOC Step 1 and Step 2, as available, OSED – D79

3.3 Differences between new and previous Operating Methods

3.3.1 Business and Mission Trajectory (including Trajectory Management Framework)

The main difference between SESAR step 1 and the previous operating method is the improved availability and quality of information that is exchanged especially between the airspace user and the NM. The first big improvement is the introduction of the extended flight plan that will extend the information that was previously exchanged with the ICAO flight plan. The main extensions are the exchange of the 4D trajectory as planned by the airspace user as well as flight specific performance data that can be added to the EFPL, which is optional information. This will align the view onto the planned trajectory between the airspace user and the ATM stakeholders and will lead to a more accurate planning and collaboration of all actors.

On the other side the ATM stakeholder will provide more detailed information on the availability of airspaces, by the provision of real time ASM data. In addition the concept of using CTOTs in case that a flight has to be delayed at any point of the trajectory will be replaced by a more transparent procedure called the most penalizing delay concept. With this concept NM will inform the AU about the location and extent of the most penalizing delay. The AU can now find the optimal way to avoid or consider such delay.

All this information is now exchanged among all concerned stakeholders and will – through an alignment of all network and trajectory information – allow collaboration between all actors. This will lead in the first implementation of the SBT (as iSBT) and the RBT (iRBT) that will represent a first implementation of a commonly shared, used and agreed trajectory that will be the reference of the flight.

With SESAR Step 2 the SBT and RBT concept will be implemented in completeness that means that trajectory are shared, negotiated and agreed on the level of 4D trajectories (not only routings and single targets). This will also include the definition of dynamic flow constraints by NM that consider the anticipated traffic demand that results on already provided SBT Flight Intent and SBT Trajectory information. The resulting trajectory will now be used as reference for all stakeholders. A change of this RBT will require an RBT revision among all concerned stakeholders what will ensure the stability of the whole traffic flow and will allow to reduce ATM buffers what might allow to plan and fly more efficient trajectories. The efficiency of the business trajectory will now also benefit from the fact that free route will be the standard for flight planning, extended to all complexity types of airspaces and aligned among all ANSPs in a way that negative impact on the flight cost efficiency, caused by e.g. airspace entry and exit procedures, is minimized to the lowest possible level.

The airspace user will have the opportunity to optimize the business trajectory throughout the whole lifecycle of the flight. That means that the airspace user can fully participate in the RBT revision process and even trigger the RBT revision process.

The assignment of flow constraints can now be influenced by the airspace user while joining the collaborative decision making/ what-if assessment process that allows the AU to assess the impact of a potential hotspot onto its flight operation. The AU will now have the opportunity to avoid or minimize the impact of constraints by assessing the effect of different flight priorities (see UDPP) or different trajectories without the risk that a formerly agreed trajectory is suspend or replaced by inefficient trajectory.

3.3.2 Free Route

Free Routing through either the use of Direct Routing or Free Routing is already in use in Europe today. Therefore, for Step 1 there is no change in the operating method, except for the fact, that both concepts are now deployed more widespread, thus, enabling the benefits for the airspace users through more optimized trajectories provided planned by the FOC. In Step 2, the major change will be that Free Route will be available everywhere in Europe (above a certain flight level), which will enable maximum benefits for the airspace user. However, unless new traffic management concepts are introduced here that need to be respected by the FOC in flight planning, there will be again no noteworthy change in the operating method.

3.3.3 Aeronautical Information Management (AIM) / METeorology

Some difference between the traditional pre-flight briefing services/applications and the new Digital Integrated Briefing system have been already highlighted in the previous section 3.2. The most important operational differences are discussed in this section

3.3.3.1 Improved data quality

Thanks to the inherent automatic processing, the information contained in a digital NOTAM is much more suitable for automatic checks (automatic data validation, automated cross-checking with other data sources), which can ensure better compliance with ICAO standards and recommended practices and improved coherence and correctness.

The implementation of AIXM format for AIS static data and WXXM for MET data allows machine readable information processing and facilitates data verification.

The previous operating method focused on the pre-flight briefing was enabled by usage of Ground/Ground information exchange. The key enabler for SESAR Step 1 was the introduction of Initial Ground-Ground System Wide Information Management (SWIM) allowing standardized information exchange with equal quality of data from all concerned stakeholders.

In SESAR Step 2 the new concept of in-flight updates has been introduced, thus allowing the instant access to AIS/MET information via on-board Electronic Information Devices (EID). Data link standards for the AIS/MET in-flight information exchange are subject of standardization groups, such as RTCA/EUROCAE.

3.3.3.2 Improved information selection and prioritization

PIB is typically in the range of 30-80 pages for a cross-European flight. Between 40% and sometimes up to 90% of the information provided has no direct impact on the flights provided. Due to the size of the documents provided the probability of pilots not being aware of important and pertinent information is increasing. Digital NOTAM and digital MET information are expected to significantly improve the data selection possibilities, so that only the really relevant NOTAM and MET information are presented to the pilot. Digital data enables data selection based on the properties of the feature affected and the exact condition. Filtering capabilities allow to hide irrelevant information from the PIB and to provide a briefing bulletin directly tailored to the "users" needs.

Note: Regulatory authority may require the capability to disable the filtering criteria.

3.3.3.3 Improved information presentation

Digital NOTAM and digital MET data are expected to radically improve the way that the information is presented to the end user, in particular by providing a graphical way for information visualization. The saying that "a picture is worth a thousand words", rarely applies as well as it does for pre-flight briefing. New briefing systems will have to be based on the visualization of information and the fusing of different sources of information. It will allow the users to identify immediately location and impact of the information provided.

3.3.3.4 Reduced briefing effort and time for Airspace Users

Currently, the aeronautical information comes through various channels (AIS documents and NOTAM and MET information). During the flight preparation phase and during the pre-flight briefing, airspace users have to integrate all information available into a consolidated operational picture. This requires time and effort. For flight crew the provided information has to cover all potential circumstances and possible irregularities, therefore might be too complex and time consuming.

Fully Digital NOTAM / MET data will deliver an integrated view, presenting the actual situation of the operational environment, tailored to the needs of the individual airspace user. Graphical presentation, in the form of maps and charts, will facilitate the understanding of this integrated picture, reducing the time and effort spent by the airspace users in the briefing phase.

3.3.3.5 Situational awareness benefits

Significant positive impact to human performance factors as described in the sections above and demonstrated during a validation exercise driven will deliver situational awareness benefits. Especially reduction in size enhanced with visualization of the information will significantly support pilots fulfilling pre-departure tasks under enormous time pressure.

The capabilities of in-flight updates of will enable the pilot to take better tactical decisions with regard to the trajectory ahead. This is particularly important for long inter-continental flights that pass through the Intertropical convergence zone (ITCZ) or other areas with potential for rapid changes in the MET situation. This shall reduce the number of situations where the aircraft is confronted with dangerous weather conditions that might affect the situational awareness of the flight or the comfort of the passengers.

The capability to extend the available briefing package by additional airports with the required NOTAM and MET information will deliver significant situational awareness benefits allowing much better operational decisions not limited to the information available.

3.3.4 Airspace Management and Advanced Flexible Use of Airspace

In SESAR Step 1 the main difference is that the airspace management data is now automatically exchanged among the stakeholders. This information can be used by the FOC for efficient flight planning (including inflight trajectory amendment using the real time status of airspace). Furthermore, the VPA design principle is introduced allowing a modular design of ARES. In comparison with SESAR Step 1, the concept sees further improvement in SESAR Step 2: The shared use of military areas is now in use on a Europe-wide scale and also the VPA design principle is applied to Cross Border Operation and Cross Border activities. These two improvements lead to no change in the operating method, but allow for more beneficial trajectories. The Dynamic Mobile Areas introduced in SESAR Step 2 will be considered in flight planning by the FOC through a what-if assessment. The uplink of changes in the airspace configuration to the aircraft also includes the possibility to uplink new trajectories taken into account these changes, which will require the FOC to constantly monitor the flight, assess the effect of the changes and, finally, generate a new trajectory and provide support to the flight crew.

3.3.5 User Driven Prioritization Process

The table below describes the differences imposed by UDPP processes compared to the current operating methods.

OFA	Previous Operating Methods (capabilities / procedures)	New Operating Methods (capabilities / procedures)
UDPP	Delays are imposed to AU`s in order to manage limited capacity during a CCS. AU´s have only limited non formalized input into this process.	Standardized procedures allowing the AU`s to actively participate in the management of limited capacity during a CCS. UDPP processes are built on a user friendly and efficient automated constant dialogue between all stakeholders involved in the process of updating SBT/RBTs based on the rules defined by UDPP, to take reprioritisation and subsequent re-sequencing into account. Re-prioritization by AU`s helps to reduce delay on important flights and will have deliver significant cost savings to participating AU`s.

3.3.6 SWIM

WP 11.01 will contribute to, and benefit from, the development of SWIM defining Information Services that will enable end users to exchange information with the systems it is developing, including the Digital NOTAM and Digital Briefing applications. The idea is that Digital NOTAM originators, providers and Service providers, regardless of whether they are completely separate systems at different sites, or co-located, will be able to use these services to request the Digital NOTAM application to provide or process Digital NOTAM data as required.

Similarly, pilots, dispatchers, and ATM operators will be able to access services provided by the Digital Briefing application to retrieve briefings and flight updates, or to upload reporting information.

As a consequence in the process and services, the European NOTAM/Briefing data chain is extended with the role of other ATM data providers. It defines organisations/systems that through SWIM make available the reference data that is necessary for the encoding and verification of Digital NOTAM as well as the complementary ATM data necessary for the provision of Digital Briefing services.

4 Detailed Operational Environment

4.1 Operational Characteristics

This section will give a summary of the operational environment including all stakeholders. It is described in detail in the DOD D11.1.1-1.

4.1.1 Types of airspace users

4.1.1.1 Civil airspace users

4.1.1.1.1 Types of civil airspace user operations

Civil airspace users are those that operate under the conditions defined by the International Civil Aviation Organization (ICAO). The airspace user operations of those ICAO compliant airspace users can be further separated into

- Commercial aviation; and
- General (private) aviation,

while commercial aviation can be separated into

- Scheduled flight operations; and
- Non-scheduled flight operations.

From this structure three main types of civil airspace user operations can be deducted:

1. Commercial airspace user operation that provides scheduled air transportation services for passengers, mail or freight, like passenger airlines and cargo airlines. Flights that correspond to this group are – in the majority of cases – known well in advance to the flight execution (scheduled).
2. Commercial airspace user operation that provides non-scheduled air transportation services for passengers, mail or freight, or air services with commercial purposes, other than transportation, like measuring or observation flights. Commercial non-scheduled flight operation is conducted by business aviation carriers, taxi or shuttling flight providers etc. Flights that correspond to this group are – in the majority of cases – only known short before the flight execution.
3. General or private airspace user operation that solely provides non-commercial flights. General or private airspace user operation is solely performed by private persons or non-commercial entities. Flights that correspond to this group are – in the majority of cases – only known short before the flight execution.

4.1.1.1.2 Structure of civil airspace user operations

The civil airspace user can be structured into two sub-elements that are required to describe the whole scope of airspace user activities. This separation also serves a more efficient implementation approach that tries to avoid additional effort and costs caused by system certifications. This additional effort refers mainly to the certification of aircraft and their equipment. Therefore a separation into

- Civil AU operations support and
- Civil AU flight deck management.

The *civil AU operations support* groups all activities that are required to ensure a safe and cost efficient airspace user and flight operations; excluding all activities that relate directly to the conduction of the flight, meaning the activities of the flight crew directly related to flying the aircraft, including flight navigation, radio communication and aircraft systems monitoring.
The *civil AU flight deck management* groups all activities that directly relate to the conduction of the flight as flying the aircraft, flight navigation, radio communication and aircraft systems monitoring.

Business Trajectory (including Trajectory Management Framework) specific aspects

Airspace User Characteristics

OPERATIONS CHARACTERISTICS[12]

Airspace User can be characterized by the type of their operations. The AU in scope of this document can be divided into

- Scheduled Airlines
- Business Aviation
- General Aviation

In principle all these types of AU are performing the same processes, but mostly in different time windows. That means all AU are gathering Business Development Scenario will create a certain kind of schedule information (maybe not a full schedule in every case) and will create a Business Trajectory that will be published in the NOP and later agreed with all ATM stakeholders to get the RBT. What is different for the different types of AU is the time window when the single information; especially the Business Development Scenario reaches a maturity that it is sufficient to create subsequent information as schedule and BT information.

Implementation of Flight Operation Centre System

Not every AU might operate a *full scope* FOC system in their organization due to business or cost reasons. Nevertheless most processes defined in the scope of the SESAR project will request for an extended support of the flight operations by technical systems. Especially BA and GA as well as small airlines might not be able to operate an FOC system.

For those AU 3rd party FOC service provider will deliver essential functionalities that are needed to support the Trajectory Management processes. In such a case a central FOC system will provide services that can be accessed by several AUs. It is not in scope of the document - respectively the SESAR project - to describe the services and system structure of such a 3rd party FOC system, as the implementation of such a system will be done on an individual basis. This document will only describe typical specifications and properties of AU in regard to the FOC integration.

Despite this all requirements specified within the SESAR documents must be fulfilled all types of FOC systems.

There are in principle two possible types of FOC system operation:

- The AU operates the FOC trajectory system on its own
- The AU is accessing an FOC system operated by a third party service provider

In both cases the provider of the FOC system might provide basic data (as navigational data), the data structure, business logic, interfaces to 3rd party systems (e.g. to IFPS) and user interfaces. Despite this (depending on the type of FOC operations) the AU might have the capabilities to directly maintain and manipulate operational data (related to his business).

The connection to the ATM world might be established in different ways. The first option (as for the AU operated FOC system) might be a direct connection of the FOC service system with the ATM world. The second option is that the FOC service system is returning the requested information back to the AU. In such a case the AU has to establish the connection to the ATM world.

The following descriptions have reference to the full FOC or single functionalities that can be grouped as FOC functionalities. That means that the configurations described below can be a configuration of a single service or the whole FOC.

AU OPERATED FOC SYSTEM

In this configuration the basic FOC system will be provided by the system manufacturer (regardless whether the AU developed the system internally or not) including technical and data support. The server on which the FOC applications are running might be located in the facilities of the AU or in a datacentre operated by the FOC manufacturer/ FOC provider.

12 This document is only referring to civil airspace user. Therefore military airspace user will not be described within this document.

The AU will have direct access to such an FOC system and the possibility to directly influence processes, functions and data. Such a system might lead to more accurate Business Trajectories as the coverage and selection of optimization boundary conditions can be influenced directly by the AU and the FOC will store AU specific data.

The FOC system will in most cases have a direct connection to the ATM world (ATC, NM, NOP etc.)

3RD PARTY OPERATED FOC SYSTEM

In such a case the FOC system will be operated by a service provider which has only a service-based relationship with the respective AU. The AU will only have limited access to the system or contractual limitations that allow only the use of defined services. A direct connection will not be available. The connection is only realised via a communication service.

The AU will only have limited capabilities to influence the processes and data used by the FOC system, depending on the scope and content that is implemented in the user interface. Even if such a system configuration might not be sufficient to satisfy the needs of a big scheduled airline, it might be helpful for GA or BA that just seek for a trajectory or need an EFPL.

The following picture gives an overview in regard to the different configuration for the FOC system/ services. The figure is showing three possible configurations. The respective configurations can be implemented for single FOC services or the full system. Therefore Figure 12 is only showing possible configuration options and not a real implementation.

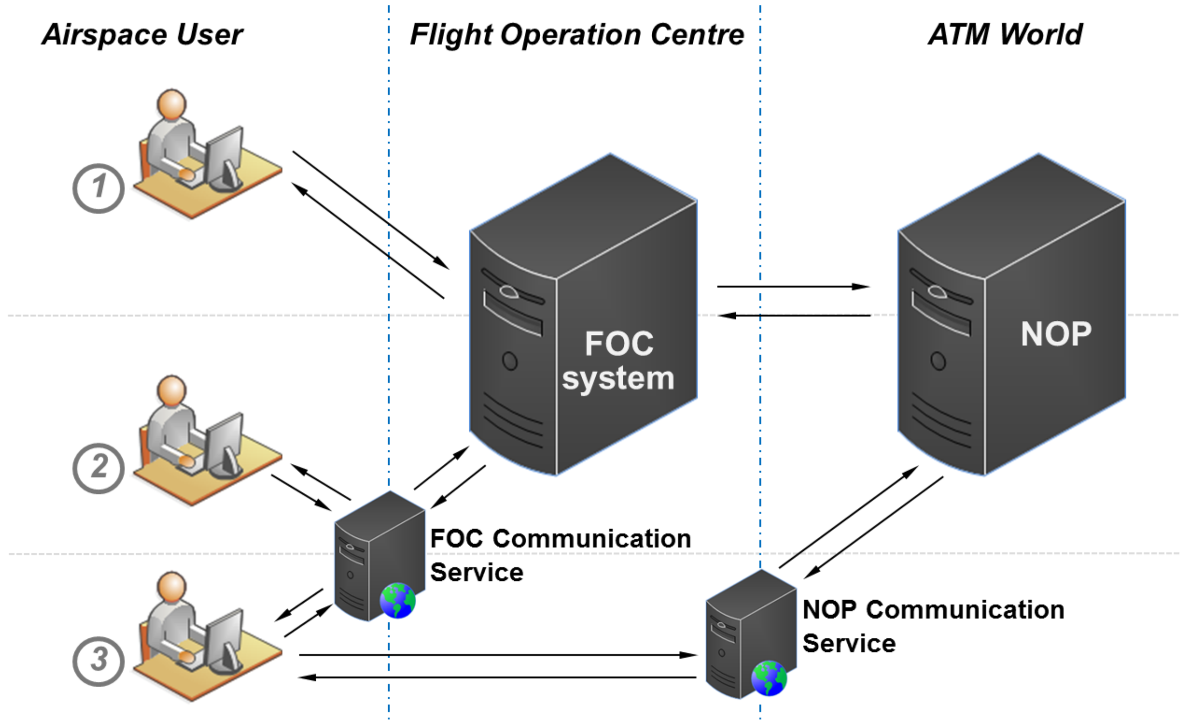


Figure 12: Possible FOC system/ services implementations

Configuration 1 in Figure 12 shows an implementation of a fully integrated FOC system (AU operated FOC system). In this case the AU has direct connection to the FOC system and the FOC system is directly connected to the ATM world/ NOP.

Configuration 2 in Figure 12 shows an implementation of an FOC system/ service that is not fully integrated in the AUs operations (3rd party operated FOC system). In this case the AU has a service based connection to the FOC service system via any kind of communication service (no direct connection). In this case the FOC service system is establishing the communication with the ATM world/ NOP and will return the respective status to the AU. The FOC service system – for example – will generate an EFPL upon request of the AU and will publish it to the NOP. Afterwards the FOC service system will return the status of the EFPL to the AU.

Configuration 3 in Figure 12 shows an implementation of an FOC system/ service that is not fully integrated in the AUs operations (3rd party operated FOC system). In this case the AU has a service based connection to the FOC service system via a communication service (no direct connection). The FOC service system – in this configuration – will not have a direct connection to the ATM world/ NOP. That means that the system will return data to the AU upon request and the AU has to establish the communication of this data to the ATM world/ NOP. The FOC service system – in this case – might provide an EFPL to the AU and the AU will establish the connection to the NOP to publish the EFPL.

Airspace Characteristics

Route System

With SESAR Step 2 the characteristics of the airspace will become more dynamic. As default the airspace will be free of any static route structure. It will be a so-called Free Routing Airspace. In such an airspace only a limited number of waypoints will be defined that might be used to build a trajectory. Despite that there will be the possibility to use self-defined waypoints in the BT. Business Trajectories build to be used in such an airspace will consequently consist of a chain of published and unpublished waypoints that will be connected by directs.

The availability of Free Routing Airspaces will be extended – wherever possible - to a 24/7 schedule. Despite that there will be the possibility for the NM to switch from Free Routing Airspace to Fixed Route airspace.

In Fixed Route airspaces waypoints and connecting route segments will be predefined by the responsible ATSU and the NM. Business Trajectories build to be used within such a Fixed Route airspace will consist of a chain of published and unpublished waypoints along the predefined ATS route system. The use of waypoints that have not been published by the ATSU will be mandatory for the FOC as these points will be needed to create an accurate description of the planned trajectory within the EFPL.

The location and the duration of the respective Free Route/ Fixed Route status will be defined regionally in accordance with the whole ATM network. But this regional fragmentation of the whole ATM network into these two types of airspaces will have effect onto the respective BT as some portions of the BT will traverse Free Routing Airspaces and some portions will traverse Fixed Route airspaces.

Despite this the availability and non-availability of Free Route will depend on time. For that reason it might happen that a Fixed Route airspace will turn into a Free Routing Airspace while the BT is going through it. This must be reflected by the FOC system in the trajectory generating function.

Thanks to the EFPL it will be obvious whether the BT is according to these rules at every routing point.

Constraints

During the generation of the Business Trajectory many different types of constraints must be considered. On the one hand the BT has to comply with target time constraints on the other hand requirements coming from the Advanced Flexible Use of Airspace and the Airspace Management have to be considered. Furthermore there will be Short Term ATFCM Measures that must be taken into consideration when generating a BT.

All these constraints might be defined in the same way, assuming that all these types are 4D constraints. That means that in every case a volume in space (latitude, longitude, altitude dimensions) has to be defined and the time window in which this constraint has to be considered. Despite these 4 dimensions a 5th dimension must be defined that includes an “instruction” linked to the respective volume that must be followed.

The simplest case would be a *closure* of the volume for the respective flight. In such a case the BT would not traverse the defined volume if it would be reached in the time window specified as closed. An example for closed volumes is military areas closed for civil traffic or closed sectors where the traffic-demand exceeds the capacity.

On the other hand the use of such a volume might be *mandatory* for the flight. In such a case the flight would traverse the respective volume if it would be reached in the respective time window[13]. An example for such constraints is the Target Time of Arrival constraint.

Within the defined time windows Business Trajectory will avoid closed volumes in the space and will use the mandatory ones.

Traffic Characteristics

Composition of Traffic

Many airlines are flying not only within the area of responsibility of EUROCONTROL and hence within the ECAC area, they are operating worldwide. For that reason there will be a mixture of traffic between ECAC-domestic and ECAC-international traffic.

ECAC Domestic Traffic

This traffic is departing and arriving within the ECAC area. That means that this traffic will be monitored by all SESAR ATM stakeholders during the whole flight time. An exception in regard to the continuous monitoring will be traffic that is departing and arriving within the ECAC area but will fly a trajectory that is partially leaving the ECAC area. For that reason the ECAC-domestic traffic can be separated into Type 1, where the whole trajectory is located in the ECAC area and Type 2, where the trajectory will partly be located outside the ECAC area. Figure 13 shows Type 1 and Type 2 examples for ECAC Domestic traffic[14].

AU's using the FOC will monitor the evolvement of the flown trajectory for both types of traffic during the whole duration of the flight. All other ATM stakeholder (that might not continuously monitor the evolvement especially for ECAC-Domestic Type 2 traffic) must expect that the FOC might start a trajectory revision process for such a flight regardless whether the aircraft is within the area of responsibility of EUROCONTROL or not.

13 Mandatory constraints, if implemented, must been analysed carefully as "reaching at the specific time window" might be too fuzzy and would not lead to the expected results. The reason behind is that in this case there is no clear definition where to check the time dimension. If linked to the respective volume, it will only be checked if the volume has been "touched". If the volume has not been touched the BT will not use it and never the less be correct.

14 The displayed routes are only exemplary to figure out the differences between the single types of traffic. There is no relationship to any routing used in operations.

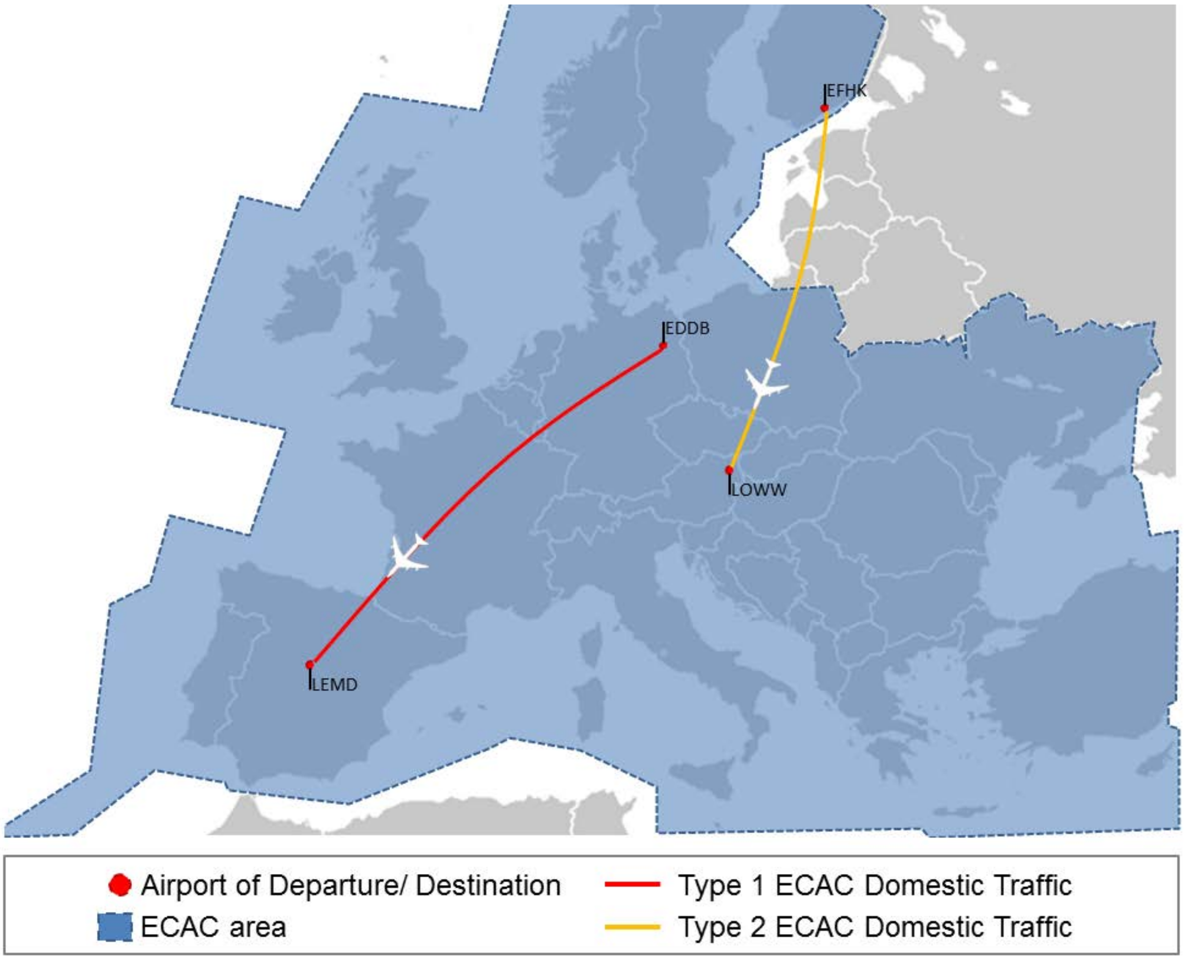


Figure 13: Different Types of ECAC Domestic Traffic.

ECAC International Traffic

This traffic is departing but not arriving respectively arriving but not departing within the ECAC area[15]. This traffic will only partially monitored by all ATM stakeholders within the ECAC area. That means that for the NM and ATC domain the evolvement of those flights will only be monitored as long as the aircraft is within the area of responsibility of the ECAC members. Despite these AUs using the FOC will monitor those flights during the whole duration of the flight.

All other ATM stakeholders have to expect revisions of the trajectory triggered by the AU/ FOC regardless whether respective flight is within the ECAC area at this moment or not. This must be expected for flights to and from airports within the ECAC area that are close to the borders of these areas. If the revision would only be done, in those cases, as long/ soon as the flight is in the area of responsibility of the ECAC, there wouldn't be much time for any ATM measure. Figure 14 shows Type 1 and Type 2 ECAC-domestic trajectories[16].

[15] Traffic that is neither departing nor arriving in the ECAC area is out of scope of this specification.

[16] The displayed routes are only exemplary to figure out the differences between the single types of traffic. There is no relationship to any routing used in operations.

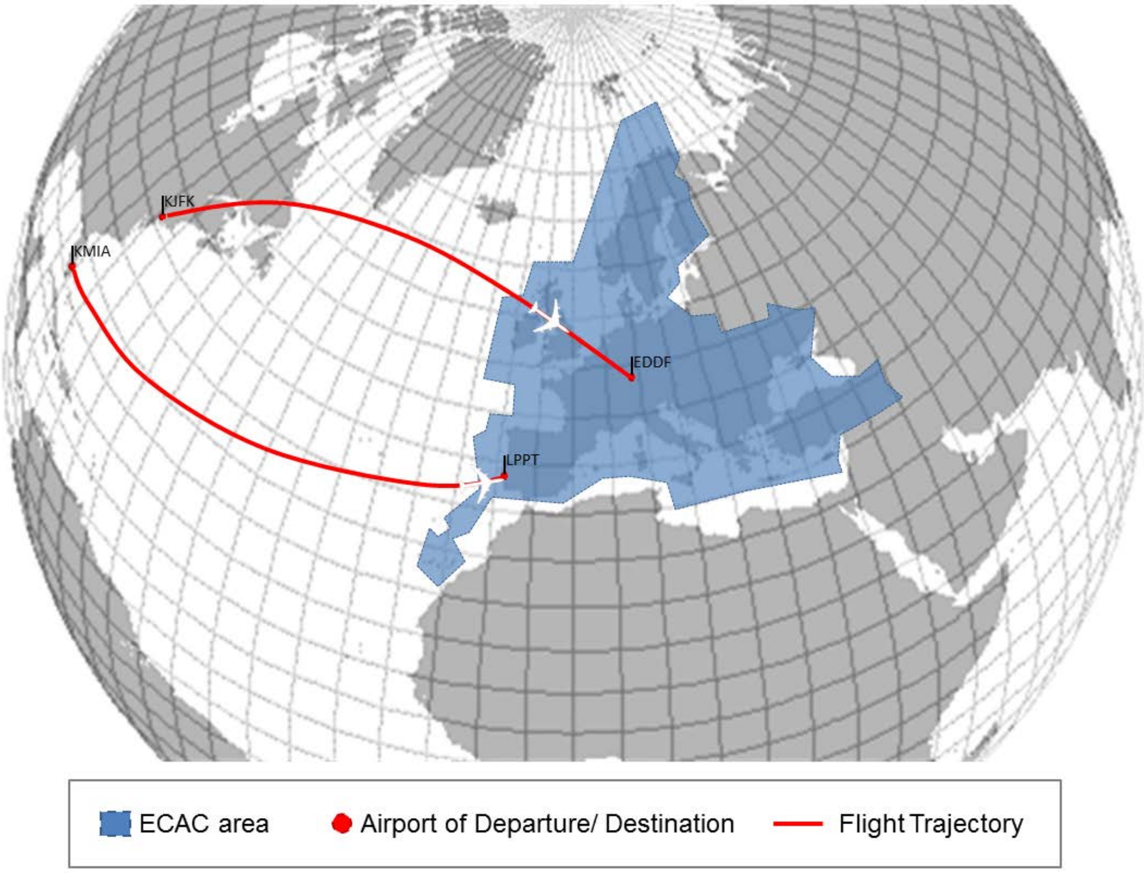


Figure 14: Different Types of ECAC International Traffic.

