TMF INTEROP for Step 1-Final Release (5.5.1 Deliverable - 4.5 Contribution)

Document information	
Project Title	Trajectory Management Framework in En Route
Project Number	05.05.01
Project Manager	ENAV
Deliverable Name	TMF INTEROP for Step 1-Final Release (5.5.1 Deliverable - 4.5 Contribution)
Deliverable ID	D846
Edition	00.03.00
Template Version	03.00.00
Task contributors	
DFS, ENAIRE, EUROCONTROL, NATS	

Abstract

This document provides operational interoperability requirements for the exchange of flight and trajectory information in SESAR step 1. These information exchanges are in support of a number of different identified SESAR solutions.

Note this document is not complete in scope (i.e. there are some topics not yet tackled, and some topics for which agreement is pending), and requirements (while all agreed by partners) are "In Progress"; therefore more work is needed to reach a fully validated set of requirements.

The content of the document is considered mature enough to continue the development work necessary to reach the full maturity of IOP solution.

Authoring & Approval

Prepared By - *Authors of the document.*		
Name & Company	Position & Title	Date
[redacted] NATS	[redacted]	4/11/2016
[redacted] EUROCONTROL		15/12/2016
[redacted] DFS		4/11/2016
[redacted] EUROCONTROL		4/11/2016
[redacted] EUROCONTROL		15/12/2016
[redacted] ENAIRE		4/11/2016

Reviewed By – *Reviewers internal to the project.*		
Name & Company	Position & Title	Date
[redacted] Indra	[redacted]	24/10/2016
[redacted] Thales		24/10/2016
[redacted] ENAV		24/10/2016

Reviewed By – *Other SESAR projects, Airspace Users, staff association, military, Industrial Support, other organisations.*		
Name & Company	Position & Title	Date
[redacted] DFS	[redacted]	15/12/2016
[redacted] DFS		15/12/2016
[redacted] DFS		15/12/2016
[redacted] DSNA		15/12/2016
[redacted] DSNA		15/12/2016
[redacted] DSNA		15/12/2016
[redacted] ENAV		15/12/2016
[redacted] ENAIRE		15/12/2016
[redacted] EUROCONTROL		15/12/2016
[redacted] EUROCONTROL		7/11/2016
[redacted] EUROCONTROL		15/12/2016
[redacted] EUROCONTROL		15/12/2016
[redacted] Leonardo		15/12/2016
[redacted] Leonardo		15/12/2016
[redacted] Indra		15/12/2016
[redacted] Indra		15/12/2016
[redacted] Thales		15/12/2016
[redacted] Thales		15/12/2016
[redacted] Thales		15/12/2016

Approved for submission to the SJU By – *Representatives of the company involved in the project.*		
Name & Company	Position & Title	Date
[redacted] AIRBUS	[redacted]	9/11/2016
[redacted] DFS		9/11/2016
[redacted] ENAIRE		15/12/2016
[redacted] ENAV		15/12/2016

[redacted] EUROCONTROL	[redacted]	15/12/2016
[redacted] Indra		15/12/2016
[redacted] NATS		9/11/2016
[redacted] Thales		9/11/2016

Rejected By – *Representatives of the company involved in the project.*		
Name & Company	Position & Title	Date

Rational for rejection

Document History

Edition	Date	Status	Author	Justification
00.00.01	24/06/2016	Draft	[redacted]	- New Document, based on D823 TMF INTEROP for Step 1 Initial Release. - Incorporating Release Function update
00.01.00	01/07/2016	Interim Deliverable		- Interim Deliverable, incorporating review comments
00.01.01	02/08/2016	Draft		- Revised document layout including aligning section 4 with Analysis Team Features - Revised concept overview section aligning with Analysis Team concept material
00.01.02	02/09/2016	Draft		- Restructure requirements section to include initial, deployable and full categories - Include CTA, EPP, NM requirements from D823
00.01.03	20/09/2016	Draft		- Update following template review
00.01.04	11/10/2016	Draft		- F1 requirements added
00.01.05	13/10/2016	Draft		- F3 & 5 requirements added
00.01.00	27/10/2016	Final		- Comments addressed
00.01.01	01/11/2016	Draft		- F 2 requirements added - Appendix A, rectified - Editorial changes
00.02.00	04/11/2016	Draft		- Update following review, Analysis team F2F #18
00.02.02	12/12/2016	Draft		- Update following Toulouse workshop, F#1, F#2 and F#5

			[redacted]	- F#8 requirements added
00.03.00	15/12/2016	Final		- Update following IOP AT#21 F2F discussions

Intellectual Property Rights (foreground)

This deliverable consists of SJU foreground.

Table of Contents

List of tables

List of figures

Executive summary

The SESAR Technology Solution “Automated Assistance to Controller for Seamless Coordination, Transfer and Dialogue through improved data sharing” is based on a concept to support the sharing of consistent flight data between all ATM stakeholders. Its purpose is to ensure that all systems have a consistent view of the flight, and that the data is widely and easily available, subject to appropriate access controls.

Today initial flight plan data is distributed by IFPU to all crossed ATS Units a few hours before expected entry time and then each ATSU will develop and maintain its own view of the flight, based on a set of local rules and data to derive a trajectory from the flight plan data. This leads to fractions of trajectories that are only linked together through synchronization of coordination data by phone or OLDI messages. Obvious drawbacks are absence of updated information before the first OLDI message is received, and the limited scope of what can be passed on through OLDI messages. This results in a poor awareness of the downstream controllers on aircraft manoeuvres before his/her ACC boundary that may impact the trajectory in his/her centre. IOP brings an increased level of synchronization by allowing each stakeholder to share a complete set of data used to build a common end-to-end trajectory, and to exchange controllers’ inputs on each side of ATSU boundaries. It is also used to increase controller situation awareness by providing up-to-date data on aircraft flying in the vicinity of his/her airspace even when they will not enter it (notion of Area of Interest).

This specification provides high level interoperability requirements for the exchange of flight and trajectory information according to the concept developed for the Solution above. This answers the AF#5 PCP scope.

In doing so, the requirements have been grouped according to the following features:

- Feature #1: Coordination and Transfer
- Feature #2: Management of Flight Object Flight Script
- Feature #3: Informative distribution between systems
- Feature #4: FO protocol failures
- Feature #5: Control Sequence Handling
- Feature #6: IOP recovery
- Feature #7: Manual FO correction
- Feature #8: SSR codes
- Feature #9: FO mechanism
- Feature #10: Scope and Management of FO trajectory
- Feature #11: Arrival & Departure Management
- Feature #12: Original FP data
- Feature #13: IOP support to PCP ATM features

This Specification is covering Features #1, #2, #3, #5, #8, #9.

The Requirements expressed in this document capture different degree of inter-operability (more details in the specific section) :

- Basic IOP: Requirements considered necessary to be compliant to the PCP.
- Intermediate IOP: Requirements considered necessary to replace the expected levels of interoperability at the time of ATM Functionality 5 full operational capability.
- Full IOP: Set of requirements to further develop interoperability.

This categorization has been used for requirements of all features.

The second major aspect covered by this specification is the air/ground exchange of trajectory information. This supports operations that require a synchronized air/ground view of the trajectory, such as those using a CTA/CTO constraint (for example, SESAR solution #06: Controlled Time of Arrival (CTA) in Medium density / medium complexity environment; and TRACT, an element of the solution PJ10-02A Improved Performance in the Provision of Separation).

It is noted that the trajectory information provided through ground/ground “one-to-many” based mechanisms and by the aircraft can support improvements to controller decision support tools, although such details are outside the scope of this specification.

The requirements in this specification express high level operational interoperability needs, not technical interoperability. It is expected that technical specifications developed within SESAR by the system projects will trace to the requirements in this specification.

Note this document is not complete in scope (i.e. there are some topics not yet tackled, and some topics for which agreement is pending – see 0), and requirements are “In Progress” (more work is needed to reach a fully validated set of requirements).

1 Introduction

1.1 Purpose of the document

This document expresses the operational requirements driving the need for inter-operability between ATC systems. The requirements are to cover the level of IOP that is needed for initial deployment and were developed by the IOP analysis team in 2016.

Note this document is not complete in scope (i.e. there are some topics not yet tackled, and some topics for which agreement is pending – see 0), and requirements are “In Progress” (more work is needed to reach a fully validated set of requirements).

1.2 Intended readership

This intended readership for this initial release of the specification is as follows:

- ENB 03.01.01 Trajectory Management Framework
  - P04.05 and P05.05.01: the partners responsible for developing this specification.
  - P09.01, P10.02.01 and P10.02.05: to review the requirements for clarity and feasibility with respect to the required enabler development and for traceability to the existing technical specification requirements.
- OFA 03.03.01 Ground Based Separation Provision En Route
  - P04.03: this specification can be referenced in the data-pack for SESAR solution #28 as it expresses the consolidated flight and trajectory interoperability needs associated to seamless coordination and transfer (CM-0201-A).
  - P04.07.02: for awareness of the current consolidated interoperability needs that are applicable for the TRACT service (CM-0403-A).
- OFA 04.01.02 Enhanced Arrival and Departure Management in TMA and En Route
  - P04.03 and P05.06.01: this specification can be referenced in the data-pack for SESAR solution #06 as it expresses the consolidated flight and trajectory interoperability needs associated to Controlled Time of Arrival (CTA) in medium density/complexity environment (TS-0103).
  - P05.06.04 and P05.06.07: for awareness of the consolidated interoperability needs that could be used to support Arrival Management Extended to En Route Airspace – single TMA (TS-0305-A). It is noted that the use of the TMF interoperability is not mandatory for this SESAR Solution in Step 1 (#5 Extended Arrival Management (AMAN) horizon), but may form an appropriate solution for arrival management flight and trajectory data needs in the future.
  - P10.07.01: this specification defines operational interoperability requirements allocated to the air/ground datalink functional blocks.
- OFA 03.01.03 Free Routing
  - P04.07.02: For awareness of interoperability needs that could support free routing.
  - P07.05.03: For awareness of interoperability needs that could support free routing.
- OFA 03.01.04 Business and Mission Trajectory
  - P07.06.02: for awareness of the current consolidated interoperability needs associated to Initial Reference Business Trajectory (iRBT) information that is shared with ATC (AUO-0225; AUO-0226) at the end of the planning phase.

1.3 Inputs from other projects

The content of this version of the INTEROP document was fed with inputs from the IOP analysis team.

1.4 Glossary of terms

The following terms are used within this specification.

Term	Definition
Arrival ATS Unit (A-ATSU)	The downstream ATS unit providing an AMAN (or XMAN) service for a flight
Current Controlling ATS Unit (C-ATSU)	The ATS unit with current control responsibility of a flight
Transferring ATS Unit (T-ATSU)	The upstream ATS unit involved in a coordination for the transfer of control or in the process of transferring control of responsibility of a flight
Receiving ATS Unit (R-ATSU)	The downstream ATS unit involved a coordination for the transfer of control that will assume control of responsibility of a flight
En-Route Cruise Level	The level that the flight is to maintain for a significant part of the flight after reaching Top of Climb and prior to Top of Descent, as planned by ATC. The ECL may be the same as the filed Requested Flight Level (RFL), but can be changed by ATC (for example, due to conflicting traffic at the cruise level). As per the RFL, whenever there is a planned change to the ECL, it is associated to each point of the affected cruise portion in the planned route. Note also that there may be multiple en-route cruise levels associated to different portions of the route.

Term	Definition
Flight Intent	Flight intent is a description of the operational requirements and constraints that must be respected by a predicted trajectory (e.g. for a planned trajectory this would include the planned route, standard operational procedures, such as the SID and STAR, applicable trajectory constraints, operator preferences where known, etc.). Flight Intent is the set of flight data required as the key input to the trajectory prediction processes of the aircraft FMS, Ground TP and FOC tools. When used in conjunction with other data, it allows different stakeholders to create consistent, but not necessarily identical, trajectories for a flight. When a stakeholder requires a change to the trajectory of a flight, it does so through the modification and sharing of the flight intent. The flight intent is seen as a basic blueprint for trajectory prediction where the details are left unspecified. For this reason, the exchange of flight intent information plays a key role in trajectory management. In the SESAR context, flight intent corresponds to the agreed data of the (i)RBT/MT. Note: This definition of flight intent matches the usage of the term in the Trajectory Management section of the B4.2 Step 1 CONOPS and has been coordinated with WP8 for inclusion in the AIRM. This is the intended usage of the term within this document. Note also, however, that the AIRM also provides an alternative ICAO definition which defines flight intent as the future 4D profile of the aircraft. Note also that the definition of flight intent does not imply that the trajectory prediction processes of the different stakeholders (e.g. aircraft FMS, ATC ground TP, etc.) have exactly the same flight intent information as inputs. There are expected differences even after information exchanges which will synchronise certain elements of the flight intent.
Flight Object Partners	Within the context of this document, a Flight Object partner represents an eligible stakeholder whose system fulfils at least one of the FDMP, FDC or FDU roles defined in the Flight Object Interoperability Specification (ED-133).
Level Constraint	Defines a restriction on the vertical profile of the trajectory at a specified point on the route. The restriction may result in the vertical profile crossing a defined point (or area) ‘at’, ‘at or below’, ‘at or above’, or ‘between’ specified levels.
Letter of Agreement (LOA)	Document that specifies the exchange of flight data and the associated procedures between ATC units for the purpose of notification, coordination and transfer or for information exchange for flights for which the responsibility of the control does not change
Planned Route	A set of route points describing the horizontal intent of a flight as planned by ATC. It will be revised by both planned and cleared Route Changes i.e. alternative routings that the aircraft is not yet cleared to follow (non-cleared route elements), and changes to the Cleared Route, e.g. when the aircraft is cleared from present position direct to a fix further along its route.
Planned Trajectory	A time ordered sequence of predicted trajectory points representing the probable behaviour of a flight.

Term	Definition
Route Change	A modification to the Planned Route representing a route clearance that has been issued or yet to be issued to the aircraft.
Speed Constraint	Defines a speed restriction at either a specified point on the route or an altitude. The restriction may be qualified when applied to a point on the route, such that the speed is 'at', 'at or below', or 'at or above'. Furthermore, flight phase affects the way the speed restriction is applied before and after the route point. For restrictions at a point in the climb phase, the restriction applies to the aircraft prior to it sequencing the point. For restrictions in the descent, the restriction applies to the aircraft after sequencing the specified point. Certain speed restrictions are associated with an altitude and not associated with waypoints or procedures. These speed restrictions are intended as speed limits below the specified altitude and apply to a block of airspace or region. For speed restrictions associated with an altitude, the aircraft speed shall remain at or below the restriction as long as the aircraft altitude is below the speed restriction altitude.
Standard Instrument Departure (SID)	A designated instrument flight rule (IFR) departure route linking the aerodrome or a specified runway direction of the aerodrome with a specified significant point, normally on a designated ATS route.
Standard Arrival Route (STAR)	A designated instrument flight rule (IFR) arrival route linking a significant point, normally on an ATS route, with a point from which a published instrument approach procedure can be commenced.
Standard Conditions	Conditions that are in accordance with the ones specified in Letters of Agreement
Non-Standard Conditions	Conditions that are not in accordance with the ones specified in Letters of Agreement
Time Constraint	Defines a restriction on the time at which the aircraft is expected to cross a specified point on the route with a given accuracy. The restriction may be qualified such that the aircraft should cross the specified point 'at', 'at or before', or 'at or after' the specified time.

Term	Definition
Trajectory Constraints	Conditions that may restrict the aircraft from following its desired trajectory. The term is used generically to refer to time, speed or level constraints that can be applied to points on the planned route of the flight (or for some cases at a defined altitude). However, it is noted that specific types of constraints can be further distinguished based upon a number of different factors. For example whether the constraint is defined strategically (prior to flight execution) or tactically (during flight execution); the stakeholders groups that need to be aware of the constraint; and so on. ATM constraints are defined strategically (i.e. prior to execution) through standard ATC procedures, such as SIDs and STARs, and as such are known to aircraft databases. Other types of trajectory constraint that are applicable to this specification include boundary crossing levels defined in LoA between ATSUs, etc., and constraints set through planning processes during flight execution, as set by the planner, MSP, AMAN, local Traffic Manager, etc. There may be trajectory constraints with different operational priorities, dependent upon the source of the constraint. For example, a non-standard coordination defining a level on a coordination point agreed between controllers would supersede any strategically defined level constraint on the coordination point (e.g. as set through LoA).
Trajectory Point	An element of a trajectory that describes the aircraft state at a given instance of time. The minimum information contained within a trajectory point describes its position for the specified time: i.e. identification of the point (e.g. latitude and longitude), the flight level, and the date-time. Note that further attributes may be defined for a trajectory point (e.g. estimated speed, mass, type of point, etc.).

1.5 Acronyms and Terminology

The following acronyms are used within this specification

Term	Definition
2D	Two Dimensional
4D	Four Dimensional
ADS-C	Automatic Dependent Surveillance – Contract
AGDC	Air-Ground Datalink Communications (functional block of ATC system)
AGDS	Air-Ground Datalink Services (functional block of ATC system)
AMAN	Arrival Manager
APP	Approach ATC
AoI	Area of Interest
AoR	Area of Responsibility

Term	Definition
ATC	Air Traffic Control
ATCO	Air Traffic Control Officer / Air Traffic Controller
ATM	Air Traffic Management
ATMS	Air Traffic Management System
ATS	Air Traffic Service
ATSU	Air Traffic Services Unit
CAP	Controller Awareness Phase
C&T	Coordination & Transfer (functional block of ATC system)
CFL	Cleared Flight Level
CHMI	Controller Human Machine Interface management (functional block of ATC system)
ConOps	Concept of Operations
CTA	Controlled Time of Arrival
CTO	Controlled Time Over
CTOT	Calculated Take-Off Time
CWP	Controller Working Position
DCB	Demand-Capacity Balancing
DOD	Detailed Operational Description
EC	European Commission
ECL	En-route Cruising Level
ECS	En-route Cruising Speed
EFL	Entry Flight Level
ENB	Enabler (in the context of a collection of related projects within the SESAR programme)
ENR	En-route ATC
EPP	Extended Projected Profile
ETA	Estimated Time of Arrival
FDC	Flight Data Contributor (Flight Object system role)

Term	Definition
FDMP	Flight Data Manager Publisher (Flight Object system role)
FDPS	Flight Data Processing System
FDU	Flight Data User (Flight Object system role)
FMP	Flow Management Position
FMS	Flight Management System
FO	Flight Object
FOC	Flight Operations Centre
GAT	General Air Traffic (civil)
GGIOP	Ground-Ground IOP Management (functional block of ATC system)
HMI	Human Machine Interface
IFPS	Initial Flight Plan Processing System
IFR	Instrument Flight Rules
INAP	Integrated Network management and ATC Planner
INTEROP	Interoperability Requirements
IOP	Interoperability (often used as shorthand for Flight Object Interoperability)
LoA	Letter of Agreement
MTCD	Medium Term Conflict Detection
NM	Network Manager
NP	Negotiation Phase
OAT	Operational Air Traffic
OFA	Operational Focus Areas
OI	Operational Improvement
OLDI	On-Line Data Interchange
OSED	Operational Service and Environment Definition
RBT/MT	Reference Business Trajectory/Mission Trajectory
SAP	System Awareness Phase
SESAR	Single European Sky ATM Research Programme

Term	Definition
SESAR Programme	The programme which defines the Research and Development activities and Projects for the SJU.
SFL	Supplementary Flight Level
SI	System Instance
SID	Standard Instrument Departure
SJU	SESAR Joint Undertaking (Agency of the European Commission)
SPR	Safety and Performance Requirements
STAR	Standard Instrument Arrival
SWIM	System Wide Information Management
TFL	Transfer Flight Level
TMA	Terminal Manoeuvring Area
TMF	Trajectory Management Framework
TP	Trajectory Predictor
TP&M	Trajectory Prediction & Management (functional block of ATC system)
TRACT	Trajectory Adjustment through Constraint of Time
TS	Technical Specification
TTA	Target Time of Arrival
TTO	Target Time Over
VFR	Visual Flight Rules
WIC	What-if Contributor (Flight Object system role)
WIMP	What-If Manager Publisher (Flight Object system role)
XFL	Exit Flight Level
XMAN	Cross border AMAN

1.6 Limitations

This INTEROP includes ATM Interoperability requirements as developed by the SESAR IOP Analysis Team so far in 2016. This work is ongoing, and it is anticipated that these requirements will be further matured, and additional features covered, in future versions of this document under the SESAR 2020 programme. Appendix C details this further work.

This document also contains operational requirements relating to IOP topics that do not fall under the scope of the work of the Analysis team. These requirements have been copied from the previous version of the TMF INTEROP (D823 [6]), but have not been assessed for consistency with the feature work of the analysis team.

2 Concept Overview

2.1 Previous Operating Method

During flight execution in today's operation, trajectories are managed by controllers mainly through tactical clearances to ensure a safe, orderly and expeditious flow of traffic. In most cases this involves level changes, vectoring and direct routing. The communication between controller and pilot to clear and/or change a flight's trajectory is mainly R/T channels and datalink.

Revisions impacting the future evolution of the trajectory, whilst applied locally, are not propagated immediately to the downstream ATSUs. Additionally, some decisions to revise a trajectory are often taken without reference to the wider impact on the trajectory. Such decisions may adversely affect the workload for downstream stakeholders and trigger changes to their planning activities if they are even aware of the change. Usually a downstream ATSU will not know the updated planning until the flight reaches the proximity of the boundary which may affect the stability of its planning processes. Similarly, the lack of reference to network level planning goals creates inefficiencies for the airspace user: pilots may be requested to speed up or route direct in order to expedite the flight, whilst in a downstream sector they are requested to fly at a slower speed or are put in a hold. The flight data exchange required to support notification, coordination and transfer processes are limited to those mandated by European commission implementing regulation 1032/2006 [9].

The planning processes in both the ground and air make extensive use of trajectory predictions. However, not only can the trajectories maintained by different ground units become unsynchronised due to locally applied changes not being shared, but the trajectory used by the aircraft can have significant differences to the ground held plan. These air and ground trajectory predictions often take into account different information, intents and constraints. Aircraft trajectories are assumed to be the most accurate if they were to include all relevant ATC constraints (which they may not have access to) and have up-to-date meteorological information, whereas ATC trajectories today don't have access to some major aircraft characteristics (e.g. mass) and airline preferences (e.g. speed profiles, operating policies), etc. There is limited exchange of information to reconcile any differences.

These intent discrepancies can lead to a number of problems:

- Inaccurate ground trajectory prediction with large uncertainties, this reduces the effectiveness of controller support tools (e.g. for conflict detection or queue management) and hence increases controller workload.
- Inefficiencies (both airspace and environmental) as the flight does not execute its optimised trajectory profile.
- The intent discrepancies can cause a difference between the controller's expectation of the trajectory and the actual aircraft behaviour – leading to potential safety hazards.

In summary, there are discrepancies in the view of the planned trajectory held by the different ATM stakeholders and there are limited processes to share information which could reconcile these differences.

2.2 Flight Object Concept of use

This section describes the use of the Flight Object from an operational viewpoint.

The main characteristic of the Flight Object is that it provides more information at an earlier time.

Just as trackers are updated with the frequent radar input, the Flight Object provides the means for the flight data related to a flight to be continuously updated by instructions passed by controllers and by downstream constraints, made by inputs from the controller. This is different from the current "snap-shot" view where the flight plan data remains quasi-static.

This continuously updated input means the data that the flight data processing systems use to create their trajectories and hence the source of data used by the existing tools in the ATSUs will be more accurate and up-to-date improving the decision making capabilities and minimising disruption to flights.

2.2.1 What is the Flight Object?

The EUROCAE document describing the Flight Object (FO) interoperability (IOP) specification describes the FO as:

> *"…a concept to support the sharing of consistent flight data between all stakeholders. Its purpose is to ensure that all systems have a consistent view of the flight, and that the data is widely and easily available, subject to appropriate access controls...*
>
> *The fundamental idea is that a single logical entity, the FO is kept up to date by all parties wishing to share information about a flight. All parties use the FO as a reference and all keep it updated with the latest information, thereby ensuring that all systems have the most up to date and consistent view of the flight data."*

In the current ATM system, in Europe, the flight plan is filed by the airline operator via the Network Manager. This plan is then distributed to all centres along the expected route of the flight and updated with any changes, routes, delays, cancelations etc. Once the flight is airborne the network is notified that the execution phase has started and the main means of updating the flight is the responsibility of the Air Traffic Service Units (ATSU) that controls its progression. The Network Manager is still involved receiving updates and when necessary notifying downstream units to changes to the routing or adding, removing units as the actual path of the flight changes and possible restrictions are removed or enforced.

Each ATSU in the progression is responsible for coordinating the details of the flight with the next ATSU in the centre sequence. To do this either the telephone is used to verbally coordinate or the Online Data Interchange (OLDI) for electronic coordination. These means provide a snap-shot view of the flight a set time or distance prior to entry in to the next centre, this view can be updated, revised, cancelled, etc. but remains a single static view. OLDI also provides a variety of messages to allow a dialogue, or negotiation, between controllers, messages for civil-military coordination and situational Long Term however although modern Flight Data Processing Systems (FDPS) are capable of exchanging these messages very few actually do so.

The Flight Object in its simplest form can be used to distribute the flight plan when initiated by the Network Manager, holding the flight progression and all known constraints to that flight. Once airborne the controlling ATSU can update the flight details in real time with all modifications and actions taken with relating to the flight. Downstream centres will receive a continuous stream of information dynamically updating the entry in to their area of responsibility and enabling them to request upstream changes to the routing, levels arrival routes, constraints etc.

The Flight Object also contains a trajectory describing the aircraft path, the basic information needed by the crossed FDPSs to build their own trajectory to suit their needs, information related to the aircraft detail, and so on, for more details regarding the content see the section: : Content of the Flight Object.

In principle this idea of the passing of information and setting coordination data as fixed and agreed applies between any two Air Traffic Control (ATC) sectors. With the current versions of FDPSs, using one system and a centralised flow of information the relationship between two internal sectors of an ATSU is no longer fixed to a "snap-shot", it reflects a continuous update and allows a freedom that is not available when OLDI is used. Internally flight data communication is much closer to the concept of the Flight Object than between centres and inter-sector efficiency is far higher than inter-centre.

It is the Operational understanding that a System Instance (SI) can be made up of several ATSUs which in turn are made up of sectors.

According to ED-133 section 4.1, an FDPS is the physical ATC stakeholder application system which provides and consumes flight data. It is referred to as either 'system' or 'system instance' interchangeably throughout the rest of that document.

This implies that an SI can be a single ATSU fed by a single FDPS or an SI can be built of several ATSUs all fed by a single FDPS.

For the purposes of this document the term ATSU will be used with the above sentence in mind. When it becomes necessary to clarify additional information will be given.

2.2.2 Content of the Flight Object

The Flight Object is a collection of items that are shared between the various users, see section: Roles and Responsibilities. The local user may use an internal set of information in parallel to the FO and use the FO to compliment this set or, they may use the information provided directly.

As an example: the FO contains a trajectory calculated by the current controlling ATSU and it also contains all the elements (flight plan, restrictions, STAR, etc.) that can be used to build a trajectory. The local user may elect to make use of the FO trajectory directly in its system or it may build its own trajectory based on the data supplied. Both of these choices are valid and it must be recognised that each version of the trajectory will be slightly different – there is not one trajectory algorithm used within the IOP area. The trajectories built and distributed will vary slightly as each ATSU subsequently takes over the responsibility and each ATSU that creates its own local version will apply rules and internal events that are not relevant to the wider community. In this way freedom of choice and ability to adapt to local conditions is ensured, checking routines that will be described later must take this in to account.

ED-133 provides the following list as a summary:

- Aircraft information;
- Arrival and departure information (Selected SID, STAR, IAP…);
- The flight script used for calculating the flight trajectory;
- The trajectory calculated by the IOP ATSU that is publishing this FO;
- Information related to the coordination that will affect to the flight;
- The original flight plan; and
- Technical information needed for handling the interoperability processes.

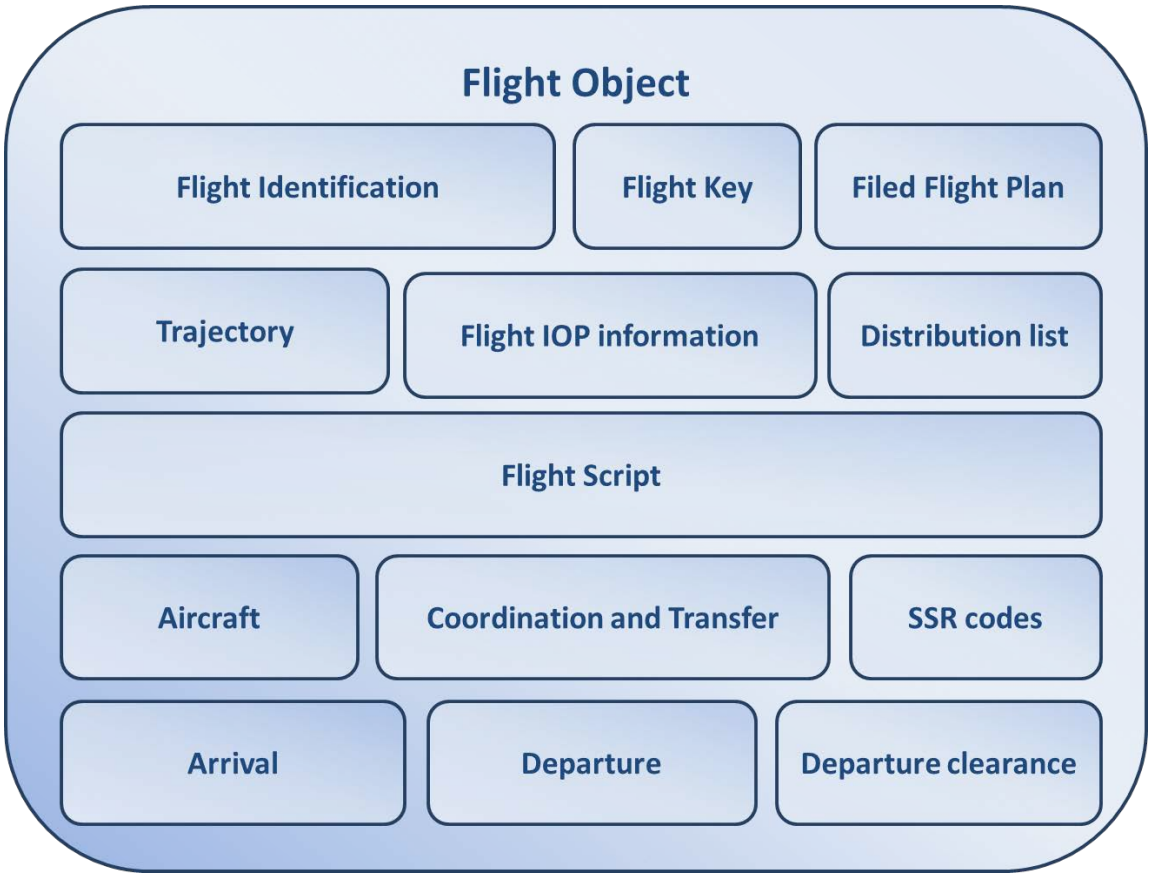


Figure 1: FO Illustration

Additions can be added to the FO quite easily. An example is the ADS-C data including the Extended Projected Profile (EPP). This is a set of aircraft flight management system information that provides the aircraft intent in four dimensions, performance characteristics such as speed schedules and other data that can be used to enhance the ground tools. It also provides a means of exchanging data and requests enabling the management of a flight to cross a waypoint at a particular time, this can be used for demand capacity balancing or arrival management.

