Step 1 Business trajectory final OSED 2016

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Abstract

This document corresponds to an update of the Step 1 OSED for Business Trajectory management and addresses the transition steps towards the target business trajectory concept implementation. Within the operational scope of Step 1- time-based operations- two distinct evolutions are detailed including the definition of an extended flight plan -quick win- (which corresponds to the SESAR solution #37 – only AUO-0203-A in scope) allowing the exchange of trajectory information between Airspace Users and ATM and the collection of user preferred route information in the medium term planning phase. Those evolutions provide the basis to develop at later stage of STEP 1, an initial implementation of the SBT (iSBT) and RBT (iRBT) supported by ICAO (FF-ICE increment 1, FIXM) and Flight Object developments and integrated with time-based DCB operations.

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Rational for rejection

None.

7 Document History

Edition	Date	Status	Author	Justification
00.00.02	27/06//2011	Draft	F.Decroly G.Mateuca C.Hampson	Initial draft including sections 2, 3, 4
00.00.04	03/09//2011	Draft	G.Mavoian G.Mateuca	Completion of sections 5 & 6 for the topic “extended flight plan”. Split of the OSED in two documents.
00.00.05	14/10/2011	Draft	G.Mavoian F.Decroly G.Mateuca	Change of the structure of the OSED. Alignment of Network DOD step 1. Version uploaded in support to Release 2 review
00.00.07	28/05/2012	Draft	G.Mavoian G.Mateuca F. Decroly	Consolidation of the document. Integration of comments from DNM, WP13, WP8 and discussions with WP11.
00.01.00	31/08/2012	Draft	G.Mateuca G. Mavoian	Integration of comments from SJU and discussions with WP8 WP11. Integration of IER requirements developed by P8.3.5. Update of definitions section
00.02.00	05/03/2013	Final	A. Gheorghe G. Mavoian A. Cagidimentrio	Finalisation of V2.0 taking into account reviewer comments.
00.02.01	07/06/2013	Final	G. Mavoian A. Gheorghe	Update of V2.0 taking into account SJU and WP11.1 comments. Update of scenarios/use-cases in section 6.
00.02.90	30/11/2014	Draft	G. Mavoian A. Gheorghe G.Mateuca MJ Ribera A. Cagidimentrio	Update taking in accounts VP-311 & VP-616 exercises results, preparation of VP-714 exercise and operational scenarios developed in the context of FIXM and ICAO FF-ICE.
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00.03.01	20/02/2015	Final	G. Mavoian	Comments from SJU Assessment clarified.
00.03.02	08/12/2015	Revised Draft for Peer Review	G. Mavoian M.Garrido E.Miquel	Update taking into account VR-715 results and further alignment with FFICE increment 1 provisions and 4DT scenarios

Edition	Date	Status	Author	Justification
00.04.00	08/12/2015	Final	M.Garrido	Update taking into account VR-715 results and further alignment with FFICE increment 1 provisions and 4DT scenarios
00.04.01	28/07/2016	Draft	M.Garrido	Update taking into account: • SJU comments from last version • VR-713 and VR-714 (D46) results. • Further alignment with last version of FFICE provisions.
00.05.00	01/09/2016	Final	M.Garrido	Update taking into account • Peer review comments
00.05.01	03/10/2016	Final	M.Garrido	Re-submitted taking into account SJU review comments.

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This deliverable consists of SJU foreground.

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Executive summary

This OSED describes Business Trajectory Management in the context of Step 1 of the SESAR V&V Storyboard viewed from the network perspective. It focuses on the transition steps towards the target Business Trajectory concept implementation.

Step 1 - time-based operations - corresponds to an initial implementation of the SBT (iSBT) and the RBT (iRBT). In coordination with ICAO concept development (FF-ICE) and standardisation activities, a formalised process will be developed for iSBT covering medium and short-term planning phases with a focus on short-term planning. The iRBT is an initial step toward the target RBT concept improving consistently of trajectories managed by different stakeholders and supporting a better integration of processes in planning and execution in particular for the management of ATFCM regulations through Target Times.

Considering that the Step 1 SBT and RBT operational improvements are ambitious and encompass several evolutions being at different levels of maturity, the 07.06.02 project team identified the need to develop first operational requirements for intermediate steps as a transition toward the target iSBT/iRBT concept.

This approach includes two evolutions initially estimated to be implementable at short term:

- the definition of an extended flight plan (EFPL), which corresponds to the SESAR solution #37 (AUO-0203-A), as a “quick win” improvement, allowing the exchange of trajectory information between Airspace Users and ATM in the short-term planning phase. More precisely, section 4 of this OSED focuses on:
  - the added EFPL information in comparison with the ICAO FPL (4D Trajectory and performance flight data);
  - the link between the NM and FOCs and the use of EFPL information in NM processes (solution included in Pilot Common Projects (PCP) scope);
  - the link with project 05.05.02 to integrate ATC requirements for FOC data to be included in the extended flight plan;
  - the use of EFPL in ATFCM operations (section 4.1.2.7).
- the collection of Nominal Preferred Route (NPR) information in the medium term planning phase (section 2.2.3).

The following table summarises the content of each edition released for the 07.06.02 Step 1 BT OSED including this final SESAR 1 draft edition 5.0.

Edition	Content and updates
00.01.00	Operational requirements for quick wins
00.02.00	Full scope of Step 1, including: • Content Edition 1.0 • Processes description, • Scenarios and use cases • Requirements related to iSBT and iRBT concepts supported by Flight Object
00.03.00	Refinements including: • Results of V2 exercises VP-311 and VP-616 on the EFPL • Requirements and use cases addressing improved NM/ATC interoperability through FO

Edition	Content and updates
	• Partial alignment between ICAO FF-ICE increment 1 and FIXM standardisation initiatives
00.04.00	Refinements including: • Further alignment with ICAO FF- ICE increment 1 and 4D Trajectory scenarios latest versions that were considered reasonably stable • The definition of FIXM compliant B2B services in support of EFPL submission and distribution; • The new elements that NM provides back via EFPLM, i.e. accepted trajectory and PTR identifiers • The results of the VP-715 exercise on the Nominal Preferred Route (NPR) information shared on the medium term planning (section 2.2.3.2). o NPR maturity level V1
00.05.00	Final update including: • Alignment with last version of 07.02 DOD 29 Step 1 Release 5 • Evolution of section 4 (Short Term Planning – EFPL - quick win) which contains o Remarks on non-PCP content o The results of VR-713 (impacting EFPL) ▪ EFPL maturity level V3 achieved ▪ Update status of the requirements o Reference to SWIM services linked to EFPL • Evolution of section 6 (The iSBT and iRBT) which contains o Transition from iSBT to iRBT o Further alignment with last version of FF-ICE provisions[1] o The results of VR-714 (impacting FO) ▪ FO maturity level V2 o Amendment of §6.3.2 IER for EFPL as iSBT element & IER for FO

Table 1 Content of all 07.06.02 Step 1 BT OSED releases

The following table shows a summary of the main concepts of this OSED and their level of maturity:

CONCEPT	COMPONENTS ADDRESSED IN THIS OSED	LEVEL OF MATURITY
EFPL	EFPL (quick win)	V3
iSBT	EFPL (quick win)	V3
	NPR	V1
iRBT	FO	V2

[1] This document is the final draft SESAR 1 Business Trajectory OSED Edition 5.0. It will remain as a draft until the final FFICE provisions will be available so complete alignment with the FF-ICE documentation could be achieved.

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 Network DOD produced by the federating OPS 07.02 project. It also contains additional information which should be consolidated back into the higher level SESAR concepts using a “bottom up” approach.

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

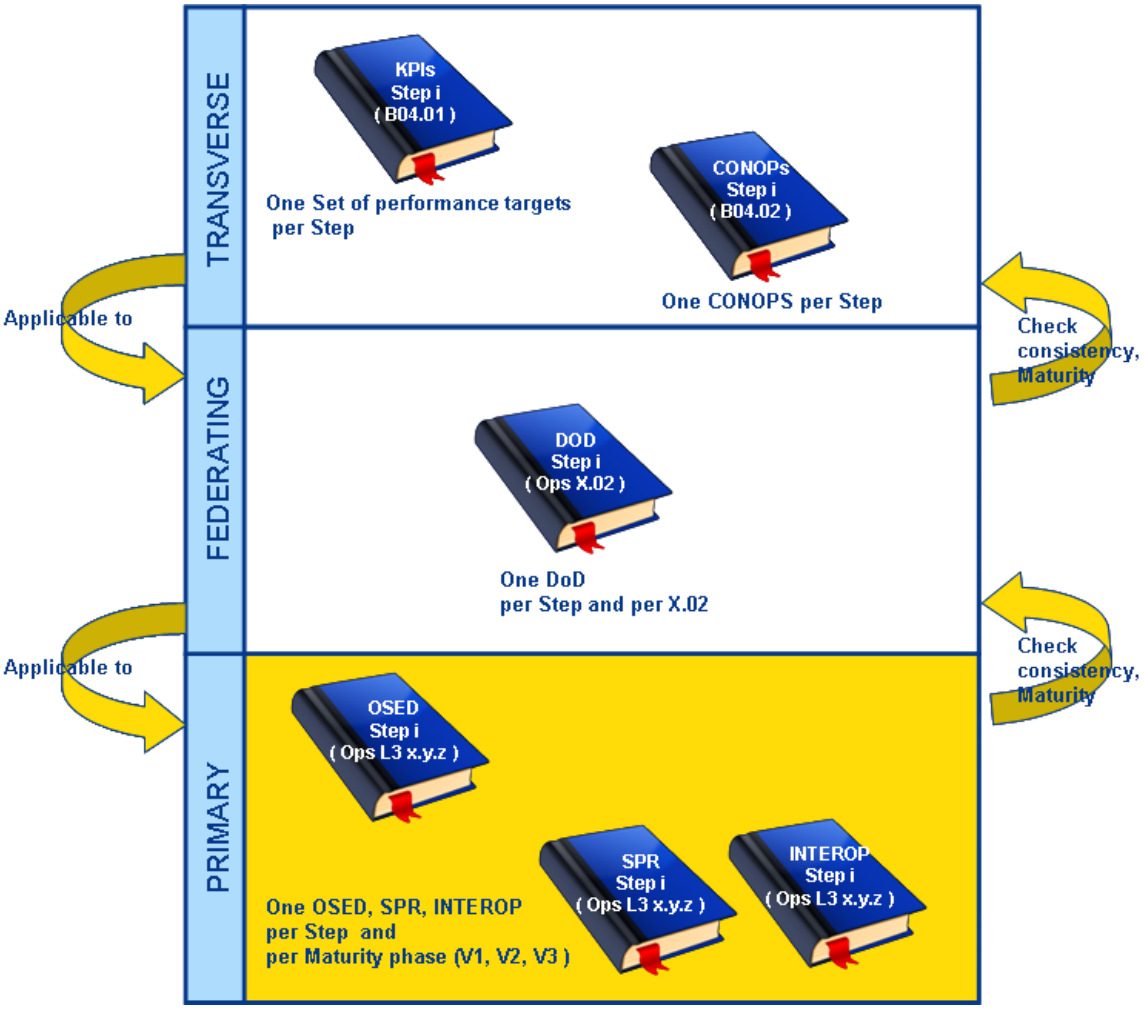

Figure 1: OSED document with regards to other SESAR deliverables

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

It is expected that several updates to this OSED will be produced during the lifecycle of the P07.06.02 project execution phase.

Five major releases are identified as follows:

- D01 - OSED Step 1 edition1.0, September 2012: Quick wins;
- D01 - OSED Step 1 edition2.0, February 2013: full Step 1 scope;
- D38 - OSED Step 1 edition3.0; December 2014: integration of validation results and inputs from FF-ICE/FIXM developments, refinement as input to future validation exercises related to the Flight Object.
- D45 - OSED Step 1 edition4.0,December 2015: update integrating results from exercise VP-715 and further alignment with FF-ICE increment 1
- D56 - Step 1 Business trajectory final OSED (edition 5.0), August 2016.

1.2 Scope

From the 3 distinct operational improvements in which the EFPL evolutions are split:

- AUO-0203-A : submission of EFPLs and use in NM systems
- AUO-0226: distribution and use of EFPLs by ATC
- AUO-0223: harmonisation of the management of ATC constraints in NM and AU systems (basically the consideration of PTRs by AU systems)

only the first OI is in the scope of Solution #37 EFPL and part of the first deployment package.

This OSED details the operational concept for the Operational Focus Area (OFA) *Business/Mission Trajectory Management in Step* 1 limited to the Business trajectory. A separate OSED is addressing the Mission Trajectory[2].

The following diagram provides a refined view of the SESAR storyboard for the target business/Mission trajectory concept covering both Step 1 and Step 2.

[2] Since BAFO1/BAFO 2 and the change request CR1821.

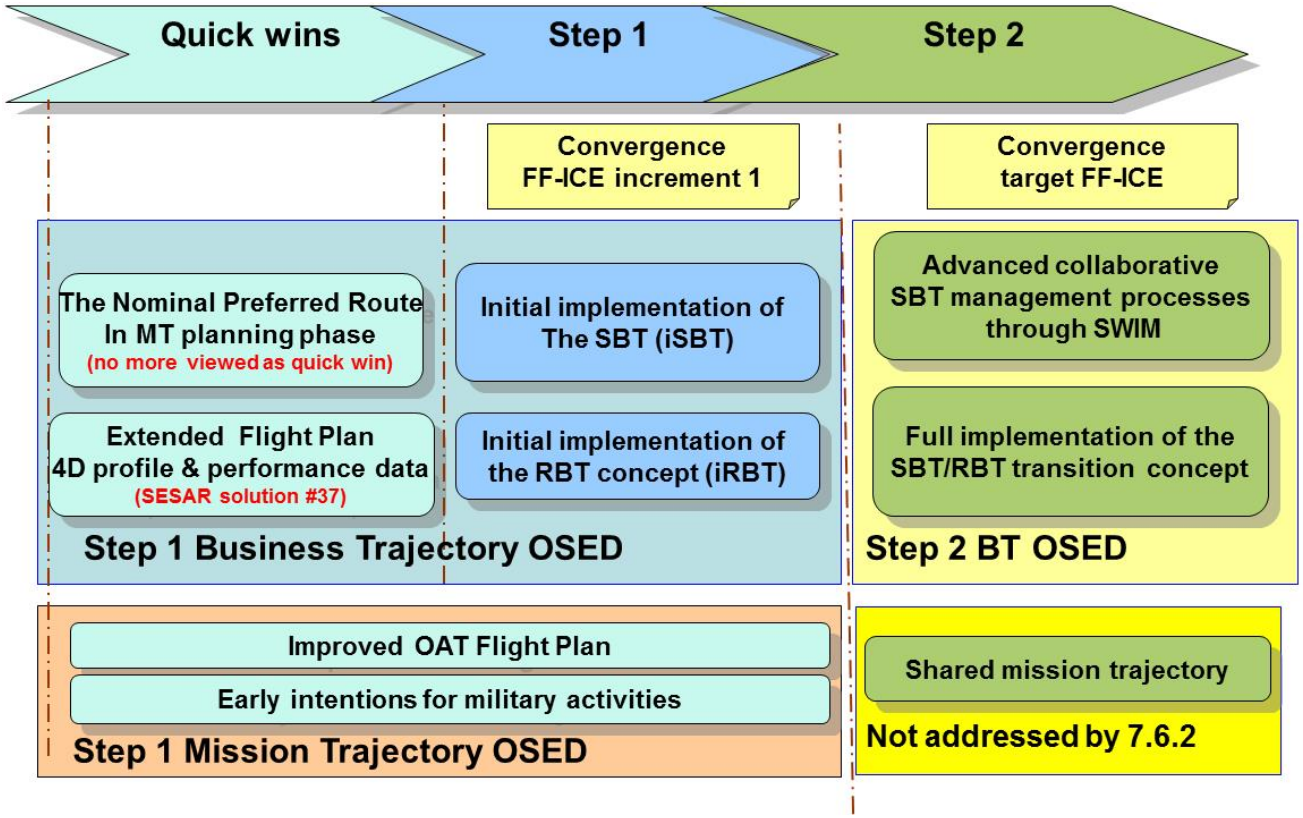

Figure 2: Story board for mission/business trajectory evolutions

The scope of the project is focusing on the **medium and short-term planning** phases. Execution phase will be addressed only partly (from a network perspective).

Referring to the definition of high-level network processes listed in the 07.02 Step 1 DOD [6], this OSED details the “Determine network demand” process**.**

The following diagram presents the hierarchy of concepts elements addressed by P07.06.02 and the link with the target business trajectory concept.

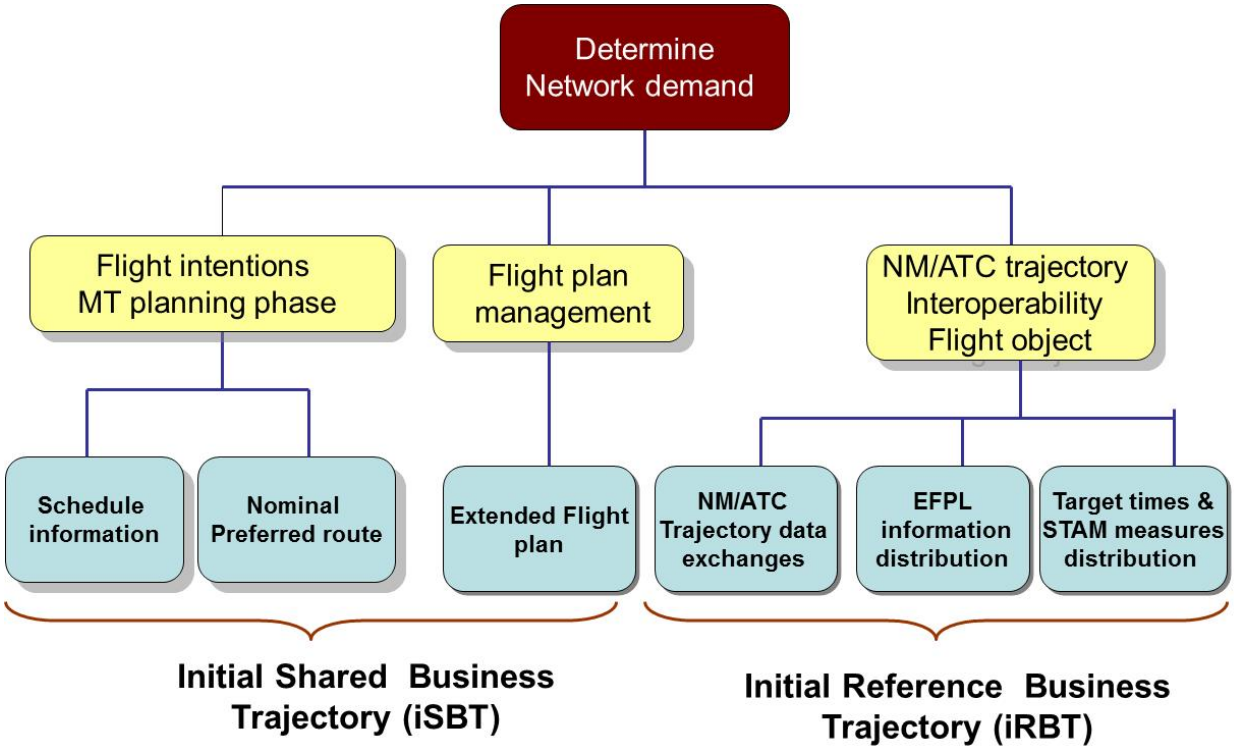

Figure 3: Hierarchy of 07.06.02 OSED concept elements

The 07.06.02 project includes in its tasks to align as much as possible SESAR and FF-ICE terminology and operational scenarios regarding SBT management/Flight planning. This final draft edition 5.0 of the OSED (Step 1) aims at achieving a first level of convergence.

1.3 Intended readership

Within SESAR, the intended audience is

- The SJU;
- SWP 07.02: 07.02 is the coordinating federating project for the OFA 03.01.04 - Business/Mission trajectory;
- P11.1 projects: this OSED develops requirements impacting FOC processes and systems. Moreover, most of requirements included in this document have been developed in close cooperation with SWP11.1;
- P11.2 projects;
- WP7 level-3 projects: most of WP3 level-3 projects have strong dependencies with flight planning /business trajectory management;
- P04.05 and P05.05.01 projects: those two projects are part of the OFA 03.01.04. Moreover there are obvious dependencies between Business/Mission trajectory and Trajectory Management Framework ENB;
- P05.05.02: content of the Extended flight plan and associated requirements as developed in this OSED taking into consideration requirements issued by 05.05.02 project [21];
- SWP4.2, SWP5.2, SWP6.2: those are being identified as consulting federating projects for the OFA 03.01.04;
- WP 8 projects included in the OFA Business and Mission Trajectory. For this release, most impacted WP8 projects are 08.03.05, 08.03.07, 08.03.04 and 08.01.09;
- Other level-3 projects (WP9) included in the OFA 03.01.04.

Additionally, the audience includes FIXM and ICAO working groups dealing with the definition of provisions and standards for future evolutions of the ICAO flight plan.

1.4 Structure of the document

The structure of the document is as follows:

- Chapter 1 gives a general description of the document structure and scope;
- Chapter 2 gives a description of the operational concept;
- Chapter 3 gives a description of the operational environment;
- Chapter 4 gives a description of the detailed elements – operating methods, scenarios, use-cases and requirements – for evolutions related to the **Extended Flight Plan (quick win)**;
- Chapter 5 gives a description of the detailed elements – operating methods, scenarios, use-cases, requirements – **for the Nominal Preferred Route** concept in the context of improved management of demand data in medium term planning phase;
- Chapter 6 will give a description of detailed elements – operating methods, scenarios, use-cases and requirements – for **the iSBT and iRBT concepts** and associated **Flight Object** enabler;
- Chapter 7 indicates the references.

The structure of the OSED template defined by the SJU has been adapted to improve readability of the document and to simplify the organisation of reviews and the management of dependencies for the different topics addressed by the project.

The table below provides the correspondence between the SJU template sections and the present OSED ones.

OSED Template (SJU)	7.6.2 Business Trajectory OSED
Section 4 – Detailed operational environment	Section 3
Section 3 – Detailed operating methods	Sections 4.1, 5.1, 6.1
Section 5 - Detailed operational scenarios / use cases	Sections 4.2, 5.2, 6.2
Section 6 - Requirements	Sections 4.3, 5.3, 6.3.

1.5 Background

1.5.1 Overview

Due to the transversal scope of the business trajectory topic, a large number of current and past programs, projects and initiatives provide input to the project. Main inputs are listed hereafter.

- SESAR definition phase:
  - The SESAR performance framework (D2) [9];
  - The SESAR Concept of Operations (ConOps): T222 [28];
  - The description of scenarios developed: T223.
- SJU B4.2 :
  - Trajectory management document [27];
- DMEAN program
  - Demand Data Repository (DDR) concept documents and business cases [20];

- Airspace Data Repository (ADR) concept documents and business cases.
- Flight Plan Repository (FPR) concept documents

- Network Manager:
  - Studies on AU /CFMU interoperability [22].
- ICAO:
  - All ICAO documentation related to the evolution of flight plan information: FPL 2012 and amendments, FF-ICE [14] [15] [16] [17] [19].
- EUROCAE, ICOG:
  - All documentation related to the Flight Object concept and standards [26].

The following paragraphs provide more details on projects/programs strongly related to the topics covered by this OSED.

1.5.2 AU/ATM systems interoperability

The lack of interoperability between the Airspace Users and the Network Manager is responsible for a number of flight data inconsistencies that impact on the operational performance of flight planning and ATFCM operations. As an example, some flight plans are unfairly rejected because of a number of difficulties for interpreting the FPL Field 15 consistently between the FPL originator and NM flight planning services (CFMU system in charge of flight plans validation and dissemination). Section 2.2.2 provides more details about current limitations.

To cope with these limitations, the CFMU (now Network Manager Operations Centre) had launched in 2005 a preliminary study intended to propose solutions to improve the flight data interoperability between the Airspace Users and the NM, such as the use of 4D trajectory in addition to the current ICAO flight plan. This preliminary study developed an operational concept and a business case [22] covering the identification and analysis of potential options, the associated benefits and constraints and assessing quantitatively the size of the benefits and of related costs.

The study was conducted in close cooperation with airspace users and Computer Flight Plan Service Providers (CFSPs).

1.5.3 Flight Plan Repository (FPR)

The concept was defined in the context of the DMEAN program and is a valuable input to 7.6.2 as some elements are closely related to the Business Trajectory:

- Requirements identified for a Flight Plan Repository [23] can be reused in SESAR in the wider scope of the development of the Flight Object concept in planning phase;
- Requirements are identified related to the notion of Filed Flight Plan providing inputs for the Reference Business Trajectory.

1.5.4 Demand Data Repository Phase 2 (DDR 2)

Demand Data Repository (DDR) is an enabler for providing authorized ATM actors with a common awareness of the individual flight intentions and a harmonised forecast about traffic & airspace demand, during the whole ATM life cycle, from early planning phase till during the execution. It will also provide the necessary elements to support post-op analysis and continuous improvement.

Out of DMEAN program (IP1), the DDR concept has been split into 3 phases, each phase supporting a specific time horizon of the Network Operation Plan: Long Term planning and airspace / route design for DDR1, Medium Term (M-T) planning for DDR2 and Short Term (ST) planning and execution for DDR3.

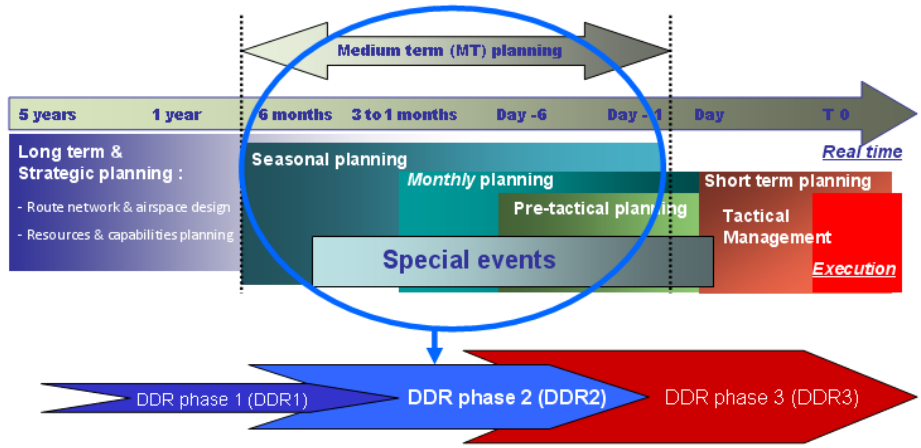

Figure 4: The 3 phases of the DDR project

DDR phase 2 concept (DDR2) is addressing enhancements required to support the Traffic demand data management during the M-T phase (from 6 months to D-1).

The main objective of the DDR2 is to collect early information about flight intentions, in order to enrich historical information and improve the predictability of the traffic demand representations (forecasts) used at key milestones during the M-T phase of the collaborative ATM planning, namely during the seasonal, the monthly, the pre-tactical planning, and for the planning of special events. The DDR2 scope is illustrated on Figure 5 by the blue dotted line.

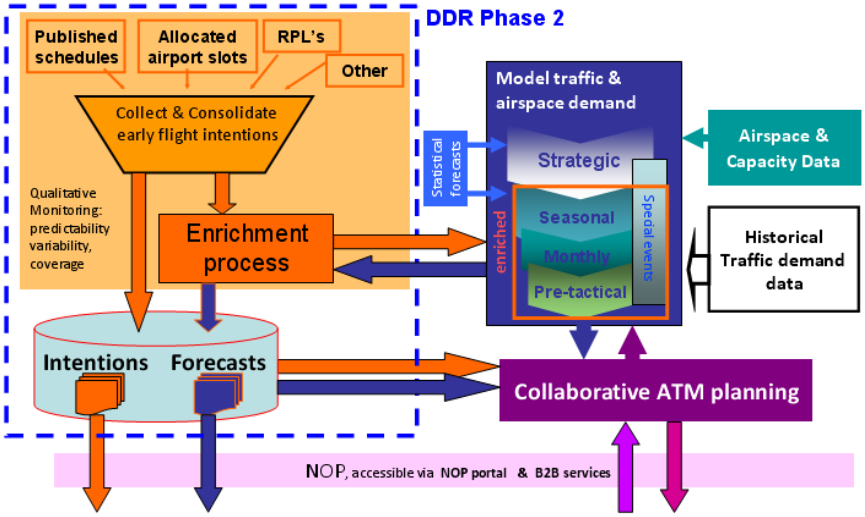

Figure 5: DDR 2 scope

In 2010, in the context of the DMEAN program, a DDR2 phase 2 business case report [20] was produced in support to the definition of the strategy for DDR2 developments and implementation.

The development of DDR2 concept is incremental, in order to minimise the risks and to deliver early achievements in the planning of Network & ATM Operations, while using acquired experience to guide the developments of further increments.

A first increment of DDR2, designated DDR2/1 was implemented to support network operations planning, as from summer 2012

DDR2/1 use cases

Operational use cases targeted for DDR2/1, from summer 2016, are:

- Support to planning of specific special events anticipated to impact significantly network operations during 2016: UEFA football championship in France.
- Support the collaborative M-T planning of the SW axis and the SKI axis during the Week End operations (seasonal & pre-tactical network plan).

Initiated and developed in the context of DMEAN / IP1, the DDR2/1 increment covers a limited scope of collected flight intentions data: limited category of flights (Innovata[3] schedule flights), airport slot data from all European coordinated airports and no information on the planned route.

1.5.5 ICAO/FF-ICE

As part of the Service Delivery Management (SDM) ATM component, the ICAO ATMRPP working group has the task of proposing a mechanism to succeed the present-day ICAO flight plan which shall be developed to enable the realisation of the Operational Concept.

The FF-ICE illustrates information for flow management, flight planning, and trajectory management associated to the ATM operational components. It will be used by the ATM Community, including ICAO groups and panels which may be concerned, as the basis from which ICAO Standards and Recommended Practices (SARPS) will be developed, in order to ensure that the FF-ICE Concept can be developed and implemented globally in a consistent way. The FF-ICE concept has been targeted for the same target period as the ATM Global Concept (2025+).

There is however a need to provide guidance/orientation to now/near term developments and to ensure that these developments implement the basis on which a transition to full FF-ICE can be built.

Therefore at least one intermediate step should lay down the foundations of the bridge towards the implementation of the Global ATM Operational Concept.

The first step corresponds to an amendment to PANS-ATM including items coming from two sources, those arising from experience with the 2012 FPL implementation, and those arising from the possibility to obtain early benefits by early implementation of some ideas from FF-ICE.

With reference to the planning of large Regional R&D/Deployment programmes, the first step is positioned in the timeframe 2018 -2020 and is referred to FF-ICE increment 1.

Taking into account operational needs and FF-ICE transition considerations, the scope of FF-ICE/1 is still in discussion although it has reached a reasonably stable level enabling this document to include its main relevant features. The scope of FF-ICE/1 should include at least the following elements in addition to the current ICAO 2012 flight plan information:

- Introduction of a Global Unique Flight Identifier (GUFI),
- Flight priority information
- Support for exchange of 4D Trajectory information between the FOC and the ATM;
- New format for flight and flow information.

1.6 Glossary of terms

Glossary and definition of general terms are available in “SESAR Lexicon” [4].

Acronyms used in this document which are not represented in the Lexicon are explained below.

Term	Definition	Source
AU	Organisations operating aircraft, and their pilots. The term Airspace User will be referring to the FOC in the whole planning phase.	Eurocontrol lexicon Release 2015
Calculated Take-off Time (CTOT)	The CTOT is the aircraft departure time as the	07.02 Step 1 DOD [6]

[3] Innovata is a company which collects SSIM (schedule flights data) from a wide set of airlines.

Term	Definition	Source
	result of the slot allocation process by Network Management	
DMEAN	European ATM programme officially closed from 31 December 2011 which provided the operational basis for SESAR (Single European Sky ATM Research) to build upon and form part of SESAR IP1 (Implementation Package 1).	Eurocontrol dossiers webpage
eFPL	Flight plan complying with FF-ICE provisions. In this document is referring to the standard ICAO definition.	ICAO ATMRPP
EFPL	Extended Flight Plan which includes the ICAO Flight Plan and the 4D trajectory computed by the AU (filed trajectory). Optionally, it may also include flight performance data. The EFPL has been defined in first step at European level . It will evolve to be fully compliant with the eFPL as defined in FF-ICE increment 1 by ICAO.	P07.06.02 OSED
Estimated Off-block Time (EOBT)	The estimated time at which the aircraft will commence movement associated with departure (ICAO) derived from the filed Flight Plan. It serves to provide a reference time first issued by the Aircraft Operator and updated according to actual events at airport for determining whether or not a new TOBT shall be agreed upon. The EOBT serves to determine the ETOT used to plan ATC operations for the flight.	07.02 Step 1 DOD [6]
Flight Object	The system instance view of a flight. It is the flight object that is shared between the IOP stakeholders.	EUROCAE (2009), Flight Object Interoperability Specification, ED-133
GUFI	This field specifies a globally unique reference to the flight, allowing all eligible members of the ATM community to unambiguously refer to information pertaining to a flight.	ICAO FF-ICE
Initial Reference Business/Mission Trajectory (iRBT/iRMT)	The initial SB/SMT is published as the initial RBT/RMT at the moment when, due to the proximity of the execution phase, iSBT/iRMT is sufficiently reliable to become the trajectory the AU agrees to fly and the Airspace Service Providers agree to facilitate. The iRBT/iRMT does not contain in step 1 all the necessary elements to enable the full implementation of Trajectory Based Operation that will be in use during step 2, among others ground routing is not part of the iRBT/iRMT, TTO/TTA are part of the iRBT/iRMT. **It must be highlighted that the term "initial" is <u>not</u> used in reference to the RBT lifecycle (e.g. first RBT in execution).**	07.02 Step 1 DOD [6]
Initial Shared Business/Mission	In Step 1, the SBT/SMT will not be fully	07.02 Step 1 DOD [6]

Term	Definition	Source
Trajectory (iSBT/SMT)	implemented yet and will only incorporate flight intentions (in the medium-term planning) which are progressively refined with incoming information from the Airspace users to become an extended flight plan in the short term period including trajectory data (filed trajectory /ReqMT). **It must be highlighted that the word "initial" is not used in reference to the SBT lifecycle (e.g. first SBT shared).**	
Nominal (user) Preferred Route (NPR)	Preferred user route in nominal conditions (e.g. meteorological). Nominal preferred routing information is provided by airspace users in Medium Term planning phase.	7.6.2 Step 1 OSED
Target Deviation Indicator	The Target Deviation Indicator is the result of the NM monitoring of the flight execution versus the published Target Times (TTO/TTA). It consists of the difference (subtraction) between the Estimated time (as updated during the flight execution) over the reference point and the published Target time at that point (i.e. ETO – TTO).	7.6.2 Step 1 OSED
Target Start-up Approval Time (TSAT)	The time provided by ATC taking into account TOBT, CTOT and/or the traffic situation that an aircraft can expect to receive start up / push back approval.	07.02 Step 1 DOD [6]
Target Time	The term Target Time is used generically and can represent either Target Time of Arrival or Target Time Over.	7.6.2 Step 1 OSED
Target Time of Arrival (TTA)	TTA is a planning time computed by ground systems for flight planning and execution to coordinate at network level and enhance the effectiveness of ATFCM measures for congestions at destination aerodromes. It expresses the desirable time for an aircraft over a specific fix from the point of view of ground ATM services. During flight execution, it will allow the monitoring of the evolution of the intended operational goal by the appropriate actors**Error! Bookmark not defined.**. A TTA consists of a nominal value and tolerance limits around the nominal value.	07.02 Step 1 DOD [6]
Target Time Over (TTO)	It is a planning time computed by ground systems for flight planning and execution to coordinate at network level and enhance the effectiveness of ATFCM measures for congestions at En-Route locations as well as the management of the Airspace Reservation process. It expresses the desirable time for an aircraft over a specific fix from the point of view of ground ATM services. During flight execution, it will allow the monitoring of the evolution of the intended operational goal by the appropriate	07.02 Step 1 DOD [6]

Term	Definition	Source
	actors . A TTO consists of a nominal value and tolerance limits around the nominal value.	
Trajectory (4D)	The 4D trajectory is a set of consecutive segments linking published waypoints and/or pseudo waypoints computed by air or ground tools (FOC system, aircraft FMS, ground Trajectory Predictor) to build the lateral transitions and the vertical profiles. Each point is defined by a longitude, latitude, a level and a time	B4.2
Desired Trajectory	The complete route and/or trajectory for which an AU(Airspace User) is requesting evaluation (in planning) or air traffic services (in filing) and which indicates the AU's best estimate of the expected trajectory.	ICAO FF-ICE increment 1
Negotiating Trajectory	The trajectory group exchanged during negotiation between the AU and ANSP. The route and/or trajectory considered by the publisher as the optimum trajectory taking all constraints and preferences into account. May be preceded by the terms 'Complete' or 'Partial' as appropriate.	ICAO FF-ICE increment 1
Filed trajectory	The trajectory group in the filed flight plan data provided by an AU	ICAO FF-ICE increment 1
	Corresponds to today's Airspace User Operational flight plan transmitted to the flight crew a few hours before departure, more detailed than the ATC flight plan , it consists in the list of points and estimates computed by the airline tool to build the lateral transitions and vertical profiles. This trajectory is provided as part of the EFPL and it is calculated taking into account constraints and meteorological information.	P07.06.02 OSED
Agreed trajectory	The trajectory group that was agreed to by an ANSP by indicating a negotiating response of agreed.	ICAO FF-ICE increment 1
Accepted trajectory	Trajectory as calculated by NM to check the compliance of the flight plan with published contraints. It is based on the filed trajectory but integrates among other elements additional "soft" constraints like LOAs/ATC constraints published as PTRs. Basically NM accepts the information provided by the AU but replies back with the trajectory that is expected to be flown by the AU.	P07.06.02 OSED
Network Planning trajectory	Trajectory as calculated by the flow management service (ETFMS system) for planning purposes after EFPL validation. It allows an identification of ATFCM restrictions and hotspots impacting the flight. This trajectory	P07.06.02 OSED

Term	Definition	Source
	is in current operations distributed to external stakeholders through the use of EFD messages.	
Planning status/service	ATM service that performs collaborative planning of a flight through exchange of ATM and other information relevant to the flight. EFPL status in which the EFPL information sent by the AU is under negotiation with NM. This status is also used by the AU to obtain results on a what-if request (Trial request). A “planning EFPL” is provided to obtain planning service.	ICAO FF-ICE increment 1 P07.06.02 OSED
Filed status/service	EFPL status in which the EFPL information sent by the AU has been accepted by NM. A filed EFPL is provided to obtain ATS.	P07.06.02 OSED
Trial request	Request from the AU to test and explore the effects of possible alternative trajectories during the planning without changing the current stated intention (and the plan being monitored). It will contain a negotiating trajectory.	ICAO FFICE increment 1
NM flight planning services	NM service in charge of validating and distributing flight plans received from AUs. This service relies on the use of the IFPS system .	P07.06.02 OSED
Flow management services	NM operational service in charge of maintaining balance between demand and capacity. This service relies on the use of ETFMS system on the day of operations.	P07.06.02 OSED
Hard constraints	ATM constraints that are applicable when submitting a flight plan. Example of hard constraints are RAD constraints, CDR closures	P07.06.02 OSED
Soft contraints	ATM published constraints that are not mandatory for the AU to consider when submitting the flight plan (for example some LoAs published as Profile Tuned Restrictions) but can contribute to improve predictability.	P07.06.02 OSED
Individual mix mode of operations	In a transition phase, the operation mode that considers for a same FPL both formats (extended and ICAO) for flight plan data exchange.	P07.06.02 OSED
Pathfinder	NM system tool which uses City Pairs Statistics to propose valid routes. Pathfinder allocates as well the highest RFL possible according to aircraft performances and then starts generating all possible routes that connect the given points (ADEP and ADES). It applies the first possible (IFPS compliant) route found.	VP-715

413 # 1.7 Acronyms and Terminology

414 ## 1.7.1 Acronyms

Term	Definition
4D	4 dimensional
a/c	Aircraft
ACC	Air Traffic Control Centre
ADR	Airspace Data Repository
AFP	ATC Flight Plan Proposal
AFTN	Aeronautical Fixed Telecommunication Network
AFUA	Advanced Flexible Use of Airspace concepts
AIM	Aeronautical Information Management
AIP	Aeronautical Information Publication
AIRAC	Aeronautical Information Regulation and Control
AIS	Aeronautical Information Service
AMC	Airspace Management Cell
ANSP	Air Navigation Service Provider
AoR	Area of Responsibility
AOWIR	Aircraft Operator What-If-Reroute
ASM	AirSpace Management
ATCO	Air Traffic Controller
ATFCM	Air Traffic Flow and Capacity Management
ATM	Air Traffic Management
ATMRPP	AIR TRAFFIC MANAGEMENT REQUIREMENTS AND PERFORMANCE PANEL – ICAO working group.
ATSU	ATS Unit
AU	Airspace User
B2B	Business to Business (B2B) web services
BADA	Base of Aircraft Data

Term	Definition
BDT	Business Development Trajectory
BMT	Business Mission Trajectory
CASA	Computer Assisted Slot Allocation
CDR	Conditional Route
CFMU	Central Flow Management Unit
CFN	Commercial Flight Number
CFSP	Computer Flight Plan Service Provider
CHMI	CFMU Human Machine Interface
CNS	Communication, Navigation and Surveillance
CONOPS	CONcept of OPerationS
CP 3.1., CP3.2	Coordination Plan 3.1/3.2
CRAM	Conditional Route Availability Message
DCB	Demand Capacity Balancing
DDR	Demand Data Repository
DOD	Detailed Operational Descriptions
DMA	Dynamic Mobile Area
DMEAN	Dynamic Management of European Airspace Network
ECAC	European Civil Aviation Conference
ECHG	Change message of the Extended FPL
EDLA	Extended DLA message
EFD	ETFMS Flight Data
EFPL	Extended Flight Plan
EFPLM	Extended Flight Plan Message It is a message containing the ICAO FPL data, the trajectory of the flight described in a 4D trajectory form and the Performance Data instantiated for that flight.
EIBT	Estimated In Block Time
EOBT	Estimated Off Block Time

Term	Definition
ETFMS	Enhanced Tactical Flow Management System
EUROCAE	European Organisation for Civil Aviation Equipment
FAB	Functional Airspace Block
FDC	Flight Data Contributor
FDMP	Flight Data Manager Publisher
FDP	Flight Data Processing
FDPS	Flight Data Processing System
FDU	Flight Data User
FF-ICE	Flight and Flow Information for a Collaborative Environment
FIXM	Flight Information Exchange Model
FL	Flight Level
FLS	Flight Suspension message
FMP	Flow Manager Position
FOC	Flight Operations Centre
FO	Flight Object
FOS	Flight Object Server
FPL	Flight Plan
FPR	Flight Plan Repository
GAT	General Air Traffic
GUFI	Global Unique Flight Identifier
ICAO	International Civil Aviation Organisation
ICOG	Interoperability Consultancy Group
IFPS	Integrated Initial Flight Plan processing System
IFR	Instrument Flight Rules
IOP	Interoperability (between ground systems)
iSBT	Initial Shared Business Trajectory (Step 1)

Term	Definition
iRBT	Initial Reference Business Trajectory (Step1)
KPI	Key Performance Indicator
LT	Long Term
LTM	Local Traffic Manager
M-T	Medium Term
MT	Mission Trajectory
NAVAID	NAVigational AID
NM	Network Manager
NMF	Network Management Function
NPR	Nominal Preferred Routing
NOP	Network Operations Plan
OAT	Operational Air Traffic
OFA	Operational Focus Area
OI	Operational Improvement
OSED	Operational Service and Environment Definition
OUC	Operational Use-Case
PANS-ATM	Procedures for Air Navigation Services – Air Traffic Management
PTR	Profile Tuning Restriction
RAD	Route Availability Document
RBT	Reference Business Trajectory
RPL	Repetitive Flight Plan
RTA	Required Time of Arrival
RVSM	Reduced Vertical Separation Minima
SARPs	Standards and Recommended Practices
SBT	Shared Business/Mission Trajectory
SDM	Service Delivery Management

Term	Definition
SJU	SESAR Joint Undertaking
SPR	Safety and Performance Requirements
STAM	Short Term ATFCM Measure
SWIM	System Wide Information Management
TO	Time Over
TOD	Top-Of-Descent
TOW	Take-Off Weight
TRL	Technology Readiness Level
TT	Target Time
TTA / TTO	Target Time of Arrival / Target Time of Overflight
TTOT	Target Take Off Time

1.7.2 Evolution of terminology

SESAR has introduced a new terminology (e.g. iSBT, iRBT, Target times) which is not necessarily familiar to ATM staff not involved in SESAR program. In parallel, the ICAO FF-ICE concept of operations has also developed its own terminology regarding flight and trajectory information. The following table corresponds to the lastest updates in terminology and aims at providing a link (but not necessary a strict correspondence) between current terms and those used in the contexts of respectively FF-ICE, SESAR 07.06.02 Step 1. Moreover, the definition of FF-ICE increment 1 scenarios and provisions definition is still on progress, therefore the terminology may still evolve.

