



PJ.18-02b - TRL6 - TS/IRS

Deliverable ID:	D3.3.080
Dissemination Level:	PU
Project Acronym:	PJ18 4DTM
Grant:	734161
Call:	H2020-SESAR-2015-2
Topic:	Flight Object Interoperability
Consortium Coordinator:	INDRA
Edition Date:	04 Dec 2020
Edition:	03.00.04
Template Edition:	02.00.02

Founding Members



Authoring & Approval

Authors of the document

Name/Beneficiary	Position/Title	Date
Walter Ehret/DFS	PJ18-2b Project Member	April 2020
Vandita Banka/DSNA	PJ18-2b Project Member	September 2020
Paul Guerard/DSNA	PJ18-2b Project Member	April 2020
Jacques Edeline/Thales	PJ18-2b Project Member	April 2020
Frédéric Picard/Thales	PJ18-2b Project Member	September 2020
Hakim Souami /Thales	PJ18-2b Project Member	June 2019
Vincenzo Esposito/Leonardo	PJ18-2b Project Member	June 2019
Luciano Caminiti/Leonardo	PJ18-2b Project Member	September 2020
Juan Jose Meana/Indra	PJ18-2b Project Member	September 2020
Bernat Minguell Montes / Indra	PJ18-2b Project Member	September 2020
Sergio Fontestad Gomez/Indra	PJ18-2b Project Member	June 2019
Manuel Antonio Benitez Morillo/Indra	PJ18-2b Project Member	October 2019
David Navarro Navarro/Indra	PJ18-2b Project Member	October 2019
Christophe Paquay/EUROCONTROL	PJ18-2b Project Member	September 2020
Kristof Schippers/MUAC	PJ18-2b Project Member	June 2019
Andres Grijalba / ENAIRE	PJ18-2b Project Member	June 2019

Reviewers internal to the project

Name/Beneficiary	Position/Title	Date
Walter Ehret/DFS	PJ18-2b Project Member	October 2020
Kristof Schippers/MUAC	PJ18-2b Project Member	October 2020
Vandita Banka/DSNA	PJ18-2b Project Member	October 2020

Paul Guerard / DSNA	PJ18-2b Project Member	October 2020
Jacques Edeline/Thales	PJ18-2b Project Member	January 2020
Frédéric Picard/Thales	PJ18-2b Project Member	October 2020
Vincenzo Esposito/Leonardo	PJ18-2b Project Member	January 2020
Luciano Caminiti/Leonardo	PJ18-2b Project Member	October 2020
Juan Jose Meana/Indra	PJ18-2b Project Member	October 2020
Bernat Minguell Montes/Indra	PJ18-2b Project Member	October 2020
Adriana Arroyo Garcia/Indra	PJ18-2b Project Member	January 2020
Sergio Fontestad Gomez/Indra	PJ18-2b Project Member	January 2020
Manuel Antonio Benitez Morillo/Indra	PJ18-2b Project Member	January 2020
González Del Valle García / Indra	PJ18-2b Project Member	January 2020
David Navarro Navarro/Indra	PJ18-2b Project Member	January 2020
Christophe Paquay/EUROCONTROL	PJ18-2b Project Member	October 2020
Andres GRIJALBA/ENAIRE	PJ18-2b Project Member	October 2020
Paul T Johnson / NATS	PJ18-2b Project Member	October 2020
Valerio Franchi Junio / ENAV	PJ18-2b Project Member	October 2020
Erik Langevi / COOPANS	PJ18-2b Project Member	October 2020

Reviewers external to the project

Name/Beneficiary	Position/Title	Date
All / EUROCAE WG59	WG59 Members	January 2020
Juliette Engel-Kloppenborg / EUROCONTROL	PJ20 member	September 2020
Mario Boyero Perez / EUROCONTROL	PJ19.02 member	September 2020
Sujan Perera / NATS	PJ19.02 member	September 2020

Radosveta Borisova /
EUROCONTROL

PJ19.02 member

September 2020

Approved for submission to the SJU By – Representatives of beneficiaries involved in the project

Name/Beneficiary	Position/Title	Date
Walter Ehret / DFS	PJ18-2b Project Member	02/11/2020
Paul Guérard / DSN	PJ18-2b Project Member	02/11/2020
Andres Grijalba / ENAIRE	PJ18-2b Project Member	03/11/2020
Valerio Franchi Junio / ENAV	PJ18-2b Project Member	02/11/2020
Philippe Leploe / EUROCONTROL	PJ18-2b Solution Leader	03/11/2020
Juan Jose Meana / INDRA	PJ18-2b Project Member	03/11/2020
Luciano Caminiti / LEONARDO	PJ18-2b Project Member	02/11/2020
Pierre Guyader / MUAC	PJ18-2b Project Member	03/11/2020
Frederic Picard / THALES	PJ18-2b Project Member	02/11/2020
Dave Lewin / NATS	PJ18-2b Project Member	03/11/2020
Erik Langevi / COOPANS	PJ18-2b Project Member	03/11/2020

Rejected By – Representatives of beneficiaries involved in the project

Name/Beneficiary	Position/Title	Date

Document History

Edition	Date	Status	Author	Justification
00.00.01		Draft	Paquay Christophe	Conversion of SESAR1 D55 deliverable to new SESAR 2020 template
00.00.03		Draft	Paquay Christophe	Integration of all Features documents into the core of the document.
00.00.05		Draft	Paquay Christophe	SSR Code requirements updated
00.00.07		Draft	Paquay Christophe	Basis for next set of updates
00.01.00	03/08/2017	Draft	Paquay Christophe	Update from Langen F2F agreements.

					This is the version for development of Build-1.
00.01.01	22/08/2017	Draft	Paquay Christophe		Apply template 02.00.01
00.01.03	26/09/2017	Draft	Paquay Christophe		Integration of update from Luciano Caminiti.
00.02.00	11/11/2017	Draft	Paquay Christophe		Update with Build2 requirements.
00.02.01	20/11/2017	Draft	Paquay Christophe		COTR.0037 TRL2 4.2.5.1.4 update with Discontinuity flag
00.02.04	27/02/2018	Draft	Manuel Antonio Benitez Morillo		WIFO section updated with Zagreb F2F agreements
00.02.05	05/03/2018	Draft	Paquay Christophe Vincenzo Esposito		Annexes clean-up; AllWIFO TRL2; SSR Code aligned with new terminology.
01.00.00	26/04/2018	Draft	IOP TECH Team		New SEQM part
01.00.01	11/10/2018	Draft	IOP Tech Team		June 2018 review Alignment with Interop v01.00.02 Initial version for IOP-EXE-01
01.00.02	25/03/2019	Initial	IOP Tech Team		Partial coverage of Build 4: Non-Supported WIFO; Flight Cancellation; Control Sequence Correction; FO Recovery; Point; Advanced SSR; Complementary Distribution. Correction following SJU assessment.
01.00.03	29/03/2019	Initial	IOP Tech Team		Small correction in TRL maturity level due to Approval comment. SEQM.1041, 1042, 1006, 1007, 1008, 1009, 1044, 1043, 1046 from TRL5 to TRL4; COTR.0135 from TRL5 to TRL 2.
02.00.00	28/06/2019	Intermediate	IOP TECH Team		EXE01 validated requirements set to TRL6 Update for EXE02 scope.
02.00.01	30/08/2019	Intermediate	IOP TECH Team		Update of FSMG part after Brussels F2F July 2019. WIFO deletion requirements. EXE01 Issues solved EXE02 scope added

02.00.02	18/10/2019	Intermediate	IOP TECH Team	Preparation for inclusion in ED133RevA Correction on EXE02 requirements
02.00.03	29/04/2020	Draft	IOP TECH Team	Correction after EUROCAE WG59 review of the technical specification section. Coverage of UC's validated by Experts Judgement (EXE03): UC#0103, UC#0115, UC#0128, UC#0133, UC#0136, UC#0224, UC#0226, UC#0231, UC#0235, UC#0306, UC#0501, UC#0505, UC#0510, UC#0518, UC#0602, UC#0801, UC#0805, UC#0807, UC#0905, UC#1002.
03.00.00	20/05/2020	Draft	IOP TECH Team	Freezed for reference in TVALP
03.00.01	05/10/2020		IOP TECH Team	Coverage of UC's validated by Experts Judgement (EXE03): UC#0120, UC#0124, UC#0127, UC#0228, UC#0234, UC#0240, UC#0304, UC#0404, UC#0503, UC#0504, UC#0506 TMA Requirements
03.00.02	26/10/2020	FINAL	IOP TECH Group	Removal of requirement INTEROP-ADMG.0001. Correction due to review comments on v03.00.01 Addition of UC#0404 related requirements. Addition of Protocol Failure Appendix Addition of assessment of non-validated requirements Addition of list of Validated Requirement applicable to NM
03.00.03	23/11/2020	Revised	Christophe Paquay	Updates in reply to SJU assessment for final delivery.
03.00.04	04/12/2020	Revised	Christophe Paquay	Updates in reply to comments received during maturity Gate.

Copyright Statement

© – 2020 – COOPANS, DFS, DSN, ENAIRE, ENAV, EUROCONTROL, INDRA, NATS, LEONARDO, THALES AIRSYS. All rights reserved. Licensed to the SJU under conditions.

PJ18 4DTM

PJ18 4D TRAJECTORY MANAGEMENT

This Technical Specification is part of a project that has received funding from the SESAR Joint Undertaking under grant agreement No 734161 under European Union's Horizon 2020 research and innovation programme.



Abstract

This document provides Technical Specification (TS) and Interface Requirements Specification (IRS) supporting the EN-Route and TMA ATC Ground to Ground IOP management. It is supporting operational interoperability through the exchange of flight and trajectory information. These information exchanges are in support of operational areas: ATFCM, Trajectory Based Operations, Separation Management,

Table of Contents

1	Executive summary	19
2	Introduction	20
2.1	Purpose of the document.....	20
2.2	Scope	20
2.3	Intended readership	22
2.4	Background	22
2.5	Structure of the document.....	22
2.6	Glossary of terms.....	23
2.7	Acronyms and Terminology	31
3	SESAR Solution Impacts on Architecture	37
3.1	Target Solution Architecture	37
3.1.1	SESAR Solution(s) Overview	37
3.1.1.1	Deviations with respect to the SESAR Solution(s) definition.....	41
3.1.1.2	Relevant Use Cases.....	41
3.1.1.3	Applicable standards and regulations	48
3.1.1.3.1	ED-133.....	48
3.1.1.3.2	FF-ICE/1 ICAO documents	48
3.1.1.3.3	FF-ICE/2 ICAO documents	48
3.1.2	Capability Configurations required for the SESAR Solution	48
3.2	Changes imposed by the SESAR Solution on the baseline Architecture	50
4	Technical Specifications	53
4.1	Functional architecture overview	53
4.1.1	Resource Connectivity Model	58
4.1.2	Resource Orchestration view	61
4.1.2.1	[NSV-4] Automatic Triggering and Closure of SAP/CAP/NP in Compliance with LoA.....	62
4.1.2.2	[NSV-4] Change of COTR data or Trajectory during NP without electronic negotiation	64
4.1.2.3	[NSV-4] Coordination and Transfer	66
4.1.2.4	[NSV-4] Creation and sharing of a level constraint provided by the Receiving Unit	70
4.1.2.5	[NSV-4] Distribution Failure.....	73
4.1.2.6	[NSV-4] FO Creation and Sharing by First Crossed IOP Unit	75
4.1.2.7	[NSV-4] FO Update Collision	77
4.1.2.8	[NSV-4] Force-assume by the Receiving RE	78
4.1.2.9	[NSV-4] Management of discrepancies with local view (basic part)	81
4.1.2.10	[NSV-4] Manual subscription/unsubscription to FO.....	84
4.1.2.11	[NSV-4] Negotiation between Two Units	86
4.1.2.12	[NSV-4] FO Recovery	90
4.1.3	Infrastructure connectivity model.....	92
4.1.4	Service view.....	93
4.1.4.1	Service description	93
4.1.4.2	Service Provisioning.....	94
4.1.4.3	Service Realization.....	96

4.1.4.3.1	Interaction ATCFlightObjectControl (PJ.18-02b).ER ACC (PJ-18-02b) - FDC_CC and ER ACC (PJ-18-02b) - FDMP_CC.....	96
4.1.4.3.2	Interaction ATCFlightObjectControl (PJ.18-02b).ER ACC (PJ-18-02b) - FDU_CC and ER ACC (PJ-18-02b) - FDMP_CC.....	97
4.1.4.3.3	Interaction ATCFlightObjectControl (PJ.18-02b).ER ACC (PJ-18-02b) - WIC_CC and ER ACC (PJ-18-02b) - WIMP_CC	98
4.1.4.3.4	Interaction ATCFlightObjectControl (PJ.18-02b).ER ACC (PJ-18-02b) - WIMP_CC and ER ACC (PJ-18-02b) - FDMP_CC	99
4.1.4.3.5	Interaction Controller Pilot ATC exchange(Voice).Civil Aircraft_CC and ER ACC (PJ-18-02b) - FDC_CC.....	99
4.1.4.3.6	Interaction Controller Pilot ATC exchange(Voice).ER ACC (PJ-18-02b) - FDMP_CC and Civil Aircraft_CC100	
4.1.4.3.7	Interaction SharedFlightObject (PJ.18-02b).ER ACC (PJ-18-02b) - FDC_CC and ER ACC (PJ-18-02b) - FDMP_CC	102
4.1.4.3.8	Interaction SharedFlightObject (PJ.18-02b).ER ACC (PJ-18-02b) - FDU_CC and ER ACC (PJ-18-02b) - FDMP_CC	102
4.1.4.3.9	Interaction SharedFlightObject (PJ.18-02b).ER ACC (PJ-18-02b) - WIC_CC and ER ACC (PJ-18-02b) - WIMP_CC	103
4.1.4.3.10	Interaction ATCFlightObjectControl (PJ.18-02b).ER ACC (PJ-18-02b) - Recovering Unit_CC and ER ACC (PJ-18-02b) - Unit_CC	104
4.1.4.3.11	Interaction IOPMonitoring (PJ.18-02b).ER ACC (PJ-18-02b) - Unit_CC and ER ACC (PJ-18-02b) - Recovering Unit_CC.....	105
4.1.4.3.12	Interaction SharedFlightObject (PJ.18-02b).ER ACC (PJ-18-02b) - Recovering Unit_CC and ER ACC (PJ-18-02b) - Unit_CC	106
4.1.5	Modified Systems View	107
4.1.5.1	En-Route / Approach ATC (PJ.18-02b).....	107
4.1.5.1.1	Composition	107
4.1.5.1.2	System Interfaces Diagram	108
4.2	Functional and non-Functional Requirements.....	110
4.2.1	General Mechanisms.....	111
4.2.1.1	IOP Roles Handling	111
4.2.1.1.1	Flight Data Manager Publisher (FDMP).....	112
4.2.1.1.2	Flight Data Contributor (FDC).....	119
4.2.1.1.3	Flight Data User (FDU).....	119
4.2.1.2	Flight Object Management.....	120
4.2.1.2.1	Flight Object Identification.....	120
4.2.1.2.2	FO Creation	124
4.2.1.2.3	FO Deletion from the Network	126
4.2.1.2.4	Search for Flight Objects in the Network	129
4.2.1.2.5	FO Update Mechanism.....	129
4.2.1.2.6	Verification rules applicable to both publications and FO requests	135
4.2.1.2.7	FO publication process.....	137
4.2.1.2.8	FO Request update process	145
4.2.1.2.9	Limitation of FO updates for non-significant changes	153
4.2.1.3	Non-supported functionalities	156
4.2.1.4	Flight Object Stabilization.....	158
4.2.1.5	ICD Versioning Strategy	158
4.2.1.5.1	Introduction	158
4.2.1.5.2	FO-IOP Versioning policy.....	158
4.2.1.5.3	Version compatibility.	159
4.2.1.5.4	Migration for Minor and Patch versions	160
4.2.2	What-if Flight Object (WIFO) Management	163

4.2.2.1	WIFO General Requirements.....	164
4.2.2.1.1	WIFO Creation and Role Assignment	164
4.2.2.1.2	Non-support of WIFO capability (full or partial)	167
4.2.2.2	Negotiation-type WIFO in negotiation between two SIs Requirements	169
4.2.2.2.1	Negotiation-type WIFO Status	169
4.2.2.2.2	Negotiated Data Identification.....	170
4.2.2.2.3	WIFO Proposal and Distribution.....	172
4.2.2.2.4	WIFO Acceptance	173
4.2.2.2.5	WIFO Commit	174
4.2.2.2.6	WIFO Rejection	174
4.2.2.2.7	Request WIFO update from the WIC	176
4.2.2.2.8	WIFO Cancellation.....	181
4.2.2.2.9	WIFO Expiration	182
4.2.2.2.10	WIFO Deletion	183
4.2.2.2.11	Others.....	185
4.2.2.3	FO requirements applicable to WIFO	186
4.2.2.3.1	IOP Roles handling	186
4.2.2.3.2	FO Deletion from the network	186
4.2.2.3.3	IOP Data Distribution	186
4.2.3	Coordination and Transfer	187
4.2.3.1	Managing SI Boundaries	187
4.2.3.1.1	Description of the concept of phases	187
4.2.3.1.2	System Awareness Phase	188
4.2.3.1.3	Initial Phase	189
4.2.3.1.4	Controller Awareness Phase	189
4.2.3.1.5	Negotiation Phase	192
4.2.3.1.6	Terminated Phase	196
4.2.3.1.7	Regression of CAP/NP for a crossing.....	197
4.2.3.2	Managing Coordination and Transfer Data	199
4.2.3.2.1	Coordination and Transfer Data Creation and Confirmation	199
4.2.3.2.2	Entry and Exit Coordination and Transfer Data	201
4.2.3.2.3	Type of Agreement for Coordination and Transfer Data	205
4.2.3.2.3	Exit time	206
4.2.3.2.4	Standard/Non-standard Crossing Conditions	207
4.2.3.2.5	Other Crossing Data	208
4.2.3.3	Transferring Flight Responsibility	210
4.2.3.3.1	Instructing the Frequency Change (Send).....	210
4.2.3.3.2	Undoing a Frequency Change (Undo-send)	211
4.2.3.3.3	Confirming contact with pilot (Assume)	212
4.2.3.3.4	Undo Assume	213
4.2.3.3.5	Requesting the frequency change to the controlling unit	213
4.2.3.3.6	Undo Request Of Frequency	213
4.2.3.3.7	Requesting back the frequency change to the former controlling unit (Reclaim)	214
4.2.3.3.8	Force-Assume of a flight	214
4.2.3.3.9	Force Assume Acknowledgement	214
4.2.3.3.10	Undo Force-Assume	215
4.2.4	SSR Code Management	215
4.2.4.1	IOP_ASSR Code Management by FDMP	216
4.2.4.2	IOP_CSSR Code Management by FDMP	217
4.2.4.3	IOP_FSSR Code Management by FDMP	217
4.2.4.4	IOP_TSSR Code Management.....	218
4.2.4.5	IOP_DSSR Code Management	219
4.2.4.5.1	IOP DSSR Code Request	219

4.2.4.5.2	IOP_DSSR Code assignment	220
4.2.4.6	Mode S Flight ID Sharing by FDMP	221
4.2.5	Flight Script Management	222
4.2.5.1	Flight Script Definition	222
4.2.5.1.1	FS Scope	222
4.2.5.1.2	FS Initial Conditions.....	223
4.2.5.1.3	FS Current Assigned Data	224
4.2.5.1.4	FS Expanded Route.....	225
4.2.5.1.5	FS Constraints.....	240
4.2.5.2	General Operations on the FO Flight Script.....	268
4.2.5.2.1	FO Creation	268
4.2.5.2.2	FO Modification triggered by FDMP	270
4.2.5.2.3	FO Modification triggered by FDC.....	271
4.2.5.2.4	FO Reception	276
4.2.5.2.5	FO Flight Script de-synchronization	279
4.2.5.3	Specific Operations on Constraints and Expanded Route	279
4.2.5.3.1	FDMP Operations	279
4.2.5.3.2	FDC Operations	281
4.2.5.3.3	Eligibility for Operations on Constraints and Route Modification	282
4.2.5.3.4	Constraint Propagation Rules.....	288
4.2.5.3.5	Constraint and Expanded Route Management in case of re-route	290
4.2.5.3.6	Strategic Constraint Management	297
4.2.5.3.7	Coordination Data relationship with Constraints and Expanded Route	300
4.2.5.3.8	Constraint Management in Case of Skip	302
4.2.5.4	Supporting Flight Script Requirements on Adaptation Data	303
4.2.6	Trajectory Management.....	304
4.2.7	IOP Data Distribution	305
4.2.7.1	Distribution for Control	307
4.2.7.2	Distribution for Vicinity	308
4.2.7.3	Distribution for Traversed	308
4.2.7.4	Distribution for Point.....	309
4.2.7.4.1	Point Establishment	309
4.2.7.4.2	Point Cancellation	310
4.2.7.4.3	FO Cleaning after Point Establishment and Cancellation.....	311
4.2.7.5	Distribution for Subscribed.....	313
4.2.7.6	Distribution for General Information	314
4.2.7.7	Distribution for End of Service	315
4.2.8	Crossed and Control Sequence Management.....	317
4.2.8.1	Calculation of initial Crossed and Controlling SI List by the FDMP.....	317
4.2.8.2	Calculation of control sequence in case of unknown points resulting in some unknown traversal IOP or non-IOP volumes.....	319
4.2.8.3	Computation and correction of the crossed and control sequence.....	321
4.2.8.3.1	SI Occurrence Identifiers	321
4.2.8.3.2	SI Qualifiers	322
4.2.8.3.3	Transition Data Qualifier	325
4.2.8.4	Technical Qualifiers usage	326
4.2.8.4.1	Correcting the sequence	326
4.2.8.4.2	Maintaining technical corrections in the crossed and control sequence	339
4.2.8.5	Operational Qualifiers usage	345
4.2.8.5.1	Skip Mechanism	345
4.2.8.5.2	Delegation Mechanism	353
4.2.8.5.3	No Contact Mechanism.....	365
4.2.8.5.4	Calculation of Control Sequence in Case of Force assume	371

4.2.8.5.5	Maintaining operational qualifier SIs in the control sequence	373
4.2.9	Air/Ground	373
4.2.9.1	Data Link Initiation	374
4.2.9.2	ATC Communication Management	374
4.2.10	Handling of IOP Protocol Failure	377
4.2.10.1	Degraded IOP Modes.....	377
4.2.10.1.1	Coordination Failsafe Mode	378
4.2.10.1.2	Severe Desynchronization.....	384
4.2.11	TMA Requirements	387
4.2.11.1	Departure Data sharing	387
4.2.11.2	Arrival Data sharing	388
4.2.12	SWIM for IOP	390
4.2.12.1	Collisions or Concurrent updates of FO releases.....	390
4.2.12.1.1	Loss of FO Clusters	390
4.2.12.1.2	Concurrent FO Updates.....	391
4.2.12.2	Distribution Failure.....	392
4.2.12.2.1	Problem in local Messaging infrastructure	392
4.2.12.2.2	Isolation/Loss of WAN connectivity	393
4.2.12.2.3	Problem in payload (version mismatch)	393
4.2.12.3	FO Recovery.....	394
4.2.12.3.1	Introduction to FO Recovery	394
4.2.12.3.2	FO Recovery Use Cases	397
4.2.12.3.3	Nominal FO Recovery Scenario	398
4.2.12.3.4	Functional Interfaces involved in FO Recovery	400
4.2.12.3.5	FO Recovery Requirements.....	401
4.2.13	Design Objectives.....	407
4.2.14	Security	408
4.2.15	Optional functionalities	408
4.2.15.1	Option #1: Support of "Negotiation"	411
4.2.15.2	Option #1.1 Support of "Negotiation Counter Proposal"	412
4.2.15.3	Option #2: Support of "Flight Phase Manual Trigger"	412
4.2.15.4	Option #3: Support of "Release Management"	413
4.2.15.5	Option #4: Support of "Flight Transfer.ROF"	413
4.2.15.6	Option #5: Support of "Undo Actions"	413
4.2.15.7	Option #6: Support of "Skip"	414
4.2.15.8	Option #7: Support of "Control Sequence.Delegation"	414
4.2.15.9	Option #8: Support of "Control Sequence.Shortcross"	415
4.2.15.10	Option #9: Support of "Point"	415
4.2.15.11	Option #10: Support of "No Contact"	415
4.2.15.12	Option #11: Support of "Activation/Deactivation of Strategic Constraints"	416
4.2.15.13	Option #12: Support of "Route Management.Cleared Route Indication"	416
4.2.15.14	Option #13: Support of "TMA Data sharing"	416
5	Implementation Options	418
6	Assumptions	419
6.1	MET Data	419
7	References and Applicable Documents	420
7.1	Applicable Documents	420
7.2	Reference Documents.....	421

Appendix A	<i>SharedFlightObject Service Description Document (SDD)</i>	422
A.1	Introduction	422
A.2	Service Identification	422
A.3	Operational and Business Context	422
A.3.1	Operational Context	422
A.3.2	Information Exchange Requirements	423
A.3.3	Other Requirements	424
A.4	Service Overview	426
A.4.1	Service Taxonomy	426
A.4.2	Service Levels (NfRs)	427
A.4.3	Service Functions and Capabilities	427
A.4.4	Service Interfaces	427
A.5	Service interface specifications	428
A.5.1	SharedFlightObjectInterface	428
1.	Operation publishFlightObject	428
2.	Operation SharedFlightObject (PJ.18-02b).SharedFlightObjectInterface.createFlightObject	428
3.	Operation SharedFlightObject (PJ.18-02b).SharedFlightObjectInterface.deleteFlightObject	429
4.	Operation SharedFlightObject (PJ.18-02b).SharedFlightObjectInterface.searchFlightObject	429
A.6	Payload Data Diagrams	430
A.7	Payload Data Types	430
A.7.1	Payload Elements	430
A.8	Service dynamic behaviour	432
A.8.1	Service Interface FlightObjectPublisher	432
Appendix B	<i>ATCFlightObjectControl Service Description Document (SDD)</i>	433
B.1	Introduction	433
B.2	Service Identification	433
B.3	Operational and Business Context	433
B.3.1	Operational Context	433
B.3.2	Information Exchange Requirements	434
B.3.3	Other Requirements	435
B.4	Service Overview	442
B.4.1	Service Taxonomy	442
B.4.2	Service Levels (NfRs)	442
B.4.3	Service Functions and Capabilities	442
B.4.4	Service Interfaces	442
B.5	Service interface specifications	443
B.5.1	FlightObjectManagementInterface	443
1.	Operation rejectFlightObject	443
2.	Operation reportFlightObjectServicesFailure	444
3.	Operation requestFlightObjectRecovery	444
4.	Operation requestFlightObjectServices	445
5.	Operation restoreFlightObject	446
B.6	Payload Data Diagrams	446

B.7	Payload Data Types	446
B.7.1	Payload Elements	446
B.8	Service dynamic behaviour	448
B.8.1	Service Interface FlightObjectManagementInterface	448
Appendix C	<i>IOPMonitoring Service Description Document (SDD).....</i>	449
C.1	Introduction	449
C.2	Service Identification	449
C.3	Operational and Business Context.....	449
C.3.1	Operational Context	449
C.3.2	Information Exchange Requirements.....	450
C.3.3	Other Requirements.....	450
C.4	Service Overview	451
C.4.1	Service Taxonomy	451
C.4.2	Service Levels (NfRs)	451
C.4.3	Service Functions and Capabilities	451
C.4.4	Service Interfaces	451
C.5	Service interface specifications	452
C.5.1	IOPMonitoringInterface	452
1.	Operation IOPMonitoring (PJ.18-02b).IOPMonitoringInterface.updateApplicationStatus.....	452
2.	Operation IOPMonitoring (PJ.18-02b).IOPMonitoringInterface.updateRecoveryStatus	452
C.6	Payload Data Diagrams	452
C.7	Payload Data Types	453
C.7.1	Payload Elements	453
C.8	Service dynamic behaviour	453
C.8.1	Service Interface IOPMonitoringInterface	453
Appendix D	<i>Service Technical Design Document (STDD).....</i>	454
Appendix E	<i>SWIM-TI Blue Profile Specification.....</i>	455
Appendix F	<i>System Parameters</i>	456
Appendix G	<i>Future Work and recommendation.....</i>	459
G.1	Non or Partially Validated requirements.	459
G.2	NM Related Requirement	463
G.2.1	In scope requirements applicable to NM.....	463
G.2.2	Out of scope specific NM requirements	465
G.3	IOP elements not in scope of this specification	469
G.3.1	What-If FlightObject (WIFO) Management	469
G.3.2	Coordination and Transfer	470
G.3.3	Flight Script Management	475
G.3.4	Crossed and Control Sequence Management.....	477
Appendix H	<i>Protocol Failure Analysis</i>	480
Appendix I	<i>Cost Benefit Analysis</i>	481

Appendix J	Requirements Definitions Guidance	482
J.1	General Guidance	482
J.2	Naming Convention	482
J.3	Requirements development style	483
J.4	Examples of requirement issues and suggested style	484
J.4.1	Proposed workaround for each of the above problems.	484

List of Tables

Table 1:	Glossary	31
Table 2:	Acronyms and terminology	36
Table 3:	SESAR Solution 18-02b OI and Enablers	41
Table 4:	SESAR Solution 18-02b Scope and related Functional Blocks/roles & Enablers	41
Table 5:	Use Cases List in scope of this specification.	44
Table 6:	Relevant Use Cases	45
Table 7:	System Processes	48
Table 8:	Institutional Enabler	48
Table 9:	List of Capability Configuration required for the SESAR Solution	50
Table 10:	Changes imposed by the SESAR Solution	52
Table 11:	Functional architecture overview	58
Table 12:	Functional decomposition	111
Table 13:	ICD Version Migration Steps	163
Table 14:	CAP/NP Regression	198
Table 15:	Coordination Phases Combinations	198
Table 16:	Identification of Variable and Non-Variable Constraint Attributes	241
Table 17 :	Constraint Types	245
Table 18 :	Possible Category per constraint type	246
Table 19 :	Target Values defined per constraint Type	250
Table 20 :	Possible Constraint Origin per constraint type	255
Table 21 :	Possible Constraint Handling attribute per constraint type	258



Table 22 : Constraint Handling Usage by FDMP	275
Table 23: SI Addition Example	327
Table 24: SI Removal Example.....	331
Table 25: SI Confirmation Example	335
Table 26: Short-cross Example	338
Table 27: Example of combined operations.....	339
Table 28: Conditions for sequence list re-application.....	340
Table 29: Example of Control Sequence Correction Re-application (Addition, Removal)	343
Table 30: Example of Control Sequence Correction Re-application (Confirmation).....	344
Table 31: Example of Control Sequence Correction Re-application (Addition, Removal, Confirmation)	344
Table 32: Full Skip Example	347
Table 33: Partial Skip Example	348
Table 34: Skip Example.....	353
Table 35: Full Delegation Example	354
Table 36 Delegation of beginning of airspace Example	355
Table 37: Delegation in the middle of airspace.....	356
Table 38: Delegation at the end of the airspace	357
Table 39: Delegation Examples	365
Table 40 Optional functionalities	411
Table 41: Negotiation Option.....	412
Table 42: Negotiation.Counter Proposal Option.....	412
Table 43: Flight Phase Manual Trigger Option	413
Table 44: Release Option	413
Table 45: Flight Transfer.ROF Option	413
Table 46: Undo Actions Option	413
Table 47: Skip Option	414
Table 48: Delegation Option	414

Table 49: Shortcross Option	415
Table 50 : Point Option.....	415
Table 51: No Contact Option.....	416
Table 52: Activation/Deactivation of Strategic Constraints Option	416
Table 53: Cleared Route Indication Option	416
Table 54: TMA Data Sharing Option.....	417
Table 55: Service identification (I).....	422
Table 56: Service identification (II).....	422
Table 57: Service identification (I).....	433
Table 58: Service identification (II).....	433
Table 59: Service identification (I).....	449
Table 60: System Parameters.....	458
Table 61: Non-Validated requirements.....	463
Table 62 Validated NM applicable requirements.....	465

List of Figures

Figure 1: Basic and Full IOP scope	20
Figure 1: IOP ATC architecture	38
Figure 2: FO Request and Distribute Resource Connectivity Model	60
Figure 3: IOP Monitoring Resource Connectivity Model.....	61
Figure 5: Example of IOP Patterns.....	130
Figure 6: Asynchronous notification of request completion.....	153
Figure 6: ICD Version Migration Work Flow	162
Figure 8: “Negotiation” WIFO Status Flow	170
Figure 9: SI State and Coordination Phase transitions	188
Figure 10: TransferStatus transitions	210
Figure 11: Expanded Route in case of route change.....	226
Figure 12: Offset Constraint	250



Figure 13: Constraint Life-cycle 264

Figure 14: FDMP modification of a FDC constraint 281

Figure 15: Examples of Constraint Propagation 289

Figure 16: Constraint Maintenance in case of re-route 294

Figure 17: Reasons for Distribution..... 306

Figure 18: Unknown IOP traversal or non-IOP volumes 319

Figure 19: Downstream skip..... 345

Figure 20: Upstream skip..... 346

Figure 21: Delegation Mechanism..... 354

Figure 22: Delegation of beginning of airspace..... 355

Figure 23: Delegation in the middle of airspace 356

Figure 24: Delegation at the end of the airspace..... 357

Figure 25: No Contact Mechanism 366

Figure 26: Functional Interfaces involved in FO Recovery 400

1 Executive summary

The ‘Flight Object’ (FO) is 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. It is the basis for the interoperability (IOP) mechanism defined by this document.

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 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.

Conceptually the FO is intended to hold all flight data that needs to be shared between any interested stakeholders: Civil ATC, Military ATC, Flow Management Systems, Airport Operators, Aircraft Operators and Aircraft Systems. The FOIPS (Flight Object Interoperability Proposed Standard) (Ref.: [35]) model was developed to provide a model of the FO data and services required to satisfy the needs of these stakeholders. However, the FO defined in this document is restricted to the flight data that needs to be shared between Civil ATC systems, the specific needs of military ATC and military flights are not considered. This will form the scope of the initial implementation of the FO, however it is expected that the scope of the data held within a FO will grow in the future as more stakeholders implement the FO concept.

The predecessor of this document, worked out by the SESAR 1 project P10.02.05 is the **D55** IOP ATC System Requirements (Final IOP TS) edition 00.03.00 [26]. The counterpart within the SWIM layer/subsystem was developed by SESAR 1 P14.01.04 (D44- 005 (BP TS))[30], which addresses other ED-133 requirements. The allocations of requirements between those two technical projects have been closely coordinated. The tracing of requirements is given with respect to SASAR2020 document 18.02b SPR-INTEROP/OSED [33].

This document is only aiming to tackle the requirements from the functional blocks related with IOP that define the interactions between several stakeholders. That is, any requirement that only defines a local behaviour (e.g. Display of data exchanged through FO to the controller) of a system and its implementation, will not be considered in the scope of this specification.

This concept of Flight Object sharing is relying on the SWIM Blue Profile. This present document contains in Appendix the Interface Requirements Specification (IRS) addressing the interface requirements for SWIM Technical Infrastructure (SWIM-TI) and applicable for the SWIM Blue Profile.

2 Introduction

2.1 Purpose of the document

This document defines the interface between different instances of civilian ATC Flight Planning Lifecycle & Distribution Systems, in support of En-route and Terminal ATC Operations, covering the operational needs defined in the 18.02b SPR-INTEROP/OSED [33]. It explicitly covers the exchange of real time Flight Information, and makes a number of assumptions about the provision of other types of information.

This document does not specifically address military to civil or military-to-military coordination, although it may be possible to reuse the mechanisms proposed within this document to also support these kinds of coordination.

This interface has been defined to ensure a consistent view of the flight data across all FDPs. It is intended to satisfy current operational needs including the European Commission Regulation (No 1032/2006) relating to notification, coordination and transfer of flights between air traffic control units, as well as to provide the basis for future operational concepts including:

- MTCO across system boundaries.
- The distribution of time constraints from AMAN applications
- Negotiation of route amendments with downstream units.
- Improvement of Free Routing

2.2 Scope

This document is the TS/IRS for solution 18-02b (ATC-ATC IOP). The scope of this solution is identified as being the BASIC IOP ATC-ATC scope. The initial maturity level for solution 18-02b was TRL4, and target maturity is TRL6.

This TS/IRS defines the functional and non-functional requirements for the handling and sharing of the FO (IOP Application) covering the necessary needs to cover the BASIC IOP ATC-ATC. Integration of NM in the BASIC IOP is in the scope of the solution 18-02b1 and is not in the scope of this specification. More advanced functionalities to get full benefits of IOP, described as being the FULL IOP is not in the scope of this document.

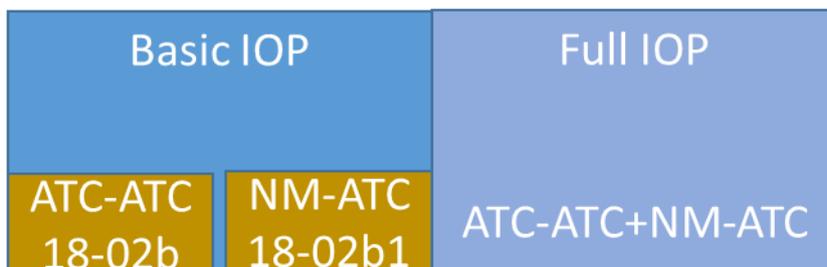


Figure 1: Basic and Full IOP scope

BASIC-IOP is defined as followed:

- Fundamental IOP mechanisms allowing exchange of flight objects reflecting the FDP information;
- Inter-centre(s) mechanisms for coordination & negotiation of transfer conditions across FIR boundaries in order to enable silent coordination& transfer;
- Cross border trajectory information sharing through the synchronization of flight script data, enabling seamless operations.
- Increased flexibility in responsibility determination through SKIP and DELEGATE functions
- All necessary failsafe mechanisms to guarantee safe operations
- NM integration in IOP (not in scope of this specification)

To complement the BASIC IOP, a FULL IOP scope is defined that includes the following elements (note that this list is not exhaustive):

- Inter-centre(s) advanced mechanisms for coordination & negotiation of transfer conditions across FIR boundaries including
 - Use of offset,
 - Advanced release,
 - Reclaim,
 - Undo-Assume,
 - Undo-Force-Assume
 - Electronic negotiation of a route modification
- Inclusion in the route description of the approach procedures
- Advanced constraints management: Speed and Rate; Gradient; Time
- Advanced Skip and Delegate
- Exchange of Aircraft Trajectory Data (ADS-C) through FO

Functionalities required to achieve Ground–Ground interoperability have been divided into features. These features provide a functional decomposition that allowed focusing in the subjects that makes the core of the IOP standard. A set of these features was considered necessary to develop the IOP in scope of BASIC IOP and therefore were the ones treated in this deliverable. Those features are:

- Feature 1: Coordination & Transfer
- Feature 2: Flight Script management



- Feature 3: IOP Data Distribution
- Feature 4: FO Protocol Failure
- Feature 5: Control Sequence Handling
- Feature 6: FO Recovery
- Feature 8: SSR codes management
- Feature 9: FO/WIFO Mechanism; Transversal technical functionality to support data exchanges in the IOP network.
- Feature 10: Trajectory Management
- Feature 11: TMA
- Feature 12: NM (Solution 18-02b1, not in scope of this specification)

The SESAR 2020 SWIM-TI Technical Specification for the SWIM Blue Profile for the validation exercises is also in the scope of this document (Cf Appendix E).

