



# Step 1 Business Trajectory final Safety Performance Requirements (SPR)

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## Abstract

This document specifies the Safety and Performance Requirements for the Business Trajectory Management within the context of the Single European Sky Research and Development Program (SESAR) Concept Story Board - Step 1. The present edition is limited to the development of the Safety and Performance Requirements for the **Extended Flight Plan concept** (which corresponds to the SESAR solution #37) as described in the final OSED Step 1 Business Trajectory (D56)

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## 9 Intellectual Property Rights (foreground)

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## Executive summary

This final edition of the Safety and Performance Requirements (SPR) document (D57) provides the safety and performance requirements for Application and Information Services related to the Operational Processes and Services defined in the P07.06.02 -D56-BT OSED Step1, 2016 [13] **section 4 dealing with the quick-win implementation of the Extended Flight plan (EFPL) in short-term planning.** This document is used to provide the basis for ensuring that these SPR requirements are applicable during initial implementation and continued operation. The Extended Flight Plan implementation has potentially an impact on a large number of operational services both at FOC, NM and ATC sides. This SPR document focuses on requirements related to network operational services: flight plan validation and distribution, DCB services.

The requirements developed in this document should show traceability to the higher level requirements described in the corresponding OSED and particularly to the Performance Requirements expressed in the OSED. Additionally, this document takes into account the results of the P07.06.02 exercises planned in release 5 which validates some of the requirements in section 3.

The Safety Requirements have been derived mainly from the Safety Assessment Report (see Appendix A).

The non-functional and Performance Requirements have been derived from non-functional and Performance requirements applied to NM services in operations (Flight plan management, DCB). They have been adapted and complemented to address the specific needs for the Extended Flight Plan implementation.

## 1. Introduction

### 1.1 Purpose of the document

This Safety and Performance Requirements (SPR) document provides the safety and performance requirements for Services related to the operational Processes defined in the 07.06.02 –D56- Step 1 Business Trajectory final OSED [13].

Several updates to the initial SPR document have been produced during the lifecycle of the P07.06.02 project execution phase.

Three major releases were planned to be delivered, including this SPR final D57:

- D03 Step 1 Business trajectory SPR interim version, May 2014: Interim SPR for Extended Flight plan (quick win);
- D87 Business Trajectory 2015 SPR update for EFPL;
- D57: Step 1 Business trajectory final SPR, September 2016 integrating Release #5 validation results (VR-713 as part of [21]).

### 1.2 Scope

This document supports the operational services and concept elements identified in the final Operational Service and Environment Definition (OSED) Step 1 BT 2016, [13]. These services are expected to be operational (IOC) in the 2018- 2020 time frame.

**THIS FINAL EDITION (3.0) DOES NOT COVER THE FULL SCOPE OF THE 07.06.02 STEP 1 OSED ON BUSINESS TRAJECTORY MANAGEMENT. IT IS FOCUSING ON THE SECTION 4 OF THE OSED DEALING WITH THE EXTENDED FLIGHT PLAN SOLUTION. HENCE BT IS ONLY VERY PARTIALLY ADDRESSED AND ONLY LIMITED TO THE DISTRIBUTION OF THE EFPL IN PLANNING PHASE TO ATC ACTORS**

The others topics developed in the OSED - demand data management in Medium term planning, iSBT and IRBT in the context of flight object – are considered at this stage as insufficiently mature to be included in the SPR.

This is the final updated version of this document planned to be delivered in 2016 as part of SESAR Step 1.

It is not planned to develop, in the context of SESAR Step 1 activities, Safety and Performance requirements related to the management of the SBT in medium term planning phase.

The performance requirements are defined using the top-down principle, originating at B04.01 level, cascaded down from strategic targets to Ops 07.02 level and subsequently to primary projects.

The requirements developed in this document should show traceability to the requirements described in the corresponding OSED and particularly to the Performance Requirements expressed in the OSED, which show traceability to the higher level KPAs (through DOD), as represented in Figure 1.

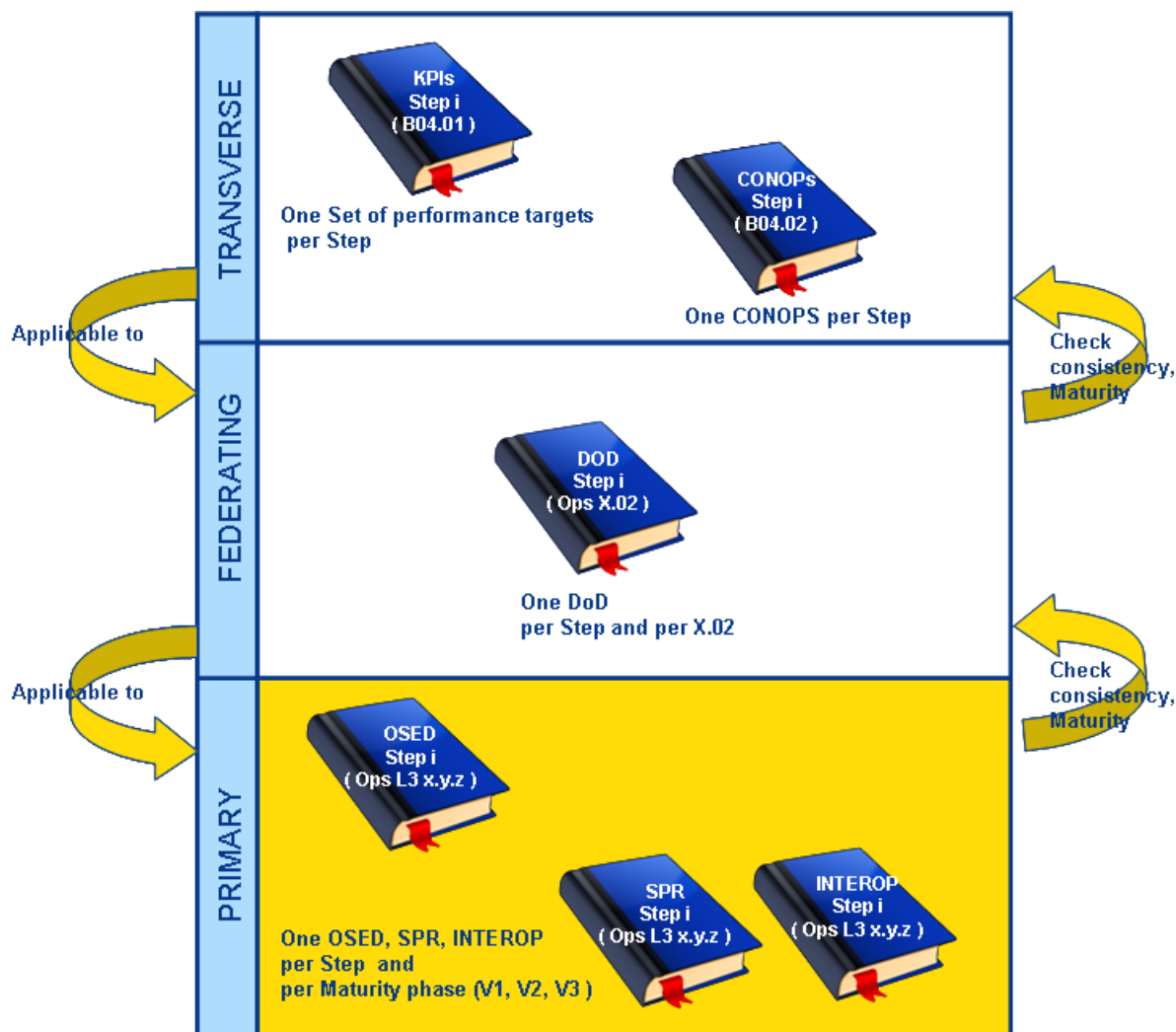


Figure 1: SPR document with regards to other SESAR deliverables

In Figure 1, the Steps are driven by the OI Steps addressed by the project in the Integrated Roadmap document [12].

### 1.3 Intended readership

Within SESAR, the intended audience is

- The SJU;
- SWP07.02: P07.02 is the coordinating federating project for the OFA03.01.04 - Business/Mission trajectory;
- P11.01 projects: this OSD develops requirements impacting FOC processes and systems. Moreover, most of requirements included in this document have been developed in close cooperation with P11.01 projects.
- P13.02.03 project which have strong dependencies with flight planning /business trajectory management.
- P04.05 and P05.05.01 projects: those two projects are part of the OFA03.01.04. Moreover there are obvious dependencies between Business/Mission trajectory and Trajectory Management Framework OFAs;

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- SWP04.02, SWP05.02, SWP06.02: those are being identified as consulting federating projects for the OFA03.01.04 ;
- WP8 projects included in the OFA Business and Mission Trajectory. For this release, most impacted WP8 projects are 08.03.10, and 08.01.03;
- P11.02. projects.
- P16.06.01 project which addresses the specification and design aspects of SESAR in Safety.
- P16.06.05 project which is the Human Performance management in accordance with the SESAR HPRM (Human Performance Reference Material) requirements.
- WP B05 is the performance analysis project of the ATM Target Concept

## 1.4 Structure of the document

The structure of the document is as follows:

**Section 1:** Introduces the document purpose, the scope, the intended audience, the background, the structure (this section) and includes the glossary of terms and acronyms and terminology.

**Section 2:** Summarizes the operational concept – limited to the extended Flight plan in this edition - based on the descriptions provided in the corresponding OSED (Ref.[13])

**Sections 3:** Provides the Safety and Performance Requirements and shows traceability to the operational requirements (applicable to Processes and Services (P&S)) as described in the OSED.

**Section 4:** Lists the Applicable and Referenced Documents.

**Appendix A:** This section the safety assessment report produced for the extended flight plan.

## 1.5 Background

See Background section in the 07.06.02 -D56- step 1 BT final OSED 2016 [13].

## 1.6 Glossary of terms

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

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

Term	Definition	Source
<b>Accepted trajectory</b>	Trajectory as calculated by NM (IFPS) to check the compliance of the flight plan with published constraints. 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 Step 1 OSED
<b>Accuracy</b>	Degree of conformance between the estimated or measured value and the true value.	P07.06.02 team

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Term	Definition	Source
<b>Calculated Take-off Time (CTOT)</b>	The CTOT complies with the aircraft departure slot issued by the NM (if any).	Network operations Step 1 DOD V1.0
<b>Data quality</b>	Degree or level of confidence that the data provided meets the requirements of the data user in terms of accuracy, resolution and integrity.	P07.06.02 team
<b>Estimated Off-block Time (EOBT)</b>	The estimated time at which the aircraft will commence movement associated with departure (ICAO) derived from the filed Flight Plan	Network operations Step 1 DOD V1.0
<b>Flight Object</b>	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
<b>GUFI</b>	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
<b>Initial Reference Business/Mission Trajectory (iRBT/iRMT)</b>	In Step1 an Initial Reference Business/Mission Trajectory is the result of the collaborative planning process that revises the iSBT/SMT (as defined in AUO-0203-A) and is published as the initial Reference Business/Mission Trajectory (iRBT/RMT), at the moment when due to the proximity of the Execution Phase, the Aircraft Operator cannot accept any more changes on the iSBT/SMT. The iRBT/RMT contains all data included in the (last) agreed iSBT/SMT, in particular the TTO/TTA".  <b>It must be highlighted that the word "initial" is <u>not</u> used in reference to the RBT lifecycle (e.g. first RBT in execution).</b>	Network operations Step 1 DOD V1.0
<b>Initial Shared Business/Mission Trajectory (iSBT/SMT)</b>	In step1, the SBT/SMT will not be fully 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).  <b>It must be highlighted that the word "initial" is <u>not</u> used in reference to the SBT lifecycle (e.g. first SBT shared).</b>	Network operations Step 1 DOD V3.03
<b>Nominal (user) Preferred Route (NPR)</b>	Preferred user route in nominal conditions (e.g. meteorological). Nominal preferred routing information is provided by airspace users in Medium Term planning phase.	P07.06.02 Step 1 OSED
<b>Target Time of Arrival (TTA)</b>	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	Network operations Step 1 DOD V3.03

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Term	Definition	Source
	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 <sup>1</sup> .  A TTA consists of a nominal value and tolerance limits around the nominal value.	
<b>Target Time Over (TTO)</b>	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 actors.  A TTO consists of a nominal value and tolerance limits around the nominal value.	Network operations Step 1 DOD V3.03
<b>Trajectory (4D)</b>	A set of consecutive segments linking waypoints and/or pseudo points computed by airline/aircraft or ground tools (pseudo/FMS or TP) to build the lateral transitions (e.g. fly by / fly over) and the vertical profile. Each point is defined by a longitude, latitude, a level and a time, with associated estimates, and constraints when and where required.	B04.02
<b>Filed trajectory</b>	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 Step 1 OSED

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## 1.7 Acronyms and Terminology

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Term	Definition
<b>4D</b>	4 dimensional
<b>a/c</b>	Aircraft
<b>ACC</b>	Air Traffic Control Centre
<b>ADD</b>	Architecture Definition Document

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Term	Definition
<b>ADR</b>	Airspace Data Repository
<b>AFTN</b>	Aeronautical Fixed Telecommunication Network
<b>AFUA</b>	Advanced Flexible Use of Airspace concepts
<b>AIM</b>	Aeronautical Information Management
<b>AIP</b>	Aeronautical Information Publication
<b>AIRAC</b>	Aeronautical Information Regulation and Control
<b>AIS</b>	Aeronautical Information Service
<b>ACK</b>	Acknowledge message
<b>AMC</b>	Airspace Management Cell
<b>ANSP</b>	Air Navigation Service Provider
<b>AO</b>	Aircraft Operators
<b>AOC</b>	Airline Operational Control / Airline Operations Centre
<b>ASM</b>	AirSpace Management
<b>ATCO</b>	Air Traffic Controller
<b>ATFCM</b>	Air Traffic Flow and Capacity Management
<b>ATM</b>	Air Traffic Management
<b>ATMRPP</b>	AIR TRAFFIC MANAGEMENT REQUIREMENTS AND PERFORMANCE PANEL – ICAO working group.
<b>AU</b>	Airspace User
<b>B2B</b>	Business to Business (B2B) web services
<b>BADA</b>	Base of Aircraft Data
<b>BDT</b>	Business Development Trajectory
<b>BMT</b>	Business Mission Trajectory
<b>CASA</b>	Computer Assisted Slot Allocation
<b>CDR</b>	Conditional Route
<b>CFMU</b>	Central Flow Management Unit
<b>CFN</b>	Commercial Flight Number

Term	Definition
<b>CFSP</b>	Computer Flight Plan Service Provider
<b>CHMI</b>	CFMU Human Machine Interface
<b>CNS</b>	Communication, Navigation and Surveillance
<b>CONOPS</b>	CONcept of OPerationS
<b>CRAM</b>	Conditional Route Availability Message
<b>DCB</b>	Demand Capacity Balancing
<b>DDR</b>	Demand Data Repository
<b>DOD</b>	Detailed Operational Descriptions
<b>E-ATMS</b>	European Air Traffic Management System
<b>ECAC</b>	European Civil Aviation Conference
<b>ECHG</b>	Modification message of the Extended FPL
<b>EDLA</b>	Extended DLA message
<b>EFD</b>	Electronic Flight Data
<b>EFPL</b>	Extended Flight Plan
<b>EFPLM</b>	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.
<b>EIBT</b>	Estimated In Block Time
<b>EOBT</b>	Estimated Off Block Time
<b>ETFMS</b>	Enhanced Tactical Flow Management System
<b>FAB</b>	Functional Airspace Block
<b>FDC</b>	Flight Data Contributor
<b>FDMP</b>	Flight Data Manager Publisher
<b>FDP</b>	Flight Data Processing
<b>FDPS</b>	Flight Data Processing System
<b>FDU</b>	Flight Data User
<b>FF-ICE</b>	Flight and Flow Information for a Collaborative Environment