In 07.06.02, the following approach has been chosen:

- iSBT/SBT information corresponds to the whole FPL information not limited to the 4D trajectory.
- The notion of SBT status / RBT status will be relevant only in step 2.

The following table summarises the relevant terminology used in the documents related to 7.6.2 BT Step 1, as well as their correspondent in ICAO FF-ICE provisions and in current operations.

TYPE OF INFORMATION	7.6.2 STEP 1	CORRESPONDING ELEMENTS IN CURRENT OPERATIONS	ICAO FF-ICE
	iSBT in medium-term planning	Airlines schedule information Repetitive Flight plan.	

TYPE OF INFORMATION	7.6.2 STEP 1		CORRESPONDING ELEMENTS IN CURRENT OPERATIONS	ICAO FF-ICE
			Commercial flight plan	
Flight plan	EFPL (Extended Flight Plan)		ICAO 2012 flight plan	eFPL
Trajectory (in planning up to agreement)	iSBT in short-term planning	Desired trajectory (AU) Negotiating trajectory (NM) Accepted trajectory[4] (NM)	Operational FPL ICAO Field 15 + EETs information	Desired Trajectory Negotiating trajectory Agreed trajectory
	iRBT (including Target Times)	Filed trajectory (AU) Agreed Trajectory (NM)	4D trajectory in FMS ETFMS 4D profile. CTOT, TSAT.	Negotiating trajectory Filed trajectory
Flight plan /trajectory status	iSBT iRBT			Planning Filing

Table 2 Current terminology vs. SESAR and ICAO FF-ICE terminology

[4] The term “accepted trajectory” is used as part of the quick-win implementation of EFPL (chapter 4 is still transition section to FF-ICE) but it is replaced by “agreed trajectory” mainly from chapter 6 onwards as full alignment with FF-ICE is achived.

2 Summary of Operational Concept from DOD

2.1 Mapping tables

This section contains the link with the relevant DOD [6], scenarios and use cases, environment, processes and services relevant for this particular OSED.

Table 2 lists the Operational Improvement steps (OIs from the definition phase) from DS13, within the associated Operational Focus Area addressed by the OSED.

Relevant OI Steps ref. (coming from the definition phase)	Any new / changed OI step (textual form)	Operational Focus Area name	Story Board Step	Master or Contributing (M or C)	Contribution to the OIs short description
AUO-0203-A	Initial Shared Business/Mission Trajectory (iS/M BT)	Business/Mission trajectory Management	Step1	M	Initial implementation of the Shared Business Trajectory in Step 1 through the standardisation of flight intent capture in medium term planning phase and the exchange of 4D trajectory information (including flight performance data) in short-term planning. Requirements for flight performance data are developed both from a network/DCB perspective (project 7.6.2) and ANSP perspective (project 5.5.2)
AUO-0204-A	Initial Reference Business / Mission Trajectory (iRBT) through Collaborative Flight Planning	Business/Mission trajectory Management	Step1	C	Only Initial implementation of the RBT in Step 1 corresponding to a reference 4D trajectory finalised shortly minutes prior to TOBT and integrating both the 4D trajectory issued by the airspace user (FOC) and time regulations issued in Short Term planning (CTOT, TTA/TTO, TSAT). The iRBT concept is supported by improved NM-ATC link through the Flight Object – both in pre-flight phase and execution - for the exchanges of trajectory constraints

Table 3: List of relevant OIs within the OFA (DS13)

At the moment of the release of this Step 1 BT final OSED D56, the ATM Masterplan has been modified, and therefore new OIs (from DS14) have to be included as part of the scope of the OSED. They are listed in Table 3:

Note:The new description of the OI AUO-0203-A should achieve V3 in SESAR 1 (so not part of the backlog) and is in the scope of the PCPs.

Relevant OI Steps ref. (coming from the definition phase)	Any new / changed OI step (textual form)	Operational Focus Area name	Story Board Step	Master or Contributing (M or C)	Contribution to the OIs short description
AUO-0203-A	EFPL in NM processes	Business/Mission trajectory Management	Step1	M	The current flight plan will be extended to include flight performance and 4D profile information. The EFPL will be provided by AU flight planning system to NM to improve current flight plan validation service. Additionally, EFPL information will be used to improve accuracy of NM traffic predictions resulting in more efficient DCB and traffic complexity management processes.
AUO-0223	Harmonised and improved integration of airspace and ATC constraints/procedures in trajectories calculated by FOCs and NM.	Business/Mission trajectory Management	Step1	M	It represents the progressive alignment of the AU and NM calculated 4D trajectories in planning phase. This alignment will be achieved first by clarifying and harmonising airspace/route constraints publication and interpretation and agreeing on ATC constraints and procedures (e.g. LOAs) needed to be taken into account to generate the SBT. This OI is a key step toward the implementation of the SBT concept and will allow improving predictability both at AU and ATM sides as well as enabling fine-tuned trajectory management processes.
AUO-0224	Nominal Preferred Routes within iSBT	Business/Mission trajectory Management	Step1	M	In the medium term, The iSBT will include, in addition to schedule information, Nominal Preferred Routes, capturing airspace user route preferences based on nominal constraint scenarios. Nominal preferred route information will be provided by airspace users either as 2D, 3D or 4D trajectory information.
AUO-0225	Agreed iRBT to provide target time to ATM systems	Business/Mission trajectory Management	Step1	C	The iRBT will be the partial implementation of the RBT, which is the reference used by all ATM partners during the flight execution. The iSBT will change to the iRBT either at a fixed time before off-block or when a specific A-CDM milestone occurs. The iRBT will include all iSBT information. The iRBT will contain, among other information, the Most Penalising Regulation target time (TTO/TTA) and is provided to ATM systems in order to share the final objective of the regulations. During the flight execution, the flight is monitored in relation to its planned profile. Deviations outside the tolerance associated to the target time are used by the Network Management function to trigger reassessment of the plan in order to manage the congested area(s) and to assess the

Relevant OI Steps ref. (coming from the definition phase)	Any new / changed OI step (textual form)	Operational Focus Area name	Story Board Step	Master or Contributing (M or C)	Contribution to the OIs short description
					implications to the wider network.
AUO-0226	Agreed iRBT: Exchange of EFPL with ATC	Business/Mission trajectory Management	Step1	C	EFPL information provided by AU's will be distributed to the ATC by NM through Flight Object (or possibly other means). The information such as T/O weight, weight profile, 4DT will be used by ATC systems and be a part of the iRBT. ATC will use that to improve the trajectory prediction for all ATC functions
AUO-0227	Agreed iRBT: Exchange of ATFCM measures with ATC	Business/Mission trajectory Management	Step1	C	Agreed STAM measures between actors levels are distributed to the ATC as part of the Flight Object. The measure is then managed by the ATCO in charge of the related area and incorporated in the ATC flight plan data.

Table 4 List of new relevant OIs (DS15)

Table 3 identifies the link with the applicable scenarios and use cases of the network DOD document [6]. It must be noted that the network DOD uses-cases are not fully consistent with the use-cases developed in the sections 4.2 and 5.2.of this OSED considering both terminology and content. This can be explained by two main reasons:

- The DOD and the OSED were developed in parallel and a full alignment is not yet fully achieved;
- The network DOD document only considers target Step 1 scenarios (and terminology) whereas some of the use-cases developed in this document correspond to quick wins which can be viewed as intermediate steps toward the target Step 1).

Scenario identification	Use Case Identification	*Reference to DOD section*
Medium/Short-term Planning	UC-NP-01 Submission of iSBT/SMT	§4.2.2.2
Medium/Short-term Planning	UC-NP-02 Update iSBT/SMT	§4.2.2.2
Medium/Short-term Planning	UC-NP-03 Process 4D Trajectory	§4.2.2.2
Medium/Short-term Planning	UC-NP-04 Validation of iSBT/SMT	§4.2.2.2
Medium/Short-term Planning	UC-NP-05 iSBT/SMT distribution	§4.2.2.2
Medium/Short-term Planning	UC-NP-06 Storing iSBT/SMT	§4.2.2.2

Scenario identification	Use Case Identification	*Reference to DOD section*
Medium/Short-term Planning	UC-NE-16 Communicate TTA/TTO information	§4.2.2.2
Execution phase	UC-NE-06 Revision of TTA/TTO	§4.2.2.2
Execution phase	UC-NE-16 Communicate TTA/TTO information	§4.2.2.2

461 Table 5: List of relevant DOD Scenarios and Use Cases

462

463 Table 4 identifies the link with the applicable environments of the Network DOD [6].

464

Operational Environment	Class of environment	*Reference to DOD section where it is described*
Network operational environment	Airspace Classification/Management Route Configuration Air Traffic Pattern and Complexity Traffic Demand SBT/SMT Information Availability over Time Horizon Capacity Data Information Availability over Time Horizon *Aircraft Mix and Equipage* CNS Capability Aircraft Performance	*§3.1*

465 Table 6: List of relevant DOD Environments

466

467 Table 5 identifies the link with the applicable Operational Processes and Services defined in the
468 Network DOD [6].

469

DOD Process / Service Title	Process/ Service identification	Process/ Service *short* description	*Reference to DOD section where it is described*
Determine Network Demand	N/A	Long term planning of the Network Operations requires the elaboration of a Demand Forecast. The Network Manager elaborates the Demand Forecast in close coordination with his partners.	§4.2.1.1.1
Determine Network	N/A	Medium to short term planning of the Network Operations requires the elaboration	§4.2.2.1.2

DOD Process / Service Title	Process/ Service identification	Process/ Service *short* description	*Reference to DOD section where it is described*
Determine Network Demand	N/A	Long term planning of the Network Operations requires the elaboration of a Demand Forecast. The Network Manager elaborates the Demand Forecast in close coordination with his partners.	§4.2.1.1.1
Demand		of a Traffic Demand as soon as information can be made available from the Airspace Users. .	

Table 7: List of the relevant DOD Processes

Table 6 summarizes the Requirements including Performance (KPA related) requirements relevant of the OSED. This table supports defining the performance objectives in the scope of the addressed OFA. The DOD performance requirements are structured to respond to Key Performance Indicators (PI) targets / decomposed PIs, so this table will support traceability to the performance framework.

DOD Requirement Identification	DOD requirement title	*Reference to DOD section where it is described*
REQ-07.02.00-DOD-0001.0000	Sharing Trajectory information	§6.1.
REQ-07.02.00-DOD-0001.0001	Commonly agree and facilitate on a reference Trajectory.	§6.1
REQ-07.02-DOD-BMTP.1040	Cost Efficiency: Increase of productivity due to improvement of demand profile information	§6.2.3.1
REQ-07.02-DOD-0001.0013	(FUEL) EFFICIENCY: Reduction in fuel burn for Step 1	§6.2.5
REQ-07.02.00-DOD-0001.0015	CAPACITY: Increase in airspace capacity for Step 1	§6.2.4

Table 8: List of the relevant DOD Requirements

2.2 Operational Concept Description

2.2.1 Introduction

The three following paragraphs describe three main evolutions in Step 1:

- Paragraph 2.2.2 develops the enabling concept of **Extended Flight Plan** in short-term planning phase (quick win);
- Paragraph 2.2.3 develops improvements related to early flight intent management with a particular focus on the share of **Nominal Preferred routing** information (further developed in this version);

- Paragraph 2.2.3.2.1 describes the initial implementation of the concept of SBT (**iSBT**) and "agreed" RBT (**iRBT**) in Step 1.
  - The iSBT concept development is built upon the Extended Flight Plan (as a quick win improvement) and the Nominal Preferred Route.
  - The iRBT concept development is built upon the progressive implementation of the Flight Object (FO) concept.

2.2.2 Short-term planning phase – Extended flight plan

2.2.2.1 EFPL concept (SESAR solution #37)

Most Airspace Users are currently using sophisticated flight planning tools in order to calculate as accurately as possible an operational flight plan for their flight. Multiple parameters and flight specific performance characteristics are taken into account in order to derive a flight profile (2D trajectory) that is as close as possible to the real evolution of the flight later in operations. Flight planning tools then derive from the operational flight plan a flight plan in ICAO format. In this process, valuable information regarding the flight, including its calculated 4D trajectory, are lost because the ICAO flight plan format neither allows nor requires such information to be included.

The resultant flight plan in ICAO format is used by ATC for the provision of air traffic services to the flight as well as the Network Manager and FMPs for air traffic flow and capacity management. Tools that are used by ATC, the Network Manager and FMPs are based on the calculation of a flight profile that is extracted from the flight plan in ICAO format. A number of assumptions are made and generic aircraft performance information is used in this process that make the locally calculated flight profile different from to the one originally calculated by the flight planning tools.

The current flight plan filing process will be extended to allow enriched information exchange

- **From AU to NM flight planning services:**
  - The transmission of the flight plan originator calculated 4D trajectory (filed trajectory) of the flight as part of the filed flight plan. This 4D trajectory sent by the AU will be used by the NM flight planning services for the flight plan validation process together with the NM planning trajectory which is estimated when the EFPL is received[5]. Consequently, the flight plan validation process of NM will be modified in order to be able to use the received 4D trajectory. This trajectory will be stored in IFPS together with the flight plan and will be available for further revalidations (e.g. when the environment data change) and distribution to its client systems, including the Flow Management services and, upon request, ATC flight data processing (FDP) systems (as part as the whole EFPL information set for distribution).

    It will also be possible for flight plan originators to provide to NM, in addition to the filed flight plan, aircraft performance information specific to the flight. This information will be stored by the NM flight planning services together with the filed flight plan and will also be available for further distribution to its client systems, including the Flow Management services and, upon request, ATC flight data processing (FDP) systems. The provided aircraft performance information, being specific to the flight, will allow for an improved local calculation of the trajectory of a flight for what-if scenarios and simulations. The Flow Management services may also use it to calculate a new prediction of the flight path upon reception of real time updates regarding the current position of the flight.

[5] Typically, there is a NM planning trajectory managed by the ETFMS before the submission of the EFPL by the AU. This is based on historical data and EFPL repetitive flights. However, after the AU submits the first EFPL, NM planning trajectory will be calculated by IFPS and based on the trajectory provided by the AU.

- **From NM flight planning services to AUs**: NM will reply to the AU with two new elements in the EFPL response message: the accepted trajectory and Profile Tuning Restrictions that may apply.

NM will have to handle various combinations of FPL data exchange messages during the transition phase. These are not selective nor exclusive, but coexist in time:

- **Global mix mode** of operations allowing some AUs to provide EFPLs whereas others will continue to transmit ICAO FPLs.
- **Individual mix mode** of operations where AUs will be able to submit a EFPLM followed by updates in ICAO format (Change, Delay, Re-Processing…) and viceversa.

Regarding ATM constraints, evolutions in step 1 involve only “soft” constraints named Profile Tuning Restrictions (PTRs). Two flows of information are considered and the type of information provided changes from one to another:

- Any AU is able to retrieve PTR information from the global database where they are published.
- For a given flight, the list of PTRs applying to that specific flight is provided as feedback in the **EFPL reply messages from NM** in the trajectory management process (i.e. as with PTRs information)

This available information will further increase the accuracy and consistency of the planned 4D trajectory of a flight and therefore increase predictability both for AUs and NM.

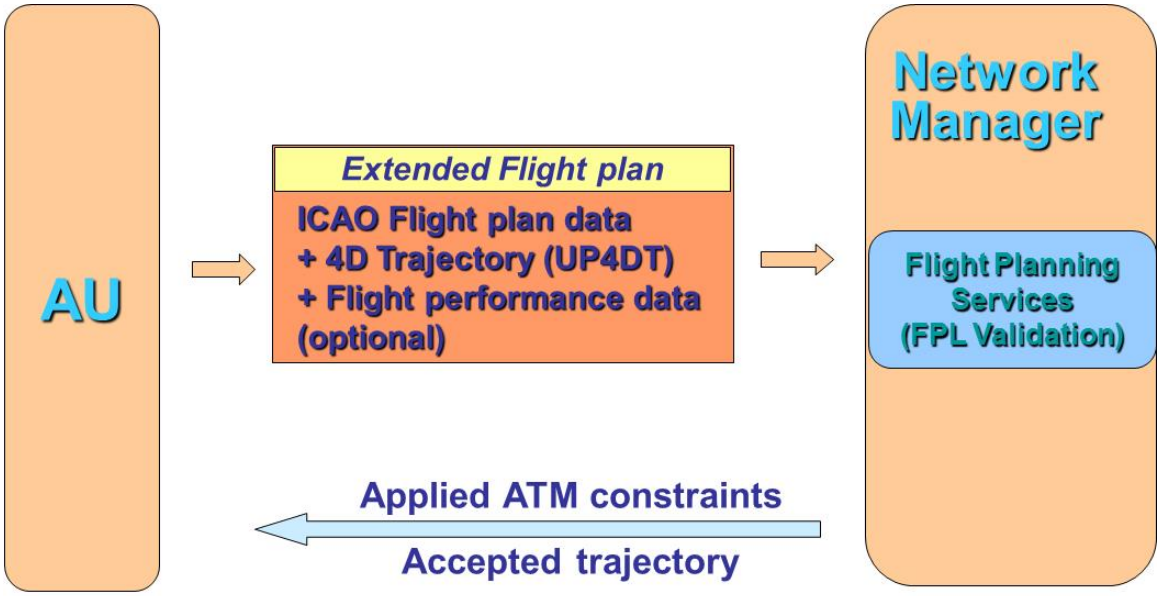

Figure 6: Extended Flight Plan validation services overview

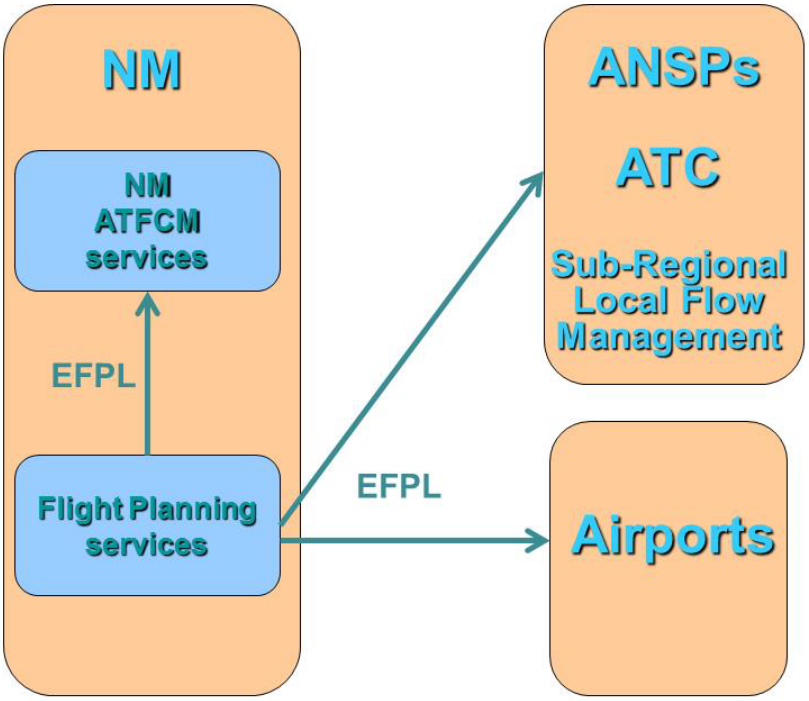

Figure 7 Extended Flight Plan dissemination data overview

In order to address regulatory and worldwide applicability aspects, the Extended FPL solution is refined in close relation with the latest ICAO flight data exchange concept and standard developments (FF-ICE, FIXM). This will allow minimizing costs for full alignment with ICAO provisions in target step 1 [8].

Expected benefits and associated benefit mechanisms of the Extended Flight plan are provided in Appendix C.

2.2.2.2 General Validation context

2.2.2.2.1 VR-713

Note 1: The validation EXE-07.06.02-VP-713 refers to the SWIM compliance report [30], since it is part of the validation.

This section is an extract from the Step 1 Business Trajectory Validation Report for EFPL. For further information on VR-713, please see [13].

2.2.2.2.1.1 General conclusions

The main conclusion from the simulations performed in the exercise is that operational feasibility of the use of the extended flight plan has been proven both at the level of flight planning and flow management. Furthermore,

- Main critical safety requirements have been validated. In particular, the exercises have demonstrated that the EFPL does not create risks in some safety critical processes like flight plan distribution to ANSPs and identification of potential overloads in DCB.
- Some immediate benefits have been demonstrated both at the level of flight planning and flow management in terms of increased transparency and trajectory alignment, less FPL rejections or increased traffic predictability in some specific areas.

- In term of performances, the benefits quantitatively measured are limited at this stage. However it is highlighted by all stakeholders that the exercise has not addressed some promising use-cases inducing potentially significant benefits such as the optimisation of todays accepted ICAO flight plans or the fine-tuning of trajectories to avoid constraints.
- The technical feasibility of EFPL dedicated services has been proven.
- Standardisation needs have been covered and the migration to FIXM - the format for the future ICAO FPL - has been tested successfully.

Considering the results of the VR-713 [13] some of the validation statuses of the EFPL requirements in section 4.3 of this Step 1 OSED have been modified. Additionally, it has been established **the current level of maturity of EFPL evolution in V3**.

2.2.2.2.1.2 General recommendations

From these results, two types of recommendations can be derived from the outcomes of the exercises:

- Recommendations regarding the first implementation step are:
  - To perform pre- operational live trials (V4) with candidate AUs in order to:
    - Minimise the risk of new flight plan rejections during the initial learning phase;
    - Identify the best options in terms of EFPL data to be used by the NM systems in order to optimise traffic predictability improvements;
    - Assess in coordination with concerned ASNPs the impact of EFPLs on flight plan distribution and traffic predictability in some specific areas.
  - To implement NM HMI improvements in order to support IFPS operators in the management of Extended Flight Plans.
- Regarding further steps of the EFPL implementation, the recommendation is to plan additional SESAR validations in SESAR 2020 in order to:
  - Assess the feasibility and benefits for AUs to better integrate ATC constraints in the AU planned trajectory included in the EFPL;
  - Clarify the requirements in terms of more structured error messages provided by NM to the AUs in the reply for an invalid EFPL ;
  - Validate EFPL distribution services and the use of EFPL data in ATC systems and processes.
  - Investigate the use of the Extended Flight Plan for the management of ATFCM regulations and the determination of TTOs/TTAs,

2.2.3 The Nominal Preferred Route (NPR)

2.2.3.1 The NPR concept

The Nominal Preferred Route concept is developed on top of IP1 DDR 2 program (see §1.5.4).

The set of Operational use cases identified in the DDR2 concept are:

- DDR2/1 use cases
- ANSP planning of rosters, developed from three to one months before operations.
- Collaborative elaboration of a medium-Term pan-European Network plan, involving Airspace Users and local, FAB (sub-regional) and Central (regional) ATM actors

- Collaborative ASM planning and ASM/ATFCM coordination, starting several months ahead for major activities and further developed with nominal operations during the pre-tactical phase (D-6 to D-1)
- Support to Airspace users looking for planned routing optimisation during the M-T, with information derived from the M-T DCB process and the planned changes in the airspace availability.

The evolution in Step 1 in support of those use-cases is the collection of user-preferred routing information corresponding to the routing planned in nominal situations. This will allow maintaining a more accurate view on the planned utilization of airspaces and sectors composing each airspace and better accommodating airspace users' preferences.

Expected benefits and associated benefit mechanisms are provided in Appendix C.

The sections dealing with the NPR concept have been updated taking into account results and conclusions of the exercise VP-715 .

2.2.3.2 General Validation context

2.2.3.2.1 Current maturity level VP-715

According to the results of the VR-715 [36], there are only two validation objectives which have enough level of maturity (E-OCVM) to be conclusive:

- Using the NPR contributes to improve the traffic demand prediction in Medium Term
- Using the NPR contributes to complement historical data information in pre-tactical phase

Throughout the OSED, only these two applications will be considered when mentioning the NPR concept.

The usage of the NPR in NM's reroutings proposal is another application presented in VR-715 that will be taken into account later in Step 2 due to its current low maturity level.

Considering the limitations of the validation exercise 715 and the limited outcome in terms of benefits for end users, **the NPR concept is considered to be in maturity level V1.**

2.2.3.2.2 Validated assumptions

Despite the limitations, the the Validation Exercise 715 [36] has found that the Nominal Preferred Route information provided by Airspace users is of added value in medium term planning phase (months/weeks before operations) while in ATFCM pre-tactical phase – from D-6 to D-1 -, current method based on the use of historical data.(filed flight plan at D-7) remains more efficient.

2.2.3.2.3 Range of criteria used in NM estimations

Currently, NM uses the statistical route catalogue together with the AU's flight intentions to estimate the NM planning trajectory in medium term. However, the statistical route catalogue does not take into account differences between airlines, type of aircraft or any other parameters that may affect to the traffic prediction. This results into a poor estimated trajectory that can be improved using a wider range of data in its calculation, i.e. including all the possible and relevant type of data.

2.2.3.2.4 Non-validated assumptions

Due to the lack of maturity of the subjects, the following asssumptions (already introduced in the Validation Exercise 715) were not achieved. As a result, they are not included in the scope of this OSED:

- The use of NPR information in re-routing proposals and DCB measures selection.
- The use of nominal preferred route information in network traffic demand prediction (except for M-T planning phase, see 2.2.3.2.2)

666

667 #### 2.2.3.2.5 Further requirements development

668 According to the results of the Validation Exercise 715, requirements should be further developed to
669 get improvements in:

670 1) Usage of historical data usage and/or NM trajectory generation tools.

671 2) NPR data collection in the scheduling phase –only when it has added value in comparison to
672 historical data (e.g. new city pair…)-.

673 3) Usage of NPR to support DCB (however, it will be only considered in the scope of Step 2 SBT
674 management)

675

676 ## 2.2.4 The SBT (iSBT) and RBT (iRBT) in Step 1

677 An initial implementation of the **Shared Business Trajectory (iSBT) and the Reference Business**
678 **Trajectory (iRBT)** can be envisaged in the timeframe 2018-2020. The implementation of the iSBT
679 relies on Extended FPL and NPR as well as standards and provisions issued by ICAO in the context
680 of FF-ICE increment 1.

681 The main elements that will constitute the initial implementation of the **iSBT** and **iRBT** are:

682 • The evolution of the format of the ICAO flight plan to support the exchange of 4D Trajectory
683 information between the FOC and the ATM (including network and ATC units) mainly in the
684 short-term planning phase.

685 • The introduction of the Globally Unique Flight Identifier (GUFI) allowing all eligible members
686 of the ATM Community to unambiguously refer to information pertaining to a flight. The use
687 of the GUFI will support ATM flight data exchanges mainly taking place in short-term and
688 execution phase. Commercial/schedule data exchanges are not expected to use the GUFI
689 as these exchanges do not normally refer to individual flights.

690 • The partial implementation of the concept of the Reference Business Trajectory at the
691 transition between planning and execution.

692 • Two groups of data are differentiated in the iRBT data: the agreed trajectory data and the
693 supporting trajectory data.

694 • The management of time-based elements issued by the network and CDM airports (e.g.
695 CTOT, TTO, TTA, TSAT) in the business trajectories.

696 • The development of SWIM NOP services allowing the sharing of Business trajectories –
697 Shared and agreed reference business trajectories - between all ground[6] actors (including
698 FOCs).

699 • The development and deployment of SWIM services (blue profile) allowing the sharing of
700 trajectory information between network actors and ATC.

701 This corresponds to a first step implementation of the business trajectory concept as depicted in the
702 SESAR CONOPS. The following limitations can be listed regarding the Shared business trajectory
703 and the agreement on the Reference business trajectory:

704 • The 4D trajectory sent by airspace users (filed trajectory) in the Extended flight plan cannot
705 be strictly assimilated to the agreed Reference 4D business trajectory since dynamic time-
706 based DCB measures issued in pre-flight phase either by the network (e.g. CTOT, TTA,
707 TTO) or CDM airports (TSAT, allocated SID) need to be integrated.

708 • **A fully formalised agreement process will not be put in place in Step 1 with a single**
709 **milestone for the transition from SBT to RBT.** As in current operations, the agreement

[6] In the context of i4D some aspects of air-ground share of trajectories in execution should be also developed but this is out of the scope the present OSED (addressed in the Trajectory Management Framework OFA)

process will start with the initial submission of the flight plan and will finish approximately at take-off time.

- Even though the SBTs and the agreed trajectories will be shared by all stakeholders (Network managers, ANSPs, airports, airspace users) it is not expected that the 4D trajectory information shared at network level will be yet strongly integrated with real-time ATC processes and systems in the execution phase.
- The Business Trajectory will not be yet fully gate-to-gate. For the arrival segment, the business Trajectory will stop at landing. For the departure segment, no detailed taxi path information is planned to be shared at network level, only the EOBT and the taxi time.
- Advanced collaborative processes allowing dynamic and iterative refinement of SBTs and RBTs will be implemented only in Step 2.

Detailed elements are provided in section 6.

2.3 Processes and Services (P&S)

2.3.1 Processes

The following table is an extraction of the D29 Step 1 Network DOD Release 5 [6].

Diagram	Node	Process	Description	Associated Use Case
Determine Network Traffic Demand	Airspace User Ops Support	Submit and Update iSBT/iSMT	An operator is to input to a central database any data available related to a particular flight as early as possible to create an initial trajectory, and then progressively update that trajectory with better and more complete data as it becomes available.	UC-NP-01 UC-NP-02
	Network Mgt.	Process 4D trajectory	This is where a flights' planned trajectory is augmented and updated with additional data such as aircraft performance to better represent that flight in 4D.	UC-NP-03
	Network Mgt.	Validation iSBT/SMT	A planned trajectory will be validated against ATM environment, initially for syntax and semantics, then for compliance with any airspace requirements and constraints that may exist. As the ATM environment and constraints are updated, then it has to be ultimately revalidated by the system in orden to identify possible new inconsistencies.	UC-NP-04
	Network Mgt.	Distribution iSBT/iSMT	Agreed iSBT/iSMT before the flight departure together with subsequent updates will be distributed automatically by the system to ATC, ATFCM and other stakeholders in the Network concerned by the flight	UC-NP-05

	Network Mgt.	Storing iSBT/SMT	The iSBT/iSMT and successive received updates will be consolidated and stored together with possible associated inconsistencies, the associated 4D trajectory submitted by the AU and the status of the flight (filed, departed) The following versions of the iSBT/iSMT will be stored separately: very first version, the last agreed version before departure, the latest version after departure	UC-NP-06

Table 9: Network process in the scope of the 7.6.2 OSED

2.3.2 Services

2.3.2.1 Operational services

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

2.3.2.2 SWIM services

The SWIM Information Services are linked to EFPL in section 4 of this document and EFPL requirements' compliance has been assessed in the SWIM Compliant Report (for further evidence please see [30]).

EXE-07.06.02-VP-713 validated the SWIM compliance of the EFPL services as defined in the ExtendedFlightPlanSubmission and FlightPlanDataDistribution Service Design Documents (please see [31] and [32]). The Step 1 Technical Specifications for EFPL V3 (please see [33]) further elaborates on the SWIM requirements. The Service Technical Design Documents, AIRM/ISRM mappings were used to produce SWIM compliance report (please see [30]).

The SWIM compliance assessment team concluded that the services in the scope of the VP-713 exercise are: Information Service Compliant (ISRM), Information Ready (AIRM) and TI Binding Yellow Profile Compliant (TI Level).

2.3.3 Mapping to Service portfolio and Systems

A correspondent section in the DOD [6] is not yet available.

3 Detailed Operational Environment

This section includes elements of the operational environment (from the Network DOD) being directly in the scope of 7.6.2 project. Other elements of the operational environment can be consulted in the Network operations DOD [6]

3.1 Operational Characteristics

3.1.1 SBT Information Availability over Time Horizon

According to the SESAR ConOps, Shared Business/Mission Trajectories (SBT) should be made available to the Network Management Plan as early as possible.

Currently, the main FOC's systems could (and as such also for Step 1) share data via point to point with the concerned stakeholder system as they already do with their operational flight plan currently destined for the flight crew. In this example, this includes much more information than actual flight plan currently sent to the ATC, e.g. the list of all points over flown by the aircraft with time estimates and also the fuel consumption as computed by the airline tools.

In reality, however, not all elements of a trajectory are known and/or reliable in the same time horizon.

Scheduled Airlines operate the most predictable flight schedule. Their business model is highly depending on predictability to optimise service quality and operating cost.

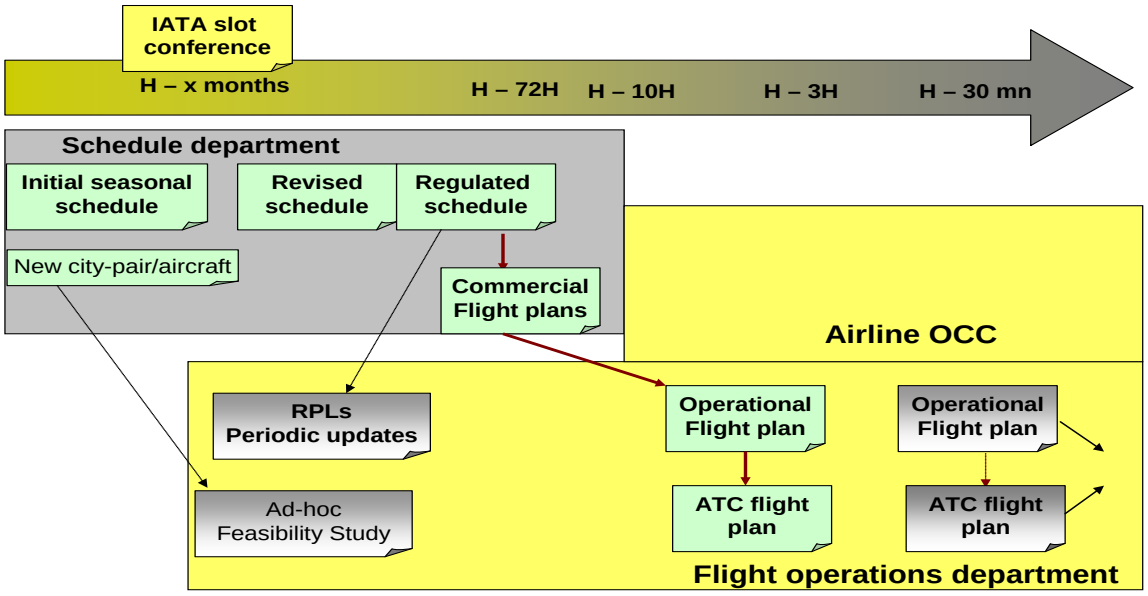

Figure 8: Flight Planning for Scheduled Airlines

The availability and reliability of flight intent (later SBT) information over time horizon varies significantly between Airspace Users with different business models (see Table 9), and the quality of the airspace user tool to build the 4D profile.

768

Legacy scheduled airlines	See figure 8.
Low fare airlines	Similar to legacy airlines but have more flexibility to adapt the schedule for commercial reason at short term.
Regional airlines	Close to legacy airlines. Innovata[7] schedule updated less frequently.
Charter airlines	Commercial part is handled by a third party: tour operators. More unstable schedule and available at shorter term.
General cargo airlines	Close to charters. Annual program + ad-hoc schedule. Schedule provided over a longer period.
Express cargo airlines	Similar to low fare airlines. They operate a more stable annual program than General cargo carriers with some ad-hoc/short term adjustments.
Business aviation	No information available 48 H before operations apart in the case of special events or airport slots.
General aviation	Nothing available.

769 Table 10: Flight Planning by Business Model

770

771 The table below shows for Step 1 an anticipation of flight data availability over the time horizon
772 (subject to negotiation with airspace users)

	Civil/military planning		**Civil /Military operational information**			
	Next season	**Monthly**	**d-6 to d-1**	**d-1**	**d-1 to -3h**	**-3h to -30min**
ADEP-ADES	**Schedules issued**	Schedules update if required. **Military planned missions**	Schedules / Missions update if required	Schedules/ Missions update if required	Update information if required	
Scheduled/Estimated Block Times	**Scheduled block times issued**	Update information if required	Update information if required	**Estimated block times issued**	Update information if required	Update information if required
Aircraft type	**Information on preferred Aircraft Type**	Update information if required	Update information if required	Update information if required	Update information if required	Update information if required
Airspace Reservation/ Restriction Demand	**Big events or exercises**	Big events or exercises updates and **expected military training schedules** including specific procedures	Updates to big events or exercises and military training schedules if required	Updates to big events or exercises and military training schedules if required on **AUP**	Updates to big events or exercises and military training schedules if required on **UUP**	Agreed airspace reservation/restriction allocation
User Preferred	**Information on**	Update	Update	Update	Update	Update

[7] Innovata is a set of services/products including in particular services for the management of a global database of airlines schedules.

	Civil/military planning		Civil /Military operational information			
	Next season	**Monthly**	**d-6 to d-1**	**d-1**	**d-1 to -3h**	**-3h to -30min**
Route	**User Nominal preferred Route to handle flight including ranked alternatives**	information if required	information if required including ranked alternatives	information if required	information if required	information if required
Shared Business/Mission Trajectory	**Information on 2D route waypoints , including RFL**	Update information if required	**Information on 4D route including aircraft performance**	Update information if required	Update information if required	Update information if required
Flight Priority			**Information on required priorities to handle specific flights**	Update if required	Update if required	Update if required
Reference Business/Mission Trajectory					**Agreed 4D trajectory including constraints (on request)**	Agreed 4D trajectory including constraints

Table 11: SBT Information Availability over Time Horizon

3.2 Roles and Responsibilities

See Network DOD [6] for roles and responsibilities related to network operations.

3.3 Constraints

3.3.1 Availability of Flight intention information in medium term

We cannot expect to get early visibility on traffic demand for all segments of traffic.

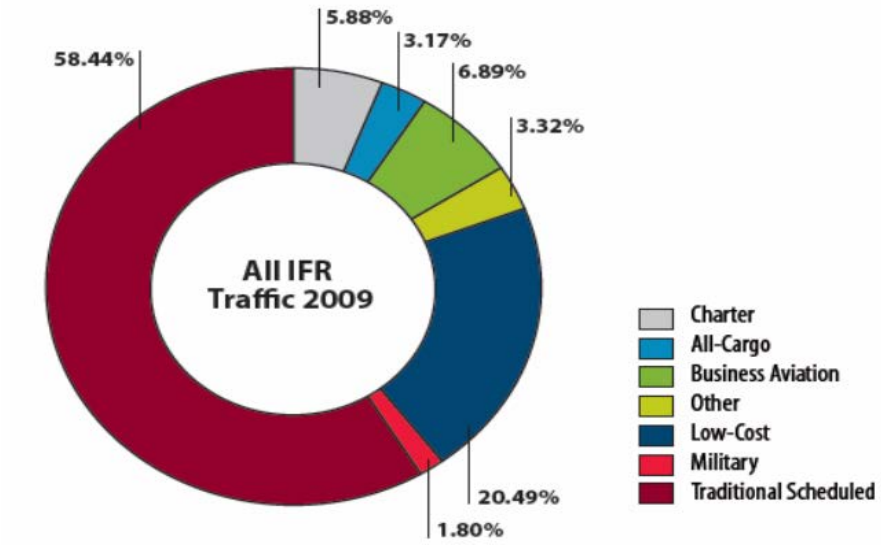

Figure 9: Market segment distribution in 2009 – from Coda publications

Indeed, there is no single method for managing traffic demand data, from an Airspace Users (AU's) perspective. Airlines have adopted different business models and they operate different types of flights.

A significant portion of IFR flights is planned and organized according to schedules that are fixed months in advance: traditional or regional scheduled airlines and low cost carriers represent globally about 80% of IFR traffic.

About another 10% of IFR traffic demand, encompassing charters and a significant portion of cargo flights, are planned within a shorter time frame (2 to 3 months in advance), in order to meet the specificity of their business model.

Legacy scheduled airlines	See figure 8.
Low fare airlines +~80%	Similar to legacy airlines but have more flexibility to adapt the schedule for commercial reason at short term.
Regional airlines	Close to legacy airlines. Innovata schedule updated less frequently.
Charter airlines	Commercial part is handled by a third party: tour operators. More unstable schedule and available at shorter term.
General cargo airlines	Close to charters. Annual program + ad-hoc schedule. Schedule provided over a longer period.
Express cargo airlines	Similar to low fare airlines. They operate a more stable annual program than General cargo carriers with some ad-hoc/short term adjustments.
Business aviation	No information available 48 H before operations apart in the case of special events or airport slots.
General aviation	Nothing available.

Table 12: Availability of traffic demand data in support to M-T planning

Scheduled traffic (traditional / low fair / regional) represent about 80% of the total IFR traffic demand.

3.3.2 ATM constraints information

During the planning phase, the flight may become subject to a number of constraints, external to the AU, and possibly affecting their intentions. Such constraints could be divided by:

- **Flight planning constraints**, which may also be divided into:
  - Hard constraints
  - Soft constraints
- **ATFM constraints** (DCB measures)
- **Real-time constraints** related to ongoing operations

Regarding the type of nature of each constraint, they can be:

- **Static constraints** that are fixed restrictions in time and space. They are ANSPs' rules for use of resources and do not change daily.

- **Dynamic constraints** that may come and go until the flight is executed. They vary daily and even hourly, and reflect issues due to special events, traffic congestion, weather, and other non-nominal situations. Accordingly, these constraints are characterised for being:
  - Rather temporary, as opposed to static, permanent constraints
  - Rather unpredictable, as opposed to period, regular constraints.

  As an example, unscheduled airspace reservations by military airspace users are dynamic constraints as military areas can be booked at short notice (and released with no prior notice).

  Such constraints are not necessarily known at the time of initial validation or may be released before departure.

3.3.2.1 Flight planning constraints

3.3.2.1.1 Hard constraints

AUs intents **must conform** to published "hard" airspace/route constraints (e.g. RAD) that are applicable for the FPL validation when submitting a flight plan (in the desired/filed trajectory), otherwise the FPL will be rejected.

The FPL validation is performed against them based on the trajectory derived by NM flight planning services from the FPL.