If a new BT is generated for those ECAC International flights local agreements and regulation of the non-ECAC states must be taken into consideration to guarantee a safe and orderly flight operation.

Duration of flights

Depending on the city pair the flight duration will vary significantly from some minutes up to several hours of flight time within the ECAC area. This is limiting for some flights the capability for an RBT revision process. For that reason there might be flights for which the AU is delegating the RBT management to the FC that might only ask for ground support.

For other flights, that last several hours, there might be the time for a RBT revision process between all ATM stakeholders. The AU might insist on involving the FOC in the RBT revision process.

Regardless whether the RBT revision is delegated to the FC or also performed by the FOC, all changes of the Operational/ Business Scenario (especially changed constraints, ATM measures etc.) and the resulting/ changed trajectories must be provided to FC and FOC. This is especially needed to ensure that FC and the FOC have every time the same view on the operations.

Deviating from this definition their might be cases where the time window that is available to react on any change of the Operational/ Business Scenario is very small. In those cases a negotiation of the BT including all ATM stakeholders might not be possible. Nevertheless the result of any revision must be shared with all ATM stakeholders concerned.

Aeronautical Information Management (AIM) / METeorology specific aspects

Airspace User Characteristics

As the knowledge of all relevant information including AIM/MET information during flight planning phase, and in pre-flight phase is one of the essential regulatory requirements, is the access to the AIM/MET data for each AU basic enabler for flight execution.

Availability of updated AIM/MET data during the flight influences not only the safety but also the efficiency of each flight. In-flight update of AIM/MET data is based on A/G connectivity of AU to the FOC system. AU without A/G connectivity will be not able to have access to AIM/MET data during each phase on flight.

Each AU has to have the access to the AIM/MET data source, either direct or through FOC systems.

Direct access enables to each AU simple set of valid AIM/MET information for each particular flight.

Access through FOC system offers to each AU not only simple AIM/MET data, but also some additional values, e.g.:

a) filtering of the AIM/MET information according to AU setting
b) update of AIM/MET information in subscribe mode
c) update of AIM/MET information on request
d) display of AIM/MET information in user friendly format
e) processing AIM/MET information from different sources in one format

AIM / MET DATA PROVIDERS CHARACTERISTICS

AIM/MET data providers can be divided into following categories:

a) AIM/MET data provider with AIM/MET data in AIXM/WXXM / WXXM format

   These AIM/MET data providers generate the AIM/MET data in AIXM/WXXM / WXXM machine readable formats.

b) AIM/MET data provider with AIM/MET data in current format

   These AIM/MET data providers generate the AIM/MET data in current formats as defined by ICAO Annex 15.

Each AU has to be able to process AIM/MET data from those sources in which area expect the operation. In case the flight operation is executed in area where the AIM/MET data are published only in old formats, FOC systems has to be able to transform them to new AIXM/WXXMWXXM format.

AIM/MET data can be provided also by authorised 3rd party. These 3rd party AIM/MET data / METdata providers consolidate AIM/MET data from each national AIM/MET data providers. Usually these providers also transform the AIM/MET data to AIXM/WIXM/FIXM formats.

User Driven Prioritization Process specific aspects

The UDPP concept is embedded within the broader DCB and dDCB processes and fully relying on trajectory management aspects.
Key characteristics from an FOC point of view is that the UDPP concept enables AU`s to prioritise flights subjected to a constraint and to trigger the opportunity to introduce flight prioritisation and/or trade-off between flexibility and predictability in the operations. With the UDPP process integrated in the FOC function, the AU gets a "one stop shop" to:

- *Identify the problem*
- *Analyze its impact (cost and delay) to the operation*
- *Re-arrange the schedule by entering preferences and priorities into the system*

4.2 Roles and responsibilities

The following chapters list the airspace user roles that belong to the airspace user operations. These roles are structured by civil and military stakeholders. For all user roles the respective responsibilities are defined referring to the activities these user roles support. An individual person acting for an airspace user can fulfill one or several of the listed roles (if applicable). This depends on the complexity and size of the airspace user operations.

4.2.1 Civil AU operations support[17]

4.2.1.1 Business Operations Centre

Role	Responsibility
Business Planner	The business planner is responsible for the definition of the business plan that includes – on the one hand – the business goals and identifies business opportunities and defines measures to reach them. This includes the definition of areas of operation, the transport service provided to the markets and KPIs used to track the business goal attainment.
Route Network Manager	Based on the business plan the route network manager defines the city pairs that shall be operated and the frequency of legs on the city pairs. This also includes the management of transit and traffic rights and the negotiation of adequate airport slots. Furthermore this might include a quantification of number and trasnport service per flight leg.
Pricing & Inventory Manager	The pricing & inventory manager assesses and specifies the classes of carriage (e.g. Economy class; business class etc.) and analyses which range of prices can potentially be applied to them. This focuses on the development of products – in the sense of transport service – that can be offered to the end customers. This also includes the assessment and definition of the quantity of transport services per class of carriage.
Revenue & Yield Manager	The revenue & yield manager optimizes the offered transport services in a way that the highest revenue possible is achieved by the airspace user operations. This includes the definition of booking classes for the different classes of carriage and allocation of a certain quantity of the transport service to such booking class. The revenue & yield manager also defines a scheme that regulates the availability of transport service for a respective booking class.

[17] The user roles and related responsibilities have been agreed by the Aus with this document and should be adopted into superior documents (e.g. Concept of Operations) to ensure consistency among the documents and within the processes by those superior documents.

Role	Responsibility
Accounting Officer	The accounting officer is responsible for invoicing of services provided by the airspace user as well as checking all invoices provided to the airspace users. This includes the review of invoices related to ATC and airport charges, fuel etc.
Data Analyst	The data analyst is responsible for inspecting, cleaning, transforming and modeling of all data that relates to the airspace user operations. The data analyst provides data that is used for all strategic planning activities, based on data that is available in the post operations phases.
Disruption & Recovery Manager	The disruption & recovery manager ensures stable airspace user operations and defines measures that shall be applied in case if the airspace user operation is endangered to come to a halt. In case the airspace user operations comes to a halt the disruption & recovery manager initiates actions that are appropriate to return to a stable airspace user operations.

4.2.1.2 Flight Operations Centre

Role	Responsibility
Flight Dispatcher	The flight dispatcher is responsible for the planning of an individual flight by assessing of all boundary conditions (e.g. meteorological conditions, regulations, NOTAMs etc.) that impact the flight execution. The flight dispatcher plans the trajectory of the flight in accordance to all requirements for an orderly and safe flight on the one hand and in accordance with the business goals of the airspace user on the other hand. Furthermore the flight dispatcher provides all briefing information to the flight crew (Operational Flight Plan). During flight execution the flight dispatcher performs flight planning support and inflight briefing to support the flight crews' decision making.
Flight Monitoring Officer	The flight monitoring officer monitors the progress of the flight and compares it with the planned values. This concerns the monitoring of all boundary conditions of a flight (e.g. meteorological conditions; regulations, NOTAMs etc.) as well as the monitoring of the aircraft trajectory and the planned trajectory. In any case the flight monitoring officer assesses whether any change of the boundary conditions as well as deviations from the planned trajectories have positive or negative impact onto the flight (in regard to an orderly and safe as well as cost efficient operations). If required the flight monitoring officer triggers the re-planning of a flight.
Flight Schedule Planner	The flight schedule planner defines the schedule of flights of the season as well as the day of operations including the relations between the different flights based on the business strategy and on management objectives of the airspace user as well as aircraft, flight crew resources and available slots. If required the flight schedule manager re-plans the flight schedule if required to recover any deviation from the flight schedule or when the planned flight schedule becomes not feasible anymore (e.g. in case of degraded meteorological conditions).

Role	Responsibility
Flight Schedule Monitoring Officer	The flight schedule monitoring officer monitors the processing of the scheduled flights and triggers a re-planning of the schedule if any changing boundary condition (e.g. meteorological conditions) have any impact onto the schedule or if a deviation from the planned schedule occurs or is about to occur. This also includes an assessment of the impact of any change of the boundary conditions as well as schedule deviation to identify opportunities and risks and the initiation of adequate actions to make use of opportunities or reduce negative impact.
Operations Control Officer	The operations control officer monitors the whole flight operations at the day of operations and assesses the impact of any deviation within the flight schedule; deviations during the execution of individual flights or the impact of changing boundary conditions onto the flight operations. This especially includes the assessment whether any deviation of individual flights has impact to other flights. This also includes securing safe and orderly flight operations in accordance with the business goals of the airspace user.
Decision Support Officer	The decission support officer is the liasison between the flight operations and all internal and external partners that have impact on a flight. The decission support manager is especially responsible for the collaborative decision making. Furthermore the decision support officer supports the the disruption & recovery manager in case of any collapse or potential collapse of the airspace user operations and contributes to a fast recovery from such situations.
Load Controller	The load controller is responsible for the correct loading of the aircraft in the sence of weight & balance assessment. The load controller provides the flight deck crew with the load and trim sheet.
Data Maintenance Officer	The data maintenance officer is responsible to update all data that impacts the flight operations. The data maintenance officers work especially includes gathering, analysis and provision of the data to the flight management. This especially includes the maintenance of aeronautical, constraint, meteorological, airline and aircraft data etc.
System Administrator	The system administrator manages all technical facilities used by the airspace user including all technical interfaces between internal and external systems.

4.2.1.3 Crew Operations Centre

Role	Responsibility
Crew Planner	The crew planner forecasts and plans the crews required for an ongoing flight operations. This also includes the assessment of needs and the organization and scheduling of adequate qualification and licensing measures for individual crew members.
Crew Disposal Officer	The crew disposal officer allocates crews to the respective flights under consideration of required periods of rest and ensures that always the required crews are available for the conduction of every flight.

4.2.1.4 Aircraft Operations Centre

Role	Responsibility
Aircraft Fleet Planner	The aircraft fleet planner takes care of the strategically fleet planning and the conditioning and commissioning and de-commissioning of the whole fleet of the airspace user. This includes the assessment of potential aircraft fleet composition to best meet the expected business goals and to best provide the planned transport service.
Aircraft Disposal Officer	The aircraft disposal officer allocates the available aircrafts to the respective flights under consideration of the required transport service and ensures that always the required aircrafts are available for the conduction of every flight.
Aircraft MRO Manager	The aircraft MRO manager is responsible for the operational readiness of every aircraft by tracking and scheduling the required maintenance activities for every aircraft and managing the repair and overhaul of any aircraft.
Aircraft Information Officer	The aircraft information officer is responsible for the maintenance of all information that relates to an aircraft and its capabilities (e.g. performance, equipment). This also includes the maintenance of the Aircraft Operating Manual (AOM).

4.2.1.5 Airport Operations Centre

Role	Responsibility
Airport Resource Manager	The airport resource manager is responsible for the assessment and organization of all airport related resources that are required to perform the aircraft turnaround at any airport. The airport resource manager is the liaison between the airspace user and the airport operator in regard to a collaborated forecast and planning of required ground facilities and services.
Airline Station Manager	The airline station manager is responsible for planning and tracking of planned task related to the aircraft turnaround. The airline station manager monitors whether all turnaround milestones are achieved in time and initiates actions in case of any deviation.
Ground Service Support Officer	The ground service support officer is responsible for the supervision and organization of individual turnaround tasks. The ground service support manager ensures that all ground services are performed in time and all milestones related to the aircraft turnaround are not endangered to be missed.

4.2.1.6 Passenger Operations Centre

Role	Responsibility
Passenger Booking Manager	The passenger booking manager keeps track of the status of all passenger bookings and reservations and handles the allocation of passengers to specific flights. This also includes the change of reservations in case if irregularities.
Passenger & Baggage Handling Officer	The passenger & baggage handling officer coordinates the passenger and baggage flow and recovery of any irregularity (as missed connection, re-booking due to flight cancellation, etc.). This also includes activities related to check-in, baggage drop-off and boarding.

4.2.1.7 Cargo Operations Centre

Role	Responsibility
Cargo Booking Manager	The cargo booking manager keeps track of the status of the booking or reservations of freight transport and handles on the other hand the allocation of freight to specific flights.
Cargo Handling Officer	The cargo handling officer coordinates the cargo flow and recovery of any irregularity (as missed connection, re-routing due flight cancellation, etc.).

4.2.2 Civil AU flight deck management

Role	Responsibility
Pilot (in Command)	The pilot designated by the operator, or in the case of general aviation, the owner, as being in command and charged with the safe conduct of a flight. The pilot-in-command of an aircraft is, whether manipulating the controls or not, responsible for the operation of the aircraft in accordance with the rules of the air, except that the pilot-in-command may depart from these rules in circumstances that render such departure absolutely necessary in the interests of safety[18]. Apart from controlling the aircraft a pilot is also responsible for flight navigation, radio communication,aircraft and aircraft systems supervision and flight management. The pilot shall become familiar with all available information appropriate to the intended operations. This includes the careful study of weather forecasts, taking into consideration fuel requirements and an alternative course of action if the flight cannot be complete as planned.[1]

4.3 Service Provider

Service Providers provide a huge variety of services to Airspace Users - from the provision of system support all the way to fully managed dispatch services. In many cases Service Providers act on behalf of the AU for automated flight plan filing, flight operations control, crew management, resolution of operations irregularities, etc.
The following AU roles or even the whole departments can be managed through service providers either through the provision of automated services or through dedicated personnel:

- Flight Operations Centre roles
- Crew Operations Centre roles
- Airport Operations Centre roles
- Passenger Operations Centre roles
- Cargo Operations Centre roles

This delegation of tasks means that in many cases the automated and manual information exchange and communication happens between ATM and Service Provider directly. Recognition and consideration of this fact is important to acquire the required authorizations and access to interfaces (e.g. NM).

[18] Annex 2 to the Convention on International Civil Aviation – Rules of the Air; Tenth Edition July 2005.

A similar shift and delegation of roles happens in the area of aircraft performance data, where aircraft manufacturers will need to grant broader access and usage rights to Service Providers to support the integrated CDM approach that comes with SESAR.

4.4 Constraints

4.4.1 Business Trajectory (including Trajectory Management Framework)

These constraints have been identified in the frame of SESAR 1 programme from FOC perspective. The mitigations will be addressed in the frame of SESAR 2020. These constraints could be considered as guideline to other SESAR projects.

4.4.1.1 Trajectory processing capabilities

Current ground based flight planning systems are forced to significantly reduce the (already available) resolution and accuracy of computed trajectories that are sent to the NM (ICAO FP), ATC (ICAO FP) and the aircraft (ACARS Route Uplink).

Moving to an extended flight plan filing will require an update in the processing systems of the NM, ATC and the aircraft to allow processing of detailed trajectory data.

Especially the domain of the FMS will be a very hard constraint due to the fact that it is not a centralized system but is available in each aircraft.

4.4.1.2 Extended Flight Plan Format

The Extended Flight Plan format as specified is a format only developed for the use within the ECAC area. ATC units outside the ECAC area will/ might not be able to use this data format. For that reason the ATS flight plan must be provided as ICAO Flight Plan only and as Extended Flight Plan in case that the any flight trajectory is planned to be partially located outside the ECAC area.

The format of the EFPL must be aligned replaced by the FF-ICE flight plan (in FIXM format) as soon as it is available.

4.4.1.3 Constraint Data

All constraints provided by ATM stakeholders must be defined in a way that a computer system is able to automatically read and use them. They have to follow a standardized syntax and format that is respected by all ATM stakeholders so that the need of human intervention is reduced to a minimum.

4.4.1.4 Trajectory Management

The Trajectory Management including the BT negotiation process and the RBT revision process is developed for the use within the ECAC area. Outside the ECAC area those terms are not used; respective processes are not implemented. Therefore processes must be defined that consider routing and filing requirements of non-ECAC member states.

Trajectory Negotiation

Constraints and regulations implemented/ used within the ECAC area during the trajectory negotiation must be defined in a way that they do not contradict with regulations given by non-ECAC member states. The AU must have the possibility to – in reasonable cases – *reject* constraints if they contradict with other regulations (that cannot be changed as they are static).

For static restrictions applicable outside the ECAC area the FOC could just file the ATC flight plan to non-ECAC states if the Trajectory Negotiation with all stakeholders within the ECAC states has finished/ when the *agreed SBT* status has been reached.

If any non-ECAC state starts with the use of dynamic constraints; respectively a dynamic BT negotiation process then further coordination with those states must be established to ensure efficient and safe trajectories.

Trajectory Revision Process

A collaborative trajectory revision process is not available outside the ECAC area. That might lead to problems within a dynamic trajectory revision process, as only the trajectory portion that is located within the ECAC area might be available for any change. That will limit or prevent the ATM stakeholders within the ECAC area to perform an efficient trajectory revision process.

4.4.1.5 Trajectory Management Automation

The Trajectory Management as defined by the SESAR project might increase the interactions between the different ATM stakeholders needed per flight from planning via execution till landing. That might increase the workload and increase the efficiency of the ATM stakeholders. Hence the Trajectory Management must be defined in a way that it can be processed automatically by technical systems/ computer systems.

The human actors shall only have a managing role. That means that they monitor the system and only intervene in abnormal cases.

4.4.1.6 Data Exchange between ATM stakeholders

It is foreseen that the data communication will be based on SWIM respectively B2B. This will lead to the issue, especially for long haul flights from or to non-ECAC states that the flight plan filing must be done via several different interfaces. The FOC system must be able to distribute the ATC flight plan and other data via different interfaces.

4.4.2 Free Route

For an FOC it will not be a problem to provide support for operations in a Free Route environment. Though, for fully optimized trajectories in a Free Route environment, advanced flight planning solutions as provided by CFSPs might be necessary.

However, for the realization of any benefit due to Free Route, the Free Route environment must be available to be used by the airspace user. Implementation of Free Route environments across Europe in a strongly limited (with regard to flight planning options) and/or unsynchronized way will constraint the realization of the benefits for the airspace users.

4.4.3 Aeronautical Information Management (AIM) / METeorology

The following chapter is referring to OSED 13.02.02:

By its nature, Digital Information will be successful only if implemented as a global specification. This was always kept in mind during the pre-SESAR phase of the project and has led to the joint development of the Digital NOTAM Event Specification between Eurocontrol and FAA. The concept was presented from the early development stages to ICAO and the provision of digital NOTAM on a global scale was included by ICAO in the “AIS to AIM Transition Roadmap” document.

The requirements list for new AIM systems in Australia, Brazil, South Africa, etc. issued in the last few years, include AIXM 5 and Digital NOTAM. This proves the global interest and it highlights the need for raising the specifications at the level of ICAO Standards and Recommended Practices.

In addition legal constraints need to be taken into consideration as the provision of “digital briefing” comes with the typical legal challenges of using and communication digital data. Currently, the crew brings the pre-flight documents during the flight and in case of incident investigation the commander can show which information they had received. If information updates are communicated digitally, it is important to be able to demonstrate which information was communicated and actually seen by the eyes of the end user. This might include the need to record “acknowledgments” from the end user that a piece of information was seen and understood.

This document does not analyse the legal implications of using digital data for briefing or the “acknowledgement” mechanism mentioned above.

4.4.3.1 Air / Ground connectivity

Air / Ground connectivity is a basic assumption to allow in-flight update of all AIM data. Without A /G connectivity the update of AIM data is limited only to pre-flight phase, which significantly limits the added value of this concept.

Mixed operation of AU with A/G connectivity and without A/G connectivity will lead to the situation that not all AUs will have same information at same time. This situation will increase the workload of ATC systems and voice communication links.

4.4.3.2 Usage of unified Machine readable format for AIM/MET data

Current AIM/MET data are published in non-machine readable formats which does not allow the display of AIM/MET in user friendly manner. Computer processing of digital data is easier than AIM/MET data in old formats.

AIXM/WXXM format for AIM/MET data simplifies also the sharing of the AIM/MET data in flight.

Not all AIM/MET data providers will be providing the AIM data in standard digital formats, due to this fact the FOC systems have to be able to process the AIM/MET data in both formats in the same moment – AIXM/WXXM formats and current ICAO Annex 15 formats or Annex 3 respectively.

4.4.4 Airspace Management and Advanced Flexible Use of Airspace

Following concepts, services and systems are assumed to be in place to enable Airspace User Operation for SESAR Step 2:

1. Airspace Management (ASM) Support System is implemented and interoperable.
2. B2B Services are used from FOC to exchange Information with Network Management Operational Function (NMOF)
3. The model of ARES includes fixed-size areas (e.g. TRA, TSA, D, R) and modular Variable Profile Area (VPA) airspaces.
4. Free Routing Airspace is implemented. Fixed Route Network is limited to exceptional cases (e.g. around airports)

4.4.5 User Driven Prioritization Process

Table 9 UDPP technical/operational constraints below identify the technical/operational constraints that might impact the concept or the solution.

Concept Component	Technical Constraint
Fleet Delay Apportionment (FDA)	Baseline delay must be received by the FOC prior to any prioritisation can be performed in order to change the sequence of individual flights.
Selective Flight Protection (SFP)	An Operationally Derived OI must be calculated and send to the FOC prior to any Operating Credits can be assigned to individual flights in order to protect them.
UDPP Step 2 (FDA and SFP)	Both constraints above need to be satisfied (baseline delay and OI published to the FOC). Airport slot rules are not a constraint for the current UDPP concept, defined in the context of Demand capacity imbalances and ATFM/ATFCM measures. In SESAR2020, if UDPP is extended to non ATFM measures, the interaction between Airport slot rules and UDPP will have to be investigated further.
	Operational Constraint
FDA/SFP	In order to provide cost information and to analyse the impact, all relevant data the AU wants to be taken into account for the cost calculation need to be stored in the FOC.

Table 9 UDPP technical/operational constraints

5 Detailed Operational Scenarios / Use Cases

5.1 Business Trajectory (including Trajectory Management Framework)

5.1.1 Step 1

From an airspace user perspective the operational scenarios related to the Business Trajectory (including Trajectory Management Framework) are not differing from the operational scenarios that have been established before Step 1. Business Trajectories will be planned in the same way based on all available boundary conditions of a certain flight. The only difference relates to the flight plan format. With SESAR step 1 the provision of the Extended Flight Plan will be implemented. This will not change the operational scenarios related to the airspace. This is fully in line with the descriptions made in the document "Step 1 Business trajectory OSED 2015 update" [19] provided by EUROCONTROL.

5.1.2 Step 2 – Publication of SBT Flight Intents

5.1.2.1 General Description of the Scenario

After the airspace user has defined business targets and created a route network this information will be used to planning the flight schedule[19]. The planning of the flight schedule will include the assessing of the need to request airport slots or to agree on a schedule at any of the operated airports[20]. The airspace user will provide the flight schedule to the NM by publishing the data to the NOP. This will be done in the form of a flight schedule[21] that includes all flights of a season.

It is currently not clear how this SBT flight intent information will be processed by NM or how it might be suspended and invalidated. This has to be worked out in the context of SESAR 2020. This also concerns the relation between slot coordination and network management.

5.1.2.2 Use Case Description

Scope

This use case deals with the provision of flight intent data to NM (to the NOP). The data could be provided by e.g. scheduled airlines at the beginning of the medium term planning phase, after the slot coordination has been finished. Other airspace user might only be able to deliver it rather close to the day of flight.

Level

This Use Case is at an operational level enabling the airspace user to provide flight intent data to other ATM stakeholders/ NOP.

[19] This will also include inputs like crew and aircraft availability etc.. These aspects do not directly relate to the FOC and are therefore only used as boundary conditions of the flight.

[20] It has not been clarified how the SBT handling on NM side interacts with the slot coordination that is performed before every season and deals with the allocation of slots or agreement on flight schedules at airports where the demand exceeds the capacity. It is not clear whether the SBT flight intent publication shall also serve the slot coordination.

[21] For scheduled airlines it is not foreseen that SBT flight intents will be published for every individual flight. It is expected that the provision of SBT flight intent data can be done for a specified time period (e.g. season month week) and include several flights within one dataset.

Summary

This use case includes the provision of flight intent data that is published to the NOP as SBT flight intent data if accepted by NM. In case of reject the NM will report the reason (airport slot) which has then to be used by the AU to update the flight intention data of a flight.

Actors

- Airspace User
- Network Manager

Preconditions

Business plan and route network have been planned[22]

Post conditions

NM accepted the flight schedule data provided by the airspace user.

Success end state

SBT flight intent data has been published to the NOP.

Failed end state

SBT flight intent data has not been published to the NOP.

Notes

At this point it is still not clear how NM would respond, on the basis of individual flights or on the whole set of flights that relate to a flight in the schedule. For example, if the AU provides flight intent data for a flight that will be operated on a daily basis. That means the flight intent data represents about 180 flights that will be operated in a season. To avoid misunderstandings on the question whether any of the individual flights is meant or whether all flights of the season are meant we assume that – when providing flight intent data – the NM will respond will relate to all flights of the season.

Trigger

The use case is triggered by the flight schedule planner upon creation of the intended flight schedule.

Main Flow

1. The airspace user creates the flight schedule data,
2. The airspace user provides the flight intentions to the NM/ NOP,
3. The NM/ NOP validates the data and responds the acknowledge of the flight intent data to the AU,
4. The AU updates the flight intent data as published to the NM/ NOP.

Alternate Flow

1. The airspace user creates the flight schedule data,
2. The airspace user provides the flight intentions to the NM/ NOP,
3. The NM/ NOP validates the data but responds a reject of flight intent data, including changed slots to the airspace user.
4. The AU updates the flight schedule data in accordance to the slot information,
5. The airspace user provides the flight intentions to the NM/ NOP,
6. The NM/ NOP validates the data and either responds with a reject of flight intent data, including changed slots to the airspace user and the process returns to step 4, or responds the acknowledge of the flight intent data to the AU.
7. The AU updates the flight intent data as published to the NM/ NOP.

22 The business plan and route network might only include a single flight event within a season that is maybe only operated for non-commercial reasons (e.g. recreation). That means that this precondition could also be applied to general aviation and business aviation, for which there might not be a real business plan (GA) but rather an idea of a intended flight.

Failure Flows

1. The airspace user creates the flight schedule data,
2. The airspace user provides the flight intentions to the NM/ NOP,
3. The NM/ NOP validates the data but responds a reject of flight intent data, including changed slots to the airspace user,
4. The AU updates the flight schedule data in accordance to the slot information,
5. The AU fails to update the flight schedule data and cannot plan the flight.

5.1.3 Step 2 – Update of SBT Flight Intents

5.1.3.1 General Description of the Scenario

After the SBT flight intent data has been published to the NOP the AU wants to change this flight intent data. The airspace user will perform the changes to the flight schedule, create the new flight intent data and will send it as update nm/ NOP. NM/ NOP will assess the data and will either accept the update of the SBT flight intents or will reject the flight intent data including the provision of the responsible reasons. In case of a reject the former SBT flight intents data that is available in the NOP will remain active. Upon the reject the AU can try to adapt the flight schedule and provide the updated flight intent data to NM/ NOP again. This use case can end with an updated of SBT flight intents or without updating the SBT flight intents.

5.1.3.2 Use Case Description

Scope

This use case deals with the update of the SBT flight intent data that is available in the NOP.

Level

This Use Case is at an operational level enabling the airspace user to provide flight intent data to other ATM stakeholders/ NOP.

Summary

This use case includes the update of SBT flight intent data that is already available in the NOP. It includes the cases of several iterations as well as cases were the update of the SBT flight intents fails.

Actors

- Airspace User
- Network Manager

Preconditions

SBT flight intent data is available in the NOP.

Post conditions

NM accepted the updated flight schedule data provided by the airspace user.

Success end state

SBT flight intent data update has been published to the NOP.

Failed end state

SBT flight intent data has not been updated.

Notes

None

Trigger

The use case is triggered by the flight schedule planner upon change of the intended flight schedule.

Main Flow

1. The airspace user creates new flight schedule data,
2. The airspace user updates the flight intentions to the NM/ NOP,
3. The NM/ NOP validates the updated data and responds the acknowledge of the flight intent data update to the AU,
4. The AU updates the flight intent data as published to the NM/ NOP.

Alternate Flow

1. The airspace user creates new flight schedule data,
2. The airspace user updates the flight intentions to the NM/ NOP,
3. The NM/ NOP validates the data but responds a reject of flight intent data, including changed slots to the airspace user.
4. The AU updates the flight schedule data in accordance to the slot information,
5. The airspace user provides the flight intentions update to the NM/ NOP,
6. The NM/ NOP validates the data and either responds with a reject of flight intent data, including changed slots to the airspace user and the process returns to step 4, or responds the acknowledge of the flight intent data to the AU.
7. The AU updates the flight intent data as published to the NM/ NOP.

Failure Flows

1. The airspace user creates new flight schedule data,
2. The airspace user provides the flight intentions update to the NM/ NOP,
3. The NM/ NOP validates the data but responds a reject of flight intent data, including changed slots to the airspace user,
4. The AU fails to update the flight schedule data and cannot update the flight intent data.

5.1.4 Step 2 – Suspension of SBT Flight Intents

5.1.4.1 General Description of the Scenario

After the SBT flight intent data has been published to the NOP the NM reassesses the SBT flight intent data and recognizes that the flights cannot be accommodated anymore without changes. NM will suspend the SBT flight intent data and provide the suspension including respective reasons (slots) [23] to the airspace user. The airspace user would have to update the flight schedule now and update the flight schedule data in the NOP to solve the issue.