2.3 Intended readership

The primary users to which this document is applicable are

- The PJ18-02b solution members. It has been used to develop the prototypes and the IBPs that have contributed to first technological validation exercise to mature the IOP solution to TRL6.
- The stakeholders interested in the development of an IOP solution for their FDP and their industrial partners.

For information, as user of the prototypes for IOP validation, people using the ATC tools and the HMI users, SESAR projects interested in the SWIM Blue Profile Technical Specification, can refer to this document maturing their respective SESAR solutions (such as other 4D Trajectory solutions, DCB, Airspace Users Operation Optimisation, Controller Tools for provision of Separation and ATM). For assessment and SESAR document management, the SJU and European ATM Architects are part of the readership of this document.

As this document will be a key input to the revised ED133 standard, it is also intended for EUROCAE WG59 members.

2.4 Background

This specification was initially developed during SESAR 1 (SESAR 1 D55 deliverable [26]) based on documents developed for each IOP feature. Then this document has been further developed and re-structures by SESAR2020 P18-02b technical team satisfying the needs defined in SESAR2020 18-02b INTEROP [33].

2.5 Structure of the document

The document is divided into seven sections as follows:

- Chapter 1: Executive Summary

- Chapter 2: Introduction- This chapter introduces the subject of this document and describes its purpose.
- Chapter 3: SESAR Solution Impacts on Architecture- This chapter provides a high level view of the scope of the prototype and the limitations within that scope. The general scope of the project is described using a functional block view of the broader Flight Planning Lifecycle & Distribution system in order to illustrate the scope of the requirements covered by this project.
- Chapter 4: Technical Specifications- This chapter forms the majority of the document, and includes the available functional and non-functional requirements for the IOP. It has to be noted that this sections covers only the requirements on the selected scope.
- Chapter 5: Implementation Options
- Chapter 6: Assumptions
- Chapter 7: References and Applicable Documents- This chapter lists the resources used throughout this document.
- Appendix A, B and C : Service Description Document (SDD)
- Appendix D : Service Technical Design Document (STDD)
- Appendix E: Swim-TI Blue Profile Specification
- Appendix F: System Parameters
- Appendix G : Future Work
- Appendix H : Protocol Failure Analysis
- Appendix I : Cost Benefit Analysis
- Appendix J: Requirements Definitions Guidance

2.6 Glossary of terms

Term	Definition	Source of the Definition
A		
Actor	An actor is an implementation independent unit of responsibility that performs a certain role.	SESAR ATM Lexicon
Area Of Responsibility	The Area of Responsibility (AoR) of a System Instance (SI).	PJ.18-02b
Area of Interest	The volumetric extension of the AoR of an SI that allows detecting flights of interest for this SI. It is typically conditioned by the need of tactical control, i.e. capability of controllers to mentally integrate the traffic and functions like MTCD. It may additionally include specific rules based on traffic flows. There are as many AoI as there are ATSU's the associated SI of which is an IOP stakeholder.	PJ.18-02b
AIM Data	Data needed by the System Instance, which are not included in the Flight Object. Some of those data are the IOP AIM object Data that are shared between the IOP stakeholders.	PJ.18-02b

Application scope	The application scope of a constraint extends from the application point to the target end point. It is the area over which the trajectory is constrained by the constraint..	PJ.18-02b
Application point	Application point of a constraint stands for the point in which the flight is expected to start the manoeuvres in order to accomplish the constraint.	PJ.18-02b
ATC Communication Management (ACM) Service	This data link service provides automated assistance to the flight crew and current and next controllers to manage ATC communications.	
Across point	A point indicated as across is a point not constraining the 2D trajectory, only present for informative reason.	PJ.18-02b
C		
Current Data Authority (CDA)	The Current Data Authority is the ATS unit that has responsibility of data communication with an aircraft.	
Context Management (CM) Application	It is the data link application initial operated between aircraft and ground to support the exchange of addressing and versioning information.	
Constraint	Any restriction brought to the preferred trajectory of an aircraft, being either a tactical constraint such as ATCO instruction, or a strategic constraint derived from the operations of the network	SESAR ATM Lexicon
Controlled Time of Arrival	An ATM imposed time constraint on a defined waypoint	SESAR ATM Lexicon
Coordination & Transfer (C&T) Data	The coordination and the transfer conditions between two successive IOP Units of the control sequence including C&T Contractual data (TFL, SFL, Heading, Direct, Speed ROC/ROD), C&T Unit Data (transferring and receiving frequency and RE identification) and C&T Functional data (phases and actions related to skip, delegation and no_contact).	PJ.18-02b
CPDLC	It is a data link application that allows for the direct exchange of text-based messages between a controller and a pilot	SESAR ATM Lexicon
Current Conditions	The initial aircraft data needed for trajectory computation. It is provided by the FDMP notifying the position, heading, speed and mass of the aircraft used by itself as start data for the trajectory computation.	PJ.18-02b
D		

Deelegatee	An IOP Unit which is neither Receiving or Transferring RE to the Delegator Unit in control sequence and to whom the control of the flight will be delegated by the Delegator Unit.	PJ.18-02b
Delegator	The first of the two successive IOP Units crossed by the IOP trajectory, who's going to delegate the flight to the Deelegatee Unit	PJ.18-02b
Distribution Cluster	To ease the distribution of FO data, it has been grouped into clusters of related data. Distribution cluster is the basis element of distribution of FO data.	PJ.18-02b
Desynchronised	An IOP stakeholder is not synchronised for a given Flight Object.	PJ.18-02b
Data Distribution Service	Data Distribution Service as specified by OMG Also: FDP Data Distribution Service When ambiguity may arise, OMG DDS and FDD are used.	OMG
Deferred Clearances	Clearances that do not imply an immediate instruction, but they condition its application to the flight having matched a condition respect to a given position or a given time.	PJ.18-02b
E		
ETA min/max	ETA min/max is the earliest/latest ETA at a waypoint, provided the aircraft flies the 4D trajectory at its max/min allowable speed, wind/temp error is also taken into account, in order to guarantee that any CTA defined within associated ETA min/max interval will be satisfied with high probability.	SESAR ATM Lexicon
F		
FDMP	A system having the role Flight Data Manager/Publisher (FDMP) for a flight is responsible to keep up-to-date and consistent the Flight Object. It is also responsible to process (accepting or rejecting) the FO update requests from the other systems involved in this flight and make the up-to-date Flight Object available to all those systems. More details are given in chapter 4.2.1.1.1	PJ.18-02b
FDC	A system having the role Flight Data Contributor (FDC) for a flight is allowed to make request to the FDMP for updating the FO with flight specific data under its responsibility. The FDC is a system planned to control the flight. Only an FDMP can identify a system as having the FDC	PJ.18-02b

	<p>role.</p> <p>More details are given in chapter 4.2.1.1.2</p>	
FDU	<p>A system having the role Flight Data User (FDU) is allowed to provide requests that do not modify flight specific information, that is, technical requests related to the FO management protocol.</p> <p>Only an FDMP can identify a system as having the FDC role.</p> <p>More details are given in chapter 4.2.1.1.3</p>	PJ.18-02b
Flight Object	The system instance view of a flight. It is the flight object that is shared between the IOP stakeholders.	SESAR ATM Lexicon
Flight Script	<p>FO contained data that is composed of the flight specific data that supports trajectory prediction. The script collects:</p> <p>The initial conditions (current aircraft position)</p> <p>The specification of horizontal legs</p> <p>The specification of vertical level targets</p> <p>The applicable constraints</p>	PJ.18-02b
FO Expanded Route	The portion of the expanded route published in the FO, exactly in the scope of the IOP Route Expansion Scope	PJ.18-02b
I		
IFPZ	The IFPS Zone (IFPZ) is the area in which IFPS is responsible for the distribution of flight plans and associated messages to the ATC world.	SESAR ATM Lexicon
Impact Modification factor	IM is the Impact Modification factor to take account of additional information regarding the operational effect of the hazard, in particular related to the number of aircraft exposed to the operational hazard.	
IOP stakeholder	<p>Any entity that provides information to other entities or that consumes such information using the IOP capabilities.</p> <p>For example:</p> <p>A system instance working for a civilian ATSU (En Route, Approach, or Tower).</p> <p>A system instance working for a military ATSU.</p> <p>Or a combination of the above.</p> <p>A system working for an Airport Authority.</p> <p>A system working for an Aircraft Operator.</p>	PJ.18-02b

	<p>A system working for an aircraft (FMS).</p> <p>A Central Flow Management Unit (CFMU).</p> <p>In the frame of ED-133, the IOP stakeholder is limited to a system instance working for one or more civilian ATSU's.</p>	
IOP area	The area corresponding to the union of the AOI of each IOP stakeholder. This area is unique.	PJ.18-02b
IOP-capable system instance	A system instance declared as able to participate in IOP. This is a static property that denotes a capability that exists but may be out of service at a given time. An IOP stakeholder has an IOP-capable system.	PJ.18-02b
IOP-enabled system instance	The system instance of an IOP stakeholder for which the IOP capability is currently in operation (enabled). It is a dynamic property of the stakeholder. It is lost as soon as the IOP capability is down.	PJ.18-02b
IOP-disabled system instance	A non "IOP-enabled" system instance.	PJ.18-02b
IOP role	There are several roles that a given IOP stakeholder can play. The role assignment is defined for a given flight-object. The assignment of role changes during the course of the flight represented by the flight-object.	PJ.18-02b
IOP holes	<p>IOP Holes are volumes that are controlled or expected to be controlled by a non-enabled IOP stakeholder. There can be two kinds of IOP Holes:</p> <ul style="list-style-type: none"> - Permanent when they are controlled by a non IOP capable SI - Temporary when they are controlled or expected to be controlled by an IOP stakeholder that is temporary not IOP enabled. 	PJ.18-02b
IOP data	The data items that are transmitted or shared between IOP stakeholders to realise IOP services with QoS.	PJ.18-02b
IOP infrastructure	The black box that provides the IOP services from the external actor view point (e.g. controller, ATC function like AMAN).	PJ.18-02b
IOP Route Expansion Scope	The scope of the FO Expanded Route.	PJ.18-02b
IOP service	One capability of the IOP infrastructure, answering one or more IOP requirements and activated in several use cases.	PJ.18-02b
M		

MAC-SC3	A situation where an imminent collision was prevented by ATC Collision prevention	
MAC SC4b	A situation where an imminent infringement coming from a planned conflict that should have been resolved by Traffic planning & Synchronization was prevented by tactical conflict management	
N		
Next Data Authority (NDA)	The Next data Authority is the next ATS unit that will assume responsibility of data communication with an aircraft.	
P		
Point-based strategic constraint	<p>Pattern of use of Constraint Points for Level Strategic Constraints. Point-based constraints have a null target segment, identified by identical start-point and end-point, corresponding respectively to the input Target Start Point (TSP) and input Target End Point (TEP).</p> <p>Only one of input Target Start Point and input Target End Point is defined Relevant Constraint Point.</p> <p>If the input TSP is provided and set Relevant Constraint Point, the TEP, although provided as the same point of input TSP (but not set Relevant Constraint Point), is evaluated using other attributes of the constraint, the Level Change Mode, the Strategic constraint mode and the Level Constraint Maintenance (ref. to relevant sections).</p> <p>If the input TEP is provided and set Relevant Constraint Point, the TSP, although provided as the same point of input TEP (but not set Relevant Constraint Point), is evaluated using other attributes of the constraint, the Level Change Mode and the Strategic constraint mode (ref. to relevant sections).</p>	PJ.18-02b
Private Strategic Constraint	Strategic constraints known only by one SI.	PJ.18-02b
Publication	The action of a publisher of sending data through the Distribution Service. It corresponds to the publish part of the publish/subscribe pattern.	PJ.18-02b
R		
Relevant Constraint Point	An indicator set for the Application Point, Target Start Point and/or Target End Point of a constraint to identify whether the constraint point is the main target for the trajectory computation.	PJ.18-02b

Responsible Entity (RE)	The RE is the ID of the sector defined in the adaptation data and hence static name. These sectors will be independent of the local mapping.	PJ.18-02b
RE (Receiving)	The RE determined by the Receiving IOP Unit as the one expected to assume the flight after a frequency change has been performed by the Transferring RE.	PJ.18-02b
RE (Transferring)	The RE determined by the Transferring IOP Unit as the one expected to perform the frequency change to the Receiving RE.	PJ.18-02b
Route Expansion Area	Convex geodetic polygon, including the 2D projections of all IOP AORs/AOIs, non-IOP AORs/AOIs filling the gaps among the IOP ones, and, if any, part of adjacent non-IOP AORs/AOIs. Defined in AIM data, and shared among all IOP Stakeholders, it exists to identify the IOP Route Expansion Scope.	PJ.18-02b
S		
Segment-based strategic constraint	Pattern of use of Constraint Points for Level Strategic Constraints. Segment-based constraints have an explicit target segment, identified by start-point and end-point, corresponding respectively to the input Target Start Point (TSP) and input Target End Point (TEP). Both input TSP and input TEP are defined Relevant Constraint Point.	PJ.18-02b
Shared Strategic Constraint	Strategic constraints defined in Adaptation Data in more than one SI.	PJ.18-02b
System Instance	A deployed unit that addresses one or more ATSUs.	PJ.18-02b
SFPL	The internal core entity which stores the flight intention in each program for developing and advanced ATC system as well as all applicable constraints during the flight lifecycle of the flight within the area of interest.	PJ.18-02b
Synchronised	An IOP stakeholder is synchronised for a flight Object when the local SFPL is aligned on the Flight Object.	PJ.18-02b
T		
Target End Point (TEP)	The target end point of a constraint is the point after which the constraint is not applicable any more.	PJ.18-02b
Trajectory	Representation of the predicted 4D path of an aircraft.	SESAR ATM Lexicon
Target segment	A route segment, identified by its start-point and end-point.	PJ.18-02b

	It defines the portion of the route on which the target value of a constraint is expected to be fulfilled, and maintained.	
Target Start Point (TSP)	The target start point of a constraint is the point at which the constraint is expected to be fulfilled.	PJ.18-02b
U		
Unit (downstream)	The downstream unit is the first involved occurrence downstream to a given transition.	PJ.18-02b
Unit (upstream)	The upstream unit is the first involved occurrence upstream to a given transition.	PJ.18-02b
Unit (transferring)	The transferring unit is the first control occurrence upstream to a given transition. It is the last occurrence before the transition that will control the flight.	PJ.18-02b
Unit (receiving)	The receiving unit is the first control occurrence downstream to a given transition. It is the first occurrence after the transition that will control the flight.	PJ.18-02b
V		
Valid FS service request	A FO service request that has succeeded the eligibility, syntactical and semantic checks by the FDMP.	PJ.18-02b
W		
WIMP	The responsibilities of this role are: Creation of the WIFO to query a WIC regarding FO changes. Publishing of the WIFO to a unique contributor (WIC). Collects and updates the value of the changed Topics of WIFO, being responsible for the consistency of the WIFO. Provide the agreements regarding the WIFO to the manager of the real Flight Object.	PJ.18-02b
WIC	The responsibilities of this role are: To answer to the WIMP by: - Accepting a proposed WIFO - Rejecting the proposed WIFO Provide a counter proposal to the WIMP by sending the modifications to the proposed WIFO.	PJ.18-02b
What-if Flight Object (WIFO)	It is an alternative Flight Object. It is generated from a real Flight Object and contains the modifications needed to propose an alternative to the real one.	PJ.18-02b
What-if Context	The what-if context in which the Flight Object is defined: "Real world", "simulation 1", etc.	PJ.18-02b

WIFO Counter Proposal	It is a request for change by a WIC to a WIMP on negotiated items that may produce a WIFO update distribution to all WIFO WICs if retained acceptable by WIMP.	PJ.18-02b
WIFO Agreement	There is an agreement between WIMP and all consulted WICs on a WIFO when the locally accepted and distributed WIFO is also accepted by all consulted WICs.	PJ.18-02b

Table 1: Glossary

2.7 Acronyms and Terminology

Term	Definition
ACC	Area Control Centre
ACM	ATC Communication Management Service
ACT	Activation message (OLDI)
ADD	Architecture Definition Document
ADEP	Aerodrome of Departure
ADES	Aerodrome of Destination
ADEXP	ATS Data Exchange Presentation
ADS-B	Automatic Dependent Surveillance - Broadcast
AFIL	Air-Filed Flight Plan
AFTN	Aeronautical Fixed Telecommunication Network
AGDL	Air-Ground Data Link
AIM	Aeronautical Information Management
AIRM	ATM Information Reference Model
ALAP	As Late As Possible
ALO	Actual Level Over
AMAN	Arrival Manager
ANSP	Air Navigation Service Provider
AO	Aircraft Operator

AOI	Area of Interest
AOR	Area of Responsibility
AP	Application point
API	Application Programming Interface
APOP	AirPort Operator
ARCID	Aircraft Identification
ASAP	As Soon As Possible
ASSR	Assigned SSR code
ATC	Air Traffic Control
ATCO	Air Traffic Controller
ATFCM	Air Traffic Flow and Capacity Management
ATM	Air Traffic Management
ATS	Air Traffic Services
ATSU	Air Traffic Service Unit
CAP	Controller Awareness Phase
CASA	Computer-Assisted Slot Allocation
CDA	Current Data Authority
CFL	Cleared Flight Level
CHG	Change Message (ICAO)
CM	Context Management Application
COF	Change of Frequency
CPDLC	Controller-Pilot Data Link Communications
CSSR	Current SSR Code
CTA	Controlled Time of Arrival
CTO	Controlled Times of Overfly
CTOT	Calculated Take-Off Time
CWP	Controller Working Position

DDS	Data Distribution Service
DLIC	This data link service exchanges information between an aircraft and a DLIC ground system to identify the data link applications that both support.
DSSR	Downstream SSR code
EAP	Extended ATC Planner
ECL	En-route Cruising Level
ECS	En-route Cruise Speed
EFL	Entry Flight Level
EOBD	Estimated Off-Block Date
EOBT	Estimated Off-Block Time
ERAM	En Route Automation Modernization (FAA)
ETA	Expected time of arrival
ETO	Expected time over a point
ETOT	Estimates Take-Off Time
FDC	Flight Data Contributor
FDMP	Flight Data Manager/Publisher
FDP	Flight Data Processing
FDPS	Flight Data Processing System
FDU	Flight Data User
FIXM	Flight Information Exchange Model
FMP	Flow Management Position
FO	Flight Object
FOC	Flight Operation Centre
FOIPS	Flight Object Interoperability Proposed Standard
FOS	Flight Object Server
FP	Flight Plan
FPL	Flight Plan

FS	Flight Script
GAT	General Air Traffic
GUFI	Globally Unique Flight Identifier
HMI	Human-Machine Interface
IAP	Instrument Approach Procedure
ICAO	International Civil Aviation Organization
ICD	Interface Control Document
ICOG	Interoperability Consulting Group
IFPL	Individual Flight Plan message
IFPS	Integrated Initial Flight Plan Processing System
IFPZ	IFPS Zone
IFR	Instrument Flight Rules
IM	Impact Modification factor.
INAP	Integrated NM and extended ATC Planning
INTEROP	Interoperability Requirements
IOP	Interoperability
IOP SI	IOP-capable System Instance
IRS	Interface Requirements Specification
LoA	Letter of Agreement
MAS	Manual Assume of Control Message (OLDI)
M-ATSU	Military ATSU
MDW	Middleware
MET	METeorological
MTCD	Medium-Term Conflict Detection
NDA	Next data Authority
NM	Network Manager
NOV	NATO Operational View

NP	Negotiation Phase
NSSR	Next SSR Code
NSV	NATO System View
OAT	Operational Air Traffic
OLDI	On-Line Data Interchange
OSED	Operational Service and Environment Definition
PJ	Project (Sesar 2020 projects)
RE	Responsible Entity
RFL	Requested Flight Level
ROCD	Rate of Climb/Descent
ROF	Request on Frequency
SAP	System Awareness Phase
SESAR	Single European Sky ATM Research Programme
SESAR EA	SESAR Enterprise Architecture
SFL	Supplementary Flight Level
SFPL	System Flight Plan
SI	System Instance
SID	Standard Instrument Departure
SIT	Slot Issued Time
SJU	SESAR Joint Undertaking (Agency of the European Commission)
SSR	Secondary Surveillance Radar
STAR	Standard Instrument Arrival
SWIM-TI	SWIM Technical Infrastructure
TEP	Target End Point
TFL	Transfer Flight Level
TOC	Top of Climb

TOD	Top of Descend
TP	Trajectory Predictor
TRL	Technology Readiness Level
TS	Technical Specification
TSP	Target Start Point
TTA	Target Time of Arrival
TTO	Target Time Over
VFR	Visual Flight Rules
VRCD	Vertical Rate Of Climb/Descent
WIC	What-if Contributor
WIFO	What-if Flight Object
WIMP	What-If Manager Publisher
XFL	eXit Flight Level

Table 2: Acronyms and terminology

3 SESAR Solution Impacts on Architecture

3.1 Target Solution Architecture

3.1.1 SESAR Solution(s) Overview

PJ.18-02b: ATC-ATC Flight Object Interoperability (FO IOP)

Develop Flight Object (FO) interoperability (IOP) between ATC systems (G/G IOP). ATC systems encompasses en-route ATC and TMA ATC. ATC-ATC interoperability will consider seamless coordination, encompassing as well more complex coordination dialogues implying negotiation between controllers across ACC boundaries.

Solution 18-02b concentrates on interoperability between ATC systems (En-Route and TMA) (G/G IOP). Because of different maturity level ATC-NM interoperability has been moved to Solution 18-02b1. ATC-ATC interoperability will consider seamless coordination, encompassing as well more complex coordination dialogues implying negotiation between controllers across ACC boundaries. These dialogues will make use of the WIFO concept, whereby flight plan avatars are synchronized across systems to represent various proposals/counter-proposals exchanged by controllers. ATC-NM interoperability will enable global Trajectory Based Operation from planning to en-route phase.

Solution 18-02b is also responsible for the maintenance of the SWIM Blue Profile based on findings from the validation and additional requirements that may come up from the new IOP functionalities.

Solution 18-02b is bringing the IOP work done in SESAR 1 to full TRL6 maturity in order to support the ATC-ATC IOP initial deployment. The work was based on the gap analysis made in SESAR 1 and will remove all deficiencies identified in the ATC-ATC interoperability.

The functional blocks relevant for IOP are:

- The 'G/G IOP Management' functional block provides the management, dissemination and synchronization of flight objects with other SI's in the IOP area
- The 'Flight Planning Lifecycle Management Data Distribution' functional block provides the management of the system flight plans (SFPL) for IFR and VFR flights from creation until their deletion from their lifecycle perspective.
- The 'Trajectory Prediction & Management' functional block provides the planned flight trajectory according to the flight intent (planned route and tactical constraints), aircraft intent (where extracted from downlinked data) and predefined environment data and constraints.
- The 'Coordination and Transfer' functional block provides the management of coordination and transfer of flights between "internal" sectors and with external SIs, civil/military coordination, pre-departure clearance coordination, and the processing of oceanic clearances.
- The 'Arrival Management (AMAN)' functional block is responsible for determining an optimal arrival sequence at designated aerodromes and providing associated advisories such as time to lose/gain and Controlled Time of Arrival based on downlinked ETA min/max at the metering point. The sequence and advisories are distributed to the Controller Working Positions and to external clients. The AMAN also allows the controller to manually alter the arrival sequence.

IOP ATC architecture in scope of this TS:

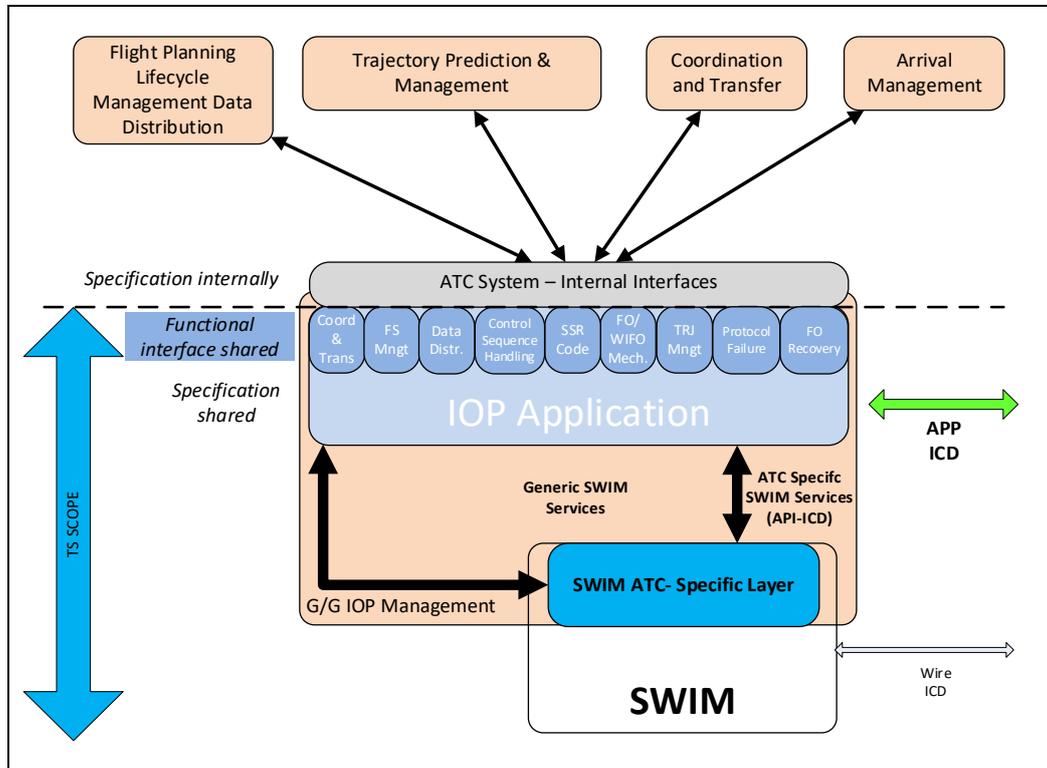


Figure 1: IOP ATC architecture

The above architecture diagram contains the following elements:

- SWIM System Wide Information Management:** The ATC-Specific Layer of SWIM is specifically devoted to ATC. It is considered as accepted that the SWIM will have a generic profile and specific ones for the ATM domains that require it. In this specific profile, are located IOP ATC specific things such as the FO Management at a low level (for example, DDS clusters definition for the FO distribution clusters, FO management parameters... etc.). Two arrows for SWIM services are represented in the interface, since the ATC will not only use ATC specific but also generic services. For example (Network supervision related, security, etc.).
- ATC System - Interfaces:** This interface is not described in this document, it is internal and specific to each ATC system instance and cannot be generalised at the level of this specification. The interface description between the functional blocs will remain at a functional decomposition level.
- The IOP Application:** It can be considered as an additional component to an ATC System. It will support anything that is specifically related with the FO handling, such as the API-ICD interface between ATC systems or the FO management handling.
- Functional interfaces:** The IOP Application needs the domain information computed and provided by FDP, as well as to feed FDP with the information received from the FO updates.



For this purpose functional interfaces are defined based on the features functional decomposition:

- Coordination & Transfer: Evolution of coordination and transfer SYSCO functionalities with the FO, including all SYSCO existing functions plus more flexible negotiation among multiple controllers, release functions, etc...
- Flight Script management: The flight script contains the initial flight plan and additional information such as strategic or tactical constraints, clearances. This define how to manage constraints, eligibility rules, notion of open and closed constraints and rules to use them to model the trajectory.
- IOP Data Distribution: This is linked to Control Sequence Handling and defines additional rules for distribution.
- Control Sequence Handling: The Control sequence is based on the list of crossed system instances computed from the IOP 4DT, but there are IOP functions defined to alter this list, such as SKIP of unit or sector, delegation of a flight to a third party and NO_CONTACT, which is a limited SKIP where the unit will still coordinate but not take the aircraft on frequency.
- SSR codes management: Management of SSR codes: current SSR code instructed to the aircraft, mode A received from aircraft, SSR code that the controlling unit intends to assign to the aircraft, SSR code that each downstream unit intends to assign to the aircraft once it is under its control.
- FO/WIFO Mechanism: This gathers a number of items related to the technical solutions covering: FDMP role transfer; Responsibilities and Capabilities of FDMP, FDC and FDU roles; WIFO mechanisms.
- Trajectory Management: Define how to manage (in scope and content) the 4D Trajectory exchanged through the FO and calculated successively by different system.
- FO Protocol Failure: To gather any non-nominal case linked to technical problem, such as FDMP selection failure, FDC requests not reaching FDMP or FO's not removed from the network by the last FDMP.
- FO Recovery: Functionalities allowing a failed IOP node to recover.
- APP-ICD: Define the interface between IOP Node at the level of the IOP Application.
- API-ICD: Define the interface between the SWIM layer and the IOP Application layer.

OI Step	OI description	Open CR
POI-0016-IS	BASIC IOP for G/G data sharing between En-Route ATC centres	
EN code	EN description	Open CR
SWIM-APS-05a	Provision and Consumption of Flight Object Sharing services	
SWIM-INFR-01a	High Criticality SWIM Services infrastructure Support and Connectivity.	
EN code	EN description	Open CR

ER APP ATC 179	Synchronization of MET data among FO ATC clients	CR 02953 TO BE WITHDRAWN - (Create ER APP ATC 179 (PJ.18-02b))
SVC-035	Update the Flight Object Services for BASIC IOP with more precise interface definitions	CR 04758 Update SVC-035 - (PJ.18-02b): Creation of new EN to Update the Flight Object Services for Basic- IOP with more precise interface definitions
PJ.18-02b	ATC-ATC Flight Object Interoperability (FO IOP)	CR 04971 Update SOL PJ.18- 02b_ATC-ATC Flight Object Interoperability (FO IOP) programmatic links PJ20
ATC-STD- 01	Ground-Ground flight data exchange	
ER ATC 160a	ATC to ATC Flight Data Exchange for En-Route BASIC IOP using the Flight Object	CR 05035 Update ER ATC 160a (PJ.18-02b): Addition of missing links to EATMA elements according to PJ19 review comments.
ER ATC 176	FO Recovery mechanisms and failure scenario	CR 05036 Update ER ATC 176 (PJ.18-02b): Addition of missing links to EATMA elements according to PJ19 review comments.
POI-0050-IS	BASIC IOP for G/G data sharing between En-Route and TMA ATC centres	
EN code	EN description	Open CR
APP ATC 177	ATC to ATC Flight Data Exchange in a TMA environment	CR 05034 Update APP ATC 177 (PJ.18-02b): Addition of missing links to EATMA elements according to PJ19 review comments.
PJ.18-02b	ATC-ATC Flight Object Interoperability (FO IOP)	CR 04971 Update SOL PJ.18- 02b_ATC-ATC Flight Object

		Interoperability (FO IOP) programmatic links PJ20
ATC-STD-01	Ground-Ground flight data exchange	

Table 3: SESAR Solution 18-02b OI and Enablers

Type	Element	EN Code	EN/CR Title	Coverage
		APP ATC 177	CR 05034 Update APP ATC 177 (PJ.18-02b)	
FB	G/G IOP Management (PJ.18-02b)			considered
		ER ATC 160a	CR 05035 Update ER ATC 160a (PJ.18-02b)	
FB	G/G IOP Management (PJ.18-02b)			considered
		ER ATC 176	CR 05036 Update ER ATC 176 (PJ.18-02b)	
FB	G/G IOP Management (PJ.18-02b)			considered
		SVC-035	CR 04758 Update SVC-035 -(PJ.18-02b)	
Serv	ATCFlightObjectControl (PJ.18-02b)			considered
Serv	IOPMonitoring (PJ.18-02b)			considered
Serv	SharedFlightObject (PJ.18-02b)			considered

Table 4: SESAR Solution 18-02b Scope and related Functional Blocks/roles & Enablers

3.1.1.1 Deviations with respect to the SESAR Solution(s) definition

Not applicable.

3.1.1.2 Relevant Use Cases

The following Use-cases (UCs) are covered by this TS document. They constitute the scope of what has been validated in IOP-EXE01, IOP-EXE02 and IOP-EXE03, note that UC in scope of IOP-EXE03 are validated by expert judgement.

The detailed operational description of the use cases can be found in the PJ18-02b INTEROP document (REF.: [33])

UC#	Title	Feature	Exe Scope
UC#0101	Automatic Triggering of SAP/CAP/NP in compliance with LOA's	Coordination & Transfer	IOP-EXE01
UC#0102	Manual Triggering of CAP/NP	Coordination & Transfer	IOP-EXE01
UC#0103	Automatic Reversion from CAP/NP to SAP	Coordination & Transfer	IOP-EXE03
UC#0105	Change of coordination data or trajectory during SAP	Coordination & Transfer	IOP-EXE01
UC#0106	Change of coordination data or trajectory during CAP	Coordination & Transfer	IOP-EXE01
UC#0109	Change of C&T data or trajectory during NP without negotiation	Coordination & Transfer	IOP-EXE01
UC#0112	Request on Frequency	Coordination & Transfer	IOP-EXE01
UC#0113	Change of Frequency & Assume	Coordination & Transfer	IOP-EXE01
UC#0115	Undo-Send	Coordination & Transfer	IOP-EXE03
UC#0118	Force-assume by the Receiving RE	Coordination & Transfer	IOP-EXE01
UC#0120	Force-assume by a further downstream unit	Coordination & Transfer	IOP-EXE03
UC#0124	Point between Transferring & Receiving Res and Point cancellation	Coordination & Transfer	IOP-EXE03
UC#0126	Negotiation between Transferring RE and Receiving RE	Coordination & Transfer	IOP-EXE01
UC#0127	Negotiation of DCT contractual data between Transferring RE and Receiving RE	Coordination & Transfer	IOP-EXE03
UC#0128	Negotiation of C&T Contractual data & trajectory by 2 FDC's	Coordination & Transfer	IOP-EXE03
UC#0133	Force-assume from a skipped Unit	Coordination & Transfer	IOP-EXE03
UC#0136	Reversion from NP to CAP	Coordination & Transfer	IOP-EXE03
UC#0201	Creation and sharing of a constraint	Flight Script management	IOP-EXE01
UC#0210	Modification of 2D Route	Flight Script management	IOP-EXE01
UC#0214	En route cruising level management	Flight Script management	IOP-EXE01
UC#0224	Management of holding & stay constraint	Flight Script management	IOP-EXE03
UC#0226	Modification of IFR/VFR and OAT/GAT	Flight Script management	IOP-EXE03

UC#	Title	Feature	Exe Scope
UC#0228	Level band clearance	Flight Script management	IOP-EXE03
UC#0231	Closed heading management	Flight Script management	IOP-EXE03
UC#0234	Management of active/inactive states of constraints	Flight Script management	IOP-EXE03
UC#0235	Management of Diversion (new destination airport)-	Flight Script management	IOP-EXE03
UC#0240	Projection of specific points	Flight Script management	IOP-EXE03
UC#0243	Sharing of executive constraints (CFL, Speed, Heading, Rate)	Flight Script management	IOP-EXE01
UC#0244	Route amendment inside a downstream airspace	Flight Script management	IOP-EXE01
UC#0245	Transfer of a constraint impacted by a route change	Flight Script management	IOP-EXE01
UC#0246	Maintenance of the cleared route in the flight object	Flight Script management	IOP-EXE03
UC#0301	FO creation & sharing	IOP Data Distribution	IOP-EXE01
UC#0304	Distribution on bilateral rules (General information)	IOP Data Distribution	IOP-EXE03
UC#0306	Manual subscription/unsubscription to FO	IOP Data Distribution	IOP-EXE03
UC#0401	Management of discrepancies with local view	FO Protocol Failure	IOP-EXE01
UC#0403	FO stabilization and Protection against multiple successive FO updates	FO Protocol Failure	IOP-EXE03
UC#0404	De-synchronization and Re-synchronization	FO Protocol Failure	IOP-EXE03
UC#0501	Automatic Skip of an IOP Unit in favour of the upstream	Control Sequence Handling	IOP-EXE03
UC#0503	Manual Unskip of an IOP Unit skipped in favour of the upstream	Control Sequence Handling	IOP-EXE03
UC#0504	Manual Skip of an IOP Unit in favour of the upstream	Control Sequence Handling	IOP-EXE03
UC#506	Internal Resp Entity-Skip/Unskip (control remains in same Unit)	Control Sequence Handling	IOP-EXE03
UC#0510	Manual partial delegation and cancellation	Control Sequence Handling	IOP-EXE03

UC#	Title	Feature	Exe Scope
UC#0518	"No Contact" implementation	Control Sequence Handling	IOP-EXE03
UC#0521	Re-entrance	Control Sequence Handling	IOP-EXE02
UC#0522	Correction of ATSU sequence list	Control Sequence Handling	IOP-EXE02
UC#0602	FULL IOP Recovery mechanism	IOP recovery	IOP-EXE03
UC#0801	Modifying & Sharing the IOP_NSSR, IOP_ASSR & IOP_CSSR	SSR codes management	IOP-EXE03
UC#0805	To request and provide the IOP_DSSR	SSR codes management	IOP-EXE03
UC#0807	Sharing the Mode S flight Id	SSR codes management	IOP-EXE03
UC#0905	Flight Object Removal	FO mechanism	IOP-EXE03
UC#0906	Management of non-supported functionalities	FO mechanism	IOP-EXE02
UC#1001	Trajectory Management and Scope	Scope and Management of the FO trajectory	IOP-EXE02
UC#1002	Advanced Trajectory Management and Scope	Scope and Management of the FO trajectory	IOP-EXE03
UC#1101	Departure Time update	TMA	IOP-EXE03
UC#1102	SID definition and change	TMA	IOP-EXE03
UC#1103	STAR definition and change (& Arrival transitions)	TMA	IOP-EXE03
UC#1109	AMAN (indication of TTL / TTG & XMAN delay sharing)	TMA	IOP-EXE03

Table 5: Use Cases List in scope of this specification.