3.3.2.1.2 Soft constraints

The NM flight planning services also uses the so-called "soft" constraints for the calculation of a flight trajectory and **not** for FPL validation (as they may not be applied in the end). Therefore, such constraints do not need to be considered by the AU when submitting a FPL but they will be addressed by NM as feedback to the AU afterwards. These soft constraints include:

- Vertical limits published (via State AIP) for SID/STAR routes
- Profile Tuning Restrictions (PTRs), e.g. flight level constraints that are mainly used to model the transfer levels included in ATC Letters of Agreement (LoAs)

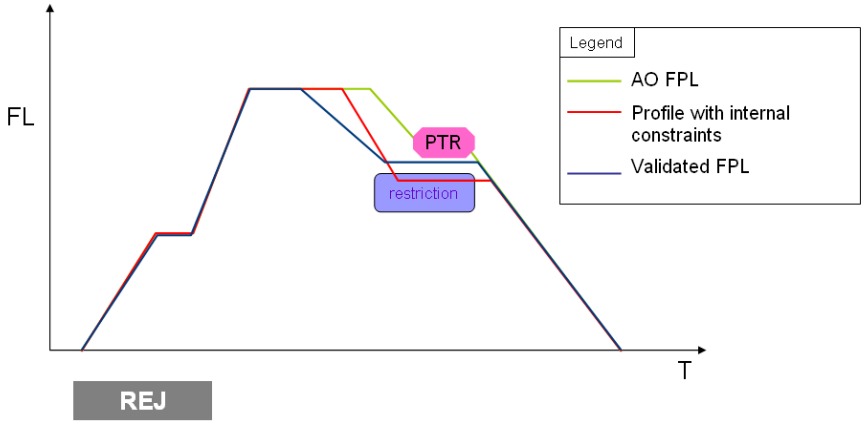

Figure 10[8]: Impact of PTR on a profile

3.3.2.1.2.1Profile Tuning Restrictions (PTRs)

[8] In this figure, AO it is used as Aircraft Operator or a synonym of Airspace User (AU).

Profile tuning restrictions (PTR) are currently used by NM flight planning services for flight trajectory calculation and they can also be used by Airspace Users for the calculation of their operational flight plan. By doing so, a full 4D trajectory information in operations is accomplished.

3.3.2.2 ATFCM constraints (DCB measures)

ATFCM constraints are applied for the purpose of demand and capacity management when traffic demand is expected to exceed what can be safely handled by ATCOs:

- At the level of flight planning, such constraints often come in the form of ATFCM slots but the efficiency of the slot allocation mechanism depends itself on the predictability and accuracy of flight planning. Inconsistencies during flight planning may result in the allocation of inconsistent departure slots resulting in a less efficient usage of available slots.
- As an alternative to slot allocation, STAM measures (e.g. re-routing/level capping proposals) may be sent to AUs to avoid delay penalties either in planning or execution phase. Similarly, the relevance of rerouting proposals depends on the relevance of the flight plan

3.3.2.3 Real-time ATM constraints

Real-time constraints are constraints known at short-notice, close to EOBT, when pre-flight operations have already started at the departure aerodrome. As the flight is “astride” the flight planning phase and the execution phase, there is a compromise to find between what should be reconciled in the flight plan in case of inconsistencies and what should be left to tactical operations.

Close to the execution phase, there is a trade-off to find between the stability aimed for the plan and the flexibility left to airspace users, which may lead to the concept of priority or criticality of a constraint: the closer to off-block time we are, the more critical a new constraint has to be in order to trigger a flight trajectory recalculation. Some mechanisms are already in place in Flow Management services that prevent late changes to the CTOT.

Note: only PTRs and DCB measures are the ones concerned by step 1 evolutions.

4 Short-term planning - Extended Flight plan (quick win)

4.1 Detailed Operating methods

4.1.1 Previous Operating Method

4.1.1.1 Overview

The IFPS is responsible for the reception, validation and distribution of flight plan data for all IFR/GAT flights within the IFPS Zone (IFPZ).

All Airspace Users intending to operate an IFR/GAT flight within the IFPZ should submit a Flight Plan to the IFPS. Flight plans may be submitted to IFPS as either an individual Flight Plan (FPL) or, for flights that are operated on a regular basis, a Repetitive Flight Plan (RPL). Individual flight plans may be submitted to IFPS via the AFTN and SITA networks or, as a recent development, via B2B connections. RPLs are usually submitted as text files via e-mail.

Flight plans are validated by IFPS from a syntactic and semantic point of view. They are as well validated against the latest available information regarding the route and airspace availability. They are equally checked for compliance with aircraft equipage and capabilities requirements.

Valid flight plan messages are acknowledged by the IFPS. Invalid messages may be automatically corrected, automatically rejected or passed for manual treatment by IFPS staff.

Valid flight plans are distributed by IFPS to ATC units concerned by the flight inside the IFPS Zone as well as to the ETFMS of the Network Manager and any other address as specified by the filer.

4.1.1.2 Flight Plan Filing

Filing a flight plan with IFPS is the process of submitting an FPL message to the IFPS for processing. Similarly, subsequent ICAO messages associated to a previously submitted FPL should be sent to the IFPS. ICAO flight plan and associated messages may be submitted to the IFPS up to a maximum of 120 hours, or five days, in advance of the estimated off-block time of the flight plan.

4.1.1.3 Initial Flight Plan Validation

The IFPS checks flight plan messages received and corrects them as far as possible within its knowledge of the ATS environment. When such corrections cannot be made, invalid messages are either automatically rejected or passed to the IFPS operator for manual processing. All messages presented to the IFPS staff for manual processing will have attached an indication of the relevant errors causing that message to fail automatic processing. All messages must be treated without undue delay.

In order to indicate to the message originator the status of the processing of a submitted message, the IFPS uses Operational Reply Messages (ORM). ORMs are implemented using three possible message types:

ACK

An Acknowledgement (ACK) message is used to indicate successful processing of a submitted FPL against environmental data held by the NM at the time of processing the FPL. The ACK message is sent when the IFPS does not detect any error in the received FPL or, after automatic or manual intervention to correct the errors originally found. Automatic processing does not necessarily mean that the FPL has been accepted by the IFPS without modifications. Consequently, two different types of ACK messages are available:

- Short ACK: when the message is automatically processed without amendment.
- Long ACK: when the message includes amendments. This type of ACK contains the complete FPL in ICAO format as accepted by the IFPS. Where a Long ACK is received, the

message originator shall check for any amendments made by the IFPS, especially when the submitted FPL contains the IFPS Re-route Accepted authorisation.

REJ

A Reject (REJ) message is sent to notify the FPL originator that the submitted FPL could not be processed successfully, either automatically or manually, and that the submitted FPL has not been accepted by IFPS. The REJ message also contains an error list (to a maximum of 10) to help the Airspace Users to rectify the error(s). The Airspace User can react by amending the original FPL appropriately and re-submitting the corrected FPL to the IFPS.

MAN

A Manual (MAN) message is used to indicate to the FPL originator that errors have been detected in the submitted FPL and that it has been referred for manual processing by the IFPS staff. The reception of a MAN message does not require any immediate action from the submitter, but implies a manual intervention of the IFPS staff. The manual treatment is followed by an ACK message if the FPL is successfully corrected by the IFPS staff, or by a REJ message if the FPL cannot be made compliant.

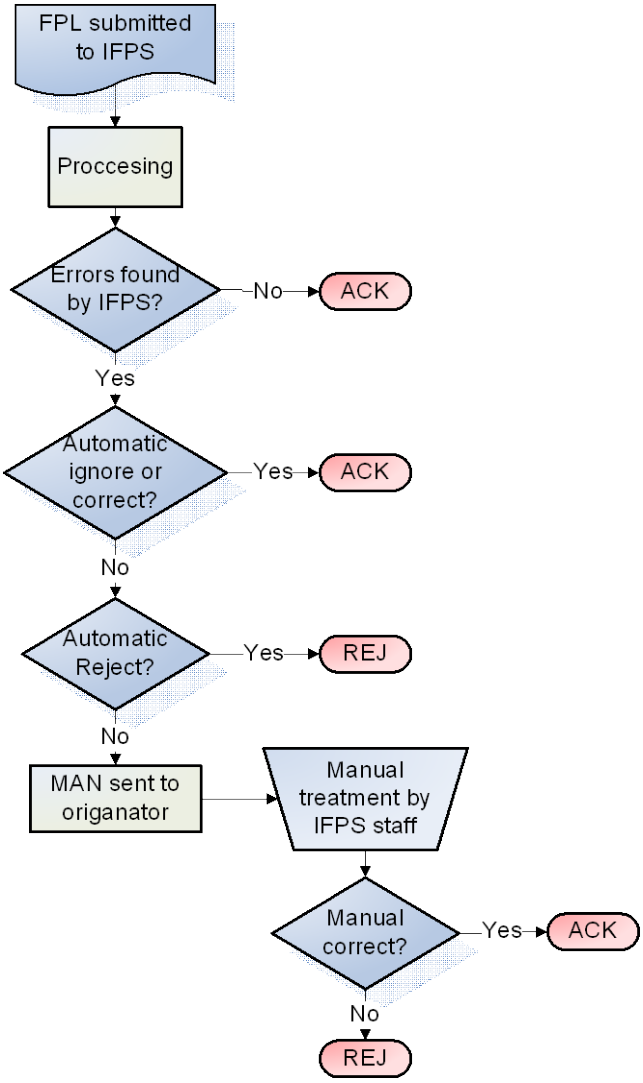

Figure 11: Initial Flight Plan validation

4.1.1.4Flight Plan Re-validation

Once accepted by the IFPS, all flight plans are subject to a revalidation process against any possible environment modifications that may impact them with the purpose to ensure that all flight plan data reflects the current airspace situation as far as possible.

In order to develop greater consistency of flight plan data between the AU, ATC and the NM, flight plans are re-validated against constraints (closures) and opportunities (openings) and/or modifications of RAD restrictions in the NM Environment database.

The reprocessing of the IFPS flight plan database occurs automatically every 30 minutes as from 12 hours (or filing time if less than 12 hours) prior to the EOBT of each flight plan until the EOBT.

Where a flight plan is reprocessed during one of the possible revalidation events and is found to be inconsistent with the current NM Environment data, the following process takes place according to a timeline:

From 12 hours before EOBT (or filing time) to 1 hour before EOBT:

Any flight which is inconsistent with the NM Environment data at the time of revalidation is given an IFPS status of ‘suspended’. The IFPS then provides the ETFMS with the necessary information in order that the flight plan shall be suspend via a Flight Suspension (FLS message).

The Originator of the ‘suspended’ flight plan message is expected to react to the FLS by sending a CHG, CNL or DLA message to the IFPS to either cancel the flight plan or update it to make it valid. Otherwise, the FPL suspension remains in place and the flight is not expected to take-off.

In case of early re-opening of routes or deactivation of a RAD restriction, the IFPS supervisor shall identify via the ‘non-compliant listing’ function those flights planned to take off in less than an hour in order to de-suspend them via a force compliant function.

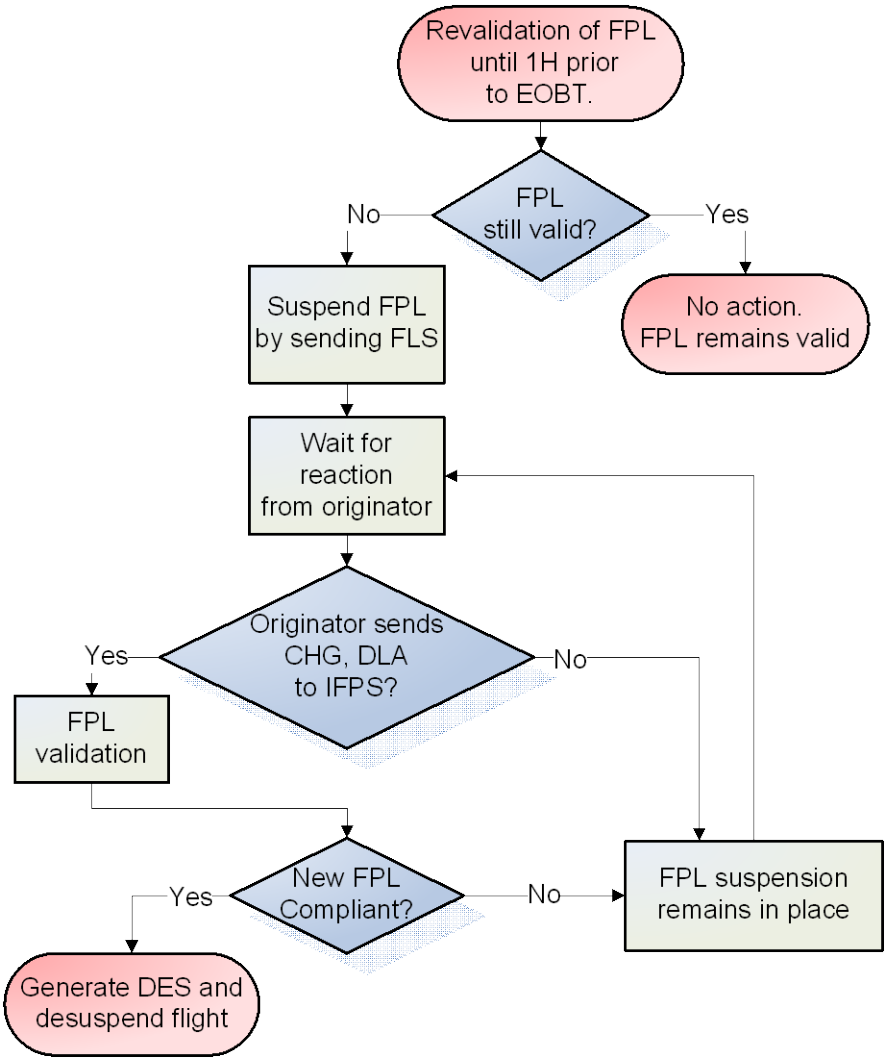

Figure 12: Flight plan revalidation process until 1 hour prior to EOBT

From EOBT to 1 hour before EOBT:

The flight is given the IFPS status of 'advisory' and a free-text message is automatically sent to the flight plan originator that contains the aircraft identification, aerodrome of departure, aerodrome of destination, EOBT, EOBD, and a proposed alternative route followed by the list of errors generated in the reprocessing.

4.1.1.5 Flight Plan Distribution

As part of the flight plan validation process, the IFPS builds a four-dimensional trajectory that is used for several purposes, one of which is to calculate those airspaces that the flight penetrates, and therefore to identify which air traffic services units require a copy of the flight plan for that flight. In identifying all the relevant ATC Units, the IFPS determines at what time and in what format (ICAO or ADEXP) to send the flight data (a copy of the FPL) to each controlling ATC Unit (within IFPZ).

The IFPS also sends a copy of each valid message to the ETFMS in order that any relevant flow management restrictions may be applied to that flight as appropriate.

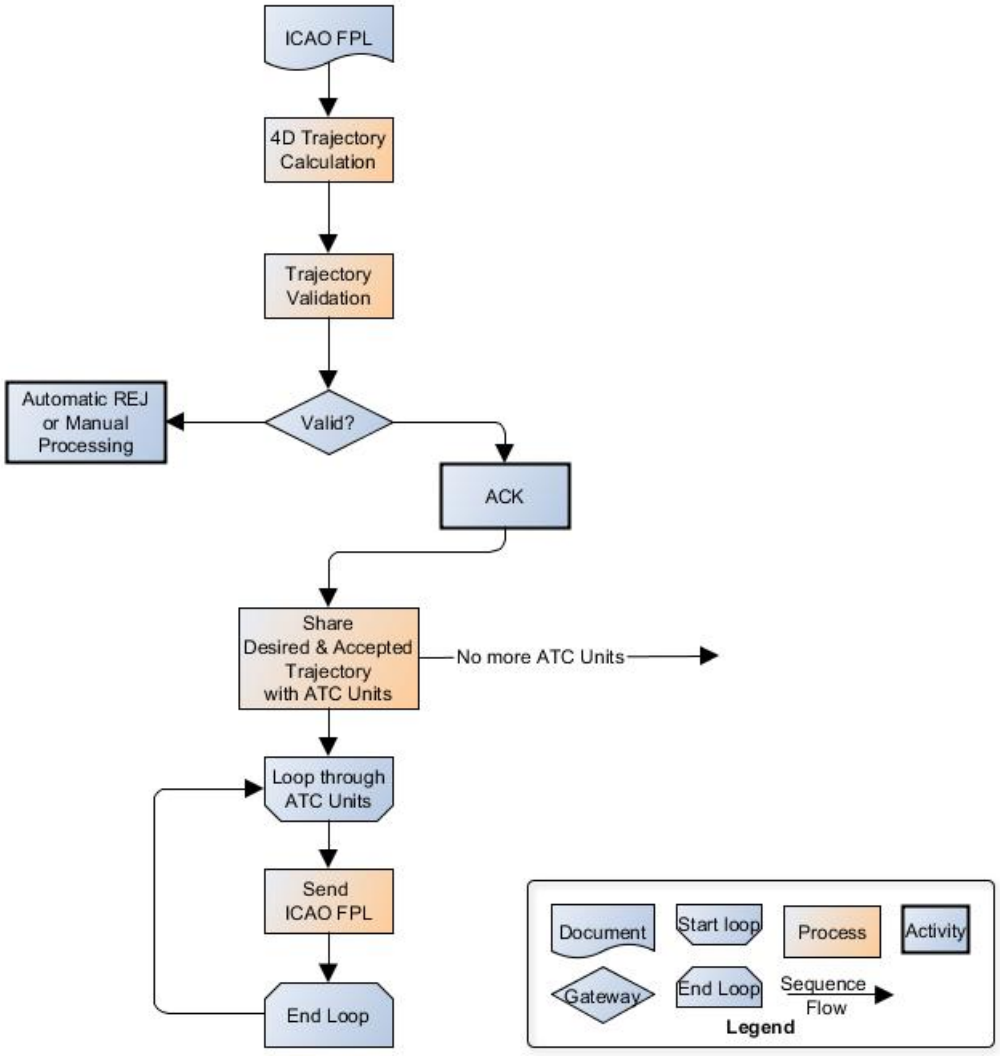

Figure 13: Flight Plan Distribution

4.1.1.6Flight Plan Update

Currently, a flight plan update may be submitted via either a change (CHG) or a delay (DLA) message, depending on the flight plan data element that is being updated. A CHG message may update any data element of the flight plan, including the estimated off-block time (EOBT) and excluding the flight plan key fields i.e. the aircraft identification and the aerodromes of departure and destination. A DLA message may be sent to delay a flight i.e. update the EOBT to a later time compared to the original EOBT. Both the CHG and the DLA message may update the EOBT only to a later time. Updating the EOBT to an earlier time requires the transmission of a cancel (CNL) message followed by a new FPL. This procedure is known as the replacement flight plan procedure. The replacement flight plan procedure may also be used to update one of the key elements of a flight plan that cannot be otherwise modified as they are used by IFPS and its client systems for message association purposes.

Similarly to flight plan messages, update messages which fail automatic processing may be automatically or manually rejected or submitted to manual processing. When processing is completed, the IFPS sends an acknowledgement message to indicate successful processing or a rejection message to notify the message originator that the message failed the processing.

4.1.2 New operating method

4.1.2.1Extended Flight Plan and associated update messages

An **Extended Flight Plan Message (EFPLM)** is a flight plan message which, in addition to the ICAO defined flight plan information, includes also flight trajectory information in the form of a 4D trajectory (filed trajectory), as calculated by the operator of the flight, as well as Performance Data specific to the flight.

The notion of Extended Flight Plan Message is introduced in this document only to make the difference, in terms of content, between a 'simple' Flight Plan Message and an "Extended" Flight Plan Message that, in addition to the "simple" Flight Plan Message contains additional information regarding the flight. The abbreviation EFPLM is created only for purpose of this document, in order to facilitate communication. It is not intended as a new message title.

Equally the notion of "message" is used in this document to facilitate communication regarding the new operating method through analogy with the current "simple" flight plan and associated messages. The actual implementation may refer to a "flight data set" or any other similar term intended to describe the set of data associated to a flight and its planned operations.

Extended flight plan and corresponding associated messages are intended to replace within the new operating method environment and therefore be sent instead of the current "simple" flight plan and associated messages. In other words, it will not be required to send to one given addressee both the "simple" and the corresponding extended flight plan message. However it is expected that "simple" flight plan messages will continue to be used, in parallel with their extended versions, by flight plan originators that have not yet implemented extended flight plan messages.

An EFPLM contains the following sections of data:

- **ICAO FPL data**: all data to be provided in a filed flight plan as specified in the ICAO Doc 4444 and the IFPS Users Manual (for data items specific to the IFPS Zone), including the Field 15 route information.
- **4D Trajectory (filed trajectory)**: AU calculated flight 4D trajectory as included in the operational flight plan (OFP) of the flight.
- **Flight Performance Data**: the climbing and descending capabilities of the aircraft specific to the flight, taking into account the performance of the airframe that is used to operate the flight as well as any other parameters that may influence it such as engine settings and status, cost factor applied by the Airspace User. .

The climb and descent performance profiles are optimum and unconstrained climb and descent profiles instantiated per flight that satisfy the following conditions:

a) Are calculated without taking into account constraints regarding the vertical evolution of the flight such as route availability, RAD level restrictions, SID/STAR restrictions;

b) Are calculated in ISA (International Standard Atmosphere) conditions

c) Are provided up to the maximum cruising level acceptable for the flight (even if not included in the flight plan). This would allow the recipient systems to generate accurate trajectories for vertical re-routings above the highest requested cruising level included in the filed flight plan. Performance profiles should be provided at least up to the highest requested cruising level given in the EFPL;

d) Do not contain step-climbs and step-descents i.e. if the aircraft is planned to do an initial climb to F350, then burn fuel during an hour of cruise, and then climb to F370, these two consecutive climbs shall be glued together.

The following table describes each data item to be included in each data section of an extended flight plan message:

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Data section	Data item	Required	Definition	Possible usage
ICAO Flight Plan Data	See ICAO Doc 4444 and IFPS Users Manual	See ICAO Doc 4444 and IFPS Users Manual	All data to be provided in a filed flight plan as specified in the ICAO Doc 4444 and the IFPS Users Manual, including the Field 15 route information	- Transmission to ATC - Retrieval of all other flight plan information than the 4D Trajectory and Flight Performance Data
Surface trajectory	Taxi Time	O	Estimated taxi time from the parking position to take-off. This data is not attached to a specific point/location of the 4D trajectory.	- To calculate the planned take-off time
Air Trajectory	Location	C	One of the following location items: (i) Aerodrome of departure/destination. Eg: EGKK (ii) Points traversed by the 4D Trajectory including but not limited to the following: 1. Points where a change of ATS route, requested cruising level or speed, flight rules (IFR/VFR) or flight type (GAT/OAT) occur; 2. Points that mark the beginning and end of a portion of flight outside a designated ATS route (direct segments); 3. Points that mark the beginning and end of a portion of flight where the direction and the vertical and horizontal speed of the flight are constant (vector points). Such points may be used to describe the climb and descent phases of the flight using intermediate points in order to provide a more accurate description of the 4D trajectory along these sections of the trajectory that are not linear. 4. Points that describe the ATS route segments planned to be flown; 5. Top of Climb (TOC) points for every transition from a climb phase	- To describe the planned horizontal (2D) evolution of the flight

Data section	Data item	Required	Definition	Possible usage
			to a cruise phase; 6. Top of Descent (TOD) points for every transition from a cruise phase to a descent phase; 7. Bottom of Climb (BOC) points for every transition from a cruise phase to a climb phase; 8. Bottom of Descent (BOD) points for every transition from a descent phase to a cruise phase; 9. Points where the 4D Trajectory intersects the boundary of FIR/UIRs in whose airspace the flight is planned to fly. Points shall be described either by using their published coded designator (Eg: SOSUR) or, for points without a coded designator, by using a commonly agreed designator (E.g. GEOPT) to indicate that the point is described only by its geographical position.	
	Location position	C	Latitude and Longitude of the location	- To solve homonym problems (two locations with the same name) and therefore uniquely identify locations
	Location type	C	Identifies the type of location e.g. aerodrome point	
	Location role	O	Identifies the role of the location. E.g.: top of climb, change of flight rules (IFR/VFR).	
	Previous route segment	C	ATS route followed to reach the location (e.g.: UN621) or DCT. Where published for the aerodromes of departure and destination, the planned SID and STAR routes shall be included in the 4D Trajectory description.	- To indicate the ATS route planned to be followed to reach the location
	Level	C	Estimated Level at the location expressed as either:	- To describe the planned vertical (3D) evolution of

Data section	Data item	Required	Definition	Possible usage
			(i) Flight level (FL) or (ii) Altitude above mean sea level (MSL)	the flight
	Elapsed Time	C	Time elapsed since take-off up to the location	- To describe the planned evolution in time (4D) of the flight
	Distance	O	Total ground distance from take-off up to the location	
	Total Weight	C/O*	Total weight of the aircraft at a location included in the 4D Trajectory, starting with the aerodrome of departure (ADEP). The total weight at the ADEP is the Take-Off Weight (TOW).	- To improve local calculations of flight trajectories for example in case of what-if scenarios
	True air speed	O	Estimated speed of the aircraft at the location expressed as True Air Speed (TAS)	- To improve local calculations of flight trajectories for example in case of what-if scenarios
	Mach number	O	Estimated speed of the aircraft at the location expressed as Mach number	- To improve local calculations of flight trajectories for example in case of what-if scenarios
Flight Performance Data	Climb Performance Profile	C/O*	The climb performance profile described as a sequence of points in which every point is defined by: a) Cumulative Distance from the aerodrome of departure b) Level c) Cumulative Time elapsed from the aerodrome of departure	-To improve local calculations of flight trajectories for example in case of what-if scenarios
	Descent Performance Profile	C/O*	The descent performance profile described as a sequence of points, in reverse order starting from the aerodrome of destination, in which every point is defined by: a) Cumulative Distance from the aerodrome of destination b) Level c) Cumulative Time elapsed from the aerodrome of destination	-To improve local calculations of flight trajectories for example in case of what-if scenarios

Table 13 Data section in Extended Flight Plan message

Legend:

C = compulsory

O = optional

* - either the Total Weight or the Climb/Descent Performance Profiles shall be included in an extended flight plan message. When one of the two data items is included the other one is optional.

Note: the content of the Extended Flight Plan as described in the table above provides the basis for release #5 validation and an initial implementation in IFPS zone. Additional elements (such as GUFI, min/max altitudes, target times application) are planned to be included in the Extended Flight Plan at further step as part of iSBT information taking into account additional requirements and alignment with FF-ICE increment 1. This additional information is described in section 6 (6.1.1.4).

As previously mentioned, the accepted trajectory and PTRs identifiers are two new elements that will be sent back in the reply by the IFPS to the AU for their usage. The following table does not describe all the elements of the full reply, but only those which are new:

Data section	Data item	Condition	Definition	Possible usage
EFPL Reply Message	Accepted trajectory	ACK	Trajectory as calculated by NM to check the compliance of the flight plan with published contraints. It is based on the filed trajectory but integrates among other elements additional soft constraints.	- Increase alignment between AU filed trajectory and NM planning trajectory - Increase trajectory predictability for AUs
	Profile Tuning Restrictions (PTRs) identifiers	ACK	Soft constraints used by all NM systems that require a calculation of a flight profile. These constraints should be regarded as a traffic flow restrictions -they tune the traffic demand calculation of flight profiles- or (LoAs), and they will not be used to validate or more importantly to invalidate a flight plan.	

Table 14 New elements on the NM reply to AU (filing state/service)

Legend:

ACK = acknowledge. The information will be sent when the result of the EFPL validation will be ACK.

Note: These new elements will be included in the reply on AUs' request.

Similarly to an Extended Flight Plan Message, an Extended Flight Plan Update Message is based on the equivalent ICAO flight plan update message to which the 4D trajectory of the flight and Flight Performance Data are added, in case they are updated as well. It could be one of the following messages:

Extended change message (ECHG)

An extended change message shall contain, as a minimum:

- Flight plan association data to allow the association of the message to the original flight plan. The association data will depend on the message format and protocol used for the data exchange. For example, in case of an exchange of flight plan data with IFPS using a web based technology (such as the existing NM B2B services), the association data would be the unique flight plan identification code allocated by IFPS to the flight upon reception of the original Extended Flight Plan message (EFPLM).
- The data elements that are modified. In case they are modified, the 4D Trajectory and/or Flight Performance Data, as defined in 4.1.2.1, shall be included as well. In case the Flight Performance Data is modified, the corresponding updated 4D Trajectory shall be included. The 4D Trajectory may be modified without the Flight Performance Data being modified as well.

An extended change message may optionally repeat all data elements included in the original extended flight plan message even if they are not updated. This will depend on the data format and protocol used for the exchange of data.

Extended delay message (EDLA)

An extended delay message shall contain, as a minimum:

- Flight plan association data to allow the association of the message to the original flight plan. The association data will depend on the message format. For example, in case of an exchange of flight plan data with IFPS using a web based technology (such as the existing NM B2B services), the association data would be the unique flight plan identification code allocated by IFPS to the flight upon reception of the original Extended Flight Plan message.
- The new estimated off-block time
- The new estimated off-block date, in case it is modified
- The updated 4D Trajectory (as defined in 4.1.2.1), in case it is modified due to the delay

An extended delay message may optionally repeat all data elements included in the original extended flight plan message even if they are not updated. This will depend on the data format and protocol used for the exchange of data.

The notions of Extended Modification and Delay Messages are introduced only to make the difference, in terms of content, with their equivalent ‘simple’ messages that contain less information. The abbreviations ECHG and EDLA are created only for purpose of this document, in order to facilitate communication. They are not intended as a new message titles.

4.1.2.2 Extended Flight Plan Filing

Operational procedures related to the filing of a flight plan are not changed by the introduction of extended flight plans. The current procedures, as described in 4.1.1.2 will continue to be applicable.

However, due to the additional data that is included in an EFPL, the flight plan transmission format and means will have to be reconsidered. The length of an EFPL message may be significantly greater compared to current flight plan messages in either ICAO or ADEXP format. As a result, the AFTN and SITA networks that are currently used for the transmission of flight plan messages may not be able handle such longer messages. To accommodate the new information and make its transmission possible, one solution is here proposed:

XML format through B2B connections

Extended flight plan messages may be transmitted using SWIM web services available via the new B2B interface with the NM. This means that the transmission of extended flight plans and associated messages would be done using Internet based technologies for the data communication and a corresponding new data exchange format such as XML, instead of the current AFTN and SITA networks and text flight plan messages in ICAO format.

4.1.2.3 Initial Extended Flight Plan Validation

4.1.2.3.1 Overview

The following new steps or modifications to existing steps will be introduced as part of the Initial Flight Plan Validation:

Syntax and semantics checking: The IFPS will validate the new data elements included in an EFPLM, the 4D Trajectory and Performance Data, from a syntax and semantic point of view.

Extraction of flight performance data: The IFPS will extract Flight Performance Data from the EFPLM.

Sanity checks[9]:IFPS will compare the 4D Trajectory included in the EFPLM against the route provided within the Field 15 of the same message for coherence.

Route Validation: The IFPS uses the EFPL 4D Trajectory within its own trajectory calculation that will result in an accepted trajectory that is then used to perform the route validation.

Further details regarding the changes are provided in the following paragraphs.

4.1.2.3.2 Extraction of flight performance data

The figure below illustrates extraction of the flight performance data. It allows for different ways of submitting the flight performance data within the Extended Flight Plan Message (EFPLM).

[9] At the moment of the release of the Step 1 BT final OSED (D56), this concept still in progress: The 2D sanity checking has become redundant, however, the flight level part of it seems to be still necessary.Flight level consistency rules between Field 15 and 4D trajectory should be further agreed.

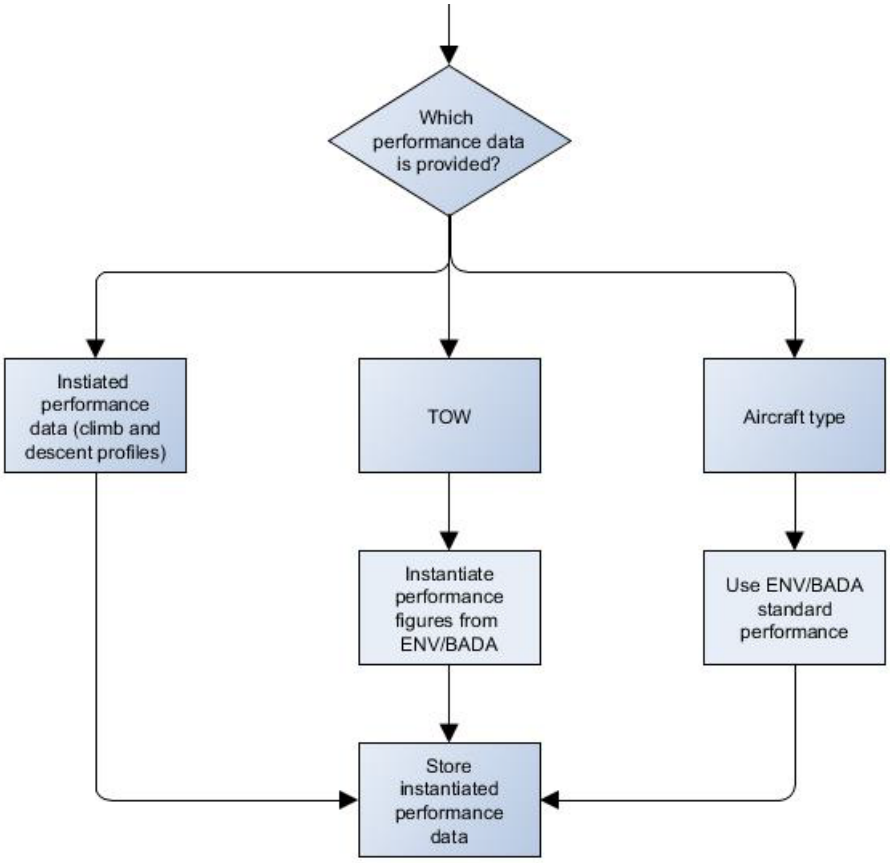

Figure 14: Extraction of flight performance data

The Flight Performance Data may be provided in the EFPLM in one of the following forms:

a. **Climb and descent performance profiles**: these are performance profiles instantiated per flight, which represent a continuous (no intermediate steps) climb and descent profile up to/from the maximum altitude achievable by the aircraft in ISA conditions. The climb/descent rates and speeds can be derived from the climb/descent profiles.

b. **Take-off Weight of aircraft (TOW):** The BADA model contains 3 different climb performance data sets corresponding to a minimum, a nominal and a maximum weight of the aircraft. The NM will select the performance data set that corresponds to the take-off weight of the aircraft. As the flight progresses the estimated weight of the aircraft at each point of the route could be used to select a different performance data set from the BADA model.

4.1.2.3.3 Sanity checks

Note: At the moment of the release of the Step 1 BT final OSED D56, this concept still remains under discussion.

The purpose of the sanity checks is to ensure that the 4D Trajectory included in the Extended Flight Plan Message (EFPLM) is coherent with other information provided in the ICAO FPL, specifically the Field 15 route.

This checking is required because the Field 15 route will continue to be used by some of the IFPS client systems such as ATC flight data processing systems to calculate the flight trajectory while IFPS and other client systems will use the provided 4D Trajectory. It is therefore considered as important to

ensure the 4D Trajectory and the Field 15 contain a consistent view on the planned evolution of the flight.

As sanity checks, the 4D Trajectory and the Field 15 will be checked for:

a) Coherence between 2D tracks

b) Coherence between flight levels

4.1.2.3.3.1 Coherence between 2D tracks of Field15 and 4D Trajectory

2D tracks of Field 15 and of the 4D Trajectory might differ, since the 4D Trajectory may contain, between two common consecutive points, intermediate points to provide a more accurate description of the trajectory.[10] These intermediate points may be represented as geographical coordinates, named waypoints, vector points as well as bearing and distance points. For example, significant intermediate points which may not be reflected in the Field 15 but could be found in the 4D Trajectory are the Top of Climb (TOC) and the Top of Descent (TOD).

Despite possible differences between both 2D tracks, they should represent the same flight intention. A predefined tolerance will be used to allow for small differences due to rounding errors and approximations that might occur for the previously discussed reasons. The SID/STAR portions will not be considered for this comparison, unless the SID/STAR is provided in both the Field 15 and the 4D Trajectory.

This comparison method is illustrated in Figure 15.

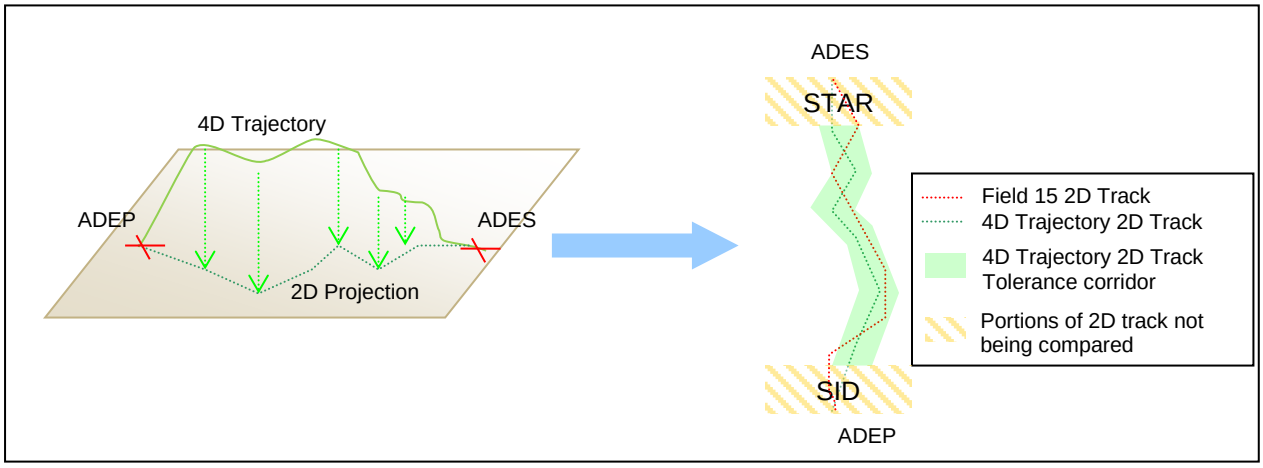

Figure 15 Tolerance between 2D track

4.1.2.3.3.2 Coherence between flight levels of Field 15 and 4D Trajectory

The flight levels expressed within Field 15 and the 4D Trajectory must be equivalent. Important differences might be observed between the levels expressed within the two data sets, since the Field 15 does not allow for great levels of detail when expressing the altitude of the flight during climb and descent portions whereas the 4D Trajectory may provide additional details of such portions, including intermediate steps. Levels in the Field 15 are specified as requested cruising levels (RFL). The change of level towards a new RFL is considered to commence at the point where the RFL is indicated. Levels within the 4D Trajectory are estimated levels at significant points in the trajectory.

Compliance with the following rule of consistency will be checked: RFLs indicated within Field 15 shall be reached and maintained on the route segment for which they are indicated.

[10] Currently combining in the field 15 latitude/longitude points with a speed/level group is not allowed for geographic points along a published ATS route that is part of the field 15. This is another potential cause of inconsistency.

This check is illustrated in the example in Figure 16.

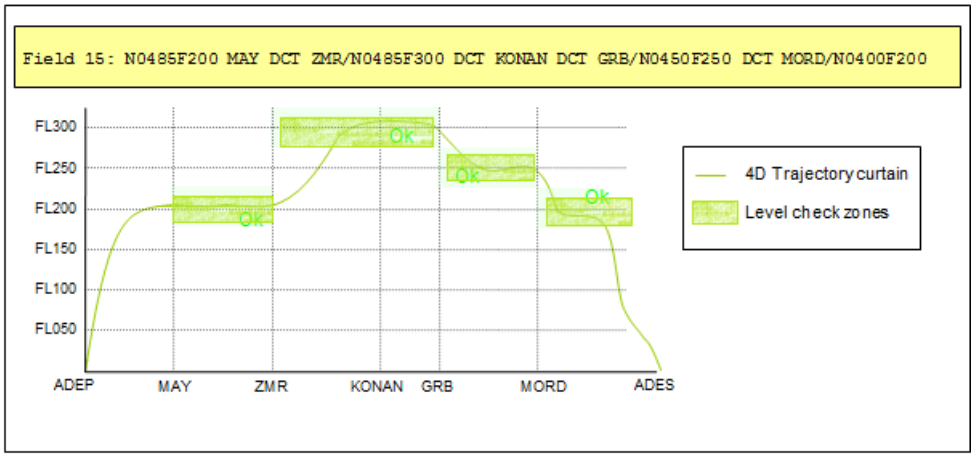

Figure 16 Example of coherence check between Field 15 and 4D Trajectory flight levels

4.1.2.3.4 Route Validation

The Route Validation will follow the same steps as per the current operations. However, the IFPS will use the 4D trajectory submitted in the EFPLM (filed trajectory) within its trajectory calculation that will result in an accepted trajectory i.e. a trajectory that takes into account the AU desired trajectory as well as some additional ATC constraints. Thereafter, the accepted trajectory is used by IFPS to do the validation.

In addition, aircraft equipment and capabilities related checks, such as the RVSM, 8.33 kHz radio channel spacing or Mode S checking, will use the accepted trajectory to perform the checking. The accepted trajectory will be used to determine the planned penetration by the flight of the various airspaces that require certain levels of aircraft equipage and capabilities.

4.1.2.4 Extended Flight Plan Distribution

The IFPS will use the accepted trajectory to determine the list of flight plan addressees.

As far as the content of the distributed flight plan messages is concerned, some of the flight plan message addressees might not be able to process an EFPL message and therefore may need to continue receiving only the ICAO FPL data of the EFPL, as per the current operations. Therefore the IFPS flight plan distribution process will have to be changed so that the content of the output flight plan message is adapted to the capabilities/ requirements of each addressee. ATC units will be able to choose between ‘simple’ content, containing only the ICAO flight plan data, and ‘extended’ content, containing Extended FPL data. By default IFPS output flight plan messages will have ‘simple’ content. This preference will be stored by IFPS and used to determine the content of the message, at the moment the output flight plan message is created.

The modified flight plan distribution process in both scenarios is represented in the diagrams in Figure 17 where the impacted areas have been highlighted in red.