To add the ADS-C data to the FO an additional cluster was included, those users not wishing to make use of the date merely discard it but it allows the systems interested in having the information and the ability to share it a simple means to cope with the distribution.

2.2.3 Building the Flight Object

2.2.3.1 The Initial Plan

The TP is first built from the initial flight plan exactly as is, so there is no checking if the points in the expanded route are valid or not.

Initially this will be sent out with the trajectory as known by the current ATSU, the filed flight plan will be expanded in to the sequence of route points and ATSUs as far as is known by the environmental knowledge of the current ATSU (for future involvement of NM see section 2.2.6). Initially each ATSU is not expected to be able to expand the complete flight plan, limited processing capabilities, memory and adaptation data will constrain the limit that the individual ATSUs are capable of handling hence an initially an incomplete expansion and list of ATSUs is distributed.

The information is distributed to those ATSUs in the sequence and each continues the expansion of the route according to their “better” knowledge of the route network and ATSUs further downstream. In the further expansion of the route each downstream ATSU will send their known constraints upstream and/or changes to the expanded route to be merged according to priority rules and local agreement on the ownership of the constraints (see section on Constraint Handling) and the updated FO containing the IOP trajectory will be re-distributed.

This continues until the complete route is expanded and agreed between all partners.

2.2.3.2 Constraints

Constraints are limitations or restrictions applied to a flight in order ensure an optimum flight path given capacity balancing, sector workload, departure and arrival procedures, environmental conditions etc. Ideally no constraints other than those requested by the airline operator would be applied, the requested flight levels (RFL), speeds, times and the 2D routing, but the ATM world is not ideal and some restrictions have to be imposed.

Constraints can be considered to be either open or closed, closed constraints result in a trajectory recalculation and open constraints do not result in a recalculation but they are shared for information.

Constraints can be of either type, for example a transfer level can be a closed constraint at a lateral boundary when coordinated with an adjacent unit, in a climbing situation the TFL is usually the division between the two units and the level itself has no impact on the climb to the cleared level, in this case it does not impact the trajectory and can be considered to be open.

Constraints can come from many different sources but can be categorised as strategic, planning or executive. The initial flight plan builds the baseline and becomes effectively a strategic set of constraints.

Strategic constraints, off-line defined, which encompass:

- Published constraints (known by at least two stakeholders, including NM),
- Private constraints defined off-line by a single IOP partner and unknown by the other IOP partners.

Planning constraints, which are other ATM constraints, neither off-line defined, nor clearances but entered in to the system to allow the trajectory to be built and the constraint shared.

Executive constraints, translations of the clearances given to the flight crew.

The initial distribution will contain predominately constraints of the type Strategic although these, as well as the Planning and Executive, can be added later.

The flight plan received sets the first definition of the trajectory and the Network Manager overlays restrictions generated due to departure or arrival limitations and ATSU sector restrictions. This new 4D profile is distributed to all the crossed and informed ATSUs and where appropriate the SAP phase begins (see section 2.2.5.2). Those ATSUs in the SAP align the profile with their internal constraints considering high/low sector profiles, computed top of descents points, etc. and provide the unit managing the flight object with the additional constraints. This unit incorporates the constraints to the best of their ability and redistributes the new trajectory and a list of all constraints that are being used to build it.

2.2.3.3 ATSU Sequence

Each of the above actions, the expansion of the route and the addition of the constraints, has an impact either on the ATSUs to whom the flight object is distributed or those who will control the flight. These ATSUs can be considered as those that will be crossed by the flight (through it's Area of Responsibility), those ATSUs who will actually control the flight and additional ATSUs to whom the information is distributed.

The initial sequence will be built from the expansion of the flight plan and impacted by the constraints added by each ATSU. Additionally some automatic alignment may take place, for example an ATSU may be crossed for a very short time or distance and by bilateral agreements can be automatically removed from the control sequence even though their airspace will be crossed – this is known as an automatic SKIP and is described further in section 3.1.4.1.

Initially the flight object will be distributed to all ATSUs who will be crossed by the flight on the assumption that these are the ATSUs who will control the flight. Each downstream ATSU, through constraints, corrections or automatic actions will amend this list and provide the ATSUs who will actually control the flight. In addition they may distribute the FO to other ATSUs who have expressed an interest in receiving the information on, for example, flights crossing their Area of Interest.

2.2.4 Roles and Responsibilities

ED-133 defines a number of roles to manage the FO. These roles change with the control status of the ATSU and the relationship of other units to the control unit or as the originator of a message.

The roles defined for the FO are therefore dynamic, those related to the aeronautical information are statically associated to each piece of information.

The roles are as follows:

- The Flight Data Manager / Publisher (FDMP). A system fulfilling the FDMP role is responsible for maintaining the consistency of the FO and distributing the FO to the other FDPSs that need it. It receives requests to update the FO from the Flight Data Contributors and does the necessary processing to ensure a coherent and consistent FO covering the whole IOP Area is maintained and published to all subscribers. The system which fulfils the FDMP role is the system which is currently operationally responsible for the flight, and changes as the flight progresses.
- The Flight Data Contributor (FDC). A system fulfilling the FDC role may request changes to parts of the FO, for example to set a constraint. These requests are processed by the FDMP and the resulting consistent FO is distributed. All systems whose airspace will be penetrated by a flight in the future are considered contributors for that flight.
- The Flight Data User (FDU). Receives FOs and associated updates from the FDMP. A FDU is not allowed to request changes to the FO.
- The What-If Manager / Publisher (WIMP). A "what-if FO" (WIFO) is a special kind of FO. It is essentially a copy of the real FO and is used to negotiate potential changes to the flight data without affecting the corresponding data for the actual flight. A system that plays the WIMP role is responsible for publishing a WIFO, for managing the responses from the What-If Contributors and for requesting any consequent changes to the real FO.

- The What-If Contributor (WIC). A WIC responds to the proposals made by the WIMP.
- There are two additional roles defined, the DADMP and the DADU, these will not be explored further in this document.
- Dynamic AIM Data Manager Publisher (DADMP). The DADMP is responsible for publishing any dynamic status changes to a particular piece of aeronautical information. It distributes it to all users on the IOP network.
- Dynamic AIM Data User (DADU). A DADU receives updates to aeronautical data from the DADMP and makes it available for use locally.

2.2.5 Use of the FO

2.2.5.1 Trajectory Update Phases

Initial assumption is that NM will not be part of the first tranche of operational systems, they are covered further later on. In this respect the FO is assumed to begin to be distributed by the first IOP control unit, be that an en-route Centre or a Tower after the plane has started push-back.

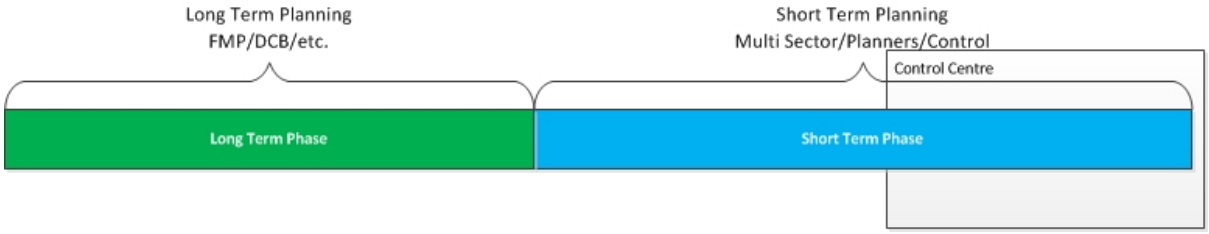


Figure 2: Trajectory Update Phases

The way the trajectory is built using the data in the FO is based on the relation to the boundary of a control centre and the level of interest that centre has in its content and impact on operations. It is built of two phases beginning with a Long Term phase where data is available and a Short Term phase where changes to the data have a more tactical impact.

In this concept the Long Term phase is when the trajectory is being used for flow, capacity type evaluations.

The Short Term phase is when the movement of the flight becomes more tactically relevant and there is a move from a flow, capacity level of planning to a sector, or multi sector level to the control by the centre.

Note that the terms “Long” and “Short” are used here for descriptive purposes only, they are used to indicate that if an ATSU chooses they may use the FO in different ways depending on the proximity to the centre.

In these phases the FO is available and the Centre can choose which elements to make use of or delay the use until a later phase. This is a local decision however the general principle laid down here is expected to be used in the majority of cases.

2.2.5.1.1 Long term

This can begin as soon as the FO is available and is being distributed. Before this point data from the Network Manager can be used and for any Centre tools during this phase will make use of trajectories from the NM, ones built by the FO and local trajectories.

Changes to the trajectory proposed by the ATS units are subject to the section on coordination later in the document.

If we bear in mind that a local FDPS may have a limited processing, memory and adaptation data possibility or may not want to create internal plans for all the flights that will cross their airspace in the hours to come and will wait until the flights are closer and more relevant, the expected use in this phase will be of the IOP trajectory built and distributed by the current, controlling, ATSU.

At each new reception the new trajectory will be re-evaluated for changes as they occur in the progression of the flight and where necessary constraints added, removed or modified.

The second possibility will be for the downstream ATSUs to make use of the flight script and either with their local FDPS, or with a separate trajectory calculation tool build their own local version of the trajectory and use the process as described above to inform the current ATSU of changes as they are needed.

During this phase the trajectories are used to calculate expected sector demand, bunching, busy flows etc. and to start to add constraints and request potential re-routings or level restrictions to off load. Where standard restrictions are known, e.g. an exit level restriction forcing a descent to a particular airport, these can be applied and added to the trajectory, known changes to airspace restrictions can be provided updating the trajectory and providing both the NM and the downstream units earlier and more accurate planning information.

Within this phase at a local level there may be planned restrictions, e.g. for a particular unit using the segment of the flight for sector load calculations, but they may decide not to add these restrictions until a certain time prior to the boundary in order to allow the traffic to mature and not enforce constraints until certain they will be required.

Similarly arrival information such as the STAR and runway may be tentatively available and could be used to update the TP however it may be decided to wait until near the destination to add this information..

2.2.5.1.2 Short Term

During this phase as the flight is closer to the Centre it is expected that the flight script will be used.

The IOP trajectory, while built from the information contained in the flight script it will always be slightly different from the locally constructed version. Due to the proximity of the flight it is felt better to build all the trajectories from, as far as possible, the same system. So in this phase the flight script is used by the local FDPS to build all trajectories in the same way with the same characteristics.

Of course for any Centre the available information will still result in some trajectories being built locally and some making use of the IOP version, but the transition to this phase is marked by the preference to make use of the flight script and the locally calculated trajectory.

The flight will still be in advance of the ATSU and so the mechanism described in the previous phase applies for requesting updates to the FO.

This phase may begin the display of data to positions more responsible for ATC than ATM . Advanced planners, multi-sector planning functions will be provided with updated situational displays and internal to this phase local planners will begin to become part of the decision process and make entries to the flight plan.

Changes to the trajectory during this phase are subject to the section on coordination later in the document.

2.2.5.2 Coordination phases

Independent of the way the trajectories are calculated locally for the tools the coordination process is run in parallel, it consists of three phases, the System Awareness Phase (SAP), the Controller Awareness Phase (CAP) and the Negotiation Phase (NP).

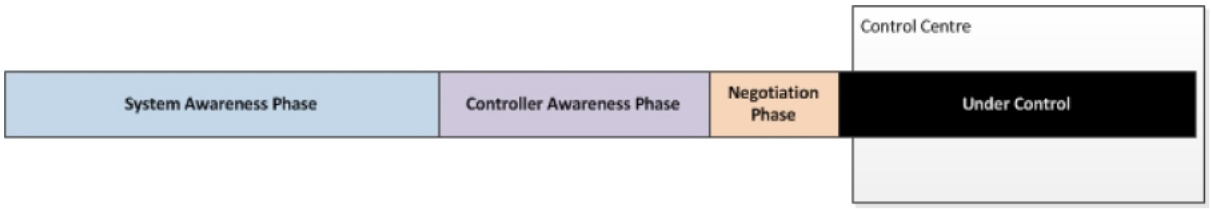


Figure 3: Coordination Phases

2.2.5.2.1 System awareness phase

The SAP phase starts as soon as the first FO is received, it feeds a continuous flow of information in to the systems and as stated above the systems may make use of the IOP TP or a locally built version based on the flight script.

Changes during this phase, e.g. the inclusion of downstream sector constraints from flow positions etc. are accepted without the systems enforcing negotiation.

The decision to display to ATCO is made locally although the display is likely to be available to tools using a wider horizon than the controller's radar picture. For example, the information is available at flow positions which may use an air situation picture with a larger horizon.

Most changes to the flight object will be incorporated by the controlling ATSU however changes that require a positive acknowledgement, either upstream or downstream may be initiated. These changes may trigger a switch to the next phase, the CAP, depending on the origin of the change. For example, a request for a constraint to be put in place from a flow position that requires an early upstream/downstream action may need to be accepted or rejected but would not trigger the CAP. An early request from an ATCO would always initiate the change of phase.

2.2.5.2.2 Controller Awareness Phase

This phase is triggered either as described above or by an event marking the moment when there is a set of common coordination information for the boundary between the ATSUs including an indication on whether the transfer conditions are standard or non-standard as bilaterally agreed. This event could be a time, distance or level from the common boundary and at this event both controllers are aware of the flight and information is displayed. This common awareness is indicated and the controllers know that if a dialogue is needed concerning a flight the partner may be consulted.

Changes to this common coordination information do not need to be acknowledged and it is up to the local implementation on whether they are highlighted or not.

Changes that require a response are forced on the display for the relevant position and in these cases will not be implemented in to the FO until agreed between these positions.

2.2.5.2.3 Negotiation Phase

The Negotiation phase begins at an agreed time, distance or level prior to the boundary of the ATSUs unless initiated by a specific action, e.g. Request on Frequency. All changes occurring during this phase are expected to be negotiated and will be implemented in the FO following agreement.

2.2.5.2.4 Impact of the phases

The following table shows the functionalities available during each of the phase:

System Awareness	Controller Awareness	Negotiation
Dialogue (triggers CAP) Controller input to trigger CAP	Coordination data modification Dialogue Change of frequency (triggers NP) Request on Frequency (from downstream, triggers NP) Controller input to trigger NP SKIP	All inputs as for CAP

	Delegate Forced Assume Reclaim	

Table 1: Available functions in phases

- Dialogue

A change to coordination data that is proposed by either the transferring or the receiving controller to the other partner in the coordination phase, in the SAP this is most likely to be initiated by a Flow type role. This proposal may be automatic due to bilateral agreements or may be selected by the sender. It is answered by an acceptance, a rejection or a counter proposal.

- Controller input to trigger CAP

An input to move into the Controller Awareness Phase, it can be made by either the transferring or receiving controller.

- Coordination data modification

A change to coordination data made by either the transferring or the receiving controller. During the CAP this will be automatically modified in the other unit with local rules as to the indication to the ATCO

- Change of frequency (triggers NP)

An indication by the sending unit that the flight has been instructed to change their selected frequency (channel) to the next unit and either call-in or monitor, waiting for the controller's to initiate the first call. This input also triggers the NP meaning that all modifications to the flight must be agreed by both partners in the NP.

- Request on Frequency (from downstream, triggers NP)

An indication by the receiving unit to the sending unit that they request the flight to be transferred to their frequency (channel). Usually earlier than the flight would normally be transferred and initiated because it is safer to have the flight in communication due to separation tasks or other clearances that need to be given. This input also triggers the NP meaning that all modifications to the flight must be agreed by both partners in the NP.

- Controller input to trigger NP

An input to move into the Negotiation Phase, it can be made by either the transferring or receiving controller.

- SKIP

An indication that an ATSU (sector) will not take the aircraft on the frequency (channel). The flight will remain with the previous ATSU (sector) or be transferred directly to the following. More details in section 3.1.4.1

- Delegate

The ability to delegate a portion of a flight to a third party not planned to be in the list of ATSU. More details in section 3.1.4.1

- Forced Assume

The ability to take control of a flight either earlier than expected or by a third party, outside of the normal distribution, for operational reasons such as an emergency.

- Reclaim

The ability to take back the control of a flight – used in case of a mistaken forced assume or return of a delegated flight.

2.2.5.2.5 Progression

The following schematic shows the progression of a flight along the phases:

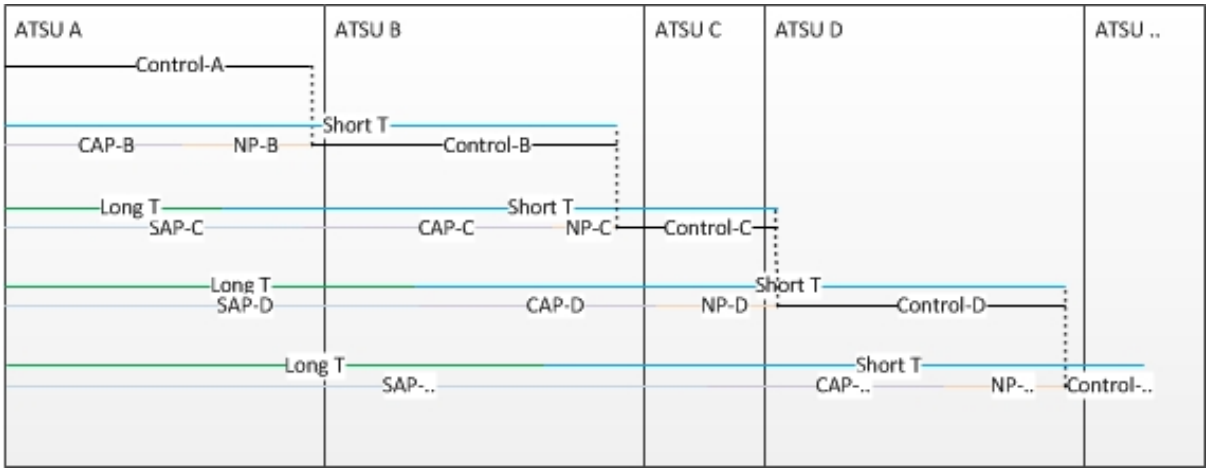


Figure 4: Progression across phases

The figure above shows the different phases compared to the sequence of centres derived from the trajectory. Each unit experiences the separate phases and the use of either the IOP Trajectory or the Flight Script is independent of the coordination status. As stated above although the use of the IOP Trajectory reduces the work at the local FDP level it is a local choice to make use of this.

2.2.5.3 Electronic Negotiation

Once the flight details are available at the ATSU some items may need to be changed to fit the downstream, or upstream, expectations of how the flight will progress, due to environmental changes, requests from the pilots or interactions with other flights.

As described above during the SAP and CAP phases the principle is that all changes are accepted without negotiation however nothing prevents a user from forcing a modification to be the subject of a negotiation if time permits to check the partner's acceptance in case of sensitive change or if it is considered advisable to negotiate. Changes affecting during the SAP will most likely be related with Demand and Capacity Balancing (DCB) and Traffic Synchronisation (TS) purposes and changes affecting during the CAP will most likely be related with Separation Management (SM) and Sector Workload Management (SWM).

The following items may be the subject of negotiation for DCB and TS purposes (not necessarily exhaustive):

- Route,
- Sector entry/exit levels, En-Route cruise levels,
- Take-Off Time Constraints/Targets, Flight Time Constraints/Targets,
- Cruise Speed,
- Release.

The following items may be the subject of negotiation for SM and SWM purposes (not necessarily exhaustive):

- En-Route cruise levels, DCT, Off-set,
- SID/STAR,
- Co-ordinated tactical ATC conditions prior to transfer: transfer flight level, heading, speed, rate of climb/descent,
- Communications Management (transfer, skip, delegation),
- Release.

The items above can be combined and negotiated in a single proposal.
In order for the sending and receiving unit to properly assess the impact of a change the units involved in the negotiation will apply the consequences (constraints etc.) of the change in order to visualise the impact on their respective airspace
The receiving unit is presented with the proposal and is able to accept it or reject it. An acceptance leads to the flight plan being updated while a rejection cancels the proposal and no change is executed.

A third option is available should the receiving unit be able to accept the proposal but with a modification, in this case a counter proposal may be returned to the original unit with the proposed alternative containing the changes introduced by the receiving unit to the original change proposal. The originating unit, after evaluation, will be able to either accept or reject this counter proposal or counter-propose again. The number of counter proposals to agree a proposal is not limited by the system, the users themselves will naturally find a practical limit and use other means to find a resolution if needed.

Each type of negotiation will be handled by the appropriate operational actors at each involved stakeholder site. Each one of them will be supported by local systems with the appropriate analysis capabilities, time-horizons of interest, uncertainty estimations and known local environmental conditions. This being the case while it is expected that most negotiations will be conducted relatively quickly it may take some time before a response is received especially for more complicated requests. During this time it is possible that the active flight may be updated due to either system or manual actions. For example if a negotiation is ongoing between two downstream partners and upstream unit may change a route or flight level changing the conditions, or validity, of the downstream proposal.

Any inputs made on the real flight should update the context of the negotiation and be reflected in the proposal to the ATSU partner with an indication that the context has changed. If the inputs are not duplicable in to the proposal, would result in an inconsistency between the actual and proposed flight path or would invalidate the proposal then the system shall inform the operator so that they can either cancel or modify the proposal.

Negotiations, especially during the SAP when they may be expected mainly from ATFCM roles, may not be directed at adjacent partners so it is possible to make a proposal for a change to any unit in the sequence of ATSUs that are aware of the flight, if the unit to which the proposal is directed is not in the SAP the negotiation will trigger the transition to this phase. As above the possibilities of accepting, rejecting or making a counter proposal are available.

Some changes to the flight plan that are identified as needing negotiation may impact more than one ATSU, e.g. a long direct crossing multiple units. The receiving ATSU is able to start negotiations with their up or downstream partner, depending on the direction of the original request, the proposal to the up or downstream partner will present the data as if the initial proposal had been accepted.

Additionally if it is identified that many partners will be affected by a proposed modification the negotiation can be entered in to with all the possible partners, for example, when a route negotiation is open between affected partners, all other ATSUs should be informed, so that they can enter the negotiation (actively or passively as observers) and prevent mutually interfering route negotiation sessions being opened for the same flight at the same time. Results, acceptance, rejection etc. are gathered from each partner sequentially and the change can only be implemented once all partners are in agreement.

2.2.6 Network Manager & Flight Object

2.2.6.1 European ATM Network

The EU Regulation ('NMF IR') lays down the rules for the implementation of air traffic management (ATM) network functions
In particular, Article 4 states: "3. To fulfil its tasks, the Network Manager shall ensure the following:

a) the availability, operations and sharing of tools, processes and consistent data to support the cooperative decision- making process at network level, including but not limited to, flight plan processing and data management systems;
b) the facilitation and coordination between operational stakeholders and support to these stakeholders in the deployment and implementation of the plans and the related network measures following cooperative decision-making;
c) the appropriate operational coordination, as well as optimisation, interoperability and interconnectivity within its area of responsibility; […]"

The Strategic Network Vision [24] stipulates that "By 2020, in order to meet the RP2 performance targets, the European ATM Network will operate as follows:

European airspace will consist of an upper airspace in which operations will be predominantly “free route” and a lower airspace including terminal airspaces around major airports in which operations will need to be planned to a high level of predictability. […]

Network operations will be integrated through cooperative traffic management, with possible adjustments of resource planning, projected trajectories, and allocation of entry/exit times for airspace volumes and airports to mitigate imbalances. […]

The European ATM Network will be supported by system wide information sharing of dynamic ATM information, serving all operational users’ needs and building on the SESAR developments. "
"Amongst the Network operational drivers, Predictability plays a key role. Predictability allows issues to be accurately identified in advance, allowing timely, appropriate and proportionate solutions to be chosen. It contributes to the taking of preventive actions which otherwise would be taken reactively. "

"Predictability requires all actors to adhere to their planning (flight plan, capacity plan) to the maximum extent possible. Any change must be justified and communicated. Increased sharing of operational information supports the predictability of network events and their impact, and it reduces uncertainty, thereby improving operational performance."

Consequently, "seamless real-time information sharing between all operational actors is essential in order to share performance and operational intelligence and enable operational CDM. It is part of the Strategic Objectives, in support of seamless and flexible airspace management with Free Routes, business trajectories facilitation, cooperative traffic management, optimum capacity and flight efficiency."

In a longer term perspective (2025 and beyond), the objective, according to the SESAR Transition CONOPS [26], is to further "enable the optimum use of airspace and ensure that Airspace Users can operate preferred trajectories while allowing maximum access to airspaces and air navigation services. […]

The Network Manager acts as catalyst and facilitator for an efficient overall network management by all ATM stakeholders. […] The Network Manager role will be enabling, facilitating and promoting the Network Operations Plan, providing a framework to allow Local/Sub-regional Network Manager and Airspace Users actors to share information (Network View), to coordinate (CDM) and to prepare scenarios to be used at network level when necessary."

2.2.6.2 NM and Interoperability

In line with FF-ICE implementation, NM has a key role in the management of the trajectory submitted by the Airspace Users: NM supports the submission of the shared trajectory by both Civil and Military Airspace Users in Planning; NM ensures the CDM agreement among all partners for the transition to the Reference Trajectory and its revision during Execution.

As can be seen from the above context description, increasing the use of a common view on the 4D trajectory at the Network level is a key enabler in the 2020 horizon. Fully sharing a common 4D trajectory and the applicable constraints at the Network level is even more fundamental in the medium to longer term horizon. The crucial need for Interoperability is reflected in the NM Interoperability Strategy [27] document: "NM operates Network Functions which are transversal by nature and involve exchange of information services with all operational actors in the Network. Building on its central position, NM sees its role as a facilitator of its operational partners’ initiatives for implementing interoperability."

"Serving all stakeholders, the NM Interoperability Strategy supports multiple technologies, while favouring and promoting the migration to state-of-art main stream technologies. In this way, NM is able to support the progressive and desynchronised deployment of new technologies of its

stakeholders, smoothening the transitions. NM plays then a bridge role, acting as a gateway that connects and integrates the different communities in the network."
Referring specifically to the NM/ATC systems interface, the Strategy identifies the following action: "Reinforce the relationship between NM and ATC systems to further improve the ATFCM processes and the sharing of more consistent planning information with all involved actors."

The reinforcement of that relationship is needed both ways in terms of data exchanges:

- From NM to ATC: for sharing the global trajectory information as early as possible in support of the collaborative processes;
- From ATC to NM: for updating the global Network view of the end-to-end trajectory when modifications take place during execution, both in the interest of that particular flight and for maintaining a more accurate context for the other flights.

More concretely, NM will fulfil the following roles and responsibilities for each flight[1]:

- NM creates the initial version of the Flight Object (i.e. the flight data, including the applicable constraints and the resulting 4D trajectory); this takes place at an appropriate time before departure or before entering the IOP airspace (whichever applies).
- NM shares it with all the involved ATSUs and ensures a common view with other stakeholders.
- NM maintains the FO and shares any update, until the first IOP-capable ATSU takes over the responsibility for that flight.
- When an ATSU is responsible for the FO, NM provides to that ATSU any contribution (e.g. updated constraint) received from an ATSU which is not capable of communicating to the responsible ATSU directly (i.e. contributions from non-IOP capable ATSUs).
- For all flights under the responsibility of an ATSU, NM receives any update of the FO at any time.

The IOP area will inevitably contain gaps, either in the transition phase until all ATSUs are IOP-enabled, or due to the perimeter shape of the IOP area. For those situations, the following options can be considered:

- NM could maintain and share the FO (instead of the next IOP ATSU) for all flights in the AORs of non IOP ATSU.
- NM could maintain and share the FO for the flights in the holes (outside IOP area).
- In the case of a temporary hole (i.e. failure of an IOP capable ATSU), the next ATSU traversed by the flight takes over the responsibility of maintaining and sharing each FO. If the next ATSU is not IOP capable, NM could take over the responsibility.

The referenced study document should be used as a basis for more detailed considerations and for the anticipated conditions and time of transfer of responsibility from and to NM.

It is anticipated that a phased implementation of the above capabilities will be planned.

In any case, several, heterogeneous, operational contexts will coexist for many years, if not permanently. Within this “mixed operational mode” NM will play a key role of gateway among actors at different levels of operational capabilities, in particular with the Yellow SWIM profile. NM will ensure global interoperability based on standardised interfaces with European actors and with the rest of the world for trajectory information exchanges.

[1] In line with the outcome of the *'CFMU FOS Study' of 2008/9*. More detailed operational scenarios and considerations are provided in the D1 document of that study

2.3 Advantages of IOP (IOP over OLDI, Performance including KPIs)

2.3.1 Trajectory Prediction

The first available source for a trajectory in an FDPS is the filed flight plan. So initially, a flight's trajectory will be equal to its flight plan. The sequence of centres and sectors that will handle the flight is derived from the trajectory. Currently this is relatively static, ATC change messages are sent to NM and the new plans are distributed but only when this impacts the control centre sequence, a change to a flight level that may impact an internal sector sequence is not notified as a centre has not changed. By using the FO to update the trajectory to match what the controllers intent is allows the information to be displayed to the centres (and internally to the sectors when needed) who need it, rather than to rely on coordination and unnecessary inputs being made by controllers to re-route flight information.

This information, as it is available at an early stage in the flight, also allows other tools to be enhanced with more accurate data, e.g. planning and flow management tools. Sector demand and capacity balancing has become a major challenge, the better the trajectories feeding these tools the better the airspace can be sectorised to meet the expected flows of traffic and controllers allocated to sectors where they are needed. IOP supports the defined SBT (Shared Business Trajectory) Concept of Operation. The publication of the Flight Object can distribute the SBT during the SAP and transition into the RBT (Reference Business Trajectory) according to agreed procedures.