A sub-set of this list of UC's have been selected for modelling. They have been selected for their relevance to demonstrate the architecture put in place to achieve the FO-IOP.

Operational Use Case	Description
[NOV-5] Coordinate and Transfer Flight	This use case describes the operational activities to transfer a flight from a controlling ATC unit to a receiving ATC unit,

	including ATS coordination information exchanges among downstream and informed units.
[NOV-5] Route Change without Negotiation	This use case describes the operational activities to make a route change impacting downstream sector(s) without negotiation and sharing this route change information among the concerned units.
[NOV-5] Coordination and Transfer data modification with negotiation Between Transferring and Receiving Units	<p>The coordination and the transfer conditions between two successive IOP Units of the control sequence must rely on pieces of information called C&T data (Coordination & Transfer data). Their modification might be the subject of a negotiation. C&T data is consist of TFL, SFL, Heading, Direct, Speed, RoC/RoD.</p> <p>This use case describes the operational activities to make a negotiation between Transferring Unit and Receiving unit and sharing the result of this negotiation among the concerned units.</p>
[NOV-5] Coordination and Transfer data modification with negotiation Between two further downstream Units	<p>The coordination and the transfer conditions between two successive IOP Units of the control sequence must rely on pieces of information called C&T data (Coordination & Transfer data). Their modification might be the subject of a negotiation. C&T data is consist of TFL, SFL, Heading, Direct, Speed, RoC/RoD.</p> <p>This use case describes the operational activities to make a negotiation between two further downstream units while none of them has the control of the flight and sharing the result of this negotiation among the concerned units.</p>

Table 6: Relevant Use Cases

System Process	Description
[NSV-4] Automatic Triggering and Closure of SAP/CAP/NP in Compliance with LoA	<p>This use case describes the process by which the coordination status between two adjacent IOP Units evolves according to the progress of the concerned flight.</p> <p>Unit A: The Transferring RE, which is the first of the two IOP Units in the control sequence. At the end of the process, the Transferring RE will transfer the flight to the Receiving RE.</p> <p>Unit B: The Receiving RE defined by the Receiving Unit, which is the second of the two IOP Units in the control sequence. At the end of the process, the Receiving RE will receive the flight from the Transferring RE.</p>
[NSV-4] Change of COTR data or Trajectory during NP without electronic negotiation	The Negotiation Phase is made to prevent REs to change coordination data or 4D Trajectory without negotiation when the flight is quite close to the boundary or to the frequency change. It indicates to both Units that any coordination data change 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.

	<p>Transferring RE – the RE determined by the Transferring Unit which is the first of the two IOP Units in the control sequence. The Transferring RE is expected to transfer the flight to the Receiving RE.</p> <p>Receiving RE – the RE determined by the Receiving Unit which is the second of the two IOP Units in the control sequence. The Receiving RE is expected to receive the flight from the Transferring RE.</p>
[NSV-4] Coordination and Transfer	<p>This Use case illustrate the process of coordination followed by the transfer of the flight between the controlling/transferring UNIT (FDMP) and the downstream/receiving UNIT (FDC).</p> <p>When the transfer is executed the receiving UNIT becomes FDMP and controlling UNIT, and the transferring UNIT becomes FDC.</p> <p>While the transferring UNIT has the FDMP role, it distributes the FO to all concerned UNIT. Coordination data and transfer data are distributed to the downstream UNIT but also to all other UNIT in the distribution list of the FO via the distribution of the FO.</p> <p>When the receiving UNIT receives the transfer data, it takes over the FDMP role. From this moment it the receiving UNIT that updates and distribute the FO. The information that the transfer is finished and that the receiving UNIT is now controlling the flight and is the FDMP is distributed to all concerned UNIT by the receiving UNIT.</p>
[NSV-4] Creation and sharing of a level constraint provided by the Receiving Unit	<p>This use case describes the management of a level constraint modified by the receiving RE.</p> <p>Unit A – (Transferring Unit) The first of the two IOP Units in the control sequence, controlling the flight.</p> <p>Unit B –(Receiving Unit) The second of the two IOP Units in the control sequence.</p>
[NSV-4] Distribution Failure	<p>This Use Case describes how a system behave in case of Flight Object distribution failure.</p>
[NSV-4] FO Creation and Sharing by First Crossed IOP Unit	<p>This use case describes the process by which a flight object for a flight is created in a system and then distributed to all the Units who are concerned about this flight.</p> <p>First crossed IOP Unit. This IOP Unit will create a flight object and share it.</p> <p>All the downstream IOP Units – the Units that will receive the flight object for that particular flight.</p>
[NSV-4] FO Recovery	<p>This Use Case describes the process of recovering for an UNIT after having lost the IOP capability.</p>
[NSV-4] FO Update Collision	<p>This Use Case describes how the system detect a Flight Object update collision.</p>

[NSV-4] Force-assume by the Receiving RE	<p>This use case describes the process by which a flight is force assumed by the Receiving RE before the Transferring RE has performed the frequency change input in the system.</p> <p>Transferring Unit – the RE determined by the Transferring Unit which is the first of the two IOP Units in the control sequence. The Transferring RE is expected to transfer the flight to the Receiving RE.</p> <p>Receiving Unit – the RE determined by the Receiving Unit which is the second of the two IOP Units in the control sequence. The Receiving RE is expected to receive the flight from the Transferring RE.</p>
[NSV-4] Management of discrepancies with local view (basic part)	<p>This use case describes the notification of discrepancies between the flight object and the local SFPL, which will provoke a synchronization of the local view with the FO.</p> <p>Transferring Unit – the RE determined by the Transferring Unit, which is the first of the two IOP Units in the control sequence. The Transferring RE is expected to transfer the flight to the Receiving RE.</p> <p>Receiving Unit – the RE determined by the Receiving Unit, which is the second of the two IOP Units in the control sequence. The Receiving RE is expected to receive the flight from the Transferring RE.</p>
[NSV-4] Manual subscription/unsubscription to FO	<p>This use case describes the process by which an IOP Unit can subscribe or unsubscribe to a FO of a specific flight.</p> <p>The operational context can be the following: The aircraft gets aware of a very bad weather forecast at destination. As a consequence, the flight crew or the FOC (Flight Operations Centre) contacts another control Unit in charge of a possible alternate in order to get all relevant pieces of information in case of diversion. As this Unit is not yet concerned by this aircraft (until it really decides to divert), the responding operator (e.g. ATCO) has to look for the flight information into the database in order to get a better idea of his position, type of aircraft, estimates..., all these data that might influence the decision (possible delay, stand availability...).</p> <p>Once the Flight crew is fully aware of the offered possibilities, he makes the decision not to divert to this airfield. The questioned Unit is no longer concerned by the flight and can unsubscribe from the distribution of the flight information.</p> <p>Unit A: Controlling Unit, the IOP Unit currently controlling the flight.</p> <p>Unit B: A downstream unit.</p> <p>Unit C: Not-served Unit, an IOP Unit that initially does not receive the flight information for a specific flight (his Area of Interest is not crossed).</p>
[NSV-4] Negotiation between Two Units	{Negotiation between Two Units }

	<p>This use case describes the negotiation of C&T Contractual data between two following IOP Units in the control sequence.</p> <p>Unit B: The Unit of the future (not currently controlling) Transferring RE. The Unit B is expected to transfer the flight to the Unit C. Unit B initiate the negotiation.</p> <p>Unit C: The Unit of the Receiving RE which is the second of the two IOP Units in the control sequence. The Receiving RE is expected to receive the flight from the Transferring RE.</p>
--	---

Table 7: System Processes

3.1.1.3 Applicable standards and regulations

3.1.1.3.1 ED-133

Institutional Enabler	Standard
ATC-STD-01_Ground-Ground flight data exchange	EUROCAE ED-133A

Table 8: Institutional Enabler

At time of publication of this specification, the EUROCAE-ED133A is not published yet. The EUROCAE WG59 is developing this new standard for publication in October 2021. The PJ.18-02b INTEROP (Ref.: [33]) and TS (this document) will be used as input to develop this new version of the standard.

3.1.1.3.2 FF-ICE/1 ICAO documents

PANS-ATM (DOC 4444) document and its amendments concerning the initial implementation of FF-ICE services.

Manual on FF-ICE Implementation Guidance, DOC 9965, Volume II Implementation Guidance.

3.1.1.3.3 FF-ICE/2 ICAO documents

There are not yet official ICAO documents regarding FF-ICE/2, the extension of FF-ICE to the execution phase. These documents may have an impact on IOP depending of the option selected and the ED-133 Rev A document will need to ensure compatibility.

3.1.2 Capability Configurations required for the SESAR Solution

FO Request and Distribution		En-Route		
CC	Op Env	Capability	Node	Stakeholder
Civil Aircraft		Adverse Condition Operations Provision; ATSAW-Spacing Monitoring Execution; Clearance/Instruction Management; CTA/CTO Management; Ground Collision Avoidance; Interval Management (IM);	Airspace User Operations; Flight Deck;	Civil Scheduled Aviation;

		<p>Meteorological Observation and Forecasting Provision; Mid-Air Collision Avoidance; Optimised Climb Execution; Optimised Descent Execution; Optimised Take-Off / Landing Execution; PinS Operations Execution; RNP based Operations Execution; Separation Technique Management; Surface Route Management; Trajectory Information Synchronisation; Trajectory Revision in Execution; Wake Turbulence Separation Provision;</p>		
Communication Infrastructure	Airport; En-Route; Network; Terminal Airspace;	Communication;		Civil CNS Service Provider; Military CNS Service Provider;
ER ACC (PJ-18-02b)	En-Route;	Coordination and Transfer;	Air Traffic Flow and Capacity Management; Airspace Management; Airspace Organisation; En-Route/Approach ATS;	Civil ATS En-Route Service Provider; Military ATS En-Route Service Provider;

IOP Monitoring				
CC	Op Env	Capability	Node	Stakeholder
Communication Infrastructure	Airport; En-Route; Network; Terminal	Communication;		Civil CNS Service Provider; Military CNS Service

	Airspace;			Provider;
ER ACC (PJ-18-02b)	En-Route;	Coordination and Transfer;	Air Traffic Flow and Capacity Management; Airspace Management; Airspace Organisation; En-Route/Approach ATS;	Civil ATS En-Route Service Provider; Military ATS En-Route Service Provider;

Table 9: List of Capability Configuration required for the SESAR Solution

3.2 Changes imposed by the SESAR Solution on the baseline Architecture

Enabler	Element type	Element name	Impact	Change
APP ATC 177	ATC to ATC	Flight Data Exchange in a TMA environment		Implement ground-ground flight data exchange between ATC units in a TMA environment, through the use of Flight Object services based on a revised Flight Object, in order to support exchange of flight data at a functional level covering at least all current implementations of the OLDI standard for coordination and transfer. This shall include functionalities supporting negotiation between neighbouring units.
	Function	Manage Coordination and Transfer Data	Update	
	Function	Manage Distribution Crossed and Controlling List	Update	
	Function	Manage Flight Script	Update	
	Function	Update and Distribute FO	Update	
	Function	Update and Distribute WIFO	Update	

ER	ATC	ATC to ATC Flight Data Exchange for En-Route BASIC IOP using the Flight Object	Implement ground-ground flight data exchange between En-Route ATC units through the use of Flight Object services based on a revised Flight Object EUROCAE Ed.133 specification, in order to support exchange of flight data at a functional level covering at least all current implementations of the OLDI standard for coordination and transfer. This shall include functionalities supporting negotiation between neighbouring units.
	Function	Ack End of Service	Introduce
	Function	Assess and Modify Coordination Data	Introduce
	Function	Complementary Distribution	Introduce
	Function	Create and Distribute FO	Introduce
	Function	Create and Distribute WIFO	Introduce
	Function	End of Complementary Distribution	Introduce
	Function	Enter in CAP	Introduce
	Function	Enter in NP	Introduce
	Function	Enter in SAP	Introduce
	Function	Manage Coordination and Transfer Data	Introduce
	Function	Manage Distribution Crossed and Controlling List	Introduce
	Function	Manage Flight Script	Introduce
	Function	Manage SSR Code Data	Introduce
	Function	Manage WIFO	Introduce
	Function	Modify Constraints	Introduce
	Function	Modify Route	Introduce
	Function	Read FO	Introduce
	Function	Read FO Update	Introduce
	Function	Read WIFO	Introduce
	Function	Read WIFO Update	Introduce
	Function	Request FO Update from WIFO	Introduce
	Function	Set Entry Condition in FO	Introduce
	Function	Take FDMP Role	Introduce
	Function	Terminated	Introduce
	Function	Update and Distribute FO	Introduce

	Function	Update and Distribute WIFO	Introduce	
	Function	Update Coord and Transf Data	Introduce	
	Function	Update IOP Trajectory	Introduce	
ER ATC 176	FO Recovery mechanisms and failure scenario			Support for loss of IOP nodes full functionality in various configuration, resilience to failure cases and recovery of Flight Object after node failure.
	Function	Create and Distribute FO	Update	
	Function	Manage Distribution Failure	Introduce	
	Function	Manage FO Recovery	Introduce	
	Function	Manage FO Update Collision	Introduce	
	Function	Recover FO	Introduce	
	Function	Reject Flight Object	Introduce	
	Function	Update and Distribute FO	Update	
SVC-035 (CR)	Update the Flight Object Services for BASIC IOP with more precise interface definitions			Provision of the Flight Object services for BASIC IOP including ATC Flight Object Control and Shared Flight Object service interfaces.
	Service	ATCFlightObjectControl (PJ.18-02b)	Update	
	Service	IOPMonitoring (PJ.18-02b)	Introduce	
	Service	SharedFlightObject (PJ.18-02b)	Update	

Table 10: Changes imposed by the SESAR Solution

4 Technical Specifications

4.1 Functional architecture overview

Functions required to perform needed Operational Activities can be allocated to Resources of a different type: Human Role, Infrastructure System or Functional Block.

Role	Functional Block	Function
[NSV-4] Automatic Triggering and Closure of SAP/CAP/NP in Compliance with LoA		
	Coordination and Transfer (PJ.18-02b)	Assume Flight; Border in CAP; Border in NP; Transfer of Frequency;
	Coordination and Transfer (PJ.18-02b)	Assume Flight; Border in CAP; Border in NP; Evaluate Entry Condition; Trigger CAP;
	Flight Planning - Lifecycle Management - Data Distribution (PJ.18-02b)	Create SFPL;
	G/G IOP Management (PJ.18-02b)	Create and Distribute FO; Enter in CAP; Enter in NP; Enter in SAP; Manage Coordination and Transfer Data; Manage Distribution Crossed and Controlling List; Read FO Update; Terminated; Update and Distribute FO;
	G/G IOP Management (PJ.18-02b)	Enter in CAP; Enter in NP; Enter in SAP; Manage Coordination and Transfer Data; Read FO; Read FO Update; Set Entry Condition in FO;

		Take FDMP Role; Update and Distribute FO;
[NSV-4] Change of COTR data or Trajectory during NP without electronic negotiation		
	Controller Human Machine Interaction Management ER/APP (PJ.18-02b)	Verbal Agreement;
	Coordination and Transfer (PJ.18-02b)	Implement Verbal Negotiation;
	G/G IOP Management (PJ.18-02b)	Read FO Update;
	G/G IOP Management (PJ.18-02b)	Manage Coordination and Transfer Data; Update and Distribute FO;
[NSV-4] Coordination and Transfer		
	Coordination and Transfer (PJ.18-02b)	Calculate Coordination Data; Transfer of Frequency;
	Coordination and Transfer (PJ.18-02b)	Assume Flight;
	G/G IOP Management (PJ.18-02b)	Manage Coordination and Transfer Data; Read FO Update; Take FDMP Role; Update and Distribute FO;
	G/G IOP Management (PJ.18-02b)	Read FO Update;
	G/G IOP Management (PJ.18-02b)	Manage Coordination and Transfer Data; Read FO Update; Terminated; Update and Distribute FO;
	Voice	Change Frequency and Contact Next ATCO;
[NSV-4] Creation and sharing of a level constraint provided by the Receiving Unit		

	Controller Human Machine Interaction Management ER/APP (PJ.18-02b)	Display New Exit Flight Level; Issue Clearance;
	Coordination and Transfer (PJ.18-02b)	Change of Entry Level;
	G/G IOP Management (PJ.18-02b)	Assess and Modify Coordination Data; Modify Constraints; Read FO Update;
	G/G IOP Management (PJ.18-02b)	Flight Script Management; Manage Coordination and Transfer Data; Update and Distribute FO; Update IOP Trajectory;
	Trajectory Prediction and Management (PJ.18-02b)	Predict Trajectory from FO; Share Clearance;
[NSV-4] Distribution Failure		
	G/G IOP Management (PJ.18-02b)	Read FO Update; Reject Flight Object;
	G/G IOP Management (PJ.18-02b)	Manage Distribution Failure; Update and Distribute FO;
[NSV-4] FO Creation and Sharing by First Crossed IOP Unit		
	G/G IOP Management (PJ.18-02b)	Read FO;
	G/G IOP Management (PJ.18-02b)	Create and Distribute FO;
[NSV-4] FO Update Collision		
	G/G IOP Management (PJ.18-02b)	Manage FO Update Collision; Read FO Update;
	G/G IOP Management (PJ.18-02b)	Manage FO Update Collision; Update and Distribute FO;
[NSV-4] Force-assume by the Receiving RE		

	Controller Human Machine Interaction Management ER/APP (PJ.18-02b)	Display Force-assume acknowledgement;
	Controller Human Machine Interaction Management ER/APP (PJ.18-02b)	Acknowledge Stolen Info; Display Stolen Information;
	Coordination and Transfer (PJ.18-02b)	Flight Stolen; Share Acknowledgement;
	Coordination and Transfer (PJ.18-02b)	Force Assume Acknowledge; Force-assume Flight;
	G/G IOP Management (PJ.18-02b)	Read FO Update; Terminated;
	G/G IOP Management (PJ.18-02b)	Manage Coordination and Transfer Data; Take FDMP Role; Update and Distribute FO;
[NSV-4] Management of discrepancies with local view (basic part)		
	Controller Human Machine Interaction Management ER/APP (PJ.18-02b)	ATCO force assume the flight; Display Rejection; Manually Modify Route;
	Coordination and Transfer (PJ.18-02b)	Force-assume Flight;
	G/G IOP Management (PJ.18-02b)	Assess and Modify Coordination Data; Desynchronize from FO; Modify Route; Read FO Update; Take FDMP Role; Update and Distribute FO;
	G/G IOP Management (PJ.18-02b)	Coordination Management; Distribution Management; Flight Script Management; Read FO Update; Update and Distribute FO;

	Trajectory Prediction and Management (PJ.18-02b)	Assess route modification with local rules; Reject Route Modification;
[NSV-4] Manual subscription/unsubscription to FO		
	Controller Human Machine Interaction Management ER/APP (PJ.18-02b)	Request Flight Information; UnSubscribe Flight Information;
	Coordination and Transfer (PJ.18-02b)	Assume Flight;
	G/G IOP Management (PJ.18-02b)	Distribution Management; Update and Distribute FO;
	G/G IOP Management (PJ.18-02b)	Read FO Update;
	G/G IOP Management (PJ.18-02b)	Ack End of Service; Complementary Distribution; End of Complementary Distribution; Read FO; Read FO Update;
[NSV-4] Negotiation between Two Units		
	Coordination and Transfer (PJ.18-02b)	Evaluate Proposal;
	Coordination and Transfer (PJ.18-02b)	Evaluate Proposal; Initiate Negotiation; Negotiation Accepted; Negotiation Rejected;
	G/G IOP Management (PJ.18-02b)	Read FO Update; Read WIFO; Read WIFO Update; Reply To WIFO;
	G/G IOP Management (PJ.18-02b)	Update and Distribute FO;
	G/G IOP Management (PJ.18-02b)	Read FO Update;

	G/G IOP Management (PJ.18-02b)	Create and Distribute WIFO; Read FO Update; Request FO Update from WIFO; Update and Distribute WIFO; WIFO Management;
[NSV-4] FO Recovery		
	G/G IOP Management (PJ.18-02b)	Manage FO Recovery; Update and Distribute FO;
	G/G IOP Management (PJ.18-02b)	Monitor IOP; Read FO; Recover FO;

Table 11 Functional architecture overview

4.1.1 Resource Connectivity Model

FO Request and Distribute is the mechanism by which a system can request modification to a Flight Object and receive the updated FO.

This is done by using 2 services:

- The request realized by ATCFlightObjectControl service
- The distribution realized by SharedFlightObject service

The request is using the synchronous query/reply design pattern.

The distribution uses the asynchronous publish pattern.

Note that the subscription for distribution is not part of the distribution service.

The system responsible for distribution (FDMP) determines the distribution based on defined criteria.

In addition any system can request the distribution of the Flight Object by using the ATCFlightObjectControl service.

This below diagram describes how ATC systems interact between each others depending on their role for a given flight.

The FDMP publishes the Flight Object to FDC and FDU using the ShareFlightObject service.



FDC and FDU Request FO update to the FDMP using the ATCFlightObjectControl service.

The WIMP publishes a What If Flight Object to the WIC using the ShareFlightObject service

The WIC interacts with the WIMP on a negotiated WIFO using ATCFlightObjectControl service.

Note that the Aircraft is present in the diagram but has no role in the IOP, it is there for completeness reason when describing the process of transferring an aircraft from the controlling ATCO to the next one.

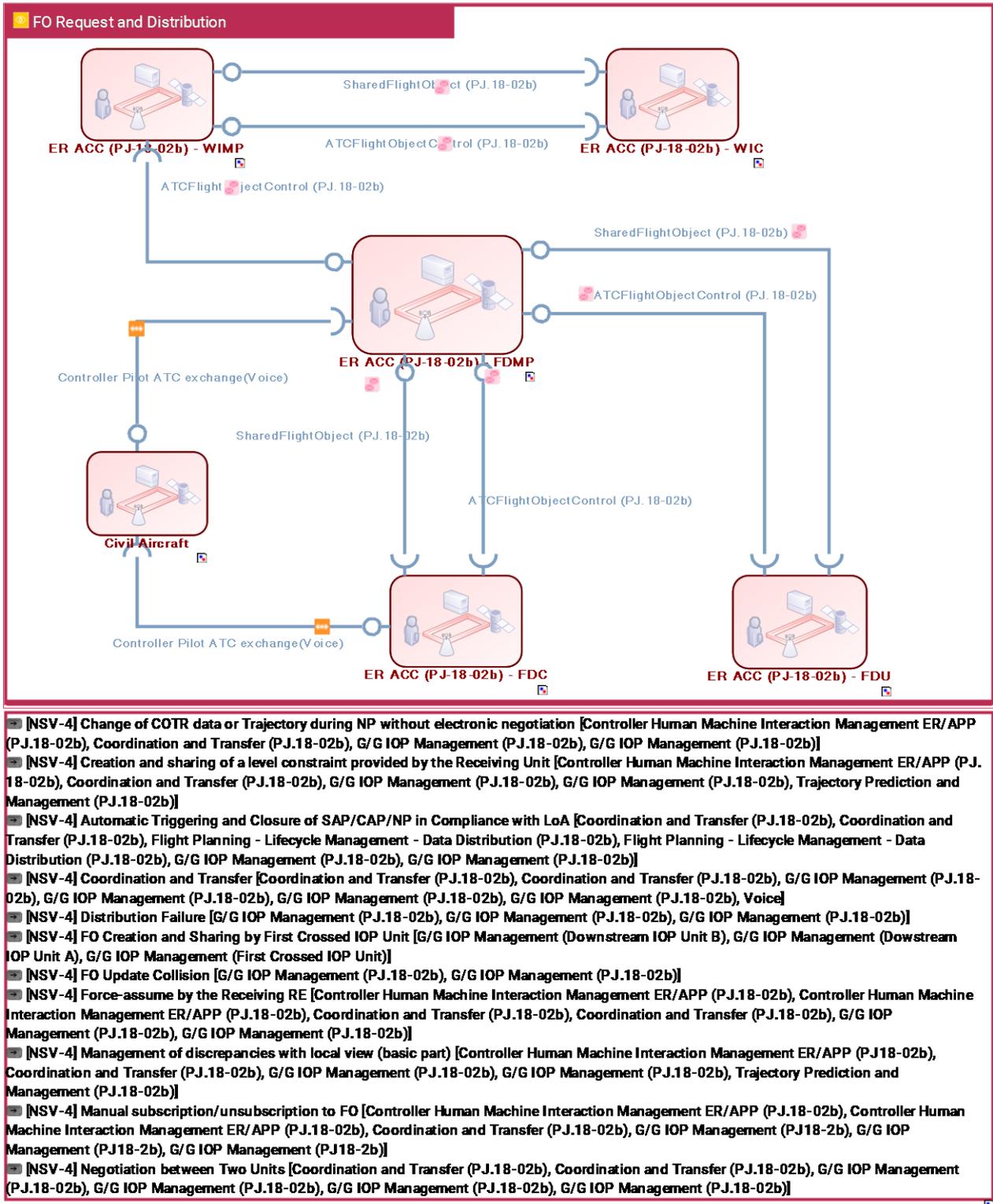


Figure 2: FO Request and Distribute Resource Connectivity Model

The below view describes the Resource Connectivity for the IOP Monitoring.

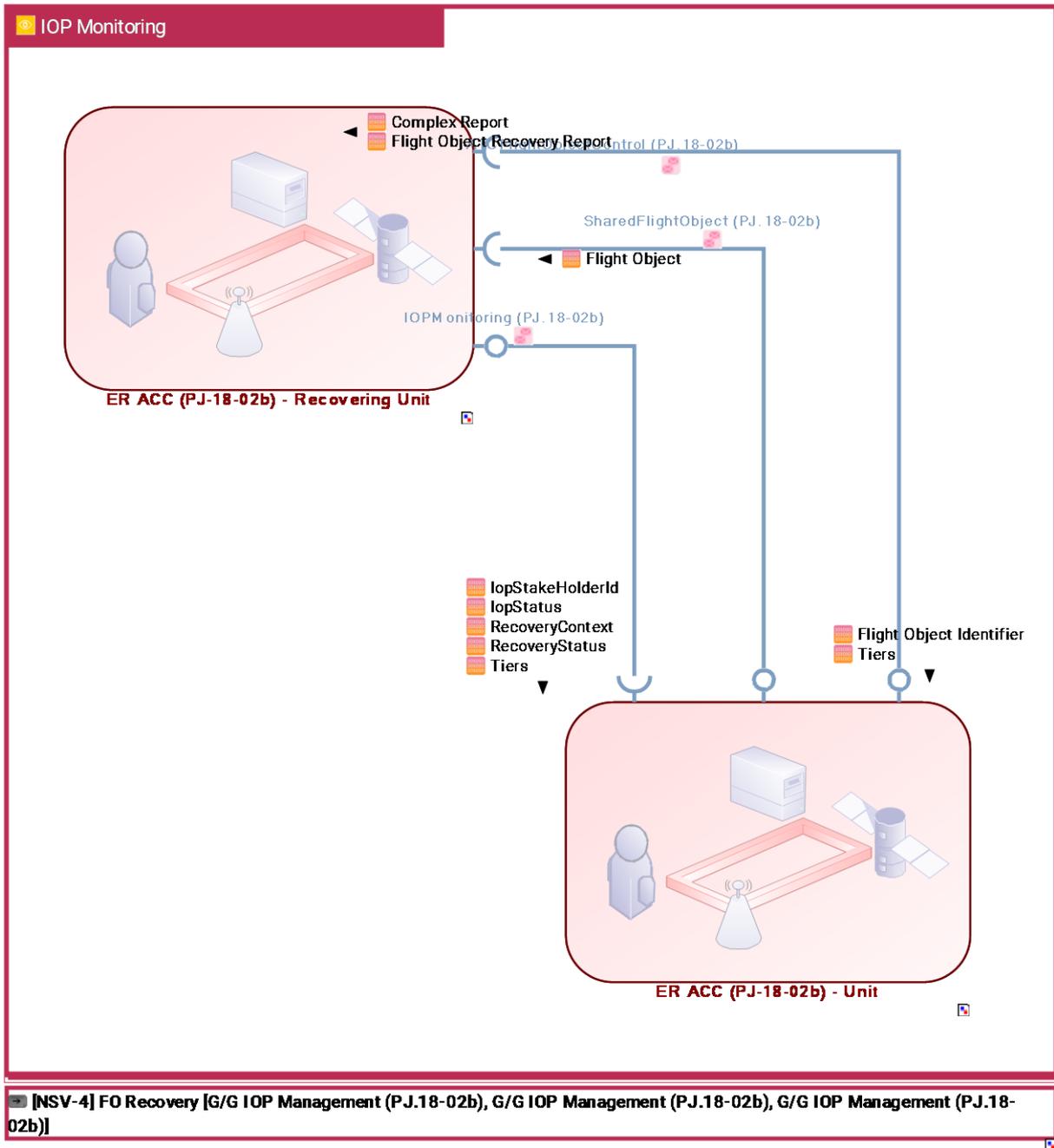


Figure 3: IOP Monitoring Resource Connectivity Model

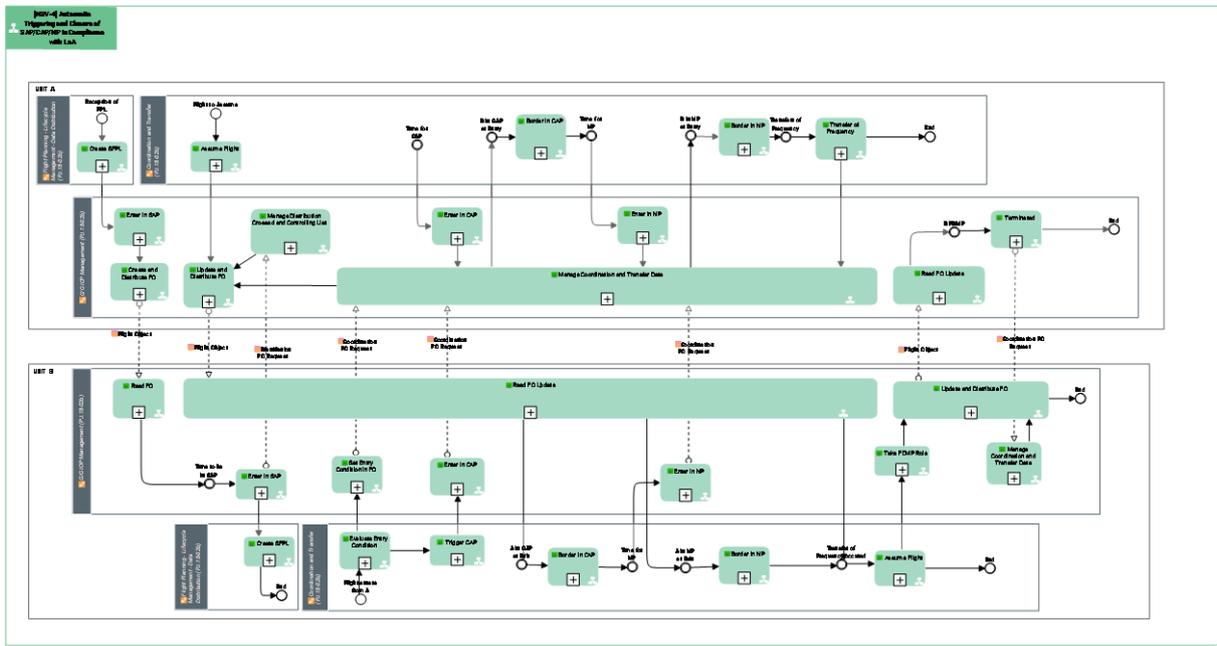
4.1.2 Resource Orchestration view

4.1.2.1 [NSV-4] Automatic Triggering and Closure of SAP/CAP/NP in Compliance with LoA

This use case describes the process by which the coordination status between two adjacent IOP Units evolves according to the progress of the concerned flight.

Unit A: The Transferring RE, which is the first of the two IOP Units in the control sequence. At the end of the process, the Transferring RE will transfer the flight to the Receiving RE.

Unit B: The Receiving RE defined by the Receiving Unit, which is the second of the two IOP Units in the control sequence. At the end of the process, the Receiving RE will receive the flight from the Transferring RE.



Function	Description
Assume Flight	Flight is assumed either automatically after local trigger, or manually by the ATCO.
Border in CAP	Controllers at both side of the crossed border are aware of a given flight.
Border in NP	Border is in negotiation phase for a given flight.
Create and Distribute FO	Creation of a Flight Object followed by its distribution to the concerned partners.

Create SFPL	Creation of the system flight plan.
Enter in CAP	Enters in controller awareness phase for a given flight at a given border.
Enter in NP	Enters in negotiation phase for a given flight over an ATSU border.
Enter in SAP	System is aware of a flight (flight plan received, FO received, ...).
Evaluate Entry Condition	Evaluation of the condition at entry of airspace.
Manage Coordination and Transfer Data	<p>Management of Coordination and Transfer data in the Flight Object.</p> <p>FDMP manage directly this data by itself.</p> <p>Other systems use ATCFlightObjectControl service to request the FDMP to update coordination and transfer data in the Flight Object.</p>
Manage Distribution Crossed and Controlling List	<p>Management of the Flight Object distribution list and crossed and control sequence.</p> <p>FDMP manages directly this data by itself.</p> <p>Other systems use ATCFlightObjectControl service to request the FDMP to update Flight Object distribution list.</p>
Read FO	Read the content of a new Flight Object.
Read FO Update	<p>Read an update to an existing FO.</p> <p>This function is performed by system having the FDC or FDU role.</p> <p>This updated FO can be expected or not.</p> <p>After having sent a request to the FDMP to update some elements of an FO, the FDC or FDU is waiting for an FO containing the result of the application of the request. The updated FO will contain the result of execution of the request indicating the success or not of this execution.</p> <p>When not expected, the reading of an updated FO inform the system of the result of a change provided directly from the FDMP activity or from the execution of a request from another FDC/FDU.</p>

Set Entry Condition in FO	FDC requests to the FDMP to set in the FO the entry condition for entry in its airspace.
Take FDMP Role	SI takes the FDMP role.
Terminated	A system indicates to the FDMP that it has finished with a flight and can be removed from the distribution list.
Transfer of Frequency	New frequency has been given to the aircraft.
Trigger CAP	Detection of an event that is triggering the Controller Awareness Phase.
Update and Distribute FO	Update the FO and distribute an updated version to the SI being in the distribution list.

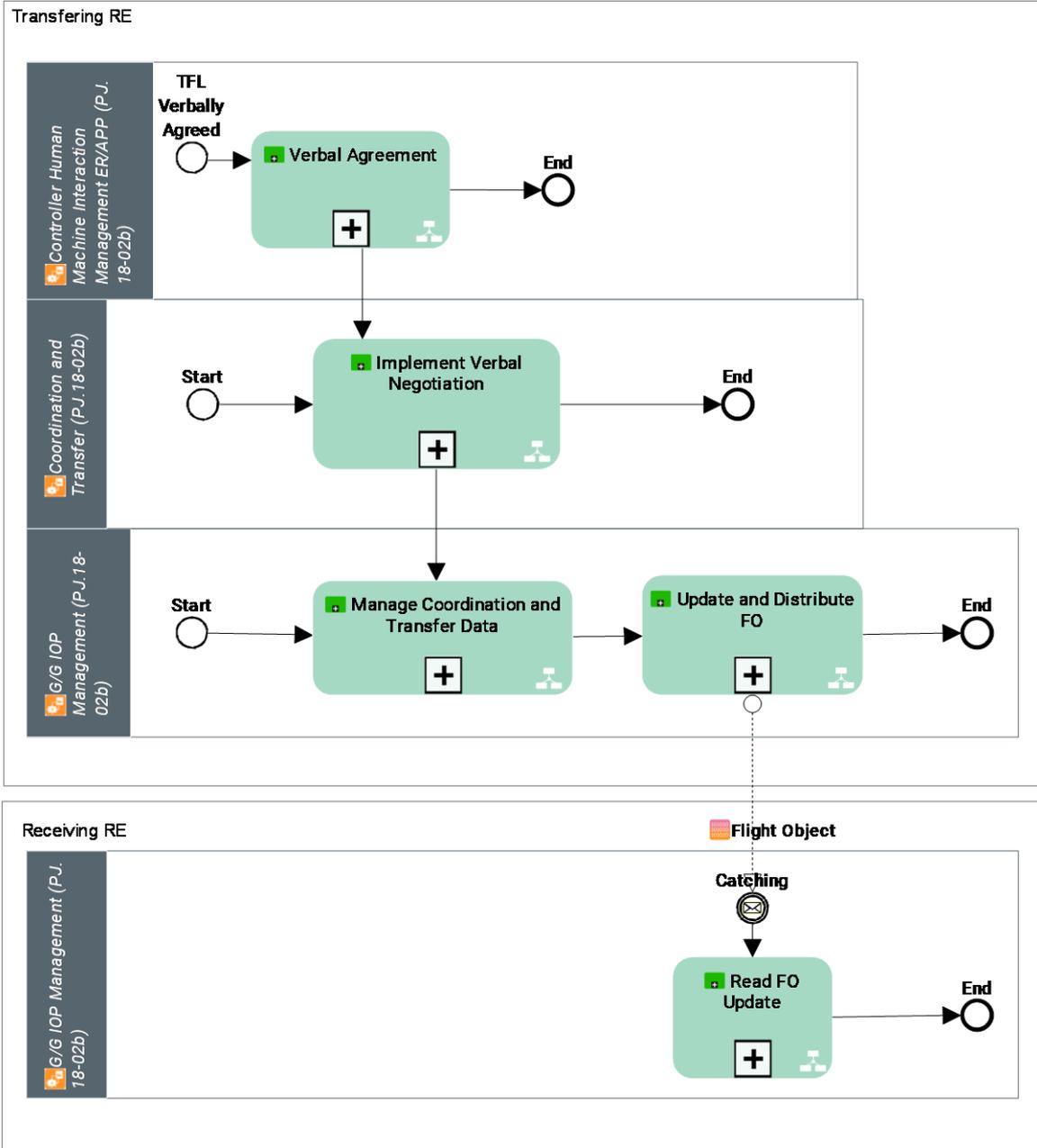
4.1.2.2 [NSV-4] Change of COTR data or Trajectory during NP without electronic negotiation

The Negotiation Phase is made to prevent REs to change coordination data or 4D Trajectory without negotiation when the flight is quite close to the boundary or to the frequency change. It indicates to both Units that any coordination data change 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.