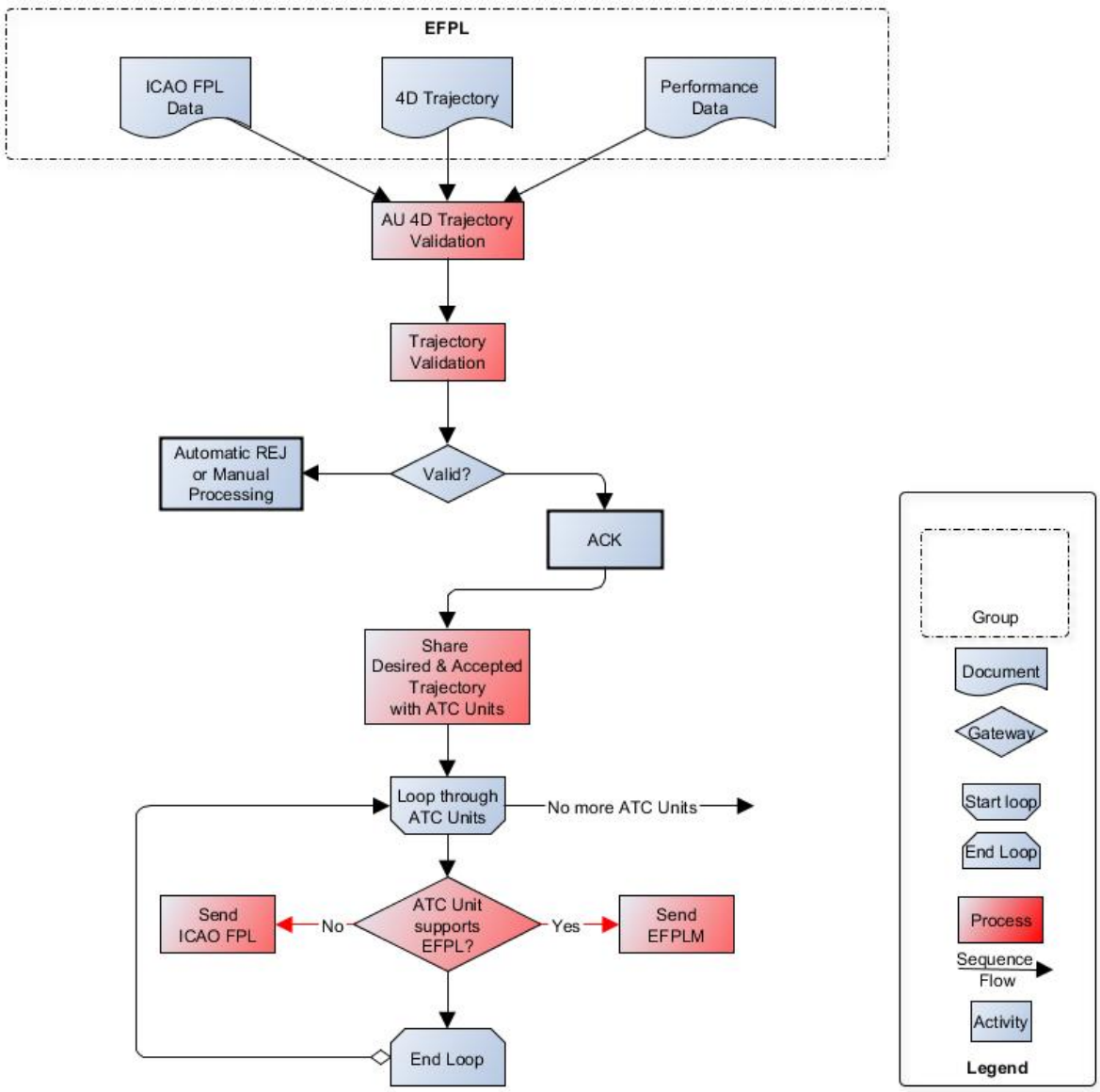

Figure 17: Flight Plan Distribution

4.1.2.5 Extended Flight Plan Re-validation

As per the current operations, the IFPS revalidation process will regularly check the validity of previously accepted flight plans against all IFPS validation criteria. For flights for which an EFPL was received, EFPL data will be revalidated using the same validation logic as for the original EFPL.

Operational procedures related to the revalidation process as described in 4.1.1.4 will not be affected by the introduction of the extended flight plan.

The content of the input flight plan and following update messages will change into their 'extended' versions. Therefore, in order to update an EFPL that was suspended as a result of the IFPS revalidation process, Airspace Users may submit an ECHG or EDLA message.

4.1.2.6 Extended Flight Plan Update

The introduction of an extended flight plan in operations will involve the addition of new data elements to the existing ICAO FPL data i.e. the accepted trajectory and/or flight specific Flight Performance Data. The new data elements may trigger additional reasons for the transmission of a flight plan update.

Updating an EFPL will have no impact on the current flight plan updating procedures as described in 4.1.1.6.

As indicated in 4.1.2.1, the content of flight plan update messages will be extended to include 4D Trajectory and Flight Performance data.

The frequency of updates could potentially be increased due to the presence of new data elements within an extended flight plan. However, in order to facilitate the implementation of the exchange of 4D Trajectory and Flight Performance information, as a first step of implementation, extended flight plan updates should be sent only in those cases that currently require the transmission of a flight plan update.

In other words, the current flight plan update process will remain unchanged and only the content of the update messages will change to include 4D Trajectory and Flight Performance within every update message.

Experience gained after the implementation of this first step as well as further studies and operational trials will then be used to further evolve the flight plan update process to later on include additional trigger events with the aim of maintaining at all times a common and accurate view of the planned evolution of flights within the ATM Network.

4.1.2.7 Use of EFPL in ATFCM operations

As the current flight plan will be extended to include flight performance and 4D trajectory information, not only an impact on flight planning procedures and systems is expected but on ATFCM operations as well.

ATFCM operational improvements have been identified regarding the introduction of the following data in the EFPL:

- **The 4D trajectory** submitted by the AUs will be used by the NM systems initially to compute traffic counts in the different sectors. .
- **Flight performance data**. In the case of a recalculation of the trajectory by the NM systems (e.g. in case of a the deviation of a flight in execution,or due to a change of an allocated SID received from a departure CDM airport), the flight performance data is used to integrate in the calculation both specific performance of the aircraft and AUs operation strategy. This will result in a recalculated trajectory that is closer to the AUs trajectory.

As a consequence of this additional data (filed 4DT and improved recalculated trajectory), the use of EFPL will have a positive impact on capacity (DCB) and efficiency (DCB measures) :

1. More **accurate traffic demand predictions**: the traffic prediction will be based on more accurate trajectories improving the reliability of the entry and occupancy counts of the sectors: Consequently, this will result in more **reliable traffic counts** allowing the DCB actors to apply more accurate DCB measures, impacting less flights, and on more targeted time periods (STAM measures, regulation, scenarios…)
2. With more reliable traffic and occupancy counts, the buffers used today for DCB can be reduced, increasing network capacity
3. **The improved alignment between AU trajectory and NM planning trajectory** may improve DCB collaborative processes (e.g. STAMs…) easing coordination between stakeholders.

4. Thanks to EFPL, the AU elapsed times and those calculated by NM will be aligned in the planning phase all along the significant points of the trajectory. This is a key enabler in support to target time management.

5. **Improvements on local and network complexity assessments**[11] triggered by a better knowledge of 3D and speed profiles of the flights. In other words, complexity models will be based on more rigorous and reliable indicators evaluating more accurately traffic complexity and supporting decision making processes (thanks to all the available information in the EFPL e.g. climbing and descending profiles).

6. **Improvements on some DCB what-if functions** (e.g. AOWIR reroute)

[11] This OSED is not validating complexity indicators but their input in terms of accuracy and reliability.

4.2 Detailed Operational Scenarios / Use Cases

4.2.1 Operational Scenarios

4.2.1.1 Filing an EFPL Scenario

4.2.1.1.1 Scenario Summary

In the following scenario, an Airspace User submits an Extended Flight Plan Message (EFPLM) to the IFPS. The EFPLM contains a 4D Trajectory and Flight Performance Data in addition to the ICAO flight plan data. Following the validation of the Extended FPL (EFPL), the IFPS notifies the ATC units concerned by the flight by sending them a copy of the accepted EFPLM or just of the ICAO data included in the EFPL to the ATC units that cannot process the new 4D Trajectory and Flight Performance data.

4.2.1.1.2 Additional Information and Assumptions

It is assumed that the IFPS is able to receive and process extended flight plan messages. The Airspace User or his delegated representative for flight plan filing is able to submit extended flight plan messages to IFPS. At least one of the ATC units concerned by the flight is capable to receive and process extended flight plan messages. Appropriate communication means, including message format and exchange protocols, have been put in place in order to allow the exchange of extended flight plan messages between the Airspace User, the IFPS, the ETFMS and ATC units.

Information regarding the preference of ATC units concerned by the flight in terms of flight plan messages content (simple/extended) has previously been coordinated by the NM with each unit and stored for usage by IFPS for flight plan distribution.

4.2.1.1.3 Operational Scenario

The Airspace User submits to the IFPS an EFPLM, which includes the 4D Trajectory of the flight- as planned by the Airspace User and Flight Perfomance Data in addition to the ICAO data.. The Airspace User ensures the EFPLM is an accurate representation of the flight intentions while complying with the latest published information regarding the availability of air routes and routing restrictions (RAD). The Airspace User may consider while generating his flight's 4D trajectory published Profile Tuning Restrictions (corresponding to ATC procedures such as LOA see §3.3.2.1). The Airspace User may submit the EFPL directly to IFPS or it may delegate the flight plan submission to a third party, e.g.: Airport Reporting Office, handling agent, computerized flight plan service provider.

The IFPS validates the EFPL. As part of the validation process, IFPS checks that the flight is compliant with the route and airspace availability, the routing restrictions (RAD) and the direct routing limits collected from States and Air Navigation Services Providers. IFPS also checks that the EFPL is compliant with aircraft equipment or capability requirements such as the 8.33 kHz radio and RVSM equipage and flight planning requirements for the airspace crossed by the flight in the IFPS Zone. In this scenario, it is assumed the EFPL complies with the IFPS validation criteria. Therefore it is deemed by IFPS as 'valid'.

The IFPS notifies the Airspace User of the result of the validation process. The notification is done using existing IFPS operational reply messages. In this scenario, as the validation process resulted into a valid EFPL, IFPS sends an acknowledgement message to the originator of the flight plan and, if different from the flight plan originator, to the Airspace User. In the EFPL reply message NM includes the 4D trajectory as calculated by NM as well as the PTRs applied by NM to the flight trajectory. The AU may generate a new 4D trajectory taking into account the PTRs received and send an updated EFPL.

The IFPS distributes the accepted EFPL to ATC units concerned by the flight and to the ETFMS. The IFPS sends an EFPL only to ATC units that have previously indicated that they want to receive

extended flight plan messages. IFPS sends to all other ATC units concerned by the flight only a copy of the ICAO flight plan data included in the EFPL, as a 'simple' FPL message.

Once validated, the EFPL information is transmitted to DCB systems allowing improvement of traffic prediction in airspaces and airports in support to DCB and complexity management processes. The EFPL information is used by NM to calculate the network planning trajectory (estimated trajectory by NM –through ETFMS- in short term planning phase) that is as close as possible to the 4D trajectory as calculated by the Airspace User. This allows an identification of ATFCM restrictions and hotspots impacting the flight that is more consistent with the flight intention.

Later on, the AU decides to use an NM what-if function dedicated to airspace users to search for a route that can reduce or avoid the ATFCM delay. The NM what-if function uses the Flight performance data or take-off weight provided within the EFPL to calculate trajectories associated to the different route options. The AU selects one of the routes taking into account the associated ATFCM information (delay) provided by NM and uses its flight planning system to regenerate a 4D trajectory and re-file an Extended Flight Plan in accordance.[12] In the execution phase, a deviation from the planned trajectory is detected (e.g. a direct has been given by a controller in the climbing phase). The DCB process recalculates a trajectory from the current position of the flight using flight specific performance data information or take-off weight information included in the EFPL. Traffic and occupancy counts are updated accordingly as input to the network monitoring tasks of flow and local traffic managers'.

4.2.1.2 Airspace Closure Scenario

4.2.1.2.1 Scenario Summary

In the following scenario, an Airspace Management Cell closes an airspace within its area of responsibility in order to reserve it for a military activity. The airspace closure makes invalid the flight plan of a flight that was planned to fly through this airspace and has previously been accepted by IFPS as an EFPL. As a result of the invalidation of the EFPL, the IFPS suspends the flight and informs the Airspace User operating the flight about the suspension. The Airspace User then reacts by updating the EFPL in order to make the EFPL valid again by filing a new route that takes into account the change in airspace availability.

4.2.1.2.2 Additional Information and Assumptions

It is assumed that the IFPS is able to receive and process extended flight plan messages. The Airspace User or his delegated representative for flight plan filing is able to submit extended flight plan messages to IFPS. At least one of the ATC units concerned by the flight is capable to receive and process extended flight plan messages. Appropriate communication means, including message format and exchange protocols, have been put in place in order to allow the exchange of extended flight plan messages between the Airspace User, the IFPS, the ETFMS and ATC units.

Information regarding the preference of ATC units concerned by the flight in terms of flight plan messages content (simple/extended) has previously been coordinated by NM with each unit and stored for usage by IFPS for flight plan distribution.

4.2.1.2.3 Operational Scenario

An Airspace Management Cell (AMC) temporary allocates an airspace of its jurisdiction to a military activity The AMC published the closure of airspace as well as the closure of all route segments that traverse the closed airspace.

The IFPS identifies, as a result of the flight plan revalidation process, a flight that was planned to operate within the closed airspace and for which the flight plan was filed with IFPS as an EFPL. Due to the airspace closure, the EFPL becomes invalid. IFPS marks the flight as being 'suspended'.

[12] This is a Step 1 scenario. In Step 2, the AU will have access to NM what-if functions through system-to-system interactions and will provide the EFPL- including the 4D trajectory - as input to the what-if (instead of a route).

The IFPS notifies the EFPL originator, the Airspace User operating the flight and the ATC units in charge of the departure aerodrome of the flight suspension. The notification is done via a flight suspension message (FLS) transmitted by the ETFMS, that is informed by IFPS of the invalid flight plan. The IFPS includes a list of detected errors within the notification message.

The Airspace User transmits a flight plan update to IFPS containing a new route that avoids the closed airspace. The flight plan update is sent in the form of an extended change message (ECHG) that includes the new 4D Trajectory of the flight, as calculated by the Airspace User and the latest aircraft Performance data specific to the flight.

The IFPS validates the ECHG in order to ensure the updated route of the flight is valid while avoiding the closed airspace. The IFPS applies the same validation criteria as for the original EFPL. In this scenario, it is assumed the ECHG complies with the IFPS validation criteria. It is therefore deemed by IFPS as 'valid'. IFPS marks the flight as being 'de-suspended'.

The IFPS notifies the EFPL originator, the Airspace User operating the flight and the ATC units in charge of the departure aerodrome of the flight de-suspension. The notification is done via a flight de-suspension message (DES) transmitted by the ETFMS, that is informed by IFPS that the flight plan has become valid again.

The IFPS distributes the accepted ECHG to ATC units concerned by the flight and to the ETFMS. The IFPS sends an ECHG only to ATC units that have previously indicated that they want to receive extended flight plan messages. IFPS sends to all other ATC units concerned by the flight only a copy of the ICAO flight plan data included in the ECHG, as a 'simple' CHG message.

4.2.2 Use Cases

4.2.2.1 Use cases overview

This section analyses the different use cases derived from the operational scenarios described in the previous section.

The following use cases have been identified:

- UC1: EFPL validation
- UC2: EFPL re-validation
- UC3: EFPL distribution
- UC4: EFPL update

4.2.2.2 UC1: EFPL validation

4.2.2.2.1 Scope

System, black-box.

4.2.2.2.2 Level

User Goal

4.2.2.2.3 Planning Level/Flight Phase

Flight Planning

4.2.2.2.4 Summary

The goal is to submit and validate an Extended FPL Message (EFPLM) associated to a single flight.

4.2.2.2.5 Actors

Airspace User (primary) - wants to submit and validate the EFPL

4.2.2.2.6 Preconditions

Extended flight plan messages are known and used by both the Airspace User and the IFPS.

4.2.2.2.7 Post-conditions

a. Success end state

The EFPL is accepted and acknowledged by the IFPS and the successful filing is logged by the IFPS.

b. Failed end state

The EFPLM fails the validation process of the IFPS and a rejection message is sent to the Airspace User.

4.2.2.2.8 Notes

In this use case it is assumed that no manual processing will take place.

4.2.2.2.9 Trigger

The use case starts when the Airspace User sends an EFPLM to the IFPS.

4.2.2.2.10 Main Flow

1. The Airspace User submits an EFPLM to the IFPS.
2. The IFPS validates the EFPLM based on the provided 4D Trajectory included in the EFPL.
3. The Use Case ends when the IFPS sends an acknowledgement message (ACK) to the Airspace User.

4.2.2.2.11 Failure Flows

[2], [4] - The IFPS detects errors in the EFPL

4. The IFPS finds errors in the EFPL.
5. The Use Case ends when the IFPS sends a REJ message to the Airspace User.

4.2.2.3UC2: EFPL re-validation

4.2.2.3.1 Scope

System, black-box.

4.2.2.3.2 Level

User Goal

4.2.2.3.3 Planning Level/Flight Phase

Flight Planning

4.2.2.3.4 Summary

The goal is to re-validate an EFPL after an airspace/route availability update.

4.2.2.3.5 Actors

Airspace Management Cell (primary)

- wants to temporary allocate an airspace of its jurisdiction for a specific activity.

Airspace User (primary)

- wants to be notified when a previously submitted EFPL is no longer valid.
- wants to update a suspended EFPL so that it becomes valid again.

4.2.2.3.6 Preconditions

The Airspace User has filed an EFPL that was accepted and stored by the NM.

Airspace and route availability status is known to the NM and the Airspace User.

4.2.2.3.7 Post-conditions

a. Success end state

The EFPL is updated in the NM and it is compliant with the airspace/route availability update.

b. Failed end state

The EFPL is not updated and remains in state “suspended”

4.2.2.3.8 Notes

None.

4.2.2.3.9 Trigger

The use case starts upon reception of a notification message from an AMC regarding the temporary allocation of an airspace within its jurisdiction for a specific activity, for a given time period.

4.2.2.3.10Main Flow

1. The Airspace Management Cell notifies the NM about a temporary airspace closure.
2. The NM searches for flights that are planned to operate through the closed airspace based on the accepted trajectory
3. The NM detects an invalid EFPL due to the airspace closure.
4. The NM marks the EFPL as suspended.
5. The NM notifies the Airspace User and ATC about the flight suspension.
6. The Airspace User sends an update via an ECHG/EDLA message
7. The NM validates the ECHG/EDLA message based on the accepted trajectory
8. The NM notifies the Airspace User and ATC about the de-suspension of the flight
9. The NM transmits the ECHG/EDLA message to ATC.
10. The Use Case ends when the NM sends an acknowledgement message (ACK) for the ECHG/EDLA message to the Airspace User.

[3] - The NM finds no invalid EFPL

11. The NM detects no invalid EFPL due to the airspace closure.
12. The flow ends.

[6] – The Airspace User cancels the EFPL

13. The NM sends an acknowledgement message (ACK) for the cancellation message to the Airspace User and it notifies the Airspace User about the de-suspension of the flight
14. The NM transmits the cancellation message to ATC.
15. The Airspace User submits a new EFPLM.
16. The flow continues at UC1 step 1

4.2.2.3.11 Failure Flows

[7] – The NM finds errors in the ECHG/EDLA message

17. The NM finds errors in the submitted ECHG/EDLA message.
18. The Use Case ends when the NM transmits a REJ message to the Airspace User.

4.2.2.4 UC3: EFPL/ECHG/EDLA distribution

4.2.2.4.1 Scope

System, black-box.

4.2.2.4.2 Level

User Goal

4.2.2.4.3 Planning Level/Flight Phase

Flight Planning

4.2.2.4.4 Summary

The goal is to distribute a copy of a valid EFPL/ECHG/EDLA associated to a flight to the ATM actors concerned by that particular flight.

4.2.2.4.5 Actors

ATC Unit (primary) - wants to receive a valid flight plan and associated updates for each flight that is planned to operate within its area of responsibility

ETFMS (primary) - wants to receive a flight plan and associated updates for all flights within the NM area of responsibility.

4.2.2.4.6 Preconditions

The IFPS has validated the EFPL/ECHG/EDLA which contains ICAO data, a 4D Trajectory and Flight Performance Data.

Some of the ATC Units concerned by the flight are able to process extended flight plan messages whereas others support only ‘simple’ flight plan messages. The ATC Units capabilities are known to the IFPS.

4.2.2.4.7 Post-conditions

a. Success end state

The flight plan information included in the EFPL/ECHG/EDLA is available to all concerned ATC Units and ETFMS.

b. Failed end state

The flight plan information is not made available to at least one of the ATC Units concerned by the flight or to ETFMS.

4.2.2.4.8 Notes

None.

4.2.2.4.9 Trigger

The use case starts when the IFPS considers an EFPL/ECHG/EDLA as valid.

4.2.2.4.10 Main Flow

1. The IFPS builds the list of ATC Units to be notified analysing the airspace penetration of the accepted trajectory
2. The IFPS determines the ATC Units included in the list of addressees that support extended flight plan messages processing.
3. The IFPS determines the ATC Units included in the list of addressees that support 'simple' flight plan messages processing.
4. The IFPS submits a copy of the EFPL/ECHG/EDLA to ATC Units included in the list of addressees that support extended flight plan messages processing and to ETFMS.
5. The IFPS submits a copy of the ICAO flight plan data included in the EFPL/ECHG/EDLA to ATC Units included in the list of addressees that support 'simple' flight plan messages processing.
6. The Use Case ends when the IFPS has distributed the flight plan or associated update to all concerned ATC Units and ETFMS.

4.2.2.4.11 Failure Flows

[1] - The IFPS builds the list of ATC Units to be notified by analysing the airspace penetration of the accepted 4D Trajectory but one of the ATC Units concerned by the flight is not included in the list

7. The concerned ATC Unit that has not received a flight plan for the flight receives an estimate for the flight from the previous ATC Unit.
8. The concerned ATC Unit transmits a request for flight plan data to IFPS.
9. The IFPS responds to the request by transmitting the available flight plan data to the ATC Unit either in the form of a 'simple' FPL message or as an EFPL, depending on the content of the flight plan data preferences stored within IFPS for that ATC Unit.
10. The Use Case continues at step 2.

4.2.2.5 UC4: EFPL update

4.2.2.5.1 Scope

System, black-box.

4.2.2.5.2 Level

User Goal

4.2.2.5.3 Planning Level/Flight Phase

Flight Planning

4.2.2.5.4 Summary

The goal is to update a previously submitted EFPL containing ICAO data, a 4D Trajectory and Flight Performance Data.

4.2.2.5.5 Actors

Airspace User (primary) wants to update an EFPL.

4.2.2.5.6 Preconditions

In the main flow, the Airspace User has filed an EFPL that was accepted and stored by the IFPS.

The flight plan update procedures including the use of Extended CHG (ECHG) and Extended DLA (EDLA) messages as well as the flight plan replacement procedure are known to the IFPS and the Airspace User.

4.2.2.5.7 Post-conditions

a. Success end state

The EFPL is updated in the IFPS.

b. Failed end state

The EFPL is not updated in the IFPS.

4.2.2.5.8 Notes

None.

4.2.2.5.9 Trigger

The use case starts when the Airspace User decides to update part of the data included in previously submitted and accepted EFPL.

4.2.2.5.10 Main Flow

1. The Airspace User sends an update via and ECHG/EDLA message.
2. The IFPS validates the ECHG/EDLA message based on the accepted trajectory in the ECHG/EDLA message.
3. The use case ends when the IFPS sends an acknowledgement message (ACK) for the ECHG/EDLA message to the Airspace User.

4.2.2.5.11 Alternative Flows

[1] – The Airspace user cancels the EFPL

4. The Airspace User cancels the EFPL via a CNL message.
5. The NM transmits the CNL message to ATC
6. The Airspace User submits a new EFPLM to IFPS.
7. The flow continues at UC1 step 2.

4.2.2.5.12 Failure Flows

[5], [7] – The IFPS finds errors in the ECHG/EDLA or CNL message

8. The Use Case ends when the IFPS transmits a REJ message to the Airspace User.

4.3 Requirements for extended flight plan services

Note 1: Requirements based on concepts out of the PCP scope will be explicitly mentioned as non-PCP requirements in their rationale field, i.e. they are not part of the solution #37 (AUO-0203-A).

Note 2: Some of the validation statuses in this section have been modified according to results gathered in Step 1 EFPL Validation Report [13] (section 4.1).Only requirements reaching V3 maturity in an exercise were modified to <Validated> status. Otherwise, they remain <In Progress>.

Note 3: EFPL requirements are compliant with SWIM services [30]

4.3.1 Operational requirements

Note: the NM flight plan management service must be seen as an **operational** service. Therefore in this section, the term **"Network Manager" encompasses both NM systems and human operators**.

[REQ]

Identifier	REQ-07.06.02-OSED-0001.0000
Requirement	The Network Manger (NM) shall be able to receive extended flight plan and associated messages (extended delay and modification messages) transmitted by Airspace Users or their designated representatives (e.g. ARO, handling agents).
Title	Reception of extended flight plan messages
Status	<Validated>
Rationale	To enable the transmission of extended flight plan information to NM. The conditions triggering the transmission of an extended modification message will be subject to validation.
Category	<Operational>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0001.0030
Requirement	An extended flight plan message shall contain the following sections of data: • ICAO FPL data: all data to be provided in a filed flight plan as specified in the ICAO Doc 4444, including the Field 15 route information and the latest updates known as the ICAO 2012 FPL • 4D Trajectory (filed trajectory): AU calculated flight trajectory taking into account constraints and meteorological information for its calculation. • Flight Performance Data: the climbing and descending capabilities of the aircraft specific to the flight, taking into account the performance of the airframe that is used to operate the flight as well as any other parameters that may influence it e.g. engine settings and status, cost factor applied by the operator. The Flight Performance Data may be provided either as climb and descent performance profiles or as the take-off weight of aircraft as part of the 4D trajectory.
Title	Content of an extended flight plan message
Status	<Validated>
Rationale	To define the content of an extended flight plan message.
Category	<Functional>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

1583 [REQ]

Identifier	REQ-07.06.02-OSED-0001.0040
Requirement	An extended modification message shall contain, as a minimum: • Flight plan association data to allow the association of the message to the original flight plan. The association data will depend on the message format and protocol used for the data exchange. For example, in case of an exchange of data in ADEXP format with IFPS, the association data would be the unique flight plan identification code allocated by IFPS. • The data elements that are modified. In case they are modified, the 4D Trajectory and/or Flight Performance Data shall be included. In case, the Flight Performance Data is modified then the corresponding updated 4D Trajectory shall be included. The 4D Trajectory may be modified without the Flight Performance Data being modified as well. An extended modification message may optionally repeat all data included in the original flight plan message that is not modified. This will depend on the data format and protocol used for the exchange of data. For example, in case of an exchange of data in ADEXP format with IFPS, all original flight plan data that is not modified shall be included as well.
Title	Content of an extended modification message
Status	<Validated>
Rationale	To define the content of an extended modification message.
Category	<Functional>
Validation Method	<Live Trial>
Verification Method	

1584

1585 [REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

1586

1587 [REQ]

Identifier	REQ-07.06.02-OSED-0001.0045
Requirement	An extended delay message shall contain, as a minimum: • Flight plan association data to allow the association of the message to the original flight plan. The association data will depend on the message format. For example, in case of an exchange of data in ADEXP format with IFPS, the association data would be the unique flight plan identification code allocated by IFPS. • The new estimated off-block time • The updated 4D Trajectory (optional) An extended delay message may optionally repeat all data included in the original flight plan message. This will depend on the data format and protocol used for the exchange of data. For example, in case of an exchange of data in ADEXP format with IFPS, all original flight plan data that is not modified shall be included as well.
Title	Content of an extended delay message
Status	<Validated>
Rationale	To define the content of an extended delay message.
Category	<Functional>
Validation Method	<Live Trial>
Verification Method	

1588

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0001.0001
Requirement	The NM shall validate received extended flight plan and associated messages.
Title	Validation of extended flight plans
Status	<Validated>
Rationale	To ensure that extended flight plans and associated messages are validated by NM, on behalf of ANSPs, according to pre-agreed conditions
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

7

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0001.0002
Requirement	NM shall check that the 4D trajectory provided in an extended flight plan message is consistent with the route provided in ICAO Field 15 format within the same message.
Title	Consistency between 4D Trajectory and Field 15 route
Status	<In progress>
Rationale	To ensure that the NM clients that will continue to use the Field 15 route as source for information regarding the planned route of the flight and clients that will use the 4D trajectory included with the extended flight plan message will have a consistent view. *Requirement out of the scope of the PCP and the solution #37.* *Requirement part of ATC distribution to be validated in S2020 PJ18*
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0001.0003
Requirement	The NM shall perform the flight plan validation processes using the accepted trajectory that it has calculated from the 4D Trajectory provided in an extended flight plan message.
Title	Flight plan validation using external 4D trajectory
Status	<Validated>

Rationale	For the NM to have a view of the planned route of the flight consistent with the view of the operator of the flight while validating the flight plan.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0001.0035
Requirement	The NM shall provide to the Airspace User within the reply to an EFPL (in the trajectory/agreement process) the list of published soft constraints (i.e. PTRs[13]) affecting the planned trajectory of the flight and the resultant accepted trajectory.
Title	4D trajectory information in an EFPL reply
Status	<In Progress>
Rationale	Providing such feedback information contributes to improving the coordination between the Airspace Users and NM/ATC. It also gives input to the AU to plan a 4D trajectory closer to what is likely to be flown. This is another step towards the full implementation of the Business Trajectory concept and is in line with operational scenarios in discussions in the context of ICAO FF-ICE increment 1 related to the negotiation of the trajectory. *Requirement out of the scope of the PCP and the solution #37.* *This requirement is planned to be validated in S2020 PJ18.*
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0001.0006
Requirement	NM shall maintain consistency between the EFPL validation process and the ICAO flight plan validation process both for flight plans submission, syntax and semantic check and notification of results.
Title	Maintain consistency between the EFPL validation process and the ICAO flight plan validation process.
Status	<Validated>
Rationale	It must be ensured that at least no significant workload is added for the AUs and systems operators as the result of the introduction of the EFPL validation process
Category	<Operational>
Validation Method	<Live Trial>

[13] In the quick win evolution only PTRs are provided as soft constraints

Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0001.0007
Requirement	The NM shall distribute valid extended flight plan messages to ATC Units concerned by the flight that have previously requested (by subscription or on demand) to receive flight plan information in the form of extended flight plans.
Title	Extended flight plan data distribution
Status	<In Progress>
Rationale	For the NM to forward trajectory information, and Flight Performance Data, to its ATC and ATFCM clients. This is expected to ensure that all stakeholders within the ATM Network share a consistent view on the planned evolution of the flight and local flight trajectory predictions by the NM client systems is improved *Requirement out of the scope of the PCP and the solution #37.* *This requirement is part of ATC distribution to be validated in S2020 PJ18*
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0001.0008
Requirement	The NM shall distribute 'normal' flight plan messages, containing data retrieved from valid extended flight plan messages, to ATC Units concerned by the flight that have not requested to receive flight plan information in the form of extended flight plans, as a default option. “Normal FPL message” corresponds to the current messages used by NM to distribute to FPL information received in ICAO 2012 format.
Title	‘Normal' flight plan data distribution
Status	<Validated >
Rationale	To ensure continuity of the flight plan data distribution by NM to ATC Units that have not requested to receive flight plan information in the form of extended flight plans.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0001.0009
Requirement	When present in an extended flight plan message, the provided 4D trajectory of the flight (once it is the accepted trajectory) shall be used to perform the flight plan addressing.
Title	Flight plan distribution using EFPL 4D trajectory
Status	<Validated>
Rationale	For the NM to have a consistent view of the planned route of the flight as the operator of the flight while determining the addressees for the flight plan distribution.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0001.0010
Requirement	It shall be possible for an authorised ATC unit to retrieve, on request, extended flight plan information for a given flight from IFPS.
Title	Retrieval of extended flight plan information by ATC
Status	<In Progress>
Rationale	To provide ATC units with the possibility to retrieve extended flight plan information for a flight. Such a retrieval may, for example, be needed by an ATC unit that has not automatically received flight plan information from IFPS, for a flight that has been rerouted while airborne. *Requirement out of the scope of the PCP and the solution #37.* *ATC distribution to be validated in S2020 validation activies.*
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0001.0055
Requirement	It shall be possible for an airspace user to retrieve, on request, extended flight plan information for one of their own flights from IFPS.
Title	Retrieval of extended flight plan information by the AU.
Status	<Validated>
Rationale	To provide airspace user with the possibility to retrieve the EFPL for a flight.
Category	<Operational>
Validation Method	<Live Trial>

Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0001.0011
Requirement	The NM shall use 4D trajectories and flight performance data provided by AUs in extended flight plans to improve traffic demand picture in support of DCB processes.
Title	Improve the quality of traffic demand predictions in support of DCB processes
Status	<Validated>
Rationale	4D trajectories and flight performance data included in extended flight plans shall allow DCB processes to have a better view of Airspace users intentions. This should allow to produce more reliable traffic counts, occupancy counts and flight trajectories (times, vertical and horizontal trajectories) in support to DCB automated processes and human decisions (reference information display requirements for DCB monitoring in 13.02.03 OSED).
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0001.0012
Requirement	Access to Flight Performance Data shall be controlled and restricted to ATM purposes.
Title	Flight Performance Data protection
Status	<In Progress>
Rationale	To ensure confidentiality for commercially sensitive data *Validation planned in V4.*
Category	<Security>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0001.0013

Requirement	The NM systems shall support a mixed mode of operations in which only part of the flights will provide extended flight plan information while the remaining flights will continue to provide flight plan data according to the current ICAO flight plan requirements.
Title	Mixed mode operations
Status	<Validated>
Rationale	To ensure continuity of the NM services in the mixed mode environment.
Category	<Functional>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

REQ]

Identifier	REQ-07.06.02-OSED-0001.0130
Requirement	During the transition phase, NM shall support an individual mixed mode of operations which considers for a same FPL both formats (EFPL and ICAO) for flight plan data exchange.
Title	Individual mixed mode of operations
Status	<Validated>
Rationale	To ensure continuity of the NM services in the individual mixed mode environment. Added requirement due to traceability with documents: SPR for BT management (D87) and Step 1 Technical Specification for EFPL V3 Prototype for SPR.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0001.0050
Requirement	The NM shall provide a means to Airspace Users to check the validity of an extended flight plan prior to the actual submission.
Title	Extension of the IFPUV service to extended flight plans
Status	<Validated>
Rationale	To ensure the availability of the NM IFPUV service for Extended Flight Plans
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0001.0060
Requirement	The AU shall provide EFPL data with an agreed pre-defined format, and minimum accuracy, resolution and integrity.
Title	Airspace user quality data input
Status	<Validated>
Rationale	To ensure the accuracy of the computed trajectory prediction Requirement based on REQ-05.05.02-OSED-0100.0100 [21] and introduced for traceability reasons with 07.06.02 - D57 – Step 1 Business Trajectory final SPR
Category	<Operational>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0001.0065
Requirement	NM shall check that the EFPL provided by the AU is sent with the agreed pre-defined format and within the minimum accuracy, resolution and integrity
Title	Verification on EFPL format and conventions
Status	<Validated>
Rationale	To ensure the correct representation of the AU data in the TP model Requirement based on REQ-05.05.02-OSED-0100.0200 [21] and introduced for traceability reasons with 07.06.02 - D57 – Step 1 Business Trajectory final SPR
Category	<Operational>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

4.3.2 Performance requirements

In this version, only high-level performance requirements are provided. Detailed requirements will be provided in the SPR.

[REQ]

Identifier	REQ-07.06.02-OSED-0001.0014
Requirement	The introduction of the extended flight plan shall reduce flight plan management operating costs
Title	Cost-effectiveness - reduction of flight planning operating costs
Status	<Validated>
Rationale	Reference to the benefit mechanism presented in appendix C of the OSED
Category	<Performance>
Validation Method	<Gaming+Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0014	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-BMTP.1040	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0001.0140
Requirement	The introduction of the extended flight plan shall reduce the number of rejected flight plan messages and manual interventions
Title	Initial flight planning validation – reduction of FPL rejection rate
Status	<Validated>
Rationale	Reference to the benefit mechanism presented in appendix C of the OSED
Category	<Performance>
Validation Method	<Fast Time Simulation+Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0001	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0001.0015
Requirement	The introduction of the extended flight plan shall improve traffic predictability
Title	Capacity - Better use of airspace and airport capacity
Status	<Validated>
Rationale	Reference to the benefit mechanism presented in appendix C of the OSED
Category	<Performance>
Validation Method	<Fast Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0015	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0001.0016
Requirement	The introduction of the extended flight plan shall improve flight efficiency
Title	Flight efficiency improvement
Status	<In Progress>
Rationale	Reference to the benefit mechanism presented in appendix C of the OSED *Validation planned in V4 in the context of pre-operational live trials.*
Category	<Performance>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0013	<Partial>

4.3.3 Requirements deleted

The following requirements included in the OSED Edition 1.00 have been suppressed. They are kept in the document (and in the Doors database) for traceability purpose with the status “deleted”.

[REQ]

Identifier	REQ-07.06.02-OSED-0001.0004
Requirement	When using the 4D trajectory provided in an extended flight plan message for the validation of the message, the NM shall allow the trajectory of the flight to penetrate ATM restrictions for a predefined amount of time/space (use a buffer) without incurring the ATM restriction.
Title	Relaxed route validation
Status	<Deleted>
Rationale	To take into account the intention of the flight to avoid ATM restrictions intersected by the flight 4D Trajectory for a very short period of time or distance. It is expected that in such cases the flight will be cleared by ATC out of the ATM restriction. The status of the requirement “Deleted” because no consensus exists yet.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-07.06.02-OSED-0001.0005

Requirement	When, in addition to the current flight plan information, only Flight Performance Data is provided in an extended flight plan message (4D Profile information is not included in the message) the NM shall use the provided Flight Performance Data in the calculation of the flight profile.
Title	Flight plan validation using external Performance Data
Status	<Deleted>
Rationale	For the NM to have a view of the planned route of the flight closer to the view of the operator of the flight while validating its flight plan. Since the 4D profile is now mandatory EFPL information this requirement is considered as obsolete.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

1689

4.3.4 Information Exchange Requirements

1690 [IER]

Identifier	Name	Issuer	Intended Addressees	Information Element	Involved Operational Activities	Interaction Rules and Policy	Status	Rationale	Satisfied DOD Requirement Identifier	Service Identifier
IER-07.06.02-OSED-EFPL.0010	EFPL message submission	AU	NM	Extended Flight Plan Message	UC1: EFPL Validation	One-Way	<Validated>	REQ-07.06.02-OSED-0001.0000	REQ-07.02-DOD-0001.0000<Partial>	
IER-07.06.02-OSED-EFPL.0020	ACK message	NM	AU	Operational Reply Message: Acknowledgement Message	UC1: EFPL Validation UC2: EFPL re-validation UC4: EFPL update	One-Way	<Validated>	REQ-07.06.02-OSED-0001.0006	REQ-07.02-DOD-0001.0000<Partial>	
IER-07.06.02-OSED-EFPL.0021	MAN message	NM	AU	Operational Reply Message: Referred for Manual Processing Message	UC1: EFPL Validation UC2: EFPL re-validation UC4: EFPL update	One-Way	<Validated>	REQ-07.06.02-OSED-0001.0006	REQ-07.02-DOD-0001.0000<Partial>	
IER-07.06.02-OSED-EFPL.0030	REJ message	NM	AU	Operational Reply Message: Rejection Message	UC1: EFPL Validation UC2: EFPL re-validation UC4: EFPL update	One-Way	<Validated>	REQ-07.06.02-OSED-0001.0006	REQ-07.02-DOD-0001.0000<Partial>	
IER-07.06.02-OSED-EFPL.0040	temporary airspace closure notification message	ASM	NM	Temporary airspace closure message notification	UC2: EFPL re-validation	One-Way	<Validated>	FPL process extended to EFPL *Not part of Solution #37 Message used already in operations. No need for specific validation*	REQ-07.02-DOD-0001.0000<Partial>	
IER-07.06.02-OSED-EFPL.0050	FLS message	NM	AU	Extended Flight Plan Suspension Message	UC2: EFPL re-validation	One-Way	<Validated>	FPL process extended to EFPL	REQ-07.02-DOD-0001.0000<Partial>	
IER-07.06.02-OSED-EFPL.0055	FLS message	NM	ATC	Extended Flight Plan Suspension Message	UC2: EFPL re-validation	One-Way	<Validated>	FPL process extended to EFPL	REQ-07.02-DOD-0001.0000<Partial>	
IER-07.06.02-OSED-EFPL.0060	Extended modification message	AU	NM	Extended Modification Message	UC2: EFPL re-validation UC4: EFPL update	One-Way	<Validated>	REQ-07.06.02-OSED-0001.0000	REQ-07.02-DOD-0001.0000<Partial>	
IER-07.06.02-OSED-EFPL.0070	Extended delay message	AU	NM	Extended Delay Message	UC2: EFPL re-validation UC4: EFPL update	One-Way	<Validated>	REQ-07.06.02-OSED-0001.0000	REQ-07.02-DOD-0001.0000<Partial>	
IER-07.06.02-OSED-EFPL.0100	DES message	NM	AU	De-suspension Message	UC2: EFPL re-validation	One-Way	<Validated>	FPL process extended to EFPL	REQ-07.02-DOD-0001.0000<Partial>	

Identifier	Name	Issuer	Intended Addressees	Information Element	Involved Operational Activities	Interaction Rules and Policy	Status	Rationale	Satisfied DOD Requirement Identifier	Service Identifier
IER-07.06.02-OSED-EFPL.0105	DES message	NM	ATC	De-suspension Message	UC2: EFPL re-validation	One-Way	<Validated>	FPL process extended to EFPL	REQ-07.02-DOD-0001.0000<Partial>	
IER-07.06.02-OSED-EFPL.0110	CNL message	AU	NM	Cancellation Message	UC2: EFPL re-validation	One-Way	<Validated>	FPL process extended to EFPL	REQ-07.02-DOD-0001.0000<Partial>	
IER-07.06.02-OSED-EFPL.0115	CNL message	NM	ATC	Cancellation Message	UC2: EFPL re-validation	One-Way	<Validated>	FPL process extended to EFPL	REQ-07.02-DOD-0001.0000<Partial>	
IER-07.06.02-OSED-EFPL.0120	EFPL distribution message	NM	ATC units supporting EFPLM	Extended Flight Plan Message	UC3: EFPL distribution	One-Way	<In Progress>	REQ-07.06.02-OSED-0001.0007 *Not part of solution #37, ATC distribution to be validated in S2020 validation activities*	REQ-07.02-DOD-0001.0000<Partial>	
IER-07.06.02-OSED-EFPL.0123	EFPL modification distribution message	NM	ATC units supporting EFPLM	Extended Modification Message	UC2: EFPL re-validation UC4: EFPL update	One-Way	<In Progress>	REQ-07.06.02-OSED-0001.0007 *Not part of solution #37, ATC distribution to be validated in S2020 validation activities*	REQ-07.02-DOD-0001.0000<Partial>	
IER-07.06.02-OSED-EFPL.0126	EFPL delay distribution message	NM	ATC units supporting EFPLM	Extended Delay Message	UC2: EFPL re-validation UC4: EFPL update	One-Way	<In Progress>	REQ-07.06.02-OSED-0001.0007 *Not part of solution #37, ATC distribution to be validated in S2020 validation activities*	REQ-07.02-DOD-0001.0000<Partial>	
IER-07.06.02-OSED-EFPL.0130	ICAO FPL distribution message	NM	ATC units not supporting EFPLM	ICAO Flight Plan Message	UC3: EFPL distribution	One-Way	<Validated>	REQ-07.06.02-OSED-0001.0008	REQ-07.02-DOD-0001.0000<Partial>	
IER-07.06.02-OSED-EFPL.0133	Modification distribution message	NM	ATC units not supporting EFPLM	Modification Message	UC2: EFPL re-validation UC4: EFPL update	One-Way	<Validated>	REQ-07.06.02-OSED-0001.0008	REQ-07.02-DOD-0001.0000<Partial>	

Identifier	Name	Issuer	Intended Addressees	Information Element	Involved Operational Activities	Interaction Rules and Policy	Status	Rationale	Satisfied DOD Requirement Identifier	Service Identifier
IER-07.06.02-OSED-EFPL.0136	Delay distribution message	NM	ATC units not supporting EFPLM	Delay Message	UC2: EFPL re-validation UC4: EFPL update	One-Way	<Validated>	REQ-07.06.02-OSED-0001.0008	REQ-07.02-DOD-0001.0000<Partial>	
IER-07.06.02-OSED-EFPL.0140	Flight estimation message	ATC	ATC	Flight estimation	UC3: EFPL distribution	One-Way	<In Progress>	*Not part of solution #37, ATC distribution to be validated in S2020 validation activities*	REQ-07.02-DOD-0001.0000<Partial>	
IER-07.06.02-OSED-EFPL.0155	FPL request message	AU	NM	Request for FPL data	UC3: EFPL distribution	One-Way	<Validated>	REQ-07.06.02-OSED-0001.0055	REQ-07.02-DOD-0001.0000<Partial>	
IER-07.06.02-OSED-EFPL.0145	FPL request message	ATC	NM	Request for FPL data	UC3: EFPL distribution	One-Way	<In Progress>	REQ-07.06.02-OSED-0001.0010 *Not part of solution #37, ATC distribution to be validated in S2020 validation activities*	REQ-07.02-DOD-0001.0000<Partial>	

1691 Table 15: IER layout

1692

5 Demand data management in Medium term planning

5.1 Detailed Operating Method

5.1.1 Previous / New Operating Method - overview (scheduled traffic)

The following diagram provides an overview of current operating methods. Explanations are developed in the next section. Boxes in Light blue colour illustrate the scope of the 7.6.2 project, while the green or white boxes illustrate related activities but in the scope of other projects.