2.3.2 Coordination

The flight object provides the capabilities to replace OLDI providing the complete functionally and the possibility to extend beyond the OLDI features. During the initial implementation it is expected that only the existing OLDI features will be deployed and with experience the full possibilities of the flight object will be exploited.
The FO therefore provides the means to reduce the workload considerably by removing a lot of the interactions during the CAP and allowing the continuous update of flight information to be displayed to the controllers. With the FO all inputs upstream are available, if required the label in the next centre can be updated with tactical inputs made by the previous centre. This gives the next centre the situational awareness lacking from OLDI allowing the CAP to be a used to indicate an agreed set of data and locally to decide if changes to that data are brought to the attention of the controller or other positions as necessary.
For the time being it is still required to maintain a phase (NP) near the boundary where any changes need to be negotiated. This is standard ATC practice where changes near to a handover, centre or sector, must be agreed.

2.3.3 Medium Term Conflict Detection

MTCD extrapolates the planned path of the flight according to the flight plan and controller inputs with a typical horizon of 20 minutes. In this way it extrapolates the plan rather than the track as is done in safety nets such as the Short Term Conflict Alert or "Probing" tools. However currently the start of the plan is only really known when the aircraft is correlated, before this it is taken from the "guess" of where the flight will be from the snap-shot taken at the activation event.
Not only are current MTCDs limited by the guess of the aircraft performance and intent they are also compromised by the starting conditions and at entry in to a centre are unreliable.

As stated above if the FO is considered to be updating the flight plan data like radar updates the track data the MTCD will be using an accurate source. There are not only substantial safety benefit as controllers will be able to assess conflicts presented to them as real, rather than have to go through the first assessment of "is it real?". This means that the potential conflicts will be solved at an earlier stage in the strategic de-confliction process increasing the number of options to optimise the preferred solution as well providing time, and hence airspace volume to manoeuvre. However it also benefits flights since the number of controller actions on each flight is reduced having less impact on the increased number of miles flown or the use of a sub optimal flight level.

3 Operational Context

This chapter presents the operational context to which the interoperability requirements (chapter 4) relate. The requirements are presented in this INTEROP according to the operational 'feature' to which they relate. These features were defined by the Analysis team to group the analysis work into specific operational topics.

The material presented is the material that is available at the time of publication; the format and level of detail therefore varies between features.

3.1 Initial Interoperability scope (captured in this document)

3.1.1 Feature 1: Coordination and Transfer

See the PowerPoint slides below for a description of scenarios linked to the coordination between ATSUs.

iOP Feature 01 C-T Animation - V2.1.pps

3.1.2 Feature 2: Management of FO Flight Script

This section describes the operating concept for management of the FO flight script. The content of this section is drawn from the Feature 2 deliverable [20].

Constraints are limitations or restrictions applied to a flight in order ensure an optimum flight path given capacity balancing, sector workload, departure and arrival procedures, environmental conditions etc. Ideally no constraints other than those requested by the airline operator would be applied, the requested flight levels (RFL), speeds, times and the 2D routing, but the ATM world is not ideal and some restrictions have to be imposed.

The flight plan received sets the first definition of the trajectory and the Network Manager overlays restrictions generated due to departure or arrival limitations and ATSU sector restrictions. Constraints originating form, e.g. Letters of Agreement that are known to NM are added to the profile. The resulting 4D profile is distributed to all the crossed and informed ATSUs and where appropriate the SAP phase begins. Those ATSUs in the SAP align the profile with their internal constraints considering high/low sector profiles, computed top of descents points, constraints not known to NM, private constraints defined off-line by a single IOP partner and unknown by the other IOP partners, etc. and provide the unit managing the flight object with the additional constraints. This unit incorporates the constraints to the best of their ability and redistributes the new trajectory and a list of all constraints that are being used to build it.

As the flight moves to the CAP phase new constraints are added as controllers update the cruising levels and fix sector and ATSU transfer levels. These are added to the trajectory and list of constraints and again redistributed.

Constraints can be grouped according to type but all contain strategic, planning and executive, described further in the document Note, some types of constraints do not have all three types, e.g. time does not have the idea of a strategic constraint – this is detailed where necessary in the requirements:

- Requested flight levels and requested speed changes, the airspace users intentions, are not retained as constraints but are used to build the first definition of the plan and translated operationally in to en-route cruising levels (ECL) and en-route cruising speeds (ECS).Level constraints:
    - En-Route Cruising Level (ECL)
    - Transfer Flight Level (TFL) this is equivalent to the Exit Flight Level (XFL) for the transferring sector and the Entry Flight Level (EFL) for the receiving sector

    - Cleared Flight Level (CFL)
    - Strategic, planning and executive level constraints
- Speed constraints:
    - En-route Cruising speed (ECS)
    - Strategic, planning and executive speed constraints
- Vertical Rate constraints (rate of climb/descent):
    - Strategic, planning and executive vertical rate constraints
- Time constraints:
    - Planning and executive time constraints
- Lateral constraints:
    - Strategic, planning and executive lateral constraints
        - Heading
        - Route
        - Diversion
        - Direct
        - Offset
        - Holding constraints
        - Stay input

For each constraint there is an accompanying set of information which enables the unit currently managing the creation of the IOP trajectory and other units building the trajectory from the list of constraints to implement the change to the profile in the way that the sender intended. The concept of “ownership” exists to provide clarity on who can ultimately change or add/remove a constraint associated with a unique identifier for each constraint, where and how the constraint is expected to start and end, how the constraint may be modified when interacting with changes to the route etc. that affect the way it may be implemented, and whether the constraint can be considered to be open or closed, i.e. impacting the trajectory.

3.1.2.1 General Description

Firstly it must be acknowledged that difference will exist between trajectory calculations and these cannot be avoided. As a consequence of this too strict management of constraints will create unnecessary rejections, In addition the trajectory will evolve with the progression of the flight so slight differences between systems have to be accepted.

What is important is that the constraints are included in the flight object and shared rather than the exact implementation in the IOP trajectory.

The intention of the sharing of the constraints is that each ATSU can build their own version of the trajectory in a way that does not vary significantly from each other.

If the difference is extreme or the controlling unit cannot implement a constraint (this will be notified) then the requesting ATSU may declare themselves desynchronised, their expected trajectory is different from the IOP version, and highlight this to an appropriate function within the centre or propose a revised constraint.

When an ATSU requests a constraint to be implemented the controlling unit shall enter the constraint as requested. If the constraint is within the requesting ATSUs AoR then, as they have the best view of the expected flights behaviour, the request should be implements “as is” accepting differences in the way the trajectory is built.

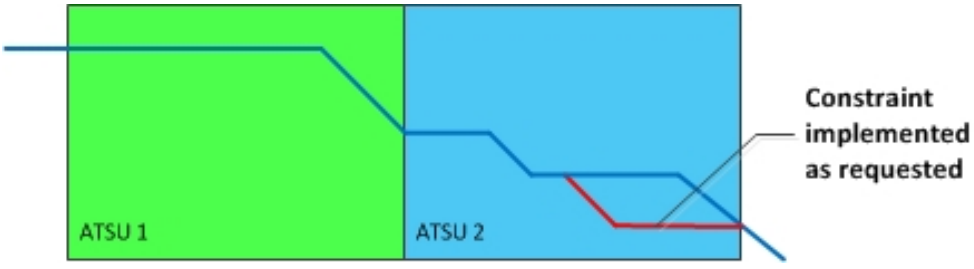


Figure 5: Constraint Implemented as requested

Should the request cross the boundary into another ATSU then the controlling unit needs to take into account the existing constraints located upstream. If the existing constraints are not affected, then the constraint shall be inserted in the flight script as requested. If the existing constraints are impacted, e.g. there exists a manual TFL at the boundary, the constraint is implemented as close as possible to the request and the updated IOP trajectory is distributed In order to avoid rejections by the requestor the way the constraint has been implemented is provided back to the ATSU, see below.

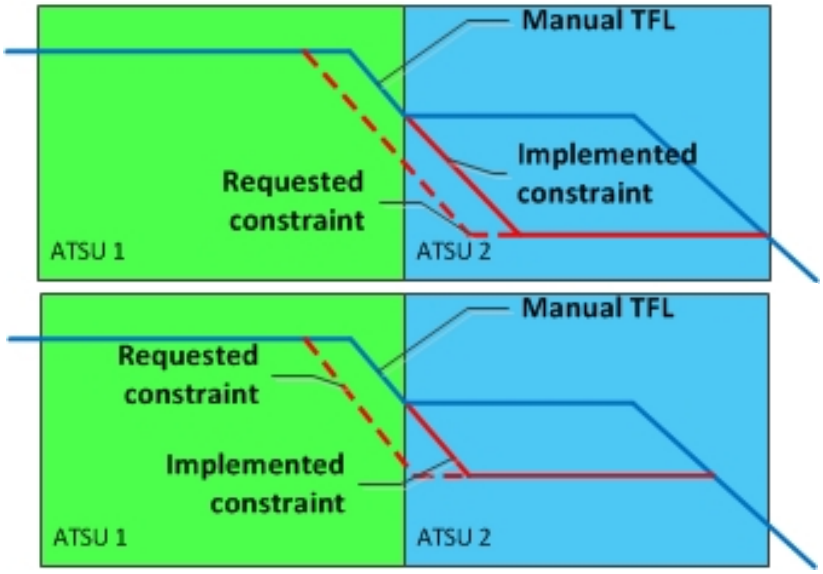


Figure 6: New constraint incompatible with an existing TFL constraint

Note that the constraints have to be implemented sequentially starting from the current controlling ATSU and working through each downstream ATSU one by one.

Constraints are shared within the flight object as they are required to be able to correctly build the local trajectories.

Note that the examples of the source of the possible inputs are not considered to be exhaustive.

Constraints may be individual values, e.g. flight level 270, or they may be made up of more complex constructions, e.g. flight level 270, to be level at XYZ. These more complex instructions are considered to be separate constraints operationally linked to the target constraint.

3.1.2.1.1 Sources and Application of Constraints

Constraints can come from many different sources but can be categorised as strategic, planning or executive. The initial flight plan builds the baseline and becomes effectively a planning set of constraints.

Strategic constraints, off-line defined, which encompass:

- Published constraints (known by at least two stakeholders, including NM),
- Private constraints defined off-line by a single IOP partner and unknown by the other IOP partners.

Planning constraints, which are built from the initial flight plan or other ATM constraints, neither off-line defined, nor clearances but entered in to the system to allow the trajectory to be built and the constraint shared.

Executive constraints, translations of the clearances given to the flight crew,

Some executive clearances may also be deferred. These are clearances that either have been entered in to the system and have been given to the aircraft but will not take effect for some time.

An example could be the flight crew are cleared immediately with the instruction to fly a new speed at the point. No acceleration or deceleration will take place until the point is reached.

Unless given by datalink the system is unaware that communication with the flight crew has taken place.

3.1.2.1.2 Level Constraints

En-Route Cruising Level (ECL) – the basic building block to the trajectory. Initially built form the translation of the Requested Flight Levels in the filed flight plan and may be modified by the controller for long portions of the flight.

Cleared Flight Level (CFL) – the current level clearance which has been passed and acknowledged by the pilot, the level to which the aircraft is currently manoeuvring to.

Transfer Flight Level (TFL) - this is equivalent to the Exit Flight Level (XFL) for the transferring sector and the Entry Flight Level (EFL) for the receiving sector. It is the level to which the aircraft will be cleared to prior to the transfer of communication at the boundary between sectors and centres. It may be automatically updated as the trajectory develops or can be manually set, once manually set it will not be changed automatically.

Strategic level constraint resulting from off-line-defined restrictions, e.g.:

- Level ATC constraints
- Default level coordination constraints

Planning level constraint resulting from, e.g.:

- FMP
- INAP (Integrated Network management and ATC Planner)
- ATCO planning input

Executive level constraint derived from ATCO input, e.g.

- An altitude constraint input is an executive input which requires the pilot to be within a level window over a point, e.g. at or above, at or below.

3.1.2.1.3 Speed Constraints

En-route Cruise speed – the requested speed taken from the filed flight plan.

Strategic speed constraint resulting from off-line-defined restrictions, e.g.:

- ATC speed constraints
- Default speed constraints from SIDs/STARs

Planning speed constraint resulting from, e.g.:

- INAP (Integrated Network management and ATC Planner)
- AMAN
- ATCO planning input

Executive speed constraint derived from ATCO input, e.g.

- Assigned speed, the current speed clearance which has been passed and acknowledged by the pilot. The assigned speed may have an additional part e.g. to be maintained at XYZ.

3.1.2.1.4 Vertical Rate Constraints

Strategic vertical rate constraint resulting from off-line-defined restrictions, e.g.:

- ATC vertical rate constraints
- Default vertical rate constraints from SIDs/STARs
- Default vertical rate constraints e.g. LoAs)

Planning vertical rate constraint resulting from, e.g.:

- INAP (Integrated Network management and ATC Planner)
- AMAN
- ATCO planning input

Executive vertical rate constraint derived from ATCO input.

- Assigned Vertical rate, the current vertical rate instruction which has been passed and acknowledged by the pilot. The assigned vertical rate may have an additional part e.g. to be maintained at XYZ

3.1.2.1.5 Time Constraints

Planning time constraint resulting from, e.g.:

- FMP
- INAP (Integrated Network management and ATC Planner)
- AMAN
- Network Manager Calculated Take of Time, and/or target times
- ATCO planning input

Executive time constraint derived from ATCO input.

- Controlled Time of Arrival/Controlled Time Over

3.1.2.1.6 Lateral Constraints

Changes to the route are operationally considered to be constraints, and they result in the revised 2D path.

Strategic lateral constraint resulting from off-line-defined restrictions, e.g.:

- Constraints derived from the inclusion of SIDs and STARs
- Automatic route replacement
- Network management

Planning lateral constraint resulting from, e.g.:

- Planned offset manoeuvre
- Holding Constraints
- Planned diversion
- Directs or route amendments
- ATCO planning input

Executive lateral constraint derived from ATCO input, e.g..

- Assigned heading, the current heading instruction which has been passed and acknowledged by the pilot.
- Executive offset manoeuvre
- Executive diversion
- Directs or route amendments

3.1.2.2 Ownership/Eligibility

In principle each constraint has an owner; this can be the unit that requests the constraint to be applied or for the case of a constraint due to a Letter of Agreement one of the two parties is assigned the ownership and is responsible to apply the restriction. The constraints built from the initial flight plan do not have an owner assigned until they are modified but an ATSU.

Most constraints will be requested by a function in an ATSU to the unit controlling the flight, these requesting ATSUs are by default the owners of the constraint. When an agreed constraint exists in documents such as an LoA both agreeing parties are knowledgeable of the constraint and therefore although one or other is assigned as owner the first in the sequence may implement the request even though they are not the owner.

The advantage of assigning an owner is that modifications to the constraint or the setting of an active/inactive status is defined by one ATSU relieving the possibilities of differing views especially cross boundaries.

On top of the concept of ownership the eligibility rules define the rights of IOP partners to modify constraints. For example items of coordination are eligible to be changed by both partners involved in the coordination.

When flights have been SKIPed or DELEGATED the ownership of the constraint remains with the original owner. Note that should the new ATSU responsible for the flight wishes to move outside of the limits of the constraint they will still need to request a release. The constraint maintenance during SKIP and DELEGATE will be described in Feature #5.

Eligibility defines the actions an IOP partner is permitted to perform on a constraint belonging to a flight. For example the unit controlling the flight has complete control over all constraints in its area of responsibility. In contrast a downstream unit does not have the authority to delete a constraint owned by the controlling unit.

The details regarding eligibility are to be defined in a future version of this document.

3.1.2.3 Start and End Points

Each manoeuvre also needs to be described as to when it is applied, when it starts and when it ends.

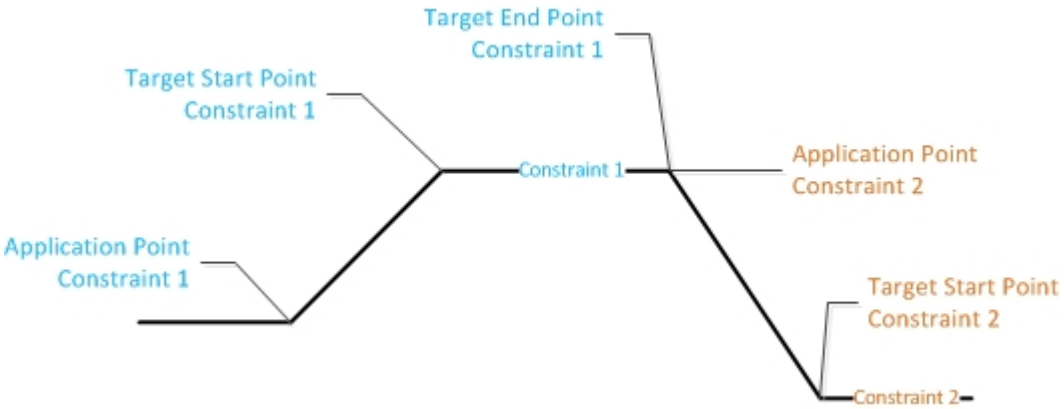


Figure 7: Constraint Points

Not all of these three pieces of information are necessary, as an example: a controller decides they need to impose a vertical constraint at a waypoint they need to tell the other units if the level change starts at the waypoint (the application point) of the level is to be achieved at the waypoint (the target start point). If the waypoint is selected as an application point then this is provided to the other units who will use their trajectory prediction tool to build the profile and the level will be achieved in a slightly different position for each calculation due to the slightly different algorithms being used. If the application and the target start point were provided then it would be unlikely that the building unit could comply with both because of the differences in the algorithms and this may result in the constraint being rejected as impossible to implement, hence it is advisable that only one of the structural points are provided.

Due to the different calculations the unit managing the FO also includes their calculated structural points to allow for checking by the requestor that the constraint has been implemented closely enough to what was intended. If not, the owner of the constraint has the responsibility to find a solution to make the constraint implementable or to wait until they have the authority to force the constraint.

2D lateral changes can also contain Protected Points, these are points which are set for example, to avoid penetration of active reserved areas should a change in the route be made. Should a Protected Point be impacted by a change an indication is presented to the operator responsible for the points.

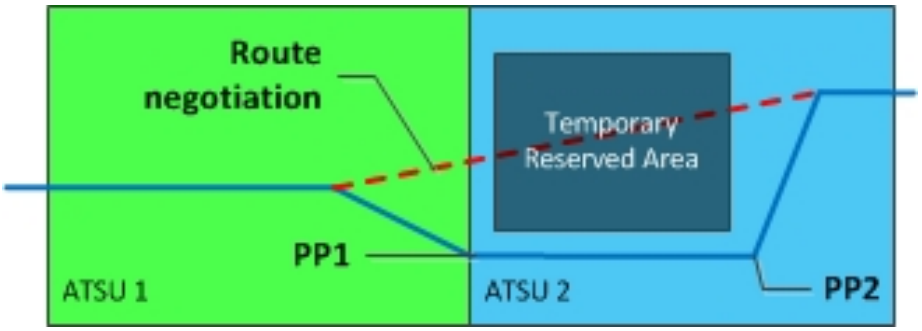


Figure 8: Protected Points

In the above figure two protected points are identified to avoid a temporary reserved area, a route proposal by ATSU 1 will be presented to ATSU 2 with an indication that the points would no longer be respected.

3.1.2.4 Maintenance

Information, called the “maintenance policy”, is also needed. An ECL derived from an RFL is what an airline operator has requested attached as part of a speed/level group to a waypoint, but what should happen to that user preference if a controller sends the flight direct and it no longer flies over the waypoint. Does the original level apply at an abeam point on the new route, a distance from the next waypoint in sequence or should it be discarded completely. This maintenance policy allows units to apply constraints under changing conditions without always having to re-request on each potential update.

In this way, in case of a route amendment, level, speed, rate and time constraints and flight rule/type changes will be transferred on to the expanded route.

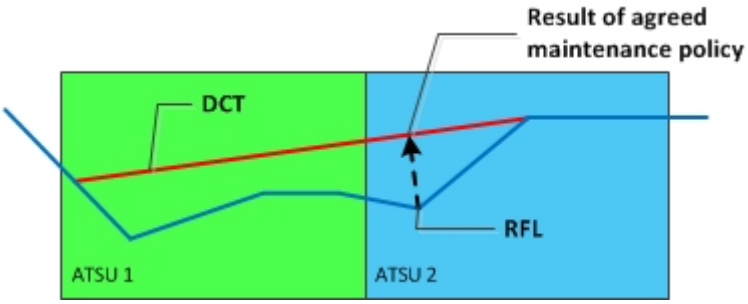


Figure 9: A typical maintenance policy

3.1.2.5 Open/Closed

Constraints can be considered to be either open or closed, closed constraints result in a trajectory recalculation and open constraints do not result in a recalculation but they are shared for information.

Constraints can be of either type, for example a transfer level can be a closed constraint at a lateral boundary when coordinated with an adjacent unit, in a climbing situation the TFL is usually the division between the two units and the level itself has no impact on the climb to the cleared level, in this case it does not impact the trajectory and can be considered to be open.

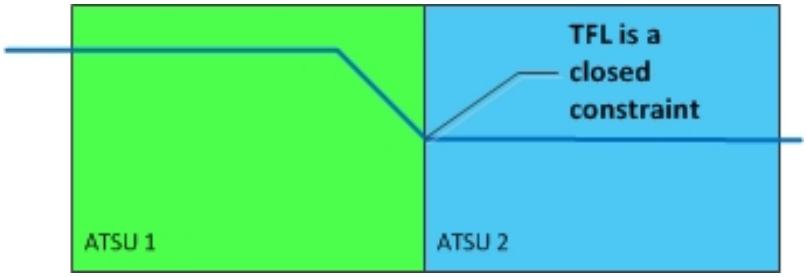


Figure 10: A closed TFL

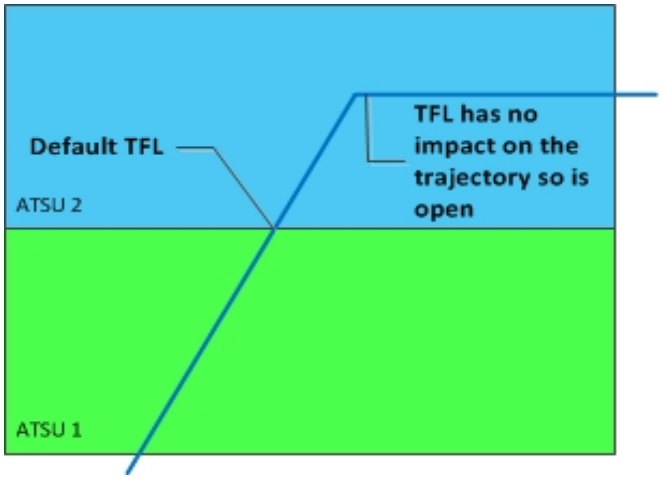


Figure 11: An open TFL

3.1.2.6 Active/Inactive

Strategic constraint defined in adaptation data are normally applied to all flights meeting certain conditions, e.g. all inbound flights to London Heathrow will be coordinated at the boundary between UACs at flight level 270. As this is a standard input it is automated to relive controller workload.

However during periods of low traffic levels it may be decided that the restriction does not need to be applied. When this happens the supervisory staff can set the constraint to “inactive”. It is still present however it is not taken in to account for the trajectory calculation.

The concept of active/inactive is to assist in the management of strategic constrains built from LoAs. A constraint may be agreed between two units but only be applicable for a certain time period, e.g. only during the day. In this period the constraint is active and will be applied to all flights meeting the criteria of the constraint, e.g. all arrivals to London Heathrow. Outside of the period the constraint is inactive, although present in the flight script. This setting of ‘active/inactive’ may be done per flight (special allowance for curfew or military area penetration…), or more usually for time periods such as during the night or weekends. If the situations change the constraint application can be set back to it’s previous value (active or inactive) and will be applied accordingly to the trajectories of all flights meeting the conditions.

3.1.2.7 Network Manager

When creating the FO, NM will include the calculated take off times (CTOT), target times (TTs – arrivals (TTA) and/or over (TTO)) resulting from the active flow constraints and all strategic constraints (LoAs, etc.) NM is aware of. This information should be provided via the FO allowing other systems using the FO to take them into account when calculating their local trajectory (especially the CTOT should certainly be considered for flights before departure). Furthermore, such information is likely to raise local FMPs and ATCOs awareness on the constrained flights.

After the first ATSU takes control NM can continue to contribute with information coming from non-IOP ANSPs that would impact the 4D trajectory in the IOP area (Message From Shanwick/Santa

Maria (MFS), Flight Notification Message (FNM), First Sector Activation (FSA), ATC Flight Plan proposal message (AFP)).

3.1.3 Feature 3: Informative distribution between systems

See the PowerPoint slides below for a description of informative distribution between systems.

Principles of Informative distributic

Requirements associated to this feature are included in feature 5 requirements.

3.1.4 Feature 5: Control Sequence Handling

This section describes the operating concept for control sequence handling. The content of this section is drawn from the Feature 5 deliverable [21]

3.1.4.1 Definitions:

It is the Operational understanding that a System Instance (SI) can be made up of several ATSUs which in turn are made up of sectors.

According to ED-133 section 4.1, an FDPS is the physical ATC stakeholder application system which provides and consumes flight data. It is referred to as either ‘system’ or ‘system instance’ interchangeably throughout the rest of that document.

This implies that an SI can be a single ATSU fed by a single FDPS or an SI can be built of several ATSUs all fed by a single FDPS.

For the purposes of this document the term ATSU will be used with the above sentence in mind. When it becomes necessary to clarify additional information will be given.

SKIP: An indication that an ATSU (sector) will not take the aircraft on the frequency (channel). The flight will remain with the previous, upstream, ATSU (sector) or be transferred directly to the next, downstream ATSU (sector). This functionality is implemented to avoid a frequency change to a specific ATSU (sector), creating a direct coordination between its upstream and downstream ATSU (sector). The upstream or downstream ATSU (sector) control the flight into the skipped airspace according to the skip type (upstream or downstream) and in compliance with the release conditions, if any. Any change beyond the release conditions must be coordinated with the controller responsible for the airspace of the skipped frequency.

Delegate: The ability to delegate a portion of a flight to a third party not crossed by the flight. This can be for the whole of their area of responsibility or only a part. The flight is handed over to the third party who then controls the flight in compliance with the release conditions, if any. Any change beyond the release conditions must be coordinated with the controller delegating the flight.

Note: In this context release is understood to mean permission given by the ATCO responsible for the coordination of the flight to the ATCO controlling the flight to proceed in accordance with the limits specified in the release conditions. The controller to whom the release has been given may provide new clearances to the aircraft as long as they are within the limits of the release: vertical, lateral or longitudinal.

Complementary Distribution:

- Vicinity: An ATSU who receives the flight object for flights which cross their AoI but not the AoR.
- General: An ATSU who receives the flight object for a flight due to bilaterally agreed rules.

- Duplication: An ATSU to whom the flight object is duplicated due to defined offline conditions. The need for “Duplication” is to be confirmed.
- Subscription: An ATSU who requests the flight object for an identified flight.
- POINT: An ATSU who received a flight object for a flight which has been pointed to them by another party.

Short cross: A short cross flight is one that crosses an ATSU for a very short time or distance (lateral or vertical). This parameter can be agreed at LoA level between partners and if activated the ATSU who is “short crossed” is automatically SKIPed. The direction of the SKIP is defined in the LoA agreement. Following the “short cross” the rules for a SKIPed ATSU (sector) apply.

3.1.4.1.1 Concept

Each of the above actions has an impact either on the ATSUs to whom the flight object is distributed or those who will control the flight. However as identified in the attached paper it is also possible for an ATSU who is expected to control the aircraft to be removed from the control sequence but still be physically crossed by the flight path.

It is proposed to maintain the idea of three groups of distribution to separate the ATSUs that are going to control the flights, those that are crossed and those additional ATSUs to whom the information is distributed. The technical specifications associated to this feature will describe the creation, and management of these groups.

- The set of controlling ATSUs, i.e. those that will control the flight, it is modified by ATSUs that are SKIPed and those that are DELEGATEd.
    - All ATSUs who will control the flight need the flight information.
- The set of ATSUs that will be crossed is simply the ATSUs through which the trajectory is calculated to pass.
    - All ATSUs whose airspace will be physically crossed need to be aware of the flight.
- The complementary set of ATSU who require the flight object, those which have been added due to the complimentary distribution.
    - All ATSUs who have requested of been presented with information should continue to receive it until the reasons to receive it are no longer valid.

The diagrams below illustrate the various groups.

3.1.4.1.2 Sequences

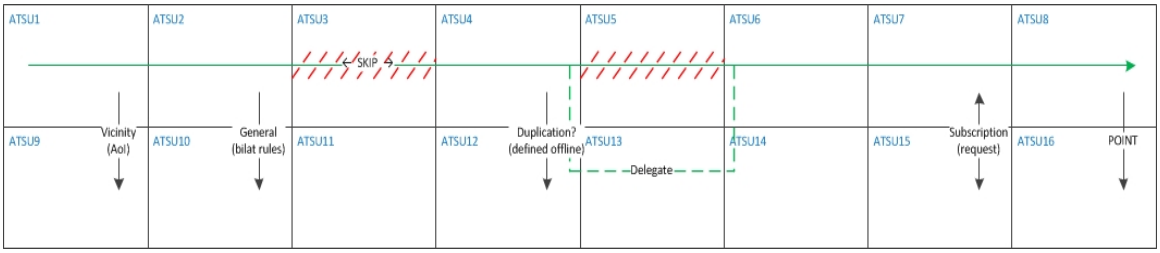


Figure 12: Sequence Modifications

The above diagram displays a flight traversing from left to right, ATSU1 to ATSU 8.

ATSU3 has SKIPed themselves (up or downstream).

ATSU5 has delegated their airspace to ATSU13.

Other ATSUs have made use of the Complementary distribution:

- ATSU9 receives the flight information as the flight crosses it's AoI (not show on the diagram)
- ATSU10 receives the flight information due to bilaterally agreed rules
- The flight information is duplicated to ATSU12 due to defined offline conditions. The need for "Duplication" is to be confirmed.
- ATSU15 has requested the flight information for a flight.
- ATSU8 has POINTed a flight to ATSU16.

The diagrams below show the impact on the various groups of ATSUs.