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Term	Definition
<b>FIXM</b>	Flight Information Exchange Model
<b>FLS</b>	Flight Suspension message
<b>FMP</b>	Flow Manager Position
<b>FOC</b>	Flight Operations Centre
<b>FO</b>	Flight Object
<b>FOS</b>	Flight Object Server
<b>FPL</b>	Flight Plan
<b>FPR</b>	Flight Plan Repository
<b>FRA</b>	Free Route Airspace
<b>GAT</b>	General Air Traffic
<b>GUFID</b>	Global Unique Flight Identifier
<b>ICAO</b>	International Civil Aviation Organisation
<b>IFPS</b>	Initial Flight Plan Service
<b>IFR</b>	Instrument Flight Rules
<b>INTEROP</b>	Interoperability Requirements
<b>IOC</b>	Initial Operating Capability
<b>IOP</b>	Interoperability (between ground systems)
<b>IRS</b>	Interface Requirements Specification
<b>iSBT</b>	Initial Shared Business Trajectory (Step 1)
<b>iRBT</b>	Initial Reference Business Trajectory (Step1)
<b>KPI</b>	Key Performance Indicators
<b>LT</b>	Long Term
<b>LTM</b>	Local Traffic Manager
<b>MT</b>	Medium Term
<b>NM</b>	Network Manager
<b>NMF</b>	Network Management Function
<b>NPR</b>	Nominal Preferred Routing

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Term	Definition
<b>NOP</b>	Network Operations Plan
<b>OAT</b>	Operational Air Traffic
<b>OFA</b>	Operational Focus Area
<b>OI</b>	Operational Improvement
<b>ORM</b>	Operational Reply Message
<b>OSD</b>	Operational Service and Environment Definition
<b>OUC</b>	Operational Use-Case
<b>PANS-ATM</b>	Procedures for Air Navigation Services – Air Traffic Management
<b>PTR</b>	Profile Tuning Restriction
<b>RAD</b>	Route Availability Document
<b>RBT</b>	Reference Business/Mission Trajectory
<b>REJ</b>	REJection message
<b>SARPs</b>	Standards and Recommended Practices
<b>SBT</b>	Shared Business/Mission Trajectory
<b>SJU</b>	SESAR Joint Undertaking
<b>SPR</b>	Safety and Performance Requirements
<b>SWIM</b>	System Wide Information Management
<b>TAD</b>	Technical Architecture Description
<b>TOC</b>	Top-Of-Climb
<b>TOD</b>	Top-Of-Descent
<b>TOW</b>	Take-Off Weight
<b>TP</b>	Trajectory Prediction
<b>TS</b>	Technical Specification
<b>TTA / TTO</b>	Target Time of Arrival / Target Time of Overflight
<b>TTOT</b>	Target Take Off Time

## 2. Summary of Operational Concept (from OSED)

### 2.1 Description of the Concept Element

#### 2.1.1 Short-term planning phase – Extended flight plan

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 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 trajectory 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 trajectory different from 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. 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 be also 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.

- **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 neither selective nor exclusive, but coexist in time:

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200 ○ **Global mix mode** of operations allowing some AUs to provide EFPLs whereas others will  
201 continue to transmit ICAO FPLs.

202 ○ **Individual mix mode** of operations where AUs will be able to submit an EFPLM followed by  
203 updates in ICAO format (Change, Delay, Re-Processing...) and vice versa.

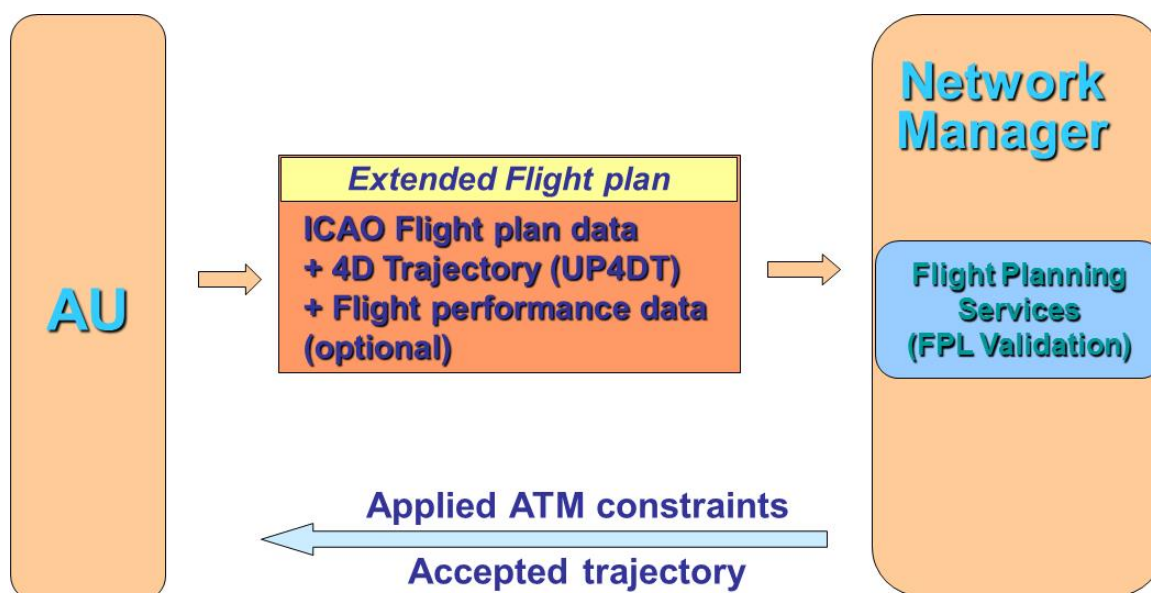
204 Regarding ATM constraints, evolutions in step 1 involve only “soft” constraints named Profile Tuning  
205 Restrictions (PTRs). Two flows of information are considered and the type of information provided  
206 changes from one to another:

207 ○ Any AU is able to retrieve PTR information from the global database where they are  
208 published.

209 ○ For a given flight, the list of PTRs applying to that specific flight is provided as feedback in  
210 the **EFPL reply messages from NM** in the trajectory management process (i.e. as with  
211 PTRs information)

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

214



215

216

Figure 2: Extended Flight Plan validation services overview

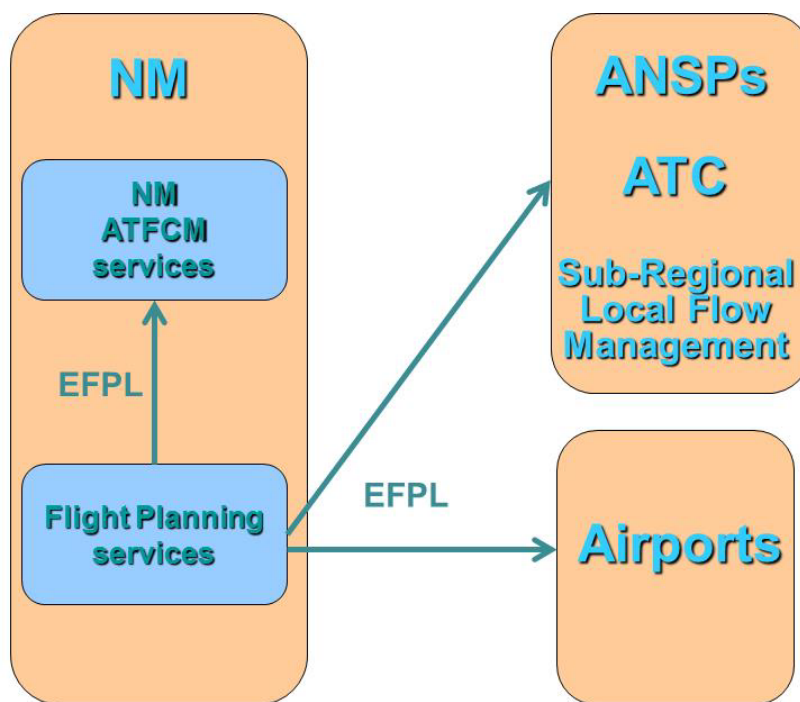


Figure 3 Extended Flight Plan dissemination data overview

In order to address regulatory and worldwide applicability aspects, the Extended FPL solution will be 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 recommendations in target Step 1 [18].

## 2.2 Description of Operational Services

See Section 2.3 of the 07.06.02 Step 1 BT OSIED 2016 [13].

## 2.3 Description of Operational Environment

See Section 3 of the 07.06.02 Step 1 BT OSIED 2016 [13].

## 3. Requirements - Extended flight plan (quick win)

*Note 1: The SPR validation method fields have been updated taking into account information from VR EXE-07.06.02 -VP-713 from the Step 1 Business Trajectory Validation Report for EFPL [21].*

*Note 2: 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).*

### 3.1 Operational Service

#### 3.1.1 Safety Requirements

[REQ]

Identifier	REQ-07.06.02-SPR-DCS1.0030
Requirement	Network predictability shall be maintained/ improved by DCB services when using EFPL data.
Title	DCB services - Undetected imbalances
Status	<Validated>
Rationale	A negative impact on network predictability might result into overloading a sector.
Category	<Safety>
Validation Method	<Fast Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	ExtendedFlightPlanSubmission	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0011	<Partial>

[REQ]

Identifier	REQ-07.06.02-SPR-FPS1.0021
Requirement	The airspace user shall provide EFPL data in accordance with the specified data quality requirements (resolution, accuracy, integrity).
Title	EFPL data quality requirements
Status	<Validated>
Rationale	Requirement extracted from the safety assessment.
Category	<Safety>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	ExtendedFlightPlanSubmission	N/A
<APPLIES_TO>	<Service>	FlightPlanDataDistribution	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0060	<Partial>

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<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0065	<Partial>
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[REQ]

Identifier	REQ-07.06.02-SPR-FPS1.0006
Requirement	The airspace user shall provide elements of the extended flight plan message used for ATC purposes like ground-based Trajectory Prediction with the accuracy and integrity level specified by the ATC application.
Title	AU flight planning transmission- Integrity of EFPL data used by ATC
Status	<In Progress>
Rationale	Requirement extracted from the safety assessment <i>Requirement out of the scope of the PCP and the solution #37.</i> <i>Requirement part of ATC distribution to be validated in S2020 PJ18</i>
Category	<Safety>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	ExtendedFlightPlanSubmission	N/A
<APPLIES_TO>	<Service>	FlightPlanDataDistribution	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0060	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0065	<Partial>

[REQ]

Identifier	REQ-07.06.02-SPR-FPS1.0008
Requirement	The EFPL validation process shall reduce/maintain the number of incorrect ACK messages that are due to flight trajectory calculation differences between NM and the AU compared to the current FPL validation process.
Title	NM flight planning service- EFPL validation adapted to the resolution and accuracy of EFPL elements
Status	<Validated>
Rationale	Requirement extracted from the safety assessment. Incorrect operational Reply Message has the potential to lead to a number of operational consequences including that a flight ends up in closed airspace or loss of separation (with ATCO being able to control the situation)
Category	<Safety>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	ExtendedFlightPlanSubmission	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0003	<Partial>

[REQ]

Identifier	REQ-07.06.02-SPR-FPS1.0011
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Requirement	The NM EFPL validation process shall raise an error in case the EFPL trajectory information is inconsistent with the equivalent ICAO Field 15 route information provided within the same EFPL.
Title	NM flight planning service - ICAO FPL data/Filed Trajectory Inconsistency
Status	<In Progress>
Rationale	Requirement extracted from the safety assessment. <i>Requirement out of the scope of the PCP and the solution #37.</i> <i>Requirement part of ATC distribution to be validated in S2020 PJ18.</i>
Category	<Safety>
Validation Method	<Shadow Mode>
Verification Method	

## [REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	ExtendedFlightPlanSubmission	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0002	<Partial>

## [REQ]

Identifier	REQ-07.06.02-SPR-FPS1.0013
Requirement	The NM shall develop the “flight messages checking and distribution” service with an appropriate assurance level (AL).
Title	NM flight planning service - Appropriate assurance level for FPL/EFPL services
Status	<In Progress>
Rationale	Requirement extracted from the safety assessment. <i>EFPL assurance level to be validated at V4 maturity in NM 20.5 Release for submission service.</i>
Category	<Safety>
Validation Method	<Shadow Mode>
Verification Method	

## [REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	ExtendedFlightPlanSubmission	N/A
<APPLIES_TO>	<Service>	FlightPlanDataDistribution	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0008	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0009	<Partial>

## [REQ]

Identifier	REQ-07.06.02-SPR-FPS1.0016
Requirement	The implementation of EFPL shall reduce/maintain the number of missing flight plans at ATC level due to wrong addressing at NM level compared to the current mode of operation.
Title	NM flight planning service - Missing flight at ATC level
Status	<Validated>
Rationale	Requirement extracted from the safety assessment. <i>Non-PCP requirement</i>

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Category	<Safety>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	FlightPlanDataDistribution	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0013	<Partial>

[REQ]

Identifier	REQ-07.06.02-SPR-FPS1.0017
Requirement	The implementation of the EFPL shall reduce/maintain the number of missing flight suspension messages (FLS) compared to the current mode of operation
Title	NM flight planning service - Missing flight suspension messages
Status	<Validated>
Rationale	Requirement extracted from the safety assessment. It addresses the situation where change of route availability occurs or RAD restriction impact a flight and the flight suspension message is not sent by NM Not a specific EFPL failure mode but frequency of occurrence could be increased by the implementation of the EFPL
Category	<Safety>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	FlightPlanDataDistribution	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0014	<Partial>

[REQ]

Identifier	REQ-07.06.02-SPR-FPS1.0018
Requirement	The implementation of the EFPL shall reduce/maintain the number of incorrect De-Suspension messages (DES) compared to the current mode of operation
Title	NM flight planning service - Incorrect de-suspension messages
Status	<Validated>
Rationale	Requirement extracted from the safety assessment. It addresses the situation where a flight is incorrectly de-suspended by NM Not a specific EFPL failure mode but frequency of occurrence could be impacted by the implementation of the EFPL.
Category	<Safety>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A

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<APPLIES_TO>	<Service>	ExtendedFlightPlanSubmission	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0014	<Partial>

## [REQ]

Identifier	REQ-07.06.02-SPR-FPS1.0019
Requirement	The implementation of the EFPL shall reduce/maintain the number of inconsistent flight plans compared to the current mode of operation
Title	NM flight planning services - Consistent flight plan information between AU and NM
Status	<Validated>
Rationale	Requirement extracted from the safety assessment.
Category	<Safety>
Validation Method	<Live Trial>
Verification Method	

## [REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	ExtendedFlightPlanSubmission	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0003	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0009	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0013	<Partial>

## 3.1.2 Performance Requirements

### 3.1.2.1 NM flight planning services

## [REQ]

Identifier	REQ-07.06.02-SPR-FPP1.0010
Requirement	EFPLs services shall be available 24h/7days outside specific maintenance periods.
Title	NM flight planning service - Availability requirement
Status	<In Progress>
Rationale	Services for EFPLs submission, processing and distribution shall inherit from the availability requirements from the current flight plan submission and processing services. <i>Validation planned in V4</i>
Category	<Reliability>
Validation Method	<Shadow Mode>
Verification Method	

## [REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	ExtendedFlightPlanSubmission	N/A
<APPLIES_TO>	<Service>	FlightPlanDataDistribution	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0000	<Partial>