5.1.4.2 Use Case Description

Scope

This use case deals with the update of the SBT flight intent data upon suspension by NM.

Level

This Use Case is at an operational level enabling the airspace user to provide flight intent data to other ATM stakeholders/ NOP.

Summary

This use case includes the update of SBT flight intent data that is already available in the NOP but was suspended by NM. It includes the cases of several iterations as well as cases were the update of the SBT flight intents fails.

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[23] It has to be mentioned that NM is not coordinating airport slots in the context of seasonal airport slot coordination. Regardless that fact NM requests that SBT intent data is provided for planned flights. This also suggests that those SBT intent data is regularly checked by NM and might be suspended if not possible to accommodate the SBT intent data of an individual flight. It has to be analyzed in SESAR 2020 when the switch from handling schedule data (including all flights of a season) to handling SBT intents of individual flights is done.

Actors

- Airspace User
- Network Manager

Preconditions

SBT flight intent data is available in the NOP.
NM has to suspend the SBT flight intent data after reassessment of the traffic situation.

Post conditions

SBT flight intentions are available in the NOP.

Success end state

The AU has successfully updated the SBT flight intent data.

Failed end state

No acceptable SBT flight intent data is available in the NOP.

Notes

None

Trigger

The use case is triggered by NM through the suspension of the SBT flight intent data.

Main Flow

1. NM suspends the SBT flight intent data, including the provision of the respective reasons,
2. The airspace user adapts the flight schedule in accordance with the reasons given by NM,
3. The airspace user updates the flight intentions to the NM/ NOP,
4. The NM/ NOP validates the updated data and responds the acknowledge of the flight intent data update to the AU,
5. The AU updates the flight intent data as published to the NM/ NOP.

Alternate Flow

1. NM suspends the SBT flight intent data, including the provision of the respective reasons,
2. The airspace user adapts the flight schedule in accordance with the reasons given by NM,
3. The airspace user updates the flight intentions to the NM/ NOP,
4. The NM/ NOP validates the data but responds a reject of flight intent data, including changed slots to the airspace user.
5. The AU updates the flight schedule data in accordance to the slot information,
6. The airspace user provides the flight intentions update to the NM/ NOP,
7. The NM/ NOP validates the data and either responds with a reject of flight intent data, including changed slots to the airspace user and the process returns to step 4, or responds the acknowledge of the flight intent data to the AU.
8. The AU updates the flight intent data as published to the NM/ NOP.

Failure Flows

1. NM suspends the SBT flight intent data, including the provision of the respective reasons,
2. The airspace user adapts the flight schedule in accordance with the reasons given by NM,
3. The airspace user updates the flight intentions to the NM/ NOP,
4. The NM/ NOP validates the data but responds a reject of flight intent data, including changed slots to the airspace user,
5. The AU fails to update the flight schedule data and cannot update the flight intent data.

5.1.5 Step 2 – Publication of SBT Trajectories

5.1.5.1 General Description of the Scenario

A few days prior to departure the collaborative planning of the business trajectory is started. The planning is started that early as main flow constraints can be planned in a dynamic way based on SBT trajectory data as well as SBT flight intent data that is provided by the individual airspace users. The airspace user can now plan trajectories with a minimum of constraints and NM will only provide constraints at locations where the traffic has to be regulated as demand exceeds capacity. That allows the AU to plan more optimal trajectories but requires that the AU has to start with the planning of individual flight some days in advance. The airspace user will plan trajectories in accordance with all boundary conditions of the flight and especially in accordance with all available constraints. A planned trajectory will then be provided to NM/ NOP which will assess the validity of the trajectory and will also check whether it could be accommodated by all ANSPs and the airports. If so the business trajectory will be published to the NOP as SBT trajectory.

5.1.5.2 Use Case Description

Scope

This use case deals with the provision of a business trajectory to NM (to the NOP) as SBT trajectory. The provision of the SBT trajectory is the prerequisite for the iterative flight planning where the finally planned trajectory is the result of a collaborative and iterative refinement of the SBT trajectory data by the AU under consideration of dynamic flow constraints that are developed by NM in response to the planned flights.

Level

This Use Case is at an operational level enabling the airspace user to provide business trajectory data to other ATM stakeholders/ NOP.

Summary

This use case includes the provision of business trajectory data that is published to the NOP as SBT trajectory data if accepted by NM. In case of reject the NM will report the reason (ATM constraints) which has then to be used by the AU to update the flight intention data of a flight.

Actors

- Airspace User
- Network Manager

Preconditions

The AU assumes that the maturity of the flights boundary conditions is sufficiently high to plan a business trajectory.

Post conditions

NM accepted the business trajectory provided by the airspace user.

Success end state

SBT trajectory has been published to the NOP.

Failed end state

SBT trajectory has not been published to the NOP.

Notes

None

Trigger

The use case is triggered by the flight dispatcher in accordance with the flight planning rules of the respective airspace user.

Main Flow

1. The airspace user plans a business trajectory in accordance with all boundary conditions of the flight,
2. The airspace user provides the business trajectory to the NM/ NOP,
3. The NM/ NOP validates the business trajectory and responds the acknowledge of the business trajectory to the AU,
4. The AU updates the business trajectory as published to the NM/ NOP.

Alternate Flow

1. The airspace user plans a business trajectory in accordance with all boundary conditions of the flight,
2. The airspace user provides the business trajectory to the NM/ NOP,
3. The NM/ NOP validates the business trajectory but responds a reject, including the constraints causing the reject to the airspace user.
4. The airspace user plans a new business trajectory in accordance with all boundary conditions of the flight and the new constraints,
5. The airspace user provides the business trajectory to the NM/ NOP,
6. The NM/ NOP validates the business trajectory and either responds with a reject of business trajectory, including responsible constraints to the airspace user and the process returns to step 3, or responds the acknowledge of the flight intent data to the AU, responds the acknowledge of the business trajectory to the AU,
7. The AU updates the business trajectory as published to the NM/ NOP.
8. The NM/ NOP validates the business trajectory and responds the acknowledge of the business trajectory to the AU,
9. The AU updates the business trajectory as published to the NM/ NOP.

Alternate Flow

1. The airspace user plans a business trajectory in accordance with all boundary conditions of the flight,
2. The airspace user provides the business trajectory to the NM/ NOP,
3. The NM/ NOP validates the business trajectory and responds the acknowledge of the business trajectory to the AU, but adds soft constraints (PTRs) to the responds,
4. The airspace user updates the business trajectory in accordance with the PTRs and updates the SBT trajectory in the NOP,
5. The NM/ NOP validates the business trajectory and responds the acknowledge of the business trajectory to the AU,
6. The AU updates the business trajectory as published to the NM/ NOP.

Alternate Flow

1. The airspace user plans a business trajectory in accordance with all boundary conditions of the flight,
2. The airspace user provides the business trajectory to the NM/ NOP,
3. The NM/ NOP validates the business trajectory but responds a reject, including the constraints causing the reject to the airspace user.
4. The airspace user plans a new business trajectory in accordance with all boundary conditions of the flight and the new constraints,
5. The airspace user provides the business trajectory to the NM/ NOP,
6. The NM/ NOP validates the business trajectory and either responds with a reject of business trajectory, including responsible constraints to the airspace user and the process returns to step 3, or responds the acknowledge of the flight intent data to the AU.responds the acknowledge of the business trajectory to the AU,
7. The AU updates the business trajectory as published to the NM/ NOP.
8. The NM/ NOP validates the data and either responds with a reject of flight intent data, including changed slots to the airspace user and the process returns to step 4, or responds the acknowledge of the business trajectory to the AU, but adds soft constraints (PTRs) to the responds,
9. The airspace user updates the business trajectory in accordance with the PTRs and updates the SBT trajectory in the NOP,

10. The NM/ NOP validates the business trajectory and responds the acknowledge of the business trajectory to the AU,
11. The AU updates the business trajectory as published to the NM/ NOP.

Failure Flows

1. The airspace user plans a business trajectory in accordance with all boundary conditions of the flight,
2. The airspace user provides the business trajectory to the NM/ NOP,
3. The NM/ NOP validates the business trajectory but responds a reject, including the constraints causing the reject to the airspace user.
4. The AU fails to plan a business trajectory in accordance with the new constraints.

5.1.6 Step 2 – Update of SBT Trajectory

5.1.6.1 General Description of the Scenario

Any change of the boundary conditions of the flight that do not suspend the SBT might require planning a new business trajectory that better fits to the changed conditions. If a more optimal trajectory has been found, the AU will update the SBT trajectory in the NOP by providing the business trajectory to NM. NM/ NOP will assess the validity of the trajectory and will also check whether it could be accommodated by all ANSPs and the airports. If so the business trajectory will be published to the NOP as SBT trajectory.

5.1.6.2 Use Case Description

Scope

This use case deals with the update of the SBT trajectory upon decision of the airspace user.

Level

This Use Case is at an operational level enabling the airspace user to update SBT trajectories.

Summary

This use case includes the update of SBT trajectory data that is already available in the NOP. It includes the cases of several iterations as well as cases were the update of the SBT trajectory fails.

Actors

- Airspace User
- Network Manager

Preconditions

SBT trajectory data is available in the NOP.

Post conditions

NM accepted the updated business trajectory data provided by the airspace user.

Success end state

SBT trajectory data update has been published to the NOP.

Failed end state

SBT trajectory data has not been updated.

Notes

None

Trigger

The use case is triggered by the flight dispatcher planner upon change of the boundary conditions of the flight requiring or offering the opportunity of planning a new business trajectory.

Main Flow

1. The airspace user plans a new business trajectory in accordance with all boundary conditions of the flight,
2. The airspace user provides the business trajectory update to the NM/ NOP,
3. The NM/ NOP validates the business trajectory and responds the acknowledge of the business trajectory update to the AU,
4. The AU updates the business trajectory as published to the NM/ NOP.

Alternate Flow

1. The airspace user plans a new business trajectory in accordance with all boundary conditions of the flight,
2. The airspace user provides the business trajectory update to the NM/ NOP,
3. The NM/ NOP validates the business trajectory but responds a reject, including the constraints causing the reject to the airspace user.
4. The airspace user plans a new business trajectory in accordance with all boundary conditions of the flight and the new constraints,
5. The airspace user provides the business trajectory to the NM/ NOP,
6. The NM/ NOP validates the business trajectory and either responds with a reject of business trajectory, including responsible constraints to the airspace user and the process returns to step 3, or responds the acknowledge of the flight intent data to the AU, responds the acknowledge of the business trajectory to the AU,
7. The AU updates the business trajectory as published to the NM/ NOP.
8. The NM/ NOP validates the business trajectory and responds the acknowledge of the business trajectory update to the AU,
9. The AU updates the business trajectory as published to the NM/ NOP.

Alternate Flow

1. The airspace user plans a new business trajectory in accordance with all boundary conditions of the flight,
2. The airspace user provides the business trajectory update to the NM/ NOP,
3. The NM/ NOP validates the business trajectory and responds the acknowledge of the business trajectory update to the AU, but adds soft constraints (PTRs) to the responds,
4. The airspace user updates the business trajectory in accordance with the PTRs and updates the SBT trajectory in the NOP,
5. The NM/ NOP validates the business trajectory and responds the acknowledge of the business trajectory to the AU,
6. The AU updates the business trajectory as published to the NM/ NOP.

Alternate Flow

1. The airspace user plans a new business trajectory in accordance with all boundary conditions of the flight,
2. The airspace user provides the business trajectory update to the NM/ NOP,
3. The NM/ NOP validates the business trajectory but responds a reject, including the constraints causing the reject to the airspace user.
4. The airspace user plans a new business trajectory in accordance with all boundary conditions of the flight and the new constraints,
5. The airspace user provides the business trajectory update to the NM/ NOP,
6. The NM/ NOP validates the data and either responds with a reject of flight intent data, including changed slots to the airspace user and the process returns to step 4, or responds the acknowledge of the business trajectory to the AU, but adds soft constraints (PTRs) to the responds,
7. The airspace user updates the business trajectory in accordance with the PTRs and updates the SBT trajectory in the NOP,
8. The NM/ NOP validates the business trajectory and responds the acknowledge of the business trajectory to the AU,
9. The AU updates the business trajectory as published to the NM/ NOP.

Failure Flows

1. The airspace user plans a new business trajectory in accordance with all boundary conditions of the flight,
2. The airspace user provides the business trajectory update to the NM/ NOP,
3. The NM/ NOP validates the business trajectory but responds a reject, including the constraints causing the reject to the airspace user.
4. The AU fails to plan a new business trajectory in accordance with the new constraints[24].

5.1.7 Step 2 – Suspension of SBT Trajectory

5.1.7.1 General Description of the Scenario

NM will steadily reassess the whole traffic flow situation and whether individual trajectories can still be accommodated. If a hotspot is predicted to develop at a specific location all concerned stakeholders (AU flying through respective location, ANSPs in which the hotspot is located, NM) could collaboratively assess the situation. This can be done with a what-if assessment process which is not in particular part of this scenario. Besides that NM can also create flow constraints without using the what-if assessment process, if the allocation of a certain constraint is without alternative. In any case NM could suspend flights if the demand capacity situation requires that. Such suspension will be linked to a certain constraint that will be provided to the airspace user. Such suspension will start this use case. The AU would have to plan a business trajectory that is in accordance with the new flow constraint(s) and provide it to NM. Equally to the previous use case NM will assess the business trajectory, report – in case of reject – constraints, that will trigger another planning loop on AU side. This use case finishes when the AU has replaced the suspended SBT trajectory by a new business trajectory that is accepted by NM.

5.1.7.2 Use Case Description

Scope

This use case deals with the update of the SBT trajectory data upon suspension by NM.

Level

This Use Case is at an operational level enabling the airspace user to provide flight intent data to other ATM stakeholders/ NOP.

Summary

This use case includes the update of SBT trajectory data that is already available in the NOP but was suspended by NM. It includes the cases of several iterations as well as cases were the update of the SBT flight intents fails.

Actors

- Airspace User
- Network Manager

Preconditions

SBT trajectory data is available in the NOP.
NM has to suspend the SBT trajectory data after reassessment of the traffic situation.

Post conditions

SBT trajectory is available in the NOP.

Success end state

The AU has successfully updated the SBT trajectory data.

[24] As the scenario was dealing with an update of the SBT trajectory this failure flow is only indicating that the update was failing. The formally accepted SBT trajectory that is available in the NOP remains valid.

Failed end state

No acceptable SBT trajectory data is available in the NOP.

Notes

None

Trigger

The use case is triggered by NM through the suspension of the SBT trajectory data.

Main Flow

1. NM suspends the SBT trajectory data, including the provision of constraints causing the suspension,
2. The airspace user plans a new business trajectory in accordance with all boundary conditions of the flight,
3. The airspace user provides the business trajectory update to the NM/ NOP,
4. The NM/ NOP validates the business trajectory and responds the acknowledge of the business trajectory update to the AU,
5. The AU updates the business trajectory as published to the NM/ NOP.

Alternate Flow

1. NM suspends the SBT trajectory data, including the provision of constraints causing the suspension,
2. The airspace user plans a new business trajectory in accordance with all boundary conditions of the flight,
3. The airspace user provides the business trajectory update to the NM/ NOP,
4. The NM/ NOP validates the business trajectory but responds a reject, including the constraints causing the reject to the airspace user.
5. The airspace user plans a new business trajectory in accordance with all boundary conditions of the flight and the new constraints,
6. The airspace user provides the business trajectory to the NM/ NOP,
7. The NM/ NOP validates the business trajectory and either responds with a reject of business trajectory, including responsible constraints to the airspace user and the process returns to step 5, or responds the acknowledge of the flight intent data to the AU, responds the acknowledge of the business trajectory to the AU,
8. The AU updates the business trajectory as published to the NM/ NOP.
9. The NM/ NOP validates the business trajectory and responds the acknowledge of the business trajectory update to the AU,
10. The AU updates the business trajectory as published to the NM/ NOP.

Alternate Flow

1. NM suspends the SBT trajectory data, including the provision of constraints causing the suspension,
2. The airspace user plans a new business trajectory in accordance with all boundary conditions of the flight,
3. The airspace user provides the business trajectory update to the NM/ NOP,
4. The NM/ NOP validates the business trajectory and responds the acknowledge of the business trajectory update to the AU, but adds soft constraints (PTRs) to the responds,
5. The airspace user updates the business trajectory in accordance with the PTRs and updates the SBT trajectory in the NOP,
6. The NM/ NOP validates the business trajectory and responds the acknowledge of the business trajectory to the AU,
7. The AU updates the business trajectory as published to the NM/ NOP.

Alternate Flow

1. NM suspends the SBT trajectory data, including the provision of constraints causing the suspension,
2. The airspace user plans a new business trajectory in accordance with all boundary conditions of the flight,

3. The airspace user provides the business trajectory update to the NM/ NOP,
4. The NM/ NOP validates the business trajectory but responds a reject, including the constraints causing the reject to the airspace user.
5. The airspace user plans a new business trajectory in accordance with all boundary conditions of the flight and the new constraints,
6. The airspace user provides the business trajectory update to the NM/ NOP,
7. The NM/ NOP validates the data and either responds with a reject of flight intent data, including changed slots to the airspace user and the process returns to step 5, or responds the acknowledge of the business trajectory to the AU, but adds soft constraints (PTRs) to the responds,
8. The airspace user updates the business trajectory in accordance with the PTRs and updates the SBT trajectory in the NOP,
9. The NM/ NOP validates the business trajectory and responds the acknowledge of the business trajectory to the AU,
10. The AU updates the business trajectory as published to the NM/ NOP.

Failure Flows

1. NM suspends the SBT trajectory data, including the provision of constraints causing the suspension,
2. The airspace user plans a new business trajectory in accordance with all boundary conditions of the flight,
3. The airspace user provides the business trajectory update to the NM/ NOP,
4. The NM/ NOP validates the business trajectory but responds a reject, including the constraints causing the reject to the airspace user.
5. The AU fails to plan a new business trajectory in accordance with the new constraints.

5.1.8 Step 2 – What-if assessment (initial draft)

5.1.8.1 General Description of the Scenario

With SESAR step 2 the flow management might become more dynamic and will allow the airspace users – at locations and in situations where it is possible – to influence whether an own flight gets a flow constraint or not. To be in the situation to influence the flow constraints the airspace user will need to participate in the SBT planning process and has to participate in the what-if/ CDM processes that are used to assess how predicted traffic hotspots can be resolved. How the what-if assessment/ CDM process is triggered is still not defined. It is assumed that the NM identifies flights that are involved in a predicted hotspot and will request respective airspace user (operating those flights) to participate the what-if/ CDM process. It is up to the AU whether the request is granted or not. In case of not participating the AU has to respect that the NM will allocate a flow constraint to the flight what would suspend the SBT trajectory[25] of the AU (see section 5.1.7).

In case the airspace user joins the what-if/CDM process the NM provides information about the respective hotspot and potentially with certain information about demand and capacity in the surrounding sectors. The airspace user can now use this information to assess which options are available to deal with the demand-capacity situation. Such decision making is very complex and cannot be part of this scenario. How it is performed is the business of the respective airspace user the decision making has to consider all boundary conditions of the flight and especially aspects as:

- Overall costs of the flight, including potential delays,
- Overall flight operations costs (effects related to the connection to other flights),
- Targets and constraints in other sectors, respectively outside the ECAC area, and
- Duty and rest times of the crew etc.

25 In this version of the OSED we will only refer to a what-if assessment/ CDM that relates to the SBT trajectory planning. But it can be assumed – and that would be desirable – that the same or an almost equal process would be used for the definition of flow constraints that would potentially suspend an RBT. It is of upmost importance that the processes would remain equal as for long haul flights flying to the ECAC the flight will already follow the RBT long before it will enter the European airspace.

This decision making process will lead to the conclusion that another business trajectory should be planned or the priority of the flight should be increased. Either the business trajectory or the new priority or a combination of both will be published to the NOP and NM has to assess whether the provided proposal can be accepted or whether a constraint has to be provided never the less.

The scenario will end (from AU perspective) with either the suspension of the SBT trajectory (as the what-if results in the definition of flow constraint) or in an update of the priority of the flight (and potentially a reduction of the priority of another flight) or a combination of both.

5.1.8.2 Use Case Description

Scope

This use case deals with the what-if/ CDM process that has the purpose to agree on flow scenario (all concerned stakeholders).

Level

This Use Case is at an operational level enabling the airspace user to impact the definition and allocation of flow constraints on an own flight.

Summary

This use case includes the update of SBT trajectory data that is already available in the NOP but was suspended by NM. It includes the cases of several iterations as well as cases were the update of the SBT flight intents fails.

Actors

- Airspace User
- Network Manager

Preconditions

SBT trajectory data is available in the NOP.

Post conditions

- The SBT trajectory has been suspended;
- The flight priority has been increased, or
- One or more constraints have been resolved offering the opportunity to plan a more optimal trajectory.

Success end state

The provided data (business trajectory and/ or flight priority) has been accepted by the NM.

Failed end state

The AU fails to find a business trajectory under the given conditions and NM cannot accommodate the SBT trajectory in the NOP anymore and has to suspend it.

Notes

The use case is only described for the handling of the SBT data, but could be extended to cover what-if assessment/ CDM process used in the context of RBT revision. The relation to RBT revision should be explored in the context of SESAR 2020.

Trigger

The use case is triggered by NM through the provision of hotspot and sector load information..

Main Flow

1. NM provides hotspot data (location + time window of occurrence) and the demand capacity data of the surrounding sectors to the AU,
2. The AU generates alternative business trajectories that could be flown,
3. The AU starts the decision making assess to assess whether a trajectory change or a flight priority change is more appropriate,

4. The AU decides to change priority of the flight to avoid a flow constraint,
5. The AU proposes the flight priority to NM/ NOP,
6. NM accepts the flight priority change as possible solution[26] and fixes the scenario,
7. The AU starts the UDPP process to update the flight priority in the NOP.

Alternate Flow

1. NM provides hotspot data (location + time window of occurrence) and the demand capacity data of the surrounding sectors to the AU,
2. The AU generates alternative business trajectories that could be flown,
3. The AU starts the decision making assess to assess whether a trajectory change or a flight priority change is more appropriate,
4. The AU decides to provide a new business trajectory to NM,
5. The AU proposes the business trajectory to NM/ NOP,
6. NM accepts the business trajectory change as possible solution and fixes the scenario,
7. The NM suspends the SBT trajectory of the AU starting the "Suspension of SBT trajectory" use case.

Alternate Flow

1. NM provides hotspot data (location + time window of occurrence) and the demand capacity data of the surrounding sectors to the AU,
2. The AU generates alternative business trajectories that could be flown,
3. The AU starts the decision making assess to assess whether a trajectory change or a flight priority change is more appropriate,
4. The AU decides to change the business trajectory and the priority of the flight to avoid additional flow constraints at other locations/ in the surrounding sectors,
5. The AU proposes the new business trajectory and the flight priority to NM/ NOP,
6. NM accepts the flight priority change and the new business trajectory as possible solution[27] and fixes the scenario,
7. The AU starts the UDPP process to update the flight priority in the NOP,
8. The NM suspends the SBT trajectory of the AU starting the "Suspension of SBT trajectory" use case.

Alternate Flow

1. NM provides hotspot data (location + time window of occurrence) and the demand capacity data of the surrounding sectors to the AU,
2. The AU generates alternative business trajectories that could be flown,
3. The AU starts the decision making assess to assess whether a trajectory change or a flight priority change is more appropriate,
4. The AU decides to change priority of the flight to avoid a flow constraint,
5. The AU proposes the flight priority to NM/ NOP,
6. NM does not accept the change of the flight priority and adds a flow constraint that has to be adhered to.
7. The AU plans a new business trajectory and proposes it to the NM again,
8. If NM does not accept the change of the flight priority and the new business trajectory he will add a further flow constraint that has to be adhered to and the process returns to step 7, else step 9 is following.
9. NM accepts the flight priority change and the new business trajectory as possible solution and fixes the scenario,
10. The AU starts the UDPP process to update the flight priority in the NOP,
11. The NM suspends the SBT trajectory of the AU starting the "Suspension of SBT trajectory" use case.

[26] That means that another flight will change its business trajectory.

[27] That means that another flight will change its business trajectory.

Alternate Flow

1. NM provides hotspot data (location + time window of occurrence) and the demand capacity data of the surrounding sectors to the AU,
2. The AU generates alternative business trajectories that could be flown,
3. The AU starts the decision making assess to assess whether a trajectory change or a flight priority change is more appropriate,
4. The AU decides to provide a new business trajectory to NM,
5. The AU proposes the business trajectory to NM/ NOP,
6. NM does not accept the change of the business trajectory and adds a flow constraint that has to be adhered to.
7. The AU plans a new business trajectory and proposes it to the NM again,
8. If NM does not accept the change of the flight priority and the new business trajectory he will add a further flow constraint that has to be adhered to and the process returns to step 7, else step 9 is following.
9. NM accepts the new business trajectory as possible solution and fixes the scenario,
10. The NM suspends the SBT trajectory of the AU starting the “Suspension of SBT trajectory” use case.

Failure Flow

1. NM provides hotspot data (location + time window of occurrence) and the demand capacity data of the surrounding sectors to the AU,
2. The AU tries to generate alternative business trajectories but fails,
3. The AU defines high priorities for the flight to avoid a flow constraint in any case,
4. The AU proposes the flight priority to NM/ NOP,
5. NM does not accept the change of the flight priority and adds a flow constraint that has to be adhered to.
6. The AU fails to plan business trajectory under consideration of the new flow constraint.

5.1.9 Step 2 – RBT agreement based on an accepted SBT trajectory

5.1.9.1 General Description of the Scenario

This use case describes the agreement process on an RBT. It will involve the AU that will agree to fly as planned and the ANSPs and airports that agree to facilitate the planned trajectory. In this use case an SBT has been planned and accepted before and will be used for the RBT agreement.

5.1.9.2 Use Case Description

Scope

This use case describes the change of status of a business trajectory from SBT trajectory to RBT.

Level

This Use Case is at an operational level enabling the airspace user to trigger the RBT.

Summary

This use case describes how the AU will trigger the RBT based on an already accepted SBT trajectory.

Actors

- Airspace User
- Network Manager
- Air Navigation Service Provider
- Airport Operator

Preconditions

An SBT trajectory has been published by the AU and accepted by NM and is available in the NOP.

Post conditions

The RBT is established.

Success end state

The AU agrees to fly the trajectory and all concerned ANSPS and airports agree to facilitate the trajectory.

Failed end state

An RBT cannot be established.

Notes

The RBT agreement process is not sufficiently mature yet. The concept and process needs to be matured in SESAR 2020.

Trigger

This use case is triggered by the AU but might be required to be started in a time window that is specified by the ATM stakeholders.

Main Flow

1. The AU selects the business trajectory that has been accepted as SBT trajectory,
2. The AU files this trajectory to the NOP to trigger the RBT,
3. All ANSPs and airports assess the business trajectory and define the tolerances within which it can be accommodated,
4. The ANSPs and airports agreement is provided to the AU including the tolerances,
5. The AU agrees on the tolerances and hence on the RBT,
6. Upon AU agreement the RBT is published to the NOP,
7. The AU initializes the crew briefing.

Alternative Flow

1. The AU selects the business trajectory that has been accepted as SBT trajectory,
2. The AU files this trajectory to the NOP to trigger the RBT,
3. All ANSPs and airports assess the business trajectory and define the tolerances within which it can be accommodated,
4. The ANSPs and airports agreement is provided to the AU including the tolerances,
5. The AU cannot agree on the tolerances and requests certain constraint data from the ANSPs and airports,
6. The AU starts the ‘Update SBT trajectory’ process and negotiates a new SBT trajectory,
7. The AU selects the new business trajectory that has been accepted as SBT trajectory,
8. The AU files this trajectory to the NOP to trigger the RBT,
9. All ANSPs and airports assess the business trajectory and define the tolerances within which it can be accommodated,
10. The ANSPs and airports agreement is provided to the AU including the tolerances,
11. If the AU cannot agree on the tolerances the process returns to step 5, else proceeds to step 12,
12. The AU agrees on the tolerances and hence on the RBT,
13. Upon AU agreement the RBT is published to the NOP,
14. The AU initializes the crew briefing.

Alternative Flow

1. The AU selects the business trajectory that has been accepted as SBT trajectory,
2. The AU files this trajectory to the NOP to trigger the RBT,
3. All ANSPs and airports assess the business trajectory but cannot accept it as the SBT trajectory has been suspended in the same moment,
4. The non-acceptance is provided to the airspace user,

5. The airspace user stops this process as the 'Suspend SBT trajectory' process has been triggered.

Failure Flows

1. The AU selects the business trajectory that has been accepted as SBT trajectory,
2. The AU files this trajectory to the NOP to trigger the RBT,
3. All ANSPs and airports assess the business trajectory but cannot accept it as the SBT trajectory has been suspended in the same moment,
4. The non-acceptance is provided to the airspace user,
5. The airspace user fails while performing the 'Suspend SBT trajectory' process.

5.1.10 Step 2 – RBT revision Initiated by AU

5.1.10.1 General Description of the Scenario

This scenario is triggered by the AU/ FOC itself. There can be several reasons for that. What all reasons have in common is that the one or more of the boundary conditions of the flight planning has or have changed. Such change could be a change of the airlines internal schedule or a weather change a deviation of the aircraft from the RBT or any other reason making it necessary to adapt the trajectory. In this scenario the update might be triggered by the AU itself or any other regulator from outside the ECAC area.

To simplify the scenario we will start it with the update/ change of the boundary conditions flight planning of a flight. How this change/ update is done will not be described further as this could be done via any of the interfaces (Ground/Ground; Air/Ground; HMI). After such update it will be assessed whether a new trajectory is needed to react on the update/ change of the boundary conditions of the flight and whether there is a need for an RBT revision. When the RBT revision is started a new trajectory is provided to the NOP and assessed by the ANSPs and airport(s) that are impacted by the trajectory. If they can accommodate the new business trajectory they will accept it, else the will provide a new constraint that the AU has to adhere to. The Au will have the choice of not responding anymore to the new constraint (the RBT will not be revises) or to propose another trajectory. The use case finishes either with the start of the RBT agreement process or with the manual stop of the process without revising the RBT.

5.1.10.2 Use Case Description

Scope

This use case describes the RBT revision initiated by an AU using the FOC with the target to get a trajectory that reflects the new boundary conditions of the flight as best as possible. In this scenario an RBT has already been triggered. The process will deliver a trajectory that is proposed to become a new RBT.