3.1.4.1.3 Distribution ATSUs:

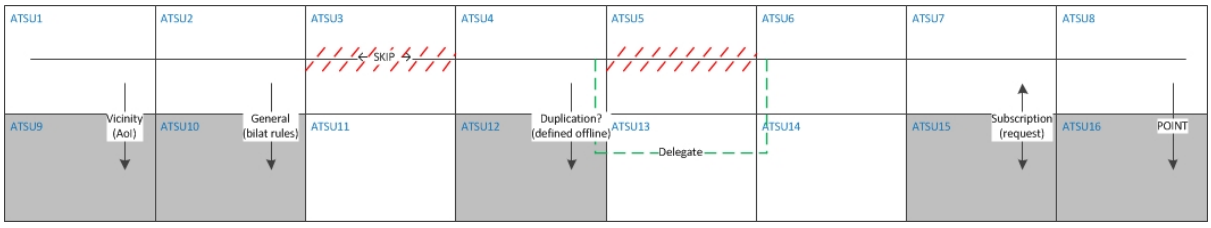


Figure 13: Distribution ATSUs

ATSUs 9, 10, 12, 15 and 16 are provided with the flight information due to the Complementary Distribution. *Note: that each entry only needs to occur once.*

3.1.4.1.4 Crossed ATSUs

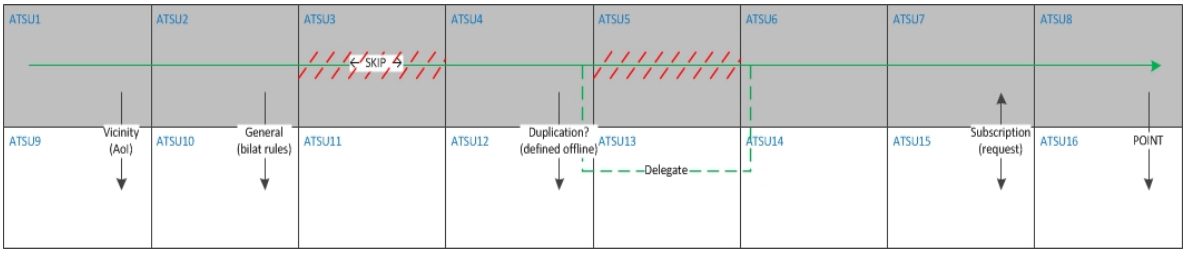


Figure 14: Crossed ATSUs

ATSUs 1 to 8 are physically crossed by the trajectory.

ATSU3 will be flagged as SKIPed and ATSU5 as DELEGATEd.

Note: that there can be multiple entries due to re-entrant flights.

3.1.4.1.5 Controlling ATSUs:

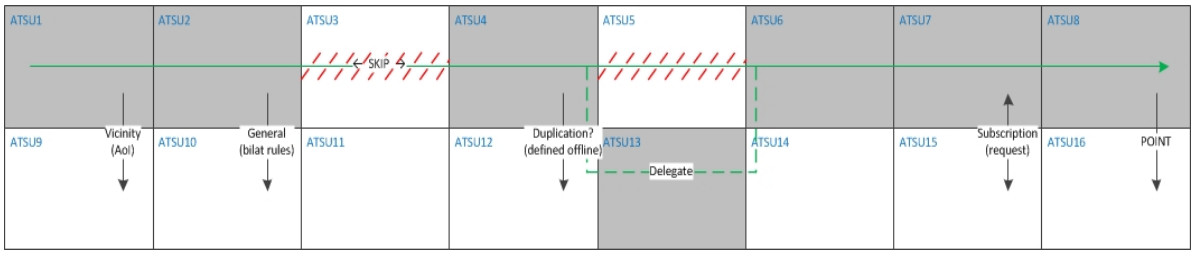


Figure 15: Controlling ATSUs

The sequence of control will be 1, 2 4, 13, 6, 7, 8. ATSU3 is SKIPed and ATSU5 has delegated to 13.

Should the DELEGATE from ATSU5 to ATSU13 be a N/A delegation the order of the control sequence would become 1, 2, 4, **5, 13, 5**, 6, etc. The other lists would remain unchanged.

Note: that there can be multiple entries due to re-entrant flights.

3.1.4.1.6 FDMP/C/U View

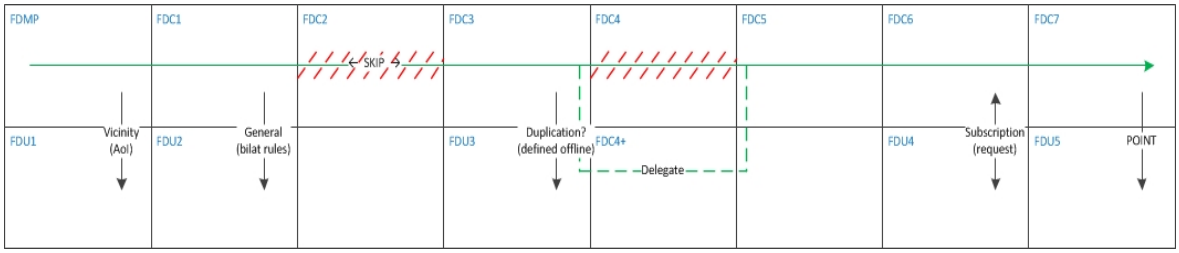


Figure 16: FDMP/C/U View

This diagram is provided to show the distribution across the FDCs and the creation of the FDUs.

3.1.5 Feature 8: SSR codes

This section introduces to various scenarios that can take place as a result of an action from an IOP stakeholder or from local systems creating or updating a flight plan's SSR Code. More scenarios could be added coming from contributors.

This group of use cases should discuss different aspects of SSR Code Management that may require some kind of agreement to grant the full synchronization of SSR Code Management data. To better understand the following paragraphs, take into account the next table:

Assigned SSR Code (ASSR)	The SSR code instructed to the aircraft by a controlling ATSU (the controlling one or a previous controlling one). There's only one ASSR common for all IOP partners.
Current SSR Code (CSSR)	The current SSR as shared by the controlling ATSU after the reception of the code broadcast

	by the aircraft. There's only one CSSR shared with all IOP partners at any one time. In nominal cases, the CSSR equals the ASSR.
Next Assigned SSR Code (NSSR)	The SSR code that the controlling ATSU is intending to instruct to the aircraft. There's only one NSSR shared with all IOP partners at any one time, to ease the correlation maintenance by the IOP partners and it can only be modified by the controlling ATSU.
Downstream SSR Code (DSSR)	The SSR code that each ATSU plans to give to the aircraft once controlling it. The DSSR of an ATSU could be blank if the ATSU doesn't plan to give a specific SSR code to the aircraft and expects to maintain the ASSR in his airspace. On the other hand, there could be as many DSSR as expected controlling ATSUs. The DSSR of an ATSU can be flagged as "requested" when its upstream ATSU wants him to provide it. The DSSR can be flagged as "To be assigned" when this (downstream) ATSU wants his upstream ATSU to give it to the aircraft (to assign it). Note that ATSU is an OPS term which might be translated as System Instance in Tech wording.

Note: In the following paragraph, when the Flight Plan is mentioned, we shall consider it as the System Flight Plan and not the ICAO FPL.

3.1.5.1 Creating a flight plan with assigned SSR Code

Creation of a new flight plan deriving from ICAO

Step	Description	FO data	SSR code detected by another partner
Step 1	The ATSU [A] process an ICAO flight plan defining the SSR Code related to it. (creation of the system FPL) The ATSU [A] is the FDMP for the flight.	ASSR = 1234 CSSR = Blank NSSR = Blank	None
Step 2	The flight plan ATSU [A] is shared with ATSU [B] through IOP DSSR is created and filled by [B] with the available data	ASSR = 1234 CSSR = Blank NSSR = Blank	1234
Step 3	CSSR is received form the track updated in the flight plan and distributed through IOP	ASSR = 1234 CSSR = 1234 NSSR = Blank	1234

3.1.5.2 Creating a flight plan without an assigned SSR Code

Step	Description	FO data	SSR code detected by another partner
Step 1	The ATSU [A] process an ICAO flight plan without the SSR Code related to it. (creation of the system FPL) The ATSU [A] is the FDMP for the flight.	ASSR = Blank CSSR = Blank NSSR = Blank	2000
Step 2	The Platform [A] automatically assign an SSR Code to the flight plan	ASSR = 1234 CSSR = Blank NSSR = Blank	2000
Step 3	The flight plan ATSU [A] is shared with ATSU [B] through IOP DSSR updated with the available data	ASSR = 1234 CSSR = Blank NSSR = Blank	2000
Step 4	The ATCO [A] instruct the aircraft to squawk 1234	ASSR = 1234 CSSR = Blank NSSR = Blank	2000
Step 5	ATSU[A] detect the new squawk and share with ATSU [B] through IOP	ASSR = 1234 CSSR = 1234 NSSR = Blank	1234

3.1.5.3 Internal SSR Code change

For any internal reason (military flight, Stay for Photo mission…), the controlling ATSU is assigning a new SSR code which has nothing to do with the DSSR of his downstream. The following use-cases address the difficulty to maintain a correlation according to a Flight Object which is not updated exactly at the moment of the new squawk detection.

Step	Description	FO data	SSR code detected by another partner
Step 1	Initial situation	ASSR = 1234 CSSR = 1234 NSSR = Blank	1234
Step 2	Internal system allocates the new SSR to be given (available for the controlling ATCO and shared in FO for IOP partners)	ASSR = 1234 CSSR = 1234 **NSSR = 2345**	1234
Step 3	The ATCO gives the new SSR code to the aircraft (NSSR). At the first radar detection, IOP partners can maintain the correlation thanks to the NSSR.	ASSR = 1234 CSSR = 1234 NSSR = 2345	**2345**
Step 4	The controlling ATSU detects the new squawk and update CSSR, NSSR and ASSR IOP partners can maintain the correlation thanks to the ASSR and/or the CSSR. In this case we are back in nominal situation.	ASSR = 2345 **CSSR = 2345** NSSR = Blank	2345

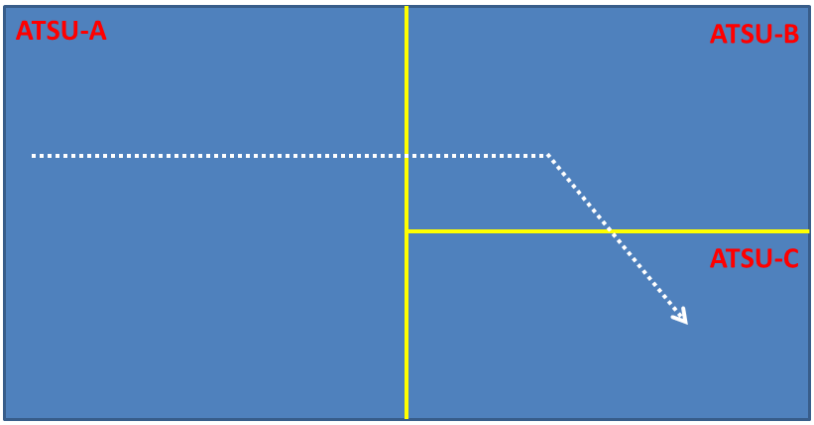
3.1.5.4 Unusual Situation

In this use-case, for any reason, the Flight crew squawks a different code from the ASSR. The benefits of the CSSR is more obvious when :

- the IOP partner discover a situation with a wrong squawk, either because the squawk change was before its own radar cover, or because the flight was not expected to enter his Area of Interest (not tracked before diversion),
- the IOP partner was not able to maintain the correlation after the squawk change.

Step	Description	FO data	SSR code detected by another partner
1	Initial situation	ASSR = 1234 CSSR = 1234 NSSR = Blank	Not detected yet
2	Radio failure. Flight crew squawks now 7600.	PSSR = Blank (or anything) ASSR = 1234 **CSSR = 7600** NSSR = Blank	Not detected yet
3	IOP partners can correlate track and FO thanks to the CSSR.	PSSR = Blank (or anything) ASSR = 1234 CSSR = 7600 NSSR = Blank	**7600**

3.1.5.5 Assign next SSR Code to a flight plan from next expected FDC



In this use-case, ATSU-B is crossed for a short period of time. By letter of agreement, ATSU-B knows the SSR code assigned by ATSU-A should be changed beyond the boundary.
ATSU-B should then choose an SSR code to be assigned in his airspace. So could ATSU-C.
These codes would be their DSSR (one for each).
But as the flight will spend more time in ATSU-C than in ATSU-B, ATSU-B does not want to use one of his limited codes.
ATSU-C may have provided the squawk he'll intend to use in his airspace, his DSSR. In case he did not provide the DSSR early enough, ATSU-B shall have a means to ask for it.
Finally, once the code is defined, ATSU-B may want ATSU-A to assign it (to give it to the pilot) before the transfer.

Step	Description	FO data	ATSU-B	ATSU-C
1	Initial situation in ATSU-A.	PSSR = Blank ASSR = 1234 CSSR = 1234 NSSR = Blank	DSSR-B = Blank Requested = False To be assigned = False	DSSR-C = Blank Requested = False To be assigned = False
2	According to a local trigger, ATSU-B looks for ATSU-C DSSR. As it is not provided, he asks for it.	PSSR = Blank ASSR = 1234 CSSR = 1234 NSSR = Blank	DSSR-B = Blank Requested = False To be assigned = False	DSSR-C = Blank **Requested = True** To be assigned = False
3	ATSU-C provides his DSSR. The 'Requested' flag is set to False again.	PSSR = Blank ASSR = 1234 CSSR = 1234 NSSR = Blank	DSSR-B = Blank Requested = False To be assigned = False	**DSSR-C = 2345** **Requested = False** To be assigned = False
4	ATSU-B adopts ATSU-C' DSSR.	PSSR = Blank ASSR = 1234 CSSR = 1234 NSSR = Blank	**DSSR-B = 2345** Requested = False To be assigned = False	DSSR-C = 2345 Requested = False To be assigned = False
5	ATCO-B wants ATCO-A to give the new SSR code to the pilot now. ATSU-A might take it as NSSR.	PSSR = Blank ASSR = 1234 CSSR = 1234 **NSSR = 2345**	DSSR-B = 2345 Requested = False **To be assigned = True**	DSSR-C = 2345 Requested = False To be assigned = False
6	ATCO-A gives the SSR code to the pilot. The 'To be assigned' flag is set to False again. NSSR is set to blank and PSSR is set to the previous assigned SSR code.	**PSSR = 1234** **ASSR = 2345** CSSR = 1234 **NSSR = Blank**	DSSR-B = 2345 Requested = False **To be assigned = False**	DSSR-C = 2345 Requested = False To be assigned = False
7	New squawk is detected by ATSU-A. PSSR should be set to blank after a time parameter. Back to nominal situation.	**PSSR = Blank** ASSR = 2345 **CSSR = 2345** NSSR = Blank	DSSR-B = 2345 Requested = False To be assigned = False	DSSR-C = 2345 Requested = False To be assigned = False

3.1.6 Feature 9: FO mechanism

This feature is aiming to tackle all the lacks detected in the existing technical solution of ED-133 V1.

Technical failures that require human intervention are to be tackled in the feature #4.

In this feature, system level interactions are to be clarified.

It is expected to cover any area for which an operational input is not required to start fixing the technical solution.

It is considered a big feature that covers the following topics:

- FDMP role transference mechanism

- Responsibilities and capacities of the SI with FDMP role. (From the system point of view, it does not have any operational implication).

- Responsibilities and capacities of the SI with FDC role. (From the system point of view, it does not have any operational implication).

- Responsibilities and capacities of SI with FDU role. (From the system point of view, it does not have any operational implication).

- WIFO related mechanisms

- SWIM / MDW related topics that are not linked with concrete operational functionalities.

3.2 Features to be studied later:

3.2.1 Feature 4: FO protocol failures

This feature has been conceived to gather any non-nominal use case that may be linked with a technical problem in the FO handling mechanism.

In this feature we are expected to identify the operational / human related consequences of technical failures.

A brainstorming will be required… a few examples are illustrated below:

- FDMP selection failure. Several SI are trying to publish the same FO. The FDMP determination procedure is not working and therefore some human operator should determine which system should be the FDMP. In addition, a mechanism to return to the nominal situation needs to be identified.

- FDC requests cannot reach the FDMP either local or network problem.

- FOs are not removed from the network by the last FDMP.

- ….

3.2.2 Feature 6: IOP Recovery

The IOP Recovery Process ('Fast Recovery') proposed in ED-133 is not optimal (recovery managed by the IOP application, pre-defined lists of nodes impacted by network evolution, order of FO updates not controlled, ...) and triggers uncontrolled storms of FO updates in the network.

The feature will propose to go for an alternative solution (described in 14.01.04 Blue Profile Technical Specifications) mitigating those drawbacks (recovery managed by the IOP-MDW, ATSU priority defined in the FO, tiered recovery based on priorities, ...).

This issue is identified in WG-59 OI#8.

The feature will also assess the consequences on the IOP Recovery Process of a node becoming IOP-disabled and of a new node integrating the IOP-network.

Performances and FO/SFPL reconciliation at recovery time will also be addressed.

3.2.3 Feature 7: Manual FO correction

Receiving a FO should trigger a number of data synchronization activities between the data included in the FO and the local view of the flight.

Whenever this synchronization fails (For example, a new FO does not allow the creation of the local SFPL or the coordination data cannot be processed locally) some kind of measures need to be defined.

Some kind of detached status may need to be defined while the correction measures are executed.

It includes the warning to a proper human actor/s as well as the facilities to correct the received data)…..

3.2.4 Feature 10: Scope and Management of FO trajectory

The Flight Object contains an IOP-Area wide 4-D trajectory computed by FDMP for the whole area on the basis of agreed Flight Script elements.

This feature will manage the WG59 open issues: #30 and #45.

In short words #30 deals with possible other area definition (like ECAC area or TP area) trajectories instead of IOP Area wide (relevant once NM is to be integrated).

The #45 discusses the selection of the correct departure time to initiate the times estimates in the trajectory. Additionally to this the case of IOP holes and re-entry needs to be consolidated.

3.2.5 Feature 11: Arrival & Departure management

This feature through IOP encompasses a global scope of arrival and departure management which includes the ATC procedures and data related to it.

Being one of the most important process in the beginning and end phase of a flight, neither ED133 nor SESAR has a good coverage on this matter.

The feature focuses on resolving the existing issues, addressing the global IOP scope, analyzing its impact on route and filling the gaps by defining use cases to cover operational scenarios and system cases for technical solutions.

This issue has already been addressed at WG59 level (OI#19) and almost agreed in a final solution that includes some improvements on route management that are not specific to arrival and departure data and that can be used in iIOP scope.

3.2.6 Feature 12: Original FP data

This feature will collect achieved agreements related to the Original FPL Data elements inclusion in the FO.

Currently the ED133 describes where and how the ICAO FPL data is to be included in the FO (in the Package FGI). However, this was done at the time when the ED133 was created (in 2009).

Since then the ICAO FPL 2012 has been implemented with some changes and improvements (more details, i.e. Navigation capabilities, etc.). Furthermore, in the context of SESAR WP 7.6.2 a new flight plan format is under development and validation, the EFPL and also the ICAO FF-ICE/1.

Both SESAR EFPL and ICAO FF-ICE include the flight 4D trajectory as calculated by the AO/CFSP, and the flight performance data.

None of these additional information are part of the ED133 FO.

The issue at hand is which/what and how these additional information are to be included in the FO.

3.2.7 Feature 13: IOP support to PCP ATM features

This feature proposes solutions to the existing issues related to all 2015 Deployment Program ATM Functions with impact on System Instances Interoperability, sharing Flight Object data.

An analysis of already defined AFs requirements related to IOP will be performed, reporting points of discussion to be clarified and cooperating to achieve a common agreement:

the Flight Object data in support to ATM Functions (e.g. needs related to AMAN Extended Horizon, DMAN and i4D information sharing among IOP Stakeholders, NM integration in the IOP Network and support to Advanced Flexible Use of Airspace, ...) will be investigated, reporting possible model extensions/updates whenever required.

4 Interoperability Requirements

4.1 Assumptions

The following assumptions are applicable to the interoperability requirements stated in this specification.

No.	Assumption
1	Flight identification information is not explicitly stated within the information exchange requirements. It is assumed that the stakeholders involved can uniquely reference and identify the flight to which the information pertains.
2	Stakeholders have access to consistent aeronautical information.

Table 2: Assumptions Applicable to the Interoperability Requirements

4.2 Naming Convention

The following requirements naming convention is used in this INTEROP. The 4 letter descriptor (e.g. COTR) is coordinated with 10.2.5 D55 Technical Specification. The 4 digits specific to each requirement are matched to those used in each analysis team feature document.
The exceptions are the last 4 lines of the table which describe operational requirements that have been carried forward from D823 [6]. For these requirements, the exig convention has been maintained, to differentiate from requirements that have been addressed by the AT.

Note that this list covers all IOP features; not all of which have been addressed in this INTEROP.

Feature #	Feature Topic	Requirement Id
1	Coordination and Transfer	REQ-05.05.01-INTEROP-**COTR**.000x
2	FO Flight Script management	REQ-05.05.01-INTEROP-**FSMG**.000x
3	Informative distribution between systems	REQ-05.05.01-INTEROP-**INFO**.000x
4	FO protocol failures	REQ-05.05.01-INTEROP-**PRFA**.000x
5	Control sequence handling	REQ-05.05.01-INTEROP-**SEQM**.000x
6	IOP recovery	REQ-05.05.01-INTEROP-**RECO**.000x
7	Manual FO correction	REQ-05.05.01-INTEROP-**MACO**.000x
8	SSR codes	REQ-05.05.01-INTEROP-**SSRC**.000x
9	FO mechanism - general	REQ-05.05.01-INTEROP-**MECH**.000x
	FO mechanism - WIFO	REQ-05.05.01-INTEROP-**WIFO**.000x
	FO mechanism - SWIM	REQ-05.05.01-INTEROP-**SWIM**.000x
10	Scope and management of FO trajectory	REQ-05.05.01-INTEROP-**SCTJ**.000x
11	Arrival and departure management	REQ-05.05.01-INTEROP-**ADMG**.000x
12	Original FP data	REQ-05.05.01-INTEROP-**FPMG**.000x
13	IOP support to PCP ATM features	REQ-05.05.01-INTEROP-**PCPF**.000x
n/a (from D823)	Synchronise air/ground trajectories	REQ-05.05.01-INTEROP-**F060**.000x
	ETA min/max	REQ-05.05.01-INTEROP-**F070**.000x
	CTA	REQ-05.05.01-INTEROP-**F080**.000x
	Create/update ground ATC view	REQ-05.05.01-INTEROP-**F110**.000x

Table 3: Naming Convention

4.3 Requirements for Interoperability

This section presents the requirements related to initial interoperability, as developed by the SESAR IOP task force in 2016. These requirements are mapped in Appendix A to a package of IOP functionality that they support: Basic, Intermediate, or Full. These packages are defined as follows:

- Basic IOP: Requirements considered necessary to be compliant to the PCP.
- Intermediate IOP: Requirements considered necessary to replace the expected levels of interoperability at the time of ATM Functionality 5 full operational capability.
- Full IOP: Set of requirements to further develop interoperability.

An m1, m2 or m3 Maturity Level is also indicated for specific requirements, with the following understanding:

- m1: the requirement is agreed but might require further work to be finalized,
- m2: the requirement is agreed but might be impacted by other features' evolutions,
- m3: the requirement is totally agreed and might not be modified.

Remarks on IOP levels and maturities:

- Some of the following requirements only apply to a specific deployment step of IOP among Basic IOP, Intermediate IOP and Full scope IOP as indicated in the Maturity Level line.
- However, it has to be considered as an initial capability date which means that Basic IOP requirements shall be still valid for Intermediate IOP and Full IOP, and Intermediate IOP requirements shall be still valid for full IOP scope.
- If it eases the technical implementation, a requirement assigned to a later step of deployment may be implemented in an earlier step

4.3.1 Coordination and Transfer

This section captures the outcome of the work performed for feature 1 in terms of operational requirements, which are aligned with the Feature 1 Deliverable [19].

This section captures only requirements that have been discussed and agreed at feature working level.

Those requirements that have not been agreed or not sufficiently discussed by the working team per feature are eventually captured in Appendix C as assumptions / hypothesis that still require further discussion.

4.3.1.1 System Awareness Phase (SAP)

IOP mechanisms provide a continuous flow of updated information since the first Flight Object (FO) publication. This FO is expected to be enriched by contributions from all the traversed ATSUs according to their local constraints. However, these contributions can only be added if the concerned System Instance has derived from the FO an internal System Flight Plan (SFPL) or local flight plan used for other purposes which can be processed, enriched with local constraints and resynchronized with the FO.

FO are expected to be created several hours before departure.

To avoid system overloads (cumulating for instance morning and evening peak hours) each System Instance shall determine the moment when its internal flight plan becomes synchronized with the FO. This moment is known as the beginning of the System Awareness Phase.

Before the SAP, the FO might be considered as not highly accurate as the SI cannot comply with the TMF INTEROP requirements REQ-04.05-INTEROP-F010-0030 to -0070 [6].

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0001**
Requirement	An ATSU shall share the information that a flight is in the SAP within this ATSU with the other FO partners.
Title	SAP status of an ATSU
Status	<In Progress>
Maturity Level	Basic IOP –m3
Rationale	The trajectory accuracy depends on the IOP Partners' contributions, which are only required in the System Awareness Phase.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

The SAP is set for each flight and is related to the whole System Instan G/G IOP Managementce which means all the different boundaries of this System Instance are in SAP at the same time. On the other hand, Controller Awareness Phase and Negotiation Phase are related to a specific boundary between two sectors of different system instances and as a consequence, the triggers of CAP and NP for different boundaries of an ATSU are independent.

In the SAP, the controller of the upstream ATSU doesn't know if the controller of the downstream ATSU is aware of the flight (it is a local decision to display or not the flight on the downstream HMI.

The SAP is considered as the period of time when the flight is of interest to the FDPS for any function (Demand Capacity Balancing, Sector Workload Management, Traffic Synchronisation, Separation Management …) and not yet of interest to any sector ATCO under this FDPS. That's the reason why, despite it may be decided locally to display part of the available information, ATCOs are not yet expected to take into account trajectory or coordination changes.

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0002**
Requirement	If a flight is in the SAP within an ATSU, this ATSU shall accept every change of the flight's coordination data or 4D trajectory performed by any upstream ATSU.
Title	Coordination changes in System Awareness Phase
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	No additional acknowledgment is necessary by the ATSU in SAP.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0005**
Requirement	Any electronic dialogue (negotiation) started in the SAP and involving adjacent ATCOs shall trigger the CAP.
Title	CAP triggered by negotiation
Status	<in Progress>
Maturity Level	Basic IOP – m2
Rationale	In order to guarantee that both ATCOs are aware of the flight.
Category	<Interoperability>
Validation Method	

Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

4.3.1.2 Controller Awareness Phase (CAP)

The Controller Awareness Phase is a status related to a specific (horizontal or vertical) boundary between two subsequent sectors (of different ATSUs) in the control sequence and qualifies the awareness of this specific downstream sector.

An ATCO is considered aware of the flight when the flight is displayed on its HMI and that nominal functionalities are available.

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0006**
Requirement	The Controller Awareness Phase (CAP) status shall be available for other SIs.
Title	Availability of the CAP status
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	The ATCOs' awareness is a prerequisite of any verbal coordination.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0007**
Requirement	Unless already triggered (MTCD, manual input, etc…), the CAP shall be triggered automatically according to LoAs parameters (any combination of time, distance or level from the boundary).
Title	CAP triggering
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	ATCOs need to anticipate their awareness before the entry of the airspace, based on bilateral agreements.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0010**
Requirement	If a flight is in the CAP within an ATSU, this ATSU shall accept every change of the flight's coordination data or 4D trajectory performed by any upstream ATSU..
Title	Coordination changes in CAP
Status	<In Progress>
Maturity Level	Basic IOP – m3

Rationale	Unless included in an electronic dialogue (negotiation), no additional acknowledgment is necessary by the ATSU in CAP.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0013**
Requirement	Upstream ATSU shall be able to trigger the CAP.
Title	Force-CAP by upstream
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	For instance, to start a verbal or electronic coordination (Force-CAP functionality)
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0014**
Requirement	Downstream ATSU shall be able to trigger the CAP.
Title	Force-CAP by downstream
Status	<In Progress>
Maturity Level	Intermediate IOP – m3
Rationale	For instance to start a verbal or electronic coordination (Force-CAP functionality)
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

4.3.1.3 Negotiation Phase (NP)

The Negotiation Phase is made to prevent ATCOs to change coordination data or 4D Trajectory without negotiation when the flight is quite close to the boundary or to the frequency change. Its indicate to both ATSUs that any coordination data change (either by upstream or by downstream) is expected to be negotiated (either verbally or electronically). It is triggered according to parameters defined in a Letter of Agreement or can be activated manually if one of the ATCOs wants to be informed in case of change in his situational awareness.

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0016**
Requirement	The Negotiation Phase (NP) status shall be available for other SIs.
Title	NP sharing
Status	<In Progress>
Maturity Level	Basic IOP – m3

Rationale	Downstream & upstream must have a consistent view of the current phase.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0017**
Requirement	The start of the NP phase shall be triggered either automatically, according to LoAs parameters (combination of time, distance or level from the boundary), or manually upon ATCOs input.
Title	NP triggering
Status	<In Progress>
Maturity Level	Basic IOP – m2
Rationale	ATCOs need to freeze coordination conditions some defined time before transfer, unless negotiated.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

The following requirement is based on the assumption that ATCOs do not change the coordination data without negotiation (electronic or verbal) in the NP. If the other ATCO agreed verbally then, there's no need to ask for an additional acknowledgement when the change is implemented.

In addition, as the system cannot determine whether a verbal coordination occurred or not, it can't block any manual input which would not be the result of an electronic dialogue.

So finally, the IOP behaviour in the NP is similar to the one in the CAP. Only ATCOs behaviour is different because they know they are in the Negotiation Phase.

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0019**
Requirement	In the NP, an ATCO shall be able to indicate that a coordination data or a 4D trajectory change has been verbally agreed and does not need further acknowledgement.
Title	Agreed change in NP
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	In order to distingh on HMI changes already approved from changes not agreed, an agreement unknown by the system (i.e. by phone) must be indicated with the change.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0020**
Requirement	The Negotiation Phase shall end when downstream ATCO assumes the flight.
Title	Negotiation Phase end
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	The frequency change must not be considered as the end of the NP.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0021**
Requirement	The downstream ATSU shall be able to trigger the Negotiation Phase.
Title	Force-NP by downstream
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	Receiving ATSU must be able to freeze the current transfer conditions to guarantee a unexpected change would not jeopardize his strategy.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0022**
Requirement	The upstream ATSU shall be able to trigger the Negotiation Phase.
Title	Force-NP by upstream
Status	<In Progress>
Maturity Level	Intermediate IOP – m3
Rationale	Transfering ATSU may want to prevent the receiving ATSU to require (without negotiation) for an unexpected change in the transfer conditions which would jeapardize his current strategy.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

4.3.1.4 Reversion from CAP or NP to SAP

See the Use-case developed in the ConOps slides for context (section 3.1.1).

An unexpected or undetermined delay might justify reverting to the SAP. It is however internal decision based on the revised entry conditions with the caveat that an ATSU (more clearly a sector) can't declare itself unaware if its downstream is aware (it shall be aware if its downstream is aware).