Only the activities fully included in the M-T planning temporal scope (illustrated with a salmon box in background) have to be considered for this specific topic.

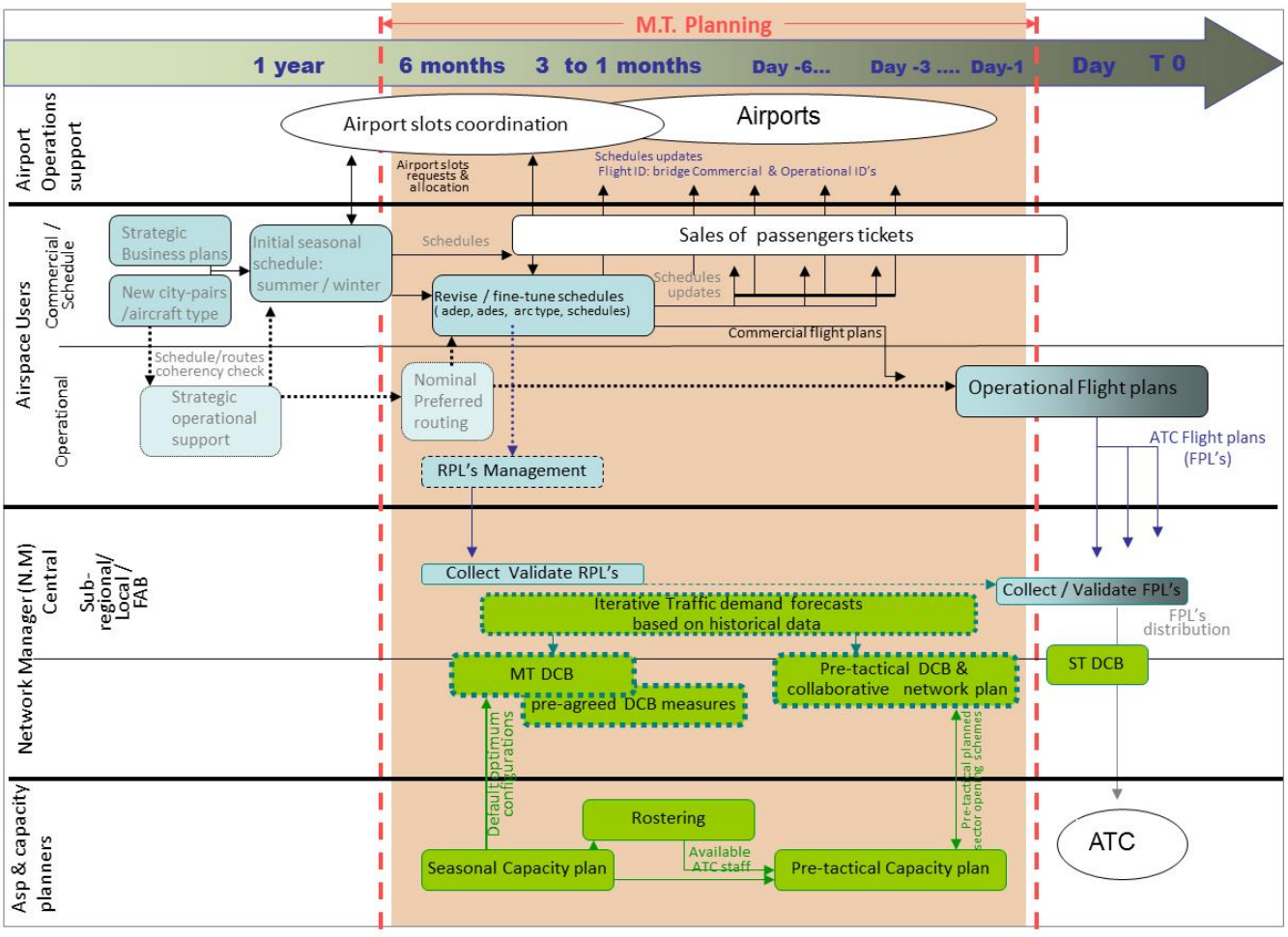

Figure 18: Current operating method

The next diagram illustrates the anticipated evolutions: the **dark blue colour** is used to identify evolutions in the scope of the 7.6.2 project.

Dotted outlines ----- used in current method diagram where replaced by continuous outlines —— in the new method diagram, illustrate increased robustness / accuracy as a result from earlier visibility on traffic demand data originating from airspace users during the M-T planning phase.

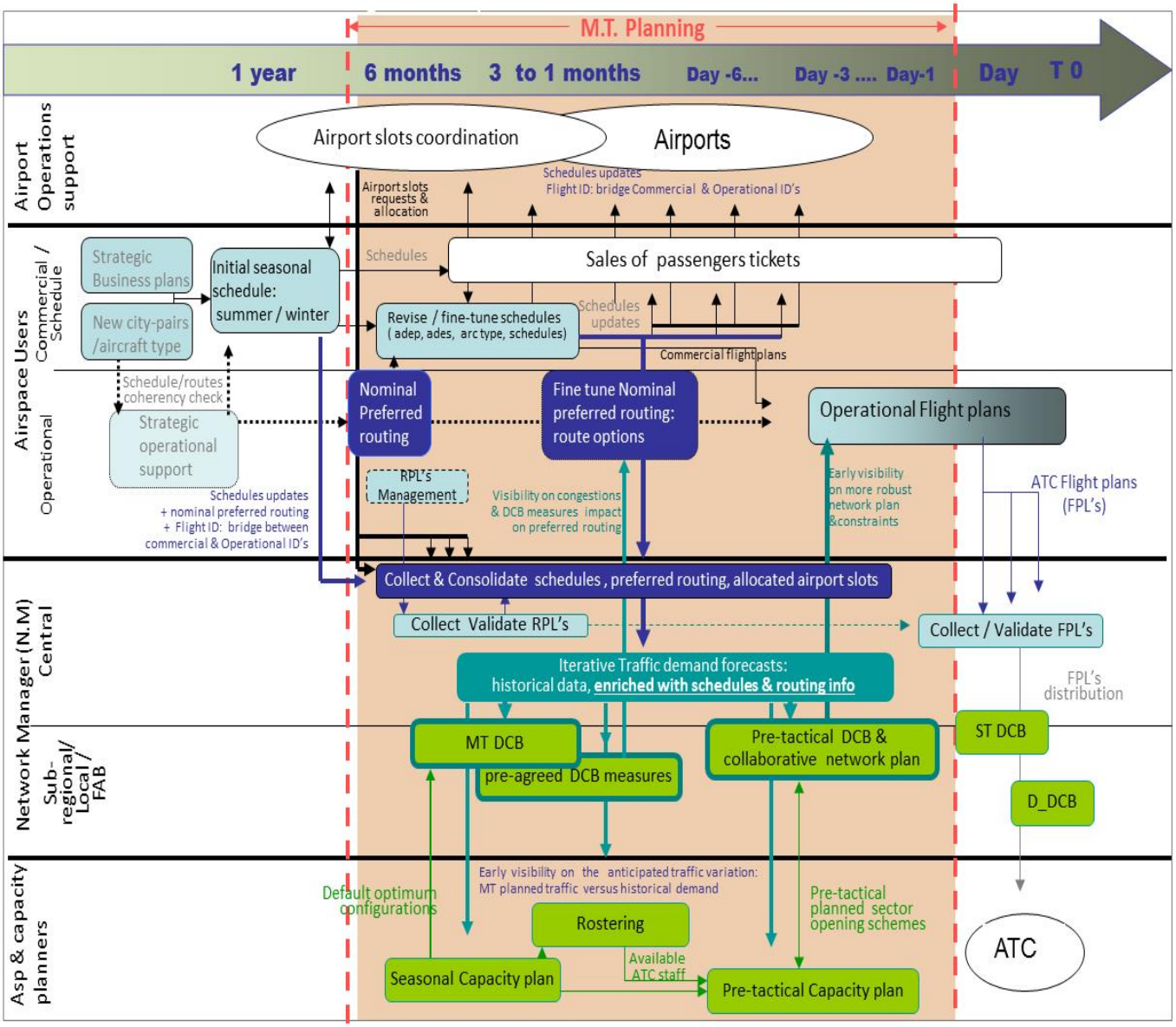

Figure 19: New operating method

5.1.2 Current operating method – description

Current operating is illustrated on Figure 18. Two roles are more specifically addressed, the airspace users role (the commercial / schedule department role and the operational centre role) and the network manager (NM) role, while keeping in background specific roles at Airports and ATC, as contributors to the traffic demand management process during the M-T planning phase.

5.1.2.1 Airspace users - Schedule department and operational centre

Flight demand data management is a process initiated by commercial / schedules departments, from 12 to 6 months before each new season: initial scheduled programmes are defined per season, mainly for internal business planning purposes and for the coordination with airports (in particular for the airport slots coordination). From about 3 months before the new season starts, initial schedules are published with some revisions applied later until during the season.

For the winter season in Europe, starting end of October and finishing end of March, initial flight schedules (without airport slot confirmation) become available in early July. Flight schedules which match airport slots become available in early September. By that time, about 80% of the legs are valid. Early October, 95 % of flight schedules (with airport slot confirmation) are stable and the remaining 5% are changed during the season.

For the summer season in Europe, starting end of March and finishing end of October, initial flight schedules (without airport slot confirmation) become available in early December. Flight schedules which match airport slots become available Early February, with about 80% of valid legs.

Mid February, about 90% of the legs are stable. A slightly higher percentage of planned legs (10%) are updated during the season, as the summer season is longer a higher number of adaptations, i.e. for charter, are required.

At early stage of the M-T planning (before the season start), the involvement of the FOC remains usually limited to ad hoc consultations, specifically required when new city pairs or new aircraft types are added in the FOC programme. They provide support for validating the feasibility and the viability of the planned schedules with flight time derived from nominal preferred routing calculation and from aircraft type performances.

The “Flight schedules” terminology is used to designate a limited set of flight data elements, namely: the commercial flight identifier, the aerodromes of departure (ADEP) and destination (ADES), the scheduled departure and arrival times, the aircraft type determining the transport capacity, the block-time (statistical estimates).

Flight schedules, also named commercial flight plans and expressed in IATA format, are managed and published by the commercial / schedule departments, mainly for commercial purposes (sales of passengers tickets) and for the planning coordination with airports.

For AUs still using RPLs, their operational flight planning department produces repetitive flight plans with a 2D route description. RPLs are delivered, in ICAO format, to the NM central function, during the last month preceding the season start. During the season, updates to RPLs are communicated when required (mainly to cover changes in the 2D route induced by the new AIRAC and changes to flight schedules).

For the vast majority of AUs not using RPLs, the transfer of responsibility between the schedule department and flight operations department takes place about 72 hours before the effective flight (from 3 days to 24 hours): operational flight plans are produced by the flight operations departments, from indications communicated in the commercial flight plans. In most airlines, ATC flight plan (also named FPL) is derived from operational flight plan. The FPL is delivered to the central NM function in charge of its checking and its distribution to the involved ATM actors.

Important to note in current method, that ATM actors are not aware of the flight demand planned and managed by scheduled airlines in coordination with airports, during the M-T planning phase: indeed, the vast majority of FPLs are delivered to the NM only in the last 10 hours before the effective flight.

The invoked reason by Airlines: ATC flight plan (FPL) is derived from operational flight plan, the one which is mandatory to calculate the regulatory minimum fuel to be loaded to operate a flight. To have a maximum accuracy, so a safe but minimum fuel to load, it is important that the influencing parameters are known, and with a maximum accuracy. So, the calculations are made at a time where registration of aircraft, upper wind, provisional load, and other operational parameters are known, with a minimum lead time of 3 hours.

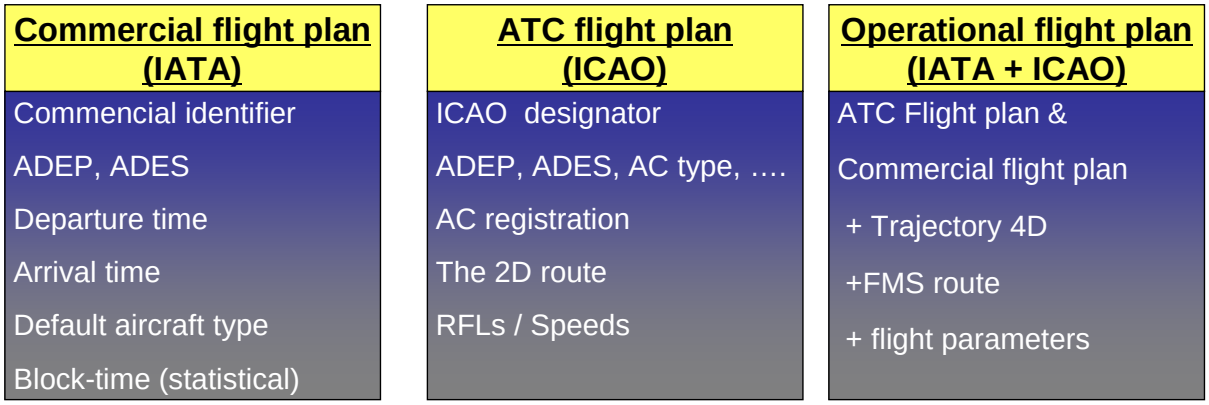

Figure 20: Flight Plan types

In summary:

- Commercial flight plans are produced by schedule departments at early stage of the planning, for commercial purposes and for planning coordination with airports;
- Despite a wealth of flight information being available during the M-T planning phase, ATM actors such as Network Management and ATC do not have access to it. Therefore the demand picture prior to the day of operation is based only on statistical forecasts and archive data.

5.1.2.2 Network Management Function (NM)

During the M-T planning phase, the role of the Network Manager is to best anticipate potential imbalances between demand and capacity, in order to elaborate and assess pre-defined solutions proposed in reaction to anticipated congested traffic flows.

Early inputs originating a) from AUs and airports about the planned traffic demand and b) from ATC about capacity and planned restrictions, are key elements required for starting an effective coordination between the different actors, in order to minimize the impact on operations of proposed restrictions and pre-defined DCB measures, and for developing the Network operation plan.

It is a rolling process initiated a few months before each new season, producing a network plan which is progressively completed and iteratively and collaboratively refined with inputs received from AUs and from local ATC centres, through CDM.

One of the main limitations in the current process is the lack of visibility during the M-T planning phase of the planned traffic demand from Airspace Users and the difficulty in obtaining reliable capacity forecasts from ATC.

Ideally, efficient capacity allocation should reflect as close as possible the traffic demand, in order to maximize the available capacity where other constraints permit.

Capacity forecasts are the results of progressive analysis starting from the capacity plans elaborated by the local airspace planners (usually on a seasonal basis), the rostering of ATC controllers (elaborated 12 to 8 weeks before operations), the local capacity plans elaborated in pre-tactical phase (from 5 days before operations).

The rolling planning of capacity and network operations requires, at each iteration, the best possible predictable representation of the planned traffic situation (Traffic demand forecast) and the planned capacity situation.

In current situation, traffic demand forecasts available during the M-T planning are essentially based on historical data (by default, year-1 traffic representations possibly adapted with statistical traffic trends for the seasonal planning, the week-1 for the pre-tactical planning), without any consideration for the traffic demand variation already planned locally by airlines and by airports.

Similarly, available M-T capacity forecasts have limited accuracy, partly due to the lack of reliable traffic demand forecasts during the M-T planning phase.

A plan built on historical situations with limited view on the future demand can not guarantee efficient allocation of resources expected from the DCB processes nor the best adequacy with airspaces users needs.

In the medium term planning phase, NM performs estimated trajectories based on AU's flight intentions (ADES – ADEP) with assigned trajectory derived from historical route data or using either a route generation tool (such as NM pathfinder tool) or a statistical route catalogue.

5.1.3 New operating method – description

As illustrated on Figure 19, the new method proposes to share commercial flight plans, allocated airport slot and Airlines preferred routing information with ATM actors, to support a better informed collaborative planning, as early as possible.

The goal is to derive more reliable traffic forecasts needed to support operational use cases participating to the elaboration of the network operation plan (NOP). It is required for producing more accurate M-T capacity forecasts (seasonal capacity plans, monthly rostering and pre-tactical sector opening configurations better fitting the planned traffic) and for developing less impacting DCB measures with better informed decisions taken in collaboration with airspace users.

More reliable traffic forecast is based on the concept of historical traffic demand data enriched with early collected information about future flights. This concept of "enrichment" is further described in project 13.02.03.

The rest of the section will address the following key questions:

- The targeted flight data elements proposed to be collected in medium term planning phase.
- The anticipated evolutions in the roles of actors involved in the management of the flight data elements.

5.1.3.1 The targeted flight data elements proposed to be collected in M-T planning phase

Commercial flight plan:

Commercial flight plan encompasses schedule data produced on a seasonal basis, by schedule departments. It may be revised and fined-tuned throughout the season.

It is assumed that data elements currently used in the commercial flight plan represent the minimum data set expected for the new method, namely:

- Commercial Flight designator (Airline designator and Flight Number);
- Period of operation (from / to Dates);
- Days of operations (operated days in the week: e.g., 12…67);
- Service type (type of flights: e.g., J for scheduled passenger service);
- Aircraft Type;
- Stations (ADEP / ADES) & passenger Terminal (if applicable);
- Schedule Time of Aircraft Departure and Arrival;
- Block time (statistical estimates).

Additional technical elements may be useful, and in particular:

- Code sharing & operating carrier;
- Onward flight designator (Flight designator of the next leg ensured by the same aircraft).

In the current method, a flight may be composed of different legs. From there, the need for properly and unambiguously instantiating each leg.

For more details on standard data elements composing IATA standard schedules records, see chapters 2, 3, 4, 5 and 7 of the IATA Standard Schedules Information Manual [24]

Expected originator: schedule department

Allocated Airport slots:

Applicable to flights liaising at least one coordinated airport (departure and/or destination), allocated airport slot data is the result of the airport slot coordination conducted between airspace users and the airport slot coordinators.

For more details on data elements composing IATA standard schedules records, see chapter 6 of the IATA Standard Schedules Information Manual, about the airport coordination / schedule movement procedure

Expected originator: airport slot coordinators, once the allocation is confirmed

Flight ID- Bridge information between commercial and operational flight identification:

Bridge information between IATA and ICAO flight designators is required to facilitate the matching between a) commercial flight identifier used for commercial flight plans, schedules and allocated airport slots and b) the operational flight identifiers used by ATM operations and communicated in ATC flight plans.

It is required to build a consistent view of the flight by consolidating and managing commercial and operational information delivered by different originators (Airlines schedule departments, Airport slot coordinators) about the same flight.

Airlines preferred routings:

Airlines preferred routings correspond route preferences defined per city pair, as output of an initial route analysis performed by flight operation departments when required to assess the operational feasibility of new schedules and the broad commercial viability of a proposed aircraft type.

The results of the initial route analysis are passed to the commercial/schedule department where the initial schedule is assessed for commercial suitability, to complete the portfolio of existing research on the proposed city-pair.

An initial route analysis is performed at early stage of the planning, taking into account airlines business preferences, nominal aircraft performance, nominal useful load, en-route charges elements, statistical values for low predictable factors (statistical winds). Its output (see illustration on Figure 21) can be seen as the first iteration of the network planning trajectory (nominal preferred routing), providing basic information such as aircraft type, departure & destination airports, flight time, nominal useful load, 2D lateral route and 3D vertical profile.

```
PLAN 1234              EGKK TO LIRF 738W  LRC/F  IFR  05/16/11
NONSTOP COMPUTED 1315Z  FOR ETD 1200Z   PROGS JUN      B737-800 KGS

***          HISTORICAL AVERAGE WINDS HAVE BEEN USED. ***

          FUEL  TIME  DIST ARRIVE TAKEOFF  LAND   AV PLD  OPNLWT
POA LIRF 004462 01/54 0811  1354Z  061878 057416  014500  041145
ALT LIRA 000491 00/08 0016  1402Z
HLD      001057 00/30
RES      000223 00/06
XTR      000000 00/00
TXI      000000
TOT      006233 02/38

EGKK BOGN1M BOGNA N615 HAWKE UN615 XAMAB UL612 MILPA UM135 TOP UL50
ELB UL146 ELKAP ELKA3A LIRF

WIND P020   MXSH 1/INPAX
FL  390
DOLLARS COST  006662
```

Figure 21: Initial route analysis illustration

When the season is starting, this information may change at any given moment during the planning phase. It is the reference on which both commercial and performance assumptions are based within the airline during the planning phase.

Important to note that the operational flight plan and the derived ATC flight plan produced a few hours before the effective flight could be different without prior notice, as the result of the flight optimisation process performed by Airlines on the day of operation.

However, the provision of early trajectory information has the potential to significantly improve the accuracy and stability of the demand picture available to ground actors such as Network Management, during the medium- term planning phase. User preferred routing information should also allow increasing the efficiency of the processes of definition and selection of pre-defined ATFCM scenarios thanks to better understanding of airspace users preferences.

With a non-negligible workload, airlines could be able to deliver preferred routes and, based on statistical values, usage of these routes inclusive profile for European flights and some long-haul flights. It would not be necessarily linked to a specific flight, but could be defined by the AU for a combined city pairs, aircraft type and time period (e.g week day/ night / week-ends).

Considering that the nominal preferred routing is the result of an internal balance between different cost elements (flight time, fuel cost, en-route charges,…), it could be useful for Airlines to express different options, with some ranking indications: a primary nominal routing and, optionally for medium and some long hauls, secondary preferred routing options. Those elements will be developed in the context of Step 2 activities.

5.1.3.2 Anticipated evolutions linked to improved flight intents collection in M-T planning phase

The table below provides an overview of activities and actors directly and indirectly contributing to or benefiting from flight intent collections in M-T planning phase. Elements with a grey background refer to dependencies outside the scope of the 7.6.2 project:

Id.	Activities	Actors
1.	Communicate seasonal schedule programs and the updates applied to it during the season	AU – Schedule department
2.	Communicate bridge information between commercial and operational Flight Id's	AU – Schedule department
3.	Communicate the allocated airport slot data and the updates applied to it during the season	Airport slot coordinators
4.	Communicate nominal preferred routing information	FOC – Operational Centre
5.	Fine-tune / Coordinate nominal preferred routing options	FOC – Operational Centre NM – Central function
6.	Collect schedule information delivered by Airlines	NM - Central function
7.	Collect Flight Id bridge information delivered by Airlines	NM - Central function
8.	Collect nominal preferred routing information delivered by Airlines	NM - Central function
9.	Collect allocated airport slot data delivered by coordinated airport slot coordinators	NM - Central function
10.	NM function consolidates early flight intents information originating from multiple sources (schedules + allocated airport slots + routing), instantiate per flight and predict missing information	NM - Central function
11.	NM function produces trajectory 4D estimates from consolidated information and from missing information predictions.	NM – Central function
12.	Instantiate consolidated flight intent information (repetitive data) for each planned leg	NM – Central function
13.	Seasonal Traffic demand forecasts: historical basis enriched with collected flights intent data	NM – Central function in collaboration with local entities
14.	Enriched seasonal traffic demand forecasts are made available from the NOP	NM – Central function
15.	Develop the seasonal local Capacity plan based on traffic demand forecasts enriched with flight intents data collected from Airspace users.	ATC – Airspace planners
16.	Coordinate / consolidate the local capacity plans into a seasonal network plan	NM – Central / sub-regional / Local functions
17.	Seasonal / M-T DCB : identify persistent bottlenecks – airspace / flows with anticipated recurrent imbalances between demand and capacity	NM – Central / sub-regional / Local functions
18.	Develop and assess pre-defined DCB measures proposed to solve	NM – Central / sub-regional /

Id.	Activities	Actors
	persistent bottlenecks	Local functions
Id.	**Activities**	**Actors**
19.	Assess the impact of pre-defined DCB measures against nominal preferred routing and coordinate the effect with AU's, in order to minimise the anticipated impact.	NM – Central / sub-regional / Local functions
20.	Publish in the NOP more robust information about pre-agreed DCB measures and their anticipated impact on AU's operations (nominal preferred routing and planned schedules)	NM - Central function
21.	Monthly Traffic demand forecasts: historical basis enriched with collected flight intents data	NM - Central function
22.	Enriched monthly traffic demand forecasts are made available from the NOP	NM - Central function
23.	Develop the monthly rostering of ATC controllers, using in input early visibility on the planned traffic variation derived from known flight intents data.	ATC – ???
24.	Pre-tactical Traffic demand forecasts: historical basis enriched with collected flight intent data	NM - Central function
25.	Enriched pre-tactical traffic demand forecasts are made available from the NOP	NM - Central function
26.	Develop the pre-tactical local Capacity plan based on traffic demand forecasts enriched with flight intent data	ATC & NM, sub-regional / Local functions
27.	Develop more robust pre-tactical network plan	NM Central / sub-regional / Local functions
28.	Assess and coordinate impact with AU's, best using information from the collected flight intent data	NM - Central function
29.	Publish in the NOP the pre-tactical Network plan and the anticipated impact on operations and on the nominal preferred routings & planned schedules	NM - Central function

5.1.4 Differences between new and previous Operating Methods

Id.	Evolutions	Assumptions / need for validation
1.	AUs share with ATM actors, information on their schedules, from a few months before the season start and updated applied during the season	Early availability of schedule data, with enough coverage Detailed composition is required
2.	AUs share with ATM actors, bridge	Early availability of Flight Id's bridge information, with

Id.	Evolutions	Assumptions / need for validation
	information between commercial and operational Flight Id's, from a few months before the season start and updated applied during the season	enough coverage Detailed composition is required
3.	AUs share with ATM actors, nominal preferred routings , from a few months before the season start and updated applied during the season	Early availability of nominal preferred routing, with enough coverage Detailed composition is required
4.	Early visibility by ATM actors on preferred routing information	Nominal preferred routing is more accurate information than historical data (seasonal / monthly / pre-tactical / special events) in Medium Term
5.	Airport slot coordinators share with ATM actors, information on allocated airport slots, from a few months before the season start and updated applied during the season	Early availability of allocated airport slot data, with enough coverage Detailed composition is required
6.	NM develops the means for collecting early available flight data information (schedules, nominal preferred routings) , best using available data flows	What are the best cost-effective means for collecting targeted information?
7.	Schedules, allocated airport slots, nominal preferred routing are consolidated and instantiated as a consolidated flight intent information per flight	Feasibility for producing consistent flight intent information from multiple targeted sources
8.	Schedules will be used to enrich traffic forecasts (seasonal / monthly / pre-tactical / special events)	Positive impact on the predictability of enriched traffic forecasts
9.	Allocated airport slots will be used to enrich traffic forecasts (seasonal / monthly / pre-tactical / special events)	Positive impact on the predictability of enriched traffic forecasts
10.	Nominal preferred routing will be used to enrich traffic forecasts (seasonal / monthly / pre-tactical / special events) and historical data	Positive impact on the predictability of enriched traffic forecasts
11.	Enriched traffic forecasts facilitate more efficient seasonal capacity planning	Operational usability of collected information – Appropriate means for its visibility by involved ATM actors
12.	Enriched traffic forecasts facilitate more efficient monthly rostering	Operational usability of collected information – Appropriate means for its visibility by involved ATM actors
13.	Enriched traffic forecasts facilitate more efficient pre-tactical network plans	Operational usability of collected information – Appropriate means for its visibility by involved ATM actors

Id.	Evolutions	Assumptions / need for validation
14.	Early Information about anticipated hotspots, about anticipated impact on nominal preferred routing, about rerouting opportunities, is published in the NOP, to support AUs in the management of their trajectory.	Usability by AUs of published NOP information about: • congested areas (sectors and routes) • impact on planned DCB measures on AUs preferred routings • rerouting opportunities

Note: Cells in grey correspond to improvements that are not directly in the scope of business trajectory management...

5.1.5 Transition from previous to new operating method

Evolutions described in the new operating method towards an initial SBT (see section 6.1.1) are planned to be progressively developed during step 1.

Some of the targeted evolutions have even planned to emerge from earlier ATM programs (DMEAN): typically, the development of the DDR phase 2 (DDR2).

Differences in concepts maturity will inevitably lead to a transition scenario, with early developments (IP1 and SESAR quick wins) paving the way to a full iSBT concept implementation. The following table provides an overview of the proposed transition scenario.

HIGH LEVEL SERVICE	DETAILED FUNCTIONS	TRANSITION STEP
Early Flight intents capture	Schedule data and allocated airport slots capture	DDR 2
	Bridge Flight Id's data between IATA and ICAO denomination	DDR 2
	Nominal preferred route capture	7.6.2 Step 1 quick-win
Early Flight intents consolidation	Multiple source data consolidation (schedule + NPR)	7.6.2 Step 1 quick-win
	Production of 4D trajectories from captured flight intent information	7.6.2 Step 1 quick-win

Table 16: Medium term planning phase: stepped evolution

Functions dealing with the use of early flight intents are developed primary by DCB projects.

The SJU 762 project will mainly focus on the concept of Nominal Preferred Routing and the possible options for capturing and consolidating it with schedules and allocated airport slot data.

There are three use cases that exploit the Nominal Preferred Routing concept in VP 715 which are described below:

- **UC a**: Use NPR to support improved route predictions
  The early flight intents collected from multiple sources and their consolidation into "hybrid" 4D trajectory estimates representing airspace user preferences will be used to support improved

route predictions (by adding NPR in the route catalogues used by PREDICT to assign a route to new intentions).
The NPR routes added to the route catalogue will aim at more accurate routing prediction when enriching historical traffic samples with early flight intents to generate traffic demand forecasts used in the pre-tactical DCB process.

- **UC b**: Use of NPR for rerouting proposal
  The Nominal Preferred Routes representing airspace user preferences will be taken into account by the NM when proposing a rerouting for a flight.
  This use case has two subcategories:
  - UCb1: The rerouting proposals to solve a DCB issue, trying to propose routes as close as possible to the user's preferences to off-load the congested sectors
  - UCb2: The rerouting proposals to improve flight efficiency by offering more direct routes making use of the available CDRs, when changes in the CDR availability make possible the use of a shorter NPR option
- **UC c**: Impact assessment of rerouting scenario
  The Nominal Preferred Routes representing airspace user preferences will be used as reference when assessing the impact of pre-defined RR/FL scenarios. The NM will assess the impact of pre-defined DCB measures against nominal preferred routing and coordinate the effect with AUs.

However, as stated before in 2.2.3.2.1, only the first use case (a)has been considered in VP-715:

- Usage of NPR to improve traffic demand prediction

5.2 Detailed Operational Scenarios / Use Cases

5.2.1 Operational Scenario

5.2.1.1 Scenario Overview:

The scenario describes traffic demand management based on early flight intents exchanged during the M-T planning, as envisaged for in the context of short-term evolution..

The operational goal is to provide the Network Management Function with early visibility on early flight intents for scheduled traffic, using scheduled data, allocated airport slots and preferred routing information.

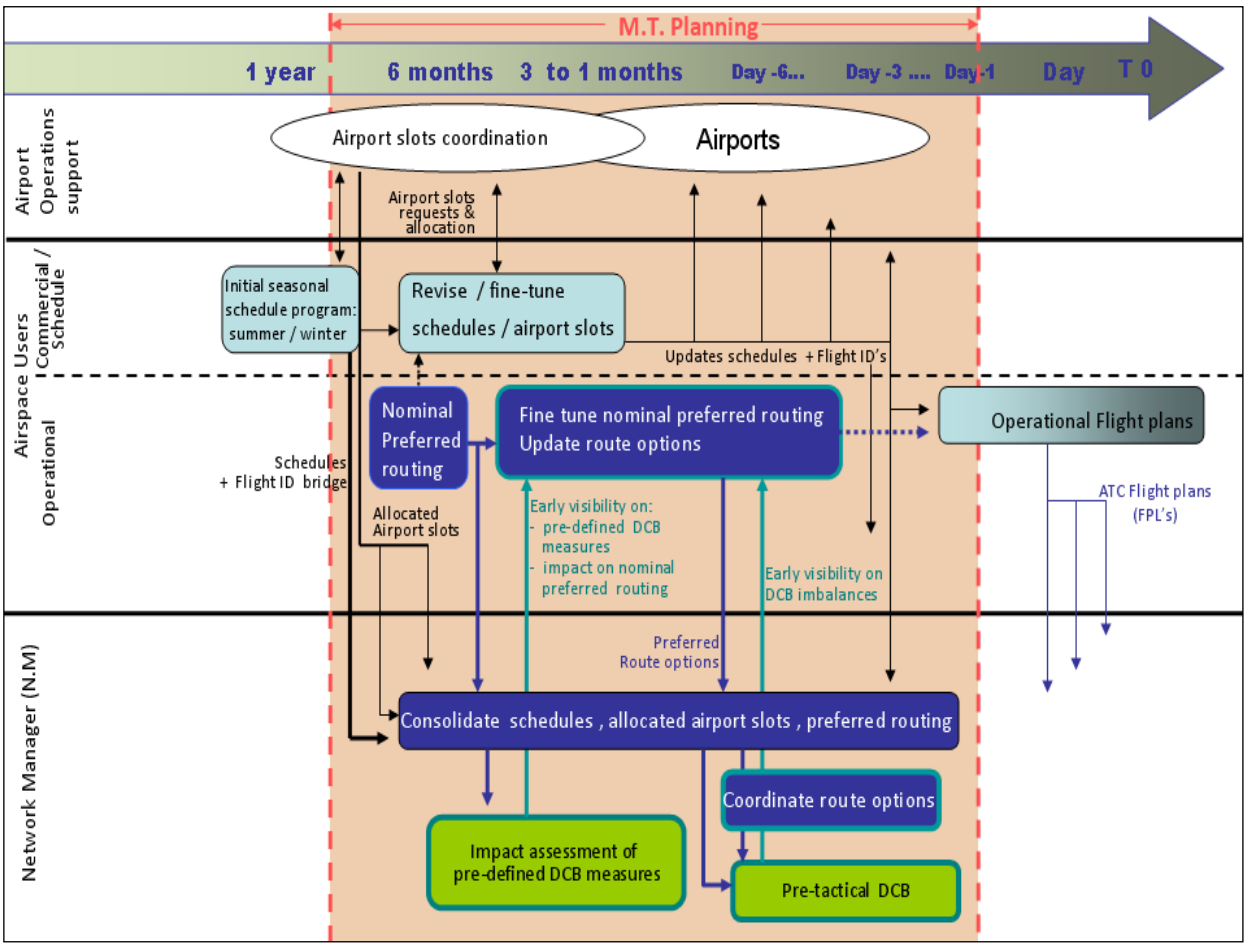

Figure 22: Improved demand management in the scheduling phase (quick-win evolution)

The scenario is composed of the following activities:

- Airlines / Schedule Departments and Airport Operations Support Units share with the Network Manager Function data about schedules and allocated airport slot data, by extending data flows already in use.
- Airlines (Operational Centre) share with the Network Manager Function 'Nominal Preferred Routing" information for the scheduled flights they intend to operate.
- The Network Management Function receives, from concerned airlines and airports units, multi-sources information about schedules, airport slots and nominal preferred routing.
- The Network Management Function consolidates received information and complements it with predictions based on statistical data, in order to produce 4D trajectory estimates in the scheduling phase. Resulting consolidation and the generated 4D trajectory estimates will describe users preferences about schedules and routing.
- Airlines, Airports and the Network Management Function will use users preferences for assessing the DCB measures impact on preferred routing, schedules and allocated airport slots. This will facilitate the coordination of route options and the identification of DCB measures with less impact on airport operations.

5.2.1.2 Nominal Preferred Routing - description

Definition: nominal preferred routing describes user preferences about intended routing for a given airport pair, a given aircraft type, in nominal conditions.

Required information: as a minimum, the routing information shall be composed of:

- A 2D route description, with speed and level indications.
- The 2D route begins and ends with the connecting points of the SID and the STAR and the codes of the liaised airports
- The use of DCT is allowed where accepted in the RAD
- The use of CDR1 or CDR2 route portions is allowed
- No stay indicator shall be included

Routing options and applicability conditions:

- Where different route is required /envisaged, during week, weekend and night, to satisfy users preferences or imposed restrictions, several routes options shall be described with the applicability conditions

Nominal conditions:

- Meteorological conditions: statistical winds models in use by the flight planning system of AUs.
- Requested routes shall respect time and level restrictions including those in the RAD at the time of the processing or required due to 8.33kHz and RVSM checking.

Granularity level:

- Defines the way the nominal preferred routing (NPR) has to be described. Several granularity options shall be considered, namely:
  - "Route catalogue like", where preferred routes are defined globally per airport pairs and for group of aircraft types (aircraft types family)
  - "Schedule like" corresponding to a lower granularity allowing a more direct linkage between flight schedules and nominal routing preference through a common commercial flight ID or an operational callsign (ARCID).
- the Validation Exercise 715 [13] concluded that NPR has a granularity similar to the granularity of the " Route Catalogue"..

Update cycle:

- Considering that NPR can be defined from a few months before a new season starts, updates to NPR might be needed during the season, to satisfy evolutions in the Airlines business preferences or in the RAD restrictions.
- Update cycle could be aligned with the AIRAC changes, at least to reflect changes in the RAD restrictions published at each AIRAC.
- Updates could be done at Airlines initiative or when incompatibility is detected with applicable restrictions

5.2.1.3 Flight Id bridge information - description

Definition: Flight Id bridge information refers to a linkage between Commercial Flight Number (CFN) used in schedules and airport slot messages and the operational Flight Id (callsign) used in ICAO flight plans and to support ATM operations.

Required information: as a minimum, it will be composed of the following information

- AU prefix + CFN (commercial flight number) + suffix
- ICAO callsign (ARCID)
- Applicability period: wef, from – to.

Granularity level: a minimum would be one linkage for each commercial flight

Update cycle: on Airline initiative, for each commercial flight.

5.2.2 Use cases

Three different use cases have been identified in the operational scenario described in the previous section: **a) capture, b) consolidate and c) use early flight intents.** The next table provides an overview of the flow of activities associated to each use case. The project scope indicates the development context of the targeted evolutions.

5.2.2.1 Use cases overview

Id.	Use cases / Flow of activities	Project scope
	a) Capture early flight intents	
1.	AU Schedule departments communicate seasonal schedule programs and the updates successively applied to it during the season	DDR 2
2.	AU Schedule departments communicate bridge information between commercial and operational Flight Ids	DDR 2
3.	Slot coordinators communicate the allocated airport slot data and the updates applied to it during the season	DDR 2
4.	AUs (operational department) communicate nominal preferred routing information	SJU 762
6.	Collect schedule information delivered by Airlines	DDR 2
7.	Collect Flight Id bridge information delivered by Airlines	DDR 2
8.	Collect nominal preferred routing information delivered by Airlines	SJU 762
9.	NM function collects allocated airport slot data delivered by coordinated airport slot coordinators	DDR 2
	b) Consolidate early flight intents	
10.	NM function consolidates early flight intents information originating from multiple sources (schedules + allocated airport slots + routing), instantiate per flight and predict missing information	DDR 2 / SJU 762
11.	NM function produces trajectory 4D estimates from consolidated information and from missing information predictions	SJU 762
	c) Use early flight intents	
5a.	FOC's (operational department) fine-tune nominal preferred routing and update route options considering anticipated DCB imbalances	SJU 762 / 765
5b.	The Network Management Function (NMF) coordinates with Airlines routing options (routing proposals) considering anticipated DCB imbalances	SJU 762 / 765
19.	Assess the impact of pre-defined DCB measures against nominal preferred routing and coordinate the effect with AU's, in order to minimise the anticipated impact.	SJU 762 / 765

5.2.2.2 Use Case – Capture early flight intents

5.2.2.2.1 Summary

Collection process by the Network Management for early flight intents sent by multiple data providers: flight schedules, bridge data between commercial and operational Flight ID's, allocated airport slots, nominal preferred routing information.

5.2.2.2.2 IP1 / SESAR Scope

DDR2/1 project: collection of flight schedules and allocated airport slots, bridge data between commercial and operational Flight ID's.

SJU 7.6.2: Nominal preferred routing.

5.2.2.2.3 Planning Level/Flight Phase

M-T planning: seasonal, monthly, pre-tactical phases

5.2.2.2.4 Actors

AU / Airlines schedule departments communicate their seasonal schedules from a few months before each season. During the season, they also communicate the updates applied to it, as soon as known and airport slots are cleared

AU / Airlines operational departments communicate nominal preferred routing before each season and the updates needed to route options during the season

AU / Airlines Schedule /operational departments communicate bridge information between commercial and operational flight Id's. During the season, they also communicate updates applied it, as soon as known

Airport Support Units (Slot coordinators) communicate allocated from a few months before each season and the updates applied successively during the season

Network Manager (regional) collects early flight intents information from above listed sources and manages successive updates in order to get the latest information about early flight intents as known by their originators.

5.2.2.2.5 Pre-conditions

Schedules are published, usually from three to six months ahead. Updates applied during the season are possible.

The bridge information between commercial and operational flight id is available at airspace users side.

Allocated airport slots become available and progressively refined after the bi-annual slot conferences organised in June for the winter season, in November for the summer season.

Nominal preferred routing: assumed to become available from the schedule publication. Updates applied during the season are possible.

5.2.2.2.6 Post-conditions

Schedules, allocated airport slots, Flight ID bridge information:

a. **Success end state**: successful transmission to the network management function, with all relevant mandatory fields required to start the Flight ID consolidation.
b. Failed end state: failed transmission to the network management function, or missing mandatory fields relevant for the Flight ID consolidation.

Nominal preferred routing

a. **Success end state:** successful transmission and validation.
b. **Failed end state:** failed transmission or failed validation.

5.2.2.2.7 Notes

Messages formats used to exchange schedules and airports slot are described and published by IATA Standard Schedule Information Manual (SSIM) [24].

Descriptions of nominal preferred routing and Flight Id bridge information are developed in sub-section 5.2.1.2 and 5.2.1.3

5.2.2.2.8 Main Flow

1. Airspace Users (commercial/schedule departments) transmit to the Network system, information about their published schedules, when transmitted to Airport operations support units: initial seasonal program (summer/ winter) is communicated from a few months before the new season starts; revisions are communicated during the season.
2. Airport operation support Units (Airport Slot Coordinators) transmit to the Network system, information about allocated airport slots: initial seasonal program (summer/ winter) is communicated from a few months before the new season starts; revisions are communicated during the season.
3. Airspace Users (AU) transmit Nominal Preferred Routing from a few months before the new season starts; revisions are communicated during the season.
4. Airspace Users transmit the bridge information between commercial and operational flight id before the new season starts; revisions are communicated during the season.
5. The network system collects transmitted multi-sources information, manages received updates / revisions and makes received information accessible to the Network Management Function.