Level

This Use Case is at an operational level enabling the airspace user to revise the RBT.

Summary

This use case includes the update of SBT trajectory data that is already available in the NOP but was suspended by NM. It includes the cases of several iterations as well as cases were the update of the SBT flight intents fails.

Actors

- Airspace User
- Network Manager
- Air Navigation Service Provider

- Airport Operator

Preconditions

The RBT has formerly been agreed.

Post conditions

A new RBT can be agreed.

Success end state

The Airspace user and the ANSPs and airports agree on a new business trajectory.

Failed end state

The Airspace user and the ANSPs and airports do not agree on a new business trajectory leading to a conflict operational issue on AU side[28].

Notes

This use case will not change the RBT. It will remain valid until the RBT agreement process is initiated that will finally change the RBT.

Trigger

This use case is triggered by the AU upon change of the boundary conditions of the flight.

Main Flow

1. The boundary conditions of the flight have changed.
2. The AU plans a new business trajectory.
3. The AU publishes the new business trajectory to the NOP.
4. All concerned ATM stakeholders receive the trajectory proposal by the AU and assess whether it can be facilitated. As the trajectory can be facilitated the acceptance is reported to the AU.
5. The AU starts the RBT agreement process

Alternative Flow

1. The boundary conditions of the flight have changed,
2. The AU plans a new business trajectory,
3. The AU publishes the new business trajectory to the NOP,
4. All concerned ATM stakeholders receive the trajectory proposal by the AU and assess whether it can be facilitated. As it cannot be facilitated a flow constraint is reported to the AU,
5. The AU plans a new business trajectory that is in accordance with the new flow constraints,
6. The AU publishes the new business trajectory to the NOP,
7. All concerned ATM stakeholders receive the trajectory proposal by the AU and assess whether it can be facilitated. If it cannot be facilitated a flow constraint is reported to the AU and the process returns to step 5, else the acceptance is reported and the process jumps to step 8,
8. The AU starts the RBT agreement process.

Alternative Flow

1. The boundary conditions of the flight have changed,
2. The AU plans a new business trajectory,
3. The AU publishes the new business trajectory to the NOP,
4. All concerned ATM stakeholders receive the trajectory proposal by the AU and assess whether it can be facilitated. As it cannot be facilitated a flow constraint is reported to the AU,

[28] As this process only applies on flights or trajectory portions that are planned within the ECAC area, constraints or regulations or other boundary conditions from outside the ECAC area might not be considered by NM or any European ANSP or airport. That might endanger the efficient and effective flight operation.

5. The AU decides to not plan a new business trajectory,
6. The AU stops the process.

Failure Flows

1. The boundary conditions of the flight have changed,
2. The AU plans a new business trajectory,
3. The AU publishes the new business trajectory to the NOP,
4. All concerned ATM stakeholders receive the trajectory proposal by the AU and assess whether it can be facilitated. As it cannot be facilitated a flow constraint is reported to the AU,
5. The AU fails to plan a new business trajectory under consideration of the new constraint.

5.1.11 Step 2 – RBT revision Initiated by ATM stakeholders

5.1.11.1 General Description of the Scenario

This scenario is triggered by the ATM stakeholders. With the RBT revision request the ATM stakeholders (NM, ANSPs, airports) will provide one or more constraints that have to be adhered by the flight. This additional constraint will update the RBT supporting data[29], what is something that might happen on NM side. Anyhow the AU/ FOC will receive a new constraint The AU will plan a new trajectory that will be assessed by the ATM stakeholders to ensure that the new business trajectory can be accommodated by all ATM stakeholders and hence can become RBT. If a trajectory has been found that can be accommodated by the ANPS and airports and that the AU agrees to fly the process ends with a revision of the cleared trajectory.

5.1.11.2 Use Case Description

Scope

This use case describes the RBT revision initiated by the ATM stakeholders with the target to agree on a new trajectory that can be accommodated by them. In this scenario an RBT has already been triggered but was suspended by a new constraint. The process will deliver a trajectory that is proposed to become a new RBT.

Level

This Use Case is at an operational level enabling the airspace user to be involved in the RBT revision once an RBT cannot be accommodated anymore..

Summary

This use case describes the RBT revision triggered by the ATM stakeholders by providing a new constraint that prevents any of them to accommodate the business trajectory.

Actors

- Airspace User
- Network Manager
- Air Navigation Service Provider
- Airport Operator

Preconditions

The RBT has formerly been agreed.

Post conditions

[29] It is required to note that the definitions related in the T-ConOps with regard to the RBT and the RBT revision process is not fully consistent. On the one hand the RBT is define as trajectory the AU agrees to fly and the ANSPS and airports agree to facilitate and on the other hand the RBT is developed as data set including almost everything that relates to the flight and can be changed among a minimum of stakeholders.

A new RBT can be agreed.

Success end state

The Airspace user and the ANSPs and airports agree on a new business trajectory.

Failed end state

The Airspace user fails to find a trajectory that can be accommodated by all ATM stakeholders.

Notes

Even if the RBT is suspended the aircraft will still follow it as it is still used as the reference. The aircraft will only change the trajectory if a new RBT has been agreed.

Trigger

This use case is triggered by the ATM stakeholders upon suspension of the RBT.

Main Flow

1. The ATM stakeholders suspend the RBT, including the provision of constraints causing the suspension,
2. The airspace user plans a new business trajectory in accordance with all boundary conditions of the flight,
3. The airspace user provides the business trajectory update to the ATM stakeholders/ NOP,
4. All concerned ATM stakeholders receive the trajectory proposal by the AU and assess whether it can be facilitated. As the trajectory can be facilitated the acceptance is reported to the AU.
5. The AU starts the RBT agreement process

Alternate Flow

1. The ATM stakeholders suspend the RBT, including the provision of constraints causing the suspension,
2. The airspace user plans a new business trajectory in accordance with all boundary conditions of the flight,
3. The airspace user provides the business trajectory update to the ATM stakeholders/ NOP,
4. All concerned ATM stakeholders receive the trajectory proposal by the AU and assess whether it can be facilitated. As it cannot be facilitated a flow constraint is reported to the AU,
5. The AU plans a new business trajectory that is in accordance with the new flow constraints,
6. The AU publishes the new business trajectory to the NOP,
7. All concerned ATM stakeholders receive the trajectory proposal by the AU and assess whether it can be facilitated. If it cannot be facilitated a flow constraint is reported to the AU and the process returns to step 5, else the acceptance is reported and the process jumps to step 8,
8. The AU starts the RBT agreement process.

Alternate Flow

1. NM suspends the SBT trajectory data, including the provision of constraints causing the suspension,
2. The airspace user plans a new business trajectory in accordance with all boundary conditions of the flight,
3. The airspace user provides the business trajectory update to the NM/ NOP,
4. The NM/ NOP validates the business trajectory and responds the acknowledge of the business trajectory update to the AU, but adds soft constraints (PTRs) to the responds,
5. The airspace user updates the business trajectory in accordance with the PTRs and updates the SBT trajectory in the NOP,
6. The NM/ NOP validates the business trajectory and responds the acknowledge of the business trajectory to the AU,
7. The AU updates the business trajectory as published to the NM/ NOP.

Alternate Flow

1. NM suspends the SBT trajectory data, including the provision of constraints causing the suspension,

2. The airspace user plans a new business trajectory in accordance with all boundary conditions of the flight,
3. The airspace user provides the business trajectory update to the NM/ NOP,
4. The NM/ NOP validates the business trajectory but responds a reject, including the constraints causing the reject to the airspace user.
5. The airspace user plans a new business trajectory in accordance with all boundary conditions of the flight and the new constraints,
6. The airspace user provides the business trajectory update to the NM/ NOP,
7. The NM/ NOP validates the data and either responds with a reject of flight intent data, including changed slots to the airspace user and the process returns to step 5, or responds the acknowledge of the business trajectory to the AU, but adds soft constraints (PTRs) to the responds,
8. The airspace user updates the business trajectory in accordance with the PTRs and updates the SBT trajectory in the NOP,
9. The NM/ NOP validates the business trajectory and responds the acknowledge of the business trajectory to the AU,
10. The AU updates the business trajectory as published to the NM/ NOP.

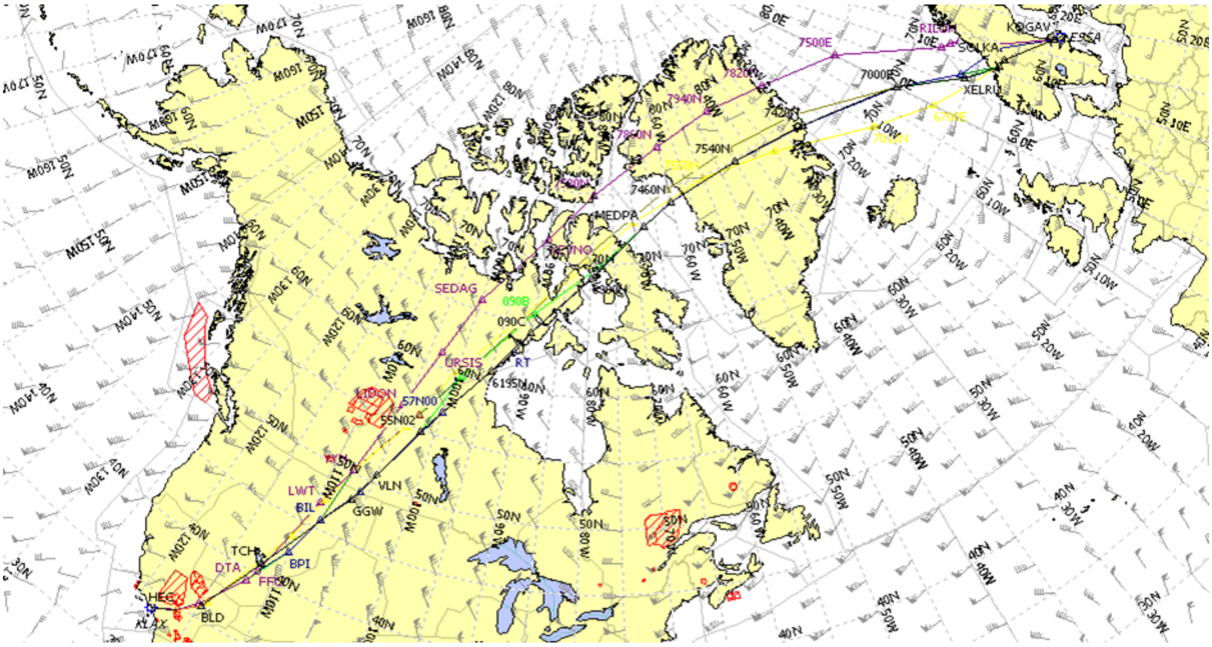
Failure Flow

1. NM suspends the SBT trajectory data, including the provision of constraints causing the suspension,
2. The airspace user plans a new business trajectory in accordance with all boundary conditions of the flight,
3. All concerned ATM stakeholders receive the trajectory proposal by the AU and assess whether it can be facilitated. As it cannot be facilitated a flow constraint is reported to the AU,
4. The AU fails to plan a new business trajectory under consideration of the new constraint.

5.1.12 Step 1 – The use of GEWF in Trajectory Generation

In the following a flight from Stockholm to Los Angeles is analysed in respect to weather ensembles. This example is taken from the validation report [30].

In this example the weather ensemble consisted of 12 ensemble members, or in other words, 12 individual upper air (GRIB) databases. With each of the weather ensemble members one optimum trajectory was generated. As one can see the lateral difference is significant, demonstrating the influence of uncertainty in weather. Of course each of the lateral routes is only optimum assuming that the used ensemble forecast member is representing the real weather at the time of the execution



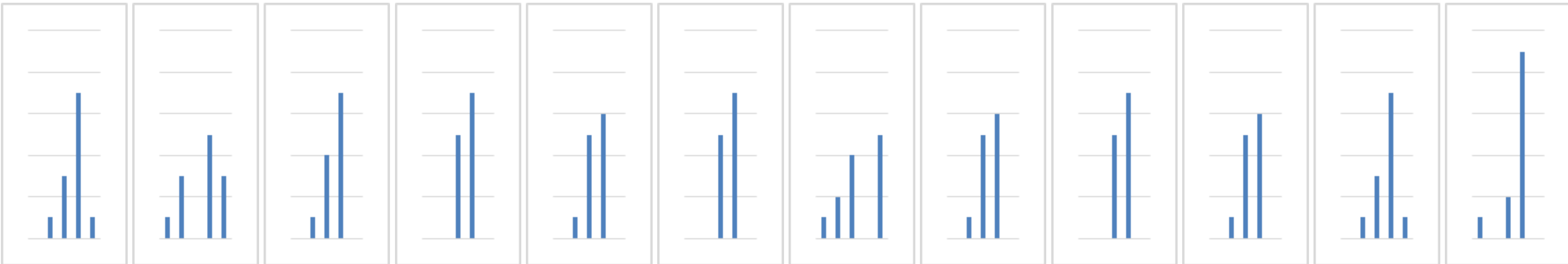
As a next step, for each of the lateral routes 12 trajectories were computed. Each one using a different weather ensemble member. As a result, a trajectory matrix was created consisting of 144 trajectories (12x12). The following three pages show the result of this analysis for trip fuel, trip time and trip cost

5.1.12.1.1 Trip Fuel Analysis

The figure below shows the trip fuels of all 144 flight calculations and the according frequency distribution.

Frequency Bins: -1000 < -500 < 0 < 500 < 2000 (less, respectively more trip fuel from the average in kg)

	Route 1	Route 2	Route 3	Route 4	Route 5	Route 6	Route 7	Route 8	Route 9	Route 10	Route 11	Route 12
W1	101914	102937	102093	102164	101913	102186	101699	101913	102184	102330	101839	103262
W2	102281	103148	102292	102322	102175	102378	101958	102175	102342	102540	102181	103384
W3	101728	102864	101787	101968	101635	102024	101438	101635	101920	102016	101528	103173
W4	101760	101644	101867	101843	101801	101931	102832	101801	101863	102123	101676	103314
W5	101956	101793	102046	102105	101916	102115	102796	101916	102094	102437	101880	103314
W6	101744	103023	101758	101741	101794	101849	101610	101794	101797	102166	101771	103349
W7	101522	101359	101633	101866	101460	101924	102979	101460	101889	101973	101505	103453
W8	101597	102916	101748	102158	101522	102191	101461	101522	102151	101992	101501	103164
W9	101867	102985	102019	102194	101792	102211	101573	101792	102156	102223	101755	103304
W10	100985	103058	101110	101772	101042	101865	100913	101042	101818	101276	100968	103350
W11	101764	101577	101967	102142	101697	102170	102750	101697	102123	102107	101678	103194
W12	101764	102917	101967	102142	101697	102170	102616	101697	102123	102107	101678	102054



Spread	1296 lbs	1789 lbs	1182 lbs	581 lbs	1133 lbs	529 lbs	2066 lbs	1133 lbs	545 lbs	1264 lbs	1213 lbs	1399 lbs

Table 10: Trajectory Ensembles - Trip fuel results

	Route 1	Route 2	Route 3	Route 4	Route 5	Route 6	Route 7	Route 8	Route 9	Route 10	Route 11	Route 12
AVG	101740,17	102518,42	101857,25	102034,75	101703,67	102084,5	102052,08	101703,67	102038,33	102107,5	101663,33	103192,92

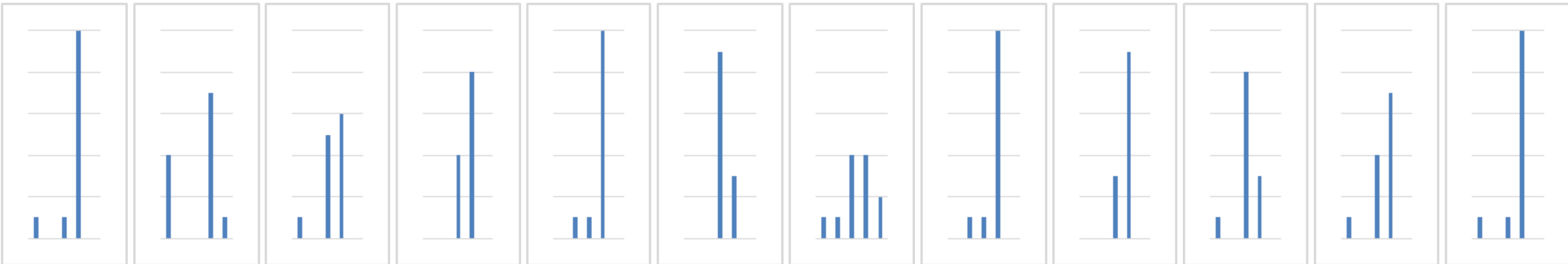
Table 11: Trajectory Ensembles – Average trip fuel results per route

5.1.12.1.2 Trip Time Analysis

The figure below shows the trip times of all 144 flight calculations and the according frequency distribution.

Frequency Bins: -3 < -2 < 0 < 2 < max trip time (slower, respectively faster trip time from the average in minutes)

	Route 1	Route 2	Route 3	Route 4	Route 5	Route 6	Route 7	Route 8	Route 9	Route 10	Route 11	Route 12
W1	646	649	646	648	645	649	645	645	648	647	646	650
W2	646	650	647	649	645	649	646	645	649	648	646	651
W3	645	648	645	648	644	648	644	644	648	646	644	650
W4	645	644	645	648	644	647	648	644	648	646	645	650
W5	645	644	646	648	644	648	647	644	648	646	645	650
W6	644	649	645	646	644	647	644	644	647	646	643	650
W7	645	643	644	647	643	648	648	643	647	646	644	651
W8	645	649	645	647	644	648	643	644	649	646	644	649
W9	645	649	646	649	644	649	644	644	649	648	645	650
W10	641	649	642	646	641	647	641	641	646	642	641	651
W11	645	643	646	648	644	648	647	644	648	646	645	650
W12	645	648	646	648	644	648	646	644	648	646	645	645



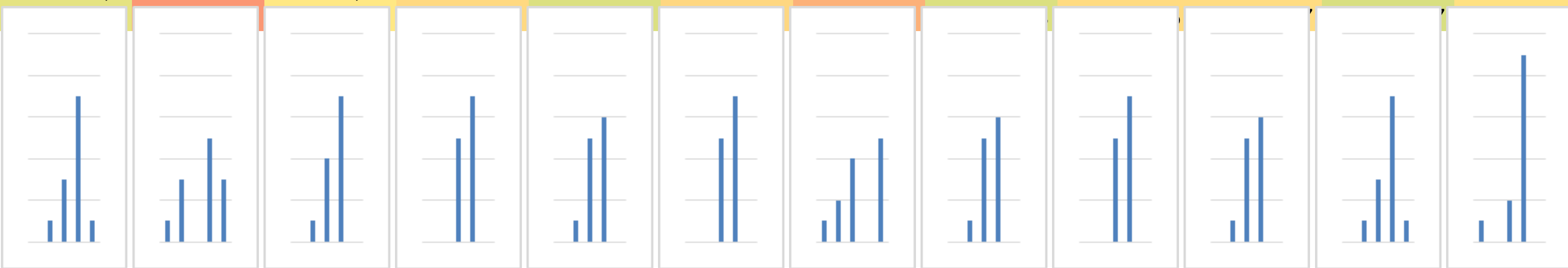
Spread	5 min.	7 min.	5 min.	3 min.	4 min.	2 min.	7 min.	4 min.	3 min.	6 min.	5 min.	6 min.

Table 12: Trajectory Ensembles - Trip time results

5.1.12.1.3 Trip Cost Analysis

The figure below shows the trip fuels of all 144 flight calculations and the according frequency distribution.
Frequency Bins: -1000 < -500 < 0 < 500 < 2000 (less, respectively more trip fuel from the average in kg)

	Route 1	Route 2	Route 3	Route 4	Route 5	Route 6	Route 7	Route 8	Route 9	Route 10	Route 11	Route 12
W1	77010,767	77725,717	77127,117	77206,6	76993,45	77237,567	76854,35	76993,45	77219,6	77297,833	76962,017	77953,633
W2	77249,317	77879,533	77273,133	77325,967	77163,75	77362,367	77039,367	77163,75	77338,967	77451	77184,317	78049,6
W3	76873,2	77661,6	76911,55	77079,2	76796,083	77115,6	76668,033	76796,083	77048	77077,067	76726,533	77895,783
W4	76894	76801,933	76963,55	76997,95	76903,983	77038,483	77640,8	76903,983	77010,95	77146,617	76839,4	77987,433
W5	77021,4	76898,783	77096,567	77168,25	76978,733	77174,75	77600,733	76978,733	77161,1	77350,717	76972	77987,433
W6	76866,933	77781,617	76892,7	76898,317	76899,433	76985,183	76779,833	76899,433	76951,383	77174,567	76867,817	78010,183
W7	76739,3	76600,017	76794,783	76996,233	76665,667	77050,6	77736,35	76665,667	77011,183	77049,117	76711,583	78094,45
W8	76788,05	77712,067	76886,2	77186,033	76722,633	77224,15	76666,317	76722,633	77214,817	77061,467	76708,983	77873,267
W9	76963,55	77756,917	77079,017	77242,767	76898,133	77253,817	76755,783	76898,133	77218,067	77244,95	76890,75	77980,933
W10	76323,583	77804,367	76421,5	76918,467	76360,633	76995,583	76276,783	76360,633	76948,367	76529,4	76312,533	78027,5
W11	76896,6	76741,717	77045,217	77192,3	76836,383	77210,5	77570,833	76836,383	77179,95	77136,217	76840,7	77909,433
W12	76896,6	[illegible]	77045,21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]



Spred	926 curr.	1280 curr.	852 curr.	428 curr.	803 curr.	377 curr.	1460 curr.	803 curr.	391 curr.	922 curr.	872 curr.	1009 curr.

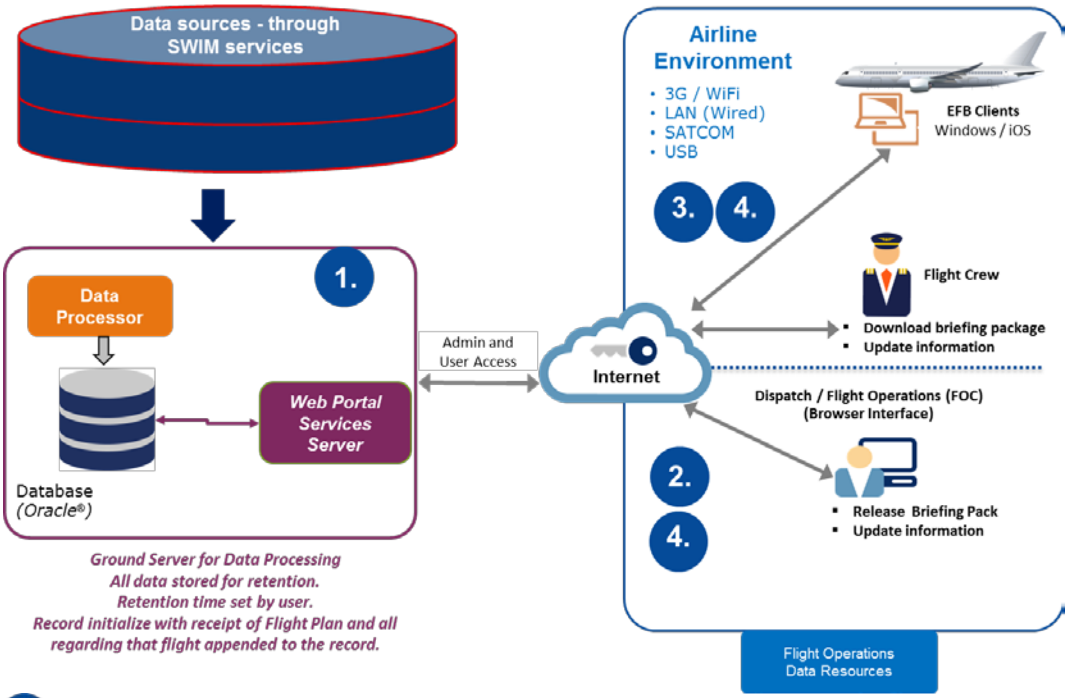
Table 13: Trajectory Ensembles - Trip cost results

	Route 1	Route 2	Route 3	Route 4	Route 5	Route 6	Route 7	Route 8	Route 9	Route 10	Route 11	Route 12
AVG	76876,942	77421,693	76961,379	77117,032	76837,939	77154,925	77088,021	76837,939	77123,528	77137,931	76821,444	77904,563

Table 14: Trajectory Ensembles – Average trip cost results per route

5.2 Step 1&2 – Aeronautical Information Management / METeorology

The diagram below shows the intended functions and the information flow of the Digital Integrated Briefing for Flight Crew Members and Flight Dispatcher during all phases of the flight.



1. Data are centrally stored for processing and retention

2. Dispatcher will check, compile and release the data for a flight specific briefing pack

3. Via a web portal the crew will download briefing pack to the ePIB device
Via a web portal the crew can select and retrieve additional information (Airports /WX / Notam)

4. Once the pack is released by the Dispatcher the system will alert Dispatcher / Crew during all phases of the flight when significant changes (breach for ceiling, visibility, wind or the addition or deletion of a Notam) occur based on parameter set by operator.

Figure 15: Digital Integrated Briefing information flow

Target of the use cases is to demonstrate the feasibility of providing D-MET and D-NOTAM information and its display to the flight dispatch / flight crew on various devices during all phases of flight (from flight preparation, pre-flight briefing on the ground to pre-flight briefing on board at the gate and in-flight updates), Permanent up to date information displayed in a graphical format and accessible for a much wider area and set of airports will improve the situational awareness by Flight Crew Members and/or Flight Dispatchers with positive impact on flight safety driven by human performance factors.

For AU that do not operate own FOC, such as some Business and General Aviation companies (but not limited to), permanent access to updated information is available through FOC system representing certain roles of FOC. During the pre-flight briefing pilots could act as dispatchers and on-board functions are represented whether by automatic functions (triggered by monitoring specific values and executing pre-programmed tasks), or again by pilots themselves.

5.2.1 Step 1 – Use case Interactive Flight Planning

Please refer to chapter 5.1 Business Trajectory (including Trajectory Management Framework) for more details about Flight Planning use case.

5.2.2 Step 1 – Use case Dispatcher working in a FOC environment

5.2.2.1 Flight Planning Briefing

The digital briefing service enables the Dispatcher to retrieve and understand the information (AIS, MET, ATFM data) that is needed in order to decide upon the feasibility of an intended flight and for the identification of an optimal flight plan.

Note that this intended function also requires support for route generation, submission, and validation, which are not in the scope of the Digital Integrated Briefing service. However, the trajectory information is included, which allows the Dispatcher to provide the intended flight trajectory and/or other input parameters for the briefing service.

Where appropriate, the information presentation is in the form of maps/charts. When presented interactively, it also includes the possibility to provide the same information in printed format.

Please refer to 5.1 Business Trajectory (including Trajectory Management Framework) for detailed information about Flight Planning.

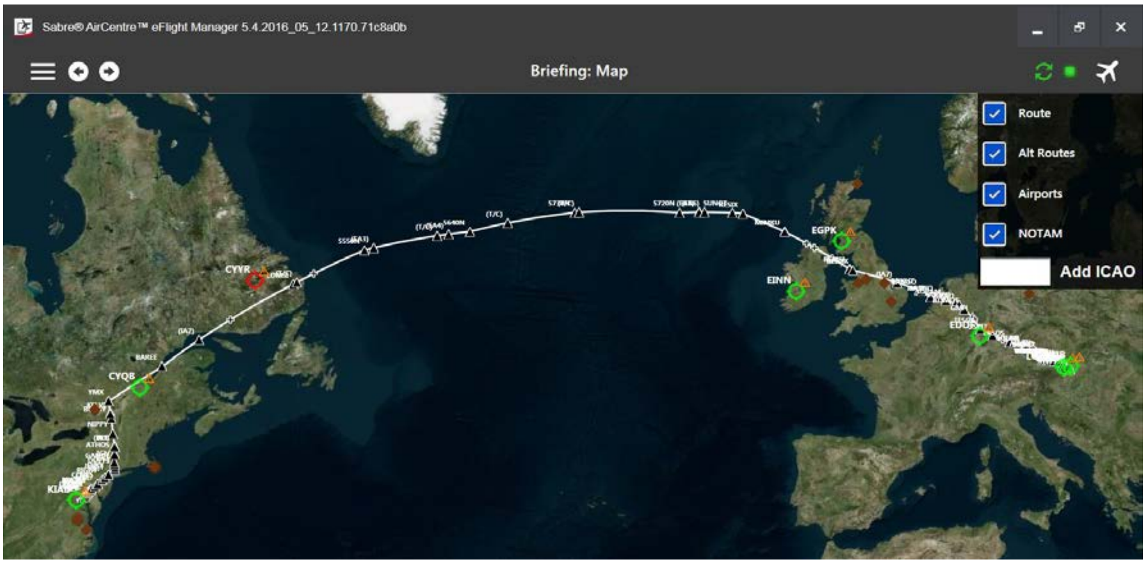


Figure 16: Graphical trajectory display

5.2.2.2 Flight Preparation

Please refer to 5.1 Business Trajectory (including Trajectory Management Framework) for detailed information about Flight Preparation.

5.2.2.3 Flight Update

The digital briefing service enables the Dispatcher to become aware of any change in the current status of the aeronautical infrastructure, airspace, route network and meteorological situation that needs to be considered or communicated to the pilot, in order to ensure the safety and the efficiency of a flight that is in execution.

Where appropriate, the information presentation is in the form of maps/charts and presented interactively.

5.2.3 Step 1 – Use case Pilot Briefing on ground

The digital briefing service enables the Pilot to become aware of the baseline capabilities, the organization and the current status of the aeronautical infrastructure, airspace, route network and meteorological situation that is relevant for the planned flight trajectory.

Note that this intended function implies the existence of a planned trajectory (FPL or route data) as a pre-requisite. Where appropriate, the information presentation is in the form of maps/charts. When presented interactively, it also includes the possibility to provide the same information in printed format.

Machine readable format of aeronautical information and meteorological data enable visualization of actual data for in-flight support as updated NOTAM and weather information. This visualization will support comprehensibility and currency of information used during flight execution.