Transferring RE – the RE determined by the Transferring Unit which is the first of the two IOP Units in the control sequence. The Transferring RE is expected to transfer the flight to the Receiving RE.

Receiving RE – the RE determined by the Receiving Unit which is the second of the two IOP Units in the control sequence. The Receiving RE is expected to receive the flight from the Transferring RE.

[NSV-4] Change of COTR data or Trajectory during NP without electronic negotiation



Function	Description
Implement Verbal Negotiation	Determine the impact on coordination and transfer data from controller input after a verbal negotiation.
Manage Coordination and Transfer Data	Management of Coordination and Transfer data in the Flight Object. FDMP manage directly this data by itself. Other systems use ATCFlightObjectControl service to request the FDMP to update coordination and transfer data in the Flight Object.
Read FO Update	Read an update to an existing FO. This function is performed by system having the FDC or FDU role. This updated FO can be expected or not. After having sent a request to the FDMP to update some elements of an FO, the FDC or FDU is waiting for an FO containing the result of the application of the request. The updated FO will contain the result of execution of the request indicating the success or not of this execution. When not expected, the reading of an updated FO inform the system of the result of a change provided directly from the FDMP activity or from the execution of a request from another FDC/FDU.
Update and Distribute FO	Update the FO and distribute an updated version to the SI being in the distribution list.
Verbal Agreement	Controller input into the system results of a verbal agreement with another controller.

4.1.2.3 [NSV-4] Coordination and Transfer

This Use case illustrate the process of coordination followed by the transfer of the flight between the controlling/transferring UNIT (FDMP) and the downstream/receiving UNIT (FDC).

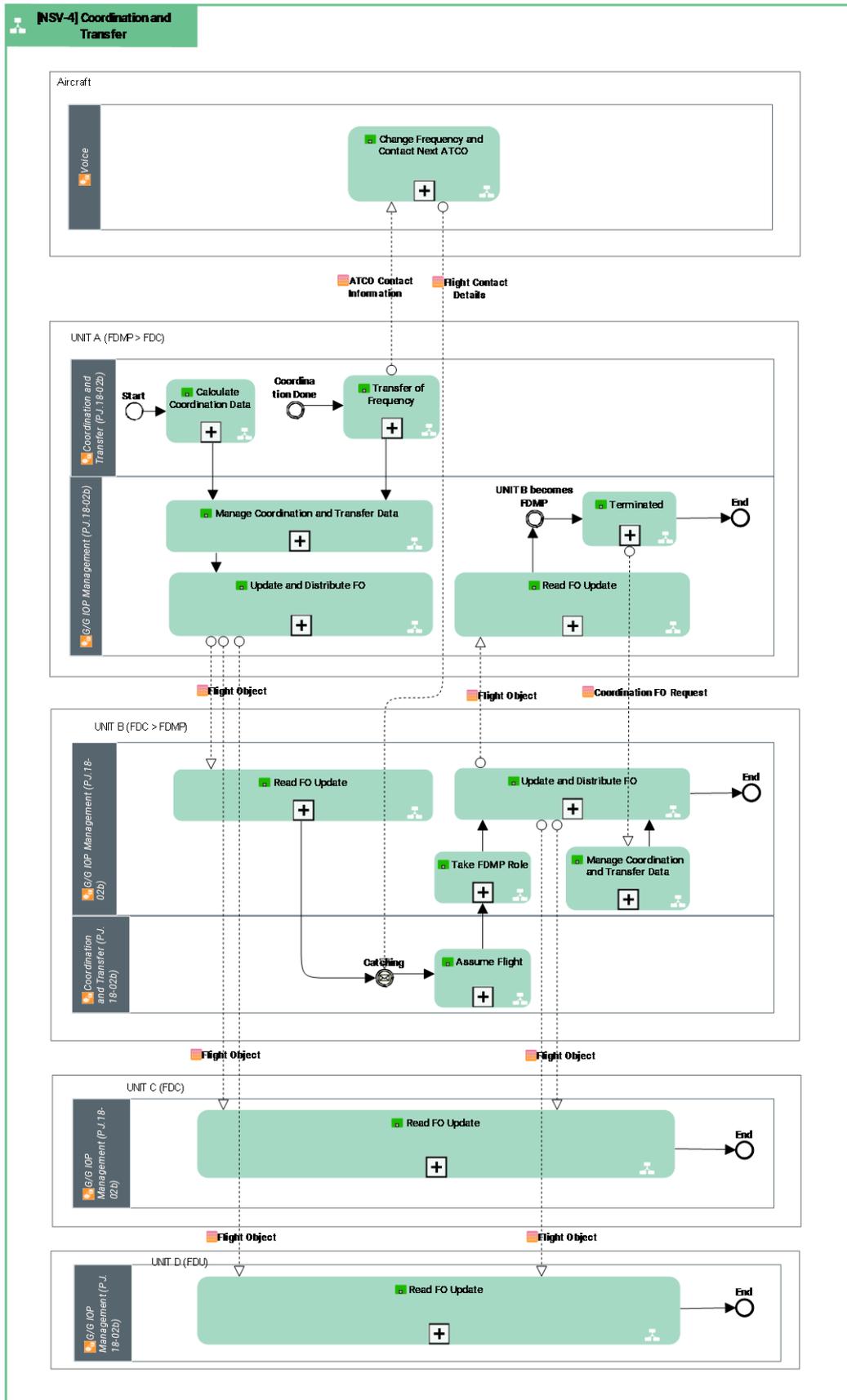
When the transfer is executed the receiving UNIT becomes FDMP and controlling UNIT, and the transferring UNIT becomes FDC.

While the transferring UNIT has the FDMP role, it distributes the FO to all concerned UNIT. Coordination data and transfer data are distributed to the downstream UNIT but also to all other UNIT in the distribution list of the FO via the distribution of the FO.

When the receiving UNIT receives the transfer data, it takes over the FDMP role. From this moment it the receiving UNIT that updates and distribute the FO. The information that the transfer is finished and



that the receiving UNIT is now controlling the flight and is the FDMP is distributed to all concerned UNIT by the receiving UNIT.



Function	Description
Assume Flight	Flight is assumed either automatically after local trigger, or manually by the ATCO.
Calculate Coordination Data	Calculate the coordination data to be exchanged/negotiated with the downstream unit.
Change Frequency and Contact Next ATCO	After having received the next controller information from the current controlling ATCO, the flight crew change the frequency to the one of the next controller and takes contact with him.
Manage Coordination and Transfer Data	<p>Management of Coordination and Transfer data in the Flight Object.</p> <p>FDMP manage directly this data by itself.</p> <p>Other systems use ATCFlightObjectControl service to request the FDMP to update coordination and transfer data in the Flight Object.</p>
Read FO Update	<p>Read an update to an existing FO.</p> <p>This function is performed by system having the FDC or FDU role.</p> <p>This updated FO can be expected or not.</p> <p>After having sent a request to the FDMP to update some elements of an FO, the FDC or FDU is waiting for an FO containing the result of the application of the request. The updated FO will contain the result of execution of the request indicating the success or not of this execution.</p> <p>When not expected, the reading of an updated FO inform the system of the result of a change provided directly from the FDMP activity or from the execution of a request from another FDC/FDU.</p>
Take FDMP Role	SI takes the FDMP role.
Terminated	A system indicates to the FDMP that it has finished with a flight and can be removed from the distribution list.
Transfer of Frequency	New frequency has been given to the aircraft.
Update and Distribute FO	Update the FO and distribute an updated version to the SI being in the distribution list.

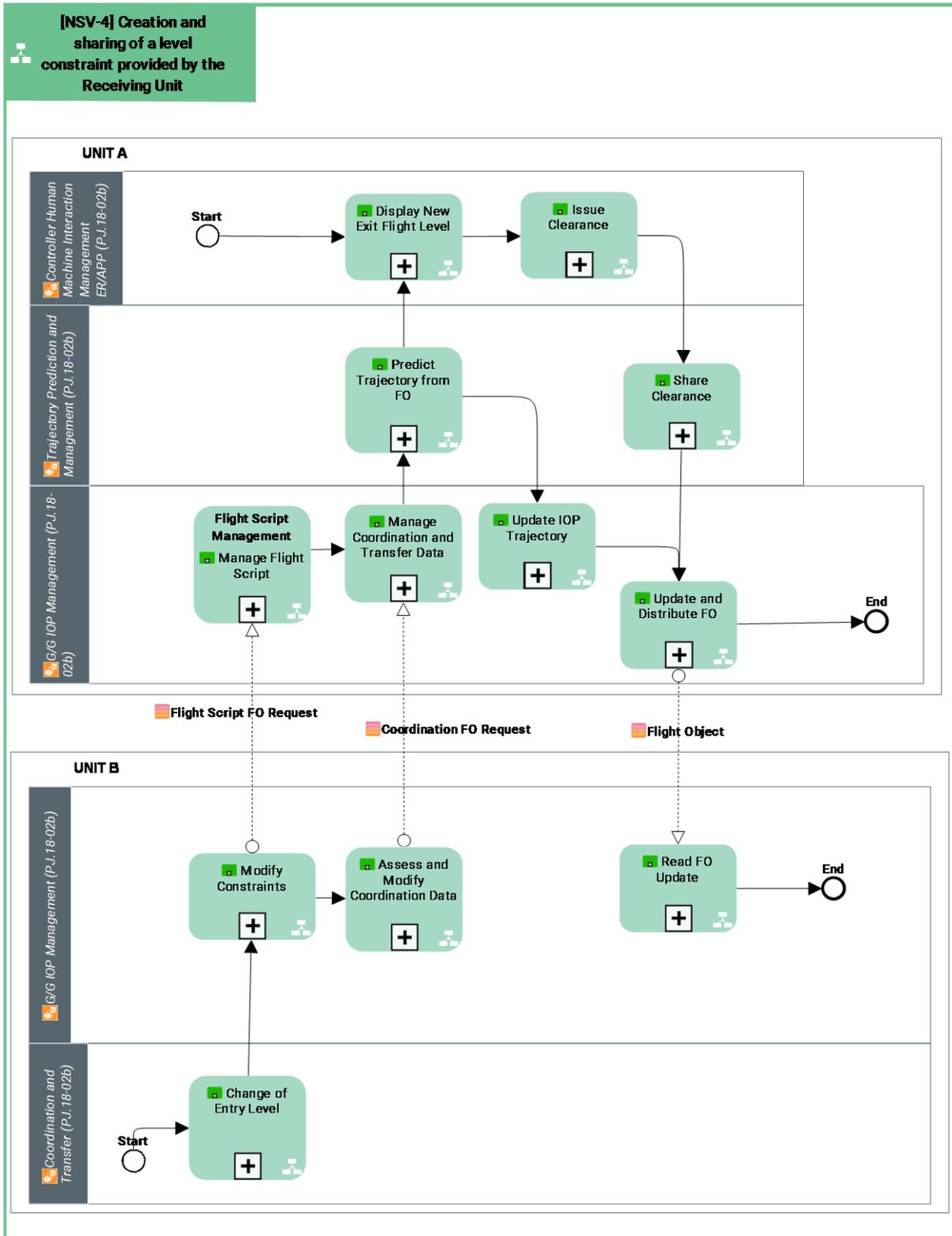


4.1.2.4 [NSV-4] Creation and sharing of a level constraint provided by the Receiving Unit

This use case describes the management of a level constraint modified by the receiving RE.

Unit A – (Transferring Unit) The first of the two IOP Units in the control sequence, controlling the flight.

Unit B –(Receiving Unit) The second of the two IOP Units in the control sequence.



Function	Description
----------	-------------

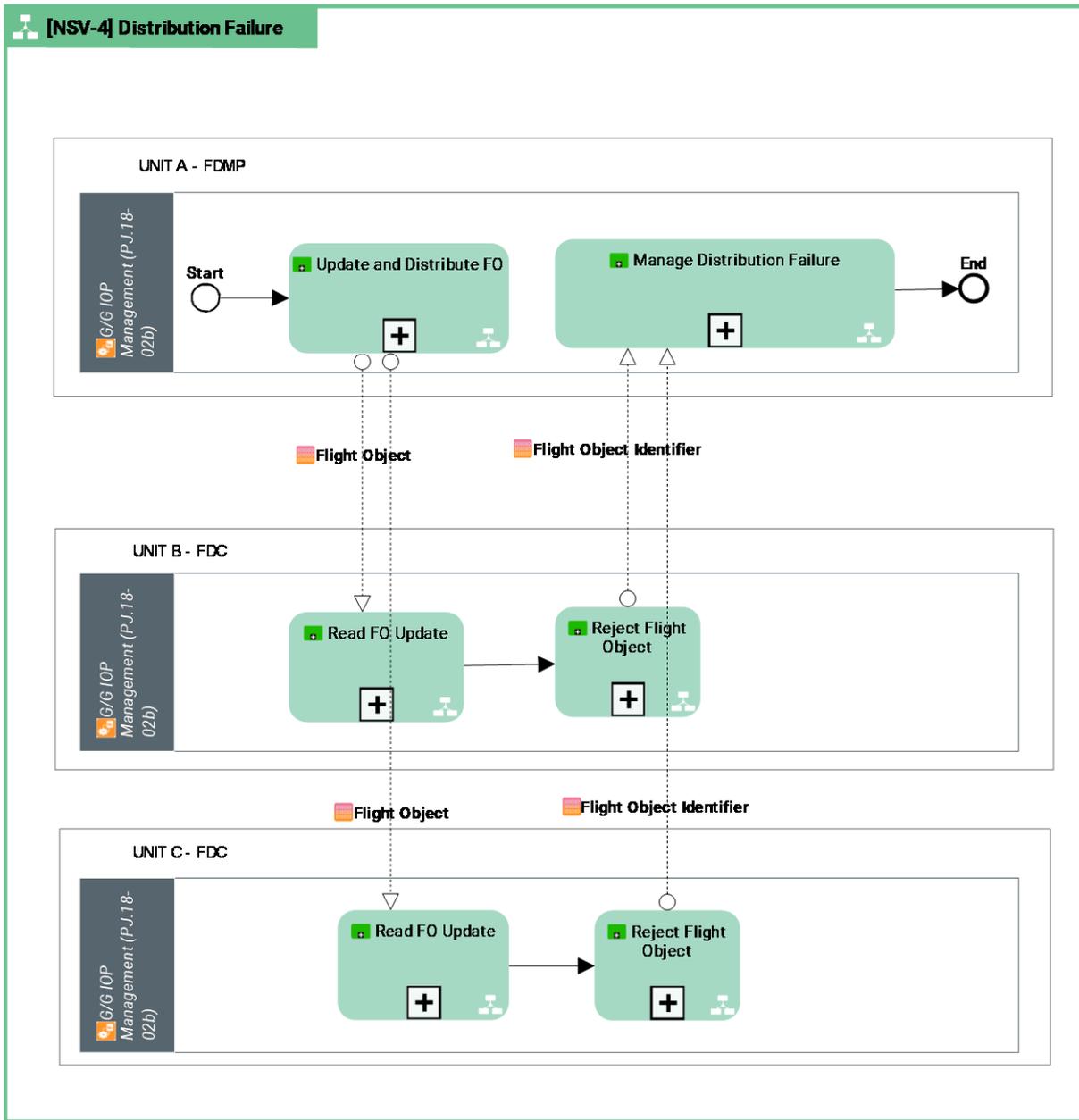
Assess and Modify Coordination Data	After a route modification the system assess the impact on the coordination data.
Change of Entry Level	Modification of an entry level.
Display New Exit Flight Level	Display to the controller that the exit level for a flight has changed as a consequence of the route being updated.
Issue Clearance	Controller communicate clearance to the aircraft.
Manage Coordination and Transfer Data	<p>Management of Coordination and Transfer data in the Flight Object.</p> <p>FDMP manage directly this data by itself.</p> <p>Other systems use ATCFlightObjectControl service to request the FDMP to update coordination and transfer data in the Flight Object.</p>
Manage Flight Script	<p>Management of the Flight Object Flight Script content.</p> <p>FDMP manage directly this data by itself.</p> <p>Other systems use ATCFlightObjectControl service to request the FDMP to update Flight Script data in the Flight Object.</p>
Modify Constraints	Request the modification of a constraint to the FDMP.
Predict Trajectory from FO	Local system is predicting the trajectory of the aircraft using the information provided in the FO.
Read FO Update	<p>Read an update to an existing FO.</p> <p>This function is performed by system having the FDC or FDU role.</p> <p>This updated FO can be expected or not.</p> <p>After having sent a request to the FDMP to update some elements of an FO, the FDC or FDU is waiting for an FO containing the result of the application of the request. The updated FO will contain the result of execution of the request indicating the success or not of this execution.</p> <p>When not expected, the reading of an updated FO inform the system of the result of a change provided directly from the FDMP activity or from the execution of a request from another FDC/FDU.</p>

Share Clearance	Share in the FO a clearance being given to the aircraft.
Update and Distribute FO	Update the FO and distribute an updated version to the SI being in the distribution list.
Update IOP Trajectory	Update IOP trajectory with result of local computation.

4.1.2.5 [NSV-4] Distribution Failure

This Use Case describes how a system behave in case of Flight Object distribution failure.

When there are at least 2 FDC/WIC in the distribution list and all the IOP stakeholders reject the [WI]FO then the FDMP/WIMP may consider this a distribution failure for the [WI]FO.



Function	Description
Manage Distribution Failure	A distribution failure is detected, this will be reported to an operator.
Read FO Update	<p>Read an update to an existing FO.</p> <p>This function is performed by system having the FDC or FDU role.</p> <p>This updated FO can be expected or not.</p> <p>After having sent a request to the FDMP to update some elements of an FO, the FDC or FDU is waiting for an FO containing the result of the</p>



	<p>application of the request. The updated FO will contain the result of execution of the request indicating the success or not of this execution.</p> <p>When not expected, the reading of an updated FO inform the system of the result of a change provided directly from the FDMP activity or from the execution of a request from another FDC/FDU.</p>
Reject Flight Object	An SI indicates that it rejects a FO because of a mismatch of payload version.
Update and Distribute FO	Update the FO and distribute an updated version to the SI being in the distribution list.

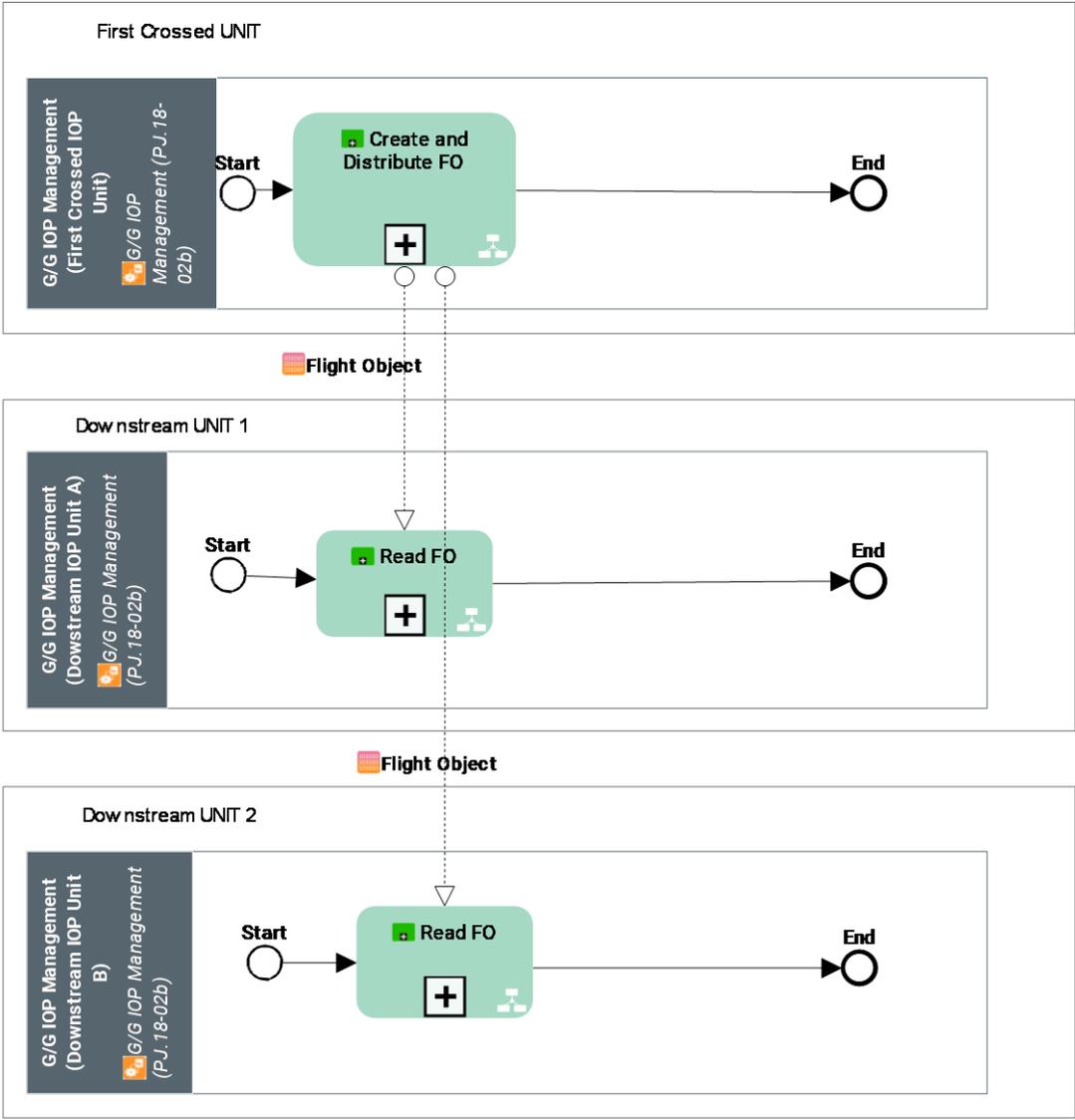
4.1.2.6 [NSV-4] FO Creation and Sharing by First Crossed IOP Unit

This use case describes the process by which a flight object for a flight is created in a system and then distributed to all the Units who are concerned about this flight.

First crossed IOP Unit. This IOP Unit will create a flight object and share it.

All the downstream IOP Units – the Units that will receive the flight object for that particular flight.

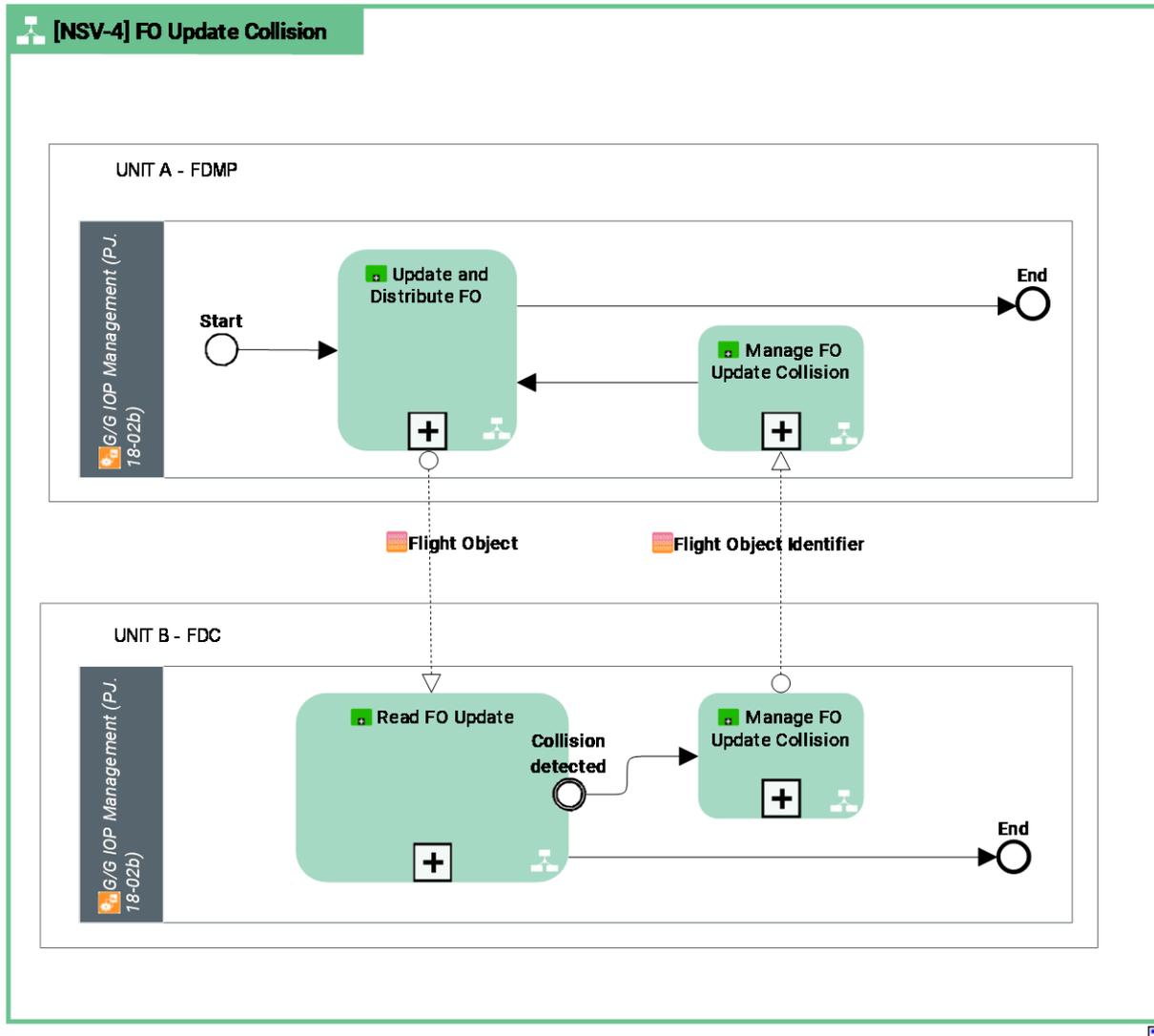
[NSV-4] FO Creation and Sharing by First Crossed IOP Unit



Function	Description
Create and Distribute FO	Creation of a Flight Object followed by its distribution to the concerned partners.
Read FO	Read the content of a new Flight Object.

4.1.2.7 [NSV-4] FO Update Collision

This Use Case describes how the system detect a Flight Object update collision.



Function	Description
Manage FO Update Collision	Collision or Concurrent FO update is detected. The FDMP is informed.
Read FO Update	<p>Read an update to an existing FO.</p> <p>This function is performed by system having the FDC or FDU role.</p> <p>This updated FO can be expected or not.</p> <p>After having sent a request to the FDMP to update some elements of an FO, the FDC or FDU is waiting for an FO containing the result of the application of the request. The updated FO will contain the result of</p>



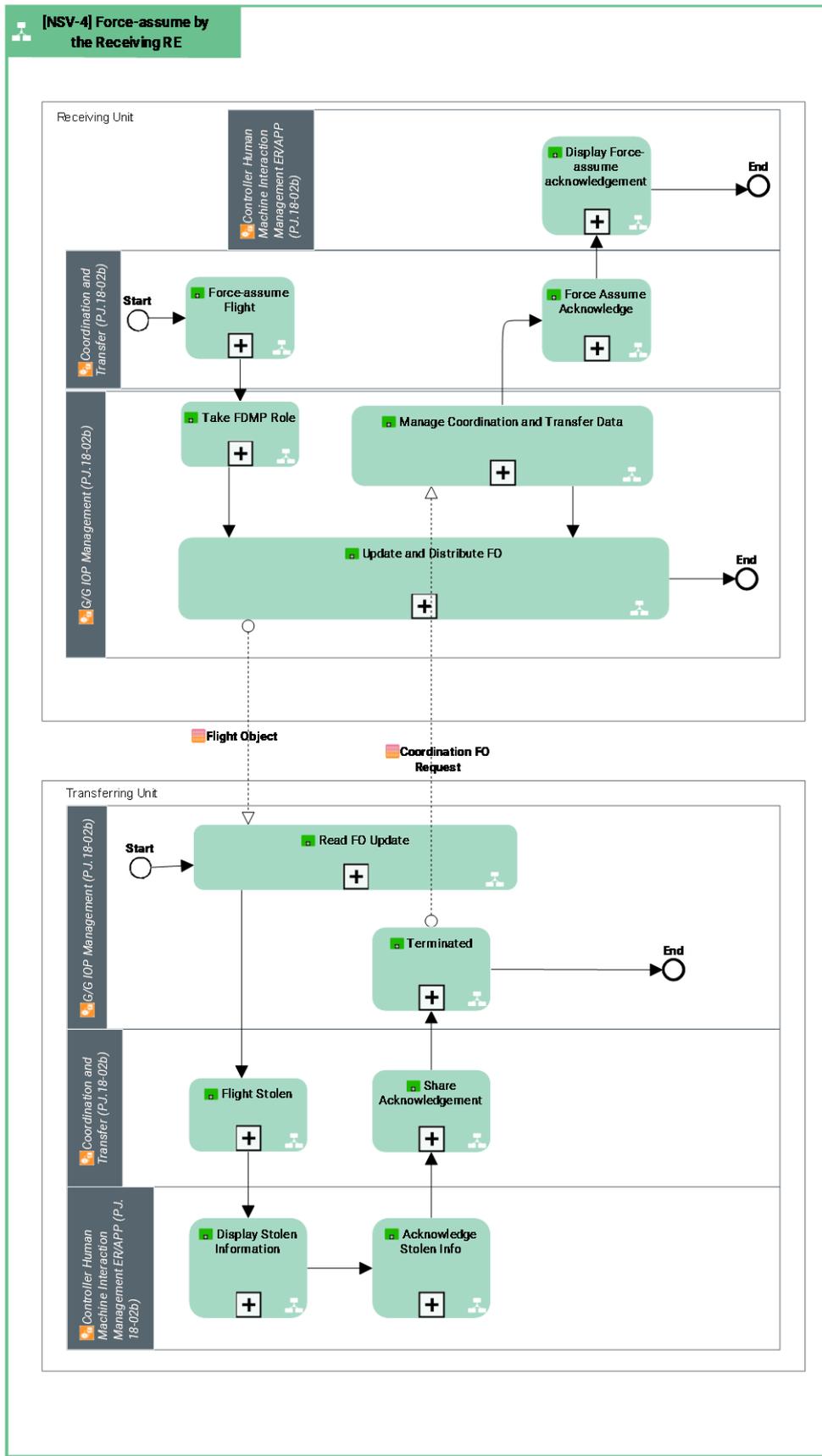
	<p>execution of the request indicating the success or not of this execution.</p> <p>When not expected, the reading of an updated FO inform the system of the result of a change provided directly from the FDMP activity or from the execution of a request from another FDC/FDU.</p>
<p>Update and Distribute FO</p>	<p>Update the FO and distribute an updated version to the SI being in the distribution list.</p>

4.1.2.8 [NSV-4] Force-assume by the Receiving RE

This use case describes the process by which a flight is force assumed by the Receiving RE before the Transferring RE has performed the frequency change input in the system.

Transferring Unit – the RE determined by the Transferring Unit which is the first of the two IOP Units in the control sequence. The Transferring RE is expected to transfer the flight to the Receiving RE.

Receiving Unit – the RE determined by the Receiving Unit which is the second of the two IOP Units in the control sequence. The Receiving RE is expected to receive the flight from the Transferring RE.



Function	Description
Acknowledge Stolen Info	Controller acknowledge Flight being Stolen by another System.
Display Force-assume acknowledgement	Display to the controller a force-assume acknowledgement.
Display Stolen Information	Display to controller information relative to a stolen flight.
Flight Stolen	Flight stolen by partner.
Force Assume Acknowledge	Acknowledgement of a force-assume.
Force-assume Flight	Force assumption of a flight.
Manage Coordination and Transfer Data	<p>Management of Coordination and Transfer data in the Flight Object.</p> <p>FDMP manage directly this data by itself.</p> <p>Other systems use ATCFlightObjectControl service to request the FDMP to update coordination and transfer data in the Flight Object.</p>
Read FO Update	<p>Read an update to an existing FO.</p> <p>This function is performed by system having the FDC or FDU role.</p> <p>This updated FO can be expected or not.</p> <p>After having sent a request to the FDMP to update some elements of an FO, the FDC or FDU is waiting for an FO containing the result of the application of the request. The updated FO will contain the result of execution of the request indicating the success or not of this execution.</p> <p>When not expected, the reading of an updated FO inform the system of the result of a change provided directly from the FDMP activity or from the execution of a request from another FDC/FDU.</p>
Share Acknowledgement	Share acknowledgement with other systems.



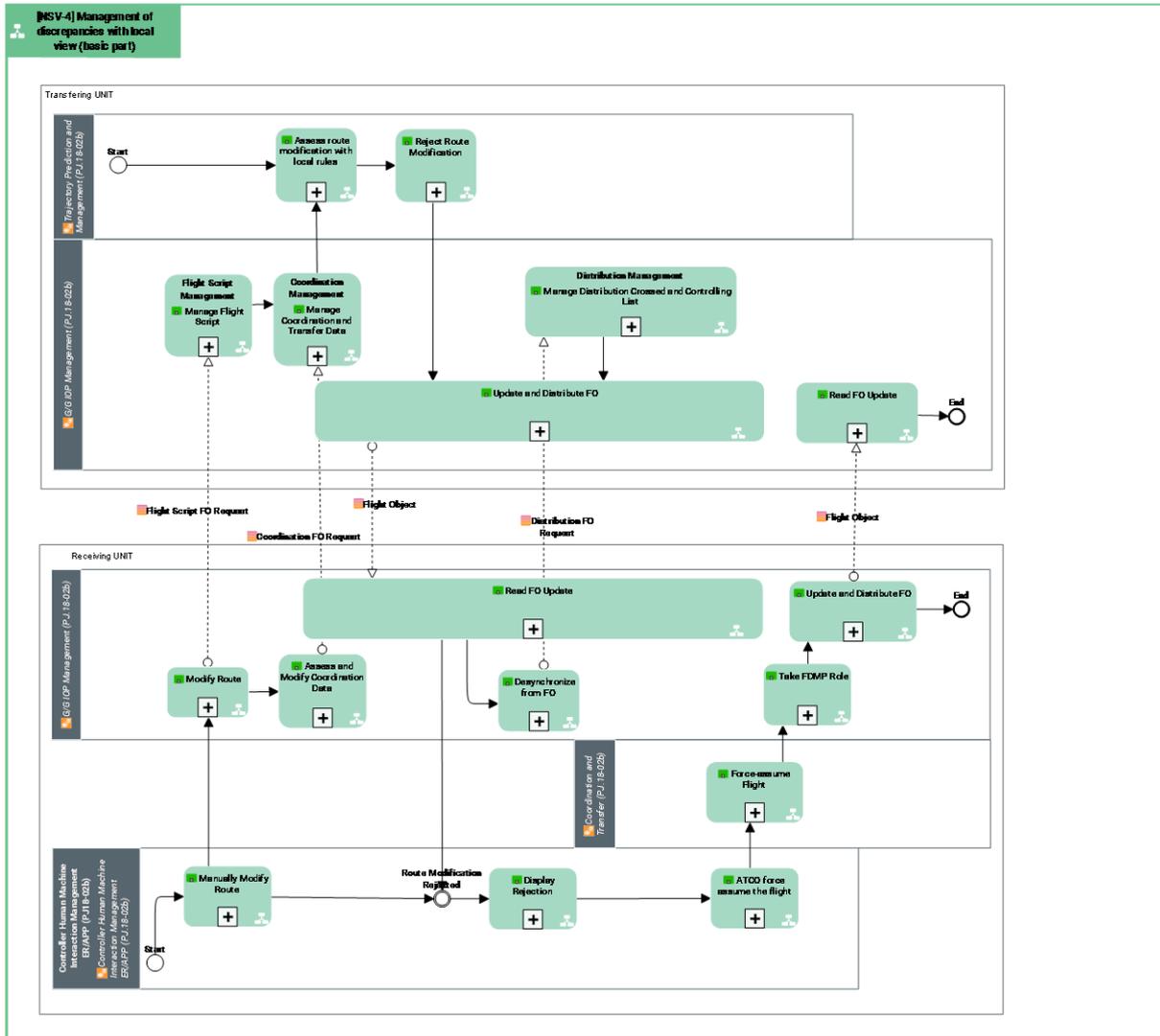
Take FDMP Role	SI takes the FDMP role.
Terminated	A system indicates to the FDMP that it has finished with a flight and can be removed from the distribution list.
Update and Distribute FO	Update the FO and distribute an updated version to the SI being in the distribution list.

4.1.2.9 [NSV-4] Management of discrepancies with local view (basic part)

This use case describes the notification of discrepancies between the flight object and the local SFPL, which will provoke a synchronization of the local view with the FO.

Transferring Unit – the RE determined by the Transferring Unit, which is the first of the two IOP Units in the control sequence. The Transferring RE is expected to transfer the flight to the Receiving RE.

Receiving Unit – the RE determined by the Receiving Unit, which is the second of the two IOP Units in the control sequence. The Receiving RE is expected to receive the flight from the Transferring RE.



Function	Description
Assess and Modify Coordination Data	After a route modification the system assess the impact on the coordination data.
Assess route modification with local rules	Assessment of the route modifications with local rules.
ATCO force assume the flight	The controller force assume a flight not automatically given to him by the system.
Desynchronize from FO	System indicate the de-synchronization of its local view with the FO.