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0023**
Requirement	If its downstream ATSU is in SAP, any ATSU shall be able to revert from CAP or NP to SAP the coordination phase related to its upstream boundary provided the LoA conditions triggering the CAP are not anymore verified,.
Title	Reversion to SAP
Status	<In Progress>
Maturity Level	Intermediate IOP – m1
Rationale	CAP should be consistent with the progress of the flight. A too much delayed flight should not remain in CAP.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

It's local decision to involve the ATCO to revert to SAP.

4.3.1.5 Coordination abrogation

See the Use-case developed in the ConOps slides for context (section 3.1.1).

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0026**
Requirement	In CAP or NP, the ATCO shall be informed of a coordination abrogation.
Title	Coordination abrogation
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	The ATCO should be aware if the sector is no longer crossed.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

In SAP, it's local decision to inform the ATCO of a coordination abrogation.

4.3.1.6 Coordination changes

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0096**
Requirement	Coordination data shall be flagged as non-standard if they are assessed as not in compliance with the Letter of Agreement by any of the two ATSUs (valid in SAP, CAP and NP).
Title	Non-standard conditions determination
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	As a flight can be displayed on downstream HMI during the SAP, non-standard transfer conditions should be indicated as soon as the transferring system or the receiving system considers them as non-standard.

Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0097**
Requirement	During the CAP or NP, the non-standard status of coordination shall be available to both ATCOs.
Title	Non-standard conditions awareness
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	Based on the LoA's definition, both ATCOs should be aware of any flight going to be handed over in non-standard conditions.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

How the non-standard status of coordination is displayed is local implementation.

[Req]

Identifier	REQ-05.05.01-INTEROP-COTR.**0027**

Requirement	The ATCO shall have access to the following coordination data: • Phase of coordination (SAP, CAP, NP) • Communication status (Frequency changed, Assumed) • Skipped as upstream or Skipped as downstream indication • Stolen information • Standard / non-standard coordination status • De-synchronization status • Transferring Sector & Transferring frequency • Receiving Sector & Receiving frequency • Request on frequency, Reclaim • Requested SSR Code *(See Feature 8)* • Transfer Flight Level (TFL) with indicator Wall/Ceiling • Supplementary Flight Level (SFL) • Coordinated Direct • Coordinated Heading (value and direction) • Coordinated Speed (≥, ≤, =, lowest, highest) • Coordinated Rate of climb / descent (≥, ≤, =, highest) • Coordinated Offset value and direction (right/left) • Release for turn, climb/descent, speed, rate to downstream Release for turn, climb/descent, speed, rate to upstream
Title	Coordination Data
Status	<In Progress>
Maturity Level	Basic IOP – m2
Rationale	Transfer conditions may rely on any combination of the described data.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
Relationship	Linked Element Type	Identifier	Compliance

[Req]

Identifier	REQ-05.05.01-INTEROP-COTR.**0028**
Requirement	During the SAP, the CAP and the NP, upstream ATSU shall be able to modify the 4D Trajectory and the following coordination data: TFL, SFL.
Title	Changeable conditions by upstream in Basic IOP
Status	<In Progress>
Maturity Level	Basic IOP – m2
Rationale	In Basic IOP, the systems should be able to implement any trajectory modification and offer to upstream ATCO the possibility to modify TFL and SFL.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0029**
Requirement	During the SAP, the CAP and the NP, downstream ATSU shall be able to modify the 4D Trajectory and the following coordination data: TFL, SFL, next SSR code.
Title	Changeable conditions by downstream in Basic IOP
Status	<In Progress>
Maturity Level	Basic IOP – m2

Rationale	In Basic IOP, the systems should be able to implement any trajectory modification and offer to downstream ATCO the possibility to modify TFL and SFL.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0030**
Requirement	During the SAP, the CAP and the NP, upstream ATSU shall be able to modify the following coordination data: Coordinated heading, speed or rate, transferring sector id, transferring frequency..
Title	Changeable conditions by upstream in Intermediate IOP
Status	<In Progress>
Maturity Level	Intermediate IOP – m3
Rationale	In Intermediate IOP, the systems should allow the upstream to modify these data, in addition to the one allowed in Basic IOP.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0031**
Requirement	During the SAP, the CAP and the NP, downstream ATSU shall be able to modify the following coordination data: Coordinated heading, speed or rate, receiving sector id, receiving frequency.
Title	Changeable conditions by downstream in Intermediate IOP
Status	<In Progress>
Maturity Level	Intermediate IOP – m3
Rationale	In Intermediate IOP, the systems should allow the downstream to modify these data, in addition to the one allowed in Basic IOP.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

4.3.1.7 Frequency Change

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0032**
Requirement	The upstream ATCO shall inform the downstream ATCO as soon as the transfer of communication was initiated. .
Title	Transfer of communication start
Status	<In Progress>
Maturity Level	Basic IOP – m3

Rationale	Downstream ATCO should know when the transfer of frequency occurred. In this requirement, the term “ATCO” indicates the information has to be available at the HMI level (local implementation).
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

Identifier	REQ-05.05.01-INTEROP-COTR.**0034**
Requirement	The downstream ATCO shall inform the upstream ATCO as soon as the flight is assumed. .
Title	Assumption
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	Upstream ATCO should be know when the flight is assumed. In this requirement, the term “ATCO” indicates the information has to be available at the HMI level (local implementation).
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0036**
Requirement	The upstream ATCO shall be able to undo the frequency change (undo-send) until the flight is assumed by downstream ATCO.
Title	Undo-send
Status	<In Progress>
Maturity Level	Intermediate IOP – m1
Rationale	Transfer of frequency could be made by mistake and ATCO should then have a means to correct his error.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0038**
Requirement	Downstream ATCO shall be able to perform an undo-Assume.
Title	Undo-assume
Status	<In progress>
Maturity Level	Full IOP – m2
Rationale	Assumption could be made by mistake and ATCO should then have a means to correct his error. It may only happen after a frequency change.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0039**
Requirement	After an undo-assume, the coordination phase shall be the one before the assumption, unless next phase should have been triggered in the meantime and the transfer of communication shall be set to initiated
Title	Undo-assume consequences
Status	<In Progress>
Maturity Level	Full IOP – m2
Rationale	As the undo-assume functionality aims at correcting an error, it should reset the scene as it was before the wrong assumption.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

4.3.1.8 Request on Frequency

This functionality is similar to the one described in section 4.2.12 of the TMF Technical Note [10] and does not describe an improvement to the ROF message used under the OLDI dialogue procedure.

Two additional messages aiming at requesting the transfer of frequency of a flight in another way than from downstream to immediate upstream unit are foreseen:

- The “reclaim” functionality, from upstream to immediate downstream ; see requirements section 4.3.1.9,
- The “delegation request” functionality, from a third-party ATSU to a controlling or downstream ATSU; see delegation requirements.

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0040**
Requirement	First controlling sector of the downstream ATSU shall be able to request an aircraft on frequency to the last controlling sector of its upstream ATSU before the actual frequency change is executed.
Title	Request on Frequency
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	Currently used with OLDI, this functionality must remain available in IOP.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0041**
Requirement	Upstream ATCO shall be informed of a request on frequency from its first downstream sector.
Title	ROF awareness
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	Currently used with OLDI, this functionality must remain available in IOP.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

Identifier	REQ-05.05.01-INTEROP-COTR.**0042**
Requirement	The ROF functionality shall be available in the CAP and the NP.
Title	ROF availability
Status	<In Progress>
Maturity Level	Basic IOP – m2
Rationale	When a ROF functionality is used, both ATCOs should be aware of the flight.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0043**
Requirement	The Request on Frequency shall trigger the Negotiation Phase.
Title	NP triggered by ROF
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	The meaning of the ROF is : “Transfer me this air craft as soon as possible in the current transfer conditions”, which means downstream ATCO does not want the transfer conditions to be modified without notice, which is the aim of the NP.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

Identifier	REQ-05.05.01-INTEROP-COTR.**0044**
Requirement	Frequency change from an ATCO to its downstream ATSU shall cancel the ROF it has been addressed to.
Title	ROF end
Status	<In Progress>
Maturity Level	Intermediate IOP – m3
Rationale	Performing the frequency change (to the requester) satisfies the request of frequency, which can then be closed.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

4.3.1.9 Reclaim

As defined in the slides in section 3.1.1, the reclaim functionality offers, in full IOP scope, the ability for the upstream to request its downstream to get the flight back on its frequency after the assumption by he downstream.

"In the following chapter, "upstream ATSU/ATCO" must be understood as "current controlling ATSU/ATCO" and "downstream" as "next controlling ATSU/ATCO", so that these requirements remain valid in case of frequency change to a third party sector (not in the initial control sequence) or from the downstream to the upstream after a reclaim".

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0045**
Requirement	Last controlling sector ATCO of the upstream ATSU shall be able to request an aircraft on frequency (reclaim) to the first controlling sector ATCO of its downstream ATSU only after the flight has been assumed by the downstream ATCO.
Title	Reclaim
Status	<In Progress>
Maturity Level	Full IOP – m2
Rationale	An ATCO who wrongly transfer on frequency a flight to his downstream (who already assumed it) should be able to ask him to get it back on frequency if needed.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

Identifier	REQ-05.05.01-INTEROP-COTR.**0047**
Requirement	The last controlling sector of the upstream ATSU shall be able to reclaim a flight until the next assumption by a subsequent ATCO. .
Title	End of reclaim availability
Status	<in Progress>
Maturity Level	Full IOP – m1
Rationale	It is not permitted to request to have back on frequency an aircraft which has already been transferred twice.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

Identifier	REQ-05.05.01-INTEROP-COTR.**0048**
Requirement	A downstream ATCO of a skipped ATSU shall be aware of a Reclaim performed by the upstream ATCO of the skipped ATSU.
Title	Reclaim with a skipped ATSU
Status	<In Progress>
Maturity Level	Full IOP – m2
Rationale	In case of skipped ATSU, the reclaim functionality should be available between the two other ATSUs involved in the transfer of frequency.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

Identifier	REQ-05.05.01-INTEROP-COTR.**0049**

Requirement	Frequency change from an ATCO to its upstream ATSU shall cancel the Reclaim it has been addressed to.
Title	Reclaim end by transfer of frequency
Status	<In progress>
Maturity Level	Full IOP – m2
Rationale	Transferring the flight to the upstream frequency satisfies the reclaim request which should then be closed.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

Identifier	REQ-05.05.01-INTEROP-COTR.**0050**
Requirement	Undo-assumption from an ATCO shall cancel the Reclaim it has been addressed to.
Title	Reclaim end by undo-assume
Status	<In progress>
Maturity Level	Full IOP – m2
Rationale	Undoing the assumption of the reclaimed flight satisfies the reclaim request which should then be closed.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

4.3.1.10 Force-assumption

In IOP, assuming a flight is the technical trigger for the system to become the FDMP (Flight Data Manager Publisher) in charge of the FO update and distribution. That's the reason why, being able to assume a flight calling your frequency is a mandatory functionality in IOP.

Despite in nominal case, the assumption should follow a frequency change from previous controlling ATCO (instruction to the flight crew and action into the system), the assumption shall be available in case of any failure in the transfer process (flight crew changing frequency without being instructed to do so, wrong flight selected by the upstream CWP when implementing the instruction into the system, frequency change IOP message failure…). This is the role of the force-assumption.

However, the force-assumption functionality creates a risk to disturb the nominal flow of exchanges between units and the impacts of its use for the other ATSU must be taken into account.

The following requirements aim at offering the functionality without forgetting tackling the consequences of its use and the way to undo the action if it was inappropriate.

Force-assumption by the immediate downstream ATSU is considered as mandatory for Intermediate IOP whereas Full IOP scope shall include the possibility for any other ATSU (further downstream or third party) to force-assume a flight.

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0051**
Requirement	First downstream ATCO shall be able to force-assume a flight.
Title	Force-assume by first downstream
Status	<In Progress>

Maturity Level	Intermediate IOP – m3
Rationale	In Intermediate IOP, an ATCO should be able to take full control of a flight when he's contacted by him, even in case of missing transfer of frequency step.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0052**
Requirement	The former controlling ATCO and the new controlling ATCO shall be notified that the flight has been stolen (force-assumed).
Title	Stolen indication
Status	<in Progress>
Maturity Level	Intermediate IOP – m1
Rationale	As the force-assumption is not a nominal case of frequency change, the former controlling ATCO should get special notice of it.
Category	<Interoperability>
Validation Method	
Verification Method	

REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0053**
Requirement	The former controlling ATSU shall be able to cancel the Stolen information (meaning he agrees with the stealing).
Title	Stolen indication cancellation
Status	<In Progress>
Maturity Level	Intermediate IOP – m1
Rationale	If the former controlling ATCO agrees with the new situation, he should be able to inform the new controlling ACTO of his agreement by cancelling the stolen indication.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0054**
Requirement	If an ATCO assumes a flight marked as "Stolen", the Stolen information shall be cancelled.
Title	Stolen indication cancellation by second assumption
Status	<In Progress>
Maturity Level	Intermediate IOP – m1
Rationale	The Stolen indication should only refer to the current assumption.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0055**
Requirement	Any ATCO of downstream, upstream or third party ATSU shall be able to force-assume a flight.
Title	Force-assume by any ATSU
Status	<In Progress>
Maturity Level	Full IOP – m3
Rationale	In Full IOP, an ATCO should be able to take full control of a flight when he's contacted by him, independently of any other system configuration (frequency change status or predefined control sequence).
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0056**
Requirement	When the flight is force-assumed by a further downstream ATSU, the stolen information shall be provided to all his upstream ATSUs not skipped up to (and including) the former controlling ATSU.
Title	Multiple stolen indication
Status	<In Progress>
Maturity Level	Full IOP – m1
Rationale	Any ATCO expected to control a flight shall be aware when a flight is already assumed by one of its downstream ATCO.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0057**
Requirement	An undo-force-assume shall be possible at any point of time.
Title	Undo-assume availability
Status	<In Progress>
Maturity Level	Full IOP – m1
Rationale	In case of wrong assumption, the ATCO should be able to correct his error. Maturity m1 as this requirement might be reconsidered while addressing the CPDLC.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0058**
Requirement	After an undo-force-assume, the coordination phase shall be the one before the force-assumption, unless next phase should have been triggered in the meantime and the transfer of communication shall be set to not started.
Title	Undo-force-assume

Status	<In Progress>
Maturity Level	Full IOP – m3
Rationale	As the undo-force-assume functionality aims at correcting a wrong force-assumption, it should reset the scene as it was before the wrong force-assumption.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0059**
Requirement	After an undo-force-assume, the Stolen information caused by this force-assumption shall be cancelled.
Title	Stolen indication cancelled by undo-force-assume
Status	<In Progress>
Maturity Level	Full IOP – m1
Rationale	As the undo-force-assume functionality corrects a wrong force-assumption, the stolen indication coming from this force-assumption should be cancelled.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

4.3.1.11 Release

The release functionality is expected to be developed in the Full IOP scope.

This functionality is based on the Interop Technical Note description section 4.2.13 [10] with the following amendments:

- Callsign qualifier: only one flight can be defined as qualifier for all the release types an ATSU is providing to another ATSU,
- Release for turn: The free text qualifier is not kept,
- Release for speed and Release for rate of climb/descent are added,
- A release can not only be provided by the upstream to his downstream, but also vice-versa.

The release functionality is a key element of the management of a flight in the airspace of another ATSU and will bring full benefits when implemented with the Skip and the Delegation functionalities (See Feature 5 (section 4.3.4).

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0060**
Requirement	An upstream ATSU shall be able to offer and modify releases offered to its downstream ATSU during the SAP, the CAP, the NP or after the assumption by the downstream.
Title	Upstream Release
Status	<In Progress>
Maturity Level	Full IOP – m3
Rationale	The release conditions can be set by the upstream automatically or manually from the beginning of the SAP to the boundary crossing (which can be after the assumption by the downstream ATCO).
Category	<Interoperability>
Validation Method	

Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0061**
Requirement	A downstream ATSU shall be able to offer and modify releases offered to its upstream ATSU before it assumes the flight, during the SAP, the CAP or the NP.
Title	Downstream Release
Status	<In Progress>
Maturity Level	Full IOP – m3
Rationale	The release conditions can be set by the downstream automatically or manually from the beginning of the SAP to the assumption by the downstream ATCO) which can be after the boundary crossing.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0062**
Requirement	Downstream ATSU shall be aware of the releases offered by its upstream ATSU.
Title	Upstream Release sharing
Status	<In Progress>
Maturity Level	Full IOP – m3
Rationale	Releases must be known by the ATCO who can have benefit of it.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0063**
Requirement	Upstream ATSU shall be aware of the releases offered by its downstream ATSU.
Title	Downstream Release sharing
Status	<In Progress>
Maturity Level	Full IOP – m3
Rationale	Releases must be known by the ATCO who can have benefit of it.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0066**
Requirement	Any Release provided shall contain one or more of the following data: release for turn, release for climb or descent, release for speed, release for rate of climb or descent.
Title	Release data

Status	<Validation>
Maturity Level	Full IOP – m3
Rationale	These data describe the needed parameters to offer a degree of freedom to the adjacent ATSU.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0067**
Requirement	Release for turn shall allow a direction limitation (right or left) with the additional possibility to limit the release to a specific angle expressed in degrees from the position and track of the aircraft when the release is granted.
Title	Release for turn
Status	<In Progress>
Maturity Level	Full IOP – m3
Rationale	Description of a release for turn.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0068**
Requirement	Release for Climb shall allow a limitation expressed in a limit Flight level.
Title	Release for climb
Status	<In Progress>
Maturity Level	Full IOP – m3
Rationale	Description of a release for climb.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0099**
Requirement	Release for Descent shall allow a limitation expressed in a limit Flight level.
Title	Release for descent
Status	<In Progress>
Maturity Level	Full IOP – m3
Rationale	Description of a release for descent.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0069**
Requirement	Release for speed shall allow a limitation expressed in knots or Mach maximum or minimum.
Title	Release for Speed
Status	<Valideted>
Maturity Level	Full IOP – m3
Rationale	Description of a release for speed.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0070**
Requirement	Release for Rate shall allow a rate limitation (climb or descent) expressed in feet per minute maximum or minimum.
Title	Release for rate
Status	<In Progress>
Maturity Level	Full IOP – m3
Rationale	Description of a release for rate
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0071**
Requirement	Any ATSU providing release data to its upstream or downstream shall be able to define another flight the release is subject to.
Title	Release subject to a flight
Status	<In Progress>
Maturity Level	Full IOP – m3
Rationale	It might happen that an ATCO wants ot offer a certain degree of freedom based on a specif flight in the vicinity of the one released.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0073**
Requirement	Upstream ATSU shall be able to ask for a specific release item to its downstream.
Title	Release request from Upstream
Status	<In Progress>
Maturity Level	Full IOP – m3
Rationale	Any release data should be negotiable.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0074**
Requirement	Downstream ATSU shall be able to ask for a specific release item to its upstream.
Title	Release request from Downstream
Status	<In Progress>
Maturity Level	Full IOP – m3
Rationale	Any release data should be negotiable.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

4.3.1.12 Point

The Point function is an ATCO to ATCO coordination function to support a telephonic coordination.

The Point function shall be available as soon as the flight is known by one of the two involved system.

This functionality, as expected to be developed for Basic IOP, is described in the INTEROP Technical note section 4.1.10 [10]. Intermediate and Full IOP scope extend this functionality to any neighbour sectors, which are not even crossed.

In the following requirements, “Point session” has to be understood as: *the process of the Point functionality, starting with the definition of the flight to be pointed out to another sector and ending with the cancellation of the point request*.

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0075**
Requirement	The last sector of the upstream ATSU shall be able to initiate a Point session to the first sector of the downstream ATSU.
Title	Point in Basic IOP
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	Currently used with OLDI, this functionality must remain available in IOP.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0076**
Requirement	The first sector of the downstream ATSU shall be able to initiate a Point session to the last sector of the upstream ATSU.
Title	Point by Downstream
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	There’s a need to extend the OLDI PNT functionality from downstream to upstream.
Category	<Interoperability>
Validation Method	

Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0077**
Requirement	The initiating Point session ATSU shall define the concerned flight and the pointed out sector.
Title	Point
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	Point functionality description.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0078**
Requirement	The initiating Point session ATSU shall provide the initiating sector identification.
Title	Point initiator
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	In case of Point from another ATSU than the adjacent one, the pointed-out ATCO should know who's the initiator of the point.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0081**
Requirement	The initiating Point session ATSU shall be able to close the Point session.
Title	Point closure by initiator
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	At the end of the verbal coordination, the initiator should be able to cancel the Point.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0082**
Requirement	The receiver of the Point shall be able to close the Point session.
Title	Point closure by receiver
Status	<In Progress>
Maturity Level	Basic IOP – m3

Rationale	At the end of the verbal coordination, the receiver should be able to cancel the Point.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

The behaviour of HMIs after a closure of a point session is local implementation (whether a highlight is maintained or not).

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0084**
Requirement	If the Point is applied during the SAP between the last sector of the upstream ATSU and the first sector of the downstream ATSU, the CAP shall be triggered.
Title	CAP triggered by Point
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	Adjacent ATCO having a verbal coordination about a flight should both be aware of it.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0085**
Requirement	Any ATSU shall be able to initiate a Point session to any first sector (i.e. in contact with the boundary) of each of its neighbour ATSUs.
Title	Point in Full IOP
Status	<In Progress>
Maturity Level	Full IOP – m3
Rationale	In Full IOP, there's a need to enlarge the Point functionality to more actors than adjacents ATSUs. It could be an FDC (whose Area of Responsability is crossed) or an FDU (whose Area of Interest is crossed) which are in the distribution list as well as other ATSUs who either : • subscribe to the FO distribution list or are added to the FO distribution list by another ATSU (in order to point a flight for instance).
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0086**
Requirement	The Point functionality shall be available between any ATSUs, crossed or not.
Title	Maximum Point functionality
Status	<In Progress>
Maturity Level	Full IOP – m3

Rationale	In final step of IOP development, the Point functionality should be available between any IOP partners.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

4.3.1.13 Negotiation

The following requirements provide a stepwise development of the negotiation tool.

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0087**
Requirement	Negotiations through electronic dialogues between two successive ATSUs shall be available in SAP, CAP, NP and even after the assumption.
Title	Negotiations availability
Status	<In Progress>
Maturity Level	Basic IOP – m2
Rationale	The negotiation capability should not depend on the coordination phases or transfer of frequency.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0088**
Requirement	The initiator of a negotiation shall define the ATSU to which the negotiation is directed.
Title	Negotiation partner
Status	<In Progress>
Maturity Level	Basic IOP – m2
Rationale	To get an answer to a proposal, it is needed to define the partner(s) involved.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0089**
Requirement	Any ATSU involved in a negotiation shall be able to accept, reject or modify it (counterproposal).
Title	Answer to a negotiation
Status	<In Progress>
Maturity Level	Basic IOP – m2
Rationale	Electronic dialogues should be able to model current negotiation by phone, which can be accepted, rejected, or modified.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0090**
Requirement	A proposal rejection by any of the involved partners shall end the negotiation process.
Title	Negotiation rejection
Status	<In progress>
Maturity Level	Basic IOP – m2
Rationale	In case of multiple partners involved in a negotiation, the negotiation should be stopped as soon as one of them disagrees.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0098**
Requirement	The acceptance of a proposal shall end the negotiation process.
Title	Negotiation approval
Status	<In progress>
Maturity Level	Basic IOP – m2
Rationale	An approved negotiation should be applied to the flight.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0091**
Requirement	Upstream & downstream ATCO shall be able to negotiate (initiate & answer) TFL, SFL and 4D Trajectory.
Title	Negotiation in Basic IOP
Status	<In progress>
Maturity Level	Basic IOP – m2
Rationale	Description of the needed negotiable items in Basic IOP.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0092**
Requirement	Upstream & downstream ATCO shall be able to negotiate (initiate & answer) a Coordinated heading.
Title	Negotiation in Intermediate IOP
Status	<In progress>
Maturity Level	Intermediate IOP – m2
Rationale	Description of the needed negotiable items in Intermediate IOP.
Category	<Interoperability>

Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0093**
Requirement	Upstream & downstream ATCO shall be able to negotiate (initiate & answer) a fixed, minimum, maximum speed or rate (of climb or descent).
Title	Negotiation in Full IOP
Status	<In progress>
Maturity Level	Full IOP – m2
Rationale	Description of the needed negotiable items in Full IOP.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0094**
Requirement	Negotiations shall be possible between more than two successive ATSU.
Title	Negotiation between multiple parnters
Status	<In Progress>
Maturity Level	Full IOP – m2
Rationale	There's a need in Full IOP to involve more than two partners in a negotiation.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-COTR.**0095**
Requirement	Negotiations shall be able to include a third party ATSU (not in the control sequence).
Title	Third party in negotiation
Status	<In Progress>
Maturity Level	Full IOP – m2
Rationale	There's a need in Full IOP to involve a non-crossed partners in a negotiation.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

4.3.2 Management of FO Flight Script

This section captures the outcome of the work performed for feature 2 in terms of operational requirements, it captures only requirements that have been discussed and agreed at feature working level[20].

4.3.2.1 General concept

For better clarity, the following requirements are using some terms commonly used from a technical perspective. The following terms shall be understood with the definition provided in the technical requirements of the Management of FO Flight Script:

Expanded route,

Flight script,

Constraint.

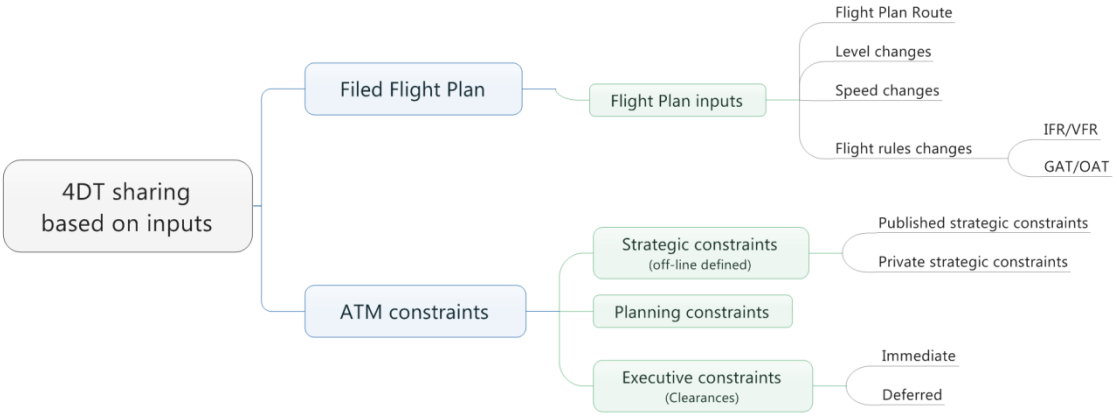


Figure 17: 4DT Sharing Based On Inputs

In the requirements below the following definitions apply:

- IOP trajectory is the 4D trajectory calculated by the FDMP and shared in the FO
- Planned trajectory is derived from the flight script by each local system

The following requirements are from the Feature 2 Deliverable [20].

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0001
Requirement	IOP partners involved in the management of a flight shall share the data needed to build similar 4 dimension trajectories which predicts the lateral route, the vertical position of the aircraft along the route and the time at which it will overfly each point of the route.
Title	4 Dimension Trajectory
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	IOP stakeholders shall share a flight script containing all the constraints needed to build internal consistent trajectories.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0002
Requirement	The IOP trajectory prediction shall be based on the use of all the lateral, vertical and longitudinal constraints that are known by the IOP partners.
Title	IOP Trajectory Prediction
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	The prediction will use all available information
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0095
Requirement	Any IOP partner shall be able to modify, add or remove multiple constraints at the same time.
Title	Multiple Constraints
Status	<In Progress>
Maturity Level	Intermediate IOP – m3
Rationale	The modification makes sense with all the constraints considered together.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0096
Requirement	Updates to the FO shall not disturb the ATCO until the information is stable
Title	Stability
Status	<In Progress>
Maturity Level	Intermediate IOP – m1
Rationale	The operational aim is to avoid disturbing the ATCO with unstable information. To avoid intermediate updates caused by other IOP partners.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-OPS-FSMG.0098
Requirement	The requester of a constraint shall define the owner of the constraint
Title	Ownership
Status	<In Progress>
Maturity Level	Basic IOP – m1

Rationale	When the constraint is not created by the owner the requestor must assign an owner.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-OPS-FSMG.0099
Requirement	The owner of the constraint shall define the eligibility of the IOP partners to modify/delete their constraint
Title	Defining of eligibility
Status	<In Progress>
Maturity Level	Basic IOP – m1
Rationale	There is a need to limit the access to changing constraints, for example a coordination partner will set a TFL and become the owner, the other coordination partner will be eligible to modify the TFL
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-OPS-FSMG.0100
Requirement	The unit controlling the flight shall become eligible to modify/delete all upstream constraints
Title	Controlling ATSU eligibility
Status	<In Progress>
Maturity Level	Basic IOP – m1
Rationale	The ATSU controlling the flight needs to be able to modify upstream constraints
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

4.3.2.2 Creation of the list of constraints

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0004
Requirement	The creation of the 2D part of the planned trajectory (called expanded route) shall be based on the filed flight plan route.
Title	Expanded Route
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	The filed flight plan is the basis for the route
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0005
Requirement	The expanded route shall be enriched with every described point of the SID and every described point of the STAR.
Title	SID/STAR
Status	<In Progress>
Maturity Level	Intermediate IOP – m2
Rationale	The shared information will encompass the departure and arrival phases
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0006
Requirement	The expanded route shall be enriched with every described point of the approach procedure.
Title	Approach
Status	<In Progress>
Maturity Level	Full IOP – m2
Rationale	The shared information will encompass the arrival phase
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0089
Requirement	In case of missed approach, the expanded route shall be amended with a route amendment containing every described points of the missed approach procedure.
Title	Approach
Status	<In Progress>
Maturity Level	Full IOP – m2
Rationale	The shared information will encompass the missed approach phase if applicable
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0007
Requirement	The Flight Object shall encompass the description of the surface movements.