5.2.2.3 Use Case – Consolidate early flight intents

5.2.2.3.1 Summary:

The Network Management function (regional) consolidates into a common and consistent data set per flight leg, early flight intents data received from multiple sources and corresponding to different granularity levels (repetitive schedules and airport slots, preferred routing (route catalogue like or schedule like) , missing information derived from historical flight plans and statistical predictions for the missing part).

The “flight leg” notion corresponds to an aircraft flying between 2 airports during a specified time period (departure time – arrival time) on a given day.

For each leg, a 4D trajectory estimate is produced from the consolidated early flight intents and it is used to feed network simulation and planning tools during the scheduling phase.

5.2.2.3.2 IP1 / SESAR Scope

DDR2/1 project: consolidate flight schedules and allocated airport slots, bridge data between commercial and operational Flight IDs.

SJU 7.6.2: additional consolidation of flight schedules and allocated airport slots with nominal preferred routing.

5.2.2.3.3 Planning Level/Flight Phase

M-T planning: seasonal, monthly, pre-tactical (D-6 to D-1) phases

5.2.2.3.4 Actors

Network Manager (regional) consolidates into one record per leg early flight intents information received from multiple sources and corresponding to different granularity levels.

Network Manager (regional) and AU Flight Operations Centres (FOCs) cooperate and apply the necessary corrections to solve anomalies detected during the consolidation process

The Network System produces 4D trajectory estimates from collected information (after correction of detected anomalies) and from statistical estimates for the missing part.

5.2.2.3.5 Pre-conditions

Schedules, allocated airport slot and NPR data is available in the Network system

5.2.2.3.6 Post-conditions

- **Success end state**: successful consolidation leading to the generation of a 4D trajectory estimate.
- **Failed end state**: failed consolidation or failed generation of the 4D trajectory estimates.

5.2.2.3.7 Notes

- None.

5.2.2.3.8 Main Flow

1. The network system identifies the flights planned to fly from scheduled data and from allocated airport slots data captured in the Network system.
2. The network system will use flight Id bridge information to support information linkage between sources using CFN (commercial Flight number) and sources using operational flight ID (ICAO callsign – ARCID).
3. The network system transforms in a common and consistent data set describing each flight leg, early flight intents data derived from multiple sources.
4. The network system shall follow a set of priority rules to resolve possible inconstancies between information sources
5. Network Manager (regional) and FOC cooperate and apply the necessary corrections to solve anomalies which could not have been solved automatically by the network system.
6. The network system produces “hybrid” 4D trajectory estimates representing airspace user preferences. They are derived from flight schedules, allocated airport slot and nominal preferred routing and for the missing part (data elements not covered by previous sources) from historical or statistical information available by the network system.

5.2.2.4 Use Case –Use early flight intents

5.2.2.4.1 Summary:

The early flight intents collected from multiple sources and their consolidation into “hybrid” 4D trajectory estimates representing airspace user preferences will be used to support the following planning /coordination activities:

- FOCs fine tune nominal preferred routing and update route options considering anticipated DCB imbalances.
- NM functions coordinate with Airlines routing options (routing proposals) considering anticipated DCB imbalances.

- Assess the impact of pre-defined DCB measures against nominal preferred routing and coordinate the effect with AUs, in order to minimise the anticipated impact.
- Enrich historical traffic samples with early flight intents to support the DCB iterations organised during the M-T planning (scheduling phase). Monitor impact on predictability.

5.2.2.4.2 IP1 / SESAR Scope

DDR2/1 project: enrich traffic samples with early flight intents derived from flight schedules and allocated airport slots.

SJU 07.06.02: use the user preferred routing information to support above listed activities

SJU 13.02.03: enrich and monitor traffic sample predictability from collected early flight intents, including user preferred routing information.

5.2.2.4.3 Planning Level/Flight Phase

M-T planning: seasonal, monthly, pre-tactical (D-6 to D-1) phases.

5.2.2.4.4 Actors

The Network Manager Function (regional / sub-regional / local) assesses the impact of pre-defined DCB measures using 4D trajectory estimates representing airspace user preferences as reference.

AU / FOC analyse and fine-tune route options considering anticipated DCB imbalances

The Network System and FOCs coordinate pre-defined DCB measures and route options in order to limit impact on airlines business.

5.2.2.4.5 Pre-conditions

4D trajectory estimates representing airspace user preferences are available for a significant proportion of (scheduled) traffic.

5.2.2.4.6 Post-conditions

a. **Success end state**: successful assessment and/or coordination

b. **Failed end state**: failed consolidation or failed assessment of DCB measures.

5.2.2.4.7 Notes

None.

5.2.2.4.8 Main Flow

1. From a few months before the new season starts, the Network Manager Function (regional / sub-regional / local) has to develop “pre-defined DCB measures” as a set of DCB tools to manage anticipated Demand / Capacity imbalances.
2. To prepare the coordination with airlines, an impact assessment of pre-defined DCB measures is initiated by the Network Manager Function, using 4D trajectory estimates representing airspace user preferences as reference.
3. Impact assessment results are coordinated between the Network Manager Function (regional / sub-regiona / local) and airlines.
4. As a first outcome of the coordination process, pre-defined DCB measure are adapted to reflect received feed-back from stakeholders: on-load / off/load effect, impact on Airlines routing preferences,…
5. As second outcome of the coordination process, Airlines, being informed of anticipated recurrent bottlenecks for the coming season, may want to adapt their routing preferences between specific city pairs or applicability conditions.

6. Airlines communicate changes to their routing preferences on applicability conditions to the Network system during the season.
7. Received updates to nominal routing preferences are used by the Network system to support the next iterations of the DCB process, enabling the progressive refinement of the impact assessment of DCB measures.

5.3 Requirements

Note: in this section, the term “Network Manager” encompasses both NM systems and human operators.

5.3.1 Operational requirements

[REQ]

Identifier	REQ-07.06.02-OSED-0002.0000
Requirement	The Network Manger (NM) shall be able to receive nominal preferred routing information and associated messages transmitted by Airspace Users.
Title	Reception of nominal user preferred route information
Status	<In Progress>
Rationale	To enable the use of nominal preferred route information by network processes.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0002.0001
Requirement	The NM shall check the validity of the received nominal preferred route information in terms of syntax and respect of constraints. Airspace users shall be informed of errors detected (warnings).
Title	Verification of nominal preferred route information
Status	<In Progress>
Rationale	Nominal preferred routes sent by airspace users shall comply with syntactic rules as well as RAD permanent constraints.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0002.0002

Requirement	The NM shall be able to treat nominal preferred route information received with different levels of granularity and details. Nominal preferred route information can be provided by Airspace User either: - per city pair and aircraft type - or per "commercial"/schedule flight. The Nominal preferred route description can include: - an "ICAO field 15" like route - a 4D trajectory - a combination of "ICAO field 15" like route and 4D trajectory
Title	Nominal preferred route information - different levels of granularity and detail
Status	<In Progress>
Rationale	Depending on airspace users' processes and system capabilities, nominal preferred route information may be provided with different level of granularity. A unique flight data set shall be defined (a subset of Extended Flight Plan data) with a number of optional fields.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0002.0003
Requirement	The NM shall use the nominal preferred route information to improve network traffic demand predictability from the medium term planning phase, in order to support a robust network plan which best reflects airlines routing preferences .
Title	Nominal preferred route information - Consolidation of traffic demand predictions in medium planning phase
Status	<In Progress>
Rationale	In medium term planning phase network traffic demand prediction is elaborated based on historical data enriched with additional information coming from different sources (airline schedule, airport slots, …). Nominal preferred route information shall be used when historical data is not available (new city pair) or to derive more accurate 4D trajectory calculations.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0002.0004

Requirement	When elaborating predefined DCB/ASM scenarios, the NM and other involved stakeholders involved in the CDM processes shall have access to nominal preferred route options, in order to select re-routing proposals which are the closest to nominal preferred routes expressed by the airlines or to select DCB measures which are impacting the least airlines preferred routing
Title	Nominal preferred route information - Use in the context of predefined scenarios
Status	<In Progress>
Rationale	Nominal preferred route information will provide a better view of flight intent and facilitate the impact assessment of DCB/ASM solutions measured against airlines routing preferences.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0002.0007
Requirement	When NM uses the statistical route to plan the trajectory for a flight, not only the city-pair shall be considered but more detailed statistics such as per airline, aircraft type, days the week.
Title	Improved NM assign route estimation in medium term
Status	<In Progress>
Rationale	To increase accuracy in traffic demand prediction
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0002.0008
Requirement	The NM shall use advanced route generation tools to estimate the planned trajectory of a flight when neither NPR or historical data are available in medium term planning phase
Title	NM assign route estimation in medium term
Status	<In Progress>
Rationale	Historical data is not available in a number of cases such as an AU operating a city pair or significant change in airspsace/route structure has been applied in the new AIRAC cycle. NM already use a route generation tool (Pathfinder) to plan trajectories but VP-715 exercise has highlighted the need to improve the tool.
Category	<Operational>
Validation Method	<Live Trial>

Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

5.3.2 Performance requirements

[REQ]

Identifier	REQ-07.06.02-OSED-0002.0005
Requirement	The use of nominal preferred routing information shall contribute to Cost-effectiveness KPA performance target, through earlier and better predicted traffic demand from medium term planning phase, needed to support cost / effective resources / capacity allocation adapted to traffic demand
Title	Cost-effectiveness - more efficient resources /capacity allocation
Status	<In Progress>
Rationale	Reference to the benefit mechanism presented in appendix C of the OSED
Category	<Performance>
Validation Method	<Fast Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0014	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0002.0006
Requirement	The collection of nominal preferred route information shall support flight efficiency improvement, through routing optimisation by airlines, during the scheduling phase (M-T planning), with information derived from the M-T DCB process (anticipated bottlenecks) and from the planned changes in the airspace availability.
Title	Flight efficiency improvement
Status	<In Progress>
Rationale	Reference to the benefit mechanism presented in appendix 3 of the OSED
Category	<Performance>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0013	<Partial>

5.3.3 Information Exchange Requirements

Due to the low maturity level of the concepts, this section will not be developed in SESAR 1. Only requirements related to the NPR will induced IER. Improvements on statistical methods or route generation tools have no impact on information exchanged since it is an internal NM or Local ANSP process.

6 The iSBT and iRBT

6.1 Detailed operating methods

6.1.1 The iSBT

6.1.1.1 Previous operating methods

The iSBT concept covers two processes in current operations:

- The flight planning process in short-term planning phase.
- The collection of flight intentions in medium-term planning phase.

Previous operating methods for these two processes are detailed respectively in sections 4 and 5 of this document.

6.1.1.2 New Operating Methods

6.1.1.2.1 Content of the iSBT in Step 1

The content description of the iSBT strongly relies on quick-win evolutions presented in sections 4, 5 as well as trajectory information defined in the context of ICAO-FF-ICE increment 1. In this section, as well as along the document, the EFPL is taken into account as a concept fully compliant with the eFPL as defined in ICAO.

There are two phases in the SBT lifecycle, each one operating different type of information that will depending of the timeline:

- **Scheduling phase**. This phase starts some months before to the day of operations and the scheduling information used during this phase will not be necessarily detailed (e.g. NPR).
- **4D trajectory planning phase**. This phase starts when the planning of the trajectory for an individual flight begins, i.e. whenever the AU submit a “planning EFPL” or a “filed EFPL”.

The following table provides a summary of the content of the iSBT depending on the planning phase.

PHASE	ISBT DATA	TRAFFIC CONCERNED	SUBMISSION / UPDATE PROCESS	REMARKS
SBT Scheduling phase / ATM Medium-term planning(months, weeks, days before ops)	Schedule data	Scheduled traffic	First iSBT shared after the IATA slot conference or later (depending on the type of scheduled airline, see section 3.3.1. Update of the iSBT at each modification of schedule data	In the scheduling phase, the iSBT data will not be provided per individual flight but per “repetitive flight leg” See section 5.1.3.1 for more details about schedule data elements.
	NPR		Included (optionally) in the first iSBT submitted. The NPR data updated in the iSBT whenever required (e.g. change of route structure at a new AIRAC cycle)	
	Airport slots			
4D trajectory	GUFI	All	Included in all related (extended)	See ICAO FF-ICE

PHASE	ISBT DATA	TRAFFIC CONCERNED	SUBMISSION / UPDATE PROCESS	REMARKS
planning phase ATM Short term planning (day of operations)			flight plan updates	documentation
	Extended FPL data	All	Similar to submission/validation/update process of current ICAO flight plan (see more detailed in section 6.1.1.4). It will progressively evolve according to ICAO FF-ICE increment 1 provisions.	Extended Flight Plan data will include all elements detailed in section 4.1.2.1 as well as some additional elements (see §6.1.1.4)

Table 17: Content of the “iSBT” in Step 1

6.1.1.3 The GUFI

The GUFI is recognised to be an important element of FF-ICE, allowing unambiguous identification of which information relates to which flight without the need for mapping details such as ADEP, ADES, Callsign and EOBT, as is done today in most systems with occasional incorrect results.

The GUFI is currently discussed in the context of ICAO working groups.

Among others statements, there is an agreement that the GUFI will be assigned whenever an ATM flight is instantiated. Considering the current definition of the iSBT in Step 1, the GUFI should be allocated at the initial submission of the EFPL/eFPL in short term planning phase since no instantiated flight information is expected to be exchanged in medium-term planning phase. However, NM could pre-allocate the GUFI under agreement with an airline or operator that is willing to engage in these planning activities and to use the GUFI when ‘submitting’ the eFPL.

6.1.1.4 The Extended Flight Plan as iSBT element

The Extended Flight Plan as introduced in section 4 of this OSED corresponds to a quick win implementation in IFPS zone. A more advanced version of the Extended FPL will be defined to align with the ICAO FF-ICE increment 1 (eFPL) while integrating SESAR Step 1 requirements.

In terms of information content, the advanced version of the Extended Flight Plan will include at least the following data:

- All EFPL data defined in Section 4;
- The GUFI;
- Additional new data elements:
  - Airport slots reference (if the flight is departing/arriving from/to coordinated airports).
  - Indication of Target Times applied to generate the 4D trajectory. This is an optional information, not included in the initial submission of the EFPL, only in subsequent updates when target times are issued (e.g. EOBT - 2 hours).
  - Departure and arrival runway
  - Additional information on each point of the trajectory (see 11.01.02 OSED [12] and Appendix B):
    - Min/Max altitude on each point of the trajectory.
    - The uncertainty sigma in all four dimensions e.g.: to model uncertainties in wind predictions.

- Aircraft equipment/capability elements necessary to ensure the compliance of certain measures (e.g. ADS-C for ETA min/max exchanges or a FMS RTA function to follow a CTA).

  Note: Coordination with WP5 team was conducted to specify if or which aircraft capability elements should be included in the advanced EFPL. There was no clear consensus due to the lack of maturity of the subject. Therefore the 7.6.2 D56 BT OSED does not cover this attribute and it remains an open point to be addressed during SESAR2020.

6.1.1.5 The iSBT submission, verification process and agreement process

Processes and rules will be different in medium and short term planning phases.

In the scheduling phase (ATM medium-term planning phase), both schedule and the iSBT will be provided per "repetitive" flight leg. There will not be a formal submission process of the iSBT but errors and inconsistencies compared to the already known airspace structure and availability will be detected and notified to the airspace users.

In 4DT planning phase (ATM short-term planning phase), iSBT submission and verification and validation processes will evolve compared to current flight plan validation process. Main differences are:

- The use of new SWIM-based services for the submission of the iSBT in FIXM format.
- More frequent updates of the iSBT (compared to the ICAO flight plan) as more detailed information is provided.
- Almost fully automated verification and validation processes (much less manual corrections by NM operators) when submitting a flight plan message.

  In accordance with future FF-ICE increment 1 provisions, the verification and validation processes of the iSBT will include at least three distinct checks as followed:

  - Check for compliance with the format and data conventions (semantic and syntax checkings);
  - Check to the extent possible, for compliance with required operating approvals such as over-flight approvals, approval at destination aerodrome
  - Check for completeness and, to the extent possible, accuracy for compliance with any applicable hard constraints known at the time. In case of non-compliance a negotiation phase will be launched by NM.

- In accordance with the latest version of the FF-ICE increment 1 provisions (which are reasonably stable at the date of the release of this document); there will be two different services associated with a submitted flight plan (preliminary and filed) in the 4DT planning phase (ATM short term planning phase):

  - **Planning service.** This is an optional service that will be invoked by the Airspace User through a Preliminary flight plan submission (flight plan submitted in "planning state"). The AU will send an EFPL with its preferred trajectory (desired trajectory) - taking into account the required hard constraints that have been previously published-.

    The planning service is intended to serve two main purposes:

    - To enable NM to obtain an earlier, more detailed and more accurate assessment of the anticipated traffic demand.
    - To allow feedback and negotiation to occur in order to reach agreement on a flight plan that best meets the objectives and constraints of the AU and NM. A negotiating trajectory could be provided by NM as a proposal to the AU which

the AU is at liberty to either use or ignore in favour of its own processes for trajectory determination.

Several processes may trigger or contribute to trajectory negotiation in a pre-flight phase, namely:

- Flight plan submission and acceptance i.e. through submission of the desired trajectory within the preliminary flight plan by the AU in the planning phase.
- Flow management processes and associated measures (e.g. ATFCM regulations, STAMs, re-routing scenarios)
- Airport CDM TSAT allocation process[14].

Additionally, any AU may desire to test alternative trajectories during planning without changing the current stated intention. Consequently, they will be able to send a **"Trial Request"**[15] which is a request from which NM is not retaining the information, but simply assessing the request as a 'what-if'. After the evaluation of a Trial Request, NM will continue to use the previously submitted preliminary flight plan. However, the AU may decide to update his flight intentions via submitting an update to the preliminary flight plan due to the positive result of the Trial Request.

Once a valid and stable flight plan will be agreed (NM shared an agreed trajectory), the AU will send a "filed" flight plan to NM including a filed trajectory. No update to the planning status should be expected after a filed flight plan is submitted as the preliminary flight plan no longer represent the AU's intent.

- **Filing service.** This service allows an airspace user to file and amend a filed flight plan and receive acknowledgement and error conditions. It is triggered by the AU basically when submitting a flight plan in "filed state". This could take place
  - when the AU files directly a flight plan without having executed any previous negotiation process. *See Figure 25*.
  - following a planning period of negotiation during which, ideally, a trajectory acceptable to both AU and NM has been determined (agreed trajectory).

Once a filed flight plan has been submitted for the flight it becomes the reference for all ATM purposes and the Preliminary flight plan is no longer relevant. Cancellation of the filed flight plan will result in the removal of both the filed flight plan and the Preliminary flight plan data.

This EFPL in "filed status" will include the filed route/trajectory as calculated by the AU which ideally will match the negotiated route/trajectory achieved during the planning process. The filed extended flight plan (once it is ACK by NM) will be distributed to ATC and other regions and airports. At this stage, the EFPL information will be shared with EFPL capable stakeholders whereas the ICAO flight plan will still be sent to all.

Once an EFPL/trajectory is "filed" it triggers both the FO and the iRBT creation and becomes the reference trajectory for traffic prediction. Any parallel submission of an EFPL (including a negotiating trajectory) to the planning service it is a **Trial Request** and it will be considered as a "what-if request" not impacting traffic predictions (the existing flight plan remains the intent). At the actual off-block time or when a CDM event occurs at some airports, the filed flight data can no longer be modified by the AU as it requires coordination with ATC.

[14] This process will not be further contemplate in the planning service. It is considered a very dynamic process that it is too close to EOBT to trigger any feasible trajectory negotiation. Hence, it has been considered out of scope.

[15] A Trial Request will not be accepted unless a flight plan (preliminary or filed) has already been submitted for the flight. Unlike the Preliminary Flight Plan, a Trial Request can be provided after the associated flight plan has been filed. The Trial Request should therefore also contain the relevant GUFI.

The following table summarises the trajectory groups considered in SESAR Step 1 per service:

Service/States	Flight plan	Trajectory issued by AU	Trajectory issued by NM
Planning	Preliminary	Desired Negotiating (Trial request)	Negotiating Agreed
Filing	Filed	Filed Negotiating (Trial request to planning service)	Negotiating Agreed

Table 18 Trajectory types considered in SESAR Step 1

- Agreements reached during planning may change in response to changing conditions. Planning may also continue after filing to accommodate these dynamic conditions. **Considering this, planning and filing phases should not be treated as exclusive nor sequential, they refer to the same flight and may run in parallel and be overlapped.**

  For example, a trial request (to the planning service) may be started for a flight that has already entered the filing process i.e. it has been already filed (see step 5 of figure 24).

  The next figure illustrate the timeline when the flight planning service is used before submitting a filed flight plan. Different steps have been added in the understanding of the overall process.

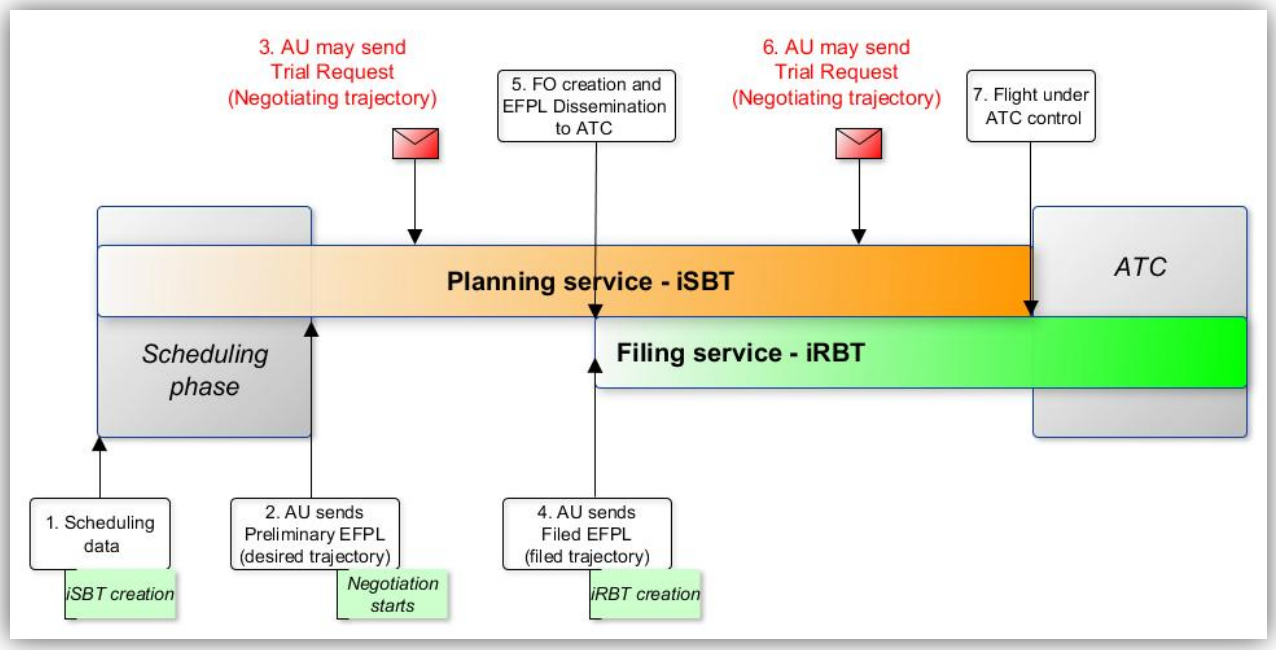

Figure 23 Planning and filing service

The Figure 24 pictures the steps and the timeline of the overall process in case the AU decides not to use the available planning services at first instance (as it is optional) before filing a flight plan.

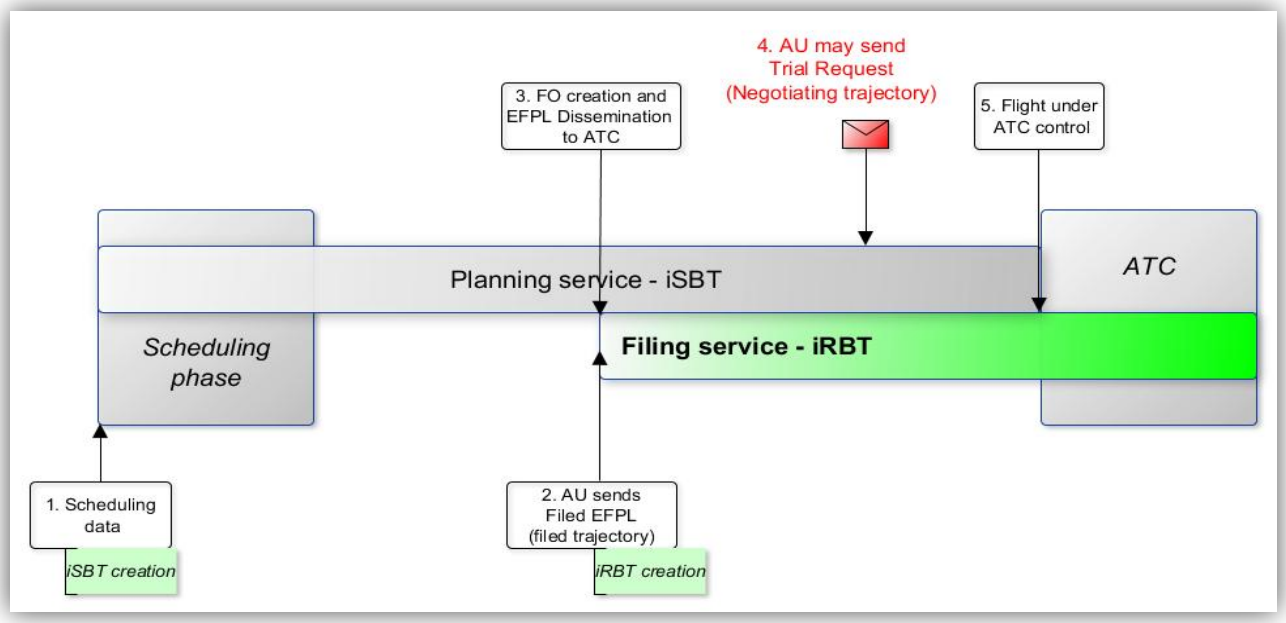

Figure 24 Only filing service

- Response messages: NM will provide feedback on each flight plan submitted by an AU. Depending on the service, the response message will be composed of either:
  - a submission response plus a *planning* status message, or
  - a submission response plus a *filing* status message.

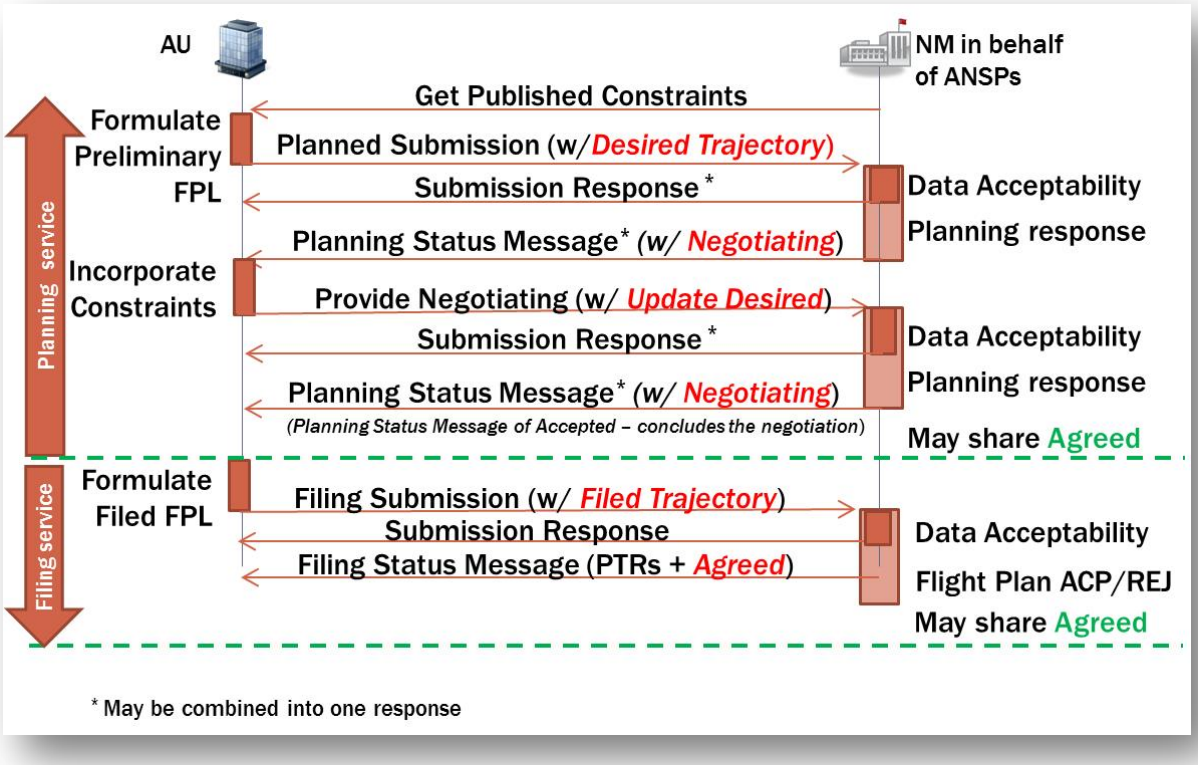

Figure 25 Main exchanges between AUs and NM concerning Planning and Filing states/services

These messages exchanged between AU and NM as appearing in Figure 25 are all computer – generated. A more detail description is explained below:

- **Submission response** refers to a synchronous response provided immediately to the originator indicating whether the message can be accepted or not:
  - (i) *Acceptance*: the flight data has been accepted by NM and has resulted in an update to the flight data maintained by NM.
  - (ii) *Rejection*: the flight data cannot be processed or does not meet NM specific rules for data acceptance
  - (iii) *Manual processing*: the provided information has been referred for manual processing. It is a first holding response which will be followed by another response with the correspondent rejection or acceptance.
- **The Planning or Filing Status** message provides information concerning primarily the status of the route and trajectory. As this status may change over time the Filing and Planning Status messages are asynchronous and may be updated periodically, meaning that they can be received without the AU having submitted a message.
  - *Planning Status message*: It can therefore be repeated as operational conditions change and previous constraints are removed or new constraints become necessary, providing the operational feedback. It contains the negotiating trajectory.
  - *Filing Status message*: this message contains the agreed trajectory and PTRs information. The notion of the agreed trajectory has been introduced to reflect the ATM view of the trajectory when accepting the AU's filed trajectory. The filing response may not be a quick response after the filing submission due to its dependency to the flow management process. It also

2453 should be updated as necessary to reflect changes in the environment
2454 which may affect the flight.

2455 The availability of two types of response provides NM with greater flexibility, enabling the
2456 acceptance of a submission and retention of the flight intent for planning purposes while, at
2457 the same time, is able to indicate that, for instance, the 4DT does not comply with all
2458 existing constraints. This is intended as a feature of the planning service as it facilitates the
2459 subsequent negotiation of the optimal trajectory.

2460 The content of the message exchanges between NM and the AU is described in more
2461 detail in the following **Table 17**:

2462

Submission response (related to EFPL status)	**Planning Status Message** (related to 4DT)			**Filing Status Message** (related to 4DT)	
	Acceptable (Concur)	*Negotiate*	*Not Acceptable (Non-Concur)*	*Acceptable (Concur)*	*Not Acceptable (Non-Concur)*
Accepted	The desired trajectory is acceptable without the need for modification. This should mean that if the flight plan were to be filed, it would be accepted.	The desired route is acceptable and would be accepted if filed, but the trajectory determined by NM has included additional constraints and/or has applied environmental factors resulting in a different trajectory (negotiating trajectory) returned as feedback. The AU is expected to assess the feedback and determine whether or not it wishes to amend it's desired trajectory	The desired trajectory is not acceptable and would probably result in a rejection or at least an error indication if the flight plan were to be filed. An automatic or manual correction/modifications have been made to the 4DT and returned as the negotiating trajectory in order to make it acceptable.	Flight Plan Filed	ANSP maintains data. Flight plan not eligible
Rejected	The 4D trajectory has not been modified.		Alternative 4DT proposal may be provided by NM as an additional service	N/A	N/A

Table 19 Content description of the exchanges between NM and the AU

6.1.2 The iRBT

NOTE: THIS SECTION DOES **NOT** AIM TO COVER THE FULL SCOPE OF THE IRBT CONCEPT. IT IS DEVELOPED FROM THE NETWORK PERSPECTIVE FOCUSING ON THE TRANSITION FROM ISBT TO IRBT AND THE IMPROVED LINK BETWEEN PLANNING AND EXECUTION

6.1.2.1 Previous operating methods

In current operations, several processes take place in the short-term planning phase impacting the 4D trajectory that is planned to be flown as illustrated below.

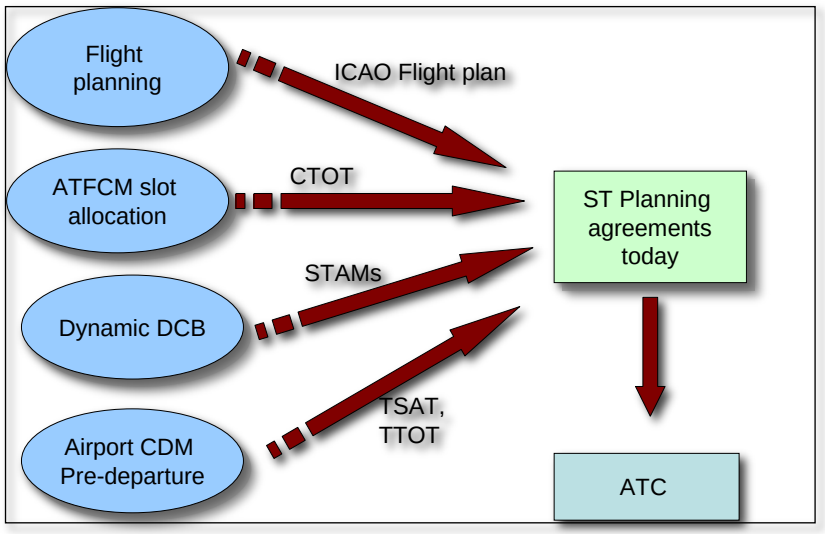

Figure 26: Current “agreements” in short term planning phase

Some remarks on the diagram above:

- The flight plan submission and validation can be considered as an agreement regarding the compliance of the “trajectory” with regard to hard constraints (see more details on the flight planning process in section 4 of this OSED and the IFPS User Manual document)
- The ATFCM slot allocation process impacts the departure time[16] and consequently the 4D trajectory to be flown (see more details in the ATFCM user Manual Document). It must be noted that this process has also an indirect impact on planned 3D routes since for a proportion of the traffic airspace users decide to change the route and/or flight levels in the flight plan to avoid an ATFCM regulation and associated delay[17].
- The assignment of the TSAT and TTOT at CDM airports impacts as well the departure time and consequently the 4D trajectory[18] (see Airport CDM implementation User Manual [25]).
- Local dynamic DCB processes impact trajectories for a limited proportion of the traffic by issuing targeted STAM measures (e.g. re-routing, level capping, see 13.02.03 OSED for more details).

For each flight in ECAC area the Flow Management service (ETFMS system) calculates and updates along its life-cycle (from FPL creation until flight termination) a network planning trajectory which takes

[16] Only for flights impacted by ATFCM regulations
[17] Moreover some re-routing/level capping scenarios are performed through the application of “zero-rate’ ATFCM regulations.
[18] The departure airport CDM process may impact also the allocated SID and consequently the 4D trajectory. This is not further mentioned in this document for simplification purpose.

into account all aforementioned elements (Flight plan, CTOT, TSAT, TTOT, STAM measures) in planning as well as real time traffic events in execution.

This 4D trajectory is primarily used for network traffic demand evaluation purpose. As it is a prediction, not a formal agreement, it cannot be assimilated to the agreed trajectory in planning phase. However, this trajectory is currently the only consolidated 4D trajectory data in the ATM system available integrating all “agreements” concluded in the planning phase.

In the future, considering the introduction of the extended flight plan, this network 4D trajectory should become closer to the agreed trajectory in the planning phase as it will integrate the filed trajectory calculated by the FOC as part of the operational flight plan.

Transition from iSBT to iRBT:

Note: There are different perspectives that currently exists to determine de transition from SBT to RBT (either Step 1 and/or Step 2).In this section only the perspective of 07.06.02 -D56- Step 1 BT OSED is described, see Appendix E for further information on the rest of alternatives.

The iRBT creation is triggered by the AU when submitting a filed flight plan (with a filed trajectory). However the iRBT creation does not corresponds necessary to the transition iSBT/iRBT.

The transition from iSBT to iRBT is envisaged as a progressive and smooth transformation starting when the filing event takes place (the AU submits the filed trajectory approximately 2 hours[19] before EOBT) and therefore the iRBT is created. The transition is completed at the actual off-block time (i.e. when the AU can no longer change the filed flight plan) or when a CDM event occurs at some airports. At this very moment the flight starts to be under ATC control.

The following diagram summarises this option on a flight timeline basis:

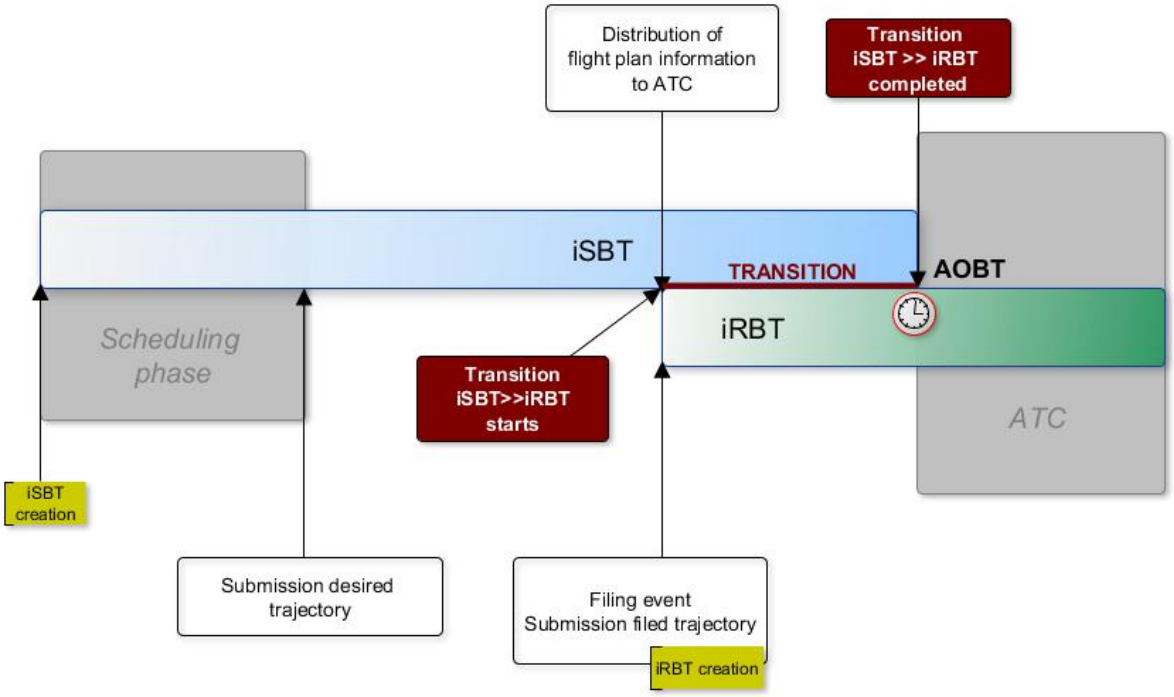

Figure 27 Transition from iSBT to iRBT

In current operations a single milestone cannot be identified corresponding to this transition as there is not a unique integrated agreement process in planning phase. The following milestones are potentially contributing to the progressive transition from iSBT to the iRBT.

[19] This is to be considered only as an order of magnitude

MILESTONE	PROCESS IMPACTED	WHEN	REMARKS
Initial flight plan submission	Flight planning	EOBT -3 Hours	EOBT- 3hours corresponds to a requirement (IFPS user manual) The majority of flight plans are submitted between 6 to 3 hours before EOBT. Around 10% of flight plans are submitted after EOBT -3H.
Publication of the ATFCM slot	ATFCM slot allocation	EOBT -2 Hours	Slot Allocation Message (SAM)
Refuelling completed	Flight operations STAM	Depending on flights and airline 45 minutes before EOBT is an order of magnitude (not standard)	Sometimes, low-cost airlines refuel with the PAX on board very shortly prior STD Once this milestone is achieved, a re-routing/Level capping measure (inducing extra-fuel cost) becomes very costly. Flexibility on a STAM re-routing/level capping measure is highly reduced.
TSAT issuance	Airport CDM process	20 to 40 minutes before off-block	Only a limited number of airports. Procedure depending on airports
"Freeze"[20] of the ATFCM slot	ATFCM slot allocation	Take-off - ~30 minutes	Parameter depending on airports.
Flight enters under ATC control.	Flight planning	Either at take-off or off-block depending on departure airport	Once this milestone is achieved the NM does not accept any submission./change of certain types of information i.e EOBT and/or route from the airspace User. Changes are through ATC.

Table 20: Current milestones for the "transition from iSBT" to iRBT"

Referring to this table, the transition to iRBT can be considered as fully completed at the last milestone is achieved, once the flight enters under ATC control and FPL/iRBT changes are done through ATC.

6.1.2.2 New Operating Methods

6.1.2.2.1 Evolution of "iRBT agreements" (Step 1)

In Step 1 main evolutions impacting Trajectory agreements in short-term planning and execution phase are:

- The move from CTOT to Target Times management.

[20] This is a simplification. See ATFCM user Manual for more details (section 4.3.3. on slot amendment procedures, TIS/TRS parameters)

- The move from current ICAO flight plan towards the iSBT and FF-ICE increment 1 inducing much more detailed trajectory information in flight plan

The progressive implementation of the flight object concept (FO) and associated technical enablers supporting the establishment of a formalised workflow between network decisions and tactical management of the traffic in execution. The filed trajectory and agreed trajectory will be the two main trajectories of interest to be potentially included and distributed through the FO.The following diagram provides an illustration of iRBT elements in Step 1.

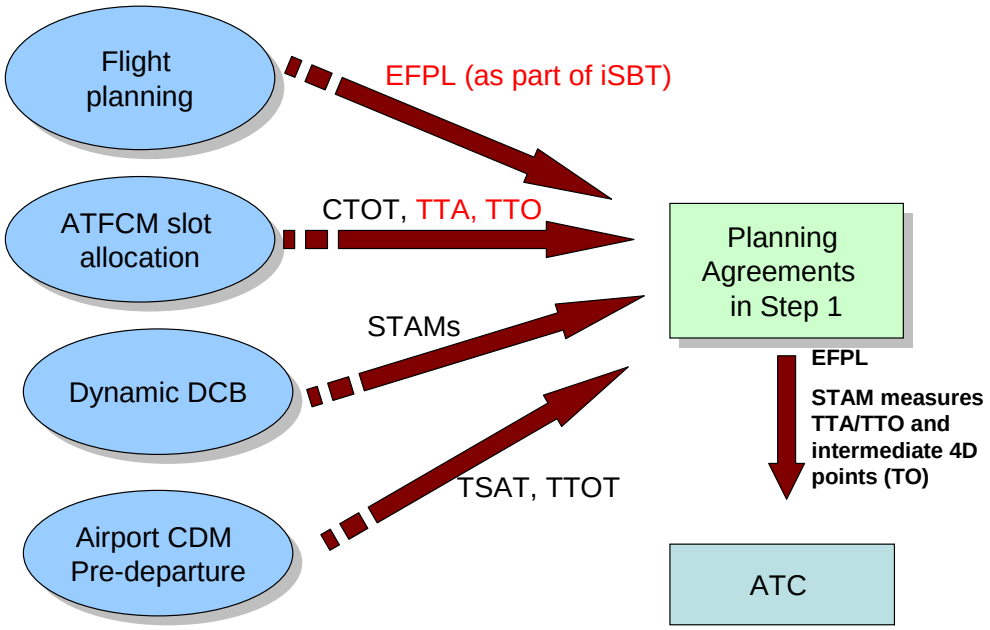

Figure 28: iRBT elements in Step 1

Note: in the diagram 27, intermediate 4D points (TO) are elements of the network planning trajectory.