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[REQ]

Identifier	REQ-07.06.02-SPR-FPP1.0015
Requirement	In case of a system failure EFPL services shall be available again within 1 hour.
Title	NM flight planning service - Recovery following a service failure
Status	<In Progress>
Rationale	Services for EFPLs submission, processing and distribution shall inherit from the availability requirements from the current flight plan submission and processing services. <i>Validation planned in V4</i>
Category	<Reliability>
Validation Method	<Shadow Mode>
Verification Method	

281

282

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	ExtendedFlightPlanSubmission	N/A
<APPLIES_TO>	<Service>	FlightPlanDataDistribution	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0000	<Partial>

283

284

[REQ]

Identifier	REQ-07.06.02-SPR-FPP1.0020
Requirement	NM services and associated systems shall be designed in such a way that under all circumstances no EFPL message shall get lost, including during a system crash or catastrophe.
Title	NM flight planning service - Reliability requirement
Status	<In Progress>
Rationale	Services for EFPLs submission, processing and distribution shall inherit from reliability requirements from the current flight plan submission and processing services. <i>Validation planned in V4</i>
Category	<Reliability>
Validation Method	<Shadow Mode>
Verification Method	

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[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	ExtendedFlightPlanSubmission	N/A
<APPLIES_TO>	<Service>	FlightPlanDataDistribution	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0000	<Partial>

287

288

[REQ]

Identifier	REQ-07.06.02-SPR-FPP1.0030
Requirement	In order to allow application of software maintenance and interventions, a weekly maintenance period shall be planned at a fixed time with a duration of maximum 1 hour during which submission and processing of EFPL will not be possible.
Title	NM flight planning service - Maintainability requirement

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Status	<In Progress>
Rationale	Services for EFPLs submission, processing and distribution shall inherit from the maintainability requirements from the current flight plan submission and processing services. <i>Validation planned in V4</i>
Category	<Maintainability>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	ExtendedFlightPlanSubmission	N/A
<APPLIES_TO>	<Service>	FlightPlanDataDistribution	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-SPR-FPP1.0040
Requirement	When a shutdown of the NM systems is required in order to implement a major upgrade of NM systems in support of EFPL services, the planned shutdown shall be announced in a Deployment Plan which shall be published 3 months before.
Title	NM flight planning service - Maintainability requirement for major upgrade
Status	<In Progress>
Rationale	Services for EFPLs submission, processing and distribution shall inherit from the maintainability requirements from the current flight plan submission and processing services. <i>Validation planned in V4</i>
Category	<Maintainability>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	ExtendedFlightPlanSubmission	N/A
<APPLIES_TO>	<Service>	FlightPlanDataDistribution	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-SPR-FPP1.0050
Requirement	The B2B EFPL filing services shall inherit from the security, authorisation and authentication requirements from the current B2B flight plan filing services
Title	NM flight planning service - Security requirement
Status	<In Progress>
Rationale	EFPLs management does not require any specific security requirement compared to current flight plans management. The OSED includes a requirement related to the confidentiality of some EFPL information (e.g. TOW). <i>Validation planned in V4</i>

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Category	<Security>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	ExtendedFlightPlanSubmission	N/A
<APPLIES_TO>	<Service>	FlightPlanDataDistribution	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0000	<Partial>

[REQ]

Identifier	REQ-07.06.02-SPR-FPP1.0055
Requirement	An airspace user shall only be able to retrieve the EFPLs that he has submitted.
Title	NM flight planning service - Restricted access by airspace user
Status	<In Progress>
Rationale	This requirement is a specific case of the general security requirement: REQ-07.06.02-SPR-FPP1.0150. <i>Validation planned in V4</i>
Category	<Security>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	FlightPlanDataDistribution	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0055	<Partial>

[REQ]

Identifier	REQ-07.06.02-SPR-FPP1.0060
Requirement	The average processing time of an EFPL shall remain equal/below the 110% of the processing time of an ICAO flight plan.
Title	NM flight planning service - Processing times
Status	<In Progress>
Rationale	It must be ensured that the quality of service in terms of response times is not significantly degraded due to the introduction of the Extended flight plan <i>Validation planned in V4</i>
Category	<Performance>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	ExtendedFlightPlanSubmission	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0014	<Partial>

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[REQ]

Identifier	REQ-07.06.02-SPR-FPP1.0070
Requirement	Evolving from ICAO FPL submission to EFPL submission shall reduce the number of rejected flight plans at least 5%.
Title	NM flight planning service - Rate of invalid FPLs
Status	<Validated>
Rationale	The target is to reduce significantly the rate of invalid flight plans (by 10% could be an average target based on the results of past V1/V2 validations) without creating safety issues. The minimum requirement is to avoid increasing the rate of rejections.
Category	<Performance>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	ExtendedFlightPlanSubmission	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0140	<Partial>

[REQ]

Identifier	REQ-07.06.02-SPR-FPP1.0080
Requirement	The average duration for manual processing of an EFPL by an IFPU operator after the learning phase shall remain equal/below the average duration for manual processing of an ICAO flight plan.
Title	NM flight planning service - IFPU operators workload
Status	<Validated>
Rationale	The target is to reduce significantly the overall operators' workload (not per message). The minimum requirement is to not increase operators' workload.
Category	<Performance>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	ExtendedFlightPlanSubmission	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0014	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0140	<Partial>

[REQ]

Identifier	REQ-07.06.02-SPR-FPP1.0130
Requirement	IFPS shall enable AUs to send specific flight performance data according to their business constraints.
Title	Validation - Flexibility in performance data provision for the IFPS
Status	<Validated>

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Rationale	To enable AU's to choose the form in which specific flight performance data could be sent, i.e. either via climb/descend profile or via take-off weight
Category	<Performance>
Validation Method	<Gaming>
Verification Method	

## [REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	ExtendedFlightPlanSubmission	N/A
<APPLIES_TO>	<Service>	FlightPlanDataDistribution	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0000	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0030	<Partial>

## [REQ]

Identifier	REQ-07.06.02-SPR-FPP1.0140
Requirement	IFPS shall be able to process at least the same amount of EFPL messages sent by AUs or representatives than in the current operations with ICAO format (6 per second <sup>1</sup> ).
Title	Processing EFPL messages
Status	<In Progress>
Rationale	IFPS should at least comply with the minimums in terms of ICAO successful processing rate <i>Validation planned in V4</i>
Category	<Performance>
Validation Method	<Shadow Mode>
Verification Method	

## [REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	ExtendedFlightPlanSubmission	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0000	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0001	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0006	<Partial>

## [REQ]

Identifier	REQ-07.06.02-SPR-FPP2.0005
Requirement	The individual mix mode of operations shall reduce/maintain the number of missed or rejected modification messages compared to the current mode of operations
Title	Individual mix mode of operations
Status	< Validated >
Rationale	This requirement is to avoid in transition phase a degradation of the flight plan acceptance process due to mix mode operations. <i>Partly validated in V3. Planned to be fully validated in V4.</i>
Category	<Performance>

<sup>1</sup> Since the mix mode will exist, that would mean 6 flight plans (ICAO FL+EFPL) per second

Validation Method	<Gaming >
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	ExtendedFlightPlanSubmission	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0013	<Partial>

[REQ]

Identifier	REQ-07.06.02-SPR-FPP1.0150
Requirement	IFPS shall provide extended flight plan information for a given flight on each authorised AU's request
Title	EFPL information retrieval upon request
Status	<In Progress>
Rationale	To enable AU to retrieve extended flight plan information of a flight <i>This was verified in the VP-713 part B. Validation planned in V4 in the context of NM 21 Release</i>
Category	<Performance>
Validation Method	<Real Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	FlightPlanDataDistribution	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0055	<Partial>

[REQ]

Identifier	REQ-07.06.02-SPR-FPP1.0170
Requirement	IFPS validation process shall guarantee confidentiality for AUs on commercially sensitive data distribution and accessibility
Title	Confidential distribution of sensitive FSPD information
Status	<In Progress>
Rationale	Commercially sensitive data should not be distributed nor accessible to other AUs to avoid unfair competition <i>Validation planned in V4</i>
Category	<Security>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	ExtendedFlightPlanSubmission	N/A
<APPLIES_TO>	<Service>	FlightPlanDataDistribution	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0012	<Partial>

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### 3.1.2.2 DCB services

[REQ]

Identifier	REQ-07.06.02-SPR-DCP1.0090
Requirement	DCB services availability shall remain unaltered by the use of extended flight plans
Title	DCB services - Availability requirement
Status	<In Progress>
Rationale	DCB services need be adapted to take into account EFPL information. It shall be ensured that this has no negative impact on the availability of DCB services <i>Validation planned in V4</i>
Category	<Reliability>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	ExtendedFlightPlanSubmission	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0011	<Partial>

[REQ]

Identifier	REQ-07.06.02-SPR-DCP1.0100
Requirement	Reliability of the prediction of airspaces crossed by a flight - in particular in the climbing and descending phases - shall be increased using EFPL information vs. using ICAO flight plan.
Title	DCB services - Improved prediction of airspaces crossed by a flight
Status	<In Progress>
Rationale	Improving traffic prediction is one of the main objectives of the EFPL concept. Improving the prediction of sectors crossed has a positive impact on safety and capacity KPAs. <i>Validation planned in V4</i>
Category	<Performance>
Validation Method	<Fast Time Simulation>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	ExtendedFlightPlanSubmission	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0011	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0015	<Partial>

[REQ]

Identifier	REQ-07.06.02-SPR-DCP1.0105
Requirement	Accuracy of the prediction of entry times in sectors, overfly times and arrival times shall be increased in average using EFPL information vs. using ICAO flight plan.
Title	DCB services - Improved prediction of estimated times

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Status	<Validated>
Rationale	Improving traffic prediction is one of the main objectives of the EFPL concept. Time predictions are key input to the management of ATFCM regulations particularly in the context of the evolution to the management of TTOs/TTAs. Improving times predictions has a positive impact on safety, capacity, efficiency and predictability KPAs.
Category	<Performance>
Validation Method	<Fast Time Simulation>
Verification Method	

## [REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	ExtendedFlightPlanSubmission	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0011	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0015	<Partial>

## [REQ]

Identifier	REQ-07.06.02-SPR-DCP1.0110
Requirement	Accuracy of airspace occupancy predictions calculated and used by DCB services shall be increased using EFPL data vs. using ICAO flight plan.
Title	DCB services - Improved prediction of occupancy counts
Status	<Validated>
Rationale	Improving traffic prediction is one the main objective of the EFPL concept. Improving the accuracy of occupancy counts has a direct impact on the efficiency DCB/STAM of measures and consequently on capacity, efficiency and safety KPAs. (reference to 07.06.05 BT OSED)
Category	<Performance>
Validation Method	<Fast Time Simulation>
Verification Method	

## [REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	ExtendedFlightPlanSubmission	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0011	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0015	<Partial>

## [REQ]

Identifier	REQ-07.06.02-SPR-DCP1.0120
Requirement	The accuracy of some complexity metrics (e.g. level crossed in a sector) shall be improved using EFPL information vs. using ICAO flight plan.
Title	DCB services - Improved prediction of complexity indicators
Status	<In Progress>
Rationale	EFPL information should allow to improve the quality of some complexity metrics (e.g. number of levels crossed in a sector) used in DCB (mainly at local level). This should allow to improve the efficiency of DCB measures (particularly dDCB measures) <i>Validation planned in V4</i>

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Category	<Performance>
Validation Method	<Shadow Mode>
Verification Method	

#### [REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	Traffic Demand Management	N/A
<APPLIES_TO>	<Operational Focus Area>	OFA03.01.04	N/A
<APPLIES_TO>	<Service>	ExtendedFlightPlanSubmission	N/A
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0011	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0015	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0001.0016	<Partial>

### 3.1.3 Requirements deleted

The following requirements included in the **SPR 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-SPR-FPS1.0002
Requirement	ATC Units shall transmit to the Network Manager all applied ATM constraints affecting the 4D trajectory of flight plan. That includes relevant information already provided today including Profile Tuning Restriction (PTR) information.
Title	NM flight planning service- Trajectory constraints information sharing
Status	<Deleted>
Rationale	This requirement has been removed as it is not specific to EFPL and is already applicable to the baseline environment. <i>Requirement out of the scope of the PCP and the solution #37.</i>
Category	<Safety>
Validation Method	<Shadow Mode>
Verification Method	

#### [REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

#### [REQ]

Identifier	REQ-07.06.02-SPR-FPS1.0009
Requirement	The EFPLM validation process shall be commensurate with the required level of integrity of the different EFPLM elements.
Title	NM flight planning service- EFPL validation fitted with integrity requirement
Status	<Deleted>
Rationale	Requirement suppressed in the current Safety Assessment Report
Category	<Safety>
Validation Method	<Live Trial>
Verification Method	

#### [REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
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[REQ]

Identifier	REQ-07.06.02-SPR-FPS1.0022
Requirement	The use of Extended Flight Plan data elements shall be limited to Compatible ATC units
Title	Use of EFPL data only by compatible ATS units
Status	<Deleted>
Rationale	Requirement suppressed in the current Safety Assessment Report <i>Non-PCP requirement</i>
Category	<Safety>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-07.06.02-SPR-FPS1.0015
Requirement	NM shall maintain an accurate list of ATC units compatible with Extended Flight Plan in order to prevent distribution of Extended Flight Plan to non-compatible ATC Unit
Title	NM flight planning service - Maintenance of the list ATC units compatible with EFPL
Status	<Deleted>
Rationale	Requirement suppressed in the current Safety Assessment Report <i>Non-PCP requirement</i>
Category	<Safety>
Validation Method	<Live Trial>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

The following requirements included in the **SPR Edition 2.00** 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-SPR-FPS1.0020
Requirement	The NM shall validate 4D trajectories provided by AUs in extended flight plans by considering all ATM constraints required to be taken into account in planning phase.
Title	NM flight planning service- Constraints consideration in EFPL validation
Status	<Deleted>
Rationale	It has been removed from the safety requirements as it has become a business requirement.
Category	<Safety>

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Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-07.06.02-SPR-FPS1.0010
Requirement	The EFPLM validation process shall verify the completeness of EFPLM elements
Title	NM flight planning service - Verification of the completeness of Extended FPL information
Status	<Deleted>
Rationale	Requirement removed from the safety assessment.
Category	<Safety>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-07.06.02-SPR-FPS1.0012
Requirement	The EFPLM validation process shall reduce/maintain the number of incorrect ACK messages - from an operational point of view - compared to the current mode of operation
Title	NM flight planning service - Rate of incorrect ACK messages
Status	<Deleted>
Rationale	This requirement has been removed because it evolved to the same requirement as REQ-07.06.02-SPR-FPS1.0008 in a higher level. After analysis, REQ-07.06.02-SPR-FPS1.0008 was preferred because it explicitly refers to the only part changing in the IFPS validation process due to the EFPL introduction: the trajectory calculation.
Category	<Safety>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-07.06.02-SPR-FPS1.0005
Requirement	NM shall distribute elements of the extended flight plan message used for ATC purposes without altering the required accuracy and integrity level specified for the ATC application
Title	NM flight planning services - Integrity of EFPL data used by ATC

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Status	<Deleted>
Rationale	This requirement has been removed because the required accuracy and integrity levels specified for the ATC are unknown. Furthermore, the requirement is stricter in comparison with a smooth transition from current FPL. <i>Non-PCP requirement</i>
Category	<Safety>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

[REQ]