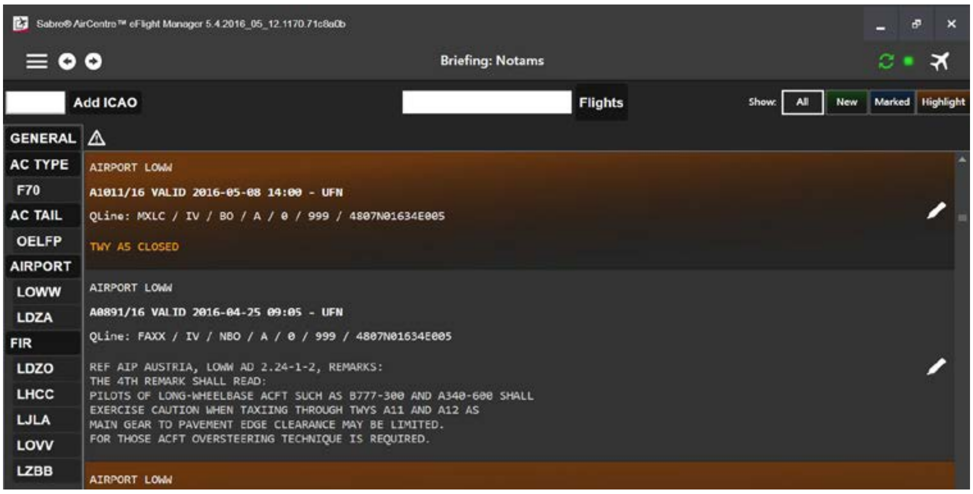


Figure 17: Highlighted NOTAM update relevant for the flight

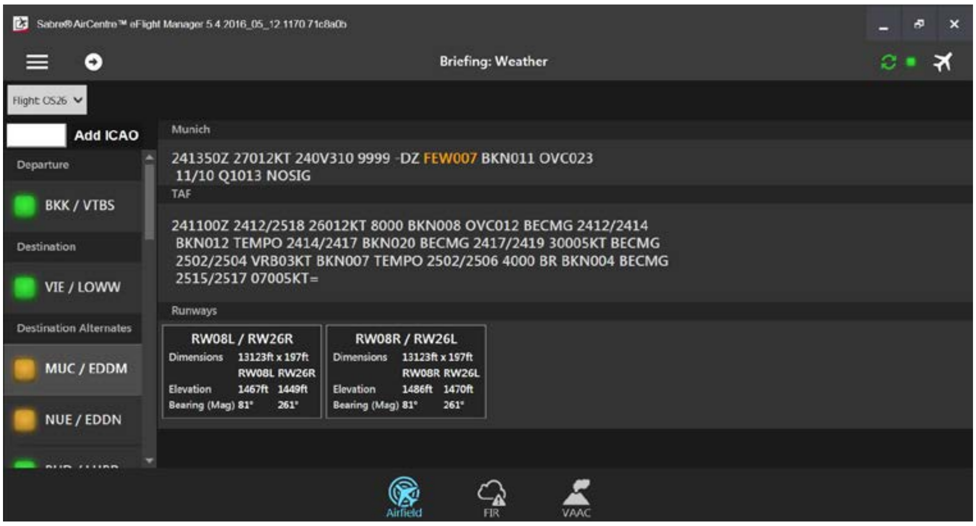


Figure 18: Highlighted MET updates relevant to the flight

5.2.4 Step 2 – Use case Pilot Briefing on board

5.2.4.1 Pre-flight Data Load

The digital briefing service enables an On-board briefing device to request and get the data about the baseline capabilities/organization and current status of the aeronautical infrastructure, airspace, route network and meteorological situation, which is needed for pilot briefing not only along the planned flight trajectory but also in the event of a re-routing.

5.2.4.2 In-flight Data Update

The digital briefing service enables providing to an On-board briefing device in-flight any relevant updates of the data provided during the Pre-flight Data Load, via data link.

Pilots can see graphical information about active airspaces together with graphical weather layers, which helps them significantly to avoid the area in most efficient way, while taking into consideration several active airspaces together with several weather phenomena (Figure 19: In-flight graphical display).

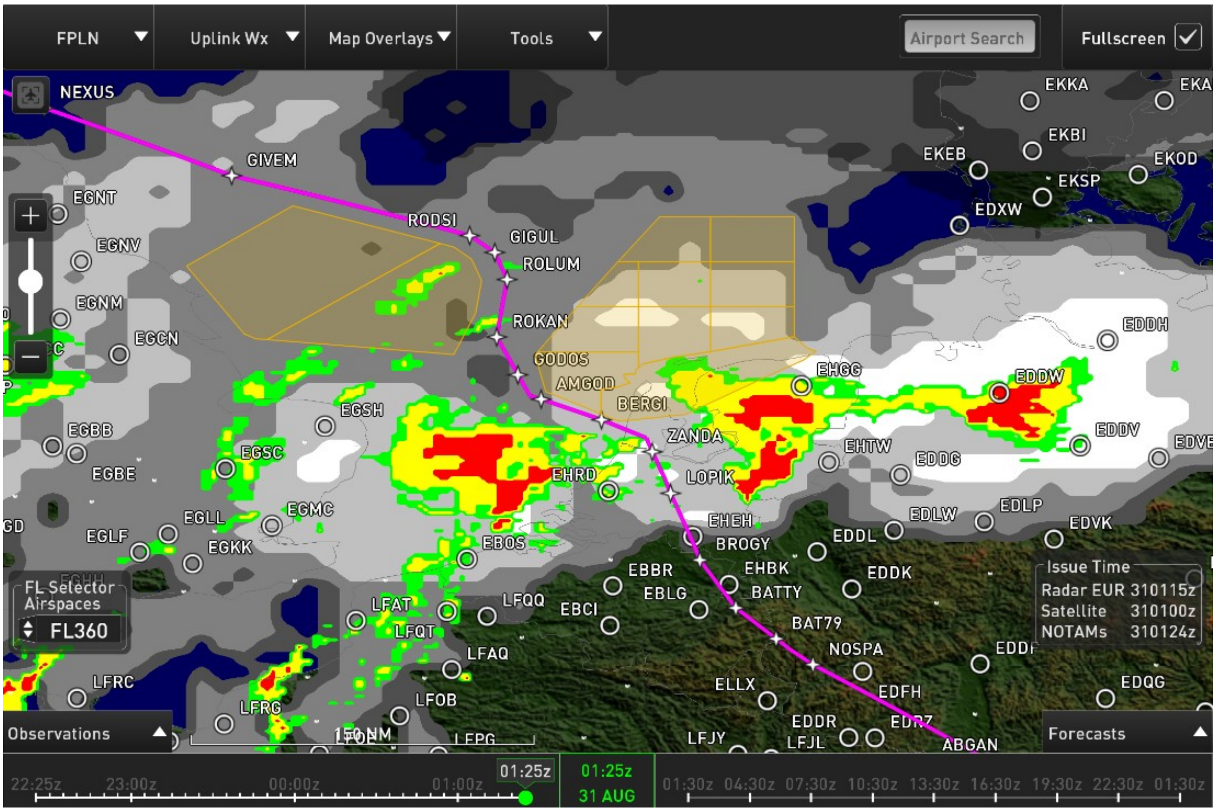


Figure 19: In-flight graphical display

On the Figure 19 there is an active airspace EDR307T (FL185-FL325) which does not allow the aircraft to use the optimum flight level. During the flight the airspace is de-activated earlier than planned. The information about the cancellation of such airspace is uploaded to the on board tool and displayed to the FC to have updated overview.

Figure 20: In-flight detailed information about active airspace

5.2.4.3 ePIB Load

The digital briefing service enables an On-board briefing device to request and get an initial ePIB upload. This will typically take place at the gate, before the flight.

5.2.4.4 ePIB Update

The digital briefing service enables an On-board briefing device to subscribe for and get ePIB updates in-flight, when relevant data updates are received on the ground.

5.3 Airspace Management and Advanced Flexible Use of Airspace

5.3.1 Step 1 – Early Release of an Activated ARES

5.3.1.1 General Description of the Scenario

Starting point of this scenario is the sharing of RTSA information among the ATM stakeholders' community at local and network level via a B2B connection. RTSA message in the form of a SUUP conveys information on the changing status of an airspace (activated, de-activated, modified) on a tactical level, to update concerned ATM stakeholders of any modification with regard to what has been previously communicated via relevant AUPs/UUPs. It may include information on a single ARES, on part of it or on a set of changes related to several airspace reservations.

When an ARES is released prior relevant scheduled time of de-activation, RTSA information sharing offers opportunities for improving concerned trajectories to the benefit of mission economics. The potential stemming from the new scenario is tactically assessed by the airspace users with due regard to the overall operational situation based on individual procedures and priorities in place at each FOC. The aim is to make informed decisions on the actual use of released airspace.

Regardless of the individual FOC's decision-making set up, the performing of the assessment encompasses the ability to receive the RTSA information, to process it, to recognize the flights impacted and to re-calculate relevant trajectories. The baseline is the previously planned operational scenario for each flight.

Upon reception and storing of the RTSA information (i.e. the FOC checks the real time status of a planned ARES to identify de-activations), flights possibly concerned are recognized, be them off-blocks (including airborne aircraft) or still at the departure gate. Then respective trajectories are re-calculated according to the new airspace status. Since weather is a principal determinant of proper flight planning, the actual weather data are used for trajectory generation.

Generated trajectories are first assessed in terms of safety (change in fuel requirements compared to fuel on-board, check of terrain clearances and of other safety-relevant elements). Then, the new trajectories are assessed to check whether they are beneficial to concerned AO's operations (in terms of direct operating cost changes prompted by the new operational scenario and individual operational priorities).

Here, major determinants of the decision-making are fuel cost and flight time cost. The calculation of fuel cost is a relatively simple concept, and its implementation in the assessment straightforwardly follows the amount of trip fuel as re-calculated (the lower the trip fuel – that is, the lower the air distance – the lower the fuel cost). The same might not be true for flight time-related cost. In general, flight time reductions are associated to lower time-related DOCs. However shortcuts (evaluated in terms of air distance) influence previously calculated time profiles (in terms of TTAs/TTOs) and might even lead to additional operating costs (e.g. holding at destination). Therefore, FOC's proper assessment of the new operational scenario is a major pre-requisite for deciding whether to actually make use or not of the released ARES. It is worth emphasizing that such an assessment is enabled by the data processing capabilities of relevant FOC systems but might require officers' evaluation and decision-making (depending on the individual FOC set up and procedures).

In case of positive results (i.e. when the airline positively values the offered opportunities) the AO informs involved ATM stakeholders with the trajectories to be amended by actually filing updated flight plans (CHGs) to be validated by NMOC. Upon reception of relevant acknowledgment, the airline sends the updated package to involved crews, with due regard to the flight phase the aircraft is in. This ends the scenario from a FOC perspective. In case of a flight plan rejection, the airline adjusts the concerned trajectory and re-files relevant EFPL for validation by NMOC. Upon reception of relevant acknowledgment, the airline sends the updated package to involved crews, with due regard to the flight phase.

5.3.1.2 Use Case Description

Scope

This Use Case describes the process of handling an early release of an activated ARES. The release can be either related to all modules of the ARES or can be also limited to de-activation of single modules.

Level

This System Use Case is at a sub-function level enabling the FOC system to provide trajectories to other ATM stakeholders that are matching the business needs of the user itself, including related safety requirements.

Summary

The Use Case starts as soon as a SUUP conveying the information of an early release of an ARES (or of part of it or of more than one ARES) is recognized by an airspace user. This occurrence triggers a scenario assessment on the new operational setting at the users' level.

As the SUUP data are stored in the relevant FOC system, the collected information is used to update the Operational Scenario of each flight whose previously filed trajectory could be considered for updates. Flights possibly concerned are recognized and listed. Each listed flight is associated to following operational attributes:

- Flight number.
- Phase of flight (already off-blocks or still at the gate).
- Final fuel (aircraft at the gate) or fuel on-board (aircraft off-blocks).
- Time to released ARES (aircraft off-blocks).
- Availability of any datalink.

Then, relevant trajectories are re-calculated according to the new airspace status. Since weather is a principal determinant of proper flight planning, the actual weather data are used for trajectory generation.

Generated trajectories are first assessed in terms of safety. Following items are considered:

- Trip fuel.
- Final fuel or fuel on-board.
- Obstacle clearance altitudes with regard to possible engine failures.
- Oxygen diversion routes in case of decompression.
- NOTAMs.
- Non-scheduled weather messages (e.g. SIGMETs).
- Airline-specific safety items.

As safety criteria are fully met, the new trajectories are assessed to check whether they actually benefit the operations of the involved AO (mainly with regard to the direct operating cost changes prompted by the new operational scenario and individual operational priorities). Following items are considered:

- Trip fuel.
- Flight time.
- ATS charges
- TTAs/TTOs.
- AO-specific operational priorities.

As the AO positively values the offered opportunities, it informs involved ATM stakeholders with the trajectories to be amended by actually filing updated flight plans (CHGs) to be validated by NMOC. As relevant ACK is received, the airline sends the updated package to involved crews with due regard to the flight phase (aircraft off-blocks or still at the gate), to inform the pilots about the new operational scenario and enable Captain's decision-making[30]. The Use Case finishes when the involved crews have accepted the proposal. In case of a refusal, the FOC shall amend the operational environment accordingly (back to originally accepted plan). Updated information is sent to all airborne crews that have still time to make their own assessment of the proposal for final decision. Therefore, the FOC shall identify the flights that are too close to the released airspace to have the time for assessing the information. In this case the actual usage of the airspace is left to the decisions directly taken by the crew in touch with the ATCO.

In case of a refusal of proposed trajectory by NMOC (REJ), the airline adjusts the concerned trajectory and re-files relevant EFPL for validation by NMOC. Upon reception of relevant ACK, the airline sends the updated package to involved crews, with due regard to the flight phase for Captain's decision-making.

Actors

Direct actors:

- Flight Dispatcher; Inflight Monitor Officer, Flight Crew

Indirect actors:

- NMOC, ATC systems, ATCO.

Preconditions

- A flight plan as already been filed and the RBT is already available and distributed between all ATM stakeholders.
- An ARES is de-activated.

Post conditions

The FOC has proposed a new trajectory to NM that has been accepted as the new RBT.

Success end state

The trajectory has been adapted, submitted to NMOC, accepted and distributed.

Failed end state

The ad hoc de-activated or cancelled ARES is not used.

Notes

N/A

Trigger

The Use Case starts as soon as a RTSA message conveying the information of an early release of an ARES (or of part of it or of more than one ARES) is recognized by an airspace user.

Main Flow

1. The FOC receives a RTSA information and stores it.
2. The FOC identifies impacted flights and displays them together with relevant operational attributes.

[30] In most regulatory environments – specifically, in all European regulatory environments – the authority for operational control is delegated to the Captain. This means that any change to the intended trajectory must be assessed and approved by the Captain of the flight concerned.

3. The FOC generates an amended trajectory consistent with available RTSA information.
4. The FOC assesses the new trajectory against safety items.
5. The FOC assesses if the new trajectory is beneficial (in terms of mission costs and airline-specific operational requirements).
6. The trajectory exchange process is initiated.
7. The FOC receives the ACK from the NMOC.
8. The FOC distributes the amended trajectory to the concerned crew.
9. The Captain accepts the amended trajectory.
10. The scenario is deactivated.

Alternative Flow 1 (from point 10 of Main Flow)

11. The Captain refuses the amended trajectory.
12. The FOC re-stores previously filed trajectory.
13. The trajectory exchange process is initiated.
14. The FOC receives the ACK from the NMOC.
15. The FOC distributes the amended trajectory to the concerned crew.
16. The scenario is deactivated.

Alternative Flow 2 (from point 8 of Main Flow)

9. The FOC receives a REJ from the NMOC.
10. The FOC generates an amended trajectory.
11. The FOC assesses the new trajectory against safety items.
12. The FOC assesses if the new trajectory is beneficial (in terms of mission costs and airline-specific operational requirements).
13. The trajectory exchange process is initiated. The FOC receives the ACK from the NMOC.
14. The FOC distributes the amended trajectory to the concerned crew.
15. The Captain accepts the amended trajectory.
16. The scenario is deactivated.

Failure Flows (from point 5 of Main Flow)

6. The FOC assessment is negative (trajectories are not amended).
7. The scenario is deactivated.

5.3.2 Step 1 – Unplanned Activation of Airspace Volumes[31]

5.3.2.1 General Description of the Scenario

Starting point of this scenario is the sharing of RTSA information among the ATM stakeholders' community at local and network level via a B2B connection.

When an ARES is activated in addition to the planned schedules communicated by the latest available AUPs/UUPs, RTSA information sharing offers the airspace users the opportunity to limit the impact on involved trajectories to the benefit of mission economics. As a matter of fact, the airlines' goal is to

[31] Please note that this scenario might lead to a safety issue for the flight operations, as for example the fuel onboard might not fit with the new boundary conditions. This important point should be further considered in SESAR2020.

adapt the flight trajectories to the new allocated airspace volumes in the most efficient way, considering flight safety and the impact on mission costs. The new scenario – that includes re-route proposals from NM – is tactically assessed with due regard to the overall operational situation, based on individual procedures and priorities in place at each airline's FOC. The aim is to make informed decisions on how to re-route concerned traffic.

Regardless of the individual FOC's decision-making procedures and priorities, the performing of the tactical assessment encompasses the ability to receive the RTSA information and related re-route proposals, to process them, to recognize the flights impacted and to re-calculate relevant trajectories. The baseline is the previously planned operational scenario for each flight, assumed to be the best possible outcome at the time of initial planning (i.e. – trajectory-wise – the trajectory generated considering the constraints known at the time of planning, including latest AUPs/UUPs).

Upon reception and storing of the RTSA information (i.e. the FOC checks the real time status of a planned ARES to identify new activations) and of re-route proposals, the flights concerned are recognized, be them already off-blocks (including airborne) or still at the departure gate. Then, respective trajectories are re-calculated according to the new airspace status. Since weather is a principal determinant of proper flight planning, the actual weather data are used for trajectory generation.

Generated trajectories are first assessed in terms of safety (change in fuel requirements compared to fuel on-board, check of terrain clearances and of other safety-relevant items). Then, the new trajectories are assessed with regard to the direct operating cost changes prompted by the new operational scenario.

Here, major determinants of the decision-making are additional fuel cost and additional flight time cost. The calculation of additional fuel cost is a relatively simple concept, and its implementation in the assessment straightforwardly follows the amount of trip fuel as re-calculated (the higher the trip fuel – that is, the higher the air distance – the higher the fuel cost). The same is true for time-related cost items associated to the additional flight-time. Additional flight time is associated to higher time-related DOCs. Furthermore, longer routes (evaluated in terms of air distance) influence previously calculated time profiles (in terms of TTAs/TTOs) and might even lead to additional operating costs (e.g. holding at destination). Therefore, FOC's proper assessment of the new operational scenario is a major pre-requisite for deciding how to react to unforeseen ARES activations. It is worth emphasizing that such an assessment is enabled by the data processing capabilities of relevant FOC systems but might require officers' evaluation and decision-making.

The outcome (regardless it sticks to proposed re-routes or not) is shared with NM by actually filing updated trajectories to be validated by NMOC. Upon reception of relevant acknowledgment, the airline sends the updated package to involved crews, with due regard to the flight phase the aircraft is in. This ends the scenario from a FOC perspective. In case of a flight plan rejection, the airline adjusts the concerned trajectory and re-files relevant flight plan for validation by NMOC. Upon reception of relevant acknowledgment, the airline sends the updated package to involved crews, with due regard to the flight phase.

5.3.2.2 Use Case Description

Scope

This use case describes the process of reacting to new information about an unplanned activation of additional airspace volumes from a civil airspace user perspective.

Level

This System Use Case is at a sub-function level enabling the FOC system to provide trajectories to other ATM stakeholders that are matching the business needs of the user itself, including related safety requirements.

Summary

The Use Case starts as soon as a SUUP conveying the information of the activation of an additional ARES (or of part of it or of more than one ARES) is recognized by an airspace user. This occurrence triggers a scenario assessment on the new operational setting at the users' level.

As the SUUP message is stored in the relevant FOC system, the collected information is used to update the operational scenario of each impacted flight. Flights concerned are recognized and listed. Each listed flight is associated to following operational attributes:

- Flight number.
- Phase of flight (already off-blocks or still at the gate).
- Final fuel (aircraft at the gate) or fuel on-board (aircraft off-blocks).
- Time to newly activated ARES (aircraft off-blocks).
- Availability of any datalink.

Then, relevant trajectories are re-calculated according to the new airspace status. Since weather is a principal determinant of proper flight planning, the actual weather data are used for trajectory generation. The optimizer of the FOC system proofs all segments in a defined area between departure and destination and calculates the amended trajectory considering minimum costs requirements. Since the optimum trajectory would lead through the airspace volumes as allocated to the airspace requestor and which is planned to be active during planned flight time, the optimizer chooses a trajectory which leads around the previously planned area.

Generated trajectories are first assessed in terms of safety. Following items are considered:

- Fuel required by the new trajectory.
- Final fuel or fuel on-board.
- Obstacle clearance altitudes with regard to possible engine failures.
- Oxygen diversion routes in case of decompression.
- NOTAMs.
- Non-scheduled weather messages (e.g. SIGMETs).
- Airline-specific safety items.

As safety criteria are fully met, the new trajectories are assessed with regard to the direct operating cost changes prompted by the new operational scenario. Following items are considered:

- Trip fuel.
- Flight time.
- ATS charges
- TTAs/TTOs.
- AO-specific operational priorities.

As the AO positively values the re-calculated trajectories, updated trajectories are forwarded to NMOC for validation (CHGs).

Upon reception of relevant ACK the airline sends the updated package to involved crews with due regard to the flight phase (aircraft off-blocks or still at the gate), to inform the pilots about the new operational scenario and enable Captain's decision-making[32]. The Use Case finishes when the involved crews have accepted the proposal. In case of a refusal, the FOC shall amend the operational environment accordingly. Updated information is sent to all airborne crews that have still time to make their own assessment of the proposal for final decision. Therefore, the FOC shall identify the flights that are too close to the released airspace to have the time for assessing the information. In this case the actual usage of the airspace is left to the decisions directly taken by the crew in touch with the ATCO.

[32] See note 1 above.

In case of a refusal of proposed trajectory by NMOC (REJ), the airline adjusts the concerned trajectory and re-files relevant EFPL for validation by NMOC. Upon reception of relevant ACK, the airline sends the updated package to involved crews, with due regard to the flight phase for Captain's decision-making.

Actors

Direct actors:

- Flight Dispatcher; In-flight Monitor Officer, Flight Crew

Indirect actors:

- NMOC, ATC systems, ATCO.

Preconditions

- A flight plan as already been filed/ and the RBT is already available and distributed between all ATM stakeholders.
- An additional ARES is activated.

Post conditions

The FOC has proposed a new trajectory to NM that has been accepted as the new RBT.

Success end state

The trajectory has been adapted, submitted to NMOC, accepted and distributed.

Failed end state

The trajectory has not been adapted and submitted to NMOC.

Notes

N/A

Trigger

The Use Case starts as soon as a SUUP conveying the information of the activation of an additional ARES (or of part of it or of more than one ARES) is recognized by an airspace user.

Main Flow

1. The FOC receives the RTSA information and stores it.
2. The FOC receives re-route proposals from NM.
3. The FOC identifies impacted flights and displays them together with relevant operational attributes.
4. The FOC assesses re-route proposals on minimum cost requirements.
5. The FOC generates an amended trajectory on minimum cost requirements.
6. The FOC assesses the new trajectory against safety items.
7. The trajectory exchange process is initiated. The FOC receives the ACK from the NMOC.
8. The FOC distributes the amended trajectory to the concerned crew.
9. The Captain accepts the amended trajectory.
10. The scenario is deactivated.

Alternative Flow 1 (from point 9 of Main Flow)

10. The Captain refuses the amended trajectory.

11. The FOC re-calculates and assess the trajectory according to the information exchanged with the Captain.
12. The trajectory exchange process is initiated.
13. The FOC receives the ACK from the NMOC.
14. The FOC distributes the amended trajectory to the concerned crew.
15. The scenario is deactivated.

Alternative Flow 2 (from point 8 of Main Flow)

9. The FOC receives a REJ from the NMOC.
10. The FOC generates an amended trajectory.
11. The FOC assesses the new trajectory against safety items.
12. The FOC assesses the new trajectory in terms of impact on mission costs.
13. The trajectory exchange process is initiated.
14. The FOC receives the ACK from the NMOC.
15. The FOC distributes the amended trajectory to the concerned crew.
16. The Captain accepts the amended trajectory.
17. The scenario is deactivated.

Failure Flows (from point 2 of Main Flow)

3. The FOC is unable to amend and communicate to the crew the trajectory.
4. The RBT is changed tactically between the ATCO and the crew.
5. The scenario is de-activated.

5.3.3 Step 2 – Handle ad-hoc (de-)activation of planned CBA or DMA activation

SCENARIO

A flight is planned on day XX departing 16:30 pm from Venice/Tessera (LIPZ/VCE) and arriving at 18:00 in Frankfurt (EDDF/FRA). The flight is planned with an Airbus A321. Supported by the flight planning system provided by the FOC, the dispatcher performs a fully automated weather/NOTAM check regarding the landing and take-off suitability of runways for departure, destination and alternate airports. The FOC flight planning system compares the weather and NOTAM situation with the flight parameters defined by dispatch and returns with 4 suitable alternate airports (Cologne, Stuttgart, Luxembourg and Nuremberg).

The planned load for this flight will be 15000kg.

The system returns with a trajectory optimised by minimum fuel consumption, which results in a total time of 1h02min and a trip fuel consumption of 2953kg.

The trajectory leads through a Cross Border Area (CBA) which has been requested by military airspace users and which has been established based on formal agreements between the applicable civil and military service providers. Since in SESAR Step2 the VPA module design principle is also extended to Cross Border Areas, the modular design of this airspace is adapted to the military airspace users' needs and enables the Flight Dispatcher to plan through the trajectory across the modules which are not activated.

X min before take-off, the Flight Dispatcher receives a message from the NMOC about an ad-hoc activation of additional CBA/ VPA modules due to operational reasons. At the same time, in return, previously activated CBA VPA modules have been released. Additionally, the NMOC system has already calculated a proposed trajectory, which the NMOC has analysed considering capacity balancing aspects. The NMOC provides the proposed trajectory to the Flight Dispatcher. The Flight Dispatcher analyses the proposal in regard to airline specific business needs and network-imposed constraints. The proposal leads to a trip fuel increase of 214 additional kg and 05 additional minutes of flight time. The costs would increase to $6037, which would be a difference of $429, -

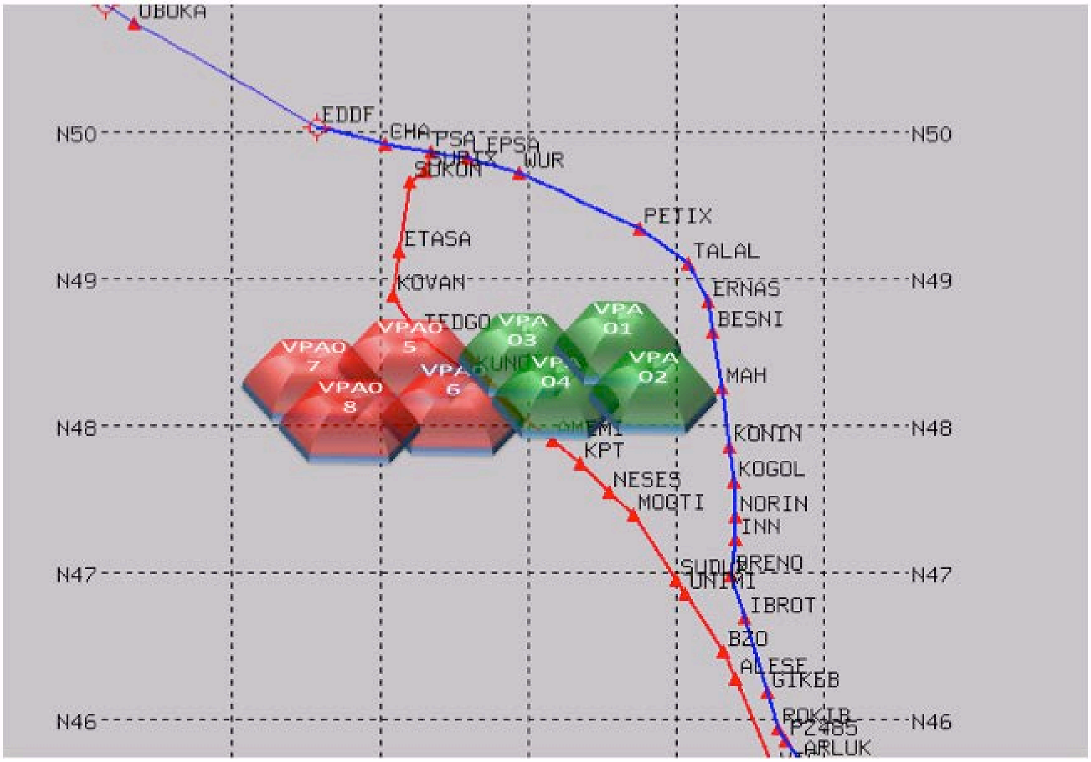


Figure 21: AFUA Scenario

Since some previously activated CBA/VPA modules have been released, the Flight Dispatcher optimises a new trajectory through the released CBA/VPA modules. This trajectory saves 6 minutes of flight time and reduces the costs to $5528, which is even less than the originally submitted SBT. The fuel consumption is reduced by 264kg compared to the route proposal sent by NMOC.