Display Rejection	Display to controller rejection status.
Force-assume Flight	Force assumption of a flight.
Manage Coordination and Transfer Data	<p>Management of Coordination and Transfer data in the Flight Object.</p> <p>FDMP manage directly this data by itself.</p> <p>Other systems use ATCFlightObjectControl service to request the FDMP to update coordination and transfer data in the Flight Object.</p>
Manage Distribution Crossed and Controlling List	<p>Management of the Flight Object distribution list and crossed and control sequence.</p> <p>FDMP manages directly this data by itself.</p> <p>Other systems use ATCFlightObjectControl service to request the FDMP to update Flight Object distribution list.</p>
Manage Flight Script	<p>Management of the Flight Object Flight Script content.</p> <p>FDMP manage directly this data by itself.</p> <p>Other systems use ATCFlightObjectControl service to request the FDMP to update Flight Script data in the Flight Object.</p>
Manually Modify Route	Controller is modifying the flight route.
Modify Route	Request the modification of the route to the FDMP.
Read FO Update	<p>Read an update to an existing FO.</p> <p>This function is performed by system having the FDC or FDU role.</p> <p>This updated FO can be expected or not.</p> <p>After having sent a request to the FDMP to update some elements of an FO, the FDC or FDU is waiting for an FO containing the result of the application of the request. The updated FO will contain the result of execution of the request indicating the success or not of this execution.</p> <p>When not expected, the reading of an updated FO inform the system of the result of a change provided directly from the FDMP activity or from the execution of a request from another FDC/FDU.</p>

Reject Route Modification	FDMP reject a route modification request.
Take FDMP Role	SI takes the FDMP role.
Update and Distribute FO	Update the FO and distribute an updated version to the SI being in the distribution list.

4.1.2.10 [NSV-4] Manual subscription/unsubscription to FO

This use case describes the process by which an IOP Unit can subscribe or unsubscribe to a FO of a specific flight.

The operational context can be the following:

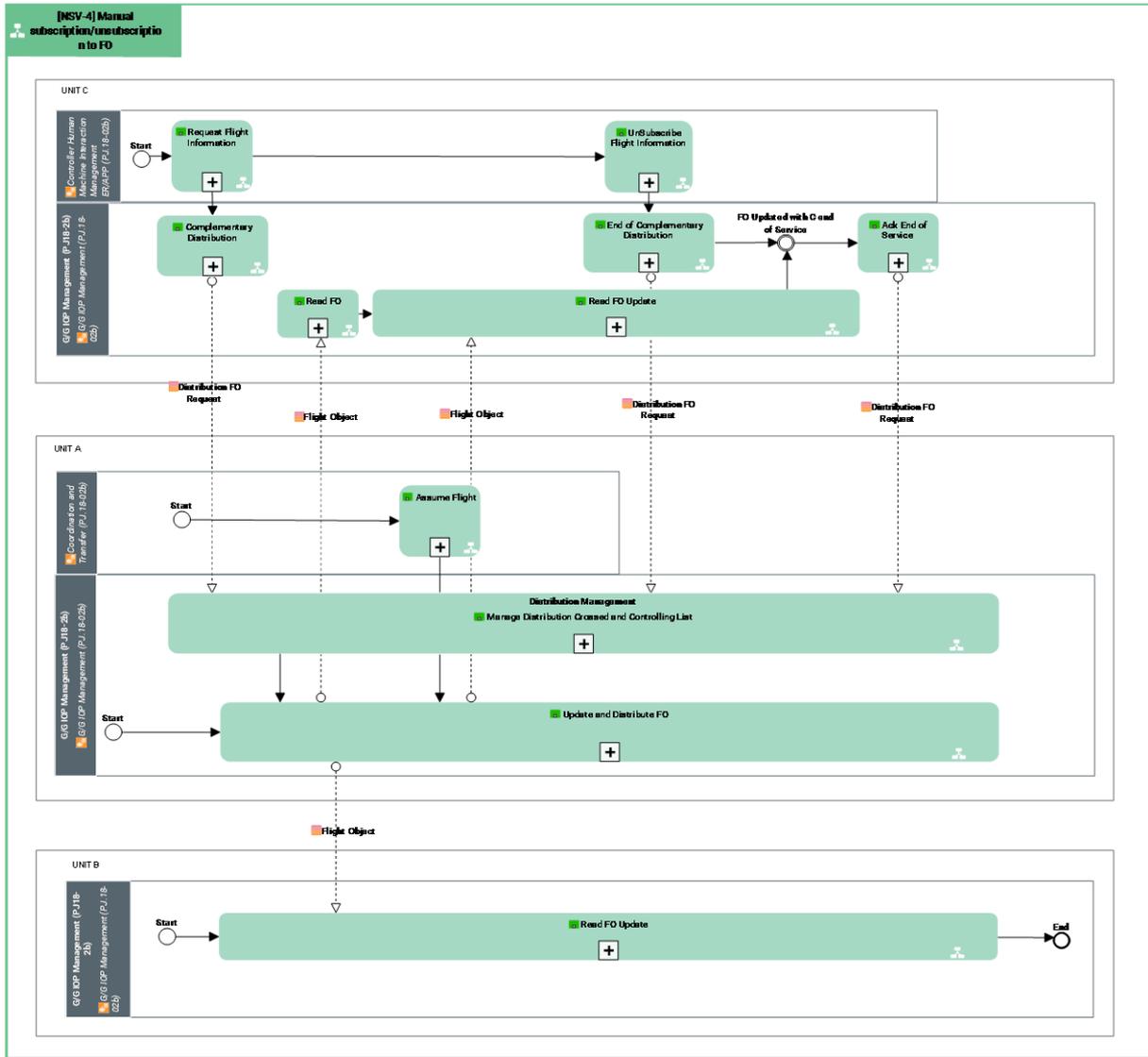
The aircraft gets aware of a very bad weather forecast at destination. As a consequence, the flight crew or the FOC (Flight Operations Centre) contacts another control Unit in charge of a possible alternate in order to get all relevant pieces of information in case of diversion. As this Unit is not yet concerned by this aircraft (until it really decides to divert), the responding operator (e.g. ATCO) has to look for the flight information into the database in order to get a better idea of his position, type of aircraft, estimates..., all these data that might influence the decision (possible delay, stand availability...).

Once the Flight crew is fully aware of the offered possibilities, he makes the decision not to divert to this airfield. The questioned Unit is no longer concerned by the flight and can unsubscribe from the distribution of the flight information.

Unit A: Controlling Unit, the IOP Unit currently controlling the flight.

Unit B: A downstream unit.

Unit C: Not-served Unit, an IOP Unit that initially does not receive the flight information for a specific flight (his Area of Interest is not crossed).



Function	Description
Ack End of Service	System is acknowledging the end of FO distribution to itself.
Assume Flight	Flight is assumed either automatically after local trigger, or manually by the ATCO.
Complementary Distribution	A system not calculated as being in the control sequence, requests to the FDMP the distribution of the FO
End of Complementary Distribution	A system not calculated as being in the control sequence, requests to the FDMP to remove itself from the FO distribution.

Manage Distribution Crossed and Controlling List	<p>Management of the Flight Object distribution list and crossed and control sequence.</p> <p>FDMP manages directly this data by itself.</p> <p>Other systems use ATCFlightObjectControl service to request the FDMP to update Flight Object distribution list.</p>
Read FO	Read the content of a new Flight Object.
Read FO Update	<p>Read an update to an existing FO.</p> <p>This function is performed by system having the FDC or FDU role.</p> <p>This updated FO can be expected or not.</p> <p>After having sent a request to the FDMP to update some elements of an FO, the FDC or FDU is waiting for an FO containing the result of the application of the request. The updated FO will contain the result of execution of the request indicating the success or not of this execution.</p> <p>When not expected, the reading of an updated FO inform the system of the result of a change provided directly from the FDMP activity or from the execution of a request from another FDC/FDU.</p>
Request Flight Information	A controller is querying the system to get information on a given flight.
UnSubscribe Flight Information	The controller does not need access to the information on a given flight.
Update and Distribute FO	Update the FO and distribute an updated version to the SI being in the distribution list.

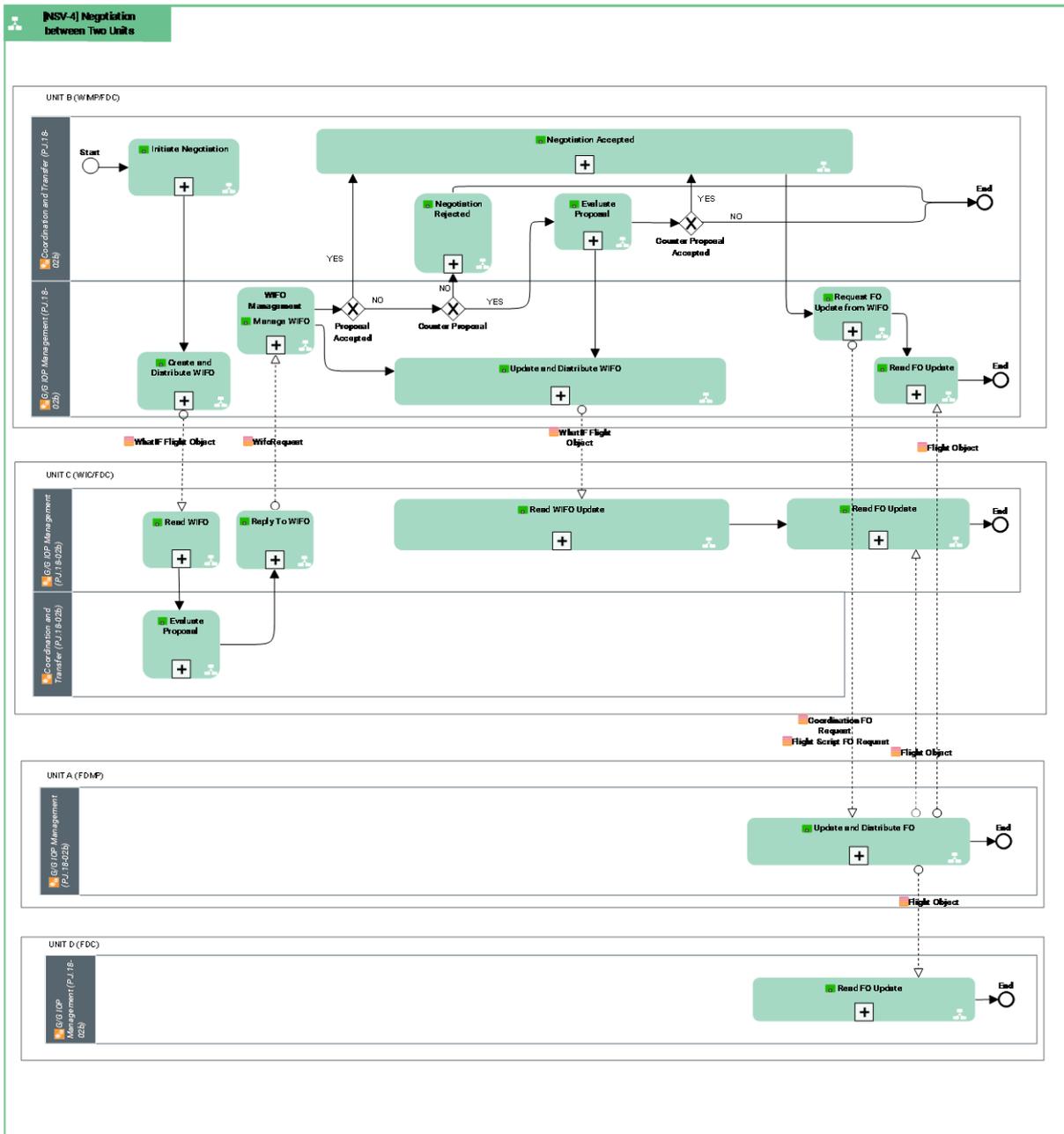
4.1.2.11 [NSV-4] Negotiation between Two Units

Negotiation between Two Units

This use case describes the negotiation of C&T Contractual data between two following IOP Units in the control sequence.

Unit B: The Unit of the future (not currently controlling) Transferring RE. The Unit B is expected to transfer the flight to the Unit C. Unit B initiate the negotiation.

Unit C: The Unit of the Receiving RE which is the second of the two IOP Units in the control sequence. The Receiving RE is expected to receive the flight from the Transferring RE.



Function	Description
Create and Distribute WIFO	Creation of a What if Flight Object followed by its distribution to the concerned WIC's.

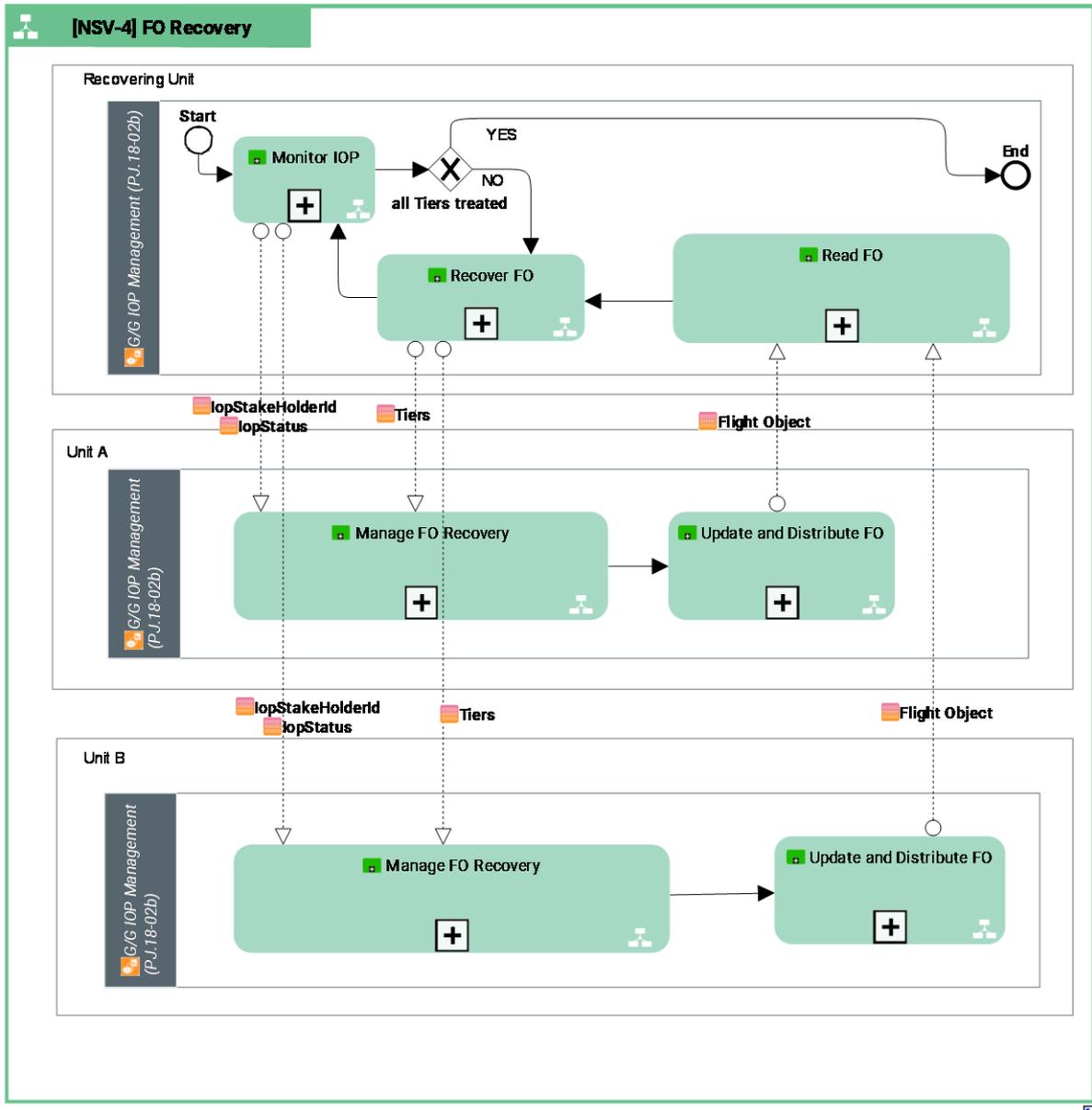
Evaluate Proposal	Evaluation of a negotiation proposal (WIFO).
Initiate Negotiation	Start of a negotiation process.
Manage WIFO	<p>Management of the What If Flight Object.</p> <p>WIMP manage directly this data by itself.</p> <p>Other systems involved in a What If Flight Object (WIC) use ATCFlightObjectControl service to request the WIMP to update WIFO data in the Flight Object.</p>
Negotiation Accepted	Termination of a negotiation with acceptance.
Negotiation Rejected	Termination of a negotiation with rejection.
Read FO Update	<p>Read an update to an existing FO.</p> <p>This function is performed by system having the FDC or FDU role.</p> <p>This updated FO can be expected or not.</p> <p>After having sent a request to the FDMP to update some elements of an FO, the FDC or FDU is waiting for an FO containing the result of the application of the request. The updated FO will contain the result of execution of the request indicating the success or not of this execution.</p> <p>When not expected, the reading of an updated FO inform the system of the result of a change provided directly from the FDMP activity or from the execution of a request from another FDC/FDU.</p>
Read WIFO	Read the content of a new WIFO.
Read WIFO Update	Read update to an existing WIFO.
Reply To WIFO	WIC sends its reply to the WIMP.



Request FO Update from WIFO	Request the FDMP to update the FO with the content of the WIFO.
Update and Distribute FO	Update the FO and distribute an updated version to the SI being in the distribution list.
Update and Distribute WIFO	Update the WIFO and distribute an updated version to the SI being in the distribution list.

4.1.2.12 [NSV-4] FO Recovery

This Use Case describes the process of recovering for an UNIT after having lost the IOP capability.



Function	Description
Manage FO Recovery	Manage the Flight Objects recovery after loss of IOP capability.
Monitor IOP	This function is monitoring the status of the IOP Node during the recovery process.



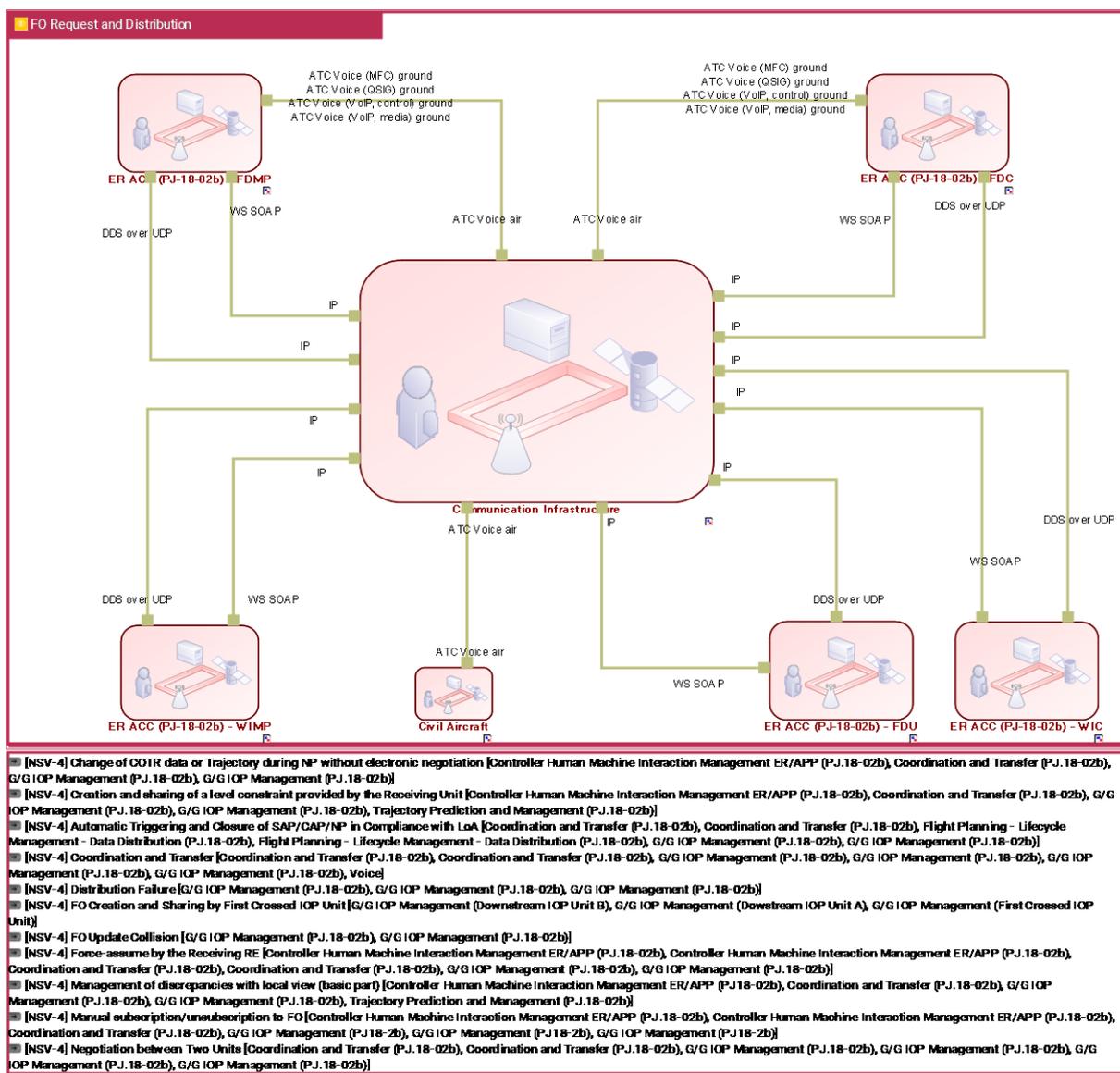
Read FO	Read the content of a new Flight Object.
Recover FO	A recovering Unit is recovering the FO it is interested in.
Update and Distribute FO	Update the FO and distribute an updated version to the SI being in the distribution list.

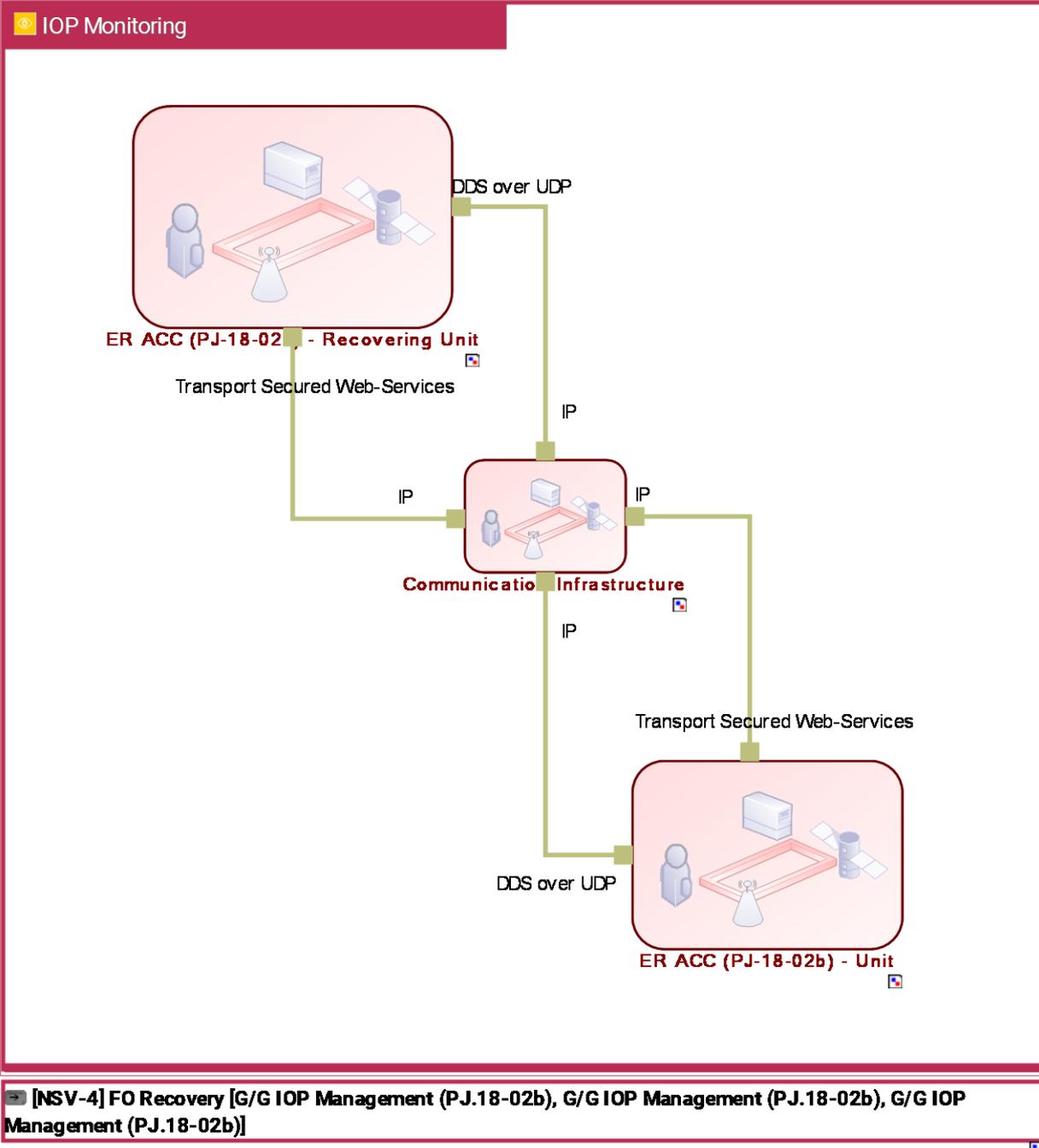
4.1.3 Infrastructure connectivity model

These Views describe the infrastructure Connectivity for Solution PJ.18-02b supporting the Resource Connectivity diagram of previous chapter.

The following technologies are used:

- DDS
- Web Services





4.1.4 Service view

4.1.4.1 Service description

Service	Service description
ATCFlightObjectControl (PJ.18-02b)	The ATC Flight Object Control query/reply service allows FDC to request a number of changes to a Flight Object, which is being managed by the

	<p>FDMP, any SI involved with a FO exchange to report a failure, reject an FO, restore an FO or recover from an IOP failure.</p> <p>It defines the following operations:</p> <ul style="list-style-type: none"> - RequestFlightObjectServices: This operation allows a system to request any kind of update/change to the Flight Object to the FDMP. - ReportFlightObjectServicesExecution: This operation reports to an FDC, the result of the implementation of an already accepted RequestFlightObjectServices operation call. - RejectFlightObject: This operation requests the rejection of a given Flight Object, reporting the reason for rejection to the current FDMP. - RestoreFlightObject: This operation allows a system to restore the latest version of a specific Flight Object. This triggers the invocation of the RestoreFlightObject operation to the FDMP of the Flight Object to request its republication. - RequestFlightObjectRecovery: This operation allows an application to request recovery of a subset or all of the Flight Objects.
SharedFlightObject (PJ.18-02b)	<p>The SharedFlightObject publishing service allows the FDMP to distribute the Flight Object Clusters and Summary to all systems being identified in the list of addressees. A System is present in this list either by the result of the FDMP trajectory calculation determining the airspace volumes being traversed and applying the rules of distribution or because being explicitly requested by the System itself to be included in the distribution using the RequestFlightObjectServices service.</p>
IOPMonitoring (PJ.18-02b)	<p>The IOPMonitoring service is used by IOP systems to provide to the SWIM layer the current state of the IOP Application.</p> <p>Following operations are defined:</p> <ul style="list-style-type: none"> - UpdateRecoveryStatus: used during the recovery of an IOP node to indicate the current state of the recovery - UpdateApplicationStatus: used to indicate the current state of the IOP application (enabled or not-enabled)

4.1.4.2 Service Provisioning

Interaction	Consumer CC	Consumer System	Provider CC	Provider System
SharedFlightObject (PJ.18-02b).ER ACC (PJ-18-02b) - Recovering Unit_CC and ER ACC (PJ-18-02b) - Unit_CC	ER ACC (PJ-18-02b) - Recovering Unit	En-Route / Approach ATC (PJ18-2b);	ER ACC (PJ-18-02b) - Unit	En-Route / Approach ATC (PJ18-2b);

Interaction	Consumer CC	Consumer System	Provider CC	Provider System
ATCFlightObjectControl (PJ.18-02b).ER ACC (PJ-18-02b) - Recovering Unit_CC and ER ACC (PJ-18-02b) - Unit_CC	ER ACC (PJ-18-02b) - Recovering Unit	En-Route / Approach ATC (PJ18-2b);	ER ACC (PJ-18-02b) - Unit	En-Route / Approach ATC (PJ18-2b);
IOPMonitoring (PJ.18-02b).ER ACC (PJ-18-02b) - Unit_CC and ER ACC (PJ-18-02b) - Recovering Unit_CC	ER ACC (PJ-18-02b) - Unit		ER ACC (PJ-18-02b) - Recovering Unit	
Controller Pilot ATC exchange(Voice).Civil Aircraft_CC and ER ACC (PJ-18-02b) - FDC_CC	Civil Aircraft	Aircraft;	ER ACC (PJ-18-02b) - FDC	Voice;
Controller Pilot ATC exchange(Voice).ER ACC (PJ-18-02b) - FDMP_CC and Civil Aircraft_CC	ER ACC (PJ-18-02b) - FDMP	Voice;	Civil Aircraft	Aircraft;
SharedFlightObject (PJ.18-02b).ER ACC (PJ-18-02b) - FDC_CC and ER ACC (PJ-18-02b) - FDMP_CC	ER ACC (PJ-18-02b) - FDC	En-Route / Approach ATC (PJ18-2b);	ER ACC (PJ-18-02b) - FDMP	En-Route / Approach ATC (PJ18-2b);
ATCFlightObjectControl (PJ.18-02b).ER ACC (PJ-18-02b) - FDC_CC and ER ACC (PJ-18-02b) - FDMP_CC	ER ACC (PJ-18-02b) - FDC	En-Route / Approach ATC (PJ18-2b);	ER ACC (PJ-18-02b) - FDMP	En-Route / Approach ATC (PJ18-2b);
ATCFlightObjectControl (PJ.18-02b).ER ACC (PJ-18-02b) - WIMP_CC and ER ACC (PJ-18-02b) - FDMP_CC	ER ACC (PJ-18-02b) - WIMP	En-Route / Approach ATC (PJ18-2b);	ER ACC (PJ-18-02b) - FDMP	En-Route / Approach ATC (PJ18-2b);

Interaction	Consumer CC	Consumer System	Provider CC	Provider System
ATCFlightObjectControl (PJ.18-02b).ER ACC (PJ-18-02b) - WIC_CC and ER ACC (PJ-18-02b) - WIMP_CC	ER ACC (PJ-18-02b) - WIC	En-Route / Approach ATC (PJ18-2b);	ER ACC (PJ-18-02b) - WIMP	En-Route / Approach ATC (PJ18-2b);
SharedFlightObject (PJ.18-02b).ER ACC (PJ-18-02b) - WIC_CC and ER ACC (PJ-18-02b) - WIMP_CC	ER ACC (PJ-18-02b) - WIC	En-Route / Approach ATC (PJ18-2b);	ER ACC (PJ-18-02b) - WIMP	En-Route / Approach ATC (PJ18-2b);
ATCFlightObjectControl (PJ.18-02b).ER ACC (PJ-18-02b) - FDU_CC and ER ACC (PJ-18-02b) - FDMP_CC	ER ACC (PJ-18-02b) - FDU	En-Route / Approach ATC (PJ18-2b);	ER ACC (PJ-18-02b) - FDMP	En-Route / Approach ATC (PJ18-2b);
SharedFlightObject (PJ.18-02b).ER ACC (PJ-18-02b) - FDU_CC and ER ACC (PJ-18-02b) - FDMP_CC	ER ACC (PJ-18-02b) - FDU	En-Route / Approach ATC (PJ18-2b);	ER ACC (PJ-18-02b) - FDMP	En-Route / Approach ATC (PJ18-2b);

4.1.4.3 Service Realization

4.1.4.3.1 Interaction ATCFlightObjectControl (PJ.18-02b).ER ACC (PJ-18-02b) - FDC_CC and ER ACC (PJ-18-02b) - FDMP_CC

System Port: WS SOAP at ER ACC (PJ-18-02b)_CC

Protocol Stack	Protocol
WS SOAP	

System Port: IP_GND at Communication Infrastructure_CC

Protocol Stack	Protocol
IP	

System Port: IP_GND at Communication Infrastructure_CC



Protocol Stack	Protocol
IP	

System Port: WS SOAP at ER ACC (PJ-18-02b)_CC

Protocol Stack	Protocol
WS SOAP	

Service Interface Definition	
FlightObjectManagementInterface	
Standard	MEP, Security Configuration, Interface Bindings
BP.Synchronous Request-Response Binding	

4.1.4.3.2 Interaction ATCFlightObjectControl (PJ.18-02b).ER ACC (PJ-18-02b) - FDU_CC and ER ACC (PJ-18-02b) - FDMP_CC

System Port: WS SOAP at ER ACC (PJ-18-02b)_CC

Protocol Stack	Protocol
WS SOAP	

System Port: IP_GND at Communication Infrastructure_CC

Protocol Stack	Protocol
IP	

System Port: IP_GND at Communication Infrastructure_CC

Protocol Stack	Protocol
IP	

System Port: WS SOAP at ER ACC (PJ-18-02b)_CC

Protocol Stack	Protocol

WS SOAP	
---------	--

Service Interface Definition	
FlightObjectManagementInterface	
Standard	MEP, Security Configuration, Interface Bindings
BP.Synchronous Request-Response Binding	

4.1.4.3.3 Interaction ATCFlightObjectControl (PJ.18-02b).ER ACC (PJ-18-02b) - WIC_CC and ER ACC (PJ-18-02b) - WIMP_CC

System Port: WS SOAP at ER ACC (PJ-18-02b)_CC

Protocol Stack	Protocol
WS SOAP	

System Port: IP_GND at Communication Infrastructure_CC

Protocol Stack	Protocol
IP	

System Port: WS SOAP at ER ACC (PJ-18-02b)_CC

Protocol Stack	Protocol
WS SOAP	

System Port: IP_GND at Communication Infrastructure_CC

Protocol Stack	Protocol
IP	

Service Interface Definition	
FlightObjectManagementInterface	
Standard	MEP, Security Configuration, Interface Bindings
BP.Synchronous Request-Response Binding	

4.1.4.3.4 Interaction ATCFlightObjectControl (PJ.18-02b).ER ACC (PJ-18-02b) - WIMP_CC and ER ACC (PJ-18-02b) - FDMP_CC

System Port: WS SOAP at ER ACC (PJ-18-02b)_CC

Protocol Stack	Protocol
WS SOAP	

System Port: IP_GND at Communication Infrastructure_CC

Protocol Stack	Protocol
IP	

System Port: IP_GND at Communication Infrastructure_CC

Protocol Stack	Protocol
IP	

System Port: WS SOAP at ER ACC (PJ-18-02b)_CC

Protocol Stack	Protocol
WS SOAP	

Service Interface Definition	
FlightObjectManagementInterface	
Standard	MEP, Security Configuration, Interface Bindings
BP.Synchronous Request-Response Binding	

4.1.4.3.5 Interaction Controller Pilot ATC exchange(Voice).Civil Aircraft_CC and ER ACC (PJ-18-02b) - FDC_CC

System Port: ATC_VOICE_GND at ER ACC (PJ-18-02b)_CC

Protocol Stack	Protocol
ATC Voice (MFC) ground	
	ATS MFC R2

ATC Voice (QSIG) ground	
	ATS QSIG
ATC Voice (VoIP, control) ground	
	SIP
	TCP
	IP
ATC Voice (VoIP, media) ground	
	RTP
	UDP
	IP

System Port: VOICE_RADIO_AIR at Communication Infrastructure_CC

Protocol Stack	Protocol
ATC Voice air	
	VHF - AM 25kHz/8.33kHz
	HF - AM 25kHz

System Port: ATC_VOICE at Civil Aircraft_CC

Protocol Stack	Protocol
ATC Voice air	
	VHF - AM 25kHz/8.33kHz
	HF - AM 25kHz

System Port: VOICE_RADIO_AIR at Communication Infrastructure_CC

Protocol Stack	Protocol
ATC Voice air	
	VHF - AM 25kHz/8.33kHz
	HF - AM 25kHz

4.1.4.3.6 Interaction Controller Pilot ATC exchange(Voice).ER ACC (PJ-18-02b) - FDMP_CC and Civil Aircraft_CC

System Port: VOICE_RADIO_AIR at Communication Infrastructure_CC

Protocol Stack	Protocol
ATC Voice air	
	VHF - AM 25kHz/8.33kHz
	HF - AM 25kHz

System Port: ATC_VOICE_GND at ER ACC (PJ-18-02b)_CC

Protocol Stack	Protocol
ATC Voice (MFC) ground	
	ATS MFC R2
ATC Voice (QSIG) ground	
	ATS QSIG
ATC Voice (VoIP, control) ground	
	SIP
	TCP
	IP
ATC Voice (VoIP, media) ground	
	RTP
	UDP
	IP

System Port: ATC_VOICE at Civil Aircraft_CC

Protocol Stack	Protocol
ATC Voice air	
	VHF - AM 25kHz/8.33kHz
	HF - AM 25kHz

System Port: VOICE_RADIO_AIR at Communication Infrastructure_CC

Protocol Stack	Protocol
ATC Voice air	
	VHF - AM 25kHz/8.33kHz
	HF - AM 25kHz

4.1.4.3.7 Interaction SharedFlightObject (PJ.18-02b).ER ACC (PJ-18-02b) - FDC_CC and ER ACC (PJ-18-02b) - FDMP_CC

System Port: DDS over UDP at ER ACC

Protocol Stack	Protocol
DDS over UDP	
	DDS
	DDSI-RTPS
	UDP

System Port: IP_GND at Communication Infrastructure_CC

Protocol Stack	Protocol
IP	

System Port: IP_GND at Communication Infrastructure_CC

Protocol Stack	Protocol
IP	

System Port: DDS over UDP at ER ACC

Protocol Stack	Protocol
DDS over UDP	
	DDS
	DDSI-RTPS
	UDP

Service Interface Definition	
SharedFlightObjectInterface	
Standard	MEP, Security Configuration, Interface Bindings
BP.Publish-Subscribe TCP Binding with Security	