When the iSBT submission and validation process is completed (i.e. the iSBT is validated in NM flight planning services) the iSBT information (4D trajectory and flight performance data) is distributed to the network DCB service (including to the flow management service) and to ANSPs. It is expected that in a first phase the ANSPs will 'subscribe' to receiving as a minimum the flight performance information that is highly likely to improve their local FDPS trajectory calculation.

The network DCB service uses the iSBT 4D trajectory (and the additional information) and applies DCB (ATFCM slot allocation) providing a CTOT and target times for the traffic subject to constraints[21]. The flight planning constraints (reflecting the ATM/ANSPs constraints along the flight's trajectory) are communicated back to FOC who could respond with an ECHG message taking into account the Target Time. The FOC could decide to absorb part of the delay during the flight execution (for further details see 13.2.3 OSED). The updated 4D trajectory reflects not only the AU 4D trajectory as calculated by the FOC but also the constraints resulted from DCB process (flow management measures), making it closer to an agreed trajectory. This 4D trajectory is then used and updated by the NM systems, and communicated to the ANSPs at regular intervals or whenever necessary. The 4D trajectory updates will also reflect the application of the Dynamic DCB measures, the known ATC constraints (that are not necessarily integrated by the AU), and/or Airport CDM process pre-departure.

In execution, this predicted network 4D trajectory will be updated from local ANSPs trajectory prediction through the flight object.

[21] The CTOT is determined through a back calculation taking into account the Target Time (corresponding to the most penalising regulation) and the flight duration extracted from the Extended Flight plan 4D trajectory. This ensures that the CTOT and the TTs published are consistent with the 4D trajectory planned by the airspace user (filed trajectory).

6.1.2.2.2 Content of the iRBT in Step 1

The following table provides a summary of the content of the iRBT (at the end of the planning phase) in Step 1.

IRBT DATA	TRAFFIC CONCERNED	SUBMISSION / UPDATE PROCESS	REMARKS
GUFI	All	Included in all (extended) flight plan messages	See ICAO FF-ICE documentation
Extended FPL data	All	Similar to submission/validation/update process of current ICAO flight plan (see more details in section 6.1.1.4).	Extended Flight plan data will include all elements detailed in section 4.1.2.1 as well as additional elements (see 6.1.1.4). The data should reflect the application of known ATC constraints.
Real time constraints or ATC constraints/LoAs and Dynamic DCB measures	All	ATC constraints updates and/or dDCB measures to be made available via the NM systems.	The 4D trajectory updates will also reflect the application of the Dynamic DCB measures, and the ATC constraints (that are not necessarily integrated by the AU).
DCB measures and tolerances (ATFCM slot and TTA/TTO)	All regulated flights.	Similar to calculation/update process of current CTOT to which the TT (target time) is appended for a more efficient management of en-route and arrival regulations.	Multiple TT can be provided. The CTOT will continue to be calculated based on the most penalising constraint. CTOT will continue to be used mainly for the interface with the airport of departure. The target times have fixed tolerances attached (much like the situation with the CTOT today). (see also the Assumption 3 above)
TSAT/TTOT	Flight departing from CDM airports	TSAT is published by the CDM airport. See airport CDM manual	No major change in Step 1.

Table 21: Content of the “iRBT” in Step 1

Flight Planning constraints or *Targets Times (TT)* are computed by the network management function to inform the Airspace Users and ATM service providers about constrained resources along the profile. They are the input to the process which leads to the definition of the iRBT which is represented by the *agreed trajectory*. The *agreed trajectory* should be used as a common goal and reference for the execution of the flight by both Airspace Users and ATM service providers.

Transition from iSBT to iRBT:

The table of milestones as presented in the “previous operating methods” section remain unchanged. Only minor changes related to data exchanged.

PROCESS	MILESTONE	WHEN	REMARKS
Flight Plan Submission and Feedback	Extended flight plan submission (corresponding to the medium-term iRBT) in the 'filed state'		EOBT-3 hours is an order of magnitude. No major change of the flight planning lifecycle is foreseen in Step 1. This milestone corresponds also to the creation of the Flight Object and the initial exchange of trajectory constraints information between NM and ANSPs
Flight planning	Provision of update of ATC constraints	EOBT – 2 hours (or before)	ANSPs provide updates of the ATC constraints if any.
ATFCM slot allocation	Publication of the ATFCM slot and TTs	EOBT -2 hours	Multiple TT can be provided. The CTOT will continue to be calculated based on the most penalising constraint. CTOT will continue to be used mainly for the interface with the airport of departure.
Flight operations STAM	Refuelling completed	Depending on flights 45 minutes before EOBT is an order of magnitude.	Once this milestone is achieved, a re-routing/Level capping measure (inducing extra-fuel cost) becomes very costly. Flexibility on a STAM measure is highly reduced.
Airport CDM process	TSAT issuance	20 to 40 minutes before off-block	No change in Step1
ATFCM slot allocation	"Freeze" of the ATFCM slot (CTOT/TTA/TTO)	Take-off – 30 minutes	No change in Step1
Flight planning	Flight enters under ATC control.	At off-block time	No change in Step1

Table 22: Milestones for the "transition from iSBT" to iRBT" in Step 1

6.1.2.3 Use of the FO in support of the new operating methods

6.1.2.3.1 Flight Object Introduction and Background

The 'Flight Object' (FO) is a concept developed to support the sharing of consistent flight data between all stakeholders. Its purpose is twofold: first to ensure that all systems have a consistent view of the flight, and that the data is widely and easily available, subject to appropriate access controls; and secondly to avoid cumbersome and ad-hoc point to point communications.

The fundamental idea is that a single logical entity, the FO is kept up to date by all parties interested to share information about a flight. All parties use the FO as a reference and all keep it updated with the latest information, thereby ensuring that all systems have the most up to date and consistent view of the flight data. This is true for all stages of a flight, from planning through flight execution to

post-flight analysis. However, this single logical FO is physically distributed over a network of 'FO Servers (FOS)', each FOS being associated with an FDPS. Each FOS holds physical copies of the FOs of interest to its clients. The network of FOSs, not the clients, is responsible for ensuring that the different physical copies of the FO are kept consistent. **Similar to the operational rules, for any of the FOs at any one moment in time there will be one single system (Interoperable – IOP system) that is responsible for collecting the agreed changes to the FO, updating the FO information ensuring consistency and publishing the updated FO to the subscribed partners. This is the 'Flight Data Manager Publisher (FDMP)' role. While one system is the FDMP for the FO, the other IOP systems interested by that FO are either having the role of 'Flight Data Contributor (FDC)' or 'Flight Data User (FDU)'. The FDC is an IOP system whose area of responsibility is traversed by the FO and as such it is eligible/entitled to propose updates to FO resulting from operationally agreed changes. A FDU can only subscribe to a complete FO and receive FO updates – its area of responsibility is not necessarily traversed by the FO.**

Conceptually the FO is intended to hold all flight data that needs to be shared between any interested stakeholders: Civil ATC, Military ATC, Flow Management Systems, Airport Operators, Airspace Users and Aircraft Systems. However, this is not to say that all stakeholders will deploy/implement FOSs.

Initially the FOS implementation is planned for the NM and some ATC systems. As such a solution for bridging the ANSPs FO information with the AUs, Military ATC and Airports is needed - the NM would be best placed to fill such a role with the FOS development.

In 2008 a study has been undertaken to consider how best to integrate a NM FOS with the set of FOSs, and as such inclusion of NM in the IOP Area (InterOPerability Area). The study had been performed in the current concept of operations. As result, the study defined a set of principles for how the ATC and the NM systems would interact and it defined a set of basic requirements for the NM FOS.

Fundamental to SESAR Step 1 improvements is a more accurate and continuously updated network operations planning properly disseminated to actors in the execution phase (thus involving them in the implementation of the target times), aiming to reduce the 'gap' between planning and execution. If planning represents execution better, higher quality ATFCM measures can be expected, increasing the added value of the network planning and coordination and therefore increasing the efficient utilisation of network resources, thus improving network operations performance.

6.1.2.3.2 FO Scope in Step 1

The FO development is planned under SESAR Step 2 however, initial development and validation of prototype ATC FOSs and the NM FOS have been started already during SESAR Step 1 timeframe, and address 3 areas of improvement.

Communication of flight planning constraints (e.g. target times like TTO or dDCB measures like STAM measures) and derived measures (e.g. CTOT) to relevant actors as targets, aiming to ensure that the execution of the flight is performed in line with the plan - which would improve the network optimised performance. The NM FOS will have the capability of including (during pre-departure phase) target times like TTO/TTA, to be used by ATC, and updates/revisions of that target time during the flying phase of the flight. (This represents the validation of the NM FOS role of Flight Data Manager Publisher (FDMP) and/or Flight Data Contributor (FDC), where NM provides constraints for inclusion to a FO.).

Communication of the filed trajectory received from the Airspace Users via the EFPL, to relevant actors (including the flight's performance data). Update the 4D trajectory with flight planning constraints before the flight's departure and make the information available to the relevant actors. The aim is to enrich the plan before the departure with more accurate information that helps moving

forward towards time based operations, thus improving the flight plan adherence. EFPL data will also allow ATC in execution to improve its operations through a better awareness of flight intentions and performance parameters (see [21] for more details).

Network planning trajectory enriched with local ANSPs information on constraints and procedures affecting the trajectory. This will allow reducing the gap between the different trajectories in the ATM system and improving efficiency of network monitoring and DCB/dDCB processes.

6.1.2.3.3 General Validation context

6.1.2.3.3.1 Validation exercise for VP-714

According to the results of the VR-714 [37], the exercise managed to achieve most of the initial purposes:

- Flight Object concept has been proven to be technologically feasible
- Integrating NM in the FO-network could allow ATCOs to visualize valuable TTO/TTA information.
- Exchanging information through FO mechanisms improves NM traffic prediction. By using Flight Object mechanisms, local constraints are taken into account in an early stage of the flight. NM traffic predictions improvement will increase the efficiency of both network and local processes (e.g local DCB/complexity management tools, XMANs) since NM traffic predictions are increasingly used as input by these local processes (e.g. use of EFDs.)
- NM-ATC interoperability improved although the current scope of the exercise was not fully representative for the target operational concept.

6.1.2.3.3.2 Current maturity level

VP-714 exercise has been assessed as TRL3 (Technology Readiness Level) and although a TRL4 assessment was also performed, TRL4 has not finally been achieved.

Hence, the FO concept, considered as a supportive pillar for iRBT, presents maturity level V2.

6.2 Detailed Operational Scenarios / Use Cases

6.2.1 Detailed Operational Scenarios

The Operational Scenario covers the communication and monitoring of flight planning measures as target times (e.g. TTO/TTA) and DCB/ATFCM measures to relevant actors as targets, aiming to ensure that the execution of the flight is performed in line with the plan - which in turn would improve the network optimised performance and predictability.
The NM systems receive EFPLs from the FOCs (which are compliant with the hard constraints) and based on known regulated areas, NM calculates the target time per flight to enter in that congested location and/or the correspondent CTOT. The NM systems will also compute TOs (Time Over) for the entry points of the flights in each ANSPs' Area of responsibility along the flights' routes. These are derived intermediate 4D points that would be used to ensure consistent view on the trajectory calculated by each IOP system. The constraints (TTs, DCB measures) communicated to the FOC will amend the original EFPL and the FOC could provide an updated EFPL taking them into consideration.
The TTs and the calculated TOs may require to be updated or reviewed both in the pre-flight phase but also during the flight execution phase -as result of the flight execution monitoring and ATC interventions-. In the pre-flight phase the updates can result, for instance, from slot recalculation/reallocation, AU input, re-routing. while in the flight execution phase the updates can result for example from planned or tactical STAM measures applied during flight execution, new ATC constraints. The updates in the execution phase are always at the initiative of the LTM (or tactical ATC). The updates will have to be properly communicated to all involved/concerned partners.

The monitoring of the TT for the flights in execution is performed essentially by the NM but ATC also may have a limited role. The NM system will provide ATC systems with updated information on the estimated time over the locations subject to TTs.

6.2.2 From EFPL planning and filing to flight execution

Two scenarios have been developed in order to represent the steps of a EFPL from submission in planning and filing state in the pre-flight phase to EFPL steps in tactical.

- **SCN A: Submission to planning service and filing**. In this use case the AU submit a EFPL to planning services prior to filing and it is subject to a STAM in short term planning and a regulation in the arrival airport;
- **SCN B: STAM scenario (flight in execution)**. In this use case the flight is already airborne and it is subject to a STAM measure (e.g. Flight Level capping)

6.2.2.1 SCN A: Submission to planning service and filing

In this scenario an aircraft departing from an airport (A-CDM or not) is addressed and subject to a STAM in short term planning and a TT due to an arrival ATFCM regulation.

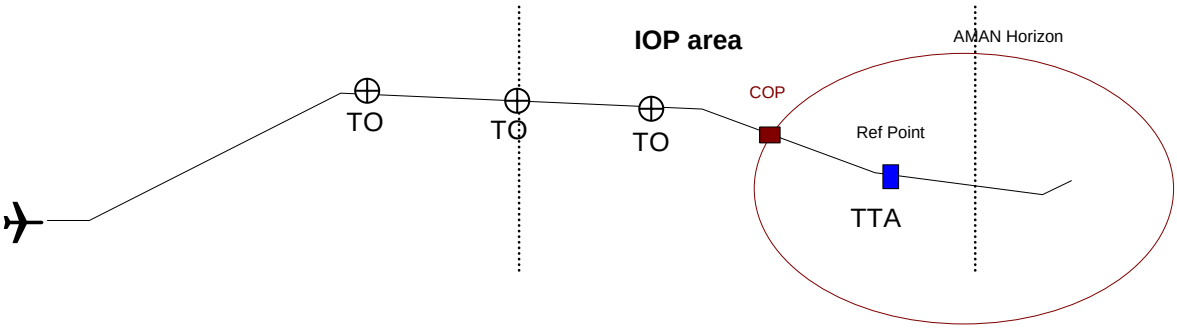

Figure 29: EFPL planning and filing scenario illustration

The flight trajectory traverses both IOP and non-IOP areas and the NM FOS will maintain the FDMP role until the flight enters the first IOP ANSP.Notes:

- "Flight crew" and ATCOs actors are not specifically addressed in the scenario (although in the use cases it is proposed that pilots are made aware of the TT, while controllers are informed of the flights subject to TT),
- "B2B" includes all the communication means available at network level (e.g. B2B Web services)
- "TOs": Time Over for the entry points of the flights in each ANSPs' FIR/Areas of responsibility along the flights' routes. TOs must not be confused with TTOs. TOs are not DCB measures, only means of synchronising trajectories and additional means for monitoring adherence to the RBT.
- **Times of event are provided just as indication to give an order of magnitude.**
- The events included in the table below are examples to provide concrete indications of the "timeline", but they are not corresponding to operational parameters (apart from the TT/CTOT publications time at EOBT-2 hours)
- The flight is intra ECAC area[22]

Event#	Event time	Actors	Actions	Com.	Remark
1	Dday-1	NM	Activation of the arrival ATFCM regulation (non	NOP	This step is just to indicate that the arrival ATFCM regulation is

[22] Due to lack of time, no operational scenario has been developed with traffic arriving from out of the ECAC area, although it was suggested as an interesting use case.

Event#	Event time	Actors	Actions	Com.	Remark
			flight specific). Publication in the NOP		already published when the initial EFPL is sent but it is provisional.
2	EOBT-X hours	FOC	Submit the Preliminary Flight Plan including a desired trajectory in planning state.	B2B	The desired trajectory is required to comply only with hard constraints like RAD, CDR/airspace closures which are published before FOC's submission of the Preliminary Flight Plan.
3	EOBT-X hours	IOP ANSP	Provides updated ATC constraints (primarily FL constraints)	FO	
4	EOBT-X hours	NM	Provide to FOC a planning status message including: - "Negotiate" status - Reference to the ATFCM regulation - Negotiating trajectory - Applied "soft" constraints (flight specific) on the negotiating trajectory	B2B	The negotiating trajectory integrates soft constraints (PTRs) but not the provisional ATFCM delay because it is unstable. The status is" Negotiate" because of the ATFCM regulation. Otherwise the status would have been "Concur"
5	EOBT- 2 hours	NM	Publish the CTOT and/or TTs and updated ATC constraints to FOC	B2B	The CTOT would be backward calculated from the TT using the EFPL 4D trajectory times
6	EOBT- 2 hours (ATFCM parameter SIT 1)	NM	Provide to FOC updated planning status message including: - "Negotiate" status - Negotiating trajectory - Target Time and/or CTOT - Applied "soft" constraints	B2B	The negotiating trajectory integrates: • the ATFCM delay • "soft" constraints like PTRs. If the time shift due to the ATFCM delay invalidates the flight plan (e.g. move it into an active military area) then the status is "Non-Concur". Optionally the NM can provide back a negotiating trajectory proposal. Note: the CTOT (if any) is backtrack calculated using EET information in the AU negotiating trajectory.

Event#	Event time	Actors	Actions	Com.	Remark
7	EOBT – 1 H45mn	FOC	Re-optimise the trajectory taking into account feedback from NM and submit a negotiating trajectory in a trial request with modified vertical profile, weights, speeds, times complying with the TT.	B2B	**Optional step: TRIAL REQUEST** Only if the AU considers it is relevant to re-optimise the flight due to the target time/delay received. The submission in that case can be viewed just as a what-if since it is a negotiating trajectory. If the AU doesn't send any new desired trajectory then by default NM will consider that there is just a "shift" of the departure time to comply with the TT.
8	EOBT – 1 H 45mn	NM	Provide to FOC planning status message including: - "Concur" status - Agreed trajectory - Applied "soft" constraints	B2B	
9	EOBT – 1 H 40mn (time decided by the FOC)	FOC	Submit a filed flight plan with a filed trajectory	B2B	The filed trajectory should be the same than the agreed trajectory submitted in step 8.
10	EOBT – 1 H 40mn	NM	Provide to FOC a filing status message with: ➔ "Concur" status ➔ Agreed /Filed trajectory ➔ Applied "soft constraints" (PTRs)	B2B	
11	EOBT-1 H 40mn	NM	Create FO and disseminate the filed EFPL as well as TTs and agreed/filed trajectory to ATS units/airports only for information.	B2B&FO	
12	EOBT-1 H 40mn	NM	Publish a new TT/CTOT based on AU departure time proposal included in the updated filing status message	B2B&FO	The CTOT is backward calculated from the TT using the EFPL 4D trajectory times

Event#	Event time	Actors	Actions	Com.	Remark
13	EOBT-40 mn	CDM airport	Publishes the TSAT. Dissemination of TSAT and TTOT at network level through existing means (DPIs)	B2B	Only impacts DCB traffic predictions. No direct impact on filed/agreed/negotiating trajectories apart from the case when the TSAT triggers a revision of the TT and CTOT. In that case the scenario goes back to Step 4. (to be discussed for the case of a flight not involved in any ATFCM regulation)
14	EOBT – 35 mn	NM	Publishes the STAM measure – FL cap– it is sent within a filing status message to the FOC	B2B&FO	The STAM measure will be the result of a a CDM process and published as a negotiating trayectory within a element to the AU
15	EOBT-30mn	FOC	Provide a new filed trajectory in the filed EFPL in accordance to the STAM measure	B2B	
1	EOBT – 30mn	NM	Provide to FOC an updated filing status message including: - "Concur" status - Agreed trajectory - Applied "soft constraints" (PTRs)	B2B	
17	EOBT-30 mn	NM	Update FO (EFPL, TT, TOs) and disseminate the EFPL information.	FO	The update also reflects/includes e.g. the ATC constraints, STAM measure.
18	EOBT-30 mn	NM	Disseminate EFPL information to non-IOP ANSP unit (EFPL, TT, TOs)	B2B&FO	
19	OBT- 10 mn	APT CDM	Transfer control to ATC	FO	Could correspond for example to the pre-departure clearance. The procedure will vary depending on the airport.

Table 23 EFPL planning and filing steps

Next table continues with the execution phase after the planning and filing:

Event#	Event time	Actors	Actions	Com.	Remark
21	At first flight departure information (FSA/CPR/ATC activation) around the CTOT(if any)	NM	Update the ETO at the TT location based on the ATOT information. *Note: the updating of the ETO at the TT location is part of the NM monitoring of flight adherence to the TT.*	B2B&FO	Based on this information, the IOP ANSPs will compute and provide the ATC with the TT Deviation (in accordance to assumptions in

Event#	Event time	Actors	Actions	Com.	Remark
			.		6.1.2.2.1.1)
22	During execution TT – 1H20	LTM or TMA manager (non-IOP)	Propose a revised TT		
23	During execution TT – 1H20	NM	Disseminate revised TT & updated TOs information to ANSP units Note: if NM is still FDMP, it will update the FO; if NM is FDC it will propose inclusion of updated TT and TO in the FO to the FDMP.	B2B & FO	
24	ETA – 40 mn (entry in AMAN horizon)	Arrival TMA	Publish CTA (See scenarios developed by WP4/WP5.)		
25	All along execution	IOP ANSP	Update the FO information (including trajectory) according to the flight execution and ATC clearances. NM gets updates via NM FOS enabling NM to perform the monitoring of the flight adherence to TT.	FO	

Table 24 Execution phase after planning and filing

6.2.2.2 SCN B: STAM scenario (flight in execution)

In this scenario we address an aircraft subject to a STAM rerouting in execution (airborne phase). The first IOP-ANSP is the FDMP.

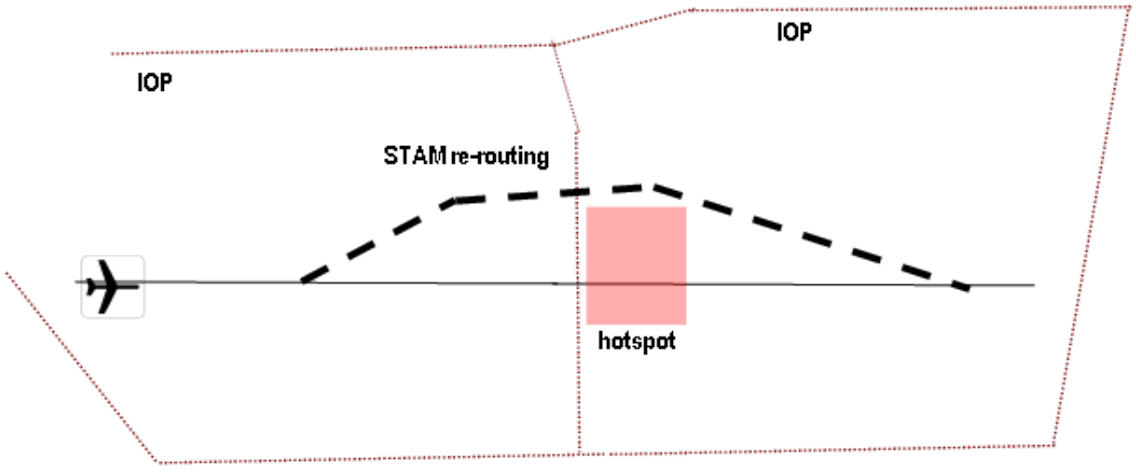

Figure 30: STAM scenario illustration

The re-routing affects two IOP areas. The flight is within an IOP area when the re-routing is agreed and needs to be implemented,

Notes:

- "flight crew" and ATCOs actors are not addressed in this scenario
- "Entry time" is the time at which the flight is expected to enter in the hotspot/problematic area

Event#	Event time	Actors	Actions	Com.	Remark
1	Entry time – 1 Hour	FMP	Initiate a CDM process for STAM re-routing measure. The IOP ANSPs uses FO mechanisms for the coordination and agreement of the measure (what-if FO).	B2B & FO	
2	Entry-time – 50 mn	Concerned FMPs and NM	Agree on the STAM re-routing measure (see 13.02.03 OSED for more details)	FO &B2B NM coordination means	
3	Entry–time - 45mn	IOP-ANSP unit	Updates the local system flight plan according to the agreed STAM rerouting (agreed What-if FO) and the transfer condition to the next IOP ANSP Unit.	FO	
4	Entry–time - 45mn	IOP-ANSP unit	Updates and communicates the FO according to the implementation of STAM rerouting, indicating if necessary that the flight is subject to a STAM measure.	FO	
5	Entry–time - 45mn	NM	Update the 'network view' according to the FO trajectory information received.	B2B & FO	

Table 25: STAM scenario steps

6.2.3 Detailed use-cases

6.2.3.1 Use Case 1 – Flight information (including TTs) exchange and updates before departure

Note: It includes a STAM measure affecting some flights in the pre-flight phase.

Actors Involved

- NM, one IOP ANSP, FOC

IOP Roles

- NM is the FDMP
- IOP ANSP is the FDC

General conditions:

- **GC1 -** At least one Downstream ANSP is IOP.
- **GC2 -** The flights' trajectories traverse the AoR of the Downstream ANSP that is IOP.
- **GC3 -** The flights are subject to DCB measures (flow regulations).
- **GC4 -** Some of the flights are subject to STAM measures (pre-flight phase)

Pre-conditions:

- **PreC1 -** Flights are in the pre-flight phase.
- **PreC2 -** The NM systems compute the TTs, TOs and CTOTs for the flights based on their EFPLs and the regulations (protecting en-route airspace and/or the destination aerodrome).
- **PreC3 -** The IOP ANSP and the NM can exchange FOs information.
- **PreC4 -** The TTs and TOs are revised in pre-flight phase

Post-conditions:

- **PostC1 -** Target times computed by the NM systems were communicated and made available to the ATCO, the pilots and AU.
- **PostC2 -** Updated target times were communicated and made available to ATCO, the pilots and AU.
- **PostC3 -** FO information updated based on the agreed STAM measure (FL cap)
- **PostC4 -** The NOP is updated according to the FO trajectory information.

Operating method:

Based on the EFPL/FPL submitted by the AU, the NM systems calculate TTs, CTOTs and TOs over points that have operational significance for the ATCO, i.e. are published waypoints. The TOs are calculated over published waypoints that are at the boundary between two ANSPs. The TTs will be calculated as described in the 13.02.03 OSED.

The TTs are communicated to the AU/FOC together with, and in the same time as the CTOT (e.g. 2h before EOBT). The AU/FOC updates the EFPL to comply with the TTs. The AU/FOC communicates the TTs to the pilot. The TO and the TTs are communicated to the IOP ANSP through the NM FOS upon FO creation (a parameter time before the EOBT, e.g. 90 min. before EOBT will be used for the validation exercise). The FO will be created based on and will include the information provided in the FPL/EFPL; i.e. 4D trajectory information (amended with the flight planning constraints), additional performance information from the EFPL (e.g. weight at waypoints, speed).The ATCOs of the IOP ANSP is informed of the TO and the TTs when the flight is activated in their system (or a time parameter before) – for details on the ATCOs involvement in monitoring of TT see 6.1.2.2.1.1.

Upon receiving the FO, the IOP ANSP communicates updated constraints for the flights with impact on the flight profile. The respective FOs are updated (the update includes all the parameters of the flight profile that are impacted by the planed change). The NM updates the 'network view' according to the FO trajectory information.

The NM systems receive a CHG/ECHG message that impacts the flight profile and the flight planning constraints (TTs, CTOT). The respective FOs are updated and communicated to the IOP ANSP (the update includes all the parameters of the flight profile that are impacted by the planed change).

The updated target times (and agreed trajectory) are communicated to the concerned partners – AU/FOC and the IOP ANSP. The FOC communicate the revised TT to the pilot. The updated TO and TT are made available to the IOP ANSP when the flight is activated in their system (or a time parameter before).

Note: the communication of the TT to the pilot could also be done by the tower controller of the departure aerodrome however it is believed that a communication via the AU (who can afterwards send an ACARS message to the pilot) is quicker.

35 min before flights' departure the LTM activates a STAM measure without impact on the TT –a FL capping affecting some of the flights. The FL constraint is proposed for inclusion in the FO by the IOP ANSP. NM updates the respective FOs with the FL constraint and communicates to the IOP ANSP.

6.2.3.2 Use Case 2 – Monitoring of the TTs during flight execution

Actors Involved

- NM, one IOP ANSP, AU/FOC

IOP Roles

- NM is the FDMP
- IOP ATSU is the FDC
- IOP FDMP role is transferred to the first IOP ATSU and NM becomes FDC

General conditions:

- **GC1 -** At least one Downstream ATSU is IOP.
- **GC2 -** The flights' trajectories traverse the AoR of the Downstream ATSU that is IOP.
- **GC3 -** The flights are subject to DCB measures (flow regulation) protecting an en-route airspace.

Pre-conditions:

- **PreC1 -** Flights are in the flight execution phase.
- **PreC2 -** Target times computed by the NM systems were communicated and made available to ATCOs, the pilots and AU (see Use Case 1 above).
- **PreC3 -** The IOP ATSU and the NM can exchange FOs information.
- **PreC4 -** The flights' adherence to the TT is monitored by the NM.

Post-conditions:

- **PostC1 -** The updated ETOs at the TT location are provided by NM
- **PostC2 -** The TT Deviation are made available to ATCOs.

Operating method:

At flight departure information (FSA/CPR/ATC activation) provided to the NM systems, the NM updates the ETO at the TT location based on the ATOT information and provides it through the FO update.

When the flight is in execution, NM receives a CPR that triggers the update of the ETOs at TT location and distribute the Target Time related information through the flight object.

Note 1: The previous sentence corresponds clearly to a non-agreed assumption. 7.6.2 validation objective related to that use case will be limited to assess the feasibility to distribute the Target Time related information to ATC through the flight object .

Note 2: The NM remains responsible of FO updates after flight departure until a parameter time before the flight enters the AoR of the first IOP ANSP.

The flight is now under the responsibility and control of the ATCO of the IOP ANSP. (i.e. the FDMP role is transferred to the IOP ANSP and NM becomes FDC). NM will continue to contribute with updated ETOs to updates of the FO whenever deviations are identified.

6.2.3.3 Use Case 3 – TT exchange with updates after departure

Actors Involved

- NM, two adjacent IOP ANSPs (ANSP1 and ANSP2), AU/FOC

IOP Roles

- NM is the FDMP
- IOP ANSPs are FDC
- IOP FDMP role is transferred to the ANSP1 and NM becomes FDC

General conditions:

- **GC1 -** At least two adjacent Downstream ANSPs are IOP.
- **GC2 -** The flights' trajectories traverse the AoRs of the ANSP1 and ANSP2.
- **GC3 -** The flights are subject to DCB measures (flow regulation) protecting an en-route airspace.

Pre-conditions:

- **PreC1 -** Flights are in the flight execution phase.
- **PreC2 -** IOP FDMP role is transferred to ANSP1 and NM becomes FDC
- **PreC3 -** Target times computed by the NM systems were communicated and made available to ATCOs, the pilots and AU (see Use Case 1 above).
- **PreC4 -** The IOP ANSPs and the NM can exchange FOs information.
- **PreC5 -** The flights' adherence to the TT is monitored by the NM.

Post-conditions:

- **PostC1 -** The updated ETOs at the TT location are provided by NM
- **PostC2 -** The TT Deviation is provided to ATCOs.
- **PostC3 -** The revised TT time value is communicated (included in the FO)

Operating method:

At flight departure information (FSA/CPR/ATC activation) provided to the NM systems, the NM updates the ETO at the TT location based on the ATOT information and provides it through the FO update. The TT location is in the ANSP2 AoR.

When the flight is in execution, NM receives a CPR (flight is in a non-IOP ATSU AoR) that triggers the update of the ETO at TT location and distribute the Target Time related information through the flight object.

Note: The NM remains responsible of FO updates after flight departure until a parameter time before the flight enters the AoR of the first IOP ANSP.

The flight in now under the responsibility and control of the ATCO of the ANSP1. (i.e. the FDMP role is transferred to the first IOP ANSP and NM becomes FDC). This ANSPs (as contributor) indicates a modification (e.g. ATC constraint, small re-route inside its AoR) in the plan that impacts the ETO at the TT. As the TT is located in its own AoR it is assumed that the deviation is acceptable and required, as such this modification in the plan is translated in a revision of the TT itself. The FO is updated and communicated. Based on this information NM will provide a revised TT value to be included in an updated FO. ANSP1 updates the FO.

Note: The modification of the plan initiated by the ANSP2 can be originated either by the LTM or ATCO.

6.2.3.4 Use Case 4 – STAM measure for flight in execution

Actors Involved

- NM, two adjacent IOP ANSP (ANSP1 and ANSP2), FOCs

IOP Roles

- NM is the FDC
- The first IOP ANSP (ANSP1) is the FDMP

General conditions:

- **GC1 -** The ANSP1 and ANSP2 are IOP.
- **GC2 -** The flights trajectories traverse the AoRs of the ANSP1 and ANSP2.
- **GC3 -** ANSPs involved are applying STAM for flights in execution.

Pre-conditions:

- **PreC1 -** Flights are in the flight execution phase.
- **PreC2 -** The flights are subject to STAM measure due to a 'hotspot' in the ANSP2
- **PreC3 -** The IOP ANSPs and the NM can exchange FOs information.

Post-conditions:

- **PostC1 -** The STAM measure coordination is done using FO mechanisms (e.g. What-if FO) between the ground systems involved in the CDM process.
- **PostC2 -** The agreed STAM measures are reflected in the FO, and the flights are indicated as being subject to STAM measure.
- **PostC3 -** The NM updates the NOP in accordance with the updated FO trajectory information received.

Operating method:

The FMPs/LTMs, FOC and NM agree on a STAM rerouting initiated by ANSP2 for a flight – details about the identification and activation of a hotspot are in the 13.02.03 OSED. The FMPs/LTMs and NM coordinates the STAM measure using What-if FO mechanism.

The ANSP1 (who has the flight under control) implements the STAM measure in the system flight plan and implicitly updates the FO information. The updated FO is communicated to the NM (this includes the updated 4D trajectory). The flight will be 'flagged' as subject to STAM measure in the FO information. The flight follows the STAM measure as instructed by the controlling ATCO.

The NM updates the flight's 4D profile in accordance with the updated FO information (essentially outside the IOP area). This will result in providing updated flight's profile information to the non-IOP partners – via EFD messages. The update will also be reflected in the network view (e.g. via CHMI).

6.2.3.5 Use Case 5 – Target Times exchange and replaced by CTA/CTO

Note: this use case requires further coordination with the WP 5 and WP 6. It is added here as a proposal for discussion with the WPs mentioned.

Actors Involved

- NM, one IOP ANSP, FOCs

IOP Roles

- NM is first the FDMP then the FDC
- IOP ANSP is first the FDC then FDMP

General conditions:

- **GC1 -** At least one Downstream ANSP is IOP.
- **GC2 -** The flights trajectories traverse the AoR of the Downstream ANSP that is IOP.
- **GC3 -** The flights are subject to DCB measures (flow regulation) protecting the destination aerodrome.

Pre-conditions:

- **PreC1 -** Flights are in the pre-flight phase.
- **PreC6 -** The NM systems compute the TTs and CTOTs for the flights based on their FPL/EFPLs and the regulation protecting the destination aerodrome.
  Note: the TTA is calculated over a point that is in the IOP-ANSPs AoR.
- **PreC2 -** The IOP ANSP and the NM can exchange FOs information.
- **PreC3 -** The destination aerodrome has implemented AMAN to sequence arriving traffic.

Post-conditions:

- **PostC1 -** Target times computed by the NM systems were communicated and made available to the ATCOs, pilots and the FOCs.
- **PostC2 -** The Downstream IOP ANSP communicates the CTA replacing the TTA.
- **PostC3 -** 'The NOP is updated according to the FO trajectory information.

Operating method:

The NM systems calculate TTs, CTOTs and TOs over points that have operational significance for the ATC, i.e. are published waypoints. The TOs are calculated over published waypoints that are at the boundary between two ANSPs. The TTs will be calculated as described in the 13.02.03 OSED.

The TTs are communicated to the AU/FOC together with, and in the same time as the CTOT (e.g. 2h before EOBT). The AU/FOC updates the EFPL to comply with the TTs. The FOC communicates the TT to the pilot. The TO and the TTs are communicated to the IOP ANSP through the NM FOS upon FO creation (a parameter time before the EOBT, e.g. 90 min. before EOBT will be used for the validation exercise). The FO will be created based on and will include the information provided in the FPL/EFPL; i.e. 4D trajectory information (amended with the flight planning constraints), additional

performance information from the EFPL (e.g. weight at waypoints, speed). The ATCOs of the IOP ANSP is informed of the TO and the TTs when the flight is activated in their system (or a time parameter before) – for details on the ATCOs involvement in monitoring of TT see 6.1.2.2.1.1.

The ADES AMAN is fed with TTs resulting from the ADES regulation. AMAN is using that information to pre-plan the arrival sequence. As the flight progresses NM monitors the flight adherence to the TT and provides updated ETOs at the TTs location – including the TT that is of interest for the AMAN. The AMAN system (using its logic and rules) computes a CTA or CTO for the flight and communicates it to the IOP ANSP. The IOP ANSP controller communicates the CTA/CTO to the pilot and updates the system flight data with this information (the TT is replaced by the CTA/CTO). The pilot inputs the CTA/CTO as RTA[23] in the aircraft's Flight Management System and confirms if the RTA is achievable. The updated information (resulting from the CTA/CTO) will also be reflected in the network view (also available to the AU).

6.3 Requirements

6.3.1 Operational requirements

[REQ]

Identifier	REQ-07.06.02-OSED-0003.0010
Requirement	The iSBT shall contain all flight information that is required to be shared by the airspace user for the planning phases of the flight in the context of SESAR Step 1 time-based operations.
Title	General requirement regarding the content of the iSBT.
Status	<In Progress>
Rationale	iSBT (initial SBT) is the implementation of the SBT for the SESAR Step 1.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0003.0020
Requirement	The iRBT shall contain all flight information that is required to be shared for the execution phase of the flight in the context of SESAR Step 1 time-based operations
Title	General requirement regarding the content of the iRBT.
Status	<In Progress>
Rationale	iRBT (initial RBT) is the implementation of the RBT in the SESAR Step 1.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[23] Prerequisite: Aircraft is equipped with the RTA Functionality

<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0001	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0003.0030
Requirement	The iSBT and iRBT content, rules and procedures shall comply with the ICAO provisions developed in the context of FF-ICE increment 1
Title	Compliance with ICAO provisions
Status	<In Progress>
Rationale	iSBT developments in particular shall be aligned with ICAO FF-ICE developments to ensure global interoperability
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0003.0040
Requirement	The flight information included in the iSBT and iRBT shall be formatted as specified in the FIXM model for the FF-ICE increment 1.
Title	Compliance with FIXM standard
Status	<In Progress>
Rationale	FIXM is the standard for flight data exchanges supporting ICAO FF-ICE concept implementation
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0003.0050
Requirement	The Network Manager shall ensure the interoperability of the flight information contained in the iSBT and iRBT with other regions of the world, in the pre-departure phase of the flight
Title	Interoperability with outside ECAC regions
Status	<In Progress>
Rationale	Interoperability must be ensured in particular for intercontinental flights.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0003.0060
Requirement	The NM shall publish in the NOP iSBT and iRBT information. Some elements of the iSBT/iRBT shall be subject to restricted access. These elements are the aircraft weight information and flight specific performance data.
Title	Publication of iSBT/iRBT in the NOP and restricted access
Status	<In Progress>
Rationale	iSBT and iRBT need to be accessible either through HMIs (e.g. NOP portal, CHMI) and systems to systems interface (e.g. B2B). Some elements may of restricted access (see REQ-07.06.02-OSED-0001.0012 - flight performance data protection)
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0004.0010
Requirement	As soon as the schedule information is stabilized, a schedule airline shall publish an iSBT per "repetitive" flight leg. The iSBT shall include the following information: commercial flight designator, period of operation, days of operation, service type, aircraft Type, ADES, ADEP, schedule Time of Aircraft Departure and Arrival, airport slots (optionally)
Title	First submission of the iSBT for scheduled airlines in medium-term planning
Status	<In Progress>
Rationale	Schedule information is considered at part of the SBT data and is required to improve traffic prediction in medium-term planning phase.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0004.0020
Requirement	As each change of the airline schedule, the AU shall update the iSBTs of impacted flight legs.
Title	Updates of the iSBT for scheduled airlines in M-T planning

Status	<In Progress>
Rationale	Schedule information is considered at part of the SBT data and is required to improve traffic prediction in medium-term planning phase.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0004.0030
Requirement	At the first or any subsequent iSBT publications, the iSBT shall include optionally the Airspace Users Nominal preferred Route (NPR) information (including flight levels)
Title	Inclusion of NPR information in the iSBT
Status	<In Progress>
Rationale	Nominal preferred route information is required to improve traffic prediction in medium term planning phase and to support CDM processes in medium-term planning phase.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0004.0040
Requirement	The AU shall optionally update the iSBT with corrected NPR information in case of environment change invalidating the route
Title	Update of NPR information in the iSBT
Status	<In Progress>
Rationale	Valid nominal preferred route information is required to improve traffic prediction in medium term planning phase and to support CDM processes in medium-term planning phase.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0004.0050
Requirement	The NM shall check the content of each iSBT update in medium-term to verify that is syntactically (format) and semantically (compliant with air navigation environment and ATM constraints) correct. The results of the iSBT check shall be sent back to the Airspace Users.
Title	Validity check of the iSBT sent by the AU in M-T planning phase
Status	<In Progress>
Rationale	In medium-term planning phase there is not a formal validation/acceptance process of the iSBT. Errors and inconsistencies will be notified to the airspace Users with a recommendation to correct the iSBT.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0004.0060
Requirement	In case of change of the ATM environment and constraints (e.g. at each AIRAC cycle), the NM shall check the validity of already received SBTs and shall sent the results of the check to the airspace user.
Title	Validity check of the iSBT in M-T planning phase in case of change of the ATM environment
Status	<In Progress>
Rationale	In medium-term planning phase there is not a formal validation/acceptance process of the iSBT. Errors and inconsistencies will be notified to the airspace users with a recommendation to correct the iSBT.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0004.0065
Requirement	The ATM environment and constraints shall be made available at least several AIRAC cycles in advance to allow proper planning for the Airspace Users.
Title	Anticipated share of ATM environment and constraints
Status	<In Progress>
Rationale	To ensure the validity of iSBT data provided by Airspace Users in medium-term planning phase.
Category	<Operational>
Validation Method	<Live Trial>

Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0004.0070
Requirement	The NM shall use iSBTs information and merge it with other source of traffic data to generate consolidated network traffic demand forecast.
Title	Consolidated Network demand forecast in medium-term planning using iSBT
Status	<In Progress>
Rationale	In medium-term iSBT will be available only for a proportion of the traffic. So other sources of traffic data (e.g. Innovata, historical data, …) must be used in complement.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0004.0080
Requirement	The NM shall publish in the NOP consolidated traffic demand forecast that can be accessible either through a HMI or system-to-system interface.
Title	Publication of consolidated traffic demand and ATM constraints in the NOP
Status	<In Progress>
Rationale	Consolidated traffic demand forecast are required by stakeholders to implore their planning process (airports, Airspace users, ANSPs)
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

REQ]

Identifier	REQ-07.06.02-OSED-0004.0090
Requirement	The NM shall provide planning and filing status messages integrating feedback on FPL route/4D trajectory assessment including soft constraints and DCB measures applied to the flight
Title	NM flight planning services - Reply messages including feedback to AUs
Status	<In Progress>

Rationale	To reach FPL route/4D trajectory consensus. Compliance with ICAO FFICE provisions
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

REQ]

Identifier	REQ-07.06.02-OSED-0004.0100
Requirement	The NM shall check the impact of time-based DCB measures (e.g. CTOT or Target Times) on the compliance of the 4D trajectory with other published hard constraints (e.g. RAD, airspace closure)
Title	Trajectory compliance with published contraints when using DCB measures
Status	<In Progress>
Rationale	This is an issue identified in current operations. This iRBT shall always be trajectory-compliant with published constraints.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0005.0010
Requirement	During the short term planning phase, the Airspace User shall update the iSBT with Extended Flight Plan information.
Title	Content of the iSBT in short term planning phase.
Status	<In Progress>
Rationale	This is in accordance with the SBT concept and the progressive refinement of Business Trajectory information
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0005.0014

Requirement	The iSBT in short-term planning phase shall include the GUFI as well as all required information to ensure unambiguous mapping with early SBT provided in medium-term planning phase (M-T iSBT provided per "repetitive flight leg").
Title	GUFI included in the iSBT in short-term planning phase
Status	<In Progress>
Rationale	To allow unambiguous identification of which information relates to which flight without the need for mapping details such as ADEP, ADES, Callsign and EOBT. The GUFI is currently discussed in the context of IATA and ICAO working groups. More detailed requirements will be developed at later stage.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0005.0017
Requirement	The NM shall validate the content of each iSBT update in the short-term to ensure syntactically (format) and semantically (compliant with air navigation environment and ATM constraints) correctness. The results of the iSBT check shall be sent back to the Airspace Users.
Title	Validity check of the iSBT in short-Term planning phase
Status	<In Progress>
Rationale	In short-term planning phase the iSBT validation process will be similar to the current ICAO flight plan validation process.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0005.0020
Requirement	For the stakeholders whose system is IOP capable, NM shall perform the distribution of iSBT updates during the short-term planning phase using the Flight Object mechanisms over the SWIM infrastructure
Title	Distribution of iSBT information in IOP area
Status	<In Progress>
Rationale	For interoperability purpose and to ensure a fully consistent management of flight data in Flight Object servers
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0005.0030
Requirement	The NM shall ensure that every iSBT update will be distributed also to the concerned stakeholders that still belong to the non (Flight Object) IOP areas for iSBT updates, using other SWIM distribution mechanisms (e.g. B2B)
Title	Distribution of iSBT information in non-IOP area
Status	<In Progress>
Rationale	To ensure that iSBT information is available in all ECAC area and outside ECAC area (when relevant)
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0005.0040
Requirement	The iSBT validation in the short-term planning phase shall include consistency checks between Extended Flight Plan and airport slot data included in the iSBT.
Title	Consistency check between iSBT and airport slot
Status	<In Progress>
Rationale	Rules, procedures and operational parameters shall be defined by airports.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0005.0045
Requirement	Both in the short-term planning phase and execution phase, the Network Management function shall have the possibility to trigger the revision of iSBT through the publication of Target Times for DCB purpose.
Title	Target Times applied to iSBT.
Status	<In Progress>
Rationale	Target times will be published for arrival/en-route DCB regulations or targeted dDCB measures. CTOTs shall continue to be published to keep the interface with departure airports unchanged. See 13.02.03 OSED for more details.