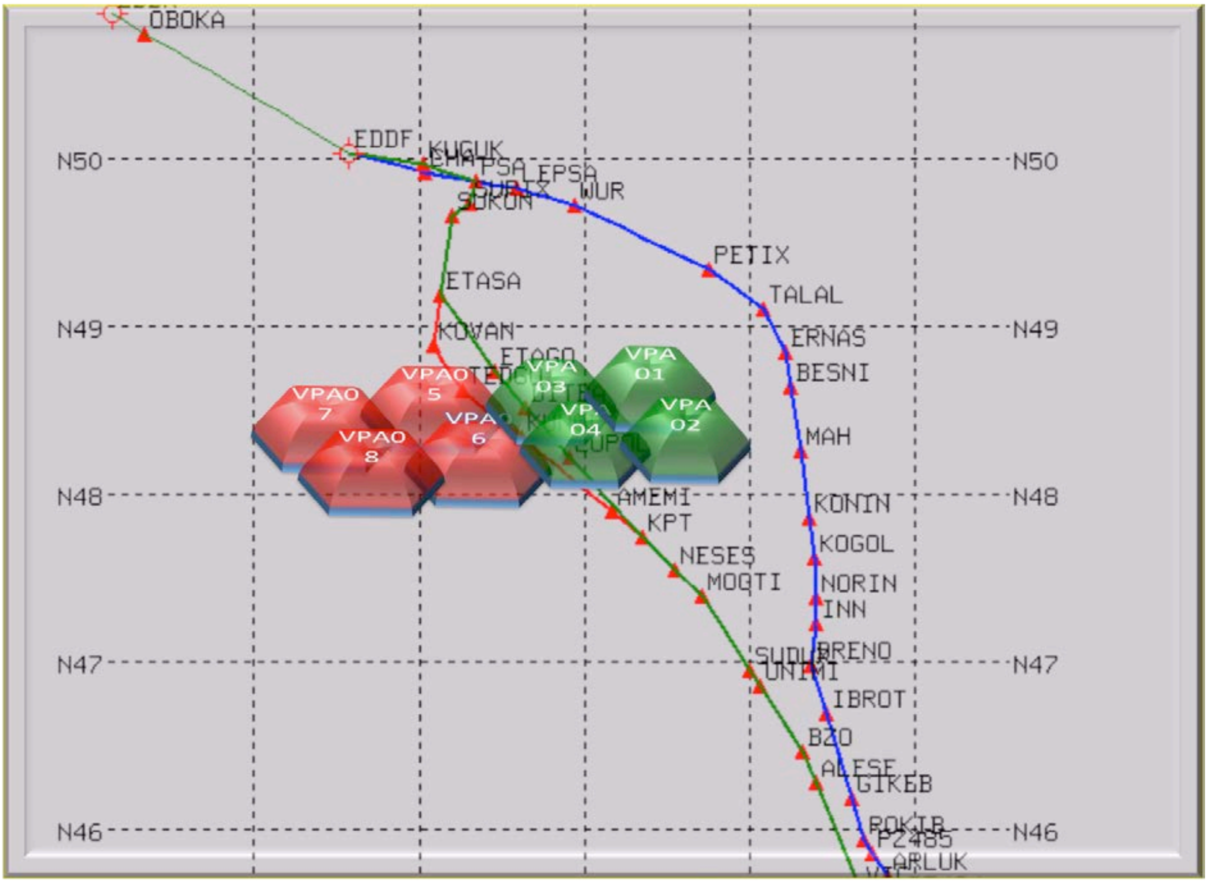


Figure 22: AFUA Scenario

The Flight Dispatcher rejects the route proposal sent by NMOC and submits a new proposed trajectory, which has been calculated by the FOC system. NMOC analyses the proposed trajectory considering constraints and network impact and, after successful validation, acknowledges the proposed trajectory.

USE CASE

Scope
This use case describes the process of handling an adhoc de-activation of planned CBA or DMA activation

User goal
Submission of a proposed trajectory to the NMOC and successful validation

Summary
As soon as trajectories are affected by a real-time airspace status change, the airspace user is informed by the NMOC and, in case the airspace user has subscribed for receiving proposed trajectories from NMOC, provided with a proposed trajectory. The airspace user analyses the proposed trajectory and compares it to own calculated trajectories. Depending on the result of the proposed trajectory analysis, the airspace user has following possibilities:

1. accept the proposed trajectory sent by NMOC, adapt the affected trajectory accordingly and return this trajectory as proposed trajectory for validation
2. reject the proposed trajectory sent by NMOC and send in return a proposed trajectory calculated by the airspace user to the NMOC for validation.

Primary actor
Airspace User

Supporting actors
NMOC

System actor

- FOC system
- ASM Support System

Pre conditions

1. Planned airspace allocation is agreed and published.
2. A trajectory has been submitted to NMOC.
3. NMOC has validated the submitted trajectory

Post conditions

A proposed trajectory has been sent to NMOC.

Success End State

The proposed trajectory has been acknowledged by NMOC.

Failure End State

The proposed trajectory has been rejected by NMOC

Trigger

This Use Case is triggered when the civil airspace user receives a real-time airspace change, which affects trajectories already published in the NOP.

Flows

Main Flow

1. The AU receives a real time real time airspace status change message and a proposed trajectory by the NMOC
2. The AU analyses the proposed trajectory
3. The AU accepts the proposed trajectory
4. The AU submits the proposed trajectory
5. The AU receives an acknowledgment (ACK) from NMOC confirming the successful validation
6. The AU includes produces a new briefing package including the new trajectory
7. The AU provides the information to the cockpit crew.

Alternative flow 1

1. The AU receives a real time airspace status change message
2. The AU adapts an impacted trajectory
3. The AU sends a proposed trajectory to NMOC
4. The proposed trajectory is rejected by NMOC
5. The AU corrects the flight plan
6. The AU submits the corrected flight plan
7. The proposed trajectory is validated by NMOC
8. The AU receives an acknowledgement from NMOC confirming the successful validation
9. The AU produces a new briefing package including the new trajectory
10. The AU provides the information to the cockpit crew.

Alternative Flow 2

1. The AU receives a real time airspace status change message
2. The AU adapts an impacted trajectory to match the new airspace allocation
3. The AU sends a proposed trajectory to NMOC
4. The proposed trajectory is manually processed by NMOC
5. After manual processing of proposed trajectory by NMOC, the AU receives an acknowledgement confirming the successful validation or
6. Alternatively the AU receives a reject by NMOC
7. The AU corrects the trajectory
8. The AU submits the corrected flight plan
9. The revised proposed trajectory is validated
10. The AU produces a new briefing package including the new trajectory
11. The AU provides the information to the cockpit crew.

5.4 User Driven Prioritization Process (UDPP Step2V2)

The Use Cases described are independent from individual scenarios and corresponding to the 2 key processes (FDA and SFP), as specific scenarios will not impact Input/Output/Process flows, for this reason the following tables are structured without the context of specific scenarios. However detailed information with specific scenarios are described in section 5 of the 07.06.02 Final FOC Step 1 and Step 2, as available, OSED – D79

UDPP 1: FOC providing FDA priority of flights to UDPP in CCS/HSPT use case	
Purpose	This use case describes the process by which an AU submits a set of draft SBT updates with new FDA Priorities to the DCB for assessment, after a CCS / HSPT has been published.
Stakeholder	Airspace Users, DCB
Input	• HSPT's impacting the operation • Capacity reduction for CCS/HSPT • Duration of the CCS/HSPT •
Output	• Individual AU re-prioritized flight lists with adjusted FDA values
Process Flow	1. AUs are notified of a CCS/HSPT operation (constrained operation scenario) 2. AUs assess the relative value of flights which are operating during the respective CCS/HSPT operational period. 3. AUs providing the reprioritized list of flights (reassignment of FDA) based on internal business objectives and relative value of flights. 4. AUs will receive the flight list with update flight distribution from A-UDPP process. 5. Cost/Delay analysis for updated flight list received

UDPP 2: FOC providing OC's to flights to during CCS/HSPT use case	
Purpose	AU's proactively sharing the relevant overall priority (OC's) of their flights in order to safeguard the entire operation during CCS/HSPT operation
Stakeholder	Airspace Users, DCB
Input	• Feedback to the AU on the potential for CCS/HSPT which triggers restrictions in FOC tools • HSPT's impacting the operation • Capacity reduction for CCS/HSPT • Duration of the CCS/HSPT • OI's during the CCS/HSPT • Baseline delay for the flights impacted by the CCS/HSPT • Cost/Delay analysis respective to the baseline delay
Output	• Individual AU re-prioritized flight lists with OC values and suspensions
Process Flow	1. AUs are notified of a CCS/HSPT operation (constrained operation scenario) 2. AUs are notified the updated OI during the CCS/HSPT operation 3. AUs assess the relative value of flights which are operating during the respective CCS/HSPT operational period. 4. AUs providing the OCs and flight suspensions if applicable based on internal business objectives and relative value of flights. 5. AUs will receive the flight list with updated flight distribution from A-UDPP process. 6. Cost/Delay analysis respective to the revised flight list

6 Requirements

No Safety Requirements are identified from FOC perspective.
Operational needs related to Performances will be addressed in the frame of OFA SPR through a contribution of WP11.01.02 to these OFA SPR (on request). Currently, no performance requirements related to FOC have been identified.
The status of a requirement has been set to “validated” only if V3 maturity was reached in an exercise from WP11.1 point of view. Otherwise, the status of a requirement remains “in progress”.

6.1 Requirements for Process / Service PCS/SVC

The Operational requirement ID numbering is based on the following rules:
WP11.1 OSED document: REQ-11.01.02-OSED-ABCD.XXXX:

- ABC = D00, BMT, FRA, AIM, MET, FUA, UDP to indicate if the requirement is related respectively to “Global” (compatibility ensured with OSED Step 1), “Business Trajectory”, “Free Route”, “Aeronautical Information Management”, “Meteorology”, “Airspace Management and Advanced Flexible Use of Airspace”, “User Driven Prioritization Process”
- D = indication if the requirement is a Step 1 (D = 1), Step 2 (D = 2) or Step 1 & 2 (D = 3) requirement
- XXX = number unique for each ABCD combination with:
  - o XXX different for each requirement identified for a functional item.

6.1.1 Business Trajectory (including Trajectory Management Framework)

6.1.1.1 Step 1

[REQ]

Identifier	REQ-11.01.02-OSED-BMT1.0010
Requirement	The airspace user shall provide iSBT for every flight that is planned to be operated in the ECAC area.
Title	iSBT provision
Status	<Validated>
Rationale	With SESAR step 1 and time based operations the AU has to provide a flight plan that is used as iSBT. It might not differ from the current ICAO flight plan but could also include a 4D trajectory and optionally flight specific performance data.
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Full>
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-01	<Full>
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-02	<Full>
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0020	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0030	N/A
<ALLOCATED_TO>	<Service>	ExtendedFlightPlanSubmission	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-BMT1.0020
Requirement	The airspace user shall update the iSBT during the short-term planning phase if a new business trajectory has been planned.
Title	iSBT update
Status	<Validated>
Rationale	As the publication of the iSBT might be done some days prior to departure,

	the related business trajectory might be changed in accordance with changing boundary conditions of the flight. As this might have impact onto the traffic flow NM requests to be informed about such changes.
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Full>
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-01	<Full>
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-02	<Full>
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0020	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0030	N/A
<ALLOCATED_TO>	<Service>	ExtendedFlightPlanSubmission	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-BMT1.0030
Requirement	The AU shall provide all information that is required by the NM for the planning phase in the context of SESAR step 1 time-based operations in the iSBT.
Title	iSBT content
Status	<Validated>
Rationale	The iSBT will be used by the NM within the planning phase to assess the feasibility to accommodate the trajectory.
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0001	<Full>
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-01	<Full>
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-02	<Full>
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<ALLOCATED_TO>	<Service>	ExtendedFlightPlanSubmission	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-BMT1.0040
Requirement	NM shall inform the AU about changes to the trajectory from the iSBT and provide related profile tuning constraint data.
Title	iSBT trajectory alignment
Status	<Validated>
Rationale	In SESAR Step 1 full transparency with regard to all types of constraints (e.g. LOA, PTR etc.) might not be achieved. Therefore NM might be required to adapt the trajectory provided by the AU in the SBT trajectory. But those changes have to be reported to the AU, including a specification of the reasons for the change (constraint data).
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Full>
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-01	<Full>
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-02	<Full>
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0020	N/A
<ALLOCATED_TO>	<Service>	ExtendedFlightPlanSubmission	N/A

<ALLOCATED_TO>	<Service>	AeronauticalInformationNotification	N/A
<ALLOCATED_TO>	<Service>	AeronauticalInformationFeature	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-BMT1.0050
Requirement	NM shall adopt the trajectory from the iSBT trajectory if updated by the AU with the profile tuning constraints
Title	iSBT update based on profile tuning constraints
Status	<In Progress>
Rationale	If the NM has adapted an iSBT trajectory based on profile tuning constraint the AU will be informed about that. The AU can accept the changes done by the NM or provided an updated iSBT trajectory that considers the profile tuning constraints. If so the NM shall adopt this updated iSBT (if no further profile tuning constraints are raised) instead of the own estimation.
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Full>
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-01	<Full>
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-02	<Full>
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0030	N/A
<ALLOCATED_TO>	<Service>	ExtendedFlightPlanSubmission	N/A
<ALLOCATED_TO>	<Service>	FlightPlanDataDistribution	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-BMT1.0060
Requirement	The airspace user shall trigger the iRBT for every flight to trigger the agreement on the business trajectory.
Title	iRBT agreement
Status	<In Progress>
Rationale	Before a flight is executed the AU will have to file a flight plan. This will be replaced in SESAR step 1 by the formal agreement on the iRBT. This has to be achieved before the flight departs.
Category	
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0001	<Full>
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-01	<Full>
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-02	<Full>
<SATISFIES>	<ATMS Requirement>	S07-04-HLOR-01	<Full>
<SATISFIES>	<ATMS Requirement>	S07-04-HLOR-02	<Full>
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0040	N/A
<ALLOCATED_TO>	<Service>	ExtendedFlightPlanSubmission	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-BMT1.0070
Requirement	Upon publication of a target time the airspace user shall provide a new iSBT.
Title	Target time constraints
Status	<In Progress>
Rationale	NM will publish target times that the flight has to adhere too. This will update the boundary conditions of the flight what will require the planning of a new business trajectory that will be published again as iSBT.

Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0001	<Full>
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-01	<Full>
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-02	<Full>
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0020	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0030	N/A
<APPLIES_TO>	<Operational Service>	SVC11.01.02-D08-0001.0020	N/A
<ALLOCATED_TO>	<Service>	ExtendedFlightPlanSubmission	N/A

6.1.1.2 Step 2

[REQ]

Identifier	REQ-11.01.02-OSED-BMT2.0010
Requirement	The airspace user shall publish flight intent data as SBT to NM as soon as the flight schedule is ready for negotiation.
Title	SBT flight intent provision
Status	<In Progress>
Rationale	The provision of flight intent data as SBT shall allow the NM an early assessment of developing city pair connections. This requirement refers to the provision of flight intent data that is rather flight schedule data.
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0001	<Full>
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-01	<Full>
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-02	<Full>
<APPLIES_TO>	<Operational Process>	OFA03.01.04	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0010	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-BMT2.0020
Requirement	The airspace user shall publish a 4D trajectory as SBT to NM as soon as the flight planning of an individual flight has started and a business trajectory can be planned.
Title	SBT trajectory provision
Status	<In Progress>
Rationale	The business trajectory will be negotiated with the NM who will organize traffic flows. These traffic flows are the result of all trajectories provided by the single AUs as SBT and of those coming from other sources like statistical data, predictions etc.
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0003	<Full>
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-01	<Full>
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-02	<Full>
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0020	N/A

<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0030	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-BMT2.0030
Requirement	The airspace user shall provide SBT data in accordance with FF-ICE provisions.
Title	SBT FF-ICE compliance
Status	<In Progress>
Rationale	To ensure global interoperability the FF-ICE standards will be used for the implementation of the SESAR trajectory planning concept. Will follow the recommendations made by ICAO in the context of FF-ICE.
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0001	<Full>
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-01	<Full>
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-02	<Full>
<APPLIES_TO>	<Operational Process>	OFA03.01.04	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0030	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-BMT2.0040
Requirement	Every flight planned by the airspace user shall have a GUFI
Title	GUFI
Status	<In Progress>
Rationale	Every flight requires a unique identifier that is used globally by all stakeholders to clearly identify every flight.
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0002	<Full>
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0030	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-BMT2.0050
Requirement	NM shall adopt the business trajectory as provided by the AU in the SBT trajectory
Title	Use of SBT trajectory
Status	<In Progress>
Rationale	The SBT trajectory shall be used to trigger the RBT. That will be the trajectory the AU agrees to fly and the ANSPs and airports agree to facilitate. As the AU flies the trajectory he is the only instance that can correctly plan the trajectory. The ANSPs and airports are accommodating the trajectory. That means they have to assess whether the trajectory can be flown or whether any constraint prevents that.
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0001	<Full>

<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-01	<Full>
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-02	<Full>
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0030	N/A
<APPLIES_TO>	<Operational Service>	SVC11.01.02-D08-0001.0010	N/A
<ALLOCATED_TO>	<Service>	FlightPlanDataDistribution	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-BMT2.0060
Requirement	NM shall inform the AU about any constraint that prevents any ANSP or airport to accommodate the SBT trajectory.
Title	SBT trajectory reject
Status	<In Progress>
Rationale	A constraint will reject any trajectory provided by the AU. To get an trajectory accepted the AU has to plan the trajectory under consideration of all constraints. That requires that NM informs the AU about any constraint (and its content) that prevents him to accept the trajectory. This is especially important since constraints might be defined on a dynamic basis.
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0001	<Full>
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-01	
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-02	
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Operational Service>	SVC11.01.02-D08-0001.0010	N/A
<ALLOCATED_TO>	<Service>	AeronauticalInformationNotification	N/A
<ALLOCATED_TO>	<Service>	AeronauticalInformationFeature	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-BMT2.0070
Requirement	The airspace user shall update an SBT upon reception of any dynamic flow constraint.
Title	SBT suspension
Status	<In Progress>
Rationale	The NM will provide flow constraints in case that an SBT has to be suspended. These flow constraints will be developed dynamically and might be the result of an what-if/ CDM process.
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0002	<Full>
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-01	
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-02	
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.03	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0020	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0030	N/A
<APPLIES_TO>	<Operational Service>	SVC11.01.02-D08-0001.0030	N/A
<ALLOCATED_TO>	<Service>	AeronauticalInformationNotification	N/A
<ALLOCATED_TO>	<Service>	AeronauticalInformationFeature	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-BMT2.0080
Requirement	The airspace user shall consider airport milestones (TOBT, TSAT, TTOT etc.) as published in the NOP when planning a business trajectory
Title	Consideration of airport milestones

Status	<In Progress>
Rationale	The 4D trajectory used for SBT and RBT shall be planned from gate to gate. While the ground routing will not be part of this business trajectory the airport milestones are of paramount importance for the definition of the business trajectory as the have impact onto the air segments of the aircraft and might lead to a trajectory suspension if not adhered too.
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0002	<Full>
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-01	<Full>
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-02	<Full>
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0020	N/A
<ALLOCATED_TO>	<Service>	AirportFlightInformationPublication	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-BMT2.0090
Requirement	The AU shall trigger the RBT within the time window specified by the ATM stakeholders to file a flight plan
Title	RBT agreement trigger
Status	<In Progress>
Rationale	The triggering of the RBT relates to establishment of the agreement between the AU and the ANSPs and airports. This includes a contract that the AU will fly as agreed and the ANSPs and the airport will accommodate as agreed. This agreement can be revised at any time through an RBT revision that considers the fact that the boundary conditions of a flight are dynamic.
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0002	<Full>
<SATISFIES>	<ATMS Requirement>	S07-04-HLOR-01	<Full>
<SATISFIES>	<ATMS Requirement>	S07-04-HLOR-02	<Full>
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0040	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-BMT2.0100
Requirement	ANSPs and airports shall agree on an RBT that is based on an accepted SBT
Title	RBT based on SBT
Status	<In Progress>
Rationale	If an SBT has formally accepted by NM it is expected that this SBT trajectory is agreed as RBT if the boundary conditions have not changed.
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0002	<Full>
<SATISFIES>	<ATMS Requirement>	S07-04-HLOR-01	<Full>
<SATISFIES>	<ATMS Requirement>	S07-04-HLOR-02	<Full>
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A

<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0040	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-BMT2.0110
Requirement	Any reason preventing to accommodate the RBT shall be reported to the airspace user in form of a 4D constraint
Title	4D constraint provision
Status	<In Progress>
Rationale	Whenever the RBT cannot be accommodated anymore and an RBT revision is required the AU has to be in the position to plan a new business trajectory. This requires the provision of the reason of the RBT suspension in a way that allows the AU to plan a new business trajectory. As the flight operations might in wide ranges be based on free routing planning principles the AU will require constraints defined as airspace volumes that are closed (or forced?) within a certain time window. Those are called 4D constraints.
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0002	<Full>
<SATISFIES>	<ATMS Requirement>	S07-04-HLOR-01	<Full>
<SATISFIES>	<ATMS Requirement>	S07-04-HLOR-02	<Full>
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Operational Service>	SVC11.01.02-D08-0001.0020	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0050	N/A
<ALLOCATED_TO>	<Service>	AirportFlightInformationPublication	N/A
<ALLOCATED_TO>	<Service>	AeronauticalInformationNotification	N/A
<ALLOCATED_TO>	<Service>	AeronauticalInformationFeature	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-BMT2.0120
Requirement	The NM shall allow the provision of an RBT agreement trigger for a business trajectory that has not been provided as SBT
Title	Provision of any business trajectory for RBT agreement
Status	<In Progress>
Rationale	The negotiation shall be used to reduce the probability to get a reject when triggering an RBT and to improve the network planning for the ATM stakeholder. But it has still to be possible to simply file a flight plan what means that an RBT could be triggered directly and without negotiation.
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0002	<Full>
<SATISFIES>	<ATMS Requirement>	S07-04-HLOR-01	<Full>
<SATISFIES>	<ATMS Requirement>	S07-04-HLOR-02	<Full>
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-BMT2.0130
Requirement	Every RBT revision requires the participation of the AU.
Title	RBT revision process participation
Status	<In Progress>
Rationale	The RBT is the trajectory the AU agrees to fly and the ANSPs and airports

	agree to facilitate. Hence the airspace user has to be involved whenever the RBT and the related agreement is revised.
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0002	<Full>
<SATISFIES>	<ATMS Requirement>	S07-04-HLOR-01	<Full>
<SATISFIES>	<ATMS Requirement>	S07-04-HLOR-02	<Full>
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0040	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-BMT2.0140
Requirement	RBT revision process shall allow the participation of the FOC throughout all phases of the flight
Title	FOC participation within the RBT revision process
Status	<In Progress>
Rationale	The FOC is the instances of an AU that plans and monitors individual flights. Regardless the organizational division of the airspace user as a legal entity the planning instances have to be able to join the RBT revision. The decision about that is solely in the response of the individual airspace user. That requires that the RBT revision process is defined in way that allows the airspace user to decide which kind of involvement is appropriate.
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0002	<Full>
<SATISFIES>	<ATMS Requirement>	S07-04-HLOR-01	<Full>
<SATISFIES>	<ATMS Requirement>	S07-04-HLOR-02	<Full>
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0050	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0020	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0030	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0040	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-BMT2.0150
Requirement	RBT revision process shall allow the participation of the flight deck throughout all phases of the flight
Title	Flight deck participation within the RBT revision process
Status	<In Progress>
Rationale	The flight deck and its crew take the full responsibility to commence the flight. This requires that the flight crew is involved in every decision related to the RBT and hence needs to be involved in the RBT revision. Whether the flight crew will plan changes to the trajectory or is only briefed about changes of the RBT and confirms whether they will comply with these changes has to be specified by the airspace user individually and might change from flight to flight. That requires that the RBT revision process is defined in way that allows the airspace user to decide which kind of involvement is appropriate.
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0002	<Full>
<SATISFIES>	<ATMS Requirement>	S07-04-HLOR-01	<Full>
<SATISFIES>	<ATMS Requirement>	S07-04-HLOR-02	<Full>
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0050	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0020	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0030	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0040	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-BMT2.0160
Requirement	The RBT revision process shall allow the FOC to trigger an RBT revision throughout all phases of the flight
Title	RBT revision process triggered by the FOC
Status	<In Progress>
Rationale	There might be the need that the airspace user is required to change the trajectory that is flown by the aircraft. Such reason can be the non-adherence of the aircraft to the RBT, changing meteorological conditions, change of non-ECAC-constraints, business reasons or any other change boundary conditions. These reasons might not be visible to the ATM stakeholders what requires that the AU is allowed to start an RBT revision. As the FOC is the flight planning and monitoring instance of the AU, it has to be allowed that the FOC can initiate an RBT revision if required.
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0002	<Full>
<SATISFIES>	<ATMS Requirement>	S07-04-HLOR-01	<Full>
<SATISFIES>	<ATMS Requirement>	S07-04-HLOR-02	<Full>
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0050	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0020	N/A
<APPLIES_TO>	<Operational Service>	PCS11.01.02-D08-0001.0040	N/A
<APPLIES_TO>	<Operational Service>	SVC11.01.02-D08-0001.0020	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-BMT2.0170
Requirement	The RBT revision process shall allow the flight deck to trigger an RBT revision
Title	RBT revision triggered by flight deck
Status	<In Progress>
Rationale	There might be the need that the airspace user is required to change the trajectory that is flown by the aircraft. Such reason can be the non-adherence of the aircraft to the RBT, changing meteorological conditions, change of non-ECAC-constraints, business reasons or any other change boundary conditions. These reasons might not be visible to the ATM stakeholders what requires that the AU is allowed to start an RBT revision. As the flight deck crew is in charge of managing the flight conduction they need to have the possibility to trigger a revision of the RBT.
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0002	<Full>

<SATISFIES>	<ATMS Requirement>	S07-04-HLOR-01	<Full>
<SATISFIES>	<ATMS Requirement>	S07-04-HLOR-02	<Full>
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0050	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0030	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0040	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-BMT2.0180
Requirement	ANSPs shall inform the airspace user (flight deck and FOC) about any reason that prevents the accommodation of RBT to start the RBT revision process.
Title	RBT suspension - ANSP
Status	<In Progress>
Rationale	For being fully able to decide which instance of the airspace user should be involved in the RBT revision it is required which reason is forcing the ANSP to trigger an RBT revision. Upon this information the AU will decide whether the flight crew solely agrees on changes to the RBT or whether this process is also supported by the FOC.
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0002	<Full>
<SATISFIES>	<ATMS Requirement>	S07-04-HLOR-01	<Full>
<SATISFIES>	<ATMS Requirement>	S07-04-HLOR-02	<Full>
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Operational Service>	SVC11.01.02-D08-0001.0020	N/A
<ALLOCATED_TO>	<Service>	AeronauticalInformationNotification	N/A
<ALLOCATED_TO>	<Service>	AeronauticalInformationFeature	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-BMT2.0190
Requirement	Airports shall inform the airspace user (flight deck and FOC) about any reason that prevents the accommodation of RBT to start the RBT revision process.
Title	RBT suspension - Airports
Status	<In Progress>
Rationale	For being fully able to decide which instance of the airspace user should be involved in the RBT revision it is required which reason is forcing an airport to trigger an RBT revision. Upon this information the AU will decide whether the flight crew solely agrees on changes to the RBT or whether this process is also supported by the FOC.
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0002	<Full>
<SATISFIES>	<ATMS Requirement>	S07-04-HLOR-01	<Full>
<SATISFIES>	<ATMS Requirement>	S07-04-HLOR-02	<Full>
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Operational Service>	SVC11.01.02-D08-0001.0020	N/A
<ALLOCATED_TO>	<Service>	AirportFlightInformationPublication	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-BMT2.0200
Requirement	The airspace user shall be able to join the what-if/ CDM process

Title	DCB participation
Status	<In Progress>
Rationale	The what-if/ CDM process will be used to agree on certain flow scenarios and to specify and allocate 4D constraints. This process will be used to collaboratively resolve hotspots and airspace congestion.
Category	<Operational>
Validation Method	<Live Trial><Shadow Mode><Gaming Technique (Agent Based Analysis)>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0002	<Full>
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-01	<Full>
<SATISFIES>	<ATMS Requirement>	S07-01-HLOR-02	<Full>
<SATISFIES>	<ATMS Requirement>	S07-04-HLOR-01	<Full>
<SATISFIES>	<ATMS Requirement>	S07-04-HLOR-02	<Full>
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Operational Service>	SVC11.01.02-D08-0001.0030	N/A
<APPLIES_TO>	<Operational Service>	SVC11.01.02-D08-0001.0020	N/A
<ALLOCATED_TO>	<Service>	AirportFlightInformationPublication	N/A
<ALLOCATED_TO>	<Service>	AeronauticalInformationNotification	N/A
<ALLOCATED_TO>	<Service>	AeronauticalInformationFeature	N/A

6.1.2 Free Route

For Direct Routing (AOM-0500) no new requirements have been identified. Hence, the requirements below are for Free Routing (AOM-0501, AOM-0505, and AOM-0506). As stated above Free Routing is also already implemented today, however, in contrast to Direct Routing, the number of implementation possibilities is much higher. Therefore, rather general requirements are listed here that cover all those implementation options. These requirements are valid for Step 1 and Step 2 as there is no major change in the operating method.