Title	Surface Movement
Status	<In Progress>
Maturity Level	Full IOP – m1
Rationale	Surface movement will be included in the shared information if available (taxiing and apron movements)
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0009
Requirement	Any change of level, speed, or flight rules/type inserted into the filed flight plan by the airspace user shall be integrated in the flight script.
Title	Changes in the Flight Plan
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	User requirements will be shared
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0092
Requirement	When integrated in the flight script, every cruise level change extracted from the filed flight Plan shall be converted into an En-Route Cruise Level (ECL) constraint.
Title	Changes in the Flight Plan
Status	<In Progress>
Maturity Level	Basic IOP – m1
Rationale	ECLs will reflect the vertical changes requested by the user
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0094
Requirement	When integrated in the flight script, every cruise speed change extracted from the filed flight Plan shall be converted into an En-Route Cruise Speed (ECS) constraint.
Title	Changes in the Flight Plan
Status	<In Progress>
Maturity Level	Intermediate IOP – m2
Rationale	ECSs will reflect the speed changes requested by the user
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0010
Requirement	Every authorised IOP partner shall add to the flight script any strategic, planning & executive constraint applicable to this flight, that were not already included.
Title	Addition of Constraints
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	This includes SID, STAR, approach and missed approach procedures. In this requirement, an authorised IOP partner is: • An IOP partner whose AoR is crossed for strategic and planning constraints, • Only controlling IOP partner for executive constraints, • Expected controlling IOP partner for planning constraints.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0085
Requirement	When eligible, the Network Manager shall add to the flight script of a flight any strategic or planning constraint applicable to this flight.
Title	NM Addition of Constraints
Status	<In Progress>
Maturity Level	Intermediate IOP – m1
Rationale	NM requirements will be included in the shared information
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0011
Requirement	Every IOP partner entering the System Awareness Phase shall share any known published constraints applicable to the corresponding flight
Title	Published Constraints
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	When the information is received by a partner they will complement it with published constraints not already included
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0012

Requirement	Every IOP partner entering the System Awareness Phase shall share any of their own private constraints that are applicable to the corresponding flight.
Title	Private Constraints
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	When the information is received by a partner they will complement it with their own constraints
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

4.3.2.3 Type of constraints

4.3.2.3.1 Lateral Constraints

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0008
Requirement	The expanded route shall be updated every time a lateral constraint applies to it.
Title	Expanded Route Update
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	Lateral constrains will be added to the route
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

4.3.2.3.2 Level constraints

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0087
Requirement	Any level change or restriction defined in the SID or STAR description shall be integrated into the list of constraints.
Title	Departure/Arrival Levels
Status	<In Progress>
Maturity Level	Intermediate IOP – m2
Rationale	Level constraints will be shared
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0017

Requirement	When an IOP partner shares a level constraint, it shall define how to be compliant with the constraint from among the following solutions: • To be strictly at the defined level, • To be at or above the defined level, • To be at or below the defined level, • To be between two levels.
Title	Level constraint description
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	Level constraints will include a description of how they should be implemented
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

4.3.2.3.3 Speed constraints

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0019
Requirement	When an IOP partner shares a speed constraint, it shall define how to be compliant with the constraint among the following solutions: • To be strictly at the defined speed, • To be at the defined speed or greater, • To be at the defined speed or less. • To remain in a speed band (between a minimum and a maximum speed)*, • To fly at the minimum speed (lowest)*, • To fly at the maximum speed (highest)*.
Title	Speed constraint description
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	Speed constraints will include a description of how they should be implemented. (*): these functionalities will be considered as deployable IOP functionalities.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

4.3.2.3.4 Rate constraints

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0086
Requirement	When an IOP partner shares a rate constraint, it shall define: • A specific assigned rate of climb or descent, or • A maximum rate of climb or descent (at or less), or • A minimum rate of climb or descent (at or greater), or • An instruction to fly at the highest possible rate of climb or descent (expedite)*.
Title	Rate of Climb/Descent

Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	Vertical rate constraints will include a description of how they should be implemented. (*): This functionality will be considered as Full IOP functionality
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

4.3.2.3.5 Gradient

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0088
Requirement	When an IOP partner shares a gradient constraint, it shall define: • A maximum gradient to respect (at or less), or • A minimum gradient to respect (at or greater).
Title	Gradient
Status	<In Progress>
Maturity Level	Intermediate IOP – m2
Rationale	Most of the SIDs are defined with a gradient which, compared to the rate of climb, do not depend on the speed of the aircraft.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

4.3.2.3.6 Time constraints

Time constraints are always planning or executive constraints (no strategic time constraint).
A time constraint can be open or closed. A TTA/TTO is open (execution phase), a CTA/CTO is open until transmitted to the pilot and acknowledged, a CTA/CTO is closed when the pilot committed to respect a CTA/CTO.
A CTOT is considered as a closed constraint.

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0021
Requirement	An IOP partner who shares a time constraint shall define its type among the following types: • Calculated Take-off Time (CTOT) • Calculated Time of Arrival (CTA) • Calculated Time Over (CTO) • Target Time of Arrival (TTA) • Target Time Over (TTO)
Title	Time Constraints
Status	<In Progress>
Maturity Level	Intermediate IOP – m1
Rationale	Time constraints will include a description of how they should be implemented
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0044
Requirement	An IOP partner shall be able to handle several planning time constraints.
Title	Multiple Time Constraints
Status	<In Progress>
Maturity Level	Full IOP – m1
Rationale	In the ground system, more than one time constraint can exist at the same time
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0022
Requirement	When accepted by the flight crew CTA or a CTO shall be taken in to account in the trajectory.
Title	CTA/O
Status	<In Progress>
Maturity Level	Intermediate IOP – m1
Rationale	Before acceptance the CTA/CTO will be considered as an open constraint.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0023
Requirement	For flights in the execution phase (post-departure), the target times shall be shared as open constraints (i.e. time constraints which do not model the trajectory)
Title	TTA/O
Status	<In Progress>
Maturity Level	Intermediate IOP – m1
Rationale	Target times are considered as information only
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-OPS-FSMG.0042
Requirement	A time constraint shall encompass all the following items: • A point of the expanded route where the constraint has to be

	respected, • A time to be respected • A qualifier on the way the time restriction has to be respected ([at], [at or later], [at or before]. Optionally, a duration in case of time interval to be respected can be added.
Title	Time constraint
Status	<In Progress>
Maturity Level	Intermediate IOP – m1
Rationale	Time constraints will include a description of how they should be implemented
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0053
Requirement	An IOP partner shall be able to share a holding constraint providing: • A holding entry point defined on the expanded route, • And optionally: o A holding level, o A holding exit point o An expected exit time o A holding exit level
Title	Hold
Status	<In Progress>
Maturity Level	Intermediate IOP – m3
Rationale	Holding constraints will include a description of how they should be implemented
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0091
Requirement	An IOP partner shall be able to share a stay constraint providing: • A stay identification, • A start point defined on the route, • A duration, • And an end point defined on the route.
Title	Stay
Status	<In Progress>
Maturity Level	Intermediate – m3
Rationale	Stay constraints will include a description of how they should be implemented
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

4.3.2.3.7 Flight Rules

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0025
Requirement	Any modification or addition to the planned changes from Visual Flight Rules to Instrument Flight Rules and vice-versa shall be integrated into the flight script and defined as a point where the change occurs.
Title	Flight Rules
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	Changes to flight rules will be shared
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0026
Requirement	Any modification or addition to the planned changes from General Air Traffic to Operational Air Traffic and vice-versa shall be integrated into the flight script and defined as a point where the change occurs.
Title	Flight Type
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	Changes to flight type will be shared
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

4.3.2.3.8 Clearances

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0027
Requirement	It shall be possible to share every clearance entered into the system, including a cancellation of a clearance, among the IOP partners.
Title	Sharing Clearances
Status	<In Progress>
Maturity Level	Full IOP – m3
Rationale	Clearances and their cancelation will be shared
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0029

Requirement	The clearance issued to the flight crew shall apply from the current position of the aircraft unless the clearance is deferred.
Title	Application Point of a clearance
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	The clearance will start from the current position unless otherwise stated
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0030
Requirement	An IOP partner shall be able to share a deferred clearance when they provide the parameters to calculate the position on the route where it will start to be applicable.
Title	Deferred Clearance
Status	<In Progress>
Maturity Level	Full IOP – m2
Rationale	The partners can provide a position where clearances are applied from
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0031
Requirement	When an IOP partner shares a deferred clearance, the parameters to calculate the position on the route where the clearance will start to be applicable shall be one of the following: • A specific point on the route, • A point of the route defined by an absolute time, • A point of the route defined by a level.
Title	Start of Deferred Clearance
Status	<In Progress>
Maturity Level	Full IOP – m2
Rationale	In this context, a “specific” point is defined as an existing point of the expanded route, or a latitude/longitude on the expanded route, or a distance from an existing point of the expanded route.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0032
Requirement	In case of deferred clearance, the previous clearance of the same type (CFL, level, speed, rate, heading, offset or route) shall remain valid until the point of the expanded route where the deferred clearance applies.

Title	Validity of Previous Clearances
Status	<In Progress>
Maturity Level	Full IOP – m1
Rationale	Previous clearances are still valid up till a route diverges
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0034
Requirement	The following clearances shall be shared with the IOP partners when they are immediately applicable: • Cleared Flight Level (CFL) • Heading instruction • Specific speed instruction ([at])
Title	Shared Clearance in basic IOP
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	IOP partners need to know what clearances have been given to a flight
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0035
Requirement	The following clearances shall be shared with the IOP partners when they are immediately applicable: • Speed instruction with the qualifier [at], [at or less], [at or greater] • Rate of climb/descent instruction with the qualifier [at], [at or less], [at or greater] • To respect a time restriction over the initial approach fix • Holding • Stay
Title	Shared clearances in Intermediate IOP
Status	<In Progress>
Maturity Level	Intermediate IOP – m3
Rationale	IOP partners need to know what clearances have been given to a flight
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0037
Requirement	In case of cleared level block, the controlling IOP partner shall share the minimum and maximum levels defining the range of levels the pilot is cleared to evolve into.

Title	Level Block
Status	<In Progress>
Maturity Level	Intermediate IOP – m3
Rationale	If requested a level block can be cleared
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0038
Requirement	The controlling IOP partner shall share any additional vertical constraint associated to the vertical clearance (CFL).
Title	Additional Vertical Information
Status	<In Progress>
Maturity Level	Intermediate IOP – m3
Rationale	An additional vertical constraint associated to the vertical clearance (CFL) is defined as a level the flight crew must be [at], [at or above], [at or below], and the parameters to calculate the point of the expanded route where the constraint applies.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0046
Requirement	An IOP partner shall be able to modify the route of the planned trajectory when a direct course is entered.
Title	Direct
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	A partner can enter direct as a planning or executive constraint
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0047
Requirement	An IOP partner shall be able to modify the route of the planned trajectory when a route amendment is entered.
Title	Route amendment
Status	<In Progress>
Maturity Level	Intermediate IOP – m3
Rationale	In this requirement, Route amendment implies more complex route change than a direct. A partner can enter a change to the route as a planning or executive constraint
Category	<Interoperability>

Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0048
Requirement	An IOP partner modifying the route of the planned trajectory shall indicate: • the point of the initial route where the deviation will start, • the point of the initial route where the deviation will end (re-join), • the potential points defining the new route between these two points.
Title	Route Modification
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	Route constraints will include a description of how they should be implemented
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0049
Requirement	An IOP partner shall be able to share a vectoring clearance providing the following parameters: • The start point on the expanded route where the heading is applicable (point of divergence), • The type of vectoring (heading or track), • The heading value or track value to fly, • The direction of the turn (to the right or to the left), • Optionally, in case of closed heading clearance, the resume segment.
Title	Heading
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	Heading constraints will include a description of how they should be implemented
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0050
Requirement	When an IOP partner shares a closed vectoring clearance, it shall define the resume segment with: • the point where the aircraft is supposed to resume navigation, • the point of the route towards which the aircraft will resume navigation.

Title	Closed Vector
Status	<In Progress>
Maturity Level	Full IOP – m3
Rationale	A closed heading needs to include the closing conditions
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0051
Requirement	An IOP partner shall be able to share an offset providing the following parameters: • The start point on the expanded route where the offset will start to be applicable (point of divergence), • The side of the offset (right or left of the trajectory), • The offset lateral distance, • Optionally, the re-join point where the offset is no longer applicable and where the aircraft re-join the nominal expanded route.
Title	Offset
Status	<In Progress>
Maturity Level	Full IOP – m2
Rationale	Offset constraints will include a description of how they should be implemented
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

4.3.2.3.9 Coordinations

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0055
Requirement	If any of the following coordinated data between adjacent IOP partners has a potential impact on the trajectory, it shall be associated to a constraint: • Transfer flight level (TFL) • Supplementary flight level (SFL) • Speed restriction (minimum, maximum, fixed) • Direct • Heading • Rate of climb or descent restriction (fixed, minimum, maximum, best)* • Offset*
Title	Coordination Data Constraints
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	Coordination data derived from the trajectory having no impact on it need not be associated to a constraint in the flight script. Coordination data having a potential impact on the trajectory is derived from LoA or manual input. (*): This functionality will be considered as Full IOP functionality
Category	<Interoperability>

Validation Method	
Verification Method	Coordination data derived from the trajectory having no impact on it need not be associated to a constraint in the flight script. Coordination data having a potential impact on the trajectory is derived from LoA or manual input. (*): This functionality will be considered as Full IOP functionality

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0056
Requirement	In the absence of a relevant point the Target Start Point of a constraint related to a coordination data shall be at the boundary between the two IOP partners.
Title	Default relevant point of a coordination data
Status	<In Progress>
Maturity Level	Basic IOP – m2
Rationale	The relevant point could be defined through a LoA or manually. See REQ-OPS-FSMG.0055 for the list of applicable constraints
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

4.3.2.4 Application of a constraint

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0060
Requirement	An IOP partner sharing a constraint shall provide at least one of the following points: • The point where the flight starts to evolve to respect the constraint [Application point], • The point where the flight respects the constraint [Target Start Point or TSP], • The point up to where the flight respects the constraint [Target End Point or TEP], And indicate for each of them if it is relevant
Title	Relevant Point
Status	<In Progress>
Maturity Level	Basic IOP – m2
Rationale	From a technical point of view, “relevant” means that any trajectory computation shall consider the point as binding unless deemed incompatible with (an)other binding constraint(s). Computed values for the non-relevant points are optional.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0090

Requirement	An eligible IOP partner shall be able to modify the relevant point of a constraint.
Title	Relevant Point update
Status	<In Progress>
Maturity Level	Basic IOP – m1
Rationale	If necessary the relevant point may need to be changed, the eligibly rules need to allow this
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

Some constraints are needed in the flight script because the IOP partners want to share these data (e.g. coordination data or clearances given to the flight crew). However, according to the phase of flight, some of these constraints might not be used to model the planned trajectory because of assumptions on ATCOs' behaviour. Examples of commonly agreed assumptions:

- The Transfer Flight Level between two layered IOP partners (Ceiling TFL) will not have an impact on the trajectory of an aircraft in the climb phase as ATCOs will anticipate the frequency change to avoid any useless level-off.
- An intermediate Cleared Flight Level issued to a climbing aircraft will most of the time be superseded by a higher level clearance before the level-off.

The IOP partner adding the constraint shall then specify his assumption, i.e. whether this constraint shall model the trajectory ("closed constraint") or not ("open constraint").

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0061
Requirement	An IOP partner sharing a constraint shall indicate if this constraint must be used to model the trajectory (closed constraint) or not (open constraint).
Title	Open and Closed Constraints
Status	<In Progress>
Maturity Level	Basic IOP – m2
Rationale	Additional information regarding open or closed constraints needs to be shared
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0062
Requirement	An eligible IOP partner shall be able to change a constraint from open to closed and vice-versa.
Title	Modifying Open or Closed
Status	<In Progress>
Maturity Level	Basic IOP – m2
Rationale	For example: an open TFL (for ceiling transfer) can be switched to a closed TFL (for wall transfer) and vice-versa.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0063
Requirement	Constraints that are not implemented shall be shared with an indication that they have not been implemented in the IOP trajectory.
Title	Not-Applied Indication
Status	<In Progress>
Maturity Level	Basic IOP – m2
Rationale	The indication will explain if the constraint was rejected or if it was unable to be implemented
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0064
Requirement	A constraint shall be shared until an eligible IOP partner removes it.
Title	Constraint removal
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	Only eligible partners can remove constraints
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0070
Requirement	An eligible IOP partner shall be able to set a published constraint to active/inactive per individual flight.
Title	Deactivation and reactivation of Constraints
Status	<In Progress>
Maturity Level	Intermediate IOP – m3
Rationale	Only eligible partners can deactivate/reactivate a constraints
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0071
Requirement	A published constraint no longer applicable for one flight shall be set to inactive (i.e. kept in its list of constraints with an inactive indication).
Title	Deactivation
Status	<In Progress>
Maturity Level	Intermediate IOP – m3

Rationale	Strategic constraints shall not be removed from the flight script to avoid them being added again.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

4.3.2.5 Constraint propagation

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0065
Requirement	An En-route Cruise Level (ECL) change shall be propagated through downstream IOP partners' AoR until it meets another incompatible vertical constraint in the downstream ATSU which could model the trajectory (closed vertical constraint).
Title	ECL Propagation
Status	<In Progress>
Maturity Level	Basic IOP – m1
Rationale	Propagation of ECLs needs to be known Incompatible is to be understood to mean, the ECL is not coherent with the level range of the subsequent level constraints
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0093
Requirement	An En-route Cruise Speed (ECS) change shall be propagated through downstream IOP partners' AoR until it meets another incompatible speed constraint in the downstream ATSU which could model the trajectory.
Title	ECS Propagation
Status	<In Progress>
Maturity Level	Full IOP – m1
Rationale	Propagation of ECSs needs to be known Incompatible is to be understood to mean, the ESL is not coherent with the speed range of the subsequent speed constraints
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

4.3.2.6 Constraint maintenance

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0066

Requirement	In case of route amendment, the following constraints and information shall be transferred to the new route and reassessed: • Level constraint, • Speed constraint, • Rate constraint, • Time constraint, • Protected points • Flight rules change (IFR/VFR), • Flight type change (OAT/GAT).
Title	Maintenance of Constraints
Status	<In Progress>
Maturity Level	Intermediate IOP – m2
Rationale	Constraints need to be retained on implementation of a new route
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0067
Requirement	An ATSU shall be able to indicate specific points on the expanded route that are to be transferred on the amended route.
Title	Transfer of specific points
Status	<In Progress>
Maturity Level	Intermediate IOP – m2
Rationale	This point might be part of the eligibility rules which classify the flight as belonging to a specific flow subject to defined processes. Points to be transferred are specified locally and shared.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

4.3.2.7 Diversion

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0074
Requirement	In case of diversion, an IOP partner shall be able to modify the trajectory from the current position of the aircraft or from any point of the expanded route up to the new destination.
Title	Diversion Start Point
Status	<In Progress>
Maturity Level	Intermediate IOP – m3
Rationale	Partners need to be able to input a diversion
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

4.3.2.8 Consistency check

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0028
Requirement	When the controlling IOP partner inputs a planning or executive constraint impacting the planned trajectory, it shall assess the other constraints and update them accordingly if eligible.
Title	Constraint Update
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	On entering a constraint there may be impact on existing constraints, the partners need to make this assessment
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0075
Requirement	Any update of the IOP trajectory shall be compared with the locally calculated trajectory by every IOP partner.
Title	Trajectory Comparison
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	The local trajectory should be aligned with the IOP version and vice versa, a check needs to be conducted
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0076
Requirement	In case of discrepancy between the shared constraints used to build the IOP trajectory and its local view of the constraints, an IOP partner shall be able to: • adapt its local view to match it with the planned trajectory, or • ask for a modification of the list of constraints in order to better describe the expected behaviour, or • share a desynchronisation warning and/or trigger a manual correction.
Title	Discrepancy between the constraints
Status	<In Progress>
Maturity Level	Intermediate IOP – m2
Rationale	If there is a discrepancy in the constraints the partner needs to decide how to react
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0077
Requirement	In case of discrepancy between the IOP trajectory and local calculated trajectory based on an identical list of constraints, an IOP partner shall, according to the severity of the discrepancy: • share a desynchronisation warning, • and/or trigger a manual correction.
Title	Discrepancy between the calculated trajectories
Status	<In Progress>
Maturity Level	Intermediate IOP – m2
Rationale	If there is a discrepancy in the trajectories the partner needs to decide how to react, the severity of the discrepancy is locally defined.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0078
Requirement	When an IOP partner shares a desynchronisation warning, it shall indicate the point on the route where the desynchronisation starts.
Title	Desynchronisation Start point
Status	<In Progress>
Maturity Level	Intermediate IOP – m2
Rationale	If a desynchronisation exists downstream partners need to be aware of it. The start of the desynchronisation is dependent on the local definition describing the severity of the discrepancy.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0080
Requirement	When an IOP partner intends to raise a desynchronisation warning, it shall wait for any upstream desynchronisation to be solved and assess the new situation before raising his warning.
Title	Desynchronisation sequence
Status	<In Progress>
Maturity Level	Intermediate IOP – m2
Rationale	This requirement prevents domino effect but does not intend to prevent upstream to raise an additional warning.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0081
Requirement	The list of constraints shall be updated by every IOP partner independently from any desynchronisation raised.
Title	Desynchronisation Constraints Updated
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	A desynchronisation should not block the addition, modification or deletion of constraints
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0082
Requirement	When the IOP partner who raised a desynchronisation warning considers it to be solved, it shall remove this warning.
Title	Removal of desynchronisation warning
Status	<In Progress>
Maturity Level	Intermediate IOP – m2
Rationale	It should be possible to remove the warning if it is unnecessary
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-FSMG.0083
Requirement	The addition, modification or deletion of coordination data shall remain possible for any IOP partner in case of desynchronisation.
Title	Coordination During Desynchronisation
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	A desynchronisation should not block the ability of partners to coordinate
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

4.3.3 Informative distribution between systems

The operational requirements that arose from the Analysis Team's feature 3 work were captured in the Feature 5 Deliverable [21], and are therefore presented in section 4.3.4 below.

4.3.4 Control Sequence Handling and Distribution

This section captures the outcome of the work performed for feature 5 in terms of operational requirements. This section captures only requirements that have been discussed and agreed at feature working level, and captured in the Feature 5 Deliverable [21].

Each of the above actions has an impact either on the ATSUs to whom the flight object is distributed or those who will control the flight. However as identified in the attached paper it is also possible for an ATSU who is expected to control the aircraft to be removed from the control sequence but still be physically crossed by the flight path.

It is proposed to maintain the idea of three groups of distribution to separate the ATSUs that are going to control the flights, those that are crossed and those additional ATSUs to whom the information is distributed.

- The set of CONTROLLING ATSUs, i.e. those that will control the flight, it is modified by ATSUs that are SKIPed (removed and flagged as SKIPed) and those that are DELEGATEd (added and flagged as DELEGATEd).
    - All ATSUs who will control the flight need the flight information.
- The set of ATSUs that will be CROSSED is simply the ATSUs through which the trajectory is calculated to pass.
    - All ATSUs whose airspace will be physically crossed need to be aware of the flight.
- The complementary set of ATSU who require the flight object, those which have been added due to the complimentary DISTRIBUTION.

All ATSUs who have requested of been presented with information should continue to receive it until the reasons to receive it are no longer valid.

4.3.4.1 SKIP

REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0001
Requirement	It shall be possible for an ATSU who is planned to control the flight to be SKIPed.
Title	SKIP
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	A SKIPed user indicates that the ATSU will not take the aircraft on the frequency (channel).
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0002
Requirement	It shall be possible for an ATSU to unSKIP themselves.
Title	unSKIP
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	A SKIPed user is able to revert themselves to the unSKIPed state.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0042
Requirement	A SKIPed ATSU shall still be included in the control sequence
Title	SKIP in the control sequence
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	A SKIPed user will still be retained in the control sequence
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0043
Requirement	When an ATSU is SKIPed the identifier of the SKIPed ATSU and of the ATSU replacing the SKIPed ATSU shall be shared
Title	Sharing the SKIP Data
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	An indication of the SKIP and direction of an ATSU will be distributed
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0021
Requirement	Between any two adjacent ATSUs either ATSU shall be able to propose that the downstream ATSU is SKIPed
Title	Downstream ATSU is SKIPed
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	This covers the following requests: ATSU1 proposes skipping ATSU2 and ATSU1 to manage the flight ATSU2 proposes skipping ATSU2 and ATSU1 to manage the flight
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0044
Requirement	Between any two adjacent ATSUs either ATSU shall be able to propose that the upstream ATSU is SKIPed.
Title	Upstream ATSU is SKIPed
Status	<In Progress>
Maturity Level	Intermediate IOP – m3
Rationale	This covers the following requests: ATSU1 proposes skipping ATSU1 and ATSU2 to manage the flight ATSU2 proposes skipping ATSU1 and ATSU2 to manage the flight

Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0017
Requirement	If a change of frequency input is made to the SKIPed sector the SKIP shall be cancelled.
Title	Transfer to SKIPed sector
Status	<In Progress>
Maturity Level	Intermediate IOP – m3
Rationale	If the flight is transferred to the SKIPed sector they need to be put back in the sequence At a management of the frequency level the flight is transferred between sectors, this automatically include the ATSU for an ATSU SKIP.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0045
Requirement	If a SKIPed sector assumes the flight the SKIP shall be cancelled
Title	Assume by the SKIPed Sector
Status	<In Progress>
Maturity Level	Intermediate IOP – m3
Rationale	If the flight is assumed by the SKIPed sector they need to be put back in the sequence At a management of the frequency level the flight is transferred between sectors, this automatically include the ATSU for an ATSU SKIP.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0018
Requirement	It shall be possible to perform a SKIP proposal in any phase (SAP, CAP, NP).
Title	SKIP availability
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	The SKIP can be performed in any phase
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0019
Requirement	A manual SKIP during the SAP shall trigger the CAP.
Title	SKIP forces CAP
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	If an early SKIP is performed the ATCOs need to be aware of the flight details
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0022
Requirement	Coordination data between the skipped and the controlling sectors shall remain available.
Title	Retention of Coordination Data
Status	<In Progress>
Maturity Level	Intermediate IOP – m3
Rationale	Agreed coordination data will be available in case there is a need to re-coordinate
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0046
Requirement	It shall be possible for a sector who is planned to control the flight to be SKIPed.
Title	SKIP Sector
Status	<In Progress>
Maturity Level	Intermediate IOP – m3
Rationale	A SKIPed user indicates that the sector will not take the aircraft on the frequency (channel).
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0023

Requirement	A skipped sector shall be able to undo the skip.
Title	Undo SKIP
Status	<In Progress>
Maturity Level	Intermediate IOP – m3
Rationale	The SKIP may need to be removed
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0029
Requirement	A skipped sector shall be able to initiate or take part in a negotiation.
Title	SKIP Negotiation
Status	<In Progress>
Maturity Level	Full IOP – m3
Rationale	Changes in coordination can be conducted by the skipped sector
Category	Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

4.3.4.2 DELEGATE

REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0004
Requirement	A user shall be able to delegate a portion of a flight to a third party not planned to be in the list of ATSU.
Title	Delegate
Status	<In Progress>
Maturity Level	Full IOP - m1
Rationale	The user can indicate a third party to whom the flight will be transferred for a portion of the flight. This can be for the whole of their area of responsibility or only a part.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0005
Requirement	A user who has delegated a portion of a flight to a third party Shall be able to cancel the delegation.

Title	Cancel Delegate
Status	<In Progress>
Maturity Level	Full IOP - m1
Rationale	A user needs to be able to remove the delegated state.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0030
Requirement	A user shall be able to propose a delegate an adjacent ATSU
Title	Propose a delegate
Status	<In Progress>
Maturity Level	Intermediate IOP – m1
Rationale	A user can suggest a delegation and once agreed it will be implemented
Category	< Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0031
Requirement	If the unit to whom the flight is delegated transfers the flight back to the original unit the delegate will be canceled
Title	Transfer back to original user
Status	<In Progress>
Maturity Level	Basic IOP – m1
Rationale	If the receiving sector transfers the delegation back to the original it shall be cancelled
Category	< Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0032
Requirement	The delegate proposal can be triggered in any phase (SAP, CAP, NP).
Title	DELEGATE availability
Status	<In Progress>
Maturity Level	Deployable IOP – m1
Rationale	The will be no limit on when a DELEGATE can be performed
Category	< Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0033
Requirement	If triggered during the SAP, a DELEGATE proposal shall trigger the CAP.
Title	DELEGATE forces CAP
Status	<In Progress>
Maturity Level	Deployable IOP – m1
Rationale	If an early DELEGATE is performed the ATCOs need to be aware of the flight details
Category	< Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0034
Requirement	Coordination data between the original and the delegated sectors shall remain available.
Title	Retention of Coordination Data
Status	<In Progress>
Maturity Level	Deployable IOP – m1
Rationale	Agreed coordination data will be available in case there is a need to re-coordinate
Category	< Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0035
Requirement	A sector performing the delegate shall be able to cancel the delegation
Title	Cancel delegate
Status	<In Progress>
Maturity Level	Full IOP – m1
Rationale	The delegate may need to be removed
Category	< Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0036
Requirement	The original sector performing the delegation shall be able to modify the release at any time during the skip.
Title	Delegate Release

Status	<In Progress>
Maturity Level	Full IOP – m1
Rationale	The original controlling sector needs to be able to agree new coordination data involving the entry and exit from to the delegated sector
Category	< Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0037
Requirement	The delegation shall not be reconsidered when a change in the airspace of a receiver remains into the limits of the release offered by the original sector.
Title	Collapse/decollapse
Status	<In Progress>
Maturity Level	Full IOP – m1
Rationale	When combining or splitting sectors if the coordination limits remain the same the delegation will remain, otherwise a warning is indicated to the delegated sector
Category	< Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0038
Requirement	A change in the flight data that exceeds the release offered by the delegation shall be presented and assessed by the original sector which may then either approve the change, or cancel the delegation.
Title	Request Release
Status	<In Progress>
Maturity Level	Full IOP – m1
Rationale	The receiving sector may request to change the conditions of the release
Category	< Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0039
Requirement	The original sector shall be able to initiate or take part in a negotiation .
Title	Delegate Negotiation
Status	<In Progress>
Maturity Level	Full IOP – m1
Rationale	Changes in coordination can be conducted by the original sector
Category	< Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

4.3.4.3 General Distribution Requirements

REQ]

Identifier	REQ-05.05.01-INTEROP-GENE.0001
Requirement	An IOP Partner shall share information about a flight.
Title	General sharing
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	All information will be shared between all partners
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

REQ]

Identifier	REQ-05.05.01-INTEROP-GENE.0002
Requirement	An IOP partner shall have access to any shared information about a flight.
Title	Access to shared information
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	All partners need to be able to access IOP information.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

4.3.4.4 Specific Distribution to ATSUs

4.3.4.4.1 Vicinity

[REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0006
Requirement	The ATSU shall have access to up-to-date information of the traffic traversing the AOI of its system instance.
Title	Vicinity Distribution
Status	<In progress>
Maturity Level	Basic IOP – m3
Rationale	An ATSU can receive flight information for flights which cross their AoI but not the AoR.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

4.3.4.4.2 General

[REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0007
Requirement	The ATSUs shall be able to implement bilaterally agreed rules in order to share information on specific flights which do not cross one ATSU's Area of Interest.
Title	General Distribution
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	An ATSU needs to be able to receive flight information based on bilaterally agreed rules.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

4.3.4.4.3 Duplication

[REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0008
Requirement	An ATSU `shall be able to share information on specific flights with another ATSU's sector based on off-line conditions.
Title	Duplication
Status	<In Progress>
Maturity Level	Intermediate IOP - m1
Rationale	The capability will exist to duplicate flight information to another ATSU.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

4.3.4.4.4 Subscription

[REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0009
Requirement	An ATSU shall be able to subscribe to up-to-date information for any flight for one of its operational roles.
Title	Subscribe
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	An ATSU should be able to subscribe to receive flight information.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0010
Requirement	An ATSU shall be able to un-subscribe for one of its operational roles from a given flight that it previously subscribed to.
Title	Un-subscribe
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	When information is no longer needed the subscription needs to be able to be cancelled.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

4.3.4.4.5 Point

See Feature #1 – Coordination and Transfer.