Identifier	REQ-07.06.02-SPR-FPS1.0160
Requirement	IFPS shall reject the EFPLM when one of the performed validations fails
Title	EFPL Validation - Rejection of non-compliant EFPLM
Status	<Deleted>
Rationale	It has evolved to a business requirement
Category	<Safety>
Validation Method	<Shadow Mode>
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

## 3.2 Information Exchange Requirements (IER)

See IER provided in the section 4 of the 07.06.02 OSED. Step 1 volume 1 [13]. This section has been completed only with the IERs related to the EFPL concept as for its maturity level V3. The rest of the IERs that were included in last release Step 1 SPR for BTM -D87- Edition 2.00 are considered out of scope and therefore they have been removed –see section 1.2)

404 [IER]

Identifier	Name	Content Type	Frequency	Safety Criticality	Confidentiality	Maximum Time of Delivery	Interaction Type	Free
IER-07.06.02-OSD-EFPL.0010	EFPL message submission	<Data>	For each flight plan creation or modification	<Major>	<Restricted>	As in current operational procedures	<One-way>	
IER-07.06.02-OSD-EFPL.0020	ACK message	<Data>	For each flight plan message: submission, modification, cancel, delay, DES, FLS	<Major>	<Restricted>	As in current operational procedures	<One-way>	
IER-07.06.02-OSD-EFPL.0021	MAN message	<Data>	For each flight plan message: submission, modification, cancel, delay, DES, FLS	<Major>	<Restricted>	As in current operational procedures	<One-way>	
IER-07.06.02-OSD-EFPL.0030	REJ message	<Data>	For each flight plan message: submission, modification, cancel, delay, DES, FLS	<Major>	<Restricted>	As in current operational procedures	<One-way>	
IER-07.06.02-OSD-EFPL.0050	FLS message	<Data>	For each flight that is suspended	<Major>	<Restricted>	As in current operational procedures	<One-way>	
IER-07.06.02-OSD-EFPL.0055	FLS message	<Data>	For each flight that is suspended	<Major>	<Restricted>	As in current operational procedures	<One-way>	
IER-07.06.02-OSD-EFPL.0060	Extended modification message	<Data>	For each modification to the flight plan	<Major>	<Restricted>	As in current operational procedures	<One-way>	
IER-07.06.02-OSD-EFPL.0070	Extended delay message	<Data>	For each delay to the flight plan requested by the AU	<Major>	<Restricted>	As in current operational procedures	<One-way>	
IER-07.06.02-OSD-EFPL.0100	DES message	<Data>	Each time NM de-suspends a flight	<Major>	<Restricted>	As in current operational procedures	<One-way>	
IER-07.06.02-OSD-EFPL.0105	DES message	<Data>	Each time NM de-suspends a flight	<Major>	<Restricted>	As in current operational procedures	<One-way>	

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Identifier	Name	Content Type	Frequency	Safety Criticality	Confidentiality	Maximum Time of Delivery	Interaction Type	Free
IER-07.06.02-OSD-EFPL.0110	CNL message	<Data>	For each cancellation to the flight plan requested by the AU	<Major>	<Restricted>	As in current operational procedures	<One-way>	
IER-07.06.02-OSD-EFPL.0115	CNL message	<Data>	For each cancellation to the flight plan requested by the AU	<Major>	<Restricted>	As in current operational procedures	<One-way>	
IER-07.06.02-OSD-EFPL.0120	EFPL distribution message	<Data>	For each flight plan accepted by NM	<Major>	<Restricted>	As in current operational procedures	<One-way>	
IER-07.06.02-OSD-EFPL.0123	EFPL modification distribution message	<Data>	For each flight plan modification accepted by NM	<Major>	<Restricted>	As in current operational procedures	<One-way>	
IER-07.06.02-OSD-EFPL.0126	EFPL delay distribution message	<Data>	For each flight plan delay accepted by NM	<Major>	<Restricted>	As in current operational procedures	<One-way>	
IER-07.06.02-OSD-EFPL.0130	ICAO FPL distribution message	<Data>	For each flight plan accepted by NM	<Major>	<Restricted>	As in current operational procedures	<One-way>	
IER-07.06.02-OSD-EFPL.0133	Modification distribution message	<Data>	For each flight plan modification accepted by NM	<Major>	<Restricted>	As in current operational procedures	<One-way>	
IER-07.06.02-OSD-EFPL.0136	Delay distribution message	<Data>	For each flight plan delay accepted by NM	<Major>	<Restricted>	As in current operational procedures	<One-way>	
IER-07.06.02-OSD-EFPL.0140	Flight estimation message	<Data>	For each flight that one ATC handoffs to the next ATC	<Major>	<Restricted>	As in current operational procedures	<One-way>	
IER-07.06.02-OSD-EFPL.0155	FPL request message	<Data>	Each time AU needs to know the flight information from NM	<Major>	<Restricted>	N/A	<One-way>	

Identifier	Name	Content Type	Frequency	Safety Criticality	Confidentiality	Maximum Time of Delivery	Interaction Type	Free
IER-07.06.02-OSD-EFPL.0145	FPL request message	<Data>	Each time ATC needs to know the flight information from NM	<Major>	<Restricted>	N/A	<One-way>	

Table 1: IER layout

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## 4. References and Applicable Documents

### 4.1 Applicable Documents

- [1] **SESAR** Template Toolbox Ed.04.00.00 22/03/2014
- [2] **SESAR** Requirements and V&V Guidelines 03.01.00 05/02/2014
- [3] **SESAR** Template and Toolbox User manual Ed. 03.01.01 28/02/2014
- [4] EUROCONTROL ATM Lexicon  
<https://extranet.eurocontrol.int/http://atmlexicon.eurocontrol.int/en/index.php/SESAR>

### 4.2 Reference Documents

- [5] ED-78A GUIDELINES FOR APPROVAL OF THE PROVISION AND USE OF AIR TRAFFIC SERVICES SUPPORTED BY DATA COMMUNICATIONS.
- [6] B04.01 Performance Framework (validation targets, influence diagrams)
- [7] 07.02 –D46- Step 1 Technical Architecture Description, Edition 00.01.00, 2015.
- [8] SESAR Security Reference Material  
<https://extranet.sesarju.eu/Programme%20Library/Forms/Procedures%20and%20Guidelines.aspx>
- [9] SESAR Environment Reference Material  
<https://extranet.sesarju.eu/Programme%20Library/Forms/Procedures%20and%20Guidelines.aspx>
- [10] SESAR Human Performance Reference Material  
<https://extranet.sesarju.eu/Programme%20Library/Forms/Procedures%20and%20Guidelines.aspx>
- [11] SESAR Business Case Reference Material  
<https://extranet.sesarju.eu/Programme%20Library/Forms/Procedures%20and%20Guidelines.aspx>
- [12] WP B01 Integrated Roadmap DS16
- [13] 07.06.02 -D56- Step 1 Business Trajectory final Operational Service and Environment Definition (OSED), Edition 00.05.00, 2016.
- [14] SESAR P16.06.01 SESAR Safety Reference Material, Ed. 00.03.01, 9<sup>th</sup> March 2015
- [15] SESAR P16.06.05 Guidance to apply the SESAR Safety Reference Material, Ed. 00.02.01, 9<sup>th</sup> March 2015
- [16] Business Mission Trajectory Safety Plan, input to VALPLN, Edition 00.00.03 dated 10 June 2015  
[https://extranet.sesarju.eu/WP\\_07/Project\\_07.06.02/Project%20Plan/Trajectory-Step%201/BMT%20Safety%20Plan/P762\\_BMT%20Safety%20Plan\\_Ed00%2000%2003.doc](https://extranet.sesarju.eu/WP_07/Project_07.06.02/Project%20Plan/Trajectory-Step%201/BMT%20Safety%20Plan/P762_BMT%20Safety%20Plan_Ed00%2000%2003.doc)

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- 442 [17] 07.06.01 – D46 - Collaborative Network Operations Plan Operational Service and  
443 Environment Definition (OSD) Step 1, Edition 00.04.00,2016
- 444 [18] ICAO Document 9694
- 445 [19] 07.06.02 -D88- Step 1 Business Trajectory Validation Plan for VP-713 Ed 00.01.01 dated  
446 18/12/2015
- 447 [20] 07.06.02 Validation Plan Step 1, Volume 1 D02 Ed 00.01.01 December 2013
- 448 [21] 07.06.02 -D55- Step 1 Business Trajectory Validation Report for EFPL (VALR), Edition  
449 00.01.00, September 2016<sup>2</sup>
- 450 [22] 08.03.10-D65 Information Services Reference Model Service Portfolio Version 2.0,  
451 Ed.00.08.0
- 452 *The complete ISRM 2.0 delivery including all Service Description Documents (SDDs) and*  
453 *Service Identification Documents can be found in the SESAR extranet:*
- 454 ISRM 2.0 folder in SESAR extranet: SESAR Joint Undertaking Programme > WP 08 > Project  
455 08.03.10 > Project Execution > ISRM 2.

<sup>2</sup> This document shall be delivered at same time of the 7.6.2 -D57-Step 1 BT final SPR. Latest 2016 Edition shall be considered.

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## A Assessment / Justifications

### A.1 Safety assessment

#### NOTES

THE SAFETY ASSESSMENT **IS FOCUSING ONLY ON THE EXTENDED FLIGHT PLAN** CONCEPT AND AS SUCH COVERS ONLY PARTIALLY THE OI AUO-0203-A RELATED TO THE INITIAL SHARED BUSINESS TRAJECTORY (SEE 07.06.02 STEP 1 OSED [13] FOR MORE DETAILS).

THE EXTENDED FLIGHT PLAN BEING A TRANSVERSAL TOPIC IMPACTING SEVERAL DOMAINS (E.G NETWORK OPERATIONS, AIRPORT OPERATIONS, ATC), THE SCOPE OF THIS SAFETY ASSESSMENT HAS A WIDER COVERAGE IN TERMS OF OPERATIONAL SERVICES THAN THE 07.06.02 OSED. **THEREFORE ONLY A SUBSET OF THE REQUIREMENTS IDENTIFIED IN THIS SECTION HAS BEEN RETAINED TO BE INCLUDED IN THE REQUIREMENTS SECTION** IN THIS EDITION OF THE SPR.

#### A.1.1 Introduction

##### A.1.1.1 A Broader approach

Business/Mission Trajectory Management has the specificity of having a transversal role, enabling various operational projects by the use of BMT.

The main objective of this safety assessment is to derive a correct and complete set of EFPL safety requirements to support the different operational projects using this data.

Based on that statement, several aspects of the safety assessment process as described in the SESAR Safety Reference Material (SRM) are not applicable to the EFPL concept like the operational environment and key properties description, the identification of pre-existing hazards, determination of relevant operational Services. Indeed these aspects will be addressed during the safety assessment of the different operational projects using EFPL (ATFCM and ATC applications). However it should be noted that ATFCM is partly in the scope of P07.06.02 (as part of WP7) whereas ATC operations are definitively out of the scope.

However the safety assessment has been conducted in accordance with the basic principles of the SESAR Safety Reference Material ([14]) and associated Guidance ([15]) considering the above point.

It is recall that SRM is based on a twofold approach:

- a new *success approach* which is concerned with the safety of operations in the absence of failure; and
- a conventional *failure approach* which is concerned with the safety of operations in the event of failure

These two approaches are applied to the derivation of safety properties at each of the relevant stages of the BMT concept development, as follows:

#### Safety specification at the Operational Level

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There is no EFPL activity planned at the operational level or service level per say considering its enabler role as described above. However the flight plan acceptance process can be view as an operational process therefore Safety Criteria (SAC) have been identified at this stage to drive the identification of relevant safety validation objectives and requirements. The safety assessment process starts by capturing the regulatory requirements applicable to flight plans and the user needs stemming from operational projects (user requirements) requiring EFPL as an enabler. From these Regulation and User Requirements a safe design of the EFPL submission, modification, validation and distribution could start

### Safe EFPL high-level Design

This describes what the EFPL submission, modification, validation and distribution is actually like internally and includes all those system properties that are not directly required by the users but are implicitly necessary in order to satisfy the User requirements. Design is essentially an internal, or “white-box”, view of the different EFPL processes. Herein, it takes the form of a high-level architectural representation which describes the EFPL processes (submission, modification, validation and distribution) in terms of several “actors” (Network Manager, Airspace Users, Air Traffic Control providers, etc.).

From a safety perspective, this high-level design is expressed in the form of EFPL Safety Requirements (sub-divided into functionality & performance and integrity/reliability properties). As defined in the Safety Plan [16], the purpose here is to check the completeness of the requirements identified in the OSED [13], and, then inform the SPR with corresponding EFPL safety requirements that will be revealed by the safety analysis. Furthermore Safety Validation objectives will be also identified and will inform the relevant validation plan.

### A.1.1.2 Scope of the Safety Assessment

This safety assessment scope is limited to the Quick Win phase defined in the frame of P07.06.02 focusing only on the Extended Flight Plan (EFPL) concept for Business Trajectories. The safety assurance activities to be carried out during this safety assessment are specified in the Safety Plan [16].

This report covers the different stages of the lifecycle as described in section A.1.1.1. It also presents the assurance that the Safety Requirements are complete, correct and (from a potential Implementation viewpoint) realistic.

The Extended Flight Plan (EFPL), which is the subject of this safety assessment, applies to the following processes related to the flight plan management in the pre-flight phase:

- Submission
- Modification (including suspending and cancelling flight plans)
- Validation
- Distribution

The use of the EFPL is out of scope in the safety assessment presented in this report. The related operational requirements coming from theses several uses are to be used as inputs for defining the corresponding safety requirements for EFPL.

### A.1.1.3 Safety Criteria

Safety Criteria (SAC) will drive the safety-related objectives for both Validation exercises and Safety assessment of P07.06.02. However, as explained in the above sections, EFPL has an enabler role and is not per se an operational concept therefore Safety Criteria have been identified considering this aspect.

It is essential to define Safety Criteria at three levels as already discussed in paragraph A.1.2.2 where safety benefits have been introduced. Indeed EFPL could impact the flight planning activity, the Demand and Capacity Balancing (ATFCM) and ATC applications.

#### A.1.1.3.1 Safety Criteria associated to the flight planning

**SAC EFPL#1:** The use of EFPLs in the NM Flight Planning processes shall lead to no more or less wrongly validated flight plan compared to the current use of ICAO Flight Plan.

#### A.1.1.3.2 Safety Criteria associated to ATFCM

**SAC EFPL#2a:** The use of EFPLs for ATFCM shall maintain or reduce the risk of sector overload compared to the current use of ICAO Flight Plan.

**SAC EFPL#2b:** The ATFCM use of EFPLs elements shall be subject to an ATFCM operational safety assessment.

#### A.1.1.3.3 Safety Criteria associated to ATC

**SAC EFPL#3a:** The use of EFPL in lieu of ICAO Flight Plan for the existing ATC applications shall not impact their current level of safety and if possible improve it.

**SAC EFPL#3b:** The ATC use of EFPLs elements (e.g. Weight, Speed) to support current or new ATC applications (e.g. TP) shall be subject to an ATC operational safety assessment.

## A.1.2 Regulatory and User Needs Identification

### A.1.2.1 Scope

As the Extended Flight Plan is an enabler to other operational processes (e.g. ATC, DCB) dealing with safety critical aspects, an identification of User needs stemming from primary operational projects dealing with these processes is made.

In order to identify a complete list of User Requirements relying on EFPL as an enabler, this section addresses the following activities:

- Determine the complete list of primary operational projects eligible to use EFPL
- Collect primary operational projects requirements (derived in normal and abnormal conditions) which require EFPL as an enabler. Only a consolidated list of users' requirements is included in this section.
- On the top of these users' requirements, relevant existing regulation requirements on flight plan and related processes are to be identified as well.