4.1.4.3.8 Interaction SharedFlightObject (PJ.18-02b).ER ACC (PJ-18-02b) - FDU_CC and ER ACC (PJ-18-02b) - FDMP_CC

System Port: DDS over UDP at ER ACC

Protocol Stack	Protocol
DDS over UDP	
	DDS
	DDSI-RTPS
	UDP

System Port: IP_GND at Communication Infrastructure_CC

Protocol Stack	Protocol
IP	

System Port: IP_GND at Communication Infrastructure_CC

Protocol Stack	Protocol
IP	

System Port: DDS over UDP at ER ACC

Protocol Stack	Protocol
DDS over UDP	
	DDS
	DDSI-RTPS
	UDP

Service Interface Definition	
SharedFlightObjectInterface	
Standard	MEP, Security Configuration, Interface Bindings
BP.Publish-Subscribe TCP Binding with Security	

4.1.4.3.9 Interaction SharedFlightObject (PJ.18-02b).ER ACC (PJ-18-02b) - WIC_CC and ER ACC (PJ-18-02b) - WIMP_CC

System Port: DDS over UDP at ER ACC

Protocol Stack	Protocol
DDS over UDP	
	DDS

	DDSI-RTPS
	UDP

System Port: IP_GND at Communication Infrastructure_CC

Protocol Stack	Protocol
IP	

System Port: DDS over UDP at ER ACC

Protocol Stack	Protocol
DDS over UDP	
	DDS
	DDSI-RTPS
	UDP

System Port: IP_GND at Communication Infrastructure_CC

Protocol Stack	Protocol
IP	

Service Interface Definition	
SharedFlightObjectInterface	
Standard	MEP, Security Configuration, Interface Bindings
BP.Publish-Subscribe TCP Binding with Security	

4.1.4.3.10 Interaction ATCFlightObjectControl (PJ.18-02b).ER ACC (PJ-18-02b) - Recovering Unit_CC and ER ACC (PJ-18-02b) - Unit_CC

System Port: WS SOAP at ER ACC (PJ-18-02b)_CC

Protocol Stack	Protocol
WS SOAP	

System Port: IP_GND at Communication Infrastructure_CC

Protocol Stack	Protocol
----------------	----------

IP	
----	--

System Port: IP_GND at Communication Infrastructure_CC

Protocol Stack	Protocol
IP	

System Port: WS SOAP at ER ACC (PJ-18-02b)_CC

Protocol Stack	Protocol
WS SOAP	

Service Interface Definition	
FlightObjectManagementInterface	
Standard	MEP, Security Configuration, Interface Bindings
BP.Synchronous Request-Response Binding	

4.1.4.3.11 Interaction IOPMonitoring (PJ.18-02b).ER ACC (PJ-18-02b) - Unit_CC and ER ACC (PJ-18-02b) - Recovering Unit_CC

System Port: WS SOAP at ER ACC (PJ-18-02b)_CC

Protocol Stack	Protocol
WS SOAP	

System Port: IP_GND at Communication Infrastructure_CC

Protocol Stack	Protocol
IP	

System Port: IP_GND at Communication Infrastructure_CC

Protocol Stack	Protocol
IP	

System Port: WS SOAP at ER ACC (PJ-18-02b)_CC

Protocol Stack	Protocol
WS SOAP	

Service Interface Definition	
IOPMonitoringInterface	
Standard	MEP, Security Configuration, Interface Bindings
BP.Synchronous Request-Response Binding	

4.1.4.3.12 Interaction SharedFlightObject (PJ.18-02b).ER ACC (PJ-18-02b) - Recovering Unit_CC and ER ACC (PJ-18-02b) - Unit_CC

System Port: DDS over UDP at ER ACC

Protocol Stack	Protocol
DDS over UDP	
	DDS
	DDSI-RTPS
	UDP

System Port: IP_GND at Communication Infrastructure_CC

Protocol Stack	Protocol
IP	

System Port: IP_GND at Communication Infrastructure_CC

Protocol Stack	Protocol
IP	

System Port: DDS over UDP at ER ACC

Protocol Stack	Protocol
DDS over UDP	
	DDS
	DDSI-RTPS

	UDP
Service Interface Definition	
SharedFlightObjectInterface	
Standard	MEP, Security Configuration, Interface Bindings
BP.Publish-Subscribe TCP Binding with Security	

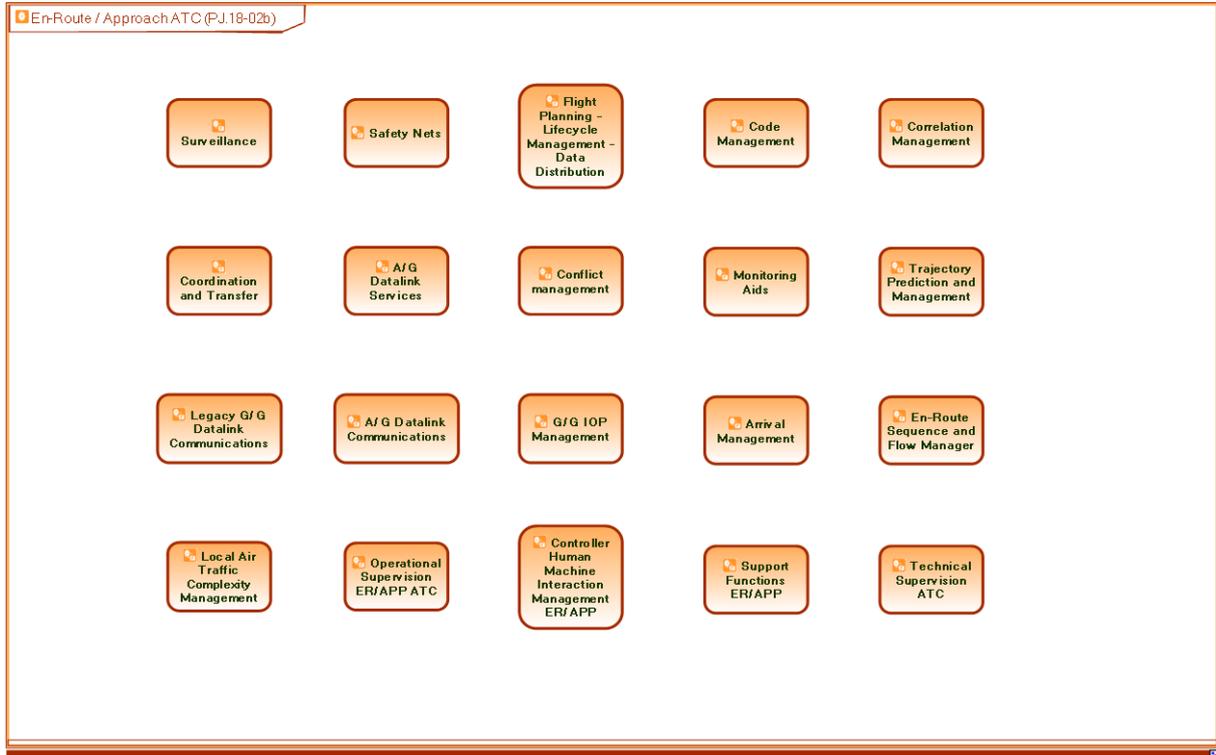
4.1.5 Modified Systems View

4.1.5.1 En-Route / Approach ATC (PJ.18-02b)

Gathers the ground based automated means, used in En-Route and Approach ATCCentres, to support the air traffic controllers in the provision of the following main Air Traffic Services:

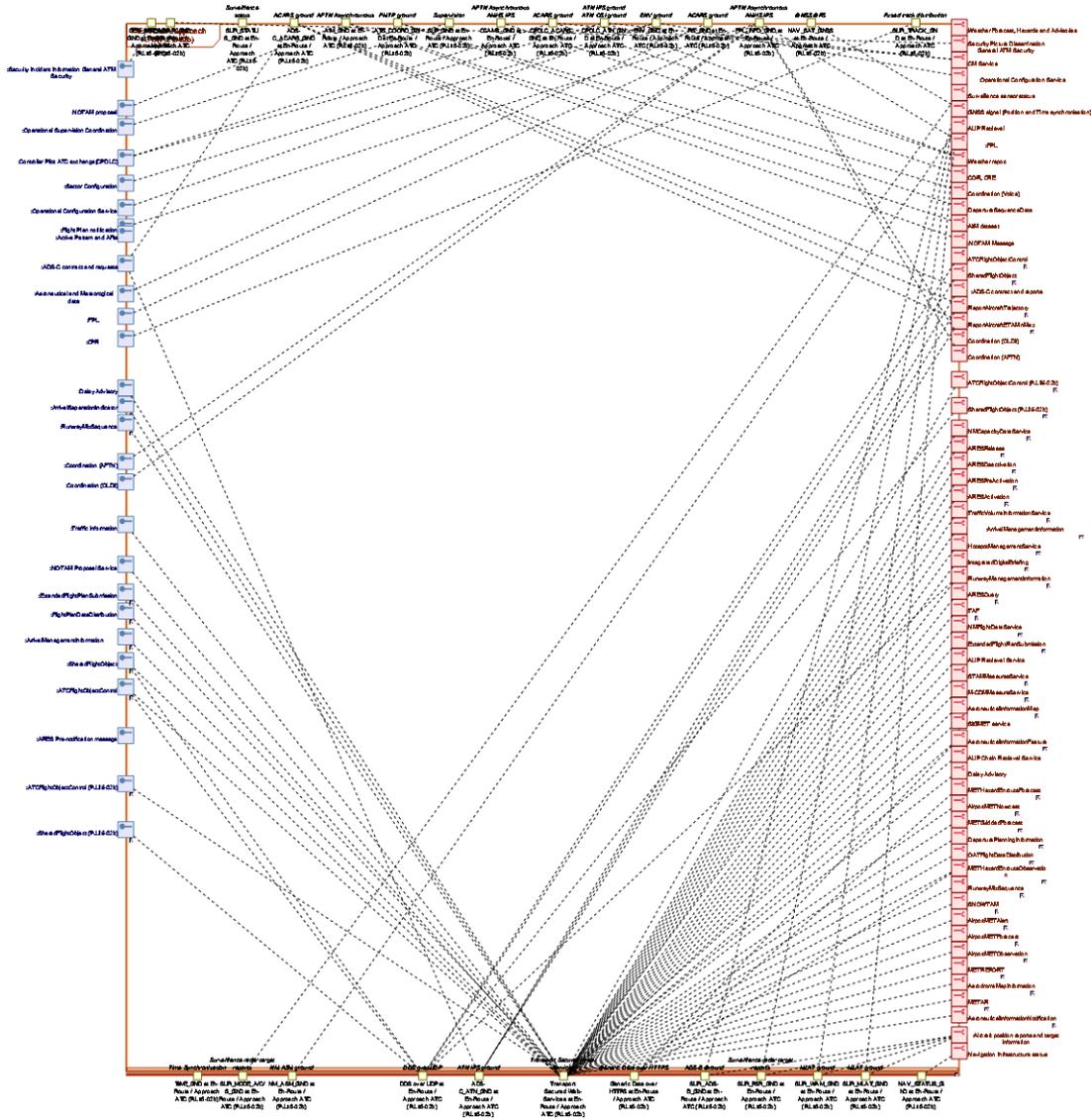
- Update and distribution of flight plan data, potentially correlated with track data built from surveillance sources (mode 3/A code or 24 bit ICAO address - Aircraft Identification (Mode S or ADS-B), when available)
- Distribution of warnings and alerts upon detection of danger areas / separation criteria infringement, or on non-conformance between aircraft behaviour and corresponding flight plan data,
- Medium-term and tactical conflicts detection, conflicts resolution assistance and local traffic complexity assessment
- Sequencing of arrival aircraft on aerodromes or groups of aerodromes,
- Ground-ground and air-ground exchanges of flight and environment data

4.1.5.1.1 Composition



<https://www.eatmportal.eu/working/data/diagrams/07E70E285A842CAA>

4.1.5.1.2 System Interfaces Diagram



<https://www.eatmportal.eu/working/data/diagrams/07E70E295A842E0F>

4.2 Functional and non-Functional Requirements

This section contains the functional and non-functional requirements. Requirements are organised in topics as described below:

General FO Mechanisms (Requirements prefix: MECH)	This topic deals with the different roles of IOP System Instances i.e. FDMP, FDC or FDU, the transition between them and management of the FO by the FDMP. Chapter. 4.2.1
What-If FO Mechanisms (Requirements prefix: WIFO)	This topic deals with the electronic negotiation between two or more IOP SIs on one or more data of the FO and their implementation in the FO. Chapter 4.2.1.5
Coordination and Transfer (Requirements prefix: COTR)	This topic deals with the management of Coordination and Transfer of flights between the two responsible entities belonging to the different system instances going to control the flights. Chapter 4.2.3
SSR Code Management (Requirements prefix: SSRC)	This topic deals with the management and distribution of the SSR code. Chapter 4.2.4
Flight Script Management (Requirements prefix: FSMG)	This topic deals with the Management of the Flight Script between the IOP stakeholders (FDMP and FDCs). The Flight Script contains the flight data required at the input to the trajectory prediction process (e.g. Expanded Route and Constraints), and when used in conjunction with other data, allows the FDPs to create consistent, although not identical, trajectories for each flight. Chapter 4.2.5
Trajectory Management (Requirements prefix: SCTJ)	This topic deals with the management of the trajectory computed by FDMP across the IOP Area. Chapter 4.2.6
IOP Data Distribution (Requirements prefix: MECH,INFO)	This topic deals with the correct distribution of the FOs to the concerned SIs for different reasons (Traversed, Control, Vicinity, Subscribed, General Information, End of Service etc.). This is a mechanism to avoid system instance overloading from too much data being distributed and to enable rational use of processing resources. Chapter 4.2.7
Crossed and Control Sequence Management	This topic deals with the management and sharing of SIs that are to be crossed or control the flight. The sequence list can be enhanced by the

(Requirements prefix: SEQM)	technical and operational correction in order to have a synchronized list. Chapter 4.2.8
Air/Ground (Requirements prefix: COTR)	This topic deals with the support of the Data Link Initiation (DLIC) and ATC Communication Management capabilities. Chapter 4.2.9
Handling of IOP Protocol Failure (Requirements prefix: MECH)	This topic deals with behavior of the system when something goes wrong and system needs to desynchronize for a flight object. Chapter 4.2.10
TMA Requirements (Requirements prefix: ADMG)	This topic deals with the support of the exchange of data specific to the TMA environment. Chapter 4.2.11
Interaction with SWIM Technical Layer (Requirements prefix: SWIM)	This topic represents the functions within the IOP Application which are needed to correctly interact with the lower level SWIM Technical Infrastructure. Chapter 4.2.12

Table 12 Functional decomposition

When a requirement states “The SI **shall verb...**”, it must be understood as:

- If SI is the FDMP, it will do the *action*
- If the SI is FDC or FDU, it will request the FDMP to do the *action*.

When SI is used in the rest of this document, it means IOP SI unless explicitly stated.

4.2.1 General Mechanisms

This section describes the IOP roles handling, basic FO management, FDMP Role transfer, alignment of local SFPL to FO and vice versa, Non-Supported functionalities handling, etc.

4.2.1.1 IOP Roles Handling

The different stakeholders interested in the FO are identified according to their responsibility regarding a given flight. Each of these stakeholders will be given a role for a FO and this role will be modified dynamically with the progression of the flight.

The roles are applied to System Instances (SI). An SI is considered the physical system in which one or more ATSUs are deployed. It is considered that the AoR/AoI of an SI is the sum of the AoR/AoI of the ATSUs deployed within that SI.

The following section determines the rules used to identify the roles applied to each SI concerned for a given FO as well as their generic responsibilities regarding the FO update.

4.2.1.1.1 Flight Data Manager Publisher (FDMP)

This section describes how the FDMP role for a given flight is successively taken by different IOP stakeholders.

This specification covers only civilian and military ATSUs, other kind of stakeholders with interest in IOP could be addressed in the future:

- in charge of the Network Manager (NM),
- who joins the IOP community (AO, APOP, M-ATSU).

Some of the requirements defined below may need to be extended to include these extra stakeholders.

The system fulfilling the FDMP role is responsible for maintaining the consistency of the FO and distributing the FO to the other IOP Stakeholders that needs it. It receives requests to update the FO from the Flight Data Contributors/Users (SI) 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, most of the times, operationally responsible for the flight, and changes as the flight progresses, or it is the first IOP-enabled Unit to have the flight under operational control.

The responsibilities of the FDMP are to:

- collect operationally agreed changes on one or more subset (Topic) of Flight Object from contributors,
- update the value of the changed Topics of Flight Object, being responsible for the consistency of Flight Object,
- publish the Flight Object to the subscribed partners,
- hold the reference value of the Flight Object, and responsibility for publishing this reference value as the FO.

A System Instance is at a given time FDMP-eligible (a dynamic property) for a given FO if all the below conditions are true:

- the SI is IOP-capable (static property of the SI),
- the SI is currently IOP-enabled (dynamic property of the SI), and
- the SI can identify a valid SFPL for the FO (dynamic property for the considered FO).

In all other cases the SI is not FDMP-eligible for this flight object.

4.2.1.1.1.1 FDMP role initialisation

[REQ]

Identifier	REQ-18-02b-TS-MECH.0002
Title	FDMP role declaration at FO creation
Requirement	The SI that creates a FO shall set the FDMP role of this FO to itself.
Status	<Validated>
Maturity Level	TRL6

Rationale	This requirement is needed to identify who is the very first holder of the FDMP role on a FO. ICD Note: The FDMP is identified in the IOP Information Cluster.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Create and Distribute FO

4.2.1.1.1.2 FDMP role assessment

The FDMP at creation remains FDMP until another system instance claims the role. This is the consequence of the basic principle driving the FDMP role transfer, i.e. the role is taken by another SI and not given to that SI.

4.2.1.1.1.2.1 Assessment of the FDMP role for an ATC stakeholder

[REQ]

Identifier	REQ-18-02b-TS-MECH.0008
Title	FDMP role for controlling SI
Requirement	The FDMP-eligible SI that has assumed the flight shall set the FDMP role of the corresponding FO to itself.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to identify the main reason for becoming FDMP of an already existing FO: assuming the flight. ICD Note: The FDMP is identified in the IOP Information Cluster.
Category	<Interoperability><safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Create and Distribute FO

This is the nominal case. The controlling SI will be the SI currently in communication with the flight. Reminding that when the flight is not controlled by an IOP stakeholder this stakeholder is not marked as responsible for that flight.

A SI has only one role at a given time for a given FO. Whenever several conditions are fulfilled, the following order of priority is applied: FDMP then FDC and then, FDU. That is, a SI in charge of two ATSU, one that is currently controlling the flight and another one that is expected to control the flight at a later stage will declare itself FDMP for the flight.

Note: Upon transfer of flight between two ATSU managed by the same System Instance, there is no change of FDMP.

Note: Upon transfer of flight between two ATCOs working for the same SI, there is no change of FDMP.

4.2.1.1.1.3 FDMP role transfer

4.2.1.1.1.3.1 From IOP ATC to IOP ATC

4.2.1.1.1.3.1.1 Nominal FDMP role transfer

The regular FDMP role transfer is managed by the requirement REQ-18-02b-TS-MECH.0008.

In the requirements about FDMP role, there is no indication whether the flight is operating under IFR/VFR or GAT/OAT. It has to be noted that this requirement does not make the assumption that the flight traverses the AOR of the controlling SI. Military SIs might also take the FDMP role, if FDMP-eligible.

4.2.1.1.1.3.1.2 Other cases of FDMP role transfer

The purpose of this section is to make robust the IOP mechanisms by ensuring that there is always a System Instance taking the FDMP role so that the continuous sharing of information of a FO can continue.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0010
Title	FDMP role assessment
Requirement	Each FDMP-eligible SI that has received a FO shall assess its own FDMP role over this FO each time one of the following condition is met: <ul style="list-style-type: none"> - The SI is notified in the FO, that the IOP-enabled status of the FDMP of this FO changes to IOP-disabled, - The SI recovers its IOP-enabled status, - The SI is notified in the FO that the FDMP of this FO lost its local view, - The SI recovers access to its local view, - The controlling SI indicated that a change of frequency to another non IOP-capable SI is effective (MAS received or equivalent verbal exchange).
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to provide backup mechanism in case of current FDMP failure.
Category	<Interoperability><safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0002
<ALLOCATED_TO>	<Service>	SharedFlightObject

<ALLOCATED_TO>	<Function>	Update and Distribute FO
----------------	------------	--------------------------

Note: The SI evaluates its role either immediately after one of the above events occurred.

4.2.1.1.3.1.2.1 FDMP backup by a SI of a non-controlling crossed SI

[REQ]

Identifier	REQ-18-02b-TS-MECH.0012
Title	FDMP role backup (first level)
Requirement	The first FDMP-eligible SI in the control sequence list with FDC role shall declare itself the FDMP for that FO, if the declared FDMP is not FDMP-eligible.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to provide backup mechanism in case of current FDMP failure. ICD Note: The currentControllingSI field in the IOPInformation cluster is emptied.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0002
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO

4.2.1.1.3.1.2.2 FDMP backup by SI in charge of a non AOR-traversed SI

Giving the possibility to be FDMP when only one's AOI is traversed provides following interests:

- The benefit of data sharing through IOP is extended to flights traversing only the AOI of the IOP stakeholders (so flights operating on the "vicinity" of the IOP area).
- The FDMP role remains available also when none of the AOR-traversed SI is IOP-enabled.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0013
Title	FDMP role backup (second level)
Requirement	Any FDMP-eligible FDU shall declare itself the FDMP for that FO if: <ul style="list-style-type: none"> - The controlling SI has not declared itself FDMP, and - No FDC has declared itself FDMP within max SP-IOP- Max_Manager_Change_Waiting_Time, and - No other FDU has yet declared itself FDMP.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to provide backup mechanism in case of current FDMP failure.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO

Note: FDU is any SI being present in the distribution list but not present in the control sequence.

Note: there is no transfer of FDMP role when a FDU took it. Unless this former FDU becomes IOP-disable, it will remain FDMP until a SI with an AOR traversal returns IOP-enabled.

4.2.1.1.1.3.1.3 FDMP role transfer during traversal of a non-IOP area

The requirement below states the conditions when a non IOP-enabled system instance takes the communication of a flight from an IOP-enabled SI.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0014
Title	Flight transferred to a non-IOP SI
Requirement	When the flight has been successfully transferred to a non IOP-capable SI, the FDMP shall indicate in the FO that it is no longer the controlling SI.
Status	<In Progress>
Maturity Level	TRL4
Rationale	This requirement is needed to allow future FDMP role change in case of traversal of a non-IOP area. ICD Note: The indication that the FDMP is no longer the controlling the flight is reflected by removing the value of the currentControllingSI field from the IOPInformation cluster.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO

When a flight traverses an IOP hole, the FO no longer contains the information of which SI is currently controlling the flight. Several OLDI SIs may take control of the flight during the traversal of the hole and this information is not available to the IOP stakeholders.

The behavior will be to publish a FO without indication of a controlling SI as the IOP stakeholders are not able to maintain this information during the traversal of the IOP hole.

The actual time when the SI downstream to the IOP hole takes the FDMP role is fixed by its internal logic. It could be the reception of an ACT message, or some parameter before boundary or the correlation, etc.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0022
Title	Flight coming back from a non-IOP SI
Requirement	The next IOP SI downstream in the control sequence to an IOP hole shall take the FDMP role at the earliest after the SI upstream to that hole has indicated it is no longer controlling the flight, and at the latest when it assumes the flight.
Status	<In Progress>
Maturity Level	TRL4
Rationale	This requirement is needed to define FDMP role change in case of traversal of a non – IOP area.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO

During the traversal of the hole, all SIs can continue to share information in the FO using the services of the FDMP.

4.2.1.1.1.3.1.4 Change of route during the traversal of an IOP hole

If a flight traversing an IOP hole gets rerouted, while under control of a non-IOP SI of the hole, so that it will never re-enter the IOP area (for example the flight is diverted to an airport located within the IOP hole), the IOP downstream SIs should be made aware of that.

As the traversal of some downstream SIs was planned, at least one of these SIs will receive the corresponding CHG (or any message) message from the originator (a non-IOP SI) or from NM. It will update the FO accordingly as FDMP or FDC.

When the FDMP has published a FO with an empty controlling SI, it means that the flight is managed by a non-IOP SI. During this time, any IOP stakeholder that receives updated information about the aircraft behavior can re-assess its role on this flight and potentially take the FDMP role. This will address the case of a reroute granted during the IOP hole traversal. The flight will re-enter the IOP area through the AOR of a different stakeholder than the one planned when entering the IOP hole.

4.2.1.1.1.3.2 Analysis of specific cases

Because of inconsistent offline configuration, or because each SI assesses its FDMP role using its own view of the flight (own local processing of the flight script in particular), it may happen that:

- more than one SI assesses it is the FDMP of the flight at the same time, or
- no SI assesses it is the FDMP of the flight.

4.2.1.1.1.3.2.1 FDMP role dispute resolution

The dispute on the FDMP role corresponds to the situation where:

- the release N of the FO indicates that the SI A is the FDMP,

- the SI A receives a further update of the FO indicating a new FDMP. When assessing again its role for this FO (as per § 4.2.1.1.1.3.1.2 and following), the SI A finds out that it should be the FDMP.

This change of FDMP is deemed not legitimate by SI A. To avoid loops, in such a situation, there is no automatic take-back of the FDMP role by SI A. This behavior is granted by REQ-18-02b-TS-MECH.0010 requirement that consider the notification of a change of FDMP is not a reason to reassess your own role on a FO.

At the next assume within the IOP stakeholders, the controlling SI (the SI of the controlling ATSU) will take the FDMP role and the “dispute” will be resolved.

4.2.1.1.1.3.2.2 Case where the FDMP SI has no more local view available for a FO

In case the FDMP of the FO loses access to its local view (cause can be various: local FDP is shut down for any reason, or software bug like a loop on this SFPL, or SFPL deleted locally), it is no more in position to hold his role of FDMP. It has to inform its partners.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0017
Title	Reporting the loss of local view for a FO
Requirement	When the FDMP has been deprived of the SFPL that corresponds to the FO for longer than the value of the SP-IOP-Max_SFPL_Deprived_Time, it shall indicate in the FO that it is not FDMP-eligible for this flight.
Status	<In Progress>
Maturity Level	TRL4
Rationale	This requirement is needed to trigger the FDMP backup mechanisms.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO

4.2.1.1.1.4 VFR/OAT parts of a flight

The IOP support is extended to the VFR and OAT segments of a flight where the SI can produce a trajectory. The ability to produce a trajectory for a given segment conducted under VFR may depend on the SI: some may be able, some not.

In some cases, there may be in the part of the flight conducted under VFR/OAT not enough information for the system to produce a trajectory. On the portions of VFR/OAT route where no trajectory can be produced, some SI may provide some level of ATC service.

When the flight enters a portion of “unknown route” while under VFR or OAT, the controlling SI will remain FDMP of the flight.

Note 1: In the FO, the traversed SI will contain the sequence of traversed SI that can be produced using the known portions of the route only.

Note 2: If a flight is fully conducted under VFR and its route is fully made of unknown items, the system is not at all able to predict the list of traversed SI. Such a flight is not published to IOP. There would be no way to predict that it is the FDC of this flight. There is no need for a specific requirement to obtain that behavior. It results from the cardinality of the traversed SI list in the ICD. It cannot be empty.

4.2.1.1.2 Flight Data Contributor (FDC)

The FDC is a SI matching one of the below conditions:

- all the SI's whose AOR of which is predicted to be traversed currently or in the future (those present in the crossed & control sequence of the FO that are not removed by means of sequence control correction) and that is not the current FDMP, and the previous controlling SI while a reclaim is possible
- those that have been delegated the possibility to control the flight (delegation mechanism)
- those SI added by means of sequence control correction
- Unlike the FDMP identification and role transference rules, the FDC identification is only performed by the latest FDMP (with some inputs from the downstream SIs).

In general a SI with FDC role is allowed to make requests to the FDMP for modifying any flight specific data that is under the responsibility of the SI that is going to control the flight. The actual limits (whenever they exist) to those requests are specified in the service definition of the ICD.

4.2.1.1.3 Flight Data User (FDU)

The FDU is a SI that is only responsible for ATSUs that are interested/concerned for the flight but that are not going to control it.

The ATSUs may be concerned because of different reasons:

- the flight crosses its Area of Interest (AoI),
- the FO is pointed to that ATSU,
- general Information distributions,
- manual subscriptions.

Unlike the FDMP identification and role transference rules, the FDU identification is only performed by the latest FDMP (with some inputs from the downstream SIs). The rules and requirements followed by the FDMP to identify the SIs with FDU role will be found in the sections 4.2.1.1.1 and 4.2.1.1.2.

In general a SI with FDU role will be allowed to provide requests that do not modify flight specific information, that is, technical requests related to the FO management protocol. For example, it can provide requests with FO data reception acknowledgements, etc. As in the case of the FDC, the actual limits to the FDU requests are specified in the services definition of the ICD.

The following type of requests are foreseen to be allowed for an FDU:

- Acknowledge the end of a distribution
- Pointing a flight to another SI.
- Request a delegation of a flight in an external AoR to another SI with FDC or FDMP role.
- Ask the FDMP to include another SIs in the distribution
 - On general rules
 - By manual subscriptions.

4.2.1.2 Flight Object Management

4.2.1.2.1 Flight Object Identification

This section addresses the requirements related to the identification of flight objects that are needed to support the IOP mechanism.

4.2.1.2.1.1 Unique identification of the flight object (FO_ID)

The IOP wide unique identification for a flight object (FO_ID) is automatically assigned by the first FDMP and used by SWIM. Two FOs must never have the same FO_ID.

There exist other kind of identifiers such as the IFPL_ID and the GUFID. Those identifiers, when available are also stored in the FO. Nevertheless, the FO_ID provided by the FDMP at creation time is the one that is actually used as unique FO identifier in the IOP network.

Note: The usage of the GUFID will be determined at the regional level, and it may be the case this element is not exchanged globally.

- This could be an identifier generated by an Air Navigation Service Provider (ANSP). In the United States, this will be the ERAM GUFID – an identifier unique for the flight in the National Airspace Service (NAS).
- This could be an identifier generated and used by the aircraft operator.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0201
Title	FO unique identification
Requirement	The SIs shall use the FO_ID assigned at the FO creation to uniquely identify a FO.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to ensure all SIs are using the FO_ID to identify FOs.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Read FO
<ALLOCATED_TO>	<Function>	Read FO Update
<ALLOCATED_TO>	<Function>	Update and Distribute FO
<ALLOCATED_TO>	<Function>	Create and Distribute FO

[REQ]

Identifier	REQ-18-02b-TS-MECH.0202
Title	Uniqueness of the FO_ID

Requirement	At FO creation the FDMP shall ensure the uniqueness of the FO_ID through the IOP area.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to force the FDMP to uniquely identify the new created Fos.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Create and Distribute FO

Note: The uniqueness of the FO_ID in the IOP area is ensured by composing the FO_ID with the identifier of the SI creating the FO and a locally defined identifier that is built according to local SI rules. The SI will be responsible for using a local identifier that is unique within its own system.

Note: Valid IOP System identifiers will be shared in adaptation.

The FO_ID will be defined as an alphanumeric string of a size capable of storing the SI identifier and the locally defined identifier. An example of FO_ID may be "KUAC101R2016". The size and any possible limitation/pattern to this string is defined in the FO model amendment.

Note: The IFPL_ID and the GUFID will be filled in the FO if they are available, but they are not required for FO identification.

At SWIM-TI level, the IOP wide unique identifier of a FO is made of a unique universal identifier for the flight object and an empty What-If Context Identifier. For a What-If FO, the IOP wide unique identifier is made of the unique universal identifier for the flight object and a unique What-If Context Identifier.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0410
Title	Unique FO identification to SWIM layer
Requirement	Upon creation of a flight object, the FDMP shall provide to the SWIM-TI an IOP wide unique identifier for the FO made of a unique universal identifier for the FO and an empty What-If Context Identifier.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to differentiate identifiers between FOs and for WIFOs.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Functional block>	G/G IOP Management

<ALLOCATED_TO>	<Function>	Create and Distribute FO
<ALLOCATED_TO>	<Service>	SharedFlightObject

4.2.1.2.1.2 Operational Key

In addition to the FO_ID, there is the need for a more operational key to identify, query and retrieve flight objects the operational one that is composed of five attributes ARCID, ADEP, ADES, EOBT and EOBD. They are required to prevent the creation of several FOs for the same flight.

It has been considered that all the items of the operational key are required to identify a flight, but the fact is that it is not necessary to have the five items to create a SFPL, sometimes the flight plans are manually created with fewer items. For example, AFIL flight plans or even flight plans creations triggered by the reception of a coordination message from a non-IOP stakeholder.

As a consequence, it is possible to create FOs that does not have a complete set of items in the operational key. This raises the problems to solve in the case of the existence of several FO's with the same subset of keys. It is explained below.

When the flights become of interest for the local system without having the whole operational key, the FDMP has to search for the existence of its associated FO by these operational keys. If no FO exists, then the FDMP will create an FO corresponding to that SFPL.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0205
Title	FO creation check
Requirement	The SI shall create a FO only if there is no FO already existing that matches the operational key.
Status	<Validated>
Maturity Level	TRL6
Rationale	Requirement needed to grant that there is no FO already created for a flight.
Category	<Interoperability><safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Create and Distribute FO

Note: The operational key will match in different cases, when a SFPL is created it needs to be linked with a FO, any of the following options will not allow the linkage with an existing FO:

- *The SFPL is being created with the five items and there is no FO with the same five items but there is more than one FO with four (or less items) that matches a subset of the SFPL.*
- *The SFPL is created with less than five items and there are other FOs with the same items or there are other FOs for which our SFPL provides only a subset of those items.*

The SI should provide a mechanism to retrieve a list of candidates that are to be reported to an operator to allow the manual linkage of the SFPL and the FO.

When there are several flight objects matching a SI's SFPL's operational key, the SI's should locally decide the mechanism to allow the linkage of a SFPL to a single FO.

In addition, it is also possible to modify (for any reason) these items after the SFPL (and therefore the FO) has been created. For example: a rerouting to other ADES, in case of storm, runway blocking, etc. It means change the operational key dynamically.

Moreover, it is possible for defined working positions to manually modify a flight plan, i.e. the fields changed by reception of a message may also be changed directly by manual input; the operational key could also be changed

Therefore the operational key in the FO cannot be considered static.

The Operational Key of a FO may be changed dynamically by the FDMP, but it has to be granted the uniqueness of the FO, which means that the operational key could be changed in a FO as long as it does not coincides with other FO with the same five values of the operational key.

The reason to prevent certain changes is to allow the use of the operational key as a valid information to prevent the existence of two FOs representing the same flight. Notice that, as long as the five values of the operational key are defined, they are considered a unique key when searching for that flight plan. Therefore, although each independent value of the key may be updated, we should avoid that as a result of that update the operational key is repeated for two different flights.

Notice that it is possible to have several FOs with a matching subset of the operational key, since three items are not KEY for the flight identification. Each SI is responsible to solve a multiple match locally in order to properly map the FO with its local view for a given flight.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0207
Title	Updating Operational Keys
Requirement	A SI shall be prohibited from modifying any attribute of a FO's operational key (ARCID, ADEP, ADES, EOBT, EOBD) when as a consequence of that update the modified key matches an existing FO's operational key.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to avoid FOs with same operational key.
Category	<Interoperability><safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO

4.2.1.2.2 FO Creation

The first SI controlling a flight at a given time is the one responsible for creating the Flight Object.

When a SI receives flight plan data (e.g. from NM) and determines that it should be the first FDMP then it will create the flight object. When the SI identified as FDMP is not creating the flight object as expected, its downstream (FDCs that are already aware of the flight plan information) will wait some time before creating the FO themselves.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0001
Title	FO Creation Conditions
Requirement	A SI shall create a FO for a flight when the following conditions are all met: <ul style="list-style-type: none"> - it predicts the flight traverses the IOP area, - the FO does not yet exist, - the SI is the first FDMP-eligible SI in the list of crossed SIs.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to identify which SI will create a FO.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0002
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0015
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Create and Distribute FO

Notes:

- *If a flight is currently not planned to enter the IOP area it will not be published as a Flight-Object. Such flights will remain as today known only to the SIs that were informed of it by a non IOP mean (AFTN, OLDI, etc.)*
- *If a flight not traversing the IOP area is later diverted into the IOP area, the SI that first gets aware (through AFTN, OLDI, verbally) of that and that assesses to be the FDMP will create the associated FO.*
- *The SI evaluates if the flight traverses or not the IOP area using its local view.*

The SI uses the search mechanism described in §4.2.1.2.4 to be sure that there is no existing FOs matching the operational key, before creating a new one.

If the SI should play the FDMP role, when the flight becomes of its interest, it will create a flight-object corresponding to that SFPL as has been stated in the section 4.2.1.2.1.2 (Operational Key). Moreover it is the responsible to grant the uniqueness of the FO_ID. See section 4.2.1.2.1.1 (Unique identification of the flight object (FO_ID))

[REQ]

Identifier	REQ-18-02b-TS-MECH.0332
Title	FO creation timer
Requirement	When the flight becomes of interest to an SI which assesses not to be the FDMP and if there is no existing FO matching the operational key of the SFPL, it shall wait a SP-IOP-Waiting_time_before_FO_creation time before creating the FO corresponding to that SFPL.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement intends to provide a priority at the time of creating a FO so it prevents that several SIs receiving flight plan information at the same time try to create the FO at the same time for the same flight.
Category	<Interoperability><safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0015
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Create and Distribute FO

[REQ]

Identifier	REQ-18-02b-TS-MECH.0413
Title	FPL Data sharing at creation
Requirement	When creating the FO, FDMP shall populate the Initial Flight Plan Data of the FO with the content of the corresponding flight plan.
Status	<Validated>
Maturity Level	TRL6
Rationale	FPL data is useful to IOP Units to see the changes compared with the actual flight plan shared through the FO.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0003
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Create and Distribute FO

Because at first inclusion of a SI in the distribution list its synchronization status is not defined, this must be declared as 'undefined'.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0414
Title	Initial desynchronization state
Requirement	Upon inclusion of a new SI in the distribution list its synchronization status shall be set to undefined.

Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to define the initial synchronization status of the SIs. This is done at FO creation when creating first distribution list, but also at each update of the distribution list.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Create and Distribute FO

Later each FDC will update its synchronization status using the 'srv_local_desynchronization_update' service.