[REQ]

Identifier	REQ-11.01.02-OSED-FRA3.0010
Requirement	Airspace Users shall have procedures and means in place to be informed about the Free Routing Airspace volume availability (e.g. Military areas) and process it
Title	Information about and processing of FRA volume availability by AU
Status	<In Progress>
Rationale	In order to be able to plan trajectories in FRA Airspace Users must obtain information about the FRA volume availability and process this information in a way it can be used for flight planning. A change of the volume availability of the FRA constitutes a change in the boundary conditions of the flight (see Business Trajectory).
Category	<Interface><Operational>
Validation Method	<Fast Time Simulation><Real Time Simulation><Shadow Mode>
Verification Method	<Analysis><Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.03	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0002	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0023	<Full>
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0020	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0050	N/A
<SATISFIES>	<ATMS Requirement>	S06-02-HL-04	<Full>
<ALLOCATED_TO>	<Service>	AeronauticalInformationFeature	N/A
<ALLOCATED_TO>	<Service>	AeronauticalInformationNotificaton	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-FRA3.0020
Requirement	Airspace Users shall have procedures and means in place to be informed about the Free Routing Airspace time availability (e.g. Night FRA) and process it.
Title	Information about and processing of FRA time availability by AU
Status	<In Progress>
Rationale	In order to be able to plan trajectories in FRA Airspace Users must obtain information about the FRA time availability and process this information in a way it can be used for flight planning. A change of the time availability of the FRA constitutes a change in the boundary conditions of the flight (see Business Trajectory).
Category	<Interface><Operational>
Validation Method	<Fast Time Simulation><Real Time Simulation><Shadow Mode>
Verification Method	<Analysis><Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.03	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0002	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0023	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0027	<Full>
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0020	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0050	N/A
<ALLOCATED_TO>	<Service>	AeronauticalInformationFeature	N/A
<ALLOCATED_TO>	<Service>	AeronauticalInformationNotificaton	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-FRA3.0030
Requirement	Airspace Users shall have procedures and means in place to be informed about the flight planning rules in the Free Routing Airspace and process them. They include: • Allowed segment lengths (minimum/maximum) • Usable points for flight planning • Entry/exit conditions (both horizontal and vertical) • Flow measurements
Title	Information about and processing of FRA flight planning rules by AU
Status	<In Progress>
Rationale	In order to be able to plan trajectories in FRA Airspace Users must obtain information about the flight planning rules in the FRA and process them in a way they can be used for flight planning. A change of the flight planning rules in the FRA constitutes a change in the boundary conditions of the flight (see Business Trajectory).
Category	<Interface><Operational>
Validation Method	<Fast Time Simulation><Real Time Simulation><Shadow Mode>
Verification Method	<Analysis><Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.03	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0002	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0021	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0025	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0026	<Full>
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0020	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0050	N/A
<ALLOCATED_TO>	<Service>	AeronauticalInformationFeature	N/A
<ALLOCATED_TO>	<Service>	AeronauticalInformationNotificaton	N/A

6.1.3 Aeronautical Information Management / METeorology

6.1.3.1 Digital briefing

[REQ]

Identifier	REQ-11.01.02-OSED-AIM3.0010
Requirement	The actual SBT/RBT shall be available from NM to FOC system via B2B
Title	RBT availability
Status	<In Progress>
Rationale	NM should share the latest RBT via B2B with FOC system
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-D001.0001	<Full>
<APPLIES_TO>	<Operational Focus Area>	ENB02.01.02	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-AIM3.0020
Requirement	The FOC system shall receive actual and valid D-NOTAM/D-MET information from NM
Title	EAUP/EUUP access
Status	<In Progress>
Rationale	The FOC system shall have instant access to actual and valid D-NOTAM and D-MET information from NM
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-D0001.0025	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-D0001.0026	<Full>
<APPLIES_TO>	<Operational Focus Area>	ENB02.01.02	N/A
<ALLOCATED_TO>	<Service>	AeronauticalInformationNotification	N/A

6.1.3.2 On-board electronic information devices

The operational requirements for the on-board electronic information devise (EID – such as EFB/ Electronic Flight Bag) are described below.

[REQ]

Identifier	REQ-11.01.02-OSED-AIM3.0030
Requirement	The on-board EID shall allow the flight crew to perform pre-flight and in-flight briefing
Title	Briefing on EID
Status	<In Progress>
Rationale	The on-board EID shall have all functions and features to allow the flight crew to perform pre-flight briefing on ground in the cockpit, and in-flight briefing (e.g. top of descend briefing) with actualized data
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-D0001.0027	<Full>
<APPLIES_TO>	<Operational Focus Area>	ENB02.01.02	N/A
<ALLOCATED_TO>	<Service>	IntegratedDigitalBriefing	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-AIM3.0040
Requirement	The on-board EID shall allow to display in-flight updates (triggered by the user or by the system)
Title	In-flight updates
Status	<In Progress>
Rationale	The on-board EID shall have all software and hardware functions and features to allow in-flight two way data communication, to receive updates of AIM data, whether requested by the user (FC/FOO) or by the system
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-D0001.0025	<Full>
<APPLIES_TO>	<Operational Focus Area>	ENB02.01.02	N/A
<ALLOCATED_TO>	<Service>	IntegratedDigitalBriefing	N/A

6.1.3.3 Aeronautical Information Management/MET

Business Trajectory is developed on set of AIM/MET data valid in the time of generation of Business Trajectory. Based on this data also the briefing package with valid AIM/MET data is generated. Any changes, updates, cancellation or new issued NOTAM or MET data which are published after briefing package generation has to be available to FOC system to increase the situational awareness of FC and/or FOO during all flight phases.

[REQ]

Identifier	REQ-11.01.02-OSED-AIM3.0050
Requirement	The FOC system shall allow the user to gain knowledge about all relevant D-NOTAM and D-MET information relevant for the planned flight trajectory
Title	D—NOTAM/D-MET knowledge
Status	<In Progress>
Rationale	The user (FOO or FC) shall have all relevant D-NOTAM and D-MET information available, to gain the knowledge of all relevant information with regard to the planned trajectory
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-D0001.0027	<Full>
<APPLIES_TO>	<Operational Focus Area>	ENB02.01.02	N/A
<ALLOCATED_TO>	<Service>	IntegratedDigitalBriefing	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-AIM3.0060
Requirement	FOC system shall receive updated AIM/MET data
Title	AIM data update
Status	<In Progress>
Rationale	AIM data update allows to FOC system to keep FC aware about any changes in AIM/MET data after issue the pre-flight briefing package. The FOC system shall be able to receive updated AIM data any time.

Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	ENB02.01.02	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-D0001.0025	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-D0001.0026	<Full>
<ALLOCATED_TO>	<Service>	AeronauticalInformationNotification	N/A

6.1.3.4 AIM/MET data visualization

Current format of AIM/MET data doesn't allow easy visualization of their content. The important information can be easily lost in current format of AIM/MET data (the list of NOTAMs according to ICAO Annex 15 format, METAR/TAF coded information). Visualization of AIM/MET data will simplify the understanding of their content and increase the situational awareness of the FC and/or FOO.

[REQ]

Identifier	REQ-11.01.02-OSED-AIM3.0070
Requirement	The FOC system shall display to the user only relevant information for the planned flight trajectory
Title	Display only relevant information
Status	<In Progress>
Rationale	The FOC system shall apply appropriate filtering logic for displaying only relevant information for the planned flight trajectory, in accordance with company preselected filtering criteria
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	ENB02.01.02	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-D0001.0027	<Full>
<ALLOCATED_TO>	<Service>	IntegratedDigitalBriefing	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-AIM3.0080
Requirement	FOC system shall display AIM/MET data in graphical form
Title	AIM data visualization
Status	<In Progress>
Rationale	Visualization of AIM data increase situational awareness of FC and/or FOO
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	ENB02.01.02	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-D0001.0027	<Full>
<ALLOCATED_TO>	<Service>	IntegratedDigitalBriefing	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-AIM3.0090
Requirement	FOC system shall use applicable human-factors principles when showing information to user
Title	Human-factors principles

Status	<In Progress>
Rationale	The visualization of the flight relevant information to the user shall be in accordance with human factors principles practice, to take proper account of interaction between the software and humans using it
Category	<Operational>
Validation Method	<Real Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	ENB02.01.02	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-D0001.0027	<Full>
<ALLOCATED_TO>	<Service>	IntegratedDigitalBriefing	N/A

6.1.4 Airspace Management and Advanced Flexible Use of Airspace

The following requirement is valid for Step 1 and Step 2.

[REQ]

Identifier	REQ-11.01.02-OSED-FUA3.0010
Requirement	Airspace Users shall have procedures and means in place to be informed about the Real Time Status of Airspace
Title	Information about and processing of RTSA by AU
Status	<In Progress>
Rationale	In order to be able to plan trajectories respecting ARES, Airspace Users must obtain real-time airspace status information and process this information in a way it can be used for flight planning. A change of the Real Time Status of Airspace constitutes a change in the boundary conditions of the flight (see Business Trajectory).
Category	<Interface><Operational>
Validation Method	<Fast Time Simulation><Real Time Simulation><Shadow Mode>
Verification Method	<Analysis><Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA 05.03.01	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0005	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0035	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0059	<Full>
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0020	N/A
<APPLIES_TO>	<Operational Process>	PCS11.01.02-D08-0001.0050	N/A
<ALLOCATED_TO>	<Service>	AeronauticalInformationFeature	N/A
<ALLOCATED_TO>	<Service>	AeronauticalInformationNotificaton	N/A
<ALLOCATED_TO>	<Service>	ARESQuery	N/A

6.1.5 User Driven Prioritization Process

Scope of the requirements listed below is to enable the system to exchange the relevant information with other stakeholders to analyze the cost impact of a published CCS/HSPT to the flight program of a dedicated airspace user.

[REQ]

Identifier	REQ-11.01.02-OSED-UDP3.0010
Requirement	The DCB (NMF) shall provide base line delay information to the FOC for all flights impacted by a respective CCS / HSPT
Title	UDPP Delay per Flight
Status	<In Progress>
Rationale	AU can assess operational/cost impact on their schedule by evaluating delay minutes for each flight

Category	<Operational>
Validation Method	<Gaming Technique (Agent Based Analysis)>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA 05.03.06	N/A
<APPLIES_TO>	<Operational Process>	PCS-P07.06.02-OSED-S2V2.0002	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0091	<Partial>

[REQ]

Identifier	REQ-11.01.02-OSED-UDP3.0020
Requirement	The DCB (NMF)shall provide information OI information to the FOC in conjunction with activation of the SFP process.
Title	Provision of OI`s
Status	<In Progress>
Rationale	The published OI shall be available to allow the AU to evaluate the impact of SFP prioritisation on their schedule
Category	<Operational>
Validation Method	<Gaming Technique (Agent Based Analysis)>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA 05.03.06	N/A
<APPLIES_TO>	<Operational Process>	PCS-P07.06.02-OSED-S2V2.0002	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0091	<Partial>

[REQ]

Identifier	REQ-11.01.02-OSED-UDP3.0030
Requirement	The AU can submit FDA Priority to the DCB (NMF), if desired.
Title	FDA Submission
Status	<In Progress>
Rationale	The AU must submit FDA Priority values if they would like to prioritise flights with FDA
Category	<Operational>
Validation Method	<Gaming Technique (Agent Based Analysis)>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA 05.03.06	N/A
<APPLIES_TO>	<Operational Process>	PCS-P07.06.02-OSED-S2V2.0002	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0096	<Partial>

[REQ]

Identifier	REQ-11.01.02-OSED-UDP3.0040
Requirement	When using SFP prioritisation, the AU shall submit Suspend or Protect according to UDPP rules for each SBT
Title	SFP Data Exchange: Priority Submission to DCB
Status	<In Progress>
Rationale	SFP prioritisation is conducted via allocation of Operating Credits
Category	<Operational>
Validation Method	<Gaming Technique (Agent Based Analysis)>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA 05.03.06	N/A
<APPLIES_TO>	<Operational Process>	PCS-P07.06.02-OSED-S2V2.0002	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0096	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0097	<Partial>

[REQ]

Identifier	REQ-11.01.02-OSED-UDP3.0050
Requirement	The FOC shall store all relevant (submitted/received) data to enable AU`s in analysing the impact of UDPP on their flights
Title	Post-Operational Analysis
Status	<In Progress>
Rationale	The AU will use the data to conduct post operations analysis and evaluate cost and operational impact
Category	<Operational>
Validation Method	<Gaming Technique (Agent Based Analysis)>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA 05.03.06	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0111	<Partial>
<APPLIES_TO>	<Operational Process>	PCS-P07.06.02-OSED-S2V2.0002	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-UDP3.0060
Requirement	The AU shall be capable of unsuspending a suspended flight if it has sufficient credits to reapply to that flight.
Title	AU SFP OC Usage
Status	<In Progress>
Rationale	This allows flexibility for an AU to un-suspend a suspended flight. The unsuspended flight goes back to the original baseline delay position – and gets Its original 100 Operating Credits (OC) back.
Category	<Operational>
Validation Method	<Gaming Technique>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0095 REQ-07.02-DOD-0002.0096 REQ-07.02-DOD-0002.0097 REQ-07.02-DOD-0002.0098	<Partial>
<APPLIES_TO>	<Operational Process>	PCS-P07.06.02-OSED-S2V2.0002	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.06	N/A

[REQ]

Identifier	REQ-11.01.02-OSED-UDP3.0070
Requirement	The AU shall be able to update prioritisation information during a UDPP time Window of action given by DCB, according to the constraint and organisation.

Title	AU FDA Priority Reprioritisation
Status	<In Progress>
Rationale	The AU should have enough flexibility to update their FDA Priority during UDPP time window
Category	<Operational>
Validation Method	<Gaming Technique (Agent Based Analysis)>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0002.0095 REQ-07.02-DOD-0002.0096 REQ-07.02-DOD-0002.0097 REQ-07.02-DOD-0002.0098	<Partial>
<APPLIES_TO>	<Operational Process>	PCS-P07.06.02-OSED-S2V2.0002	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA05.03.06	N/A

6.2 Information Exchange Requirements

6.2.1 Business Trajectory (including Trajectory Management Framework)

[IER]

Identifier	Name	Issuer	Intended Addressees	Information Element	Involved Operational Activities	Interaction Rules and Policy	Status	Rationale	Satisfied DOD Requirement Identifier	Service Identifier
IER-11.01.02-OSED-BMT1.0010	Provision of the iSBT trajectory	FOC	NM	Extended flight plan	Extended Flight Plan Creation, Updating & Publishing; Update flight plan if needed; Submit and update iSBT/iSMT Reference Flight Plan Publishing;	One-Way	<In Progress>	This OSED (sections 2, 3, and 5)	REQ-07.02-DOD-0001.0002	
IER-11.01.02-OSED-BMT1.0020	Update of the iSBT trajectory	FOC	NM	Extended flight plan	Extended Flight Plan Creation, Updating & Publishing; Update flight plan if needed; Submit and update iSBT/iSMT Reference Flight Plan Publishing;	One-Way	<In Progress>	This OSED (sections 2, 3, and 5)	REQ-07.02-DOD-0001.0002	
IER-11.01.02-OSED-BMT1.0030	Provision of the iSBT trajectory validation reply	NM	FOC	Extended flight plan validation reply	Extended Flight Plan Creation, Updating & Publishing; Update flight plan if needed; Submit and update iSBT/iSMT	One-Way	<In Progress>	This OSED (sections 2, 3, and 5)	REQ-07.02-DOD-0001.0002	

Identifier	Name	Issuer	Intended Addressees	Information Element	Involved Operational Activities	Interaction Rules and Policy	Status	Rationale	Satisfied DOD Requirement Identifier	Service Identifier
					Reference Flight Plan Publishing;					
IER-11.01.02-OSED-BMT1.0040	Provision of the iSBT flight intent	FOC	NM	SSIM data	Flight Intention Creation & Updating; Publish Early Intent Informatiion ; Submit and update iSBT/iSMT	One-Way	<In Progress>	This OSED (sections 2, 3, and 5)	REQ-07.02-DOD-0001.0002	
IER-11.01.02-OSED-BMT1.0050	Update of the iSBT flight intent	FOC	NM	SSIM data	Flight Intention Creation & Updating; Publish Early Intent Informatiion ; Submit and update iSBT/iSMT	One-Way	<In Progress>	This OSED (sections 2, 3, and 5)	REQ-07.02-DOD-0001.0002	
IER-11.01.02-OSED-BMT1.0060	Provision of iSBT flight intent assessment reply	NM	FOC	SSIM data assessment reply	Flight Intention Creation & Updating; Publish Early Intent Informatiion ; Submit and update iSBT/iSMT	One-Way	<In Progress>	This OSED (sections 2, 3, and 5)	REQ-07.02-DOD-0001.0002	

6.2.2 Free Route

[IER]

Identifier	Name	Issuer	Intended Addressees	Information Element	Involved Operational Activities	Interaction Rules and Policy	Status	Rationale	Satisfied DOD Requirement Identifier	Service Identifier
IER-11.01.02-OSED-FRA1.0010	Provision of the Free Routing Airspace Volume Availability to the FOC	ANSP	FOC	Free Routing Airspace Volume Availability	Submit and update iSBT/iSMT	One-Way	<In Progress>	This OSED (sections 2, 3, and 5)	REQ-07.02-DOD-0001.0002	No additional new service identified
IER-11.01.02-OSED-FRA1.0020	Provision of the Free Routing Airspace Time Availability to the FOC	ANSP	FOC	Free Routing Airspace Time Availability	Submit and update iSBT/iSMT	One-Way	<In Progress>	This OSED (sections 2, 3, and 5)	REQ-07.02-DOD-0001.0002	No additional new service identified
IER-11.01.02-OSED-FRA1.0030	Provision of the Free Routing Airspace flight planning rules to the FOC	ANSP	FOC	Free Routing Airspace Flight Planning Rules	Submit and update iSBT/iSMT	One-Way	<In Progress>	This OSED (sections 2, 3, and 5)	REQ-07.02-DOD-0001.0002	No additional new service identified

6.2.3 Aeronautical Information Management / METeorology

[IER]

Identifier	Name	Issuer	Intended Addressees	Information Element	Involved Operational Activities	Interaction Rules and Policy	Status	Rationale	Satisfied DOD Requirement Identifier	Service Identifier
IER-11.01.02-OSED-AIM1.0010	Transport the AIS/MET information from external sources to FB Data Management	Data Originator	FOC	AIS/MET	Flight planning, pre-flight briefing, on-board briefing, in-flight updates	Data Originator must meet standardization criteria	<In Progress>	This OSED (sections 2, 3 and 5)	REQ-07.02-DOD-0001.0025	
IER-11.01.02-OSED-AIM1.0020	Transport AIS/MET information from Data Management to all Functional Blocks of the	Data Originator	FOC	AIS/MET	Flight planning, pre-flight briefing, on-board briefing, in-flight updates	Data based on flight trajectory, Application must monitor for new information	<In Progress>	This OSED (sections 2, 3 and 5)	REQ-07.02-DOD-0001.0025	

Identifier	Name	Issuer	Intended Addressees	Information Element	Involved Operational Activities	Interaction Rules and Policy	Status	Rationale	Satisfied DOD Requirement Identifier	Service Identifier
	FOC system									
IER-11.01.02-OSED-AIM1.0030	Request flight planning briefing	Pilot/Dispatcher	FOC, Pilot	ePIB	Flight planning		<In Progress>	This OSED (sections 2, 3 and 5)	REQ-07.02-DOD-0001.0025	
IER-11.01.02-OSED-AIM1.0040	Request pre-flight briefing	Pilot	FOC, Pilot	ePIB	Pre-flight briefing		<In Progress>	This OSED (sections 2, 3 and 5)	REQ-07.02-DOD-0001.0025	
IER-11.01.02-OSED-AIM1.0050	Request on-board briefing	Pilot	FOC, Pilot	ePIB	On-board briefing		<In Progress>	This OSED (sections 2, 3 and 5)	REQ-07.02-DOD-0001.0025	

6.2.4 Airspace Management and Advanced Flexible Use of Airspace

[IER]

Identifier	Name	Issuer	Intended Addressees	Information Element	Involved Operational Activities	Interaction Rules and Policy	Status	Rationale	Satisfied DOD Requirement Identifier	Service Identifier
IER-11.01.02-OSED-FUA1.0010	Provision of the Real Time Status of Airspace to the FOC	NM	FOC	Real Time Status of Airspace	Submit and update iSBT/iSMT	One-Way	<In Progress>	This OSED (sections 2, 3, and 5)	REQ-07.02-DOD-0001.0005	No additional new service identified

6.2.5 User Driven Prioritization Process

Due to the complexity of the process not all potential stakeholders have been involved in the validation process till now. For this reason interface exchange requirements have not been clearly defined dedicated to the respective stakeholder. Requirements to enable the FOC system to exchange the relevant information allowing AU´s to analyze the cost impact of a published CCS/HSPT to the flight program and to communicate the required information to other stakeholders are listed in the table below.

As accountable stakeholders have not been clearly defined yet, multiple potential accountable stakeholders are listed as “ISSUER or Intended Addresses

[IER]

Identifier	Name	Issuer	Intended Addressees	Information Element	Involved Operational Activities	Interaction Rules and Policy	Status	Rationale	Satisfied DOD Requirement Identifier	Service Identifier
IER-11.01.02-OSED-UDPP1.0010	AU Schedule Data transmission	FOC	DCB ,NMF,APOC	Flight Schedule data	UDPP	One Way	<In Progress>	This OSED (sections 2, 3, and 5)		No additional new service identified
IER-11.01.02-OSED-UDPP1.0020	initial set of Hotspot / CCSinformation	DCB ,NMF,APOC	FOC	Area (Airport) affected, Timings,	UDPP	One Way	<In Progress>	This OSED (sections 2, 3, and 5)	REQ-07.02.00-DOD-0002.0093	No additional new service identified
IER-11.01.02-OSED-UDPP1.0030	AU UDPP Data Exchange:	FOC	DCB ,NMF,APOC	FDA values, OC`s	UDPP	One Way	<In Progress>	This OSED (sections 2, 3, and 5)	REQ-07.02-DOD-0002.0018	No additional new service identified
IER-11.01.02-OSED-UDPP1.0040	DCB(NMF) UDPP Information Exchange:	DCB ,NMF,APOC	FOC	base line delay information per individual flight affected OI`s for the relevant CCS relulting from the hotspot	UDPP	One Way	<In Progress>	This OSED (sections 2, 3, and 5)	REQ-07.02-DOD-0002.0018	No additional new service identified

7 References

7.1 Applicable Documents

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

[1] Template Toolbox 03.01.03
https://extranet.sesarju.eu/Programme%20Library/SESAR%20Template%20Toolbox.dot

[2] Requirements and V&V Guidelines 03.01.00
https://extranet.sesarju.eu/Programme%20Library/Requirements%20and%20VV%20Guidelines.doc

[3] Templates and Toolbox User Manual 03.01.01
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 develop the deliverable:

[5] B4.2 High Level Process Models

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

[7] B 04.03 Architecture of the Technical Systems Description Document for Step 1

[8] ICAO Document 9694-AN/955 – Manual of Air Traffic Services Data Link applications

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

[12] IR DS16 – Integrated Roadmap Data Set 16.

[13] WPB.01 Integrated Roadmap Latest version

[14] WP11.1 Detailed Operational Description – DOD Step 2 and 3 as Available (D11.1.1-2c)

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

[16] SESAR Concept Of Operations Step 2 – Edition 00.00.08 – Date February 2013

[17] Transition ConOps SESAR 2020 - Consolidated deliverable with contribution from Operational Federating Projects, Edition 00.01.00
https://extranet.sesarju.eu/WP_B/Project_B.04.02/Project%20Plan/ConOps/ConOps/Transition%20ConOps%20SESAR%202020%20-%20Consolidated%20deliverable%20with%20contribution%20from%20Operational%20Federating%20Projects.docx

[18] 07 06 02 -D45-Step 1 Business trajectory OSED 2015 update, Edition 00.04.00;
https://extranet.sesarju.eu/WP_07/Project_07.06.02/Project%20Plan/Trajectory-Step%201/BT%20OSED/Edition%204.0%20-%20D45/07%2006%2002%20-D45-Step%201%20Business%20trajectory%20OSED%202015%20update.docx

[19] 07.06.02-D07-Step 2 OSED V1; Edition 00.00.18; https://extranet.sesarju.eu/WP_07/Project_07.06.02/Project%20Plan/Trajectory-Step%202/BT%20%20OSED/07.06.02-D07%20S2%20V1%20BT%20%20OSED/07.06.02-D07-Step%202%20OSED%20V1.doc

[20] 04.02.02-D37 Free Route OSED Iteration 2, Edition 00.02.01a https://extranet.sesarju.eu/WP_04/Project_04.07.02/Project%20Plan/Submitted%20Deliverables/P04.07.02%20Free%20Route%20OSED%20Iteration%202/04.07.02-D37%20Free%20Route%20OSED_2_v00.02.01a_clean.docx

[21] 07.02-D29-Step1 Release 5 DOD, Edition 00.04.01 https://extranet.sesarju.eu/WP_07/Project_07.02/Project%20Plan/Step1/07.02-D29-Step%201%20Release%205%20DOD.docm

[22] 07.02-D07-Step 2 Release 4 DOD, Edition 00.03.00 https://extranet.sesarju.eu/WP_07/Project_07.02/Project%20Plan/Step2/07.02-D07-Step%202%20Release%204%20DOD.docm

[23] EXE-07.06.02-VP-311 - Enhance current flight planning processes

[24] EXE-07.06.02-VP-616 - Enhance current flight planning processes Part 2

[25] P11.01.05 - D29 - Contribution to EXE-07.05.04-VP-710 - AFUA Step 1 V3 Validation Report, Edition 00.01.00 https://extranet.sesarju.eu/WP_11FW/Project_11.01.05/Project%20Plan/AFUA/D29-D11.1.5-3c-AFUA%20Edition%2000.01.00%20Contribution%20to%20Validation%20Report.doc

[26] D11.1.5-1ca-EFPL Contribution to EXE-07.06.02-VP-713 – EFPL Step 1 V3 Validation Plan

[27] D11.1.5-3ca-EFPL Contribution to EXE-07.06.02-VP-713 – EFPL Step 1 V3 Validation Report

[28] 11.1.5.1cb-UDPP – Update Contribution to EXE-07.06.02-VP-730 – UDPP Step 2 V2 Validation Plan

[29] 11.1.5-3ca-UDPP – Contribution to EXE-07.06.02-VP-730 – UDPP Step 2 V2 Validation Report

[30] EXE-11.01.05-VP-775 - Collaborative Trajectory Management between AOC and ATC

[31] P11.01.05 - D23 - Contribution to EXE-04.03-VP-797 Free Route Step 1 V2 Validation Report (Lufthansa Systems), Edition 00.01.00 https://extranet.sesarju.eu/WP_11FW/Project_11.01.05/Project%20Plan/FR%20(Free%20Route)/11.01.05-D23-Contribution%20to%20EXE-04.03-VP-797%20Free%20Route%20Step%201%20V2%20Validation%20Report%20LSY.doc

[32] P04.03 - M602 - Validation Report EXE-04.03-VP-797, in preparation

[33] EXE-11.01.05-VP-806 - Collaborative Trajectory Management through usage of FIXM

[34] 11.1.5-1cb-AIM- Update Contribution to EXE-13.02.02-VP-461 – AIM Step 1 V3 Validation Plan Edition 02.00.00 https://extranet.sesarju.eu/WP_11FW/Project_11.01.05/Project%20Plan/AIM/D11.1.5-1cb-AIM%20Edition%2002.00.00%20Update%20Contribution%20to%20Validation%20Plan.doc

[35] 11.1.5-3ca-AIM-SAB- Contribution to EXE-13.02.02-VP-461 - AIM Step 1 V3 Validation Report Sabre Edition 00.01.00 https://extranet.sesarju.eu/WP_11FW/Project_11.01.05/Project%20Plan/AIM/11.01.05-D33-Contribution%20to%20EXE-13.02.02-VP-461%20AIM%20Validation%20Report%20SABRE.doc

[36] D11.1.5-3ca-AIM-HON Contribution to EXE-13.02.02-VP-461 - AIM Step 1 V3 Validation Report Honeywell Edition 00.01.00 https://extranet.sesarju.eu/WP_11FW/Project_11.01.05/Project%20Plan/AIM/11.01.05-D32-Contribution%20to%20EXE-13.02.02-VP-461%20AIM%20Validation%20Report%20Honeywell.doc

[37] D11.1.5-1ca-MET FOC Validation Plan - EXE-791 Step 1 V2 (BMT-MET)

[38] D11.1.5-2ca-MET Validation Report for stand-alone FOC Step1 V2 -EXE791 (BMT-MET)

Appendix A Justifications

This section will be updated with the next version of this OSED document.

Appendix B New Information Elements

This section will be updated with the next version of this OSED document.