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No primary operational project's operational hazards have been identified until now based on current available information from SESAR projects. Thus no list of associated EFPL relevant safety users' requirements (for the failure case) is provided in the current version of this SAR. The failure aspects have been addressed then on the system design part of the assessment, following a bottom-up approach.

### A.1.2.2 Applicable Regulation concerning flight plans and related processes

The main regulation concerning flight plans to be considered in this safety assessment are listed here-after:

- EC N°1033/2006 "laying down the requirements on procedures for flight plans in the pre-flight phase for the single European sky"
  - In the Annex of this regulation, the following ICAO provisions are included:
    1. Chapter 3, Section 3.3 (Flight Plans) of ICAO Annex 2 – Rules of the Air (10<sup>th</sup> edition including all amendments up to N°42).
    2. Chapter 4, Section 4.4 (Flight Plan) & Chapter 11, Paragraph 11.4.2.2 (Movements messages) of ICAO PANS-ATM 4444 (15<sup>th</sup> Ed.2007, including all amendments up to N°2).
    3. Chapter 2 (Flight Plan) & Chapter 6, paragraph 6.12.3 (Boundary estimates) of Regional Supplementary Procedures, Doc7030, European (EUR) Regional Supplementary Procedures (5<sup>th</sup> edition of 2008 including all amendment up to N°2).
- EC N°929/2010 "amending Regulation (EC) No 1033/2006 as regards the ICAO provisions referred to in Article 3(1)"
- EC N°923/2012 of 26 September 2012 laying down the common rules of the air and operational provisions regarding services and procedures in air navigation and amending Implementing Regulation (EU) No 1035/2011 and Regulations (EC) No 1265/2007, (EC) No 1794/2006, (EC) No 730/2006, (EC) No 1033/2006 and (EU) No 255/2010

### A.1.2.3 List of primary Operational Focus Areas (OFAs) supported by EFPL

The AU extended Flight Plan is processed by the NM Flight Messages Checking and Distribution function before being distributed to ANSPs for ATC services. The purpose of the flight messages checking & distribution function is to provide a centralised processing for flight plans to rationalise receipt, validation and distribution of flight plan data. The purpose is also to provide flight data for ATFCM services to NM and ANSP (e.g. FMP). **Figure 4** illustrates this process.

It has been identified that extended flight plan is potentially used for ATFCM and ATC purposes by the following Operational Focus Areas (OFAs):

- OFA 05.03.04 Enhanced ATFCM processes
- OFA 05.01.01 Airport Operations Management
- OFA 05.03.07 Network Operations Planning
- OFA 03.01.03 Free Routing

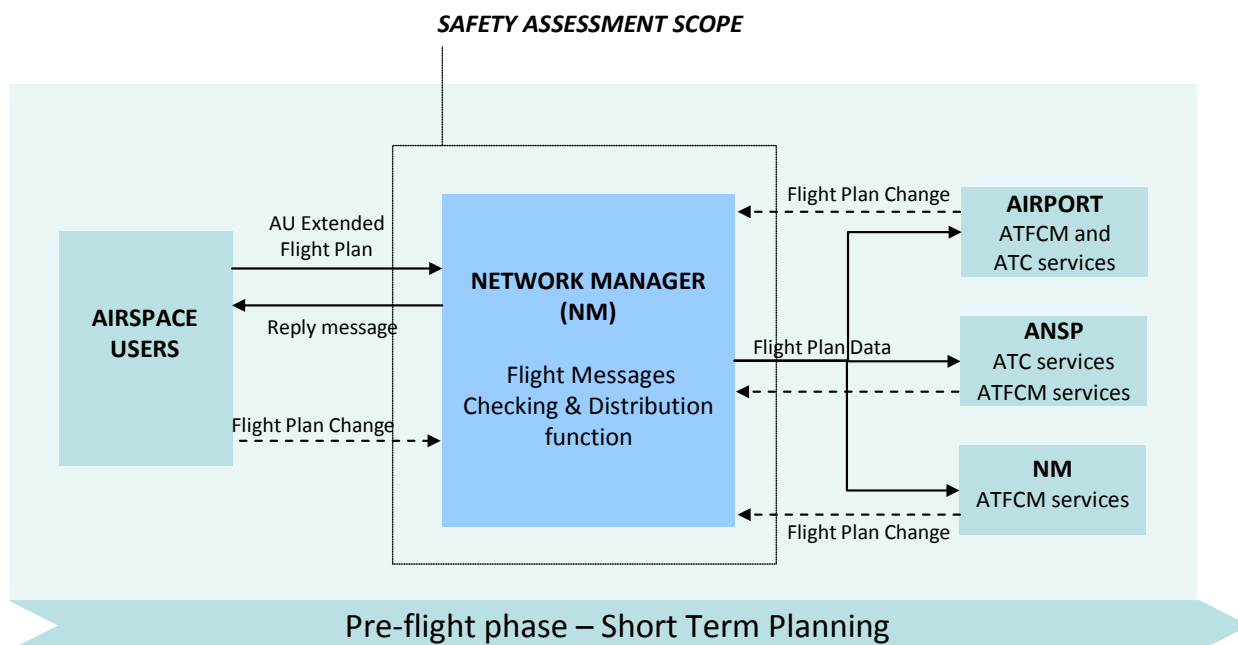


Figure 4: High-level process description for the extended flight plan

### A.1.2.4 Consolidated list of Regulatory and User Requirements

Considering the applicable regulations regarding flight plan (see A.1.2.2) and the identified user requirements the following **Table 2** provides the consolidated list of requirements to be considered for the next stage of the BMT/EFPL Safety assessment.

Consolidated Requirements	Requirement type	Associated relevant requirement <sup>3</sup>
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<sup>3</sup> From requirements listed in sections 2.2 and in Appendix A.

Consolidated Requirements	Requirement type	Associated relevant requirement <sup>3</sup>
<b>Requirements from regulation addressing SAC_EFPL#1 and SAC_EFPL#3a</b>		
REG-SUB-01	Submission of a flight plan	EC N°923/2012 Art.3 SERA 4001
REG-CON-01	Contents of a flight plan	EC N°923/2012 Art.3 SERA 4005
REG-MOD-01	Changes of the Flight plan	EC N°923/2012 Article 3 SERA 4015
REG-VAL-01	Flight plan validation associated to format and data conventions	EC N°1033/2006 Art.3.2a
REG-VAL-02	Flight plan validation associated to completeness and accuracy	EC N°1033/2006 Art.3.2b
REG-VAL-03	ATC units provides information affecting flight plans (route and/or flight level)	EC N°1033/2006 Art.3.7
REG-DIS-01	Flight plan and modified flight plan distribution to relevant ATS units	EC N°1033/2006 Art.3.3 EC N°1033/2006 Art.3.2c
REG-DIS-02	Flight plan acceptance forwarded to the originator	EC N°1033/2006 Art.3.2d
<b>User Requirements relative to ATFCM addressing SAC_EFPL#2a/b</b>		
UR-ATFCM-SUB-01	4D profile to be used by AU when using iSBT	REQ 07.06.05 OSED-0201.0000
UR-ATFCM-CON-01	Same flight plan profile view between AU and NM	REQ-07.06.05-SPR-0116.0000
<b>User Requirements relative to ATC addressing SAC_EFPL#3b and SAC_EFPL#1</b>		
UR-ATC-USE-01	Use of 4D trajectory for ATC trajectory prediction computation (TP)	REQ 05.05.02 OSED-0100.0100 REQ 04.07.01 OSED-0005.0003; .0004; .0005 and .0006
UR-ATC-VAL-01	SBT validation rule considering Free Route Airspace (FRA)	REQ 07.05.03 OSED-0001.0011

Table 2: Consolidated list of Regulatory and User Requirements applicable to BMT/EFPL

## A.1.3 Safe High-level Design

### A.1.3.1 EFPL high-level architectural representation

The high-level architectural representation of the EFPL submission, validation and distribution processes is entirely independent of the eventual physical implementation of the design. This representation describes the main functions for the submission, modification, validation and distribution of the extended flight plan.

More detailed description is provided in the OSED [13] in §4.2.1 for the EFPL submission and in §4.2.2 for the EFPL validation/re-validation, EFPL distribution and EFPL update. This description is supported by scenario/use cases identifying the different tasks to be accomplished between the several involved actors, mainly AU, NM and ATC Unit.

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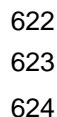


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637 The IFPS notifies to the AU/Third parties the result of the flight plan validation process by providing an  
638 Operational reply Message (ORM) indicating if the submitted flight plan is valid (Acknowledgment  
639 message- ACK), rejected (REJ) or referred for manual processing (MAN).

#### 640 **Flight Plan Distribution**

641 The IFPS distributes the accepted flight plan (initial and/or modified) to ATC units concerned by the  
642 flight and to the ETFMS.

643 The Network Manager distributes the ICAO flight plan included in the EFPLM/ECHG/EDLA to all ATC  
644 Units. For the distribution of the EFPLM, it could be done at NM level based on a list of ATC Units  
645 compatible with the Extended Flight Plan (EFPL COMP ATC) or distributed only to ATC Units which  
646 have requested to receive EFPLM (e.g. EFPL request through a dedicated B2B service).

#### 647 **Flight Plan Modification originated by AU/Third parties**

648 When flight plan modifications (ECHG and EDLA) after being submitted by AU/Third parties are  
649 validated by the IFPS, these modifications are distributed to ATC units concerned by the flight and to  
650 the ETFMS and the same distribution process applies (All ATC Units receiving ICAO FPL and some  
651 ATC units receiving ICAO FPL and EFPL)

#### 652 **Flight Plan Modification originated by airspace/route restrictions**

653 The Airspace Management Cell (AMC) informs the ETFMS about the airspace/route availability and  
654 sector capacity and the ETFMS transmit the relevant information to the IFPS.

655 In case of airspace/route restrictions (e.g. closure of airspace) the IFPS identifies if flight plans  
656 already validated are affected by such restrictions. Whenever applicable, the IFPS informs the  
657 ETFMS about the relevant invalid flight plans. The ETFMS notifies AU/Third parties and ATC Units of  
658 such situation by transmitting a flight plan suspension message (FLS).

659 Following the reception of a flight plan suspension message, the AU/Third party could either cancel  
660 the flight plan or modify it to overcome the airspace/route restriction by submitting an ECHG or EDLA  
661 message. In the latter case, the IFPS validates the modification and de-suspend the flight if validation  
662 process is successful and informs the ETFMS accordingly. The ETFMS notifies AU/Third parties and  
663 ATC Units of such situation by transmitting a flight plan de-suspension message (DES). The accepted  
664 ECHG or EDLAs are distributed to ATC units concerned by the flight and to the ETFMS and the same  
665 distribution process applies (All ATC Units receiving ICAO FPL and some ATC units receiving ICAO  
666 FPL and EFPL)

#### 667 **ATFCM**

668 The ETFMS system is a key enabler of the ATFCM services. The main purpose of the ETFMS system  
669 is to compare traffic demand with the ATC (sector) capacity available.

670

671 In cases where demand exceeds the ATC sector capacity, the system makes the information  
672 available to the Flow Management Controllers in the Network Manager Operations Centre (NMOC)  
673 and to their Flow Management Position (FMP) in the various ACCs. Together they decide whether or  
674 not to implement DCB/ATFCM measures.

#### 675 **ATC use:**

676 Flight plan are distributed to relevant ATC units considering the route included in the validated flight  
677 plan (See flight plan distribution above). Furthermore elements of the EFPL (TOW, estimated  
678 speed...) could be used to improve controller tools like the ground based Trajectory Prediction tool.

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Indeed ATC needs to maintain detailed, accurate, and up-to-date trajectories from aircraft take-off to landing. Trajectory Predictors (TP) have been developed for ATC ground systems in order to compute trajectories as close as possible to the flow trajectory if not conflicting. This trajectory information provides the ATC system tools with data of the accuracy required to build reliable sequencing or conflict-detection and resolution tools, which support the Controller tasks.

### A.1.3.1.2 Derivation of EFPL Safety Requirements (Functionality and Performance – success approach)

**Table 3** below shows how the consolidated Requirements (Functionality and Performance) derived in section A.1.2.4 map on to the related elements of the EFPL High-level architectural representation for the submission, modification, validation and distribution of EFPLM. Requirements and assumptions are derived based on the analysis of the EFPL representation and this mapping exercise.

**Table 4** provides the formalisation of the Safety Requirements (functionality and performance) which have been identified in **Table 3**.

Consolidated Requirement (Functionality and Performance)	EFPL Requirement (forward reference)	Maps on to [Flight Plan Process]  <u>Applicable SAC</u>
REG-SUB-01  REG-MOD-01	REQ-07.06.02-OSD-0001.0000 The Network Manager (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 (ARO, handling agents etc.).	Civil AU/Third Party→ IFPS  [Submission]  <u>SAC EFPL#1</u>
REG-CON-01	REQ-07.06.02-OSD-0001.0030 An extended flight plan message shall contain the following sections of data: <ul style="list-style-type: none"> <li>• ICAO FPL data</li> <li>• 4D Trajectory (Filed trajectory)</li> <li>• Flight Performance Data</li> </ul>	Civil AU/Third Party  [Submission]  <u>SAC EFPL#1</u>
REG-VAL-01  [EC 1033/2006 Article 3.2a : Member States shall take the necessary measures to ensure that when IFPS receives a flight plan, or change thereto, it checks it for compliance with the format and data conventions]	REQ-07.06.02-OSD-0001.0001  The NM shall validate received extended flight plan and associated messages	IFPS  [Validation]  <u>SAC EFPL#1</u>
REG-VAL-02  [EC 1033/2006 Article 3.2b : Member States shall take the necessary measures to ensure that when IFPS receives a flight	REQ-07.06.02-OSD-0001.0002 The 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	IFPS  [Validation]

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Consolidated Requirement (Functionality and Performance)	EFPL Requirement (forward reference)	Maps on to [Flight Plan Process]  Applicable SAC
<i>plan, or change thereto, it checks it for completeness and, to the extent possible, for accuracy]</i>	message.  REQ-07.06.02-OSD-0001.0003 When present in an extended flight plan message, the NM shall use the provided 4D Trajectory of the flight to perform the flight plan validation processes involving the use of the flight trajectory.	<u>SAC EFPL#1</u>
<b>REG-DIS-01</b>  [EC 1033/2006 Article 3.3 "Member States shall take the necessary measures to ensure that IFPS communicates to all affected ATS units the accepted flight plan and any accepted pre-flight phase changes to the key items of the flight plan and associated update messages."]  [EC 1033/2006 Article 3.2c: Member States shall take the necessary measures to ensure that when IFPS receives a flight plan, or change thereto, it takes action, if necessary, to make it acceptable to the air traffic services.]	REQ-07.06.02-OSD-0001.0007 The NM shall distribute valid extended flight plan messages to ATC Units concerned by the flight that have previously requested to receive flight plan information in the form of extended flight plans.  REQ-07.06.02-OSD-0001.0009 When present in an extended flight plan message, the NM shall use the provided 4D trajectory of the flight to perform the flight plan addressing.  REQ-07.06.02-OSD-0001.0008 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.	IFPS → FDP  [Distribution]  <u>SAC EFPL#1 and</u> <u>SAC EFPL#3a</u>
<b>REG-DIS-02</b>  [EC 1033/2006 Article 3.2d: Member States shall take the necessary measures to ensure that when IFPS receives a flight plan, or change thereto, it indicates acceptance of the flight plan or changes thereto to	REQ-07.06.02-OSD-0001.0006 The NM shall inform the originator of the extended flight plan message of the result of the validation process (accepted, rejected or referred for manual processing) through the transmission of an Operational Reply message (ORM).	IFPS → Civil AU/Third Party  [Validation]  <u>SAC EFPL#1</u>