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

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0005.0050
Requirement	When a Target Time is published in planning phase, the Airspace User shall have the possibility to revise the iSBT (including the 4D trajectory) to express his preferences - both in terms of departure time and airborne profile - on how to comply with the published Target Time.
Title	Update of the iSBT/iRBT to comply with a Target Time
Status	<In Progress>
Rationale	To give more flexibility to Airspace users.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0001	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0005.0060
Requirement	In case of an update of the iSBT/iRBT by the AU to comply with a published Target Time, the NM shall update the CTOT according to the departure time expressed by the Airspace User in the iSBT.
Title	Update of the CTOT in case of revision of the iSBT/iRBT to comply with the Target Time
Status	<In Progress>
Rationale	In Step 1, CTOT are still in use to keep the interface with the departure airport unchanged
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0001	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0005.0065
Requirement	The Network Management Function shall have the ability to apply dDCB/STAM measures on iSBTs and iRBTs.

Title	STAM/dDCB measures in short-term and execution phases
Status	<In Progress>
Rationale	The STAM/dDCB catalogue of measures affecting iSBTs/iRBTs includes re-routings, level capping and time-based measures (TTO/TTA, constraint on departure time). See 13.02.03 OSED for more details on STAM measures.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0001	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0005.0070
Requirement	The NM shall distribute to all concerned stakeholders (AUs, Airports, ANSPs) all updates of planning iRBT elements (Extended FPL, TSAT/TTOT, Target Times, CTOT, TOs from the resulting network 4D trajectory)
Title	Distribution of iRBT information elements
Status	<In Progress>
Rationale	To support in execution the adherence to the agreed measures
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0001	<Partial>

[REQ]

Identifier	REQ-07.06.02-OSED-0005.0080
Requirement	The NM shall distribute each update of the iRBT elements during the flight lifecycle to all concerned stakeholders using a SWIM infrastructure based on the Flight Object in the IOP area
Title	Distribution of iRBT elements in IOP areas
Status	<In Progress>
Rationale	For interoperability purpose and to ensure a fully consistent management of flight data in Flight Object servers
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0001	<Partial>

3059 [REQ]

Identifier	REQ-07.06.02-OSED-0005.0090
Requirement	In IOP area, the Network Management Function shall use FO coordination mechanisms for the implementation at ATC level of STAM measures agreed between network actors during execution.
Title	Implementation of STAM measures
Status	<In Progress>
Rationale	See shortcoming of current processes in section 6.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

3060
3061 [REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0001	<Partial>

3062
3063 [REQ]

Identifier	REQ-07.06.02-OSED-0005.0100
Requirement	The NM shall improve network traffic prediction by integrating local trajectory information shared through the Flight Object.
Title	Improvement of network traffic demand prediction using local trajectory information in IOP area
Status	<In Progress>
Rationale	Improving network traffic prediction will allow to improve efficiency of DCB processes both at local and network levels.
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

3064
3065 [REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0001	<Partial>

3066
3067 [REQ]

Identifier	REQ-07.06.02-OSED-0005.0110
Requirement	The AU shall take into account published hard constraints in the trajectory calculation for the submission of the Preliminary flight plan.
Title	iSBT compliant with published hard constraints
Status	<In Progress>
Rationale	Acceptability of the Preliminary flight plan by NM systems
Category	<Operational>
Validation Method	<Live Trial>
Verification Method	

3068
3069 [REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A

<SATISFIES>	<ATMS Requirement>	REQ-07.02-DOD-0001.0000	<Partial>

6.3.2 Information Exchange Requirements

This section has been subdivided to distinguished between IERs related to the enhanced EFPL as an iSBT element (in line with FFICE eFPL exchange messages) and IERs related to the Flight Object concept.

6.3.2.1 The enhanced EFPL as iSBT element

[IER]

Identifier	Name	Issuer	Intended Addressees	Information Element	Involved Operational Activities	Interaction Rules and Policy	Status	Rationale	Satisfied DOD Requirement Identifier	Service
IER-07.06.02-OSED-eFPL.0200	Submission response	NM	AU	Operational reply message: • Message information • Submission status • GUFI Optional information: • Reason of rejection	Verification Preliminary flight plan, Trial request or Filed flight plan and related Flight Plan Update messages	One-Way	<In Progress>	REQ-07.06.02-OSED-0005.0017	REQ-07.02-DOD-0001.0001<Partial>	Planning Filing
IER-07.06.02-OSED-eFPL.0210	Preliminary Flight Plan	AU	NM	• Subset of eFPL data including optionally the Desired trajectory (4DT) and flight specific performance data • GUFI	Submission Preliminary Flight Plan (iSBT)	One-Way	<In Progress>	REQ-07.06.02-OSED-0004.0010	REQ-07.02-DOD-0001.0000<Partial>	Planning
IER-07.06.02-OSED-eFPL.0220	Planning status	NM	AU	• Submission status (operational acceptability) • Planning status • GUFI • Soft constraints impacting the trajectory • All non-compliant hard constraints if any • Optionally trajectory proposal including: o flight specific constraints o Negotiating/Agreed trajectory	Acceptability of the Preliminary Flight Plan, Flight Plan Update or Trial request (Validation iSBT)	One-Way	<In Progress>	REQ-07.06.02-OSED-0004.0090 REQ-07.06.02-OSED-0004.0060	REQ-07.02-DOD-0001.0001<Partial>	Planning
IER-07.06.02-OSED-eFPL.0230	Trial Request	AU	NM	• Message information including optionally the Negotiating Trajectory (4DT) or flight specific performance data • GUFI	Submission Trial request	One-Way	<In Progress>	Enhanced What-if tool extended to iSBT/iRBT mode of operations	REQ-07.02-DOD-0001.0000<Partial>	Planning

Identifier	Name	Issuer	Intended Addressees	Information Element	Involved Operational Activities	Interaction Rules and Policy	Status	Rationale	Satisfied DOD Requirement Identifier	Service
IER-07.06.02-OSED-eFPL.0240	Filed Flight Plan	AU	NM	• Subset of eFPL data including optionally the Filed trajectory (4DT) and flight performance data • GUFI	• iRBT creation • Submission Filed Flight Plan (iRBT) • FO creation • EFPL information dissemination to ATC	One-Way	<In Progress>	Valid and stable preliminary flight plan is agreed	REQ-07.02-DOD-0001.0000<Partial>	Filing
IER-07.06.02-OSED-eFPL.0250	Filing status	NM	AU	• Submission status (operational acceptability) • Filing status • GUFI • Agreed trajectory o DCB measures o PTRs o Changes on SID/STAR	Acceptability of the Filed Flight Plan or Flight Plan Update (Validation iRBT)	One-Way	<In Progress>	REQ-07.06.02-OSED-0004.0090 REQ-07.06.02-OSED-0004.0060 REQ-07.06.02-OSED-0005.0070	REQ-07.02-DOD-0001.0001<Partial>	Filing
IER-07.06.02-OSED-eFPL.0260	Flight Plan Cancellation	AU	NM	• Flight Plan suppression message • GUFI	Cancel Preliminary Flight Plan/Filed Flight Plan	One-Way	<In Progress>	Current operational exchange process	REQ-07.02-DOD-0001.0000<Partial>	Planning Filing
IER-07.06.02-OSED-eFPL.0270	Flight Plan Update	AU	NM	• Updated information • GUFI and departure aerodrome	Update Preliminary Flight Plan/Filed Flight Plan (Update iSBT/iRBT)	One-Way	<In Progress>	REQ-07.06.02-OSED-0004.0020 REQ-07.06.02-OSED-0004.0040 REQ-07.06.02-OSED-0005.0010	REQ-07.02-DOD-0001.0000<Partial>	Planning Filing

Table 26 IER eFPL layout

6.3.2.2 Flight Object

[IER]

Identifier	Name	Issuer	Intended Addressees	Information Element	Involved Operational Activities	Interaction Rules and Policy	Status	Rationale	Satisfied DOD Requirement Identifier	Service Identifier
IER-07.06.02-OSED-FONM.0500	Distribution to IOP ATSUs of initial Flight information	NM	ATC	FO information (FO creation)	Flight lifecycle from EFPL submission to flight completion	One-Way	<In Progress>	REQ-07.06.02-OSED-0005.0080	REQ-07.02-DOD-0001.0001<Partial>	
IER-07.06.02-OSED-FONM.0510	Notification to IOP ATSUs of FPL/EFPL change	NM	ATC	FO information update (FPL, trajectory constraints, 4D trajectory)	Flight lifecycle from EFPL submission to flight completion	One-Way	<In Progress>	REQ-07.06.02-OSED-0005.0080	REQ-07.02-DOD-0001.0001<Partial>	
IER-07.06.02-OSED-FONM.0520	Notification to IOP ATSUs of FPL/EFPL delay message	NM	ATC	FO information update (EOBT, 4D trajectory)	Flight lifecycle from EFPL submission to flight completion	One-Way	<In Progress>	REQ-07.06.02-OSED-0005.0080	REQ-07.02-DOD-0001.0001<Partial>	
IER-07.06.02-OSED-FONM.0530	Notification to IOP ATSUs of FPL/EFPL cancellation	NM	ATC	FO suppression?	Flight lifecycle from EFPL submission to flight completion	One-Way	<In Progress>	FPL process extended to EFPL	REQ-07.02-DOD-0001.0001<Partial>	
IER-07.06.02-OSED-FONM.0540	Notification to IOP ATSUs of flight suspension / de-suspension	NM	ATC	FO information update (flight suspension status)	Flight lifecycle from EFPL submission to flight completion	One-Way	<In Progress>	REQ-07.06.02-OSED-0005.0080	REQ-07.02-DOD-0001.0001<Partial>	

Identifier	Name	Issuer	Intended Addressees	Information Element	Involved Operational Activities	Interaction Rules and Policy	Status	Rationale	Satisfied DOD Requirement Identifier	Service Identifier
IER-07.06.02-OSED-FONM.0550	Notification to IOP ATSUs of TT information	NM	ATC	FO information (4D trajectory +TTO /CTOT)	Flight lifecycle from EFPL submission to flight completion	One-Way	<In Progress>	REQ-07.06.02-OSED-0005.0080	REQ-07.02-DOD-0001.0008<Partial>	
IER-07.06.02-OSED-FONM.0560	Notification to IOP ATSUs of TT cancellation	NM	NM	FO information (4D trajectory +TTO/CTOT cancelled)	Flight lifecycle from EFPL submission to flight completion	One-Way	<In Progress>	REQ-07.06.02-OSED-0005.0080	REQ-07.02-DOD-0001.0008<Partial>	
IER-07.06.02-OSED-FONM.0570	Notification to IOP ATSUs of agreed trajectory update	NM	ATC	FO information (trajectory constraints, 4D trajectory)	Flight lifecycle from EFPL submission to flight completion	One-Way	<In Progress>	REQ-07.06.02-OSED-0005.0080	REQ-07.02-DOD-0001.0008<Partial>	
IER-07.06.02-OSED-FONM.0580	Notification to IOP ATSUs of an AFP message from non-IOP area	NM	ATC	FO information (FPL, trajectory constraints, 4D trajectory, FPL)	Flight lifecycle from EFPL submission to flight completion	One-Way	<In Progress>	REQ-07.06.02-OSED-0005.0080	REQ-07.02-DOD-0001.0001<Partial>	
IER-07.06.02-OSED-FONM.0590	Reception of trajectory constraints information from ATC	ATC	NM	FO information (trajectory constraints, 4D trajectory)	Flight lifecycle from EFPL submission to flight completion	One-Way	<In Progress>	REQ-07.06.02-OSED-0005.0100	REQ-07.02-DOD-0001.0001<Partial>	
IER-07.06.02-OSED-FONM.0600	Notification to NM of local route/trajectory change	ATC	NM	FO information (trajectory constraints, FPL, 4D trajectory)	Flight lifecycle from EFPL submission to flight completion	One-Way	<In Progress>	REQ-07.06.02-OSED-0005.0100	REQ-07.02-DOD-0001.0001<Partial>	
IER-07.06.02-OSED-FONM.0610	Notification of FDMP role handover	ATC	NM	FO information (FDMP role change)	Flight lifecycle from EFPL submission to flight completion	One-Way	<In Progress>	REQ-07.06.02-OSED-0005.0100	REQ-07.02-DOD-0001.0001<Partial>	
IER-07.06.02-OSED-FONM.0620	Notification of NM role preference	NM	ATC	FO information (preference status)	Flight lifecycle from EFPL submission to flight completion	One-Way	<In Progress>	REQ-07.06.02-OSED-0005.0080	REQ-07.02-DOD-0001.0001<Partial>	
IER-07.06.02-OSED-FONM.0630	Notification to IOP ATSUs of an agreed STAM measure	NM	ATC	FO information (STAM measure, trajectory constraints, 4D trajectory)	STAM scenario	One-Way	<In Progress>	REQ-07.06.02-OSED-0005.0090	REQ-07.02-DOD-0001.0001<Partial>	
IER-07.06.02-OSED-FONM.0640	Notification to IOP ATSUs of STAM measure cancellation	NM	ATC	FO information (STAM measure, trajectory constraints, 4D trajectory)	STAM scenario	One-Way	<In Progress>	REQ-07.06.02-OSED-0005.0090	REQ-07.02-DOD-0001.0001<Partial>	

3077 Table 27 IER FO layout
3078

7 References

7.1 Applicable Documents

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

[1] Template Toolbox Ed.04.00.00 22/03/2014
https://extranet.sesarju.eu/Programme%20Library/SESAR%20Template%20Toolbox.dot

[2] Requirements and V&V Guidelines Ed. 03.01.00 05/02/2014
https://extranet.sesarju.eu/Programme%20Library/Requirements%20and%20VV%20Guidelines.doc

[3] Templates and Toolbox User Manual 03.01.01 28/02/2014
https://extranet.sesarju.eu/Programme%20Library/Templates%20and%20Toolbox%20User%20Manual.doc

[4] EUROCONTROL ATM Lexicon
http://www.eurocontrol.int/lexicon/lexicon/en/index.php/SESAR

7.2 Reference Documents

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

[5] WPB.01 Integrated Roadmap Dataset DS15

[6] 07.02-D29-Step 1 Release 5 DOD Ed 00.04.01, May 2016

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

[8] ICAO Document 9694

[9] B.04.01-D41 SESAR Performance Framework (Edition 2).

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

[11] B04.01-D41 SESAR Refined Performance Framework Cycle 3 Ed. 01.01.00, 25/11/14

[12] 11.01.02 –D11.1.2-1- FOC operational and performance requirements for Step 1 (Quick Wins) including the traceability of the AU comments - OSED Step 1, Edition 00.01.04, November 2012

[13] 07.06.02 –D55- Step 1 Business Trajectory Validation Report for EFPL, Edition 00.01.00, September 2016.[24]

[14] Flight and Flow Information for a Collaborative Environment – A Concept V1.0

[15] Flight Plan filling provisions for FF-ICE, Working paper, ATMRPP-WG/27-WP/638, October 2014.

[16] Flight Plan filling provisions for FF-ICE, Working paper, ATMRPP- WP/28 - WP/656, March 2015

[17] Flight Plan filling provisions for FF-ICE, Working paper, ATMRPP- WP/29 - WP/672, July 2015

[18] Report on the first meeting, ATMRPP – Final Report, November 2015

[19] Flight Plan filling provisions for FF-ICE, Working paper, ATMRPP- WP/682, November 2015

[20] EUROCONTROL, 2014b. DDR2 Reference Manual, V1.0.4, 24 April 2014

[21] 05.05.02 –D04- Final Project Report on the concept and benefits for improving TP using AOC data, Edition 00.01.03, 11 April 2013

[24] This document shall be delivered at same time of the 07.06.02-D56-Step 1 BT final OSED. Latest 2016 Edition shall be considered.

[22] CFMU Flight Data Interoperability Business Case. D5 – Final Business Case, ADVS/ATM/FD1/D5, Edition 0.1, Mar 2009

[23] Flight Plan Repository Operational Requirements Document, DMEAN CL7_D2, Edition 1.0, September 2005.

[24] Standard Schedules Information Manual (SSIM) - IATA – March 2011

[25] Airport CDM Implementation User Manual. April 2012 http://www.eurocontrol.int/publications/airport-cdm-implementation-manual-version-4

[26] Flight Object Interoperability Specification, Ed-133, June 2009

[27] B04.02 -D01- SESAR Trajectory Management Document; Edition 00.01.00, September 2010

[28] B04.02 – Del ID D124- SESAR Concept of Operations Step 1 Final Edition, Edition 02.02.00, 2015.

[29] B04.02-D106-Transition Concept of Operations SESAR 2020, Edition 00.01.03.

[30] 08.01.01-D48-SWIM Compliance Report for R5 V&V Exercise 713, Edition 00.01.00, July 2016

[31] Service Technical Design Document for ExtendedFlightPlanSubmission Service, Edition 00.01

[32] Service Technical Design Document for FlightDataDistribution Service, Edition 00.01

[33] 07.06.02-D57 Step 1 Business Trajectory Safety and Performance (SPR), Edition 00.03.00, 2016[25]

[34] 07.06.02-D92- Step 1 - EFPL Technical Specifications, Edition 00.01.00, 2016[26]

[35] 08.03.10-D65 Information Services Reference Model Service Portfolio Version 2.0, Ed.00.08.00

The complete ISRM 2.0 delivery including all Service Description Documents (SDDs) and Service Identification Documents can be found in the SESAR extranet:

ISRM 2.0 folder in SESAR extranet: SESAR Joint Undertaking Programme > WP 08 > Project 08.03.10 > Project Execution > ISRM 2.0

[36] 07.06.02 – D05 – Step 1 BT VALR for 715, Edition 00.01.01, June 2016

[37] 07.06.02 – D46 – Step 1 BT VALR for 714, Edition 00.01.02, April 2016

[25] This document shall be delivered at same time of 07.06.02-D56-Step 1 BT final OSED. Latest 2016 Edition shall be considered.

[26] This document shall be delivered at same time of 07.06.02-D56-Step 1 BT final OSED. Latest 2016 Edition shall be considered.

Appendix A Justifications

Not applicable

Appendix B New Information Elements

B.1 Information elements in iSBT

The table hereafter summarises new information elements. Elements in **green** indicate those expected to be introduced in the context of quick-win evolutions. Detailed description of EFPL elements included in this table is provided in section 4.1.2.

Information	Information elements		Remark
ISBT medium-term planning (scheduling phase)	IATA flight identification		Equivalent to SSIM information. Information provided per repetitive flight leg.
	ADES		
	ADEP		
	Schedule Time of Departure		
	Schedule Time of Arrival		
	Aircraft type		
	Period of operations		
	Days of operations		
	Airport slots		Only for traffic arriving/departing from coordinated airports.
	Nominal preferred route		**See section 5 from more details**
Extended Flight Plan short term planning (4DT planning phase)	ICAO Flight Plan Data		See ICAO Doc 4444 and IFPS Users Manual
	GUFI		Included in the context of FF-ICE increment 1 Include elements to map with IATA flight identification
	Departure runway		
	Arrival runway		
	4D trajectory	**Taxi-time**	ETOT = EOBT + taxi-time.
		Air trajectory	**For each point of the airborne trajectory the following items can be provided (some are optional) :** • **Location** • **Latitude and longitude** • **Previous route segment** • **Level** • **Elapse time from take-off up to the location** • **Distance** • **Total weight** • **True air speed**

Information	Information elements		Remark
			• Target Time applied (only if Target time has been published.) • Minimum Altitude • Maximum altitude • Probability Sigma
	Climb Performance Profile		**The climb performance profile described as a sequence of points in which every point is defined by:** **a) Cumulative Distance from the aerodrome of departure** **b) Level:** **c) Cumulative Time elapsed from the aerodrome of departure**
	Descent Performance Profile		**The descent performance profile described as a sequence of points, in reverse order starting from the aerodrome of destination, in which every point is defined by:** **a) Cumulative Distance from the aerodrome of destination** **b) Level:** **c) Cumulative Time elapsed from the aerodrome of destination**
	Airport Slots		Included in the context of FF-ICE increment 1
TTO /TTA is	Type of time constraint (TTO/TTA)		TTO/TTA information elements are <u>in addition</u> of existing information elements related to the CTOT (e.g. CTOT, regulation id, …) see more details in ATFCM user manual on ATCM slot messages).
	Location of the point of application of the time constraint		
	Time constraint		
EFPL reply message to AU	Agreed trajectory		This trajectory is based on the filed trajectory of the AU but integrates additional soft constraints.
	PTRs		• **Soft constraints that require a calculation of the profile** • **They tune the traffic demand calculation (not used to validate or invalidate a flight plan)**

B.2 New information elements exchanged in the context of NM-ATC interoperability

A large number of IER requirements for NM-ATC interoperability (see section 1.1.1) can be addressed by reusing existing information elements defined in ED 133 (e.g. flight script, trajectory clusters). A few new elements have been identified. Only those addressed specifically by the exercise VP-714 are listed hereafter.

Information	Information elements	Remark
Target Times	Target time location	One target time per ATFCM regulation impacting the flight
	Time at the location	
	Indication of the more penalising regulation	
	Target deviation Indicator	The TDI at a Target time location is the time difference between the Target Time and the ETO.
NM role preference	An information provided by NM on its preference to remain FDMP	

To cover the full list of IERs identified in section 1.1.1, additional information elements need to be considered related to STAM, flight status or Extended Flight Plan information dissemination to ATC. Those information elements are not included in this version of the OSED since validation activities of those specific topics have been postponed in SESAR 2.

Appendix C Expected benefits / benefits mechanisms

C.1 Expected benefits for the Extended Flight Plan

Improving interoperability between AUs/CFSPs and the Network Manager is expected to bring benefits in the following areas (or use cases):

- Flight planning operations
- ATFCM / ATC operations
- Flight operations

The following figure illustrates the benefits mechanism:

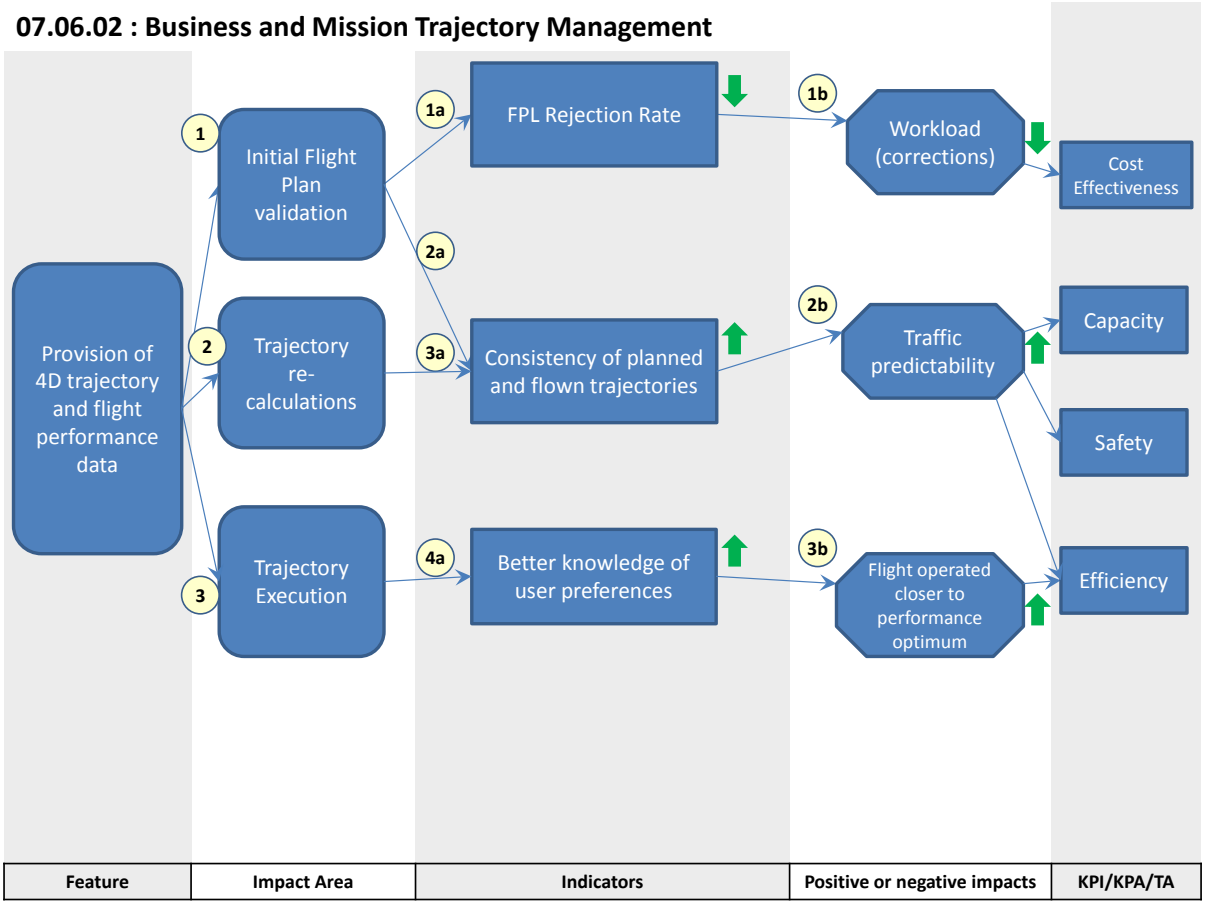

Figure 31: Benefit mechanism high-level view

Feature Description: the provision of additional data (4D trajectory and flight specific performance data) improves the interoperability of flight data between Airspace Users and NM. It enables a better description and understanding of AUs' flight intents.
(1) These additional data will impact the initial flight plan validation process as the format of input data will evolve and additional processing will be required
(2) Subsequent trajectory recalculations will use the flight specific performance data included in the

EFPL.
(3) During the trajectory execution, the NM (and the ATSUs) are better informed of AUs' intentions and preferences thanks to the more detailed description capabilities offered by EFPL
(1a) EFPL 4D trajectory will allow AUs to provide a more accurate description of their flight intentions. This should reduce occurrences of profile related rejections in the course of the initial flight plan validation. (1b) Less flight plan rejections translate directly into less associated workload, both for IFPS operators (NM) and for AUs' staff in charge of correcting/submitting FPLs. An increased cost-effectiveness can then potentially be expected (provided that the reduced workload results into fewer staff being allocated to these tasks).
(2a) AUs' 4D trajectory submitted in the EFPL will be used by the NM systems as the initial planned trajectory, instead of calculating this trajectory themselves. (3a) Subsequent recalculations of the planned trajectory will use flight specific performance data rather than generic performance data for the aircraft type, as currently. (2b) Knowing and taking into account a more accurate description of both the AUs' flight intents and the flight specific performance should enable the use of a planned trajectory closer to that which will actually be flown, thus increasing the predictability of the traffic. Enhanced traffic predictability allows reduced capacity buffers and overall improves capacity management both at network and local levels. On ATSUs' side, a better predictability translates into reduced risks of over-delivery, hence to increased safety. An improved network capacity management is expected to lead to a reduction of delays, thus to increased efficiency. The capability to describe more accurately flight intents also reduces inefficiencies associated to limitations imposed by the description format currently used. The expected increased traffic predictability can thus be seen as enabling improvements in operating methods, which in turn would lead to capacity and safety increases. These will consequently not be directly measurable within P7.6.2 but are expected to be assessed by other projects (the project 5.5.2 has already performed a V2 validation as well as a CBA for the use of FOC data (part of the elements included in the Extended Flight plan) by ATC).
(4a) The additional data and their intended use allow better describing and respecting AUs' intents. (3b) The resulting trajectory should thus be executed closer to the airframe's performance optimum, positively impacting the flight efficiency.

Table 28: Benefit mechanisms overview

The implementation of this operational concept will lead to a decrease of the number of flight data inconsistencies, as flight intents will be better taken into account, which will reduce the number of irrelevant flight plan invalidations and in parallel increase the number of flight plans automatically validated. This will therefore make easier the task of NM flight planning services and airline operators, and reduce their workload.

Past studies performed by the Network Manager have shown that flight data are currently one of the sources contributing to deviations between NM profiles and flight tracks. There are generally three types of deviations: time deviation, flight level deviation and lateral deviation.

As the concept implementation will allow the NM to get more information about AU flight intents, particularly in terms of points, flight levels, and times, the Flow Management services will use these data – more accurate and reliable than estimations made by NM about them – to calculate and update 4D trajectories, which will result in a reduction of the observed deviations between NM trajectories and reality. The concept will therefore help to reduce the share of responsibility of flight planning in discrepancy between agreed trajectory and real trajectory.

Since Flow Management services use these trajectories to elaborate traffic forecasts, the traffic demand predictions will be enhanced, hence a better predictability of sector traffic load.

The provision of more accurate flight plan data by AU allow the NM to accept more flight plans that are in line with the AU flight intents, since the number of errors due to a misinterpretation of field 15 by NM flight planning services is reduced. Consequently, the executed trajectory is closer to AU preferences, hence a route flown close to the optimum. The flight efficiency is therefore improved, resulting in a better optimization of the balance between fuel consumption and distance flown, hence in cost saving for the airline.

The following table summarises benefits per KPA:

Use Case	Capacity	Efficiency (including delays)	Cost efficiency	Safety
Flight planning operations		Executed trajectory closer to AU's preferences.	Reduced workload for NM operators due to flight data misinterpretation that need manual correction Fewer occurrences of flight plan rejections requiring FPL refilling.	
ATC/DCB	Improved network capacity management for the NM due to better traffic predictability. Reduced capacity buffers.	Lower delays due to better management network capacity management.		Increased safety in ATSU due to better traffic predictability. Reduction of over-delivery risk
Flight operations		Executed trajectory closer to AU's preferences due to the better knowledge of flight intent.		

The table above focuses on benefits from a network perspective. It must be highlighted that the introduction of the extended flight plan will allow performance improvements of local ATC and DCB processes through the dissemination of FOC flight data information. Those benefits are assessed by 05.05.02 project [21].

C.2 Expected operational benefits from the improvements of demand management in medium term planning phase

Referring to the DDR 2 project business case, main benefits are expected in the context of operational use-cases listed in the previous paragraph. Some of operational use-cases (OUC) are described in the table hereafter:

OUC1, ATFCM operational planning From 12-5 weeks before a month of operations, some ANSPs have processes to predict 'gross' sector flows. These are used as a basis for planning ATFCM measures as well as detailed rosters. Knowing these gross sector flows informs planning decisions to reduce the chance of regulations being needed.
OUC2, ANSP improved planning of ATCO rosters The key to this operational use case is to predict sector loadings derived from flight trajectories. With such a prediction, rosters can be defined with better respect to forecast

sector loadings and main traffic flows
OUC3, Planning for 'special events' DDR Phase 2 has the potential to improve the planning for such events by improving the capture of flight intentions in advance of the event. Good information weeks or days in advance would enable the refinement of ANSP staff rostering and the creation of profile management and ATFM regulation plans to achieve the most efficient response to the traffic demand.
OUC5, ANSP and NM pre-tactical refinements to ATFCM This operational use case builds on OUC1, but is focused on a potential increase in accuracy of predictions at the pre-tactical stage. With more accurate predictions: ANSP Managers would be able to make final adjustments e.g. to staffing plans and fine tune sector configurations, open and closing times, plan break times. – to maximise the available resources against the forecast traffic demand; the NM would be able to finalise daily plans and address pan-European network issues, with the aim of minimising flow regulations by defining solutions with a lower impact to Airspace Users. The Network Management Function would be able to have dialogues with Airspace Users and military staff to fine tune flow management solutions, again to avoid regulations through defining lower impact solutions.
OUC6, More collaborative pre-tactical ASM (level 2) If the DDR Phase 2 is shown to deliver a reliable 4D trajectory traffic demand forecast, this would enable collaboration between civil and military airspace planners: to enable military planners to reference civil demand when determining the opening and closing times of TSAs; to support requests to military planners for temporary availability of CDRs; to support requests to military planners for availability of CDRs on specific days.
OUC7, Airspace User flight planning This use case envisages Airspace Users using 'hot-spot' data in flight planning. Experienced flight planners already build a general knowledge of hotspots/probable regulations throughout the season and, once patterns emerge, are able to file plans appropriate to their operational/business needs. The use case offers the potential for such tacit knowledge to be directly built into flight planning systems. For example, flight planners may choose a flight plan solution of a slightly higher cost or duration in order to avoid a high probability of delay on an alternative route.

Main improvements are expected in the following SESAR KPAs:

- Efficiency (including delays)
- Capacity
- Cost-effectiveness

The following table outlines benefit mechanisms for each of the use-case mentioned above.

Use Case	Capacity	Efficiency (including delays)	Cost efficiency
1. ATFCM operational planning	Better use of sector capacity	Reduced delay by planned capacity better aligned to demand	
2. ANSP improved planning of rosters	Better assignment of ATCOs with respect to sector validations		ANSP cost savings from better match of ATCOs to demand
3. Planning for 'special events'	Better use of sector capacity	Reduced delay by planned capacity better aligned to demand	
5. ATFCM pre-tactical refinements	Better use of sector capacity	Potential reduced airborne holding (delay)	ANSP cost savings from better match of ATCOs to demand

Use Case	Capacity	Efficiency (including delays)	Cost efficiency
6. More collaborative pre-tactical ASM (level 2)	Better use of sector capacity	More direct routes from better use of CDRs. Reduced delay.	
7. Airspace User flight planning		Better informed route planning. Reduced delay	Involvement in the ATM CDM

Appendix D Assumptions on TT management considered in FO developments

The following points are presented as assumptions since there are not directly in the scope of the 7.6.2 project. These assumptions should be addressed further by relevant projects (e.g. P13.2.3, WP4)

Assumption 1: NM monitoring of the Target Times adherence

The NM monitoring phase for the flight adherence to the issued TTs starts from the flight departure and lasts until the flight termination or the FO termination. In this context the NM will include and/or provide for inclusion in the FO the following information:

- the TT - location point and time;
- the updated Estimated Time Over (ETO) on the TT location for the flights in execution

The updated ETOs on the TT location provided by NM are based on information provided to NM either by an IOP ANSP or a non-IOP ANSP (inside the IOP area the ETOs calculated by the IOP systems are aligned). Updated ETOs are provided whenever they are outside the TT tolerance window (e.g. +/- 3 mn).

Assumption 2: ATC role (limited) in the monitoring of the Target Time adherence

With the information provided by NM via the FO, the local systems will compute the Target Time Deviation indicator (TDI), i.e. the difference (subtraction) between the ETO and the TT time values. Whenever the TT Deviation is displayed to ATCOs it will be in terms of “time to lose”, “time to gain” or “on time”. The ATC needs to be aware of this information to avoid providing instructions/clearances that would have an adverse effect on flight adherence to the Target Times.

The “on time” is the minimum information to be displayed to ATCOs informing them that the flight is subject to TT.

Whenever the flight is subject of a single TT, the local system will provide the TDI for display to ATCO whenever the TT location is in a downstream ANSP’s AoR.

Assumption 3: Multiple TTs

If the flight is affected by several ATFCM regulations it has several TTs - one per regulated area- even if in the planning phase only the most penalising constraint/TT is taken in consideration to determine the CTOT.

The ATCO will be presented with only one TT deviation (i.e. for only one TT location). Whenever a flight is subject to more than one TT, the selection of the TT Deviation for display to ATCOs is done by the local system based on the TT location. The following rule is proposed for validation:

1) if the TT is located inside the AoR of the ANSP - it will not be selected for display;
2) if the TT is located in an adjacent downstream ANSP AoR – it will be selected for display;
3) if the TT is located in a non-adjacent downstream ANSP AoR – it will not be selected for display, unless it is the first TT for the flight.

The assumption 3 is not in line with 13.2.3 and B.4.2 documentation which consider only one Target Time to be published to ATC on the most penalising constraint. However considering the low maturity and limited consensus on this topic, it seems more relevant from a Flight Object system enabler perspective to consider multiple targets management to design more general technical solutions than can cope with possible future refinement/evolution of the

concept. <u>It must be highlighted that this OSED does not include any operational requirements related to the inclusion of multiple target times in the iRBT and the Flight Object.</u>

Communication of Target Times to the flight crew.

Even if in this document, some scenarios and use-cases include the dissemination of Target times to the flight crew, the OSED does not make any assumptions, nor develop any requirement related to this topic.

Appendix E - Approaches on the transition iSBT/iRBT

This appendix E aims to introduce the four different approaches/perspectives that currently exist to determine the transition from SBT to RBT (either Step 1 & or Step 2). This should also raise concern about the differences between the perspectives and the willingness to align and refine them.

E.1 The different alternatives for SBT/RBT transition

This section summarises the four different alternatives and further develop the point of view adopted by 07.06.02 -D56- BT OSED Step 1.

1. **The Transition CONOPS SESAR 2020** **[29]** states that the creation of the RBT occurs when the AU explicitly accepts the final SBT due to the proximity of the execution phase as further modifications are no longer achievable (full pre-departure CDM process is completed).
2. **07.02 D29 DOD Step 1** **[6]** states that in Step 1, the iSBT evolves progressively to iRBT starting from SIT time to TSAT (A-CDM) or at a fixed time before off-block (non A-CDM).
3. In this document **07.06.02 -D56- Step 1 BT OSED** the iRBT creation is triggered by the AU when submitting a filed flight plan (with a filed trajectory). However the iRBT creation does not corresponds necessary to the transition SBT/RBT

   In current operations a single milestone cannot be identified corresponding to this transition. Several milestones are potentially contributing to the progressive transition from iSBT to the iRBT (see in appendix the table of milestones as extracted from the 7.6.2 Step 1 OSED).

   Referring to this table, the transition to RBT can be considered as fully completed at the last milestone once flight enters under ATC control and FPL/RBT changes are done through ATC.
4. **FF-ICE increment 1** full concept implementation envisages two different services associated to a submitted flight plan: a planning service (correspondent to iSBT) and a filing service. In the planning service, AU sends the desired trajectory (the user's preferable one) within a "preliminary flight plan" in "planning state" and negotiation occurs until a valid and stable flight plan is agreed and the AU sends a filed trajectory within a flight plan in "filed status" triggering the distribution to ATC services.

   The possibility envisaged as fourth option is to map the FF-ICE filing event with the transition from SBT to RBT.

These four approaches require further discussions and validations in order to achieve a consensus on the granularity (high/low level of detail) and the content. This will be continued and provided within SESAR 2020.

The table below summarises the differences between these 4 options:

	Transition CONOPS SESAR2020	07.02 D29 DOD Step 1	7.6.2 BT OSED	FF-ICE increment 1 filing option
iSBT & iRBT Phases intersection	Sequential	Undefined	Overlapping The RBT is created when the flight plan is filed but the SBT can continue to be updated until the flight goes under ATC control.	Sequential. When the flight plan is filed, any kind of trajectory submission to the planning service is a pure what-if and therefore cannot be considered as the SBT. So any change is through RBT revision
Event triggering the transition	Acceptance of the trajectory by the AU after meeting as a minimum (to be validated) the following conditions: • The AUs has refined its preferred trajectory in function of the planning constraints. • All capacity constraints are being respected by the trajectory (as verified by the NM). • The ADEP has provided the TSAT/TTOT plus related tolerance windows	Either an airport CDM event or a time parameter before EOBT	Either actual off-block time or an airport CDM event at some airports	Submission by the AU of a flight plan in “filed state”
Actor triggering the transition	AU	AU triggers the start of the transition Airport or NM trigger the end of the transition	AU triggers the start of the transition Airport or NM trigger the end of the transition	AU
Time of the transition according to the flight lifecycle	Pre-departure. Latest time at the TSAT issuance (to be validated)	Pre-departure. TSAT (A-CDM) or at a fixed time before off-block (non A-CDM)	Actual off-block time or an airport CDM event close to EOBT.	The filing in current operations can be from several days (5 days max) to 3 hours before EOBT (or less for late filers). With the introduction of the FF-ICE planning service, the filing event could occur closer to EOBT.
Impact of the transition SBT/RBT	Further modifications of trajectory/FPL only through “limited CDM”	Undefined	Further modifications of trajectory/FPL done only through ATC.	The FPL/RBT distributed to the ATC services.

Table 29 Comparison between different approaches on the iSBT/iRBT transition

E.2 Why other options are not retained?

The Transition CONOPS SESAR 2020's option is not retained because the notion of "limited CDM" after the transition SBT/RBT is not mature enough to develop Step 1 operational requirements.

The option which considers the transition SBT/RBT completed at the FF-ICE filing event is not retained because no specific rule/procedure prevents the filing event to occur very early (e.g. several hours or even days before off-block).

Finally, the SBT/RBT transition as defined in the 7.2 Step 1DOD remains at high level, however, the 7.6.2 option is not significantly in contradiction with the DOD description.

14 **-END OF DOCUMENT-**

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