4.2.1.2.3 FO Deletion from the Network

The FO is an agreed set of data shared between all the IOP stakeholders. When a FO deletion takes place, it is important to distinguish if the FO deletion takes place in the network or locally (only the local image of the FO in a system instance is deleted).

The deletion from the network can only be done by the FDMP. The FDC only can execute a local FO deletion. This section mainly addresses the network since the local FO deletion is subject to local decisions and therefore is out of the IOP scope.

A FO deletion from the network may be automatically requested to SWIM-TI by the SI in the following situations:

- **Nominal FO deletion:** When an existing flight has landed or has exited from the AoI of the last SI, after a certain time, the FDMP deletes the FO and request the SWIM-TI to delete the FO from the network.
- **Flight cancellation:** If the flight is cancelled for whatever reason, the SI that becomes aware of the cancellation must notify it to the interested stakeholders.

In addition, there are cases in which the capability of a technical / manual deletion is required, that is, an operator may request to delete a FO manually (locally or from the network). It is also possible to remove a SFPL that is linked to a FO without requesting the removal of the FO itself. These two technical capabilities are briefly described in the following sections but they are considered local capabilities rather than common IOP functionalities.

- **SFPL deletion:** This situation handles the deletion of a local SFPL that is currently linked to a FO.
- **FO manual deletion:** It describes the situation in which a FO is removed from a technical position and the consequence of those deletions depending on the flight status.

4.2.1.2.3.1 Nominal FO Deletion

This situation takes place when an existing flight has landed or has exited from the AoI of the last SI. This last SI will be the FDMP who will be capable of removing a FO from the network.

Moreover, FO deletion from the network should not be triggered by the SWIM-TI itself but must be requested from the application layer to the SWIM-TI. Thus, the FO deletion from the network means that the FDMP requests the SWIM-TI to delete the FO after SP-IOP-waiting_time_before_FO_deletion time parameter.

The SP-IOP-waiting_time_before_FO_deletion time parameter is defined as the waiting time after the last estimated exit of the IOP area (if landing in the IOP area then it is the time after the actual landing or ETA if the landing notification has not been received by the last FDMP) that the last FDMP must wait before requesting the FO deletion to SWIM-TI.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0208
Title	FO Deletion after leaving the AOI or after landing
Requirement	When a flight has landed or has exited from the AoI of the last SI, the FDMP shall request the SWIM-TI to delete the FO from the network after a SP-IOP-waiting_time_before_FO_deletion time.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is required to ensure the deletion of the FO when it is not needed anymore.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO

When the rest of the stakeholders FDCs and FDUs receive the FO deletion information, they initiate the removal (if they had not done it yet) of the local image of the FO. The impact of removing the local image of the FO to the SFPL is determined by local requirements; but this is outside the scope of this specification.

4.2.1.2.3.2 Flight cancellation

A SI that is receiving a FO and it is aware of the cancellation of that flight by a mechanism other than IOP should notify this fact to the other SIs.

Taking into account the system role, two situations arise:

- If the system instance which receives the flight cancellation is the FDMP of the FO, it has to delete the FO from the network and share this information with the rest of the stakeholders.
- If the FDC receives a flight cancellation. It should inform the FDMP about this cancellation so the FDMP can process the FO deletion from the network.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0209
Title	FO deletion due to a flight cancellation
Requirement	When the FDMP becomes aware of the flight cancellation, it shall request the SWIM-TI to delete the FO from the network
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to ensure the FDMP request the removal of the FO when the associated flight has been cancelled.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO

[REQ]

Identifier	REQ-18-02b-TS-MECH.0210
Title	FDC notification of flight cancellation
Requirement	When the FDC becomes aware of a flight cancellation, it shall inform the FDMP about this cancellation.
Status	<Validated>
Maturity Level	TRL6
Rationale	Removing a flight that is being cancelled when the SI that received the notification does not have the FDMP role.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List

Note: The local processing of a flight cancellation received from another SI is a local topic and therefore out of scope of this specification.

4.2.1.2.3.3 Technical deletion of the SFPL

This situation arises when an input is made locally at an SI to delete an SFPL which is causing a problem inside the system. This situation may happen in SIs with any role (FDMP, FDC, and FDU), nevertheless it is only relevant to the common IOP standard when this situation is not solved locally and it affects other SIs (only when the SFPL needs to be removed in the FDMP).

In IOP it is required to have an SI capable of performing the FDMP role for a given FO. Removing the SFPL in the SI with FDMP role may imply that such SI becomes unable to fulfil this responsibility for a time period.

Nevertheless, this functionality is considered local business and therefore it is not stated as a common requirement in this specification.

4.2.1.2.3.4 FO manual deletion

It is recommended to provide the capability to manually remove an FO. It can be used for example to remove a corrupted FO that bothers the IOP operations or to remove a flight that has been left in the FO database by mistake, etc. Nevertheless, this functionality is considered local business and therefore it is not stated as a common requirement in this specification.

4.2.1.2.4 Search for Flight Objects in the Network

It is very important that a given flight is represented by a unique FO, so that all stakeholders can share the information on it. The capability to search for the existence of a FO based on some criteria contributes to the uniqueness of the flight-object.

In addition to the distribution of the full FOs to the interested IOP stakeholders, a summary of each FO is also distributed to all IOP stakeholders. This FO summary contains the FO_ID and the operational key for the FO as well as the FDMP identifier. Note that the FO summary is published each time any of this information changes. For example, each time that a new Manager/Publisher assumes the management.

Since each IOP stakeholder stores the FO summary for all the FOs that exist in the IOP area, it is aware of which FOs exist in the IOP area and where to request for them if needed.

FO Summary handling is done at SWIM-TI level (C.f. Appendix E). The SWIM-TI is in charge of updating and publishing the summaries related to the FO managed by its SI. It is also in charge of processing the FO summaries received from other SIs. Note that the SWIM-TI identifies the role of its own SI because only one role is allowed per SWIM-TI – i.e. if an IOP stakeholder in a SI publishes a FO, the SWIM-TI will automatically identify its system instance as the FDMP for that FO.

As it has been described in the Operational Key section, the operational key may be incomplete and therefore, if a search is executed with only a subset of the five attributes of the operational key, a list of candidates to match that search is possible.

The SI should be able to request from the SWIM-TI all the FO(s) matching a given subset of the operational key.

It is up to each local SI to determine how to handle the list of the received candidates according to the reason that triggered the search process.

4.2.1.2.5 FO Update Mechanism

4.2.1.2.5.1 Context

The FO as an agreed set of data shared between all the IOP stakeholders needs to be revised and updated by each one of the stakeholders. For that, there is the need to specify the different mechanisms that will allow the FO modification by the concerned SIs.

4.2.1.2.5.2 FO update process

The main objective is to maintain a consistent view of the flight data, and to allow them to coordinate changes to that flight data even between systems that are not yet operationally controlling the flight.

The FO Modification Process is a process where the FDMP is the only SI allowed to modify and distribute the FO, but a SI is able to request the FDMP to update the FO on its behalf.

The FO modification process starts when a SI needs to align the FO with its local SFPL. The local SFPL could have been updated because of a local action from the controller or other local event.

FDMP updates are fulfilling the Publish/Subscribe pattern whereas the SI requests follow the Request/Reply patterns:

- Request/Reply pattern: this pattern is a mechanism allowing the request of a service from a SI to another SI. It includes the acceptance/rejection from the requested system instance. This pattern starts with the service request from the SI, then the distribution of the request through the IOP network; the service request validations at the destination SI and finally the distribution of the reply to the requesting SI. This reply is about service acceptance or rejection and it does not include the service processing result.
- Publish/Subscribe pattern: this pattern consists of a publishing event from the FDMP and then its distribution through the IOP network.

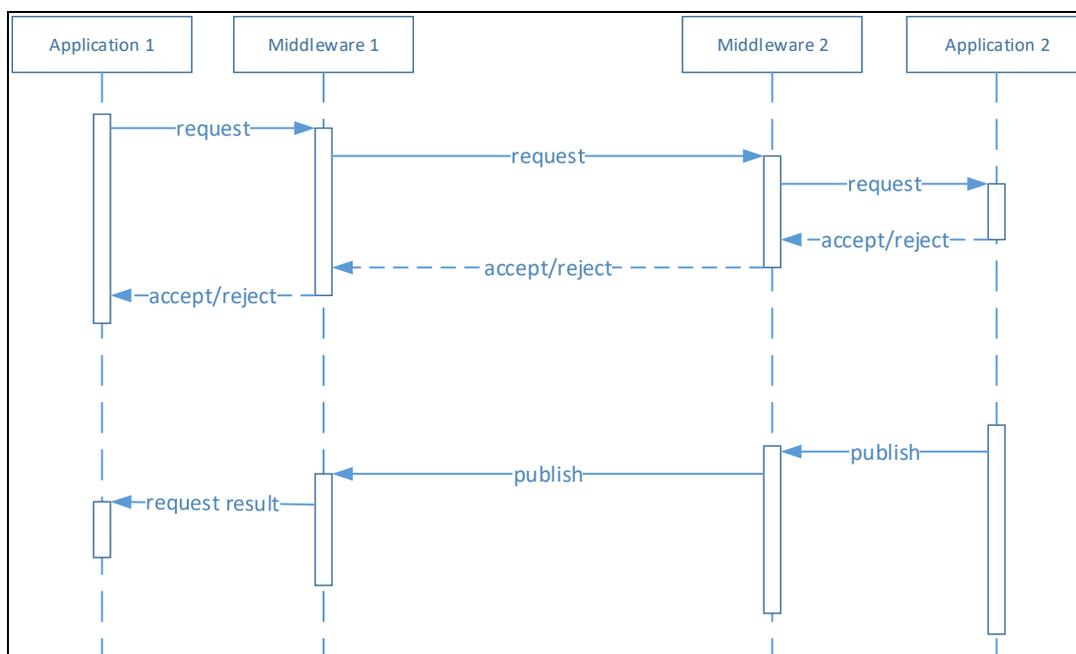


Figure 5: Example of IOP Patterns

The above figure depicts both IOP patterns; in fact, a FO update performed by another SI requires the two patterns. A synchronous request (Request/Reply pattern) is provided to the FDMP and later on an asynchronous publication of the FDMP in which the request is actually implemented.

In the first part of the example (a Request/Reply pattern), the SI requests a service to the FDMP. After service validation at the destination, the requested SI (FDMP) replies either by accepting or rejecting the service.

In the second part of the example (a distribution pattern) a publishing event occurs at the sending SI (FO publication from the FDMP). Notice that this event may be the result of processing the service initially requested in the first example, or it may be as the result of an internal trigger in the FDMP.

4.2.1.2.5.2.1 Publish FO Event (FO Publication)

The FDMP uses events to send the information to the stakeholders using the SWIM network. These “events” are published by the FDMP any time the data in the FO is updated. Each time the FO is updated, a new Release of the FO is distributed. The FO is composed by a number of clusters that gathers together the related information, each of these clusters is given a release number. The release version of the FO is composed by the aggregation of the release number of each cluster.

With each release of FO, some clusters are updated and others not. Only the updated clusters are distributed to the interested stakeholders. Every time that a cluster is updated its release number is incremented.

This is an asynchronous message and therefore the FDMP does not wait for any answer to this publication.

4.2.1.2.5.2.1.1 Understanding Ordering of FO releases

An FO release is a version of a Flight Object and is a sequence of all the releases of the clusters of the flight object.

This is basically a version vector for tracking changes to the clusters of a flight object.

At flight object creation, all the clusters releases are equal to zero.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0411
Title	Initializing FO cluster release at FO creation
Requirement	At flight object creation, the FDMP shall set all clusters release numbers to zero value.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to ensure the modified clusters are identified when a new FO update is published. ICD Note: The cluster releases are identified in the FOReleaseld field of the Flight Identification cluster.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0008
<ALLOCATED_TO>	<Enabler>	ER ATC 176
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Function>	Create and Distribute FO
<ALLOCATED_TO>	<Service>	SharedFlightObject

Each time a flight object is updated, the releases of the updated cluster are incremented and the FDMP publishes the Summary containing the FO release.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0412
Title	Updating FO cluster release on update
Requirement	Each time a flight object is updated, the FDMP shall increase the value of the release number of the updated clusters.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to ensure the modified clusters are identified when a new FO update is published.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0008
<ALLOCATED_TO>	<Enabler>	ER ATC 176
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Function>	Update and Distribute FO
<ALLOCATED_TO>	<Service>	SharedFlightObject

4.2.1.2.5.2.2 Request FO Service (FO update service request)

4.2.1.2.5.2.2.1 SI triggers a FO update

If a SI detects a change in its SFPL, it has to align its local information with the one in the FO. It performs the alignment by requesting the FDMP to implement the appropriate changes in the FO. These changes are requested through a set of FO services.

The FO services are defined with a specific purpose and designed to be atomic by themselves. That is, the parameters of each service comprise any possible data that may be affected by the modification of the main information that is going to be changed.

Each Request Message is applicable to one FO Release, to have a common understanding about the data that the SI wants to change. When the Request Message is built, it is sent to the FDMP using the SWIM network.

Once the Request Message is sent, the SI tracks from the FDMP, both the request acceptance (synchronous pattern) and the result of its implementation (asynchronous pattern).

4.2.1.2.5.2.2.2 Request processing by the FDMP

When the FDMP system receives a Request message, it analyses and processes it in two steps:

- 1) Request assessment (synchronous reaction)

The request is assessed by performing a set of verifications (Eligibility, Syntax and Semantic) at FDMP side.

The FDMP answers to the requesting SI with the result of that assessment.

The actual verifications applicable to each service are defined in the detailed definition of those services in the ICD and through local processing.

2) Request implementation (asynchronous reaction)

The services that passed the assessment are processed by the FDMP to be implemented in the local SFPL and in the FO. The local implementation of the required services is still constrained to local requirements and therefore it may still fail.

Once the request has been processed, the FDMP publishes the result of the implementation process. This publication contains the requested changes in the FO (if succeeded).

Notice that a FO publication represents an alignment of the local SFPL with the FO, therefore a FO may be published with the result of the requested services by the SI and any other data updates that were produced due to other local events and were not already published in the FO.

4.2.1.2.5.2.2.3 Requesting SI receives the answer to its Request.

Reception of the request assessment (synchronous reaction)

The SI receives a synchronous answer from the FDMP with the acceptance or rejection (with the reason for rejection) to the requested service.

When the service is accepted, the requesting SI tracks the received FOs waiting for the implementation of that service.

When the service is rejected, depending on the service and the reason for the rejection, the requesting SI determines the procedure to follow. These SI actions may range from triggering a de-synchronization process to repeat the request. Note that sometimes the actions are common/standard to all the IOP stakeholders, determined by the IOP requirements whereas sometimes they are determined by local requirements. A service rejection by the FDMP is to be considered a non-nominal situation that is generated only by failed syntactic, semantic or eligibility checks, which means a request should not be automatically repeated as a consequence of the rejection.

Reception of the request implementation (asynchronous reaction)

The requesting SI tracks the reception of a FO update containing the result implementing the service request. The answer to the service request should be received before the time parameter SP-IOP-Max_Contrib_Consequences_Waiting_Time duration.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0365
Title	Maximum time to implement a request (FDMP)
Requirement	The FDMP shall publish a FO containing the implementation of a request before SP-IOP-Max_Contrib_Consequences_Waiting_Time.
Status	<Validated>
Maturity Level	TRL6
Rationale	The maximum time allowed to the FDMP to process a request will be used by the requesting SI to realize that there is a problem and to determine if a retry is required.

Category	<Performance><safety>	
[REQ Trace]		
Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0008
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Function>	Manage Flight Script
<ALLOCATED_TO>	<Function>	Manage SSR Code Data
<ALLOCATED_TO>	<Function>	Manage WIFO

[REQ]

Identifier	REQ-18-02b-TS-MECH.0375
Title	Missing answer to a service request
Requirement	The requesting SI shall consider a request as rejected if it does not receive a FO containing the implementation result of that request before SP-IOP-Max_Contrib_Consequences_Waiting_Time.
Status	<Validated>
Maturity Level	TRL6
Rationale	The maximum time allowed to the FDMP to process a request will be used by the requesting SI to realize that there is a problem and to determine if a retry is required.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0008
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Function>	Manage Flight Script
<ALLOCATED_TO>	<Function>	Manage SSR Code Data
<ALLOCATED_TO>	<Function>	Manage WIFO

Whenever the requested service was successfully implemented, the requesting SI SFPL and the FO are successfully aligned again. Nevertheless, when the service was not properly processed (or the implementation result was not received within the time parameter) a desynchronization between the FO and the local SFPL in the SI is detected. As in the initial assessment, the requesting SI reaction may vary from trying again the alignment (retry the request) or start the process of de-synchronization with the FO.

Note that there cannot be a complete freedom in the requesting SI to perform retries indefinitely, since this would lead to infinite loops that would degrade the network. A mechanism to prevent this problem will be described in the Publish – Request Management chapter 4.2.1.2.8.

4.2.1.2.6 Verification rules applicable to both publications and FO requests

In general, the reception of FO updates from an IOP stakeholder triggers three levels of checks:

- Eligibility,
- Syntactic, and
- Semantic.

Eligibility checks

Eligibility checks determine when the source of a FO publication or FO update request has the right to perform such action. Eligibility rules are defined in the ICD chapter for each service. Additional eligibility rules can also be applied locally resulting from bilateral agreement or local decisions.

When the FDMP receives a request, these rules are verified to prevent any non-authorized operation from being executed. When met, the normal operation continues. If not, and there is rejection of another stakeholder request, the requesting stakeholder is informed.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0302
Title	Service requests received by an SI without FDMP role
Requirement	A SI without FDMP role for a given FO shall reject any request regarding that FO.
Status	<In Progress>
Maturity Level	TRL4
Rationale	Requirement needed to grant the rejection of change requests received by a stakeholder without FDMP role.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Function>	Manage Flight Script
<ALLOCATED_TO>	<Function>	Manage SSR Code Data
<ALLOCATED_TO>	<Function>	Manage WIFO

The requirement below describes the general eligibility principles to be fulfilled for services requests within the IOP network.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0305
Title	Request rejection: sender eligibility check
Requirement	When a SI request is not valid to the FDMP because of eligibility checks, the FDMP shall reject it including the eligibility reason in the rejection.

Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to ensure the requesting SI of an invalid request knows its request has been rejected for eligibility reason. Note. Whenever applicable, common eligibility rules are specified for each service in the ICD.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0011
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Function>	Manage Flight Script
<ALLOCATED_TO>	<Function>	Manage SSR Code Data
<ALLOCATED_TO>	<Function>	Manage WIFO

Syntactic checks

Before processing a service request, the FDMP has to ensure that the request has no syntactical errors. Otherwise, the FDMP could fail to correctly interpret the request. This, in turn, could lead to unwanted operational behavior within the IOP domain. Hence, it is essential to detect these types of errors as early as possible, i.e. on reception of the request.

The syntax specified for the IOP interface defines the formats to be used for service and event exchanges; the data items that each specific message contains and, for each data item, the range of values that are considered valid.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0303
Title	Request rejection: syntactical check
Requirement	When a SI request is syntactically invalid the FDMP receiving this request shall reject it including the syntactical reason in the rejection.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to ensure the requesting SI of an invalid request knows its request has been rejected because of syntax errors.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Function>	Manage Flight Script
<ALLOCATED_TO>	<Function>	Manage SSR Code Data
<ALLOCATED_TO>	<Function>	Manage WIFO

Note that the basic syntactic checks will be those derived from the ICD. Any particular/additional check could be defined per service.

Semantic checks

The FDMP may receive a request that it is syntactically correct, but is still invalid at a semantic level. For instance, an FDC may be requested for a counter-proposal from its adjacent SI even before the coordination process has been initiated (e.g. due to some technical malfunction in the adjacent center), or an FDC requests a route modification affecting part of the route already overflowed. In both cases, the FDMP must detect the semantic error and react accordingly, returning a notification message to the originator and, possibly, warning an operator in order to handle the problem. Note that the requirements cover the need for the checking and the distribution of the failure reason in case of detecting a problem. The actual common checks depend on the concrete data structures and therefore are defined in the ICD.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0304
Title	Request rejection: semantic check
Requirement	When a SI request is semantically invalid the FDMP receiving this request shall reject it including the semantic reason in the rejection.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to ensure the requesting SI of an invalid request knows its request has been rejected because of semantic errors.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Function>	Manage Flight Script
<ALLOCATED_TO>	<Function>	Manage SSR Code Data
<ALLOCATED_TO>	<Function>	Manage WIFO

4.2.1.2.7 FO publication process

The FO can only be published by the SI that has the FDMP role at a given time, and therefore it is responsible for granting the coherence of the FO. The first FDMP of a FO will be the responsible for creating and publishing the FO.

SIs without FDMP role are able to use FO services to request the FDMP to update the FO but they are not allowed to update/publish the FO directly.

What the FDMP publishes in the FO is defined in the ICD. The main set of data included in a FO is:

- FO protocol data (FO Identification, FO distribution related data, etc.),
- Flight trajectory information (route and constraints applied to the flight across the IOP area, computed trajectory from the FDMP, etc.),
- Flight coordination information between different SIs,
- Arrival and departure information,
- Aircraft related data,
- Original flight plan information.

4.2.1.2.7.1 FO structure

Conceptually the FO is a single consistent/coherent representation of a single flight. In practice the FO has been specified as a number of clusters. For the time being, the following clusters are defined:

- Flight Identification Cluster,
- Operational Key Cluster,
- Crossed and Control Sequence Cluster,
- Initial Flight Plan Data Cluster,
- IOP Information Cluster,
- Arrival Cluster,
- SSR Cluster,
- Departure Cluster,
- Flight Script Cluster,
- Trajectory Cluster,
- Coordination Cluster,
- Aircraft Cluster.

The clustering allows publishing only the clusters that have been modified at a given time. The Flight Identification cluster is always published together with any other updated cluster. Within this cluster, the latest applicable release identification of each cluster is published. That is, this cluster is used to grant the coherency of the whole FO.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0330
Title	Unique cluster identification
Requirement	The FDMP shall manage unique release identification for each cluster of data within the FO.
Status	<Validated>
Maturity Level	TRL6

Rationale	Unique release identification for each cluster of data within the flight-object. ICD Note: The release of each cluster is identified in the FOReleaseld field of the Flight Identification cluster.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO

The IOP application is responsible for versioning the FO. The FO version is composed by the version of each cluster that defines the FO. Each time a cluster is updated, the IOP application has to increase its version before publishing the FO update. The SI checks the FO version ensuring its validity. See section 4.2.1.2.6 (Verification rules applicable to both publications and FO requests).

The FO_ID is included in one of these clusters. Any time the FDMP publishes changes in a FO, it publishes the set of related clusters all together. To allow the receivers to identify the clusters being sent, the FDMP includes the cluster containing the FO_ID of the FO being modified along with the latest version number of all the FO clusters.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0331
Title	FO identification distribution
Requirement	Every time that the FDMP publishes a set of modified FO clusters it shall include in that publication the cluster containing the FO identification.
Status	<Validated>
Maturity Level	TRL6
Rationale	Requirement needed to grant the integrity of a flight object.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO

4.2.1.2.7.2 FO update

This section describes the general activities performed by the FDMP in order to update the FO.

4.2.1.2.7.2.1 SFPL – FO alignment by the FDMP

This section describes the general activities performed by the FDMP for synchronizing the local SFPL with the FO.

Note. See section 4.2.1.2.8 (FO Request preparation and delivery to the FDMP) for an alignment triggered by the FDC.

The alignment of the FO with the local SFPL being FDMP occurs whenever there's a local update. The distribution of the FO only occurs when there are some relevant updates for distribution (see section 4.2.1.2.5.2 "FO distribution").

[REQ]

Identifier	REQ-18-02b-TS-MECH.0360
Title	FO alignment to the Local SFPL (FDMP)
Requirement	When the FDMP detects an update of its local SFPL impacting the FO, the FDMP shall update and distribute the FO.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed in order to get synchronized the FO with the local SFPL of the FDMP.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0005
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0012
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0013
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO

4.2.1.2.7.2.2 SI process upon reception of a FO publication

This section describes the general activities performed by the SI at reception of a FO publication. It does not describe the application data usage or understanding which is described in the sections covering each specific functionality (coordination, flight script alignment, etc.).

Note that at reception of a publication, it must be checked that the received FO clusters are coherent, that is, there is no obsolete cluster and all of them corresponds to the latest available version. This verification is not described here since it is performed at SWIM-TI (Cf. Appendix E).

When the FDCs and FDUs receive the FO publication, they try to retrieve the local SFPL that corresponds to the FO matching the same five items of the operational key or a subset of them. The way to search for a local SFPL under a FO reception is determined by local requirements. It is out of scope of this IOP technical specification.

If the FDC or FDU does not find a local SFPL corresponding to a FO, it creates a local SFPL based on information included in the FO.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0336
Title	SFPL creation on FO reception
Requirement	An FDC or FDU shall create a local SFPL based on a received FO when no local SFPL currently exists in the SI matching this FO.
Status	<Validated>
Maturity Level	TRL6
Rationale	The creation of local SFPL will be based on the information held by the flight-object.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Read FO

Once the received FO update has been verified, the FDC or FDU initiates the correct actions to implement these changes into the local SFPL, that are either:

- Verify that the SFPL is aligned with the FO (when the received FO implements a previous request), or
- Modify the SFPL to align it with the FO.

When the SI receives a FO update, it analyses it and if the changes are locally acceptable, it updates its local SFPL to maintain its alignment with the FO.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0306
Title	Local SFPL alignment
Requirement	The SI shall incorporate in its local SFPL the changes coming from the FO published by the FDMP as long as these changes are accepted by the local SI to be integrated in the SFPL.
Status	<Validated>
Maturity Level	TRL6
Rationale	When the SI receives a flight-object update, it analyses it and updates its local SFPL to maintain its alignment with the flight-object.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0012
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0013
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Read FO

<ALLOCATED_TO>	<Function>	Read FO Update
----------------	------------	----------------

As the result of this SFPL alignment, three different situations can occur:

- The SFPL and FO are aligned.
- As a result of the SFPL modification in the SI, new changes are internally triggered in the SI and therefore it needs to perform an additional request to the FDMP. This is the general case described in §4.2.1.2.8.2.1 FO Request preparation and delivery.
- The SFPL alignment fails in the SI, then, the SFPL and FO have lost their synchronization (partially) for the information that has been tried to be implemented. The SI that gets into this case will notify the FDMP about this situation.

The requirements REQ-18-02b-TS-MECH.0307, REQ-18-02b-TS-MECH.0308, REQ-18-02b-TS-MECH.0310 and REQ-18-02b-TS-MECH.0322 describe the general policy that is used by the SI to notify a problem when aligning its SFPL with the FO.

Desynchronization is a process for which there are no common reasons or consequences and it may affect different set of information depending on the system that is affected. The following requirements affect to any kind of desynchronization that is relevant for a SI according to locally defined criteria. The following data structures have been identified as potential candidates to generate a desynchronization and specific structures for their report have been defined in the ICD:

- Flight Script
 - Route
 - Constraints
- Coordination
- Control sequence
- Computed trajectory

In addition the ICD will foresee a data structure to allow notifying undefined types of desynchronization.

Desynchronization mechanism is required to prevent infinite loops to update the FO according to the local SFPL data.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0307
Title	Notifying a desynchronization
Requirement	Upon reception of an FO update by an SI, if the SFPL cannot be aligned with the information received in the FO, the SI shall notify the FDMP of a local desynchronization if relevant local data is impacted, identifying the reason for the de-synchronization.
Status	<Validated>
Maturity Level	TRL6
Rationale	The requirement is needed to: <ul style="list-style-type: none"> - Avoid defining the local treatment (local operator warning) - Allow that any alignment issue of the SFPL and the FO becomes visible for the rest of the stakeholders.

	ICD Note: The service used to notify a desynchronization is <code>srv_local_desynchronization_update()</code> .
Category	<Interoperability><safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0078
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List

The desynchronization is to be considered specifically for the piece of data that has not been properly processed. Different reasons categorizing the misaligned data can be given in the FO. The SI determines the most relevant one according to its own local treatment. Examples of desynchronization categories included in the ICD are route, applicable constraints, SIs control list, coordination, etc. The realignment strategy in the SI is to be defined locally and it may depend on the category of the information that is generating the problem. For example, it can be defined an automatic retry to implement that information after a time period or it can be displayed for human operator treatment.

Sometimes, the received FO was triggered by a request previously delivered to the FDMP. In this case, the SI checks whether its request was successfully implemented or not. Note that the FDMP was expected to implement all the services requested by the SI. The failure in the implementation of the request by the FDMP leads to a desynchronization between the SFPL and the FO in that SI. The SI that notifies a desynchronization according to its local criteria is also responsible of notifying the end of the desynchronization.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0308
Title	Local desynch in case of service negative result
Requirement	Upon reception by the SI of a notification from the FDMP indicating that the service previously requested was not successfully implemented, the SI shall , if locally relevant data are impacted, notify the FDMP of a desynchronization, identifying the reason for the de-synchronization and providing additional information about the de-synchronization.
Status	<Validated>
Maturity Level	TRL6
Rationale	Requirement needed to notify the desynchronization of an SI. ICD Note: The service used to notify a desynchronization is <code>srv_local_desynchronization_update()</code> .
Category	<Interoperability><safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0078
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
----------------	------------	--

These desynchronizations update in the SIs that are notified to the FDMP are included in the FO so they can be locally considered by other IOP stakeholders. A desynchronization in a SI may be used by other IOP stakeholders (i.e. downstream SI) as an indication of the reliability of the FO information they are receiving. It can be used to assume local decisions on the functionality that can be feed with the FO data.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0310
Title	SI desynchronization status updates notification
Requirement	The FDMP shall include in the FO any desynchronization notification provided by a SI.
Status	<Validated>
Maturity Level	TRL6
Rationale	Requirement needed to update the FO with the desynchronization of an SI. ICD Note: The indication that a SI is desynchronized and the reason are indicated in the SI description in the distribution list (SynchronizationData).
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0078
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List

[REQ]

Identifier	REQ-18-02b-TS-MECH.0322
Title	Desynchronization termination
Requirement	The SI shall inform the FDMP when a desynchronization no longer exist.
Status	<Validated>
Maturity Level	TRL6
Rationale	Requirement needed to notify the re-synchronization of an SI. ICD Note: The service used to notify a desynchronization is not relevant anymore is <code>srv_local_desynchronization_update()</code> .
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0078
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0082
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
----------------	------------	--

4.2.1.2.8 FO Request update process

As stated in §4.2.1.2.5.2.2.1 (SI triggers a FO update), if a SI detects a change in its SFPL it has to make the local information and the FO consistent. This is done by requesting the FDMP to implement the appropriate changes in the FO.

These changes will be requested through a set of FO services.

4.2.1.2.8.1 FO Service Request structure

A FO Service Request is a message sent by an SI to the FDMP. This request is synchronous, that is, the SI waits for an answer before further processing. This answer informs about the acceptance/rejection of the request but not about the result of its implementation which will come later with a FO publication.

The FO Service Request is composed of the following information:

- A request identifier that will be used later by the SI to figure out in a subsequent FO publication which of its requests was tackled;
- A set of services that contains the changes that are requested to the FDMP. Each service is given an identifier so the FDMP is able to report the result per service.

When the FO update request is sent as the result of a negotiation, the request contains additional information:

- The Context Identifier identifying the negotiation,
- Optionally, an indication that the request is legitimately initiated by a FDU.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0316
Title	SI request identifier
Requirement	An SI shall add a unique request identifier in each FO service request sent to the FDMP.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to allow a SI to link the update of a FO received from the FDMP with the last request it has sent. ICD Note: The request identifier is included in the FORequest.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Function>	Manage Flight Script
<ALLOCATED_TO>	<Function>	Manage SSR Code Data
<ALLOCATED_TO>	<Function>	Manage WIFO

The FDMP publishes in a new FO instance the result of the implementation of the service request. Note that a successful implementation of a service does not necessarily mean that the service has been implemented as requested by the requesting SI. For instance, the request from an FDC to add a new constraint resulting in the inclusion of a REJECTED constraint in the FO Flight Script must be considered as a successful implementation of the service request.

Each FO Service Request may contain several services.

The set of services included in a request must be managed by the FDMP as a unique transaction. This means the following:

- When all services included in the FO Service Request have been implemented in the FO, the result of the service request is set to FULLY_IMPLEMENTED;
- Otherwise, when at least one service cannot be implemented, then the result of the FO service request is set to REJECTED. In that case, none of the proposed changes in the services of the request are incorporated into the FO.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0309
Title	Synchronous service response (FDMP)
Requirement	When a SI requests some update of the FO, the FDMP shall reply synchronously: <ul style="list-style-type: none"> • “Accept” when the request is accepted to be asynchronously processed, or • “Reject” when the request is rejected for any reason.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to ensure a synchronous response to a FO Service Request.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Function>	Manage Flight Script
<ALLOCATED_TO>	<Function>	Manage SSR Code Data
<ALLOCATED_TO>	<Function>	Manage WIFO

[REQ]

Identifier	REQ-18-02b-TS-MECH.0407
Title	Asynchronous service response (FDMP)
Requirement	As a consequence of a FO Service request, the FDMP shall publish an FO Update to provide the result of the execution (either positive or negative), only when the FO Service request was synchronously accepted
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to avoid asynchronous response to an already rejected (synchronously) request. ICD Note: The result of the request implementation is indicated in the FORequestInfoList in the Flight Identification Cluster (RequestResult). ICD Note: The result of the service implementation is indicated in the FORequestInfoList in the Flight Identification Cluster (ServiceResult).
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO

[REQ]

Identifier	REQ-18-02b-TS-MECH.0408
Title	Positive Asynchronous service response (FDMP)
Requirement	When the FDMP has implemented all the services provided in a valid FO service request, it shall report in the FO publication: <ul style="list-style-type: none"> the result of the FO Service Request as FULLY IMPLEMENTED, the result of each service as VALID_AND_IMPLEMENTED_IN_THE_FO.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is related to the FO Service Request asynchronous response. This requirement is needed to ensure that the FDMP reports FULLY IMPLEMENTED only when all the services of the FO Service Request have been implemented. All of the requested changes are reflected in the FO. ICD Note: The result of the request implementation is indicated in the FORequestInfoList in the Flight Identification Cluster (RequestResult). ICD Note: The result of the service implementation is indicated in the FORequestInfoList in the Flight Identification Cluster (ServiceResult).
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management

<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO

[REQ]

Identifier	REQ-18-02b-TS-MECH.0409
Title	Negative Asynchronous service response (FDMP)
Requirement	<p>When the FDMP is not able to implement all the services provided in a valid FO service request, it shall report in the FO publication:</p> <ul style="list-style-type: none"> • the result of the FO Service Request as REJECTED, • the result of each service as: <ul style="list-style-type: none"> ○ VALID_AND_NOT_IMPLEMENTED_IN_THE_FO or FAILED, when implementation information is known for each service, ○ UNKNOWN otherwise.
Status	<In Progress>
Maturity Level	TRL4
Rationale	<p>This requirement is related to the FO Service Request asynchronous response.</p> <p>This requirement is needed to ensure that when the FDMP cannot implement some services of the FO Service Request, it will report a REJECT service result. Optionally, information about the implementation of individual service can be provided.</p> <p>None of the requested changes are reflected in the FO.</p> <p>ICD Note: The result of the request implementation is indicated in the FORequestInfoList in the Flight Identification Cluster (RequestResult).</p> <p>ICD Note: The result of the service implementation is indicated in the FORequestInfoList in the Flight Identification Cluster (ServiceResult).</p>
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO

4.2.1.2.8.2 SFPL – FO alignment for SI

This section describes the general activities performed by the SI for synchronizing the local SFPL with the FO.

The alignment of the FO with the local SFPL by an SI occurs whenever there's a local update. And if there are some relevant updates that need to be synchronized with the global FO, a request will be sent to the FDMP in order to get the update.

4.2.1.2.8.2.1 FO Service Request preparation and delivery to the FDMP

When an SI needs to align the FO with its SFPL information that has been modified internally, it sends a FO Service request to the FDMP. These changes are requested through a set of FO services. See explanation in section 4.2.1.2.5.2.2.1 FDC triggers a FO update.

Each Request Message is applicable to one FO Release. When the Request Message is built, it is sent to the FDMP using the SWIM-TI.

Once the Request Message is sent, the SI will track from the FDMP, both the request acceptance (synchronous pattern) and the result of its implementation (asynchronous pattern).

[REQ]

Identifier	REQ-18-02b-TS-MECH.0321
Title	FO update request sent to the FDMP
Requirement	When the SI needs to align the FO with its SFPL, it shall request the FDMP to update the FO.
Status	<Validated>
Maturity Level	TRL6
Rationale	Requirement needed to allow updates of the FO coming from an SI due to local SFPL updates.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0005
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0014
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Function>	Manage Flight Script
<ALLOCATED_TO>	<Function>	Manage SSR Code Data
<ALLOCATED_TO>	<Function>	Manage WIFO

An SI that is requesting the alignment of the FO with its SFPL should prevent the automatic repetition of a request that was previously requested but not implemented by the FDMP. The repetition of these requests would trigger an endless loop that would be consuming the network resources until that requesting SI becomes FDMP, whenever applicable.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0385
Title	Maximum number of retries allowed upon missing implementation report
Requirement	A SI shall perform a maximum of SP-IOP-Max_Requests_Retries retries of a service request when no valid answer to that service has been received before. SP-IOP-Max_Contrib_Consequences_Waiting_Time.
Status	<In Progress>
Maturity Level	TRL4

Rationale	Requirement needed to limit the number of retries for the same request to prevent the generation of loops.
Category	<Interoperability><safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Function>	Manage Flight Script
<ALLOCATED_TO>	<Function>	Manage SSR Code Data
<ALLOCATED_TO>	<Function>	Manage WIFO

The request are referred to a concrete FO version, as a consequence of implementing a request, a new FO will be published with an updated version number. Therefore, if the SI performs two consecutive request (refer to the same version of the FO), when the FDMP process the second request it will be referring to an outdated FO version and therefore rejected. In order to prevent request that will be rejected, the SI should not make further requests until the service included in the previous request have been tackled. (The result of their implementation (success or failure) has been notified by the FDMP). That is, a new FO with an updated version including the result of the request has been published.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0315
Title	Number of concurrent requests
Requirement	After having made a request on an FO, the SI shall wait until an FO containing the result of its request has been published by the FDMP or the SP-IOP-Max_Contrib_Consequences_Waiting_Time timer has expired, before performing any new request.
Status	<Validated>
Maturity Level	TRL6
Rationale	Requirement needed to limit the number of requests from a SI to a FO.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Function>	Manage Flight Script
<ALLOCATED_TO>	<Function>	Manage SSR Code Data
<ALLOCATED_TO>	<Function>	Manage WIFO

4.2.1.2.8.2.2 FDMP process upon reception of a FO Request

The FDMP tackles the requests received from a SI in two steps:

- An initial one that is synchronous in which an initial assessment of each of the services included in the request is performed.
- A second step in which the services are processed and the result is distributed to the relevant SIs.