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Consolidated Requirement (Functionality and Performance)	EFPL Requirement (forward reference)	Maps on to [Flight Plan Process]  <u>Applicable SAC</u>
<i>the originator.]</i>		
<b>REG-DIS-01</b>  <i>[EC 1033/2006 Article 3.3 "Member States shall take the necessary measures to ensure that IFPS communicates to all affected ATS units the accepted flight plan and any accepted pre-flight phase changes to the key items of the flight plan and associated update messages."]</i>	<b>REQ-07.06.02-OSED-0001.0040</b> An extended modification message shall contain, as a minimum: <ul style="list-style-type: none"> <li>• Flight plan association data to allow the association of the message to the original flight plan</li> <li>• The data elements that are modified.</li> </ul>	Civil AU/Third Party  <b>[Modification]</b>  <u><b>SAC EFPL#1</b></u>
	<b>REQ-07.06.02-OSED-0001.0045</b> An extended delay message shall contain, as a minimum: <ul style="list-style-type: none"> <li>• Flight plan association data to allow the association of the message to the original flight plan.</li> <li>• The new estimated off-block time</li> <li>• The new estimated off-block data, if it is modified</li> <li>• The updated 4D Trajectory</li> </ul>	Civil AU/Third Party  <b>[Modification]</b>  <u><b>SAC EFPL#1</b></u>
<b>REG-VAL-03</b>  <i>[EC 1033/2006 Article 3.7 "ATC units shall, during the pre-flight phase, make available through IFPS any necessary changes affecting the route or flight level key items of a flight plan that could affect the safe conduct of a flight, for flight plans and associated update messages previously received by them from IFPS."]</i>	<b>ASSUMPTION-07.06.02-SPR-01</b>  ATC Units transmit to the Network Manager all ATM constraints which might affect the 4D trajectory of flight plan. That includes relevant information already provided today including Profile Tuned Restrictions (PTR) information.	ATC Unit → IFPS  <b>[Validation]</b>  <u><b>SAC EFPL#1</b></u>
	<b>REQ-07.06.02-OSED-0001.0035</b>  The NM shall provide to the Airspace User within the reply to an EFPL the list of published constraints (such as PTRs) affecting the planned trajectory of the flight and the resultant NM 4D trajectory.	IFPS → Civil AU/Third Party  <b>[Validation]</b>  <u><b>SAC EFPL#1</b></u>
	<b>REC-07.06.02-SPR-01:</b>  The Network Manager should provide to Airspace Users all the ATM Network constraints	IFPS → Civil AU/Third Party  <b>[Validation]</b>

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Consolidated Requirement (Functionality and Performance)	EFPL Requirement (forward reference)	Maps on to [Flight Plan Process]  <u>Applicable SAC</u>
	(including PTRs) as an input for the calculation of their operational flight plan. ATM Network constraints are all ATM constraints that IFPS is using currently for flight plan validation.	<u>SAC EFPL#1</u>
	<p><b>REQ-07.06.02-SPR-20 (Status DELETED because considered as a business requirement)</b></p> <p>The NM shall validate 4D trajectories provided by AUs in extended flight plans by considering all ATM constraints required to be taken into account in planning phase</p>	<p>IFPS [Validation]</p> <p><u>SAC EFPL#1</u></p>
<p><b>UR-ATFCM-SUB-01</b></p> <p>[Req 07.06.05 OSED-0201.0000: "The Airspace User shall fulfil the 4D profile when using the iSBT (AOC, CFPSP or flight plan filer)."]</p> <p>[Reg 07.06.05 SPR-0116.0000]</p> <p><i>The use of the same flight plan profile view between the AUs and the Network Manager and thus of consistent data shall lead to a better flight plan profile computation.</i></p>	<p>REQ-07.06.02-OSED-0001.0011 The NM shall use 4D trajectories and specific flight performance data provided by AUs in extended flight plans to improve traffic demand picture in support of DCB processes.</p> <p><b>REQ-07.06.02-SPR-30</b> Network predictability shall be maintained/ improved by DCB services when using EFPL data.</p> <p><i>Note: An undetected demand/capacity imbalance or a late detection may result in an over-delivery in a regulated sector (which may result in an overload) or an overload in a non-regulated sector.</i></p>	<p>IFPS → ETFMS [ATFCM use]</p> <p><u>SAC EFPL#2a/b</u></p>

Consolidated Requirement (Functionality and Performance)	EFPL Requirement (forward reference)	Maps on to [Flight Plan Process]  <u>Applicable SAC</u>
<b>UR-ATC-USE-01</b> <i>[REQ-05.05.02-OSD-0100.0100 "Airspace user shall provide AOC data to an agreed pre-defined format, minimum accuracy and frequency or schedule as agreed with each airspace user participating."]</i>	<b>REQ-07.06.02-SPR-06</b> The Airspace User shall provide elements of the extended flight plan message used for ATC purposes like ground-based Trajectory Prediction with the accuracy and integrity level specified by the ATC application.	Civil AU/Third Party→ IFPS AU →IFPS → ATC  <b>[ATC use]</b>  <u>SAC EFPL#3b</u>
<b>UR-ATC-VAL-01</b> <i>[REQ 07.05.03 OSD-0001.0011: "In addition to normal SBT validation rules, the planned route inside a FRA shall be considered invalid if it:            - Fails to comply with published entry/exit requirements,            - Fails to comply with Special Use Airspace rules (minimum distances, going through)"]</i>	<b>REQ-07.06.02-SPR-07</b> The NM shall check that the 4D trajectory provided in an extended flight plan message complies with any specific Free Route Airspace (FRA) criteria.	IFPS  <b>[Validation]</b>  <u>SAC EFPL#1</u>

Table 3: Mapping of User Requirements to EFPL High-level architectural representation

The following **Table 4** provides the formalisation of the Safety Requirements (functionality and performance) derived above **Table 3**.

EFPL Process	EFPL Safety Requirement [High-level design Element]	Requirement	Consolidated Requirement Ref.  <u>Applicable SAC</u>
Submission	REQ-07.06.02-OSD-0001.0000  [IFPS]	The Network Manager (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 (ARO, handling agents etc.).	<b>REG-SUB-01</b> <b>REG-MOD-01</b> <u>SAC EFPL#1</u>

EFPL Process	EFPL Safety Requirement [High-level design Element]	Requirement	Consolidated Requirement Ref.  <u>Applicable SAC</u>
	REQ-07.06.02- OSED- 0001.0030  [AU/Third Party]  [IFPS]	An extended flight plan message shall contain the following sections of data: <ul style="list-style-type: none"> <li>• ICAO FPL data</li> <li>• 4D Trajectory (Filed trajectory)</li> <li>• Flight Performance Data (optional)</li> </ul>	REG-CON-01  <u>SAC EFPL#1</u>
Validation	REQ-07.06.02- OSED- 0001.0001  [IFPS]	The NM shall validate received extended flight plan and associated messages	REG-VAL-01  <u>SAC EFPL#1</u>
	REQ-07.06.02- OSED- 0001.0002  [IFPS]	The 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.	REG-VAL-02  <u>SAC EFPL#1</u>
	REQ-07.06.02- OSED- 0001.0003  [IFPS]	When present in an extended flight plan message, the NM shall use the provided 4D Trajectory of the flight to perform the flight plan validation processes involving the use of the flight trajectory.	REG-VAL-02  <u>SAC EFPL#1</u>
	REQ-07.06.02- OSED- 0001.0006  [IFPS]	The NM shall inform the originator of the extended flight plan message of the result of the validation process (accepted, rejected or referred for manual processing) through the transmission of an Operational Reply message (ORM).	REG-DIS-02  <u>SAC EFPL#1</u>
	<b>REQ-07.06.02- SPR-20</b>  (Status DELETED because considered as a business requirement)	The NM shall validate 4D trajectories provided by AUs in extended flight plans by considering all ATM constraints required to be taken into account in planning phase  <i>Note: The validation of EFPLs consider the same set of ATM constraints than the validation of ICAO 2012 FPLs. So if an adequate level of safety is assured in current operation we can assume that we will have at least the same level of safety with EFPL. So we can consider this requirement as validated.</i>	REG-VAL-03  <u>SAC EFPL#1</u>
	<b>REQ-07.06.02- SPR-07</b>	The NM shall check that the 4D trajectory provided in an extended flight plan message complies with any specific Free Route Airspace	UR-ATC-VAL-01

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EFPL Process	EFPL Safety Requirement [High-level design Element]	Requirement	Consolidated Requirement Ref.  <u>Applicable SAC</u>
	[IFPS]	(FRA) criteria.	<u>SAC EFPL#1</u>
	<b>ASSUMPTION-07.06.02-SPR-01</b>  [ATC Unit]  [AMC]  [Airport]	ATC Units transmit to the Network Manager all ATM constraints which might affect the 4D trajectory of flight plan. That includes relevant information already provided today including Profile Tuned Restrictions (PTR) information.	<b>REG-VAL-03</b>  <u>SAC EFPL#1</u>
	REQ-07.06.02-OSD-0001.0035  [IFPS]  [AU/Third Party]	The NM shall provide to the Airspace User within the reply to an EFPL the list of published constraints (such as PTRs) affecting the planned trajectory of the flight and the resultant NM 4D trajectory.	<b>REG-VAL-03</b>  <u>SAC EFPL#1</u>
	<b>REC-07.06.02-SPR-01</b>  [IFPS]  [AU/Third Party]	The Network Manager should provide to Airspace Users all the ATM Network constraints (including PTRs) as an input for the calculation of their operational flight plan. ATM Network constraints are all ATM constraints that IFPS is using currently for flight plan validation.	<b>REG-VAL-03</b>  <u>SAC EFPL#1</u>
Distribution	REQ-07.06.02-OSD-0001.0007  [IFPS]	The NM shall distribute valid extended flight plan messages to ATC Units concerned by the flight that have previously requested to receive flight plan information in the form of extended flight plans.	<b>REG-DIS-01</b>  <u>SAC EFPL#1</u> and <u>SAC EFPL#3a</u>
	REQ-07.06.02-OSD-0001.0009  [IFPS]	When present in an extended flight plan message, the NM shall use the provided 4D trajectory of the flight to perform the flight plan addressing.	<b>REG-DIS-01</b>  <u>SAC EFPL#1</u> and <u>SAC EFPL#3a</u>

EFPL Process	EFPL Safety Requirement [High-level design Element]	Requirement	Consolidated Requirement Ref.  <u>Applicable SAC</u>
	REQ-07.06.02- OSED- 0001.0008  [IFPS]	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.	REG-DIS-01  <u>SAC EFPL#1</u> and <u>SAC EFPL#3a</u>
Modification	REQ-07.06.02- OSED- 0001.0040  [AU/Third Party]  [IFPS]	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 data elements that are modified.	REG-DIS-01  <u>SAC EFPL#1</u>
	REQ-07.06.02- OSED- 0001.0045  [AU/Third Party]  [IFPS]	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 new estimated off-block time • The new estimated off-block data, if it is modified • The updated 4D Trajectory	REG-DIS-01  <u>SAC EFPL#1</u>
ATFCM use	REQ-07.06.02- OSED- 0001.0011  [IFPS]  [ETFMS]	The NM shall use 4D trajectories and specific flight performance data provided by AUs in extended flight plans to improve traffic demand picture in support of DCB processes.	UR-ATFCM-SUB-01  <u>SAC EFPL#2a /b</u>
	REQ-07.06.02- SPR-30  [IFPS]  [ETFMS]	Network predictability shall be maintained/improved by DCB services when using EFPL data  <i>Note: An undetected demand/capacity imbalance or a late detection may result in an over-delivery in a regulated sector (which may result in an overload) or an overload in a non-regulated sector.</i>	UR-ATFCM-SUB-01  <u>SAC EFPL#2a /b</u>

EFPL Process	EFPL Safety Requirement [High-level design Element]	Requirement	Consolidated Requirement Ref.  <u>Applicable SAC</u>
ATC Use	<b>REQ-07.06.02-SPR-06</b> [AU/Third Party]  [IFPS]  [ATC Unit]  [FDP & Controller tools ]	The Airspace User shall provide elements of the extended flight plan message used for ATC purposes like ground-based Trajectory Prediction with the accuracy and integrity level specified by the ATC application.	<b>UR-ATC-USE-01</b>  <u><b>SAC EFPL#3b</b></u>
	<b>REQ-07.06.02-SPR-05</b> [AU/Third Party]  [IFPS]	NM shall distribute elements of the extended flight plan message used for ATC purposes without altering the required accuracy and integrity level specified for the ATC application	

Table 4: Derivation of EFPL Safety Requirements (functionality and performance) from Regulation and User Requirements

### A.1.3.2 Analysis of the High-level Design – Normal Conditions

This section is concerned with ensuring that the High-level design is complete, correct and internally coherent with respect to the EFPL Safety Requirements (success approach) derived in A.1.3.1.2 for normal operating conditions.

The analysis necessarily depends on proving the EFPL Safety Requirements (Functionality and Performance) from three perspectives:

- a static view of the EFPL processes( submission, validation and distribution) using an operational step analysis technique, as described in **section A.1.3.2.2** for the scenarios for normal operations described in **section A.1.3.2.1**)
- a dynamic view of the EFPL processes using in particular Real-time simulations - see **section A.1.3.2.3**.

#### A.1.3.2.1 Scenarios for Normal Operations

The Normal Operational Scenarios are partially extracted from the OSED and captured in **section A.1.3.2.3** below.

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ID	Scenario	Rationale for the Choice
#1	EFPL submission	1st step of the flight plan management process
#2	EFPL Validation	2nd step of the flight plan management process
#3	EFPL distribution for ATC and ATFCM services	3rd step of the flight plan management process
#4	EFPL modification (Change, delay, cancellation)	4 <sup>th</sup> step of the flight plan management process

Table 5: Operational Scenarios – Normal Conditions

#### A.1.3.2.2 Analysis of the High-level design – Normal Operations

Operational steps analysis for the different scenario identified in **Table 5** is carried out and additional safety requirements (functionality and performance) revealed during the analysis will be identified. These safety requirements (functionality and performance) will complement those identified in A.1.3.1.2.

Whenever possible, the operational steps description is based on the OSED operational scenarios and use cases.