Appendix C Deleted requirements

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0005**
Requirement	**The Network Manager shall calculate terminal area and en-route throughput limitations from the Air traffic demand data provided by the Airspace User.**
Title	Sharing of demand data (NPR)
Status	<Deleted>
Rationale	The timely sharing of air traffic demand data by all AUs will allow the NM and APO to calculate potential bottlenecks. The operational goal of this requirement is to ensure sufficient ATC manning en-route and in terminal controlling areas.
Category	<Operational><Performance><Safety><Design>
Validation Method	<Live Trial>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-11.01.01-DOD-D001.0001	<Full>

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0010**
Requirement	**The Flight Schedule Planner shall invoke the corrective action process detection of an unrealistic scheduled block time computed from the air traffic demand data coming from the network manager.**
Title	Usage of air traffic demand data in flight schedule planning
Status	<Deleted>
Rationale	In order to support the effort to avoid conflicts and congestions and to avoid unachievable scheduled block times, the Flight Schedule Planner must have a detailed and holistic view on the entire air traffic demand data that is available in the network manager's system.
Category	<Operational><Performance><Safety><Design>
Validation Method	<Shadow Mode>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-11.01.01-DOD-D001.0009	<Full>

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0015**
Requirement	**The Flight Dispatcher shall invoke the corrective action process upon detection of an unrealistic planned block time computed from the air traffic demand data coming from the network manager.**
Title	Usage of air traffic demand data in route analysis
Status	<Deleted>
Rationale	In order to support the effort to avoid conflicts and congestions and to avoid unachievable planned block times, the Route Analysis Officer must have a detailed and holistic view on the entire air traffic demand data.
Category	<Operational><Performance><Safety><Design>

Validation Method	<Shadow Mode>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-11.01.01-DOD-D001.0009	<Partial>

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0020**
Requirement	**When the Flight Dispatcher files a flight to the Network Manager the flight plan message shall be in the EFPL format.**
Title	Usage of 4D trajectory in the route validation process
Status	<Deleted>
Rationale	In order to improve the flight plan validation against air traffic restrictions an extended flight plan including a 4D trajectory has to be exchanged. That 4D trajectory shall be used to check the planned flight trajectory against ATM constraints.
Category	<Operational><Performance><Safety><Design>
Validation Method	<Live Trial>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-11.01.01-DOD-D001.0003	<Full>

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0025**
Requirement	**When the Automation Dispatcher files a flight to the Network Manager the flight plan message shall be in the EFPL format.**
Title	Usage of aircraft performance data in the route validation process
Status	<Deleted>
Rationale	In the absence of a 4D trajectory in the EFPL the aircraft performance data contained shall be used to check the planned flight trajectory against ATM constraints.
Category	<Operational><Performance><Safety><Design>
Validation Method	<Live Trial>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-11.01.01-DOD-D001.0003	<Full>

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0030**
Requirement	**The flight dispatcher shall invoke measures upon detection of non-adherence of the flight plan to the time constraints provided by the Network Manager.**
Title	Availability of time constraints
Status	<Deleted>
Rationale	For pre-flight and tactical overload avoidance, time constraints may be proposed by the NM respectively the ATC to overcome a conflict. The Irregularity Cost Manager, the Flight Dispatcher and the In-Flight Monitoring Officer can use this information to decide how to avoid the conflict. Either by following a time constraint or by changing to a different conflict free trajectory that is more efficient. Please refer to the Use Case 5.2.5

Category	<Operational><Performance><Safety><Design>
Validation Method	<Live Trial>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-11.01.01-DOD-D001.0006	<Full>

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0035**
Requirement	**The flight dispatcher shall plan a 4D trajectory that includes probabilistic tactical ATC restrictions and is as close as possible to the expected executed trajectory.**
Title	Availability of tactical network restrictions (PTRs)
Status	<Deleted>
Rationale	For pre-flight and tactical overload avoidance tactical network restrictions (PTRs) shall be transparently shared by ATC and NM with all other stakeholders. Each of those tactical network restriction shall be provided with a probabilistic dimension leaving the airspace user the decision whether to a) Consider it in flight planning b) Take extra fuel in order to account for the potential FL restriction c) Not consider it at all and have it covered by the regulatory contingency fuel The restriction details shall give for each time of the day the details about what to avoid and the probability that it is activated.
Category	<Operational><Performance><Safety><Design>
Validation Method	<Live Trial>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-11.01.01-DOD-D001.0010	<Full>

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0040**
Requirement	**The Route Analysis Officer shall create the most cost efficient CFMU compliant routing for every flight upon the reception of all ATM constraints from the Network Manager.**
Title	Availability of ATM constraints (RAD, CDR, Restricted Areas, NOTAM Restrictions, AIP published restrictions)
Status	<Deleted>
Rationale	In order to deliver a 100% compliant 4D trajectory (at all times), all planning restrictions have to be known to the Route Analysis Officer and the Flight Dispatcher. To support an automatic processing the delivered data has to be in a machine readable format. All details of a restriction have to be in a fully machine readable format. No detail of the restriction must be written in sole human readable remark sections.
Category	<Operational><Performance><Safety><Design>
Validation Method	<Real Time Simulation><Live Trial>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-11.01.01-DOD-D001.0006	<Full>

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0045**

Requirement	**The In-Flight Monitoring Officer shall perform consistent in-flight support from the ground from real-time executed trajectory information.**
Title	Availability of aircraft position, time and event data
Status	<Deleted>
Rationale	In order for AUs to have an accurate and actual overview on aircraft position and movement aircraft position, time and event data shall be shared by the NM.
Category	<Operational><Performance><Safety><Design>
Validation Method	<Real Time Simulation><Live Trial>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-11.01.01-DOD-D001.0014	<Partial>

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0050**
Requirement	**The ATM constraints data schema shall be persistent**
Title	Permanency of restriction data schema
Status	<Deleted>
Rationale	To ensure stability of the entire air traffic system the schema for defining ATM constraints should not change. In case a change is necessary it should only be done in accordance with all stakeholders (especially AUs and FOC system vendors). Moved to IER section
Category	<Performance><Design>
Validation Method	
Verification Method	<Inspection>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0055**
Requirement	**The published ATM constraints data shall cover 100% (and not less) of the ATM constraints.**
Title	Sole source of ATM constraints
Status	<Deleted>
Rationale	To ensure stability of the entire air traffic system the centralized ATM constraints database shall be the sole source for ATM constraints. That means that no ATM constraints can be published elsewhere (NOTAM, AIP…). This will also increase safety as the chance of overlooking a restriction is lowered. Covered by REQ-11.01.02-OSED-D001.0008. Will be handled in the TS.
Category	<Operational><Performance><Safety><Design>
Validation Method	<Live Trial>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0060**
Requirement	**Every published restriction should have a globally UNIQUE identifier to allow traceability and transparency**
Title	Unique identifier for every published restriction
Status	<Deleted>
Rationale	To ensure stability of the entire air traffic system the centralized ATM

	constraints database shall provide restrictions with a unique identifier. This will help to build a transparent and traceable system. 4D trajectories can be provided with a list of considered restrictions. Moved to IER section
Category	<Operational><Performance><Safety><Design>
Validation Method	<Review of Design><Analysis>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0065**
Requirement	**The Route Analysis Officer shall create the most cost efficient routing using the Free Route Airspace data published in the AIP.**
Title	Extension of free route areas (FRA)
Status	<Deleted>
Rationale	To increase the efficiency of the flight execution the introduction of additional free route areas should be expedited. This will give AUs an immediate benefit. Free Route Airspace data shall also be published in a machine readable format to be usable in the FOC system without manual preparation.
Category	<Operational><Performance><Design>
Validation Method	<Shadow Mode>
Verification Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	**REQ-11.01.01-DOD-D001.0015**	<Full>

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0070**
Requirement	**The In-Flight Monitoring Officer shall assess the impact of a changed RBT upon reception of an RBT revision.**
Title	Usage of RBT updates within In-Flight Monitoring
Status	<Deleted>
Rationale	The In-flight Monitoring Officer has to check whether the RBT revision is feasible in terms of fuel and other operational parameters.
Category	<Operational><Performance><Design>
Validation Method	<Shadow Mode>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	**REQ-11.01.01-DOD-D001.0014**	<Partial>

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0075**
Requirement	**The Strategic CDM Manager shall assess the impact of a changed RBT upon reception of an RBT revision.**
Title	Usage of RBT updates within A-CDM.
Status	<Deleted>
Rationale	The Airport CDM tool supports the prioritization process at the airport which helps balancing the demand with respect to the capacity as agreed upon in the AOP. The Strategic CDM Manager needs to have an up-to-date view on the currently executed flights.
Category	<Operational><Performance><Design>

Validation Method	<Shadow Mode>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	**REQ-11.01.01-DOD-D001.0014**	<Partial>

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0080**
Requirement	**The In-Flight Monitoring Officer shall assess the impact of an airport status change upon reception of an airport status change.**
Title	Usage of airport status data within In-Flight-Monitoring
Status	<Deleted>
Rationale	The In-flight Monitoring Officer has to check whether the current situation at an arrival or alternate airport is feasible in terms of fuel and other operational parameters. The status publication shall contain machine readable codes to ensure automatic (pre)-processing.
Category	<Operational><Performance><Design>
Validation Method	<Shadow Mode>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	**REQ-11.01.01-DOD-D001.0016**	<Partial>

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0085**
Requirement	**The Strategic CDM Manager shall assess the impact of an airport status change upon reception of an airport status change.**
Title	Usage of airport status data within A-CDM
Status	<Deleted>
Rationale	The Strategic CDM Manager needs to have an up-to-date view on the airport status of the airports affecting the AU's flights. The status publication shall contain machine readable codes to ensure automatic (pre)-processing.
Category	<Operational><Performance><Design>
Validation Method	<Shadow Mode>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	**REQ-11.01.01-DOD-D001.0016**	<Partial>

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0090**
Requirement	**The aircraft's FMS system shall compute an accurate speed when the Flight Crew enters the Cost Index into the FMS system**
Title	CI Speed in the aircraft's FMS system
Status	<Deleted>
Rationale	To ensure a consistent trajectory interpretation between FOC and FMS systems the CI speed derived by the FMS system has to be corrected. Since current FMS route uplink formats do not allow include speed information the resulting trajectory interpretation will differ from the speed computed by the FOC system. Reason for deletion: This important requirement has to be picked up from our DOD by the responsible operational work packages (WP4/WP5) in order to drive a technical requirement in WP9.

Category	<Operational><Performance>
Validation Method	<Live Trial>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-11.01.01-DOD-D001.0011	<Full>

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0095**
Requirement	**The aircraft's FMS system shall execute the trajectory as computed by the FOC system.**
Title	FMS non-adherence to the planned trajectory
Status	<Deleted>
Rationale	To ensure the most economic trajectory the FMS system must not restrict the lower speed limit to the MRC cruising speed in zero-wind conditions. Under tailwind conditions and with low cost indexes the resulting ECON speed lays below the MRC speed under zero-wind conditions. Disallowing this speed will result in non-economic operations. Furthermore the FMS must be capable of handling step descents and must fly the speeds in accordance to the given cost index. Reason for deletion: This important requirement has to be picked up from our DOD by the responsible operational work packages (WP4/WP5) in order to drive a technical requirement in WP9.
Category	<Operational><Performance>
Validation Method	<Live Trial>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-11.01.01-DOD-D001.0011	<Full>

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0100**
Requirement	**The Network Manager shall send the adequate flightplan format to ATC centres and network managing units upon reception of an EFPL message.**
Title	Flightplan propagation
Status	<Deleted>
Rationale	To remove the burden of identifying and maintaining the list of ATC centre's flightplan processing capability, the network manager shall is responsible for the correct flightplan propagation. This is a significant benefit to the airspace user and can be seen as a quick win.
Category	<Operational><Performance>
Validation Method	<Live Trial>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	**REQ-11.01.01-DOD-D001.0002**	<Partial>

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0105**
Requirement	**The Airspace User shall check whether the En-Route charges calculated by the CRCO are based on an actual TOW as contained in the EFPL and if so, trigger the billing process to Eurocontrol.**
Title	Accurate En Route Charge calculation

Status	<Deleted>
Rationale	The EFPL allows the transmission of an actual TOW. This shall be used to compute the En Route Charges instead of always assuming the maximum TOW. This is a cost benefit to the airspace user and can be seen as a quick win. This can furthermore be considered as a driver for a quick establishment of the EFPL.
Category	<Operational><Performance>
Validation Method	<Expert Group (Judgement Analysis)>
Verification Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	**REQ-11.01.01-DOD-D001.0018**	<Full>

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0110**
Requirement	**The Flight Dispatcher shall plan for sufficient holding fuel upon the reception of airport capacity data from the airport operator**
Title	Airport capacity data sharing for flight planning
Status	<Deleted>
Rationale	The Airspace User needs to have an up-to-date view on airport capacity data in order to support the concept of CDM and UDPP. Runway throughput and procedures in use are required to predict potential arrival and departure delays.
Category	<Interface><Interoperability><Operational><Performance>
Validation Method	<Live Trial>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	**REQ-11.01.01-DOD-D001.0016**	<Partial>

REQ]

Identifier	**REQ-11.01.02-OSED-D001.0115**
Requirement	**The Operations Controller shall prioritize flights according the most cost efficient sequence upon reception of airport capacity data.**
Title	Airport capacity data sharing for operations control
Status	<Deleted>
Rationale	The Airspace User needs to have an up-to-date view on airport capacity data in order to support the concept of A-CDM and UDPP. Runway throughput and procedures in use are required to predict potential arrival and departure delays.
Category	<Interface><Interoperability><Operational><Performance>
Validation Method	<Live Trial>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	**REQ-11.01.01-DOD-D001.0016**	<Partial>

REQ]

Identifier	**REQ-11.01.02-OSED-D001.0120**
Requirement	**The Irregularity Cost Manager shall update irregularity costs for affected flights upon the reception of airport capacity data from the airport operator.**
Title	Airport capacity data sharing for irregularity costs
Status	<Deleted>
Rationale	The Airspace User needs to have an up-to-date view on airport capacity data in

	order to support the concept of UDPP. Airport capacity data is needed to predict each and every flight's delay costs.
Category	<Interface><Interoperability><Operational><Performance>
Validation Method	<Live Trial>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	**REQ-11.01.01-DOD-D001.0016**	<Partial>

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0125**
Requirement	**The Flight Dispatcher shall plan for sufficient taxi fuel upon the reception of airport taxi time data from the airport operator**
Title	Airport taxi information sharing for flight planning
Status	<Deleted>
Rationale	Currently FOC systems use fixed or statistical taxi times when computing the taxi fuel. An up-to-date view on the actual and expected taxi times is required to better predict the expected taxi fuel.
Category	<Interface><Interoperability><Operational><Performance>
Validation Method	<Live Trial>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	**REQ-11.01.01-DOD-D001.0016**	<Partial>

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0130**
Requirement	**The Irregularity Cost Manager shall update irregularity costs for affected flights upon the reception of airport taxi time data from the airport operator**
Title	Airport taxi information sharing for irregularity costs
Status	<Deleted>
Rationale	The Airspace User needs to have an up-to-date view on airport taxi situation in order to support an accurate flightplanning process and the concept of CDM and UDPP. Every change in expected taxi time potentially has an impact on the delay costs for a given flight.
Category	<Interface><Interoperability><Operational><Performance>
Validation Method	<Live Trial>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	**REQ-11.01.01-DOD-D001.0016**	<Partial>

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0135**
Requirement	**The Irregularity Cost Manager shall update irregularity costs for affected flights upon the reception of gate assignment and parking position information from the airport operator.**
Title	Gate and parking position information sharing
Status	<Deleted>
Rationale	The Airspace User needs to have an up-to-date view on the gate assignments, gate opening and closing times and parking positions in order to support an accurate flightplanning process and the concept of CDM and UDPP. Every

	change in gate assignment and parking position potentially has an impact on the delay costs for a given flight.
Category	<Interface><Interoperability><Operational><Performance>
Validation Method	<Live Trial>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	**REQ-11.01.01-DOD-D001.0016**	<Partial>

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0140**
Requirement	**The Irregularity Cost Manager shall update irregularity costs for affected flights upon the reception of gate location and distance information from the airport operator.**
Title	Gate location information sharing
Status	<Deleted>
Rationale	The Airspace User needs to have an up-to-date view on the gate location and distances as well as the terminal transfer times to support the concept of CDM and UDPP. Every change in gate location and distances potentially has an impact on the delay costs for a given flight.
Category	<Interface><Interoperability><Operational><Performance>
Validation Method	<Live Trial>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	**REQ-11.01.01-DOD-D001.0016**	<Partial>

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0145**
Requirement	**The Operations Controller shall publish the EOBT to the NOP once a final decision has been made to delay a flight to support A-CDM**
Title	EOBT sharing
Status	<Deleted>
Rationale	The Operations Controller shall publish the EOBT to the NOP in order to support the concept of A-CDM and to allow the airport operator in predicting capacity vs. demand.
Category	<Interface><Interoperability><Operational><Performance>
Validation Method	<Live Trial>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	**REQ-11.01.01-DOD-D001.0017**	<Full>

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0150**
Requirement	**The Flight Dispatcher shall create a flight plan that is compliant to every NOTAM immediately after reception of such without a manual pre-processing.**
Title	Digital NOTAMs
Status	<Deleted>
Rationale	Currently airspace users have to spend a huge amount of time and manpower

	to process global NOTAM data. Majority of the information published in NOTAMs is important during the flight planning process. Since the amount of NOTAMs published has increased significantly over the last years this workload is also increasing (please refer to reference [16]). NOTAMs in digital format, where the relevant information is coded in a machine interpretable (“understandable”) format will help managing this increasing effort.
Category	<Interface><Interoperability><Operational><Performance>
Validation Method	<Live Trial>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	**REQ-11.01.01-DOD-D001.0019**	<Full>

[REQ]

Identifier	**REQ-11.01.02-OSED-D001.0155**
Requirement	**Flight dispatcher shall create FMS uplink message with actual weather forecast based on RBT.**
Title	FMS weather update
Status	<Deleted>
Rationale	To support 4D operation and FMS and Flight planning system synchronisation
Category	<Interoperability><Operational><Performance><Safety>
Validation Method	<Fast Time Simulation><Live Trial><Real Time Simulation><Shadow Mode>
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-11.01.01-DOD-D001.0011	<Full>

Appendix D Future MET requirements

The textual requirements identified below are outcomes of Airspace Users workshops and meetings with METEO FRANCE. These requirements should be refined and analyzed further. Impacts on FOC systems should be identified in the future (SESAR 2020). Currently, these requirements should be identified at maturity level not more than V1.

Additional information provided is outcomes from Airspace Users workshops and meetings with METEO FRANCE as WP11.02 representatives. This additional information concerns potential solutions to fulfill the needs.

D.1 Additional FL for winds and temperatures

Requirement	Aviation Winds and Temperatures aloft forecast data should be provided to FOC for all Flight Levels.
Title	Additional FL for winds
Rationale	Winds aloft are computer prepared and contain forecast wind direction and speed as well as forecast temperatures. The standard published information is currently published for specific flight levels only: FL180-240-300-340-390. Interpolation for a specific flight level is then done by Service Provider or directly by the operator. It is in the interest of the operator to have forecasts for Winds and Temperatures available to all flight levels.
Additional information	Information used in FMS provided by WAFS (World Area Forecast System) at a refresh rate of 6 hours (4 data set per days): Flight levels of Wind, Temp data : 50 (850 hPa), 80 (750 hPa), 100 (700 hPa), 140 (600 hPa), 180 (500 hPa), 210 (450 hPa), 240 (400 hPa), 270 (350 hPa), 300 (300 hPa), 320 (275 hPa), 340 (250 hPa), 360 (225 hPa), 390 (200 hPa), 410 (175 hPa), 450 (150 hPa), 480 (125 hPa) and 530 (100 hPa) Flight levels of Humidity data : 50 (850 hPa), 80 (750 hPa), 100 (700 hPa), 140 (600 hPa) and 180 (500 hPa) [Amendement 77 – Nov 2016] Future plan for WAFS: higher horizontal, vertical and temporal resolution than today (ASBU Blocks 1 & 3) Delivery: - today via SADIS FTP (WAFC London) and WIFS (WAFC Washington), data files are in GRIB2 and cover the whole globe - tomorrow: web services such as MET-GATE, data sets in bounding boxes - future (S2020): via an enhanced MET-GATE, extract of data in an envelope around flight track.

D.2 Rain prediction in TMA

Requirement	FOC should have prediction of rain/thunderstorms areas (type, intensity, localization, time, duration) in terminal manoeuvring area (TMA).
Title	Rain prediction in TMA
Rationale	To anticipate the arrival route. To estimate more precisely delays and fuel reserves needed. To take the right decision (i.e : land or divert)
Additional Information	Detection and nowcast of rain/thunderstorm works better using radar imagery rather than satellite. Most TMAs are covered by MET radar (whereas satellite-based detection would be more suitable for tracks over oceanic areas) Solution existing at Météo-France: - detection and nowcast (1hour) of convective cells based on radar imagery (precipitation intensity); 1km resolution and 5' refresh rate;

	- coverage: France. To be extended to Europe (3 to 5-km resolution and 15’ refresh rate) soon. Rain forecast in TMA: to be based on NWP forecast. Similar or lower resolution (few kms, 15’ or more) Tomorrow: 2D and 3D convection information based on European radar composite (1 to 5-km resolution and 15’ refresh rate) Delivery: via MET-GATE, interoperable data formats (xml) Open point : How far in advance is the information needed? Other types of precipitation: refer to TAFs or to enhanced local services based on radar imagery or to enhanced airport forecast services such as cdm@xxx at major airports in France

D.3 Customized TAF for specific time window

Requirement	FOCs should have complete Terminal Aerodrome Forecast (TAF) at any time (24 h per day / 7 days per week), and to be able to address a forecast window of 24 hours minimum through friendly HMIs.
Title	Customized TAF for specific time window
Rationale	To increase situational awareness level TAF not available for all airports (for any time) TAF are not always complete To optimize fuel consumption (to decrease fuel contingency) Interpretation of current TAF is unfriendly.
Additional information	Amendment rules are not currently convenient sometimes (E.g. wind speed tolerance is 10Kts, unless wind speed changing is greater than 10Kts, TAF is not amended. However VRB02KT and 18010KT wind values have different risk for Istanbul Atatürk Airport). TAF is an ICAO-standardized product. Currently no demand to deeply change this standard. Initiatives to define new information and services for the terminal area. Availability at airports is defined by agreement between the MET authority and civil aviation (airport category level). Deficiencies are noted at airports in some regions. Delivery: via AMHS or MET-GATE, in new interoperable format (AvXML) Enhanced visualisation: Solution existing in France: website cdm@xxx (subscription needed) similar solutions in Canada, Japan …

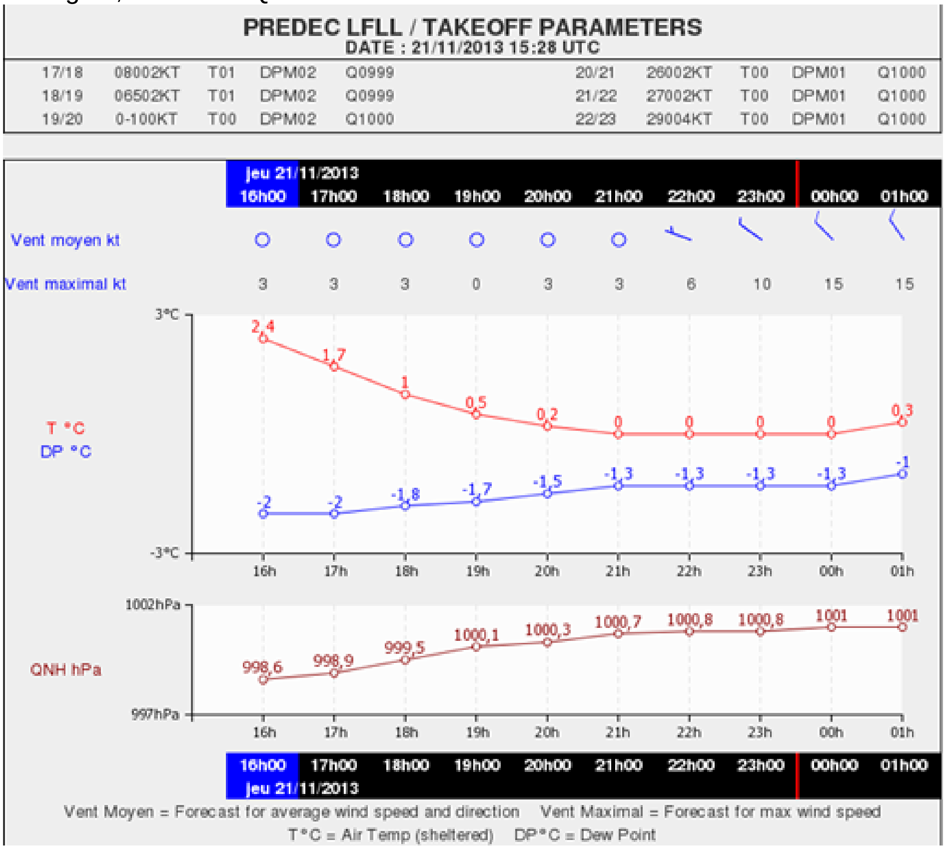
D.4 Amended TAF

Requirement	FOC should have TAF amended each time the weather risk on airport flight operations changes
Title	Amended TAF
Rationale	To increase situational awareness level TAF not available for all airports (for any time) TAF are not always complete To optimize fuel consumption (to decrease fuel contingency) Interpretation of current TAF is unfriendly.
<u>Additional information</u>	Amendment rules are not currently convenient sometimes (E.g. wind speed tolerance is 10Kts, unless wind speed changing is greater than 10Kts, TAF is not amended. However VRB02KT and 18010KT wind values have different risk for Istanbul Atatürk Airport). TAF is an ICAO-standardized product. Currently no demand to deeply change this standard. Initiatives to define new information and services for the terminal area. Availability at airports is defined by agreement between the MET authority and civil aviation (airport category level). Deficiencies are noted at airports in some regions. Delivery: via AMHS or MET-GATE, in new interoperable format (AvXML) Enhanced visualisation: Solution existing in France: website cdm@xxx (subscription needed) similar solutions in Canada, Japan …

D.5 TEMP and QNH prediction in forecast

Requirement	FOC should have TEMP and QNH prediction in forecast and trends (MIN, MAX)
Title	TEMP and QNH prediction in forecast
Rationale	To compute the A/C take-off/landing performances with better accuracy and reliability

Additional information	In normal case, the trend can be anticipated. The need is more related to abnormal cases (quick weather change). TREND messages provide TEMP and QNH prediction. Aerodrome warnings advice on other weather phenomena or sudden changes. Solution in place in France on big airports : Take-off forecasts provide wind/gust, T/DP and QNH forecasts



D.6 Lighting information

Requirement	FOC should have lighting information (intensity, localization, time, duration)
Title	Lighting information
Rationale	To anticipate the route. To change the route to avoid the lighting area To increase situational awareness
Additional information	Radar and satellites images can include this information. Lightning information (localization, time, intensity, +/-) exists around the whole globe but is not free. Data quality is lower over large oceanic areas. Prototype for a convection service (not only lightning information) developed by EUMETNET and proposed to deployment.

D.7 Ad-hoc weather observation (small airport, working area)

Requirement	FOC should have ad-hoc weather observation for all airports, especially for small airports.
Title	Ad-hoc weather observation (small airport, working area)
Rationale	To increase situational awareness, especially when no IFR procedure is available.
Additional information	Airports are classified and level of service is in accordance with this classification. Negotiation with national civil aviation or MET authority is needed to have more services or an enhanced service on small airports. Initiative of interest : Virtual Tower (to concentrate small airports control activity to one virtual tower)

D.8 Ad hoc product for significant weather phenomena (i.e. typhoon, twister, etc)

Requirement	FOC should have ad hoc prediction in forecast for significant weather phenomena (type, intensity, localization, time, duration).
Title	Ad hoc product for significant weather phenomena (i.e. typhoon, twister, etc)
Rationale	To anticipate the route. To change the route to avoid the significant weather phenomena To estimate more precisely delays and fuel reserves needed. To take the right decision To increase situational awareness / flight safety
Additional information	To have up to date information in these cases is very important Current products for significant weather : SIGMET, VAA/VAG, TCA/TCG New format for this information (IWXXM/AvXML) would allow interoperability, integration into decision aid systems (ATM, airlines) and uplink to aircrafts. New products or information services are under development or nearly used in operation.

D.9 Top of Clouds to be reported

Requirement	FOC should have localization of clouds (top and bottom) reported (TAF, METARs).
Title	Top of Clouds to be reported
Rationale	To optimize fuel consumption (to decrease fuel contingency) To increase the passengers comfort To increase situational awareness / flight safety
Additional information	Clouds are linked to ice, turbulences, lighting or even thunderstorms Information already provided in few convection services for CB clouds. Remote detection (by satellite) is not performing well in all cases. Need for onboard observation to verify/validate cloud top altitudes.

	Information to be extracted from NWP systems.

D.10 Indicate reliability of forecast information

Requirement	FOC should have reliability of forecast information reported
Title	Indicate reliability of forecast information
Rationale	To help to take the right decision on ground or on board
Additional information	Could be addressed through the use of ensemble forecast system or probabilistic forecast information (MET project in SESAR2020)

D.11 Volcanic ash

Requirement	FOC should have prediction in forecast for volcanic ashes The nine VAACs (Volcanic Ash Advisory Centers) have been designated by the International Civil Aviation Organization to provide their expertise to civil aviation in case of significant volcanic eruptions. Homogenization of best practices and products given by all the VAACs
Title	Volcanic ash
Rationale	To anticipate the route. To change the route to avoid the volcanic ash To estimate more precisely delays and fuel reserves needed. To take the right decision To increase situational awareness / flight safety
Additional information	To have up to date information in this case is very important

D.12 Precipitation forecast

Requirement	FOC should have prediction in forecast for precipitation (heavy rain, snow, freezing rain) including CBs (type, intensity, localization, time, duration)
Title	Precipitation forecast
Rationale	For snow phenomena, it is important to have cumulative depth. To anticipate the route. To change the route to avoid the areas of precipitation To estimate more precisely delays and fuel reserves needed. To take the right decision To increase situational awareness / flight safety
Additional information	SESAR Deployment : EUMETNET (FMI) intends to deploy a service for winter conditions forecast (on Nordic airports)

Requirement	FOC should have a weather radar picture fully covering the whole EU region, with high quality (not only simple linear track) for short term forecast
Title	Improve weather radar information
Rationale	To anticipate the route. To change the route to avoid the weather phenomena To estimate more precisely delays and fuel reserves needed. To take the right decision To increase situational awareness / flight safety
Additional information	To have up to date information in these cases is very important. European radar composite available in ECOMET catalogue. SESAR Deployment: EUMETNET (UKMO, MF) intends to deploy a convection information service based on this European radar composite.

D.13 CAT forecast

Requirement	FOC should have CAT forecast more accurate and updated in real time. FOC should be advised of the best FL to cross CAT areas.
Title	CAT forecast
Rationale	To increase the passengers comfort To increase situational awareness
Additional information	To have up to date information in this case is very important. SESAR Deployment: EUMETNET (UKMO, MF, and DWD) intends to deploy a harmonized turbulence forecast service over Western Europe Coverage: (72 deg N, 42 deg E) (20 deg N, 32 deg W) Horizontal resolution: 0.1 ° (~10km) Vertical Levels: 400, 300, 250, 200, 150 hPa roughly corresponding to FL 240, 300, 340, 390 and 150 NMS need onboard “observation” which means occurrence of turbulence encounters (and intensity of phenomenon); Pilot REPort (PIREP) should be standardized, provided globally and disseminated to NMS. EDR : same issue

D.14 Best FL to cross CAT forecast

Requirement	FOC should be advised of the best FL to cross CAT areas.
Title	Best FL to cross CAT forecast
Rationale	To increase the passengers comfort To increase situational awareness
Additional information	To have up to date information in this case is very important. SESAR Deployment: EUMETNET (UKMO, MF, and DWD) intends to deploy a harmonized turbulence forecast service over Western Europe Coverage: (72 deg N, 42 deg E) (20 deg N, 32 deg W) Horizontal resolution: 0.1 ° (~10km) Vertical Levels: 400, 300, 250, 200, 150 hPa roughly corresponding to FL 240, 300, 340, 390 and 150 NMS need onboard “observation” which means occurrence of turbulence encounters (and intensity of phenomenon); Pilot REPort (PIREP) should be standardized, provided globally and disseminated to NMS. EDR : same issue

D.15 Icing forecast

Requirement	FOC should have Icing forecast more accurate and updated in real time
Title	Icing forecast
Rationale	To dispatch the A/C (MEL considerations) To anticipate the route To change the route to avoid the icing areas To estimate more precisely delays and fuel reserves needed. To take the right decision To increase situational awareness / flight safety
Additional information	To have up to date information in these cases is very important SESAR Deployment: EUMETNET (UKMO, MF, and DWD) intends to deploy a harmonized icing forecast service over Western Europe: Coverage 40°W-50°E, 30°N-70°N Horizontal resolution: 0.05° (~5km) Vertical Levels: 1000, 950, 925, 900, 850, 800, 700, 600, 500, 400 hPa roughly corresponding to the flight levels 0 (ground), 20, 25, 30, 50, 65, 100, 140, 180, 240

D.16 Cosmic Radiation (Solar storms)

Requirement	FOC should have ad hoc prediction in forecast for cosmic radiation (intensity, localization, time, duration).
Title	Cosmic Radiation (Solar storms)
Rationale	To optimize crew planning
Additional information	ICAO initiative in MET Working Group Met Information Service & Development (MISD) work stream Space Weather to define new services for space weather. User needs to be clarified.

- END OF DOCUMENT -