4.3.4.5 Crossed ATSUs

[REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0011
Requirement	An ATSU whose airspace is planned to be crossed by the flight shall receive up-to-date information for that flight.
Title	Crossed ATSUs
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	ATSU whose airspace is crossed need to receive flight information.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0012
Requirement	The sequence of ATSUs that are crossed by the flight shall be updated to be in line with the changes of the flight's trajectory.
Title	Change of crossed ATSU
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	A controlling ATSU can change the sequence of ATSUs who will be physically crossed by the flight by modifying the route. There can be multiple entries due to re-entrant flights.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

4.3.4.6 Controlling ATSUs

[REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0014
Requirement	An ATSU who is planned to control a flight shall receive up-to-date information for that flight.
Title	Controlling ATSUs
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	ATSUs who will control the flight must have flight information.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0040
Requirement	The sequence of controlling ATSUs shall be derived from the sequence of crossed ATSUs.
Title	Sequence of controlling ATSUs
Status	<In Progress>
Maturity Level	Basic IOP – m2
Rationale	The crossed ATSUs are the sequence for the distribution to the controlling ATSUs enhanced by SKIP, DELEGATE and known rules
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0015
Requirement	An ATSU in the control sequence shall be able to change its next ATSU who will be in the sequence.
Title	Change of Next Controlling ATSU
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	A controlling ATSU can change the sequence of ATSUs who will control the flight. by using SKIP/DELEGATE.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

REQ]

Identifier	REQ-05.05.01-INTEROP-SEQM.0041
Requirement	An ATSU in the control sequence shall be able to change the downstrteam sequence of controlling ATSUs based on Letters of Agreement
Title	Change to Controlling ATSU Sequence
Status	<In Progress>

Maturity Level	Full IOP - m1
Rationale	Controlling ATSUs are able to change the downstream sequence of controlling ATSUs
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

4.3.5 SSR Code Management

[REQ]

Identifier	REQ-05.05.01-INTEROP-SSRC.0001
Requirement	The ATSU controlling the flight shall be the unique ATSU allowed to modify and share the ASSR in the FO
Title	ASSR Code modifying and sharing
Status	<In Progress>
Maturity Level	Basic-IOP – m3
Rationale	This requirement is needed to prevent that every ATSU can change ASSR Code value in IOP environment
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-SSRC.0002
Requirement	The ATSU controlling the flight shall be the unique ATSU allowed to modify and share the NSSR in the FO
Title	NSSR Code modifying and sharing
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	.This requirement is needed to prevent that every ATSU can change NSSR Code value in IOP environment
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-SSRC.0003
Requirement	The ATSU controlling the flight shall be the unique ATSU allowed to modify and share the CSSR in the FO

Title	CSSR Code modifying and sharing
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	.This requirement is needed to prevent that every ATSU can change CSSR Code value in IOP environment
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-SSRC.0004
Requirement	ATSUs shall be able to modify and share their DSSR code
Title	DSSR Code modifying and sharing
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	This requirement is needed to prevent that every ATSU can change any DSSR Code value in IOP environment. Downstream SSR codes, if available, will be shared.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-SSRC.0005
Requirement	ATSUs shall be able to indicate if they require the upstream unit to assign their downstream SSR (DSSR)
Title	DSSR request and assignment
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	The code intended to be instructed to the aircraft to squawk before exiting your AoR. Normally on request of a downstream partner to enable early correlation
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-SSRC.0006
Requirement	ATSUs shall be able to request a code from a partner if bilaterally agreed
Title	Request Code
Status	<In Progress>

Maturity Level	Basic IOP – m3
Rationale	An upstream unit will be able to request a code from a downstream partner.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-SSRC.0007
Requirement	ATSUs shall be able to provide requesting units with a code if requested
Title	Supply Code
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	A downstream unit will be able to provide an upstream unit with a code following a request.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-SSRC.0008
Requirement	ATSUs shall be able to share the Mode S Flight ID
Title	Mode S Flight ID
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	For identification the Mode S flight ID (call-sign received in Mode S data) will be shared even if different from the Flight Plan ID.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-SSRC.0009
Requirement	The controlling ATSU shall change and share the CSSR as soon as it detect from the track and is able to link the track with the flight plan
Title	Linkage between CSSR and Flight Plan
Status	<In Progress>
Maturity Level	Basic IOP – m3
Rationale	This requirement prevent to share every code (also erroneous) received
Category	<Interoperability>
Validation Method	

Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

4.4 Requirements for Air-Ground Trajectory Management

The requirements presented in this section are carried forward from the previous version of the TMF INTEROP (D823 [6]). These topics were not addressed by the Analysis team in 2016, and as such these requirements have not been assessed with respect to the output of the IOP Analysis Team in 2016. These requirements are not assigned to specific deployment phases (Basic, Intermediate, Full).

4.4.1 Synchronize Air/Ground Trajectory

Synchronize Air/Ground Trajectory is a new process defined under SESAR step 1 whereby trajectory information is provided by the aircraft to ATSU during flight execution.

The following table describes the information subsequently referenced in the synchronize air/ground trajectory requirements.

Information Element	Description
Speed Schedule Profile	Nominal (and optional minimum and maximum) values for the climb, cruise, and descent phases of flight. For climb and descent, this typically consists of a constant IAS, constant Mach pair. The altitude where the IAS and Mach are equivalent is known as the crossover altitude. Below the crossover altitude the IAS portion of the speed schedule is the controlling speed parameter and above the crossover altitude the Mach portion is the controlling speed.
Aircraft Mass	The aircraft gross mass at a point in time
Guidance Mode Indicator	An indication of whether the aircraft guidance system is engaged against the lateral, vertical and speed elements of the FMS trajectory
Consistency Check Indicator	An indication of whether the route information held by the aircraft and ground is consistent within defined tolerances

Table 4: Aircraft View and Air/Ground Synchronization Information Elements

[REQ]

Identifier	REQ-05.05.01-INTEROP-F060-0010
Requirement	An ATSU shall be able to receive from the aircraft, on request, the current view of its planned trajectory, including: - EPP, - Speed Schedule Profile.
Title	Aircraft View of Planned Trajectory
Status	<In Progress>

Rationale	Trajectory information received from the aircraft via datalink can be used to improve ATS operations. The sequence of points (and associated constraints) is required by the ground as part of consistency checks prior to operations which require synchronization between air and ground (such as CTA operations). Associated estimates from the aircraft view may be useful to downstream DCB and traffic synchronisation functions (subject to satisfactory consistency between air and ground in the flight intent). Guidance mode indicators can also be used to assess the validity of the estimate information. Mass and speed schedule information are fundamental inputs to many trajectory prediction models and as such can be used by the ground to improve the ground TP where applicable. The information described above in this rationale is contained within the "EPP" and "Speed Schedule Profile" of an ADS-C data report (for ATN B2). The specific version of the ATN B2 interop on which this requirement is based is defined in §4 References.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-05.06.01-OSED-SG02.0100	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-05.06.01-OSED-SG02.0200	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.3085	<Full>
<ALLOCATED_TO>	<Functional block>	Air-Ground Datalink Communications (AGDC)	N/A
<ALLOCATED TO>	<Functional block>	Air-Ground Datalink Services (AGDS)	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-F060-0020
Requirement	An ATSU shall establish the ADS contract with the aircraft to receive the current view of its planned trajectory: - after reception of the Logon Parameters from the Logon Forward process, or - after the CM-Logon datalink service has completed.
Title	Obtain Aircraft View of Planned Trajectory
Status	<In Progress>
Rationale	Trajectory information from the aircraft can be used to improve ATS operations. Note: a period of overlap can be expected when both C-ATSU (as the transferring unit) and R-ATSU (the next downstream unit) have ADS contracts established for provision of EPP. The R-ATSU is expected to initiate its contract at some parameter time/distance from the boundary, as typically defined in LOA for the Logon Forward process.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ]

Identifier	REQ-05.05.01-INTEROP-F060-0030
Requirement	An ATSU shall share with Flight Object partners the aircraft's current view of its planned trajectory upon downlinking of a new report containing the information.
Title	Share Aircraft View of Planned Trajectory

Status	<In Progress>
Rationale	The aircraft view needs to be made accessible to other interested stakeholders (both ATS units and NM) so that the air and ground trajectories can be synchronized to support CTA operations and so that other ground stakeholders can take advantage of the information to improve their trajectory prediction or other functions that use trajectory information.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-05.06.01-OSED-SG03.0100	<Full>
<ALLOCATED_TO>	<Functional block>	Air-Ground Datalink Communications (AGDC)	N/A
<ALLOCATED TO>	<Functional block>	Air-Ground Datalink Services (AGDS)	N/A
<ALLOCATED TO>	<Functional block>	Trajectory Prediction & Mgt (TP&M)	N/A

[REQ]

Identifier	REQ-05.05.01-INTEROP-F060-0100
Requirement	The C-ATSU shall be able to send via datalink to the aircraft level constraint information associated to waypoint(s) in the climb and descent portions of the route.
Title	Provide Level Constraints to Aircraft
Status	<In Progress>
Rationale	A synchronized view between air and ground is desirable for some ATS operations, such as flying to a CTA. NOTE: The following explanatory note is from Thales Avionics: *In current and expected step 1 FMS implementations, use of Alt/Level constraints if used in the aircraft's cruise segment (a/c calculated TOC to a/c calculated TOD) may be ignored or may create unexpected flight profile geometries, depending upon implementation; thus vertical flight profiles will become sub-optimal. For FL allocations associated to a waypoint, the FMS uses a STEP feature (distinct from the Alt/Level constraint). However, the Route Clearance structure does not have the relevant fields for this.*
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-05.06.01-OSED-SG03.0100	<Full>
<ALLOCATED_TO>	<Functional block>	Air-Ground Datalink Communications (AGDC)	N/A
<ALLOCATED TO>	<Functional block>	Air-Ground Datalink Services (AGDS)	N/A
<ALLOCATED TO>	<Functional block>	Trajectory Prediction & Mgt (TP&M)	N/A

Identifier	REQ-05.05.01-INTEROP-F060-0105
Requirement	The C-ATSU shall be able to provide to the aircraft the ATC planned level information associated to waypoint(s) in the cruise sections of the route.
Title	Provide ATC Level Information to Aircraft
Status	<In Progress>
Rationale	A synchronized view between air and ground is desirable for some ATS operations, such as flying to a CTA. NOTE: The following explanatory note is from Thales Avionics: *In current and expected step 1 FMS implementations, use of Alt/Level constraints if used in the aircraft's cruise segment (a/c calculated TOC to a/c calculated*

	TOD) may be ignored or may create unexpected flight profile geometries, depending upon implementation; thus vertical flight profiles will become sub-optimal. For FL allocations associated to a waypoint, the FMS uses a STEP feature (distinct from the Alt/Level constraint). However, the Route Clearance structure does not have the relevant fields for this.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-05.06.01-OSED-SG03.0100	<Full>
<ALLOCATED_TO>	<Functional block>	Air-Ground Datalink Communications (AGDC)	N/A
<ALLOCATED_TO>	<Functional block>	Air-Ground Datalink Services (AGDS)	N/A
<ALLOCATED_TO>	<Functional block>	Trajectory Prediction & Mgt (TP&M)	N/A

Identifier	REQ-05.05.01-INTEROP-F060-0110
Requirement	An ATSU performing the air/ground synchronization process shall share with Flight Object partners the consistency check indication between the air and ground views of the route.
Title	Share Consistency Check Indicator
Status	<In Progress>
Rationale	Downstream ATS units may be interested in the consistency status of those ATS units which lie upstream to determine the potential validity of using the EPP information or performing some i4D operations within the AoR (e.g. suitability of EPP ETAs for AMAN, validity of requesting the ETA min/max or agreeing a CTA with the flight crew, etc.).
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-05.06.01-OSED-SG5a.0100	<Full>
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A
<ALLOCATED_TO>	<Functional block>	Air-Ground Datalink Services (AGDS)	N/A

4.4.2 Request ETA Min/Max

The following table describes the information subsequently referenced in the requirements associated to the Request ETA Min/Max process.

Information Element	Description
ETA min/max	ETA min/max provided by the aircraft identifies: - The computation time for the trajectory information - The ETA for the specified significant point - The significant point to which the ETA min/max information applies - Minimum ETA, indicating the earliest estimated time at which the aircraft could reach the associated significant point with high probability - Maximum ETA, indicating the latest estimated time at which the aircraft could reach the associated significant point with high probability

Table 5: ETA Min/Max Information Element

Identifier	REQ-05.05.01-INTEROP-F070-0010
Requirement	An ATSU shall be able to receive from the aircraft, on demand, the ETA min/max for a specified significant point.
Title	Obtain ETA Min/Max
Status	<In Progress>
Rationale	ETA min/max received from the aircraft via datalink can be used to determine a CTA which is likely to be acceptable to the flight crew. NOTE: the ED-228 standard uses the term TOArange (Time of Arrival range) for ETA min/max information
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-05.06.01-OSED-SG5a.0400	<Full>
<ALLOCATED_TO>	<Functional block>	Air-Ground Datalink Communications (AGDC)	N/A
<ALLOCATED_TO>	<Functional block>	Air-Ground Datalink Services (AGDS)	N/A
<ALLOCATED_TO>	<Functional block>	Arrival Mgt (AMAN)	N/A

Identifier	REQ-05.05.01-INTEROP-F070-0030
Requirement	The C-ATSU shall share with Flight Object partners the ETA min/max received from an aircraft for a significant point specified by a D-ATSU.
Title	Share ETA Min/Max
Status	<In Progress>
Rationale	To enable the operation if the D-ATSU does not have the necessary air/ground interoperability.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

<ALLOCATED TO>	<Functional block>	Air-Ground Datalink Services (AGDS)	N/A

4.4.3 Propose CTA

The following table describes the information subsequently referenced in the requirements associated to the Propose CTA and Cancel CTA processes.

Information Element	Description
CTA	Details of the CTA time constraint provided through an ATC instruction that is issued to a flight or provided in advance of such issue: - Identification of the significant point on which the CTA should be applied - The time (to a precision of seconds) - A tolerance indicating the accuracy with which the CTA time needs to be met
CTA Status	An indication as to whether the CTA time constraint is proposed, accepted, rejected or cancelled
CTA Cancellation	An ATC instruction that is issued to a flight to cancel a CTA

Table 6: CTA Related Information Element

[REQ]

Identifier	REQ-05.05.01-INTEROP-F080-0010
Requirement	The C-ATSU shall be provided with the CTA from the A-ATSU.
Title	Provide CTA Proposal to C-ATSU
Status	<In Progress>
Rationale	The C-ATSU will have to provide the CTA to the aircraft.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-05.06.01-OSED-SG05.0800	<Full>
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A
<ALLOCATED_TO>	<Functional block>	Trajectory Prediction & Mgt (TP&M)	N/A
<ALLOCATED_TO>	<Functional block>	CHMI Mgt	N/A

Identifier	REQ-05.05.01-INTEROP-F080-0020
Requirement	The C-ATSU shall uplink the CTA instruction to the aircraft via datalink (if operationally acceptable to the C-ATSU).
Title	Uplink CTA Instruction
Status	<In Progress>
Rationale	C-ATSU is the unit with control authority to issue clearances and instructions to the aircraft. Additionally, operations in the current controlling ATS unit may be impacted if the aircraft operates under its own speed authority, so the timing will need to be at the discretion of C-ATSU.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-05.06.01-OSED-SG06.0200	<Full>
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.3062	<Full>
<ALLOCATED_TO>	<Functional block>	Air-Ground Datalink Communications (AGDC)	N/A
<ALLOCATED_TO>	<Functional block>	Air-Ground Datalink Services (AGDS)	N/A
<ALLOCATED_TO>	<Functional block>	CHMI Mgt	N/A

Identifier	REQ-05.05.01-INTEROP-F080-0060
Requirement	The A-ATSU shall be notified if the requested CTA was rejected by the C-ATSU.
Title	Notify A-ATSU of C-ATSU CTA Rejection
Status	<In Progress>
Rationale	The A-ATSU needs to know the status of the CTA proposal.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-05.06.01-OSED-SG06.0600	<Full>
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A
<ALLOCATED_TO>	<Functional block>	Coordination & Transfer (C&T)	N/A
<ALLOCATED_TO>	<Functional block>	CHMI Mgt	N/A

Identifier	REQ-05.05.01-INTEROP-F080-0070
Requirement	The A-ATSU shall be notified by the C-ATSU of airborne acceptance, rejection or stand-by response to the CTA instruction.
Title	Notify CTA Status
Status	<In Progress>
Rationale	The A-ATSU needs to know the status of the CTA proposal.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-05.06.01-OSED-SG06.0500	<Full>
<ALLOCATED_TO>	<Functional block>	Air-Ground Datalink Communications (AGDC)	N/A
<ALLOCATED_TO>	<Functional block>	Air-Ground Datalink Services (AGDS)	N/A
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A
<ALLOCATED_TO>	<Functional block>	Coordination & Transfer (C&T)	N/A
<ALLOCATED_TO>	<Functional block>	CHMI Mgt	N/A

4.4.4 Cancel CTA

During the Execute CTA process, if it is determined that the CTA is no longer operationally required or it is recommended to revert to normal operations, the CTA constraint needs to be cancelled. By removing the constraint, the aircraft no longer has to constrain its profile in order to (try to) meet the CTA.

When the flight is currently under the jurisdiction of an upstream ATSU, the request to cancel the CTA needs to be shared. The ATSU with current control authority over the flight will need to issue the instruction to cancel the CTA to the flight crew.

[REQ]

Identifier	REQ-05.05.01-INTEROP-F080-0110
Requirement	The A-ATSU shall be able to request to the C-ATSU the cancellation of a CTA.
Title	Request CTA Cancellation
Status	<In Progress>
Rationale	The trajectory should not be constrained with a CTA if it is no longer needed.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-05.06.01-OSED-SG05.0500	<Full>
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A
<ALLOCATED_TO>	<Functional block>	Coordination & Transfer (C&T)	N/A
<ALLOCATED_TO>	<Functional block>	CHMI Mgt	N/A

Identifier	REQ-05.05.01-INTEROP-F080-0130
Requirement	The C-ATSU shall issue the CTA cancellation instruction to the aircraft (via voice or datalink).
Title	Issue CTA Cancellation Instruction
Status	<In Progress>
Rationale	The trajectory should not be constrained with a CTA if it is no longer needed.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-04.07.02-OSED-0003.2040	<Full>
<ALLOCATED_TO>	<Functional block>	Air-Ground Datalink Communications (AGDC)	N/A
<ALLOCATED_TO>	<Functional block>	Air-Ground Datalink Services (AGDS)	N/A
<ALLOCATED_TO>	<Functional block>	CHMI Mgt	N/A

Identifier	REQ-05.05.01-INTEROP-F080-0140
Requirement	The A-ATSU shall be informed by the C-ATSU once a CTA has been successfully cancelled (either by voice or datalink).
Title	Notify CTA Cancellation
Status	<In Progress>
Rationale	The A-ATSU needs to know the status of the CTA.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-05.06.01-OSED-SG08.0300	<Full>
<ALLOCATED_TO>	<Functional block>	Air-Ground Datalink Communications (AGDC)	N/A
<ALLOCATED_TO>	<Functional block>	Air-Ground Datalink Services (AGDS)	N/A
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A
<ALLOCATED_TO>	<Functional block>	Coordination & Transfer (C&T)	N/A
<ALLOCATED_TO>	<Functional block>	CHMI Mgt	N/A

4.5 Create/Update the Ground ATC View

The requirements presented in this section are carried forward from the previous version of the TMF INTEROP (D823 [6]). These topics were not addressed by the Analysis team in 2016, and as such these requirements have not been assessed with respect to the output of the IOP Analysis Team in 2016. These requirements are not assigned to specific deployment phases (Basic, Intermediate, Full).

The following table provides a description of the information that is provided to support ATS operations from NM at the end of the planning phase. These information elements are referenced by subsequent requirements.

Information Element	Description
Extended Flight Plan (EFPL)	Contains the following information, provided by the airspace user: • ICAO FPL, • 4D trajectory (output from FOC flight planning tools), • Flight performance data.
Target Time of Arrival / Target Time Over (TTA/TTO)	Target times are computed by the network management function to inform the airspace users and ATM service providers about constrained resources along the profile. The airspace user is expected to file an extended flight plan compliant with an assigned target time. Targets are linked to static tolerances (+/- 3 minutes) and can be void if not required.
Target Take-Off Time (TTOT)	The target take-off time is a key milestone for a departing flight at a CDM airport. Tower ATC at a CDM airport are responsible for maintaining the target take-off time for departures (both accuracy and timeliness of update) and publishing it to NM and other airport CDM partners. Management of the TTOT may be automated through the use of a DMAN.
Calculated Take-Off Time (CTOT)	A time calculated and issued by the Network Manager as a result of tactical slot allocation, at which the flight is expected to become airborne. In SESAR step 1, the CTOT is still used for regulated flights, but is expected to be back-calculated from the applicable TTA/TTO.

Table 7: Trajectory Information Provided by NM

[REQ]

Identifier	REQ-05.05.01-INTEROP-F110-0010
Requirement	An ATSU shall receive the following information and any updates to it prior to flight execution from the NM for flights crossing its AoI: • the extended flight plan (EFPL); • the TTA/TTO (if set by NM for the flight); • the CTOT (if set by NM for the flight); • the TTOT (if available from departure CDM airport).
Title	Obtain Planning Phase Trajectory Information from NM
Status	<In Progress>
Rationale	The high level goal for using the additional information is to improve the ATC planned trajectory, and hence the ATC tools output using it (e.g. arrival management, complexity assessment, etc.). EFPL data provides FOC information like take-off mass and climb/descent speeds which are currently estimated by ATC in trajectory prediction processes. TTA information may be used to improve current sequencing, e.g. by providing an estimate for

	when the flight will arrive which ATM partners are working to facilitate. TTOT information may also improve arrival management sequencing by providing a more accurate picture of demand prior to aircraft departure.
Category	<Interoperability>
Validation Method	
Verification Method	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-07.06.02-OSED-0005.0020	<Full>
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A
<ALLOCATED_TO>	<Functional block>	Trajectory Prediction & Mgt (TP&M)	N/A

5 References

5.1 Applicable Documents

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

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

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

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

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

[5] COMMISSION IMPLEMENTING REGULATION (EU) No 716/2014
http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=uriserv:OJ.L_.2014.190.01.0019.01.ENG

5.2 Reference Documents

The following documents were used to provide input or guidance:

[6] P04.05 D823, TMF INTEROP for step 1, Initial Release, 2015

[7] ED-78A Guidelines for Approval of the provision and use of Air Traffic Services supported by Data Communications, December 2000

[8] ICAO Document 9694, First Edition, 1999

[9] Commission Regulation (EC) No 1032/2006 of 6 July 2006 laying down requirements for automatic systems for the exchange of flight data for the purpose of notification, coordination and transfer of flights between air traffic control units

[10] P04.05, TMF Technical Note for 2014, D822, Edition 01.00.00

[11] P07.06.02, Step 1 Business Trajectory OSED 2014 Update, D38, Edition 00.03.01

[12] P05.06.01, Step 1 OSED Iteration 3, D74, Edition 01.00.00

[13] P05.06.04, Consolidated OSED, D35, Edition 02.00.00

[14] P04.07.02, OSED_3, D10, Edition 01.00.00

[15] ED-229 Interoperability Requirements Standard for Baseline 2 ATS Data Communications, Initial Release, March 2014

[16] ED-133 Flight Object Interoperability Specification, June 2009

[17] EUROCONTROL-SPEC-106, EUROCONTROL Specification for On-Line Data Interchange (OLDI), Edition 4.2, 16/12/2010

[18] P10.01.07, Technical Architecture Description – Cycle 2014, D115, Edition 00.01.01

[19] IOP Feature 1 Deliverable, Edition 01.00.03, 30/09/2016

[20] IOP Feature 2 Deliverable, Edition 00.01.02, 30/11/2016

[21] IOP Feature 5 Deliverable, Edition 00.00.06, 30/11/2016

[22] IOP Feature 8 Deliverable, Edition 00.03.00, 10/12/2016

[23] P10.02.05, IOP ATC System Requirements (Final IOP TS), D55, Edition 00.00.01

[24] Commission Regulation (EC) No 677/2011 of 7 July 2011

[25]Network Strategy Plan 2015-2019 – Ed. 22 July 2014
[26]Transition Concept Of Operations SESAR 2020" – B.4.2 D106 – 30 June 2016
[27]NM Interoperability Strategy – Ed. 1.0 12.05.2016
[28]IOP / FO Concept of use, Analysis Team, version v0.7, 28 November 2016

Appendix A Allocation of Interoperability Requirements to Deployment Packages

The requirements in Chapter 4 combine to present three coherent packages of IOP functionality:

Basic: Requirements considered necessary to be compliant to the PCP.

Intermediate IOP: Requirements considered necessary to replace the expected levels of interoperability at the time of ATM Functionality 5 full operational capability.

Full IOP: Set of requirements to further develop interoperability.

The following table maps each requirement to the three IOP packages.

It has to be considered that Basic IOP requirements shall be still valid for Intermediate IOP and Full IOP, and Intermediate IOP requirements shall be still valid for full IOP scope.

Note: requirements that have been carried forward from D823 have not been allocated to a deployment package as they have not been addressed by the analysis team.