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#### 1.1.1.1.1 Scenario # 1 EFPL submission

# Step	ACTOR	Action / Op. Step description	Inputs	Outputs	Conditions		Identification of additional Requirements (Results of the operating steps analysis)
					Status	Next Op. Step	
Sub# 01	Civil AU or third party	Submission of an EFPLM	EFPLM to be provided with the correct format (REQ-07.06.02-OSED-0001.0030)	EFPLM received by the Network manager (REQ-07.06.02-OSED-0001.0000)	Civil AU/Third party able to handle 4D trajectory	If condition satisfied: Sub#03  If condition not satisfied: Sub#02	NM ability to receive either EFPL or ICAO FPL (REQ-07.06.02-OSED-0001.0013)
Sub# 02	Civil AU or third party	Submission of an ICAO FPL ("normal FPL")	Normal FPL to be provided with the current format	Normal FPL received by the Network manager	Civil AU/Third party able to handle ICAO FPL	Sub#03	
Sub# 03	NM	End of submission process	EFPL or ICAO FPL from AU/Third party	Start of the validation process- See Scenario#2			

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#### 1.1.1.1.2 Scenario #2 EFPL validation

# Step	ACTOR	Action / Op. Step description	Inputs	Outputs	Conditions		Identification of additional Requirements (Results of the operating steps analysis)
					Status	Next Op. Step	
Val# 01	NM	EFPL Validation	EFPL received by the Network manager	-EFPL successfully validated (ACK) -AUs/Third parties	The submitted EFPL passes the validation criteria	If condition satisfied: Val#04	To comply with EC 1033/2006 art 3.2, complete and correct EFPL validation

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# Step	ACTOR	Action / Op. Step description	Inputs	Outputs	Conditions		Identification of additional Requirements (Results of the operating steps analysis)
					Status	Next Op. Step	
			(REQ-07.06.02-OSD-0001.0000)	are notified about the successful validation status (REQ-07.06.02-OSD-0001.0001 and REQ-07.06.02-OSD-0001.0006)	(REQ-07.06.02-OSD-0001.0002; REQ-07.06.02-OSD-0001.0003).	If condition not satisfied: Val#02	criteria are needed considering ATC and ATFCM use of the 4D trajectory and of the specific flight performance data. Therefore following requirements are necessary:  <b>REQ-07.06.02-SPR-08</b> The EFPL validation process shall reduce/maintain the number of incorrect ACK messages that are due to flight trajectory calculation differences between NM and the AU compared to the current FPL validation process..  <b>REQ-07.06.02-SPR-10</b> (Status DELETED because considered as a business requirement) The EFPLM validation process shall verify the completeness of the EFPLM elements.
Val# 02	NM	Rejection of the EFPL	EFPLM received by the Network manager (REQ-07.06.02-OSD-0001.0000)	-EFPLM rejected (REJ) -AUs/Third parties are notified about the rejection status (REQ-07.06.02-OSD-0001.0001 and REQ-07.06.02-OSD-0001.0006)	The submitted EFPL does not pass the validation criteria (REQ-07.06.02-OSD-0001.0002; REQ-07.06.02-OSD-0001.0003).	If condition satisfied (EFPL rejected requiring a new flight plan submission): See Scenario#1 Sub#01  If condition not satisfied: Val#03	
Val# 03	NM	EFPL manual processing	EFPL received by the Network manager (REQ-07.06.02-OSD-0001.0000)	-A manual processing for the EFPL is needed -AUs/Third parties are notified about this status	The submitted EFPL requires manual processing for validation (REQ-07.06.02-OSD-0001.0002; REQ-07.06.02-	If manual processing lead to EFPL validation: Val#01  If manual processing lead	

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# Step	ACTOR	Action / Op. Step description	Inputs	Outputs	Conditions		Identification of additional Requirements (Results of the operating steps analysis)
					Status	Next Op. Step	
				(REQ-07.06.02- OSED-0001.0001 and REQ-07.06.02- OSED-0001.0006) -NM fixes the FPLN issues/problems	OSED-0001.0003) and NM fixes the issues/problems.	to EFPL rejection: Val#02	
Val# 04	Civil AU or third party	End of validation process	Validated EFPL	Start of the distribution process- See Scenario #3			

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## 1.1.1.1.3 Scenario # 3 EFPL distribution for ATC and for ATFCM

# Step	ACTOR	Action / Op. Step description	Inputs	Outputs	Conditions		Identification of additional Requirements (Results of the operating steps analysis)
					Status	Next Op. Step	
Distri# 01	NM	EFPL distribution for ATC purposes	Validated EFPL	The EFPL is distributed to relevant ATC units which are "EFPL compatible"  (REQ-07.06.02- OSED-0001.0007 and REQ-07.06.02- OSED-0001.0009)	The EFPL is distributed for ATC purposes	Distri#02	Requirements derived in are

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# Step	ACTOR	Action / Op. Step description	Inputs	Outputs	Conditions		Identification of additional Requirements (Results of the operating steps analysis)
					Status	Next Op. Step	
				The ICAO FPL extract of the EFPL is distributed to relevant ATC units which are "not EFPL compatible" (REQ-07.06.02-OSED-0001.0008 and REQ-07.06.02-OSED-0001.0009)	The ICAO FPL is distributed for ATC purposes		A.1.1.1.1 complete
Distri# 02	NM	EFPL distribution for capacity and flow management	Validated EFPL	The EFPL is distributed to ETFMS (REQ-07.06.02-OSED-0001.0011 and <b>REQ-07.06.02-SPR-30</b> )	The EFPL is distributed for ATFCM purposes	Distri#03	
Distri# 03	NM	End of distribution process	Distributed EFPL	End if no modifications are applied to the distributed EFPL. If modification see scenario#4			

730

## 1.1.1.1.4 Scenario # 4 EFPL modification

# Step	ACTOR	Action / Op. Step description	Inputs	Outputs	Conditions	Identification of additional
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					Status	Next Op. Step	Requirements (Results of the operating steps analysis)
Mod# 01	Civil AU or third party	EFPL modification originated by AU	Update via ECHG/EDLA message (REQ-07.06.02-OSED-0001.0040 and REQ-07.06.02-OSED-0001.0045)	Submission of the EFPL update to the NM	Submission of the EFPL message update (ECHG/EDLA message)	See Val#01 - Scenario#2 above.	Requirements derived in A.1.1.1.1 are considered as complete
Mod# 02	NM	EFPL modification originated by AMC	Airspace modification provided by AMC	Suspended flight plan (FLS) notified to AU and ATC	NM identification of EFPL impacted by the airspace modification	Mod#03	Requirements derived in A.1.1.1.1 are considered as complete
Mod# 03	Civil AU or third party	EFPL modification submission following suspended flight	Update via ECHG/EDLA message (REQ-07.06.02-OSED-0001.0040 and REQ-07.06.02-OSED-0001.0045)	Submission of the EFPL update to the NM	Submission of the EFPL message update (ECHG/EDLA message)	Mod#04	
Mod# 04	NM	Flight de-suspended	Extended delay and modifications messages received by the Network manager (REQ-07.06.02-OSED-0001.0000)	- Extended delay and modifications messages successfully validated -AUs/Third parties and ATC are notified about the	The flight is de-suspended (DES)	See Distri#01-Scenario#3 above	

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# Step	ACTOR	Action / Op. Step description	Inputs	Outputs	Conditions		Identification of additional Requirements (Results of the operating steps analysis)
					Status	Next Op. Step	
				de-suspension of the flight			

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### A.1.3.2.3 Dynamic Analysis of the high-level design – Normal Conditions

#### 1.1.1.1.5 V2 Validation exercises (EXE-07.06.02-VP-311 and VP-616)

##### 1.1.1.1.5.1 Introduction

Two V2 validation exercises have been conducted in the frame of P07.06.02. A Validation Plan [20] and a Validation Report [21] have been produced.

The main objectives of these V2 validation exercises were the following:

- Determine the effect of the Extended Flight Plan concept on the Flight Plan Validation process (impact on the rate of acceptance/rejections). This validation exercise EXE-07.06.02-VP-311 is an off-line exercise which was conducted between November 2012 and April 2013.
- Evaluate the Extended Flight Plan concept and determine the impact on Flight Planning, accuracy of traffic predictions and DCB. This validation exercise EXE-07.06.02-VP-616 is a shadow-mode exercise which follows and complements the EXE-07.06.02-VP-311 exercise. EXE-07.06.02-VP-616 was conducted between November 2013 and April 2014.

##### 1.1.1.1.5.2 Results

#### Conclusions on EFPL

The exercises performed (EXE-07.06.02-VP-311 and EXE-07.06.02-VP-616) have demonstrated that:

- It is feasible for IFPS to use a trajectory that is built by another system i.e. a flight planning system to perform its flight plan validation function.
- The use of the 4D trajectory that is calculated by the flight planning system may make valid a significant percentage of the flight plans that are invalid when using the IFPS calculated trajectory.
- FOC and NM trajectories can be aligned in terms of 2D and time elements in most of cases.

On the other hand:

- The exercises has confirmed the occurrences of flight plans accepted when submitted using the ICAO format and rejected as EFPL. Through the analysis of the cases, it is expected that most of these rejections are due to the differences that currently exist between IFPS and flight planning systems in terms of data; interpretation of published airspace and route information as well as algorithms that are used for the calculation of trajectories:

The A.U flight planning system should ensure that a trajectory that it generates is compliant with all the ATM Network constraints that the IFPS will then apply for validation.

The use of Profile Tuning Restrictions (PTRs) in the IFPS trajectory calculation is another source that can lead to significant differences between the IFPS trajectory and the trajectory currently calculated by flight planning systems.

It should be highlighted that the resolution of these issues should contribute to increase safety since EFPLs rejected corresponds to cases where the 4D trajectory planned by the AU in the Operational FPL and transmitted to the pilot is not respecting some airspace constraints. This result is supporting SAC\_EFPL#1 achievability.

- The exercises have also confirmed that, though the EFPL allows strong improvement of FOC and NM trajectories alignment compared to ICAO flight plan, full alignment of trajectories in

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772 the vertical dimension will be difficult to achieve in the very short term due to a number of  
773 issues requiring significant time and coordination to be solved.

774 The exercises have also allowed identifying that NM systems model the trajectory (in particular  
775 lat/long coordinates) at a lower level of accuracy than FOC systems. There will be the need to assess  
776 in future validation whether this gap has an impact on operational processes.

777 Regarding maturity assessment of EFPL, flight planning and DCB/complexity management are not at  
778 the same maturity stage:

- 779     ▪ As far as flight planning is concerned, EFPL use is close to V3 maturity completion. What  
780     needs to be done yet is to confirm the potential benefits identified in conditions closed to  
781     deployment and ensure acceptability from end-users (dispatchers, IFPU operators).
- 782     ▪ Regarding the use of the EFPL in DCB, maturity is lower and remains V2 since vertical  
783     alignment of trajectories is required to fully integrate the AU 4D trajectory. However, the  
784     exercise EXE-07.06.02-VP-311 has demonstrated that in a first transition step, flight specific  
785     performance data allow to significantly improve traffic predictions and consequently improve  
786     DCB/complexity management processes efficiency.

## 787 788 **Recommendations on EFPL**

789 The main recommendations for future validation steps are:

- 790     ▪ Regarding Flight planning operation, perform E-OCVM V3 validation activities as close as  
791     possible to operational environment.
- 792     ▪ Assess whether the gap of level of accuracy between NM and FOC systems (in particular  
793     lat/long coordinates) needs to be addressed and impacts operational processes.
- 794     ▪ Perform additional E-OCVM V2 validation exercise on the use of Extended Flight Plan for  
795     DCB traffic prediction.
- 796     ▪ Investigate other aspects which were not/partially covered :  
797         The integration in AU flight planning systems of published PTRs to align 4D Trajectories  
798         calculated by NM and AUs,  
799         The use of Extended Flight plan in the context of management of ATFCM regulations and the  
800         determination of TTOs/TTAs,  
801         Use of EFPL information in ATC systems and processes.

## 803 **1.1.1.1.1.6 Validation exercise (EXE-07.06.02-VP-713)**

### 804 **1.1.1.1.1.6.1 Introduction**

805 This validation activity covers the SESAR Release 5 exercise, known as EXE-07.06.02-VP-713,  
806 foreseen in collaboration with WP11.1 to validate the effect of implementing the Extended Flight Plan  
807 (EFPL) on Flight Plan Validation and Distribution processes and Traffic predictability. Validation  
808 objectives and activities are described in the Validation plan [19] and results and recommendations  
809 are described in the Validation Report [21].

810 EXE-07.06.02-VP-713 validation exercise has been conducted in close cooperation with airspace  
811 users and computerised flight plan systems providers (from WP11), and has assessed both the  
812 operational and technical feasibility of EFPL implementation and the associated performance gains.  
813 Validation activities will cover three main areas:

814     Flight Planning;

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Demand and Capacity balancing / Predictability;

Distribution to ATC.

This Validation Exercise is split into two sub-exercises corresponding to two different maturity levels:

EXE-07.06.02-VP-713 Part A: Short Term Implementation of the EFPL (V3 maturity level) focusing on the evaluation of the current EFPL within conditions as close as possible of the operational environment.

EXE-07.06.02-VP-713 Part B: Medium Term Implementation of the EFPL (V2 Maturity level) focusing on further development and refinement of the operational concepts and supporting enablers in order to make AUs able to create a 4D trajectory that can be directly be used (without further changes) by NM and ATC.

EXE-07.06.02-VP-713 Part A will consist of Shadow Mode sessions at AUs premises for quantitative analysis and human assessment (IFPS operators only) on real traffic and Gaming sessions on test traffic where FPL Systems will be used at CFSP premises:

EXE-07.06.02-VP-713 Part B will consist of a mix of Gaming sessions and off-line analysis at CFSPs premises.

#### 1.1.1.1.6.2 Results

##### Conclusions

As main conclusion from these simulations, operational feasibility of the use of the extended flight plan has been proven both at the level of flight planning and flow management.

- 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 today's 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.

##### 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 airlines 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;

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- 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

#### A.1.3.2.4 Additional Safety Requirements (functionality and performance) – Normal Operational Conditions

**Table 6** below shows additional safety requirements that have been revealed by the above analyses (in sections A.1.3.2.2 to A.1.3.2.3)

ID [SPR-level element]	Description	Operational Steps [Scenario # xx] <u>Applicable SAC</u>
<b>REQ-07.06.02-SPR-08</b> [IFPS]	The EFPL validation process shall reduce/maintain the number of incorrect ACK messages that are due to flight trajectory calculation differences between NM and the AU compared to the current FPL validation process.	Scenario#2 EFPLM validation <u><b>SAC EFPL#1</b></u>
<b>REQ-07.06.02-SPR-10</b> [IFPS]  (Status DELETED because considered as a business requirement)	The EFPLM validation process shall verify the completeness of EFPLM elements.	

Table 6: Additional SR from Operational Steps Analysis – Normal Operational Conditions

### A.1.3.3 Analysis of the high-level Design – Abnormal Conditions

This section is concerned with ensuring that the high-level Design is complete, correct and internally coherent with respect to the EFPL Safety Requirements (success approach) derived in A.1.3.1.2 for abnormal operating conditions.

The analysis should be carried out from three perspectives:

- can the EFPL processes (submission, validation and distribution) continue to operate effectively?

- if the EFPL processes cannot continue to operate fully effectively, is the overall risk at user level still within the tolerable limits and can the EFPL processes recover sufficiently quickly when the abnormality is removed (or at least mitigated)?

- to what degree could such abnormal conditions, while they persist, cause the EFPL processes to behave in a way that could actually induce a risk that would otherwise not have arisen?

However no abnormal conditions have been identified when considering the scope of the Extended Flight Plan. Indeed no external events (e.g. significant adverse weather conditions) which could affect the flight plan processes (Submission, Validation, Distribution or modification) have been identified so far. Initially two scenarios have been identified (Large airspace closure and incomplete EFPL data provided by most of the AUs/Third Parties) but it has been decided to address them through the failure analysis in section A.1.3.4.

Initially the abnormal scenario associated to the intentional submission of an excessive number of EFPL in order to assess the robustness of the NM was considered. Finally this scenario was not selected considering that such threat is more relevant for a security analysis (e.g. vulnerability analysis).and not for a safety analysis.

### A.1.3.4 Design Analysis – Case of EFPL processes Failures

This part of the safety assessment focuses on the EFPL causes of operational hazards. Operational hazards are identified at the level of the relevant primary operational projects identified in A.1.2.

This design analysis assesses, bottom-up, the consequences of failure for each system element, element-to-element interface of the EFPL processes including common-cause analysis

Based on this design analysis:

- derive mitigations to reduce the likelihood of specific failures - these mitigations are then captured as additional EFPL Safety Requirements (Functionality and Performance)

- derive EFPL Safety Requirements to limit the frequency with which each identified system failure could be allowed to occur, taking account of the above mitigations, such that the user needs are satisfied as identified in A.1.2.

- show that the EFPL Safety Requirements (integrity/reliability) are achievable - i.e. can be satisfied in a typical physical implementation.

#### A.1.3.4.1 Failure Mode and Effect Analysis

##### 1.1.1.1.7 Introduction

This section is a summary of the description provided in the OSED [13]

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- 916 An EFPL message contains the following sections of data:
- 917     • ICAO FPL data: all data to be provided in a filed flight plan as specified in the ICAO Doc 4444,
- 918         including the Field 15 route information and the latest updates known as the ICAO 2012 FPL
- 919     • 4D Trajectory (Filed trajectory): AU calculated flight trajectory taking into account constraints and
- 920         meteorological information for its calculation.
- 921     • Flight Performance Data: the climbing and descending capabilities of the aircraft specific to the
- 922         flight, taking into account the performance of the airframe that is used to operate the flight as well
- 923         as any other parameters that may influence it such as engine settings and status, cost factor
- 924         applied by the operator etc. The Flight Performance Data may be provided either as climb and
- 925         descent performance profiles or as the total weight of aircraft as part of the 4D trajectory.
- 926 The EFPL processes are relative to:
- 927     • EFPL submission by the airspace user or a third party
- 928     • EFPL validation by the NM
- 929     • EFPL distribution by the NM for ATC and ATFCM services
- 930 A mix mode environment will exist - EFPL and “normal” flight plan will coexist

1.1.1.1.8 Failure Mode Identification and effect

EFPL Process	Failure Mode	Failed elements High-level design	Preventive mitigations	Failure effect at operational level if not prevented	Additional Safety Requirement (protective)
EFPL Submission	Corrupted, false or incomplete EFPL data from the A.U (or third parties)	-Civil AU/Third Party  -A.U FPL	<p>- IFPS through validation process</p> <p>-REQ-07.06.02-OSED-0001.0001;</p> <p>-REQ-07.06.02-OSED-0001.0003;</p> <p><b>-REQ-07.06.02-SPR-10 (Status Deleted)</b></p> <p>-If EFPLM is corrupted/false/incomplete at the originator level and the incorrect flight plan is not detected at the NM level there is no existing additional mitigation before distribution. It is therefore important that the airspace user provides EFPL data in accordance with the specified data quality requirements (resolution,</p>	<p>Corrupted, false or incomplete EFPL data used for ATFCM might lead to incorrect ATFCM measures</p> <p>Corrupted, false or incomplete EFPL data used for ATC has the potential to lead to a number of operational consequences including that a flight ends up in closed airspace or loss of separation (with ATCO being able to control the situation).</p>	None

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EFPL Process	Failure Mode	Failed elements High-level design	Preventive mitigations	Failure effect at operational level if not prevented	Additional Safety Requirement (protective)
			<p>accuracy, integrity). <b>REQ-07.06.02-SPR-21</b></p> <p>This requirement (REQ-07.06.02-SPR-21) is also associated with the issue identified during the V2 validation exercises (See 1.1.1.1.1.1) relative to the fact that NM systems model the trajectory (in particular lat/long coordinates) at a lower level of resolution than FOC systems</p> <p>- Pre-check the EFPLM validity at AU level (REQ-07.06.02-OSD-0001.0050)</p>		
	Inaccurate EFPL data (e.g. Total weight, estimated speed)	-Civil AU/Third Party  -A.U FPL	-IFPS through validation process  <b>-REQ-07.06.02-SPR-08</b>	Inaccurate EFPL data used for ATFCM might lead to DCB/dynamic DCB performance degradation.	None
				Inaccurate EFPL data used for ATC (TP computation) might lead to MTCD	

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EFPL Process	Failure Mode	Failed elements High-level design	Preventive mitigations	Failure effect at operational level if not prevented	Additional Safety Requirement (protective)
				performance degradation.	
	ICAO FPL data/UP4DT Inconsistency	-Civil AU/Third Party -A.U FPL	IFPS through validation process by comparing the route provided in ICAO Field 15 and the 4D trajectory of the EFPL  (REQ-07.06.02-OSED-0001.0002)	In the case EFPL and route provided in ICAO Field 15 are inconsistent, then the EFPL is rejected	<b>REQ-07.06.02-SPR-11</b> The NM EFPL validation process shall raise an error in case the EFPL trajectory information is inconsistent with the equivalent ICAO Field 15 route information provided within the same EFPL.
EFPL Validation	Incorrect EFPL ORM (ACK/REJ)	IFPS	<b>-REQ-07.06.02-SPR-08</b>	Incorrect ACK Reply Message has the potential to lead to a number of operational consequences including that a flight ends up in closed airspace or loss of separation	
	Incorrect /inconsistent/ missing aircraft performance data within ENV	IFPS	-When the aircraft performances are provided in the extended flight plan, only this information is used for the validation of the trajectory (instead of the ENV Data).		

EFPL Process	Failure Mode	Failed elements High-level design	Preventive mitigations	Failure effect at operational level if not prevented	Additional Safety Requirement (protective)
EFPL Distribution	Corrupted, false or incomplete EFPL data from NM (incorrect flight plan)	IFPS	<b>-REQ-07.06.02-SPR-21</b>  -If EFPLM is not corrupted/false/incomplete at the originator level but corruption is made at NM level there is no mitigation before distribution. However it is required to limit the corruption rate by designing the “ <i>flight messages checking and distribution</i> ” NM service with an appropriate assurance level ( <b>REQ-07.06.02-SPR-13</b> )  -In addition, ATC during operation shall consider and mitigate flight plan uncertainties associated to EFPL (it’s still flight intent). despite the level of uncertainties is reduced compared to ICAO flight plan ( <b>ASSUMPTION-07.06.02-SPR-02</b> )	Corrupted, false or incomplete EFPL data used for ATFCM might lead to incorrect ATFCM measures	
				Corrupted, false or incomplete EFPL data used for ATC has the potential to lead to a number of operational consequences including that a flight ends up in closed airspace or loss of separation	
	EFPL distributed to	-IFPS	-The use of Extended Flight	EFPL data elements cannot	None

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EFPL Process	Failure Mode	Failed elements High-level design	Preventive mitigations	Failure effect at operational level if not prevented	Additional Safety Requirement (protective)
	non-compatible ATC	-EFPL non-COMP ATC	<p>Plan data elements is limited to Compatible ATC units which have requested to receive such information (REQ-07.06.02-OSD-001.007)</p> <p>-NM distributes 'normal' flight plan messages, containing data retrieved from valid extended flight plan messages, to ATC units concerned by the flight that have requested not to receive flight plan information in the form of an extended flight plans, as a default option (REQ-07.06.02-OSD-001.008)</p>	<p>be used by non-compatible ATC units.</p> <p>Such case might lead to an emergency situation because IFPS would send not only one but all flight plans to that ATC unit in EFPL format. The ATC unit would not be able to process them and remain without flight plans at all and the actual flights coming to their airspace.</p> <p><b>REC-07.06.02-SPR-02:</b> The NM should distribute 'normal' flight plan messages to all ATC units concerned by the flight even for those which have requested to receive flight plan information in the form of extended flight plan</p>	
	Missing EFPL		<p>Situation where single or multiple flight plans are missing requiring local operational procedures affecting controller workload.</p> <p>It is important to check that EFPL concept does not lead to wrong flight plan addressing meaning that flight plan are not distributed to the correct ATC Units. This is not a specific EFPL failure mode but frequency of occurrence</p>		<p>-It shall be possible for an ATC unit to retrieve, on request, extended flight plan information for a given flight from NM (REQ-07.06.02-OSD-</p>

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EFPL Process	Failure Mode	Failed elements High-level design	Preventive mitigations	Failure effect at operational level if not prevented	Additional Safety Requirement (protective)
		could be impacted by the EFPL concept.			0001.0010)  -Only ATC units which have requested to receive EFPL will receive such information (REQ-07.06.02-OSED-001.007)  - The implementation of EFPL shall reduce/maintain the number of missing flight plans at ATC level due to wrong addressing at NM level compared to the current mode of operation.  <b>(REQ-07.06.02-SPR-16)</b>
	Missing EFPL FLS message	Situation where change of route availability occurs or RAD restriction impact a flight and the flight suspension message is not sent by NM  Not a specific EFPL failure mode but frequency of occurrence could be impacted by the EFPL concept			The implementation of the EFPL shall reduce/maintain the number of missing flight suspension messages (FLS) compared to the current mode of operation <b>(REQ-07.06.02-SPR-17)</b>
	Incorrect EFPL DES	Situation where a flight is incorrectly de-suspended by NM			The implementation of the EFPL shall

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EFPL Process	Failure Mode	Failed elements High-level design	Preventive mitigations	Failure effect at operational level if not prevented	Additional Safety Requirement (protective)
	message	Not a specific EFPL failure mode but frequency of occurrence could be impacted by the EFPL concept			reduce/maintain the number of incorrect De-Suspension messages (DES) compared to the current mode of operation ( <b>REQ-07.06.02-SPR-18</b> )
	EFPL inconsistent flight plan	Situation Where NM, ATC and AU have different EFPL.  Not a specific EFPL failure mode but frequency of occurrence could be impacted by the mix mode environment (normal FPL and EFPL)			The implementation of the EFPL shall reduce/maintain the number of inconsistent flight plans compared to the current mode of operation ( <b>REQ-07.06.02-SPR-19</b> )

#### A.1.3.4.2 Common Cause Analysis

The Extended Flight Plan elements (Flight plan data) are distributed to Airport, ANSP and NM for ATC and ATFCM services. As illustrated in section A.1.2.3 (Figure 4: High-level process description for the extended flight plan), the use of these flight plan data is outside the scope of this safety assessment. However loss or corrupted flight plan data might affect several users and can be considered as a common cause of failure. Requirements derived during the failure mode and effect analysis (§A.1.1.1.1) are considered sufficient to address this aspect in particular **REQ-07.06.02-SPR-21**, **REQ-07.06.02-SPR-08** and **REQ-07.06.02-SPR-13**

#### A.1.3.4.3 Formalization of Mitigations against EFPLM failure mode

Considering the outcome of the failure mode and effect analysis, the following **Table 7** formalizes the required mitigations against failure modes identified in A.1.3.4.1.

ID	Description	[EFPL Process] Failure Mode <u>Applicable SAC</u>
REQ-07.06.02-OSD-0001.0001	The NM shall validate received extended flight plan and associated messages	[Submission]  Corrupted, false or incomplete EFPL data from the A.U (or third parties)  <u>SAC EFPL#1</u>
REQ-07.06.02-OSD-0001.0003	When present in an extended flight plan message, the NM shall use the provided 4D Trajectory of the flight to perform the flight plan validation processes involving the use of the flight trajectory.	
<b>REQ-07.06.02-SPR-10</b> (Status DELETED because considered as a business requirement)	The EFPLM validation process shall verify the completeness of EFPLM elements	
REQ-07.06.02-OSD-0001.0050	The NM shall provide a means to Airspace Users to check the validity of an Extended Flight Plan prior to the actual submission	
<b>REQ-07.06.02-SPR-21</b>	The airspace user shall provide EFPL data in accordance with the specified data quality requirements (resolution, accuracy, integrity).	
<b>REQ-07.06.02-SPR-08</b>	The EFPL validation process shall reduce/maintain the number of incorrect ACK messages that are due to flight trajectory calculation differences between NM and the AU compared to the current FPL validation process.	[Submission]  Inaccurate EFPL data (e.g. Total weight, estimated speed)  <u>SAC EFPL#1</u>

ID	Description	[EFPL Process] Failure Mode <u>Applicable SAC</u>
		[Validation]  Incorrect EFPL ORM (ACK/REJ)  <u>SAC EFPL#1</u>
REQ-07.06.02-SPR-11	The NM EFPL validation process shall raise an error in case the EFPL trajectory information is inconsistent with the equivalent ICAO Field 15 route information provided within the same EFPL.	[Validation]  ICAO FPL data/UP4DT Inconsistency  <u>SAC EFPL#1</u>
REQ-07.06.02-OSED-0001.0002	The 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.	
REQ-07.06.02-SPR-13	The NM shall develop the “ <i>flight messages checking and distribution</i> ” service with an appropriate Assurance Level (AL).  <i>Note: The purpose of an Assurance Level (AL) is to balance (or proportion) the development effort with the potential risk associated with the implementation and operation of the software or the procedure or the performance of the defined human task.</i>	[Distribution]  Corrupted, false or incomplete EFPL data from NM (incorrect flight plan)  <u>SAC EFPL#1</u> <u>SAC EFPL#2a/b</u> <u>SAC EFPL#3a</u> <u>SAC EFPL#3b</u>
ASSUMPTION-07.06.02-SPR-02	ATC during operation considers and mitigates the flight plan uncertainties associated to EFPL despite the level of uncertainties is reduced compared to ICAO flight plan	[Distribution]  Corrupted, false or incomplete EFPL data from NM (incorrect flight plan)  <u>SAC EFPL#3a</u>  <u>SAC EFPL#3b</u>
REQ-07.06.02- OSED - 0001.0007	The NM shall distribute valid extended flight plan messages to ATC Units concerned by the flight that have previously requested to receive flight plan information in the form of extended flight plans.	[Distribution]  EFPL distributed to non-compatible ATC  <u>SAC EFPL#1</u> <u>SAC EFPL#3a</u>
REQ-07.06.02- OSED - 0001.0008	NM distributes ‘normal’ flight plan messages, containing data retrieved from valid extended flight plan messages, to ATC units concerned by the flight that have requested not to receive flight plan	

ID	Description	[EFPL Process] Failure Mode <u>Applicable SAC</u>
	information in the form of an extended flight plans, as a default option	
<b>REC-07.06.02-SPR-02</b>	The NM should distribute 'normal' flight plan messages to all ATC units concerned by the flight even for those which have requested to receive flight plan information in the form of extended flight plan	
REQ-07.06.02- OSED - 0001.0010	It shall be possible for an ATC unit to retrieve, on request, extended flight plan information for a given flight from NM	<b>[Distribution]</b>  Missing EFPL  <u>SAC EFPL#1</u> <u>SAC EFPL#3a</u>
<b>REQ-07.06.02-SPR-16</b>	The implementation of EFPL shall reduce/maintain the number of missing flight plans at ATC level due to wrong addressing at NM level compared to the current mode of operation.	
<b>REQ-07.06.02-SPR-17</b>	The implementation of the EFPL shall reduce/maintain the number of missing flight suspension messages (FLS) compared to the current mode of operation	<b>[Distribution]</b>  Missing EFPL FLS message  <u>SAC EFPL#1</u> <u>SAC EFPL#3a</u>
<b>REQ-07.06.02-SPR-18</b>	The implementation of the EFPL shall reduce/maintain the number of incorrect De-Suspension messages (DES) compared to the current mode of operation	
<b>REQ-07.06.02-SPR-19</b>	The implementation of the EFPL shall reduce/maintain the number of inconsistent flight plans compared to the current mode of operation	<b>[Distribution]</b>  EFPL inconsistent flight plan  <u>SAC EFPL#1</u> <u>SAC EFPL#3a</u>

Table 7: Derivation of EFPL Mitigation means against EFPLM Failure Modes

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