Process	Req. ID	Basic	Intermediate	Full
SAP	REQ-05.05.01-INTEROP-COTR.**0001**	✓		
	REQ-05.05.01-INTEROP-COTR.**0002**	✓		
	REQ-05.05.01-INTEROP-COTR.**0005**	✓		
CAP	REQ-05.05.01-INTEROP-COTR.**0006**	✓		
	REQ-05.05.01-INTEROP-COTR.**0007**	✓		
	REQ-05.05.01-INTEROP-COTR.**0010**	✓		
	REQ-05.05.01-INTEROP-COTR.**0013**	✓		
	REQ-05.05.01-INTEROP-COTR.**0014**		✓	
NP	REQ-05.05.01-INTEROP-COTR.**0016**	✓		
	REQ-05.05.01-INTEROP-COTR.**0017**	✓		
	REQ-05.05.01-INTEROP-COTR.**0019**	✓		
	REQ-05.05.01-INTEROP-COTR.**0020**	✓		
	REQ-05.05.01-INTEROP-COTR.**0021**	✓		
	REQ-05.05.01-INTEROP-COTR.**0022**		✓	
Reversion to SAP	REQ-05.05.01-INTEROP-COTR.**0023**		✓	
Abrogation	REQ-05.05.01-INTEROP-COTR.**0026**	✓		
Coordination Revision	REQ-05.05.01-INTEROP-COTR.**0096**	✓		
	REQ-05.05.01-INTEROP-COTR.**0097**	✓		
	REQ-05.05.01-INTEROP-COTR.**0027**	✓		
	REQ-05.05.01-INTEROP-COTR.**0028**	✓		
	REQ-05.05.01-INTEROP-COTR.**0029**	✓		
	REQ-05.05.01-INTEROP-COTR.**0030**		✓	
	REQ-05.05.01-INTEROP-COTR.**0031**		✓	
Frequency Change	REQ-05.05.01-INTEROP-COTR.**0032**	✓		
	REQ-05.05.01-INTEROP-COTR.**0034**	✓		
	REQ-05.05.01-INTEROP-COTR.**0036**		✓	
	REQ-05.05.01-INTEROP-COTR.**0038**			✓
	REQ-05.05.01-INTEROP-COTR.**0039**			✓

ROF	REQ-05.05.01-INTEROP-COTR.**0040**	✓		
	REQ-05.05.01-INTEROP-COTR.**0041**	✓		
	REQ-05.05.01-INTEROP-COTR.**0042**	✓		
	REQ-05.05.01-INTEROP-COTR.**0043**	✓		
	REQ-05.05.01-INTEROP-COTR.**0044**		✓	
Reclaim	REQ-05.05.01-INTEROP-COTR.**0045**			✓
	REQ-05.05.01-INTEROP-COTR.**0047**			✓
	REQ-05.05.01-INTEROP-COTR.**0048**			✓
	REQ-05.05.01-INTEROP-COTR.**0049**			✓
	REQ-05.05.01-INTEROP-COTR.**0050**			✓
Force Assume	REQ-05.05.01-INTEROP-COTR.**0051**		✓	
	REQ-05.05.01-INTEROP-COTR.**0052**		✓	
	REQ-05.05.01-INTEROP-COTR.**0053**		✓	
	REQ-05.05.01-INTEROP-COTR.**0054**		✓	
	REQ-05.05.01-INTEROP-COTR.**0055**			✓
	REQ-05.05.01-INTEROP-COTR.**0056**			✓
	REQ-05.05.01-INTEROP-COTR.**0057**			✓
	REQ-05.05.01-INTEROP-COTR.**0058**			✓
	REQ-05.05.01-INTEROP-COTR.**0059**			✓
Release	REQ-05.05.01-INTEROP-COTR.**0060**			✓
	REQ-05.05.01-INTEROP-COTR.**0061**			✓
	REQ-05.05.01-INTEROP-COTR.**0062**			✓
	REQ-05.05.01-INTEROP-COTR.**0063**			✓
	REQ-05.05.01-INTEROP-COTR.**0066**			✓
	REQ-05.05.01-INTEROP-COTR.**0067**			✓
	REQ-05.05.01-INTEROP-COTR.**0068**			✓
	REQ-05.05.01-INTEROP-COTR.**0099**			✓
	REQ-05.05.01-INTEROP-COTR.**0069**			✓
	REQ-05.05.01-INTEROP-COTR.**0070**			✓
	REQ-05.05.01-INTEROP-COTR.**0071**			✓
	REQ-05.05.01-INTEROP-COTR.**0073**			✓
	REQ-05.05.01-INTEROP-COTR.**0074**			✓
Point	REQ-05.05.01-INTEROP-COTR.**0075**	✓		
	REQ-05.05.01-INTEROP-COTR.**0076**	✓		
	REQ-05.05.01-INTEROP-COTR.**0077**	✓		
	REQ-05.05.01-INTEROP-COTR.**0078**	✓		
	REQ-05.05.01-INTEROP-COTR.**0081**	✓		
	REQ-05.05.01-INTEROP-COTR.**0082**	✓		
	REQ-05.05.01-INTEROP-COTR.**0084**	✓		
	REQ-05.05.01-INTEROP-COTR.**0085**			✓
	REQ-05.05.01-INTEROP-COTR.**0086**			✓
Negotiation	REQ-05.05.01-INTEROP-COTR.**0087**	✓		
	REQ-05.05.01-INTEROP-COTR.**0088**	✓		
	REQ-05.05.01-INTEROP-COTR.**0089**	✓		

	REQ-05.05.01-INTEROP-COTR.**0090**	✓		
	REQ-05.05.01-INTEROP-COTR.**0098**	✓		
	REQ-05.05.01-INTEROP-COTR.**0091**	✓		
	REQ-05.05.01-INTEROP-COTR.**0092**		✓	
	REQ-05.05.01-INTEROP-COTR.**0093**			✓
	REQ-05.05.01-INTEROP-COTR.**0094**			✓
	REQ-05.05.01-INTEROP-COTR.**0095**			✓

Table 8: TMF Requirements Mapped to Deployment Packages (Feature 1)

Process	Req. ID	Basic	Intermediate	Full
General concept	REQ-05.05.01-INTEROP-FSMG.0001	✓		
	REQ-05.05.01-INTEROP-FSMG.0002	✓		
	REQ-05.05.01-INTEROP-FSMG.0095		✓	
	REQ-05.05.01-INTEROP-FSMG.0096		✓	
	REQ-05.05.01-INTEROP-FSMG.0098	✓		
	REQ-05.05.01-INTEROP-FSMG.0099	✓		
	REQ-05.05.01-INTEROP-FSMG.0100	✓		
Creation of constraints list	REQ-05.05.01-INTEROP-FSMG.0004	✓		
	REQ-05.05.01-INTEROP-FSMG.0005		✓	
	REQ-05.05.01-INTEROP-FSMG.0006			✓
	REQ-05.05.01-INTEROP-FSMG.0089			✓
	REQ-05.05.01-INTEROP-FSMG.0007			✓
	REQ-05.05.01-INTEROP-FSMG.0009	✓		
	REQ-05.05.01-INTEROP-FSMG.0092	✓		
	REQ-05.05.01-INTEROP-FSMG.0094		✓	
	REQ-05.05.01-INTEROP-FSMG.0010	✓		
	REQ-05.05.01-INTEROP-FSMG.0085		✓	
	REQ-05.05.01-INTEROP-FSMG.0011	✓		
	REQ-05.05.01-INTEROP-FSMG.0012	✓		
Type of constraints	REQ-05.05.01-INTEROP-FSMG.0008	✓		
	REQ-05.05.01-INTEROP-FSMG.0087		✓	
	REQ-05.05.01-INTEROP-FSMG.0017	✓		
	REQ-05.05.01-INTEROP-FSMG.0019	✓		
	REQ-05.05.01-INTEROP-FSMG.0086	✓		
	REQ-05.05.01-INTEROP-FSMG.0088		✓	
	REQ-05.05.01-INTEROP-FSMG.0021		✓	
	REQ-05.05.01-INTEROP-FSMG.0044			✓
	REQ-05.05.01-INTEROP-FSMG.0022		✓	
	REQ-05.05.01-INTEROP-FSMG.0023		✓	
	REQ-05.05.01-INTEROP-FSMG.0042		✓	
	REQ-05.05.01-INTEROP-FSMG.0053		✓	
	REQ-05.05.01-INTEROP-FSMG.0091		✓	
	REQ-05.05.01-INTEROP-FSMG.0025	✓		

Process	Req. ID	Basic	Intermediate	Full
	REQ-05.05.01-INTEROP-FSMG.0026	✓		
	REQ-05.05.01-INTEROP-FSMG.0027			✓
	REQ-05.05.01-INTEROP-FSMG.0029	✓		
	REQ-05.05.01-INTEROP-FSMG.0030			✓
	REQ-05.05.01-INTEROP-FSMG.0031			✓
	REQ-05.05.01-INTEROP-FSMG.0032			✓
	REQ-05.05.01-INTEROP-FSMG.0034	✓		
	REQ-05.05.01-INTEROP-FSMG.0035		✓	
	REQ-05.05.01-INTEROP-FSMG.0037		✓	
	REQ-05.05.01-INTEROP-FSMG.0038		✓	
	REQ-05.05.01-INTEROP-FSMG.0046	✓		
	REQ-05.05.01-INTEROP-FSMG.0047		✓	
	REQ-05.05.01-INTEROP-FSMG.0048	✓		
	REQ-05.05.01-INTEROP-FSMG.0049	✓		
	REQ-05.05.01-INTEROP-FSMG.0050			✓
	REQ-05.05.01-INTEROP-FSMG.0051			✓
	REQ-05.05.01-INTEROP-FSMG.0055	✓		
	REQ-05.05.01-INTEROP-FSMG.0056	✓		
Application of a constraint	REQ-05.05.01-INTEROP-FSMG.0060	✓		
	REQ-05.05.01-INTEROP-FSMG.0090	✓		
	REQ-05.05.01-INTEROP-FSMG.0061	✓		
	REQ-05.05.01-INTEROP-FSMG.0062	✓		
	REQ-05.05.01-INTEROP-FSMG.0063	✓		
	REQ-05.05.01-INTEROP-FSMG.0064	✓		
	REQ-05.05.01-INTEROP-FSMG.0070		✓	
	REQ-05.05.01-INTEROP-FSMG.0071		✓	
Constraint propagation	REQ-05.05.01-INTEROP-FSMG.0065	✓		
	REQ-05.05.01-INTEROP-FSMG.0093			✓
Constraint maintenance	REQ-05.05.01-INTEROP-FSMG.0066		✓	
	REQ-05.05.01-INTEROP-FSMG.0067		✓	
Diversion	REQ-05.05.01-INTEROP-FSMG.0074		✓	
Consistency check	REQ-05.05.01-INTEROP-FSMG.0028	✓		
	REQ-05.05.01-INTEROP-FSMG.0075	✓		
	REQ-05.05.01-INTEROP-FSMG.0076		✓	
	REQ-05.05.01-INTEROP-FSMG.0077		✓	
	REQ-05.05.01-INTEROP-FSMG.0078		✓	
	REQ-05.05.01-INTEROP-FSMG.0080		✓	
	REQ-05.05.01-INTEROP-FSMG.0081	✓		
	REQ-05.05.01-INTEROP-FSMG.0082		✓	
	REQ-05.05.01-INTEROP-FSMG.0083	✓		

Table 9: TMF Requirements Mapped to Deployment Packages (Feature 2)

Process	Req. ID	Basic	Intermediate	Full
SKIP	REQ-05.05.01-INTEROP-SEQM.0001	✓		
	REQ-05.05.01-INTEROP-SEQM.0002	✓		
	REQ-05.05.01-INTEROP-SEQM.0042	✓		
	REQ-05.05.01-INTEROP-SEQM.0043	✓		
	REQ-05.05.01-INTEROP-SEQM.0021	✓		
	REQ-05.05.01-INTEROP-SEQM.0044		✓	
	REQ-05.05.01-INTEROP-SEQM.0017		✓	
	REQ-05.05.01-INTEROP-SEQM.0045		✓	
	REQ-05.05.01-INTEROP-SEQM.0018	✓		
	REQ-05.05.01-INTEROP-SEQM.0019	✓		
	REQ-05.05.01-INTEROP-SEQM.0022		✓	
	REQ-05.05.01-INTEROP-SEQM.0046		✓	
	REQ-05.05.01-INTEROP-SEQM.0023		✓	
	REQ-05.05.01-INTEROP-SEQM.0029			✓
DELEGATE	REQ-05.05.01-INTEROP-SEQM.0004			✓
	REQ-05.05.01-INTEROP-SEQM.0005			✓
	REQ-05.05.01-INTEROP-SEQM.0030		✓	
	REQ-05.05.01-INTEROP-SEQM.0031	✓		
	REQ-05.05.01-INTEROP-SEQM.0032		✓	
	REQ-05.05.01-INTEROP-SEQM.0033		✓	
	REQ-05.05.01-INTEROP-SEQM.0034		✓	
	REQ-05.05.01-INTEROP-SEQM.0035			✓
	REQ-05.05.01-INTEROP-SEQM.0036			✓
	REQ-05.05.01-INTEROP-SEQM.0037			✓
	REQ-05.05.01-INTEROP-SEQM.0038			✓
	REQ-05.05.01-INTEROP-SEQM.0039			✓
DSITRIBUTION	REQ-05.05.01-INTEROP-SEQM.0006	✓		
	REQ-05.05.01-INTEROP-SEQM.0007	✓		
	REQ-05.05.01-INTEROP-SEQM.0008		✓	
	REQ-05.05.01-INTEROP-SEQM.0009	✓		
	REQ-05.05.01-INTEROP-SEQM.0010	✓		
CROSSED	REQ-05.05.01-INTEROP-SEQM.0011	✓		
	REQ-05.05.01-INTEROP-SEQM.0012	✓		
CONTROLLING	REQ-05.05.01-INTEROP-SEQM.0014	✓		
	REQ-05.05.01-INTEROP-SEQM.0015	✓		
	REQ-05.05.01-INTEROP-SEQM.0040	✓		
	REQ-05.05.01-INTEROP-SEQM.0041			✓
GENERAL DISTRIBUTION	REQ-05.05.01-INTEROP-GENE.0001	✓		
	REQ-05.05.01-INTEROP-GENE.0002	✓		

Table 10: TMF Requirements Mapped to Deployment Packages (Feature 5)

Process	Req. ID	Basic	Intermediate	Full
SSR Code Management	REQ-05.05.01-INTEROP-SSRC.0001	✓		
	REQ-05.05.01-INTEROP-SSRC.0002	✓		
	REQ-05.05.01-INTEROP-SSRC.0003	✓		
	REQ-05.05.01-INTEROP-SSRC.0004	✓		
	REQ-05.05.01-INTEROP-SSRC.0005	✓		
	REQ-05.05.01-INTEROP-SSRC.0006	✓		
	REQ-05.05.01-INTEROP-SSRC.0007	✓		
	REQ-05.05.01-INTEROP-SSRC.0008	✓		
	REQ-05.05.01-INTEROP-SSRC.0009	✓		

Table 11: TMF Requirements Mapped to Deployment Packages (Feature 8)

Appendix B Applicability of TMF Requirements Per OFA

This appendix lists the set of TMF Requirements which are applicable to the step 1 OIs of each OFA and associated SESAR solutions, where defined.

B1 OFA 03.03.01: Ground Based Separation Provision En Route

The TMF INTEROP requirements applicable to this OFA support:

- SESAR Solution #28: Automated Assistance to Controller for Seamless Coordination, Transfer and Dialogue through improved trajectory data sharing (CM-0201-A), being addressed under the integrated validation project P04.03. The TMF provides interoperability requirements for the notification, coordination and transfer processes.
- CM-0403-A (Early Conflict Resolution through CTO Allocation in Step 1), being addressed by P04.07.02. The TMF provides operational interoperability requirements for synchronisation of the air/ground trajectory prior to CTO allocation.

SESAR Solution	OI	TMF INTEROP Requirements	
		Process	Req. ID
#28 Automated Assistance to Controller for Seamless Coordination, Transfer and Dialogue through improved trajectory data sharing	CM-0201-A	SAP	REQ-05.05.01-INTEROP-COTR.0001
			REQ-05.05.01-INTEROP-COTR.0002
			REQ-05.05.01-INTEROP-COTR.0005
		CAP	REQ-05.05.01-INTEROP-COTR.0006
			REQ-05.05.01-INTEROP-COTR.0007
			REQ-05.05.01-INTEROP-COTR.0010
			REQ-05.05.01-INTEROP-COTR.0013
			REQ-05.05.01-INTEROP-COTR.0014
		NP	REQ-05.05.01-INTEROP-COTR.0016
			REQ-05.05.01-INTEROP-COTR.0017
			REQ-05.05.01-INTEROP-COTR.0019
			REQ-05.05.01-INTEROP-COTR.0020
			REQ-05.05.01-INTEROP-COTR.0021
			REQ-05.05.01-INTEROP-COTR.0022
		reversion to SAP	REQ-05.05.01-INTEROP-COTR.0023
		Abrogation	REQ-05.05.01-INTEROP-COTR.0026
		Coordination Revision	REQ-05.05.01-INTEROP-COTR.0096
			REQ-05.05.01-INTEROP-COTR.0097
			REQ-05.05.01-INTEROP-COTR.0027
			REQ-05.05.01-INTEROP-COTR.0028
			REQ-05.05.01-INTEROP-COTR.0029
			REQ-05.05.01-INTEROP-COTR.0030
			REQ-05.05.01-INTEROP-COTR.0031
		Frequency Change	REQ-05.05.01-INTEROP-COTR.0032
			REQ-05.05.01-INTEROP-COTR.0034
			REQ-05.05.01-INTEROP-COTR.0036
			REQ-05.05.01-INTEROP-COTR.0038
			REQ-05.05.01-INTEROP-COTR.0039
		ROF	REQ-05.05.01-INTEROP-COTR.0040
			REQ-05.05.01-INTEROP-COTR.0041

	REQ-05.05.01-INTEROP-COTR.0042
	REQ-05.05.01-INTEROP-COTR.0043
	REQ-05.05.01-INTEROP-COTR.0044
Reclaim	REQ-05.05.01-INTEROP-COTR.0045
	REQ-05.05.01-INTEROP-COTR.0047
	REQ-05.05.01-INTEROP-COTR.0048
	REQ-05.05.01-INTEROP-COTR.0049
	REQ-05.05.01-INTEROP-COTR.0050
Force Assume	REQ-05.05.01-INTEROP-COTR.0051
	REQ-05.05.01-INTEROP-COTR.0052
	REQ-05.05.01-INTEROP-COTR.0053
	REQ-05.05.01-INTEROP-COTR.0054
	REQ-05.05.01-INTEROP-COTR.0055
	REQ-05.05.01-INTEROP-COTR.0056
	REQ-05.05.01-INTEROP-COTR.0057
	REQ-05.05.01-INTEROP-COTR.0058
	REQ-05.05.01-INTEROP-COTR.0059
Release	REQ-05.05.01-INTEROP-COTR.0060
	REQ-05.05.01-INTEROP-COTR.0061
	REQ-05.05.01-INTEROP-COTR.0062
	REQ-05.05.01-INTEROP-COTR.0063
	REQ-05.05.01-INTEROP-COTR.0066
	REQ-05.05.01-INTEROP-COTR.0067
	REQ-05.05.01-INTEROP-COTR.0068
	REQ-05.05.01-INTEROP-COTR.0099
	REQ-05.05.01-INTEROP-COTR.0069
	REQ-05.05.01-INTEROP-COTR.0070
	REQ-05.05.01-INTEROP-COTR.0071
	REQ-05.05.01-INTEROP-COTR.0073
	REQ-05.05.01-INTEROP-COTR.0074
Point	REQ-05.05.01-INTEROP-COTR.0075
	REQ-05.05.01-INTEROP-COTR.0076
	REQ-05.05.01-INTEROP-COTR.0077
	REQ-05.05.01-INTEROP-COTR.0078
	REQ-05.05.01-INTEROP-COTR.0081
	REQ-05.05.01-INTEROP-COTR.0082
	REQ-05.05.01-INTEROP-COTR.0084
	REQ-05.05.01-INTEROP-COTR.0085
	REQ-05.05.01-INTEROP-COTR.0086
Negotiation	REQ-05.05.01-INTEROP-COTR.0087
	REQ-05.05.01-INTEROP-COTR.0088
	REQ-05.05.01-INTEROP-COTR.0089
	REQ-05.05.01-INTEROP-COTR.0090
	REQ-05.05.01-INTEROP-COTR.0098
	REQ-05.05.01-INTEROP-COTR.0091

	REQ-05.05.01-INTEROP-COTR.0092
	REQ-05.05.01-INTEROP-COTR.0093
	REQ-05.05.01-INTEROP-COTR.0094
	REQ-05.05.01-INTEROP-COTR.0095
General concept	REQ-05.05.01-INTEROP-FSMG.0001
	REQ-05.05.01-INTEROP-FSMG.0002
	REQ-05.05.01-INTEROP-FSMG.0095
	REQ-05.05.01-INTEROP-FSMG.0096
	REQ-05.05.01-INTEROP-FSMG.0098
	REQ-05.05.01-INTEROP-FSMG.0099
	REQ-05.05.01-INTEROP-FSMG.0100
Creation of constraints list	REQ-05.05.01-INTEROP-FSMG.0004
	REQ-05.05.01-INTEROP-FSMG.0005
	REQ-05.05.01-INTEROP-FSMG.0006
	REQ-05.05.01-INTEROP-FSMG.0089
	REQ-05.05.01-INTEROP-FSMG.0007
	REQ-05.05.01-INTEROP-FSMG.0009
	REQ-05.05.01-INTEROP-FSMG.0092
	REQ-05.05.01-INTEROP-FSMG.0094
	REQ-05.05.01-INTEROP-FSMG.0010
	REQ-05.05.01-INTEROP-FSMG.0085
	REQ-05.05.01-INTEROP-FSMG.0011
	REQ-05.05.01-INTEROP-FSMG.0012
Type of constraints	REQ-05.05.01-INTEROP-FSMG.0008
	REQ-05.05.01-INTEROP-FSMG.0087
	REQ-05.05.01-INTEROP-FSMG.0017
	REQ-05.05.01-INTEROP-FSMG.0019
	REQ-05.05.01-INTEROP-FSMG.0086
	REQ-05.05.01-INTEROP-FSMG.0088
	REQ-05.05.01-INTEROP-FSMG.0021
	REQ-05.05.01-INTEROP-FSMG.0044
	REQ-05.05.01-INTEROP-FSMG.0022
	REQ-05.05.01-INTEROP-FSMG.0023
	REQ-05.05.01-INTEROP-FSMG.0042
	REQ-05.05.01-INTEROP-FSMG.0053
	REQ-05.05.01-INTEROP-FSMG.0091
	REQ-05.05.01-INTEROP-FSMG.0025
	REQ-05.05.01-INTEROP-FSMG.0026
	REQ-05.05.01-INTEROP-FSMG.0027
	REQ-05.05.01-INTEROP-FSMG.0029
	REQ-05.05.01-INTEROP-FSMG.0030
	REQ-05.05.01-INTEROP-FSMG.0031
	REQ-05.05.01-INTEROP-FSMG.0032
	REQ-05.05.01-INTEROP-FSMG.0034
	REQ-05.05.01-INTEROP-FSMG.0035

	REQ-05.05.01-INTEROP-FSMG.0037
	REQ-05.05.01-INTEROP-FSMG.0038
	REQ-05.05.01-INTEROP-FSMG.0046
	REQ-05.05.01-INTEROP-FSMG.0047
	REQ-05.05.01-INTEROP-FSMG.0048
	REQ-05.05.01-INTEROP-FSMG.0049
	REQ-05.05.01-INTEROP-FSMG.0050
	REQ-05.05.01-INTEROP-FSMG.0051
	REQ-05.05.01-INTEROP-FSMG.0055
	REQ-05.05.01-INTEROP-FSMG.0056
Application of a constraint	REQ-05.05.01-INTEROP-FSMG.0060
	REQ-05.05.01-INTEROP-FSMG.0090
	REQ-05.05.01-INTEROP-FSMG.0061
	REQ-05.05.01-INTEROP-FSMG.0062
	REQ-05.05.01-INTEROP-FSMG.0063
	REQ-05.05.01-INTEROP-FSMG.0064
	REQ-05.05.01-INTEROP-FSMG.0070
	REQ-05.05.01-INTEROP-FSMG.0071
Constraint propagation	REQ-05.05.01-INTEROP-FSMG.0065
	REQ-05.05.01-INTEROP-FSMG.0093
Constraint maintenance	REQ-05.05.01-INTEROP-FSMG.0066
	REQ-05.05.01-INTEROP-FSMG.0067
Diversion	REQ-05.05.01-INTEROP-FSMG.0074
Consistency check	REQ-05.05.01-INTEROP-FSMG.0028
	REQ-05.05.01-INTEROP-FSMG.0075
	REQ-05.05.01-INTEROP-FSMG.0076
	REQ-05.05.01-INTEROP-FSMG.0077
	REQ-05.05.01-INTEROP-FSMG.0078
	REQ-05.05.01-INTEROP-FSMG.0080
	REQ-05.05.01-INTEROP-FSMG.0081
	REQ-05.05.01-INTEROP-FSMG.0082
	REQ-05.05.01-INTEROP-FSMG.0083
SKIP	REQ-05.05.01-INTEROP-SEQM.0001
	REQ-05.05.01-INTEROP-SEQM.0002
	REQ-05.05.01-INTEROP-SEQM.0042
	REQ-05.05.01-INTEROP-SEQM.0043
	REQ-05.05.01-INTEROP-SEQM.0021
	REQ-05.05.01-INTEROP-SEQM.0044
	REQ-05.05.01-INTEROP-SEQM.0017
	REQ-05.05.01-INTEROP-SEQM.0045
	REQ-05.05.01-INTEROP-SEQM.0018
	REQ-05.05.01-INTEROP-SEQM.0019
	REQ-05.05.01-INTEROP-SEQM.0022
	REQ-05.05.01-INTEROP-SEQM.0046
	REQ-05.05.01-INTEROP-SEQM.0023

			REQ-05.05.01-INTEROP-SEQM.0029
		Delegate	REQ-05.05.01-INTEROP-SEQM.0004
			REQ-05.05.01-INTEROP-SEQM.0005
			REQ-05.05.01-INTEROP-SEQM.0030
			REQ-05.05.01-INTEROP-SEQM.0031
			REQ-05.05.01-INTEROP-SEQM.0032
			REQ-05.05.01-INTEROP-SEQM.0033
			REQ-05.05.01-INTEROP-SEQM.0034
			REQ-05.05.01-INTEROP-SEQM.0035
			REQ-05.05.01-INTEROP-SEQM.0036
			REQ-05.05.01-INTEROP-SEQM.0037
			REQ-05.05.01-INTEROP-SEQM.0038
			REQ-05.05.01-INTEROP-SEQM.0039
		Distribution	REQ-05.05.01-INTEROP-SEQM.0006
			REQ-05.05.01-INTEROP-SEQM.0007
			REQ-05.05.01-INTEROP-SEQM.0008
			REQ-05.05.01-INTEROP-SEQM.0009
			REQ-05.05.01-INTEROP-SEQM.0010
		Crossed ATSUs	REQ-05.05.01-INTEROP-SEQM.0011
			REQ-05.05.01-INTEROP-SEQM.0012
		Controlling ATSUs	REQ-05.05.01-INTEROP-SEQM.0014
			REQ-05.05.01-INTEROP-SEQM.0015
			REQ-05.05.01-INTEROP-SEQM.0040
			REQ-05.05.01-INTEROP-SEQM.0041
		General distribution	REQ-05.05.01-INTEROP-GENE.0001
			REQ-05.05.01-INTEROP-GENE.0002
		SSR Code Management	REQ-05.05.01-INTEROP-SSRC.0001
			REQ-05.05.01-INTEROP-SSRC.0002
			REQ-05.05.01-INTEROP-SSRC.0003
			REQ-05.05.01-INTEROP-SSRC.0004
			REQ-05.05.01-INTEROP-SSRC.0005
			REQ-05.05.01-INTEROP-SSRC.0006
			REQ-05.05.01-INTEROP-SSRC.0007
			REQ-05.05.01-INTEROP-SSRC.0008
			REQ-05.05.01-INTEROP-SSRC.0009

Table 12: TMF Requirements Applicable to OFA 03.03.01 Ground Based Separation Provision En Route

B2 OFA 04.01.02: Enhanced Arrival and Departure Management in TMA and En Route

The TMF INTEROP requirements applicable to this OFA support:

- SESAR Solution #06: Controlled Time of Arrival (CTA) in medium density/complexity environment (TS-0103), being addressed by P05.06.01. The TMF provides operational interoperability requirements that enable a synchronised view of the ground based trajectory to be maintained between ATS units; for the air and ground trajectories to be synchronized; for provision of the ETA min/max; for the CTA time constraint to be proposed (or cancelled) whilst the aircraft is under control from an upstream En Route ATS unit; and for the CTA instruction to be notified to downstream ATS units.
- SESAR Solution #05: Extended Arrival Management (AMAN) horizon; TS-0305-A (Arrival Management Extended to En Route Airspace – single TMA), being addressed by P05.06.04 (and also validated under P05.06.07). The notification requirements of the TMF also support (indirectly) the flight and trajectory needs of the extended AMAN horizon. The use of the TMF "one-to-many" based notification mechanism is optional to support this OI in step 1.

SESAR Solution	OI	TMF INTEROP Requirements	
		Process	Req. ID
#06 Controlled Time of Arrival (CTA) in medium density/complexity environment	TS-0103		
		Synchronize Air/Ground Trajectory	REQ-05.05.01-INTEROP-F060-0010
		Synchronize Air/Ground Trajectory	REQ-05.05.01-INTEROP-F060-0020
		Synchronize Air/Ground Trajectory	REQ-05.05.01-INTEROP-F060-0030
		Synchronize Air/Ground Trajectory	REQ-05.05.01-INTEROP-F060-0100
		Synchronize Air/Ground Trajectory	REQ-05.05.01-INTEROP-F060-0105
		Synchronize Air/Ground Trajectory	REQ-05.05.01-INTEROP-F060-0110
		Request ETA Min/Max	REQ-05.05.01-INTEROP-F070-0010
		Request ETA Min/Max	REQ-05.05.01-INTEROP-F070-0030
		Propose CTA	REQ-05.05.01-INTEROP-F080-0010
		Propose CTA	REQ-05.05.01-INTEROP-F080-0020
		Propose CTA	REQ-05.05.01-INTEROP-F080-0060
		Propose CTA	REQ-05.05.01-INTEROP-F080-0070
		Cancel CTA	REQ-05.05.01-INTEROP-F080-0110
		Cancel CTA	REQ-05.05.01-INTEROP-F080-0130
		Cancel CTA	REQ-05.05.01-INTEROP-F080-0140

Table 13: TMF Requirements Applicable to OFA 04.01.02 Enhanced Arrival and Departure Management in TMA and En Route

B3 OFA 03.01.04: Business and Mission Trajectory

The TMF INTEROP requirements applicable to this OFA support:

- AUO-0225 (Agreed iRBT to provide target time to ATM systems), being addressed by P07.06.02. The TMF interoperability requirements support the reception of enhanced trajectory information from NM to create (and subsequently update) the view of the planned trajectory in the ENR/APP ATC domain
- AUO-0226 (Agreed iRBT: Exchange of EFPL with ATC), being addressed by P07.06.02. The TMF interoperability requirements support the reception of enhanced trajectory information from NM to create (and subsequently update) the view of the planned trajectory in the ENR/APP ATC domain
- AUO-0205-A (Management and sharing of the Initial Reference Business Trajectory (iRBT/iRMT) from publication through to termination), being managed by the TMF ENB. The notification of TMF provides the flight and trajectory information for those flights in execution allowing NM to make an improvement in the network traffic demand prediction; additionally; in

the future it is also expected that the "one-to-many" based notification informs all Flight Object partners of STAM measures implemented on flights in execution.

SESAR Solution	OI	TMF INTEROP Requirements	
		Process	Req. ID
-	AUO-0225	Create/Update the Ground ATC View	REQ-05.05.01-INTEROP-F110-0010
-	AUO-0226		

Table 14: TMF Requirements Applicable to OFA 03.01.04 Business and Mission Trajectory

Appendix C Un-reviewed Feature 5 requirements

This appendix contains requirements relating to skip and delegate functions. These have been developed within the Feature 5 work of the Analysis Team, but have not been fully reviewed by operational and technical experts at the time of delivery of this version of the INTEROP. They are included in this appendix to enable the reader to consider them in the context of control sequence handling and distribution. It is anticipated that they will be moved to Chapter 4 following adequate review.

C1 SKIP

[SKIP requirements related to change of frequency – to be discussed, also applicability to DELEGATE.

[REQ]

Identifier	REQ-OPS-**FEATURE01.0510**
Requirement	An upstream ATSU of a skipped ATSU shall be aware of a ROF from the downstream ATSU of the skipped ATSU.
Title	
Maturity Level	Deployable IOP
Rationale	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-OPS-**FEATURE01.0512**
Requirement	A skipped ATSU sending a ROF to its upstream shall cancel the Skip.
Title	
Maturity Level	Full IOP
Rationale	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<ALLOCATED_TO>	<Functional block>	G/G IOP Management	N/A

[REQ]

Identifier	REQ-OPS-**FEATURE01.0513**
Requirement	The undo-skip shall only be possible before the frequency change from the upstream sector.
Title	
Maturity Level	Full IOP
Rationale	

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

<ALLOCATED TO>	<Functional block>	G/G IOP Management	N/A

Appendix D Outstanding Actions

The following items are to be addressed in future updates to this INTEROP:

- Feature 1: rationale to be documented for each operational requirement. – OK (J.-L. F updates direct in the INTEROP document)
- Feature 2:-
  - Completion of the eligibility rules describing the addition, modification and deletion of constraints by the IOP partners with regard to their airspace and relationship to the flight.
  - Completion of the maintenance rules describing the transferring of existing constraints on to new portions of the route following directs, route amendments etc. Note that there is a technical proposal existing that shall be analysed by Operations for acceptability.
  - The understanding of open and closed constraints and their handling needs further clarification, ref. requirement 0061.
  - Coherency check for correct use and coverage of the terms “strategic”, “planning” and “executive”.
  - Completion of the de synchronization rules describing the way of recognising and handling discrepancies between trajectories calculated by the different IOP partners consistently.
  - The feature 2 operational requirements have only been discussed with the Technical Team up to and including requirement REQ-05.05.01-INTEROP-FSMG.0066. Note that the requirements, due to evolution, are not numbered sequentially and have not been discussed sequentially but in the order in which they are presented in this document.

- Feature 5: Full review of SKIP and Delegate requirements (Appendix C) by operational and technical experts – ok (J.-L. F updated document, workshop Toulouse)
- Feature 8 requirements to be added – ok (P. Leplae 9th December)
- Feature 9: Requirements associated with WIFO functionality to be added.
- Traceability to be established between Operational requirements (in this INTEROP) and Technical requirements (in 10.2.5 D55 Technical Specification [23]).
- Validation method to be established for each requirement.

-END OF DOCUMENT-