The services that passed these initial checks are processed by the FDMP that will distribute the result, asynchronously in a FO distribution.

The FDMP will then implement the changes required by the requesting SI and align the local SFPL with that information.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0319
Title	SFPL alignment (FDMP)
Requirement	The FDMP shall align its local SFPL upon a request from eligible SIs, as long as it is able to implement the changes.
Status	<Validated>
Maturity Level	TRL6
Rationale	Requirement needed to align the local SFPL in the FDMP with FO updates coming from SI.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Function>	Manage Flight Script
<ALLOCATED_TO>	<Function>	Manage SSR Code Data

The above requirement caters for the need to align the SFPL in the FDMP with the SI requests. Nevertheless, the changes may be “not compatible” with local requirements (not shared in IOP) that prevents the SFPL update. Therefore request may also fail at implementation time.

The following requirement REQ-18-02b-TS-MECH.0320 is only applicable in the scope of SESAR exercises. The FDMP will distribute the result of the request within a FO publication. The same pattern that was defined in ED-133 v1 was considered enough for the purpose of the SESAR 2020 exercises. The data structures used to report the result of the execution will be improved to allow the report to be provided per service included in the request.

This pattern optimization is expected at industrialization time. A brief introduction is provided in the next section.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0320
------------	-------------------------

Title	SI request identifier management (FDMP)
Requirement	Upon accepting a request, the FDMP shall notify in a FO publication the request implementation result to the requesting SI, including the request identifier and the reason for the implementation failure (if the FDMP failed in the implementation).
Status	<Validated>
Maturity Level	TRL6
Rationale	Requirement needed to grant the identification of the response from the FDMP to the requesting SI. ICD Note: The result of the service implementation and the reason of the failure are indicated in the FORequestInfoList in the Flight Identification Cluster (ServiceResult and serviceRejectionReason).
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO

4.2.1.2.8.2.3 Request result notification pattern expected in deployment

The current pattern implies the distribution of the execution results using regular FO distributions. This approach implies that the report of the execution result is distributed to any SI interested in that FO. In order to prevent unnecessary distribution of information that is only relevant for the SI that made the request, the following changes will be applied:

- The report of the implementation result of a request will be distributed in a dedicated message to the SI that perform the request. It will no longer be included in a FO distribution.
- When the request was implemented in a FO publication, the notification will include a reference to the version number of the FO that included the request.

If this new pattern is finally selected for deployment the requirement REQ-18-02b-TS-MECH.0320 will have to be updated as well as the ICD adapted.

4.2.1.2.8.3 Asynchronous notification of request completion/failure

A request for an FO service from requesting SI to an FDMP is assessed in a synchronous manner, i.e. it will be assessed by the FDMP in a synchronous manner, i.e. the requesting SI will wait for the assessment to complete and get a report from the FDMP as an answer to the service request.

As the implementation of the FO service request will be performed later, the FDMP will need include in its assessment report to the requesting SI enough information to correlate the request with a possible notification following the failure of the implementation of the service request.

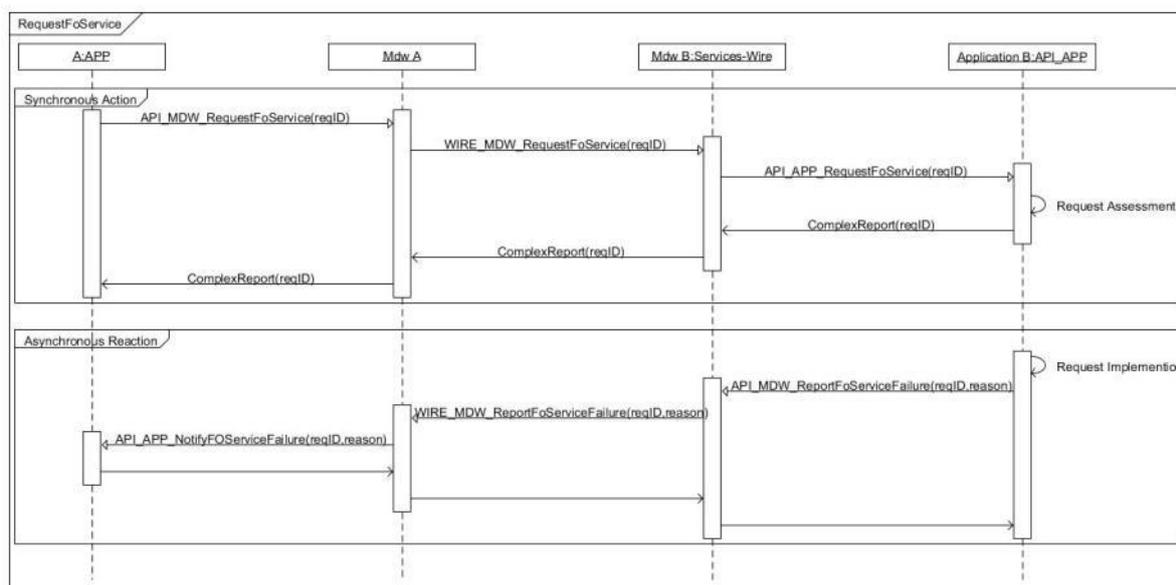


Figure 6: Asynchronous notification of request completion

4.2.1.2.9 Limitation of FO updates for non-significant changes

In order to avoid the publication of non-significant data, among all the FO data, on a set of elements some limits are going to be taken into account to consider that they have change. It is considered that they have changed only when the change exceeds a certain threshold.

The criteria are the following:

- Current Conditions: No update in FO when the unique change in the FS is the Current Conditions.
- Last Overflown Route Point: shared when changed.
- Input point (AP, TSP or TEP): element to decide the update of a constraint when the unique change in the constraint is in the input points
- Coordination time: element to decide the update of a coordination data when the unique change in the coordination is the coordination time
- ETO and Level in Route point: elements to decide the update of the Trajectory then there is no other change in the trajectory apart from ETOs and Levels of route points.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0402
Title	No publication for only current condition changes
Requirement	Current conditions changes shall only be published when other information of the Flight Script needs to be published
Status	<In Progress>
Maturity Level	TRL4
Rationale	This requirement is needed to limit the FO updates with non-significant changes.
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
--------------	---------------------	------------

<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0096
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO

[REQ]

Identifier	REQ-18-02b-TS-MECH.0403
Title	FO Publication Threshold on constraint points
Requirement	When the unique change of a constraint is in the input or computed constraint points AP, TSP or TEP, a SI shall only update the constraint if the change exceeds the _____ parameter _____ SP-IOP_INPUT_COMPUTED_POINT_THRESHOLD_DISTANCE_CONSTRAINT_UPDATE.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to limit the FO updates with non-significant changes.
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0096
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

[REQ]

Identifier	REQ-18-02b-TS-MECH.0404
Title	FO Publication threshold on coordination data
Requirement	A SI shall update the coordination data unless the only change is the time at boundary and this does not exceed the SP-IOP_THRESHOLD_TIME_COORDINATION_DATA_UPDATE parameter with respect to the last FO publication.
Status	<In Progress>
Maturity Level	TRL4
Rationale	This requirement is needed to limit the FO updates with non-significant changes.
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0096
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

[REQ]

Identifier	REQ-18-02b-TS-MECH.0405
Title	FO Publication threshold on trajectory point ETO
Requirement	A SI shall update the Trajectory when the ETO over the route points exceed the SP-IOP-THRESHOLD_TIME_TRAJECTORY_UPDATE parameter with respect to the last FO publication.
Status	<In Progress>
Maturity Level	TRL4
Rationale	This requirement is needed to limit the FO updates with non-significant changes.
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0096
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

[REQ]

Identifier	REQ-18-02b-TS-MECH.0406
Title	FO Publication Threshold on trajectory point LEVEL
Requirement	A SI shall update the Trajectory when the computed level at the route points exceed the SP-IOP-THRESHOLD_LEVEL_TRAJECTORY_UPDATE parameter with respect to the last FO publication.
Status	<In Progress>
Maturity Level	TRL4
Rationale	This requirement is needed to limit the FO updates with non-significant changes.
Category	<Performance>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0096
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

[REQ]

Identifier	REQ-18-02b-TS-MECH.0401
Title	Last Overflown Route Point update
Requirement	The FDMP shall publish the FO Flight Script whenever the Last Overflown Route Point of the FO Flight Script changed.
Status	<Validated>
Maturity Level	TRL6

Rationale	This requirement aim to synchronize the overflow route portion among all distributed SI for a given flight.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0096
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO

4.2.1.3 Non-supported functionalities

The purpose of this section is to provide a simple and common backup mechanism to all IOP stakeholders in case the implemented LoAs (or any other bilateral agreement) between different SIs are not correctly implemented and fail.

Each IOP stakeholder will adapt internally which optional functionality (identified in the Table 40 Optional functionalities in section 4.2.14) they have chosen to implement. Thereby, any SI required by another SI to implement any optional functionality that it does not support, will be able to notify the triggering SI (by firstly sending a request to the FDMP in case being FDC) that it is unable to implement that concrete functionality.

Some concrete rules and principles are defined:

- The FDMP must allow any SI to use any optional functionality and support its implementation in the FO as long as it is not involved. For instance, a FDMP which does not support a POINT in its local system, must be able to manage the POINT information in the FO of the other SIs involved.
- A FDMP that does not support a functionality must be able, as a minimum, to answer negatively to a service request from a SI that triggers that functionality (via SWIM synchronous response, not via FO publication).
- It is not the responsibility of the FDMP to undo any non-supported functionality notified by a SI already implemented in the FO. That's local decision of the triggering SI.
- A SI receiving a FO implying the use of an optional functionality must be able to send to the FDMP a service request indicating that it actually does not support it.
- The information for each SI included in the Distribution List of the FO publication regarding the non-supported functionality (NonSupportedFeatures enumerate data) will only contain the last optional functionality triggered.

For that end, a pair of requirements have been specified:

[REQ]

Identifier	REQ-18-02b-TS-MECH.0323
Title	Non-supported functionality indication
Requirement	Upon receipt of a FO requiring the SI to trigger an optional functionality that it does not implement, the SI shall inform the FDMP that it does not support that functionality.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement states the minimum action to be implemented by a SI not supporting an optional functionality (Cf. 4.2.14). ICD Note: The service used is <code>srv_not_supported_feature()</code> .
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List

The only means for the SI that does not support the functionality to inform the SI that incorrectly requested the functionality is to request the FDMP to publish this information in the FO.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0324
Title	Non-supported functionality request indication (FDMP)
Requirement	Upon receipt of an SI request indicating that it does not support an optional functionality, the FDMP shall publish a FO identifying for that SI the functionality which is not supported.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement states the minimum action to be implemented by a FDMP in response of a non-supported request from a SI. ICD Note: It is indicated in the CrossedAndControlCluster by using the field <code>nonSupportedFeature</code> .
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List

4.2.1.4 Flight Object Stabilization

Once a new FO is distributed, all SIs receive it and evaluate it. If needed, they are going to request updates in the FO to adapt it to their local view. Without a given priority, various FDC could make a request on FOs that are not stable, that is, they are yet being processed by upstream systems.

This topic should be further studied and formalised later during the standardization process in order to secure an ECAC wide industrialisation and deployment of the IOP solution.

4.2.1.5 ICD Versioning Strategy

4.2.1.5.1 Introduction

In order for the FO-IOP to evolve, allowing the addition of new functionalities, services, by correcting issues, it is necessary to put in place a mechanism to make possible the upgrade of the IOP systems with new version of the Flight Object and new version of the set of services used to handle the Flight Object.

This requires the definition of an ICD versioning strategy. This strategy should allow the following:

- FO-IOP update with new functions/services. New elements can be optional and not required by all.
- FO-IOP update with new elements, new clusters in the FO.
- FO-IOP update due to bug fixing.
- FO-IOP roll-back to previous version due to un-expected issues discovered after migration to new version.
- Support the update of ATC system with no impact on FO-IOP.

This strategy will require technical means to support the migration and will also require a well define and agreed workflow prior to the migration itself in order to guarantee the following:

- All changes going into a new version need to be agreed by all IOP partners.
- Detailed definition of the changes available and agreed.
- Development of the common ICD.
- Development of each IOP Partner's platform according to the agreed changes.
- Test-bed (where exists) to be adapted (validation, certification tool).
- ED133 standard updated if needed.
- Successful factory test executed.
- Successful live trial where necessary.
- Certification/Validation.
- Planning of the Migration phases.
- An agreed roadmap/planning needs to be put in place for the above mentioned elements.

Note that the description of this workflow is not in the scope of this document, only the technical means will be described.

4.2.1.5.2 FO-IOP Versioning policy.

The versioning of the FO payload will allow identifying changes at different levels. The following levels are defined:

- Major (X.y.z): A Major version introduces major conceptual changes for which compatibility with previous version cannot be guarantee.
- Minor (x.Y.z): A Minor version introduces new model elements and capabilities for which compatibility with previous version is guarantee with possible loss of data/functionalities during the migration period (e.g. some new elements not usable before all UNITS are migrated).
- Patch (x.y.Z): A Patch version is limited to bug fixing. It does not introduce new elements or capabilities. The compatibility with previous version is guaranteed with no loss of data/functionalities.

One FO-IOP version number will be allocated to the FO data and Services model. FO Data model and FO Services will always be released together within one version of the FO-IOP.

4.2.1.5.2.1 FO Data Model Version Identification.

FO ICD payload will start with a structure identifying the FO and Clusters version. There are currently two proposals that needs to be further analysed.

1. Add a new cluster named “Version”, always present, and always at the beginning of the payload and only containing the version number.
2. Add the version number at beginning of the Flight Identification cluster which is already present. With this option; the Flight Identification cluster is always the first one in the payload.

The version number will be made of the following three fields:

```
MajorFOVersion: positive
MinorFOVersion: positive
PatchFOVersion: positive
```

4.2.1.5.2.2 FO Services Version Identification.

FORequest payload has a version number as first element.

4.2.1.5.3 Version compatibility.

The below text does not apply to Major version, as by definition a version is set as Major if compatibility with previous version cannot be guarantee.

Notation: In the below text the FO-IOP version “n” identifies current version of FO data model and services (X.Y.Z) and FO-IOP version n+1 identifies the new version of FO Data model and services (A.B.C). The difference between n and n+1 can be at any of three levels, Major, Minor or Patch, explanation below describes the situation for each level.

When a new Minor or Patch version of the FO-IOP is agreed to be deployed the compatibility between the currently operational version and the new version to be deployed has to be guaranteed.

When a new Minor or Patch FO-IOP version (n+1) is ready for deployment, the conversion from n to n+1 and from n+1 to n has to be agreed and published together with the new version.

These conversion functions has to be implemented in the new version of each system to ensure that newly deployed systems are all able to read and understand in the same way previous and new version of data exchanges and are able to write(send) both versions of data exchange.

Introduction of new elements and new services as well as the deprecation of elements or services or removal of them will be considered as Minor version.

Different kind of changes and impact on compatibility:

1. New element(s) in a cluster: If the compatibility can be defined in both directions then there is no restriction for the use of the new element(s) by the system being migrated to the new version. If the compatibility cannot be guaranteed in both directions, then some restrictions will be put in place during the migration period (see below).
2. Removal of an element in a cluster: If the element is not used by previous nor by new version of the software, then this element can be removed with no need of any conversion (e.g. element being used by an older version of the software and which is not used any more by none of the n and n+1 version, so can be clean-up). If still in use either a conversion function can be defined in both directions or not. If it can be defined then this conversion function will be implemented in the new version of the software and will be used to generate an old version data model during the migration period. If it cannot be defined, then the element will be kept in the new data model, but marked as deprecated (e.g. renaming the element or maintaining a list of deprecated elements). In this case it must be clearly defined what the new system version is doing with this deprecated element. A further Minor update of the model will allow removal of the deprecated elements.
3. New cluster: If a new cluster is added it is most probably to add new functionalities, and will most probably not be possible to create a mapping function between the n and n+1 version. In this case, the new cluster and related functionalities will not be possible during the migration period.
4. Removal of a Cluster: The same will apply than for the removal of an element of a cluster. It will most probably be necessary to do this changes in two steps and apply the deprecation logic.
5. Simple change of definition of an existing element: This is typically changes that may occur in a Patch version where the type of on element is modified or a typo in its mane is corrected. For this kind of changes a conversion in both directions has to be provided.

4.2.1.5.4 Migration for Minor and Patch versions

The migration mechanism will allow to deploy different partners at different moment. It would be much simpler if all partners system could be deployed at the exact same time and with an empty FO network, but this not at all realistic. The migration will also allow a roll-back in case of major issue discovered during the migration.

The migration itself can only start when all IOP partners have their new version of the IOP System ready for deployment. By ready it means fully tested, validated, approved, Note that the way the content of a new deployable version is agreed and coordinated as well as the way the new version of the



systems are validated/certified is not describe here. The goal of this chapter is to define the technical means to allow a smooth migration.

The migration from FO-IOP version n to version n+1 is divided in four phases (Only valid for minor or patch new version, so both versions have same Major version number):

1. **Deployment:** During an agreed time period, all IOP partners are deploying the new version of their software. The deployed new version systems are operated in downward compatible mode. They write using version n and are able to read version n and version n+1. If new services and/or clusters are introduced in the version n+1, they are not used yet (kind of restrictions applicable to Minor Version).
2. **Ramp-up:** When all IOP partners have deployed their new systems and during an agreed relatively short time period, the IOP partners will switch their systems to the normal mode disabling the downward compatible mode. They will start writing in new version, they will start using new clusters and services. All systems are able to read new version n+1.
3. **Stabilisation:** All systems are writing and reading in version n+1 but still able to roll-back to version n if need be.
4. **Nominal:** Support for previous version (downward compatible mode) can be removed from the systems. No roll-back possible any more.

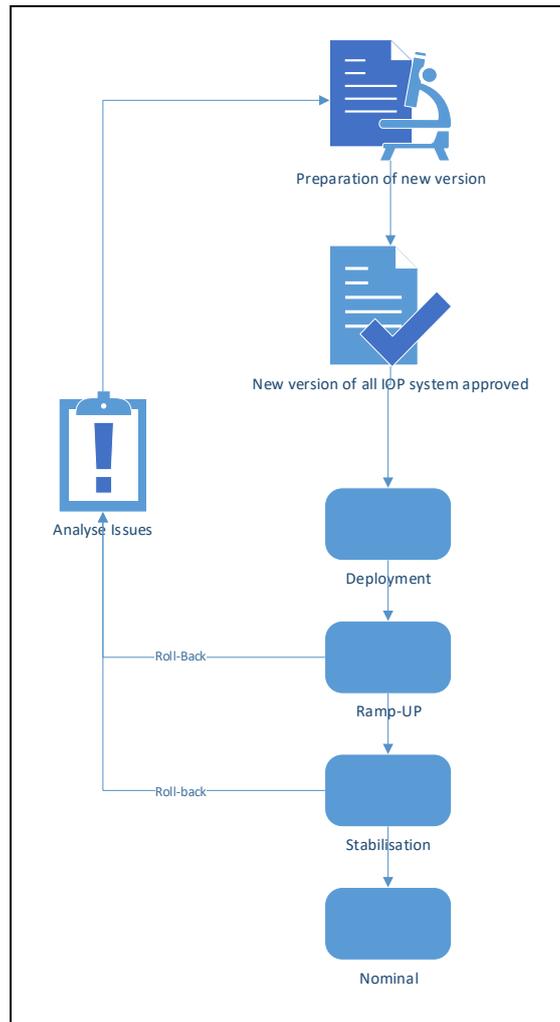


Figure 6: ICD Version Migration Work Flow

Note: In below table, in red what changes between 2 consecutive steps and underlined the version being in operation.

Phases	Sys1	Sys1	Sys2	Sys2	Sys3	Sys3	Description
	TX	RX	TX	RX	TX	RX	
Migration not started	<u>N</u>	<u>N</u>	<u>N</u>	<u>N</u>	<u>N</u>	<u>N</u>	All systems working with previous version;
Deployment	<u>N+1,N</u>	<u>N+1,N</u>	<u>N</u>	<u>N</u>	<u>N</u>	<u>N</u>	New Sys1 is deployed and ready to operate in version N+1, but still operate version N ("downward compatible mode")
	<u>N+1,N</u>	<u>N+1,N</u>	<u>N+1,N</u>	<u>N+1,N</u>	<u>N</u>	<u>N</u>	New Sys2 is deployed and ready to operate in version N+1, but still operate version N ("downward compatible mode")
	<u>N+1,N</u>	<u>N+1,N</u>	<u>N+1,N</u>	<u>N+1,N</u>	<u>N+1,N</u>	<u>N+1,N</u>	New Sys3 is deployed and ready to operate in version N+1, but still operate version N ("downward compatible mode")

Ramp-up	N+1,N N+1,N	N+1,N N+1,N	N+1,N N+1,N	N+1,N N+1,N	All systems ready to operate in version N+1, deployment is finished; the Ramp-up phase can start.
	N+1,N N+1,N	<u>N+1,N</u> <u>N+1,N</u>	N+1,N N+1,N	N+1,N N+1,N	One system (Sys2) starts transmitting version N+1 (FO update if FDMP or service request). It can receive N and N+1 messages. The backward compatible mode allows Sys1 and Sys3 to translate received N+1 msg into N message; and allows Sys2 to translate received N msg into N+1 message.
	N+1,N N+1,N	<u>N+1,N</u> <u>N+1,N</u>	<u>N+1,N</u> <u>N+1,N</u>	<u>N+1,N</u> <u>N+1,N</u>	Another system (Sys3) starts transmitting version N+1. Some systems (Sys2) can already receive N+1 messages. The backward compatible mode allows the other systems (Sys1) to translate received N+1 msg into N message.
Stabilisation	<u>N+1,N</u> <u>N+1,N</u>	<u>N+1,N</u> <u>N+1,N</u>	<u>N+1,N</u> <u>N+1,N</u>	<u>N+1,N</u> <u>N+1,N</u>	All systems are transmitting in version N+1 and are ready to roll back to version N in case of need
Nominal	<u>N+1</u> <u>N+1</u>	<u>N+1</u> <u>N+1</u>	<u>N+1</u> <u>N+1</u>	<u>N+1</u> <u>N+1</u>	Support for version N stops. Roll back not possible any more.

Table 13 ICD Version Migration Steps

4.2.2 What-if Flight Object (WIFO) Management

What-if flight objects (WIFO) are alternative versions of FOs that are built within the IOP SIs to achieve different operational purposes (negotiations, probes, etc.).

The purpose of the WIFO is identified by the WIFO kind that is defined at creation. The following kinds of WIFOs are currently identified:

- **Negotiation WIFO:** It is a WIFO that is created to support an electronic negotiation between different SIs. During the negotiation, the response may also come automatically from the system without having human intervention as per the local rules.
- **Probe WIFO:** It is a WIFO that is created to evaluate the impact of a FO modification in another SI(s).
- **Consultation WIFO:** It is a WIFO that is created to ask actors (ATCOs, FMPs, systems,..) an opinion about a proposed change, but without any commitment considering its actual implementation. The consultation functionality has not yet been defined and therefore this kind of WIFO is not in the scope of this specification.

Section 4.2.2.1 describes the general characteristics applicable to any WIFO whereas section 4.2.2.2 describes the particularities applied to the negotiation-type WIFOs only.

[REQ]

Identifier	REQ-18-02b-TS-WIFO.0001
Title	WIFO Support (WIMP)
Requirement	A SI shall create a WIFO to support electronic negotiation on a particular flight with other IOP Stakeholders.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement identifies the negotiation type WIFO as the means for an SI to negotiate FO changes with other IOP stakeholders.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0087
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0039
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0071
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0176
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0177
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0178
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0179
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0180
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0181
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Create and Distribute WIFO

4.2.2.1 WIFO General Requirements

4.2.2.1.1 WIFO Creation and Role Assignment

Similarly to FOs, the SIs that share WIFOs are given roles regarding that WIFO. These roles will determine the mechanism that is to be followed to update the WIFO. WIFOs are handled as FOs, the writing rights are determined by the role of a SI regarding that WIFO. The following roles are defined:

- **What-if Manager/Publisher (WIMP):** The WIMP is the SI that creates the WIFO, it is the only one that is capable of updating and distributing the WIFO. This role is static through the WIFO lifetime. The WIMP can either be an FDMP, FDC or FDU.
- **What-if Contributor (WIC):** WICs are the SIs that receive the WIFO. The mechanism does not prevent defining several WICs. Its number depends on the functionality that is going to be supported by that WIFO, i.e., negotiation, probe or consultation. The WIC can either be an FDMP, FDC or FDU.

The WIFO technical concept does not limit the number of stakeholders involved in a negotiation. In this specification, negotiations are restricted to two IOP SIs only, one being WIMP and the other WIC. Thus, this version of the standard only addresses the case of one WIC only.

The WIMP of a WIFO behaves in the same way as the FDMP for a FO, i.e. it updates the WIFO and publishes it. The WIC behaves as a FDC, whenever it needs to update the WIFO it uses a set of services to request the WIMP the change.

[REQ]

Identifier	REQ-18-02b-TS-WIFO.0007
Title	WIMP role declaration at WIFO creation
Requirement	The SI that creates a WIFO shall identify itself as the WIMP of that WIFO.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement specifies which SI becomes the WIMP of a WIFO. ICD Note: The WIMP is indicated in the field fdmp in the IOP Information Cluster.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0119
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0087
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Create and Distribute WIFO

When the WIMP creates a WIFO, it decides which SIs are expected to receive that WIFO.

The selection of SIs depends on the WIFO kind (negotiation, probe or consultation). Any SI that is expected to receive the WIFO will be included as a WIC in the distribution list for that WIFO.

Only consulted WICs have to be notified for distributed WIFO. The reason for distributing the WIFO is set on 'subscribed' only. The reasons for distributing the FO related to that WIFO are not set in the WIFO distribution reason.

[REQ]

Identifier	REQ-18-02b-TS-WIFO.0016
Title	WIFO Distribution List Content (WIMP)
Requirement	When creating a WIFO, the WIMP shall include the identified WICs in the WIFO distribution list with the reason for distribution set to 'subscribed' only.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement specifies which distribution reason is allocated to the WIC in the WIFO Distribution List.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0119
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0088
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Create and Distribute WIFO

The WICs that receive the WIFO will react depending on the WIFO kind. For example, a WIC of a WIFO created for negotiation is allowed to accept, reject or make a counterproposal in the context of that negotiation.

Editor's note: In future versions of the standard a WIC of a WIFO created for probe may not need such capability (.Further information on WICs' reactions for negotiation WIFO can be found in the section 4.2.2.2.

WIFOs are given a unique identification in the same way than FOs. This identification is provided by using the FO unique identification plus an additional keyword that is called the What-if context.

In order to achieve the uniqueness of the What-If Context identifier in the IOP network, the SI that creates the WIFO builds the what-if Context identifier including its own SI identifier.

Several WIFOs, with different What-if Identifiers, can be created for the same FO. A system instance may define as many WIFOs as it needs for each FO as well as different SIs may create a different WIFO for the same FO.

There is no restriction (at technical level) on the number of WIFOs created for the same FO as long as they are clearly identified by a different What-if Context identifier. WIFO is a supporting tool, any restriction (when defined) is derived from the use of the WIFO itself. For example, it may be prevented to negotiate two different coordination updates between the same SIs for the same flight. It is a local decision to establish rules to prevent not supported usages; a WIFO that is received for a non-supported use may be automatically rejected.

[REQ]

Identifier	REQ-18-02b-TS-WIFO.0017
Title	WIFO unique identification (WIMP)
Requirement	Upon creation of a WIFO, the WIMP shall provide to the SWIM Technical Infrastructure an IOP wide unique identifier for the WIFO composed of the unique universal identifier for the associated FO and a unique What-If Context Identifier.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement ensures that the WIFO are unambiguously identified with the IOP network. ICD Note: In the FO, the What-If Context Identifier is stored in the FlightIdentificationCluster.foUniqueIdentification.whatIfContext.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0087
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Create and Distribute WIFO

The WIMP that creates a WIFO has to indicate in the WIFO the reason for its creation. This indication determines the WIFO life cycle itself.

[REQ]

Identifier	REQ-18-02b-TS-WIFO.0041
Title	Stating WIFO purpose as negotiation
Requirement	When creating a WIFO to start a negotiation, the WIMP shall set the WIFO type to “negotiation”.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement ensures that the type of WIFO is indicated in the WIFO. The WIFO handling will be different according to the purpose that has triggered its creation. ICD Note: The type of WIFO is indicated in WifoData (type).
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0087
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Create and Distribute WIFO

The WIMP must create the WIFO from an existing FO and compute the exact same content as what it would have computed for the associated real FO, with the exception of the following fields:

- In the Flight Identification Cluster: the What-if context (identifying the WIFO),
- In the IOP Information Cluster: the WIFO data (identifying the negotiated data, e.g. the transition data),
- In the Crossed and controlled Sequence Cluster: the distribution list (identifying the WICs).

4.2.2.1.2 Non-support of WIFO capability (full or partial)

The WIFO capability is an optional IOP functionality. Some SIs can legitimately operate IOP without implementing the WIMP/WIC functionality at all (“full non-support”) or implementing it but only for some of the types of negotiated data specified in this standard (“partial non-support”).

The following requirements describe the behaviour of those SIs.

Full non-support

When an SI that that does not implement the WIFO mechanism receives a WIFO, it uses the WIFO reject mechanism to indicate its incapability to process the WIFO with a special reject reason (NON_SUPPORTED_NEGOTIATION).

[REQ]

Identifier	REQ-18-02b-TS-WIFO.0054
Title	Reject in case of WIFO not supported
Requirement	When an SI not implementing the WIFO functionality receives a negotiation from a WIMP, it shall reject the proposed change indicating that it does not support the negotiation function.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement states the minimum action to be implemented for SI not supporting negotiation. ICD note: This action is performed by using the REJECTED result with value NON_SUPPORTED_NEGOTIATION as closure reason in the srv_wifo_response.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0204
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0088
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0219
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0220
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject

<ALLOCATED_TO>	<Function>	Read WIFO
----------------	------------	-----------

When the WIMP receives from an SI the indication that it does not support the WIFO capability, it will stop sending any WIFO to that particular SI. This allows a SI declaring that it does not support WIFO to not receive later on WIFO updates.

[REQ]

Identifier	REQ-18-02b-TS-WIFO.0056
Title	Stopping WIFO publication to SI not supporting negotiation
Requirement	When a WIMP has initiated a negotiation and the WIC has rejected it because it does not support the WIFO functionality, the WIMP shall stop sending updates of the WIFO to that WIC.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement aims at preventing the WIMP to send again the WIFO with status REJECTED to a WIC that has previously rejected the WIFO for reason NON_SUPPORTED_NEGOTIATION.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0204
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0088
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0220
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Create and Distribute WIFO

Partial non-support

When a SI receives a negotiation-type WIFO but it does not support the negotiation of the particular data identified in the WIFO, it uses the WIFO reject mechanism to indicate its incapability to negotiate that type of data.

[REQ]

Identifier	REQ-18-02b-TS-WIFO.0055
Title	Reject in case of negotiation type not supported
Requirement	When an SI implementing the WIFO functionality receives a negotiation from a WIMP about at least one type of data that it cannot negotiate, it shall reject the negotiation indicating that it does not support this type of negotiation.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement states the fall-back action of a WIC receiving a negotiation request for a type of data it is unable to negotiate (e.g. TFL or DIRECT). The type of data is not explicitly indicated in the response. The types of negotiation in place between two adjacent SIs are defined in the LoA. ICD note. This action is performed by using the REJECTED result with value NON_SUPPORTED_NEGOTIATION_TYPE as closure reason in the srv_wifo_response.

Category	<Interoperability>	
[REQ Trace]		
Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0204
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage WIFO

4.2.2.2 Negotiation-type WIFO in negotiation between two SIs Requirements

When a WIFO is created for negotiation between different SIs, it is expected to support some specific interactions between the WIMP and the WIC in order to control such functionality.

In general, the negotiation process implemented by using WIFOs should allow:

- the WIMP to start a negotiation by sending a proposal,
- the WIMP to identify the SIs to be involved in this negotiation,
- the WIMP to identify the items that are to be negotiated in the proposal,
- the consulted SI(s) to accept or reject the proposal,
- the consulted SI(s) to send a counter-proposal,
- The WIMP to accept or reject a counter-proposal.
- The WIMP to end the negotiation process and share its result among the consulted SIs

These actions are described in details in the following sections.

4.2.2.2.1 Negotiation-type WIFO Status

When the WIFO is created for a negotiation, the following statuses are available:

- *Proposed*: The WIFO contains a proposal for negotiation. This is the initial status in which the WIFO for negotiation is created. This status is kept while the negotiation is still on-going.
- *Accepted*: The proposal within the WIFO has been accepted (by either WIMP or WIC) and it is expected to be implemented in the FO.
- *Rejected*: The proposal within the WIFO has been rejected (by either WIMP or WIC).
- *Counter-Proposed*: The proposal within the WIFO has been counter-proposed (by WIC) and it is expected to be assessed by the WIMP. This is a status for which no WIC response is expected.
- *Cancelled*: The proposal within the WIFO is no longer applicable. The WIMP has cancelled it before the WIC provides an acceptance / rejection or counter-proposal.
- *Time-out*: The proposal within the WIFO has expired. There was no acceptance / rejection (or counter proposal) received within SP-IOP-WIFO_Acceptance_Time.

“Accepted”, “Rejected”, “Cancelled” and “Time-out” are final status, i.e. after the publication of a WIFO in one of these statuses, the WIFO is going to be deleted.

The status flow for a WIFO is illustrated in Figure 8. It identifies the WIFO statuses, the conditions for transitioning from one state to another and identifies the TS requirements associated with the transitions.

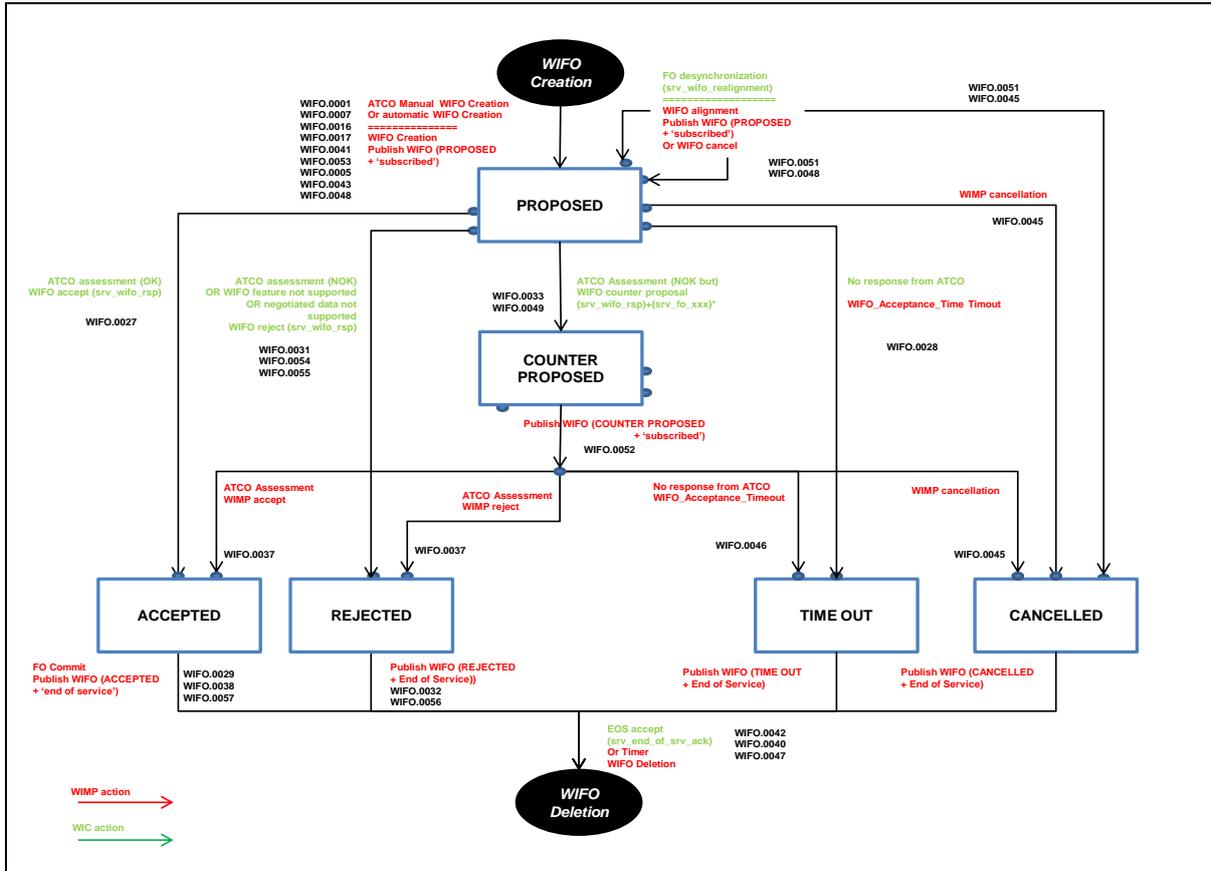


Figure 8: "Negotiation" WIFO Status Flow

4.2.2.2 Negotiated Data Identification

WIFOs are built as any other FO, they are alternative versions of a FO. Whenever they are intended as support of a negotiation process, the WIFO contains the information to be negotiated as well as any other data structure that is affected as a consequence of the proposal. These consequences are computed according to the local processing of the SI that makes the proposal and they may or may not be accurate from other SI's point of view. Therefore, it is needed to differentiate in a WIFO the information that is being negotiated from the remaining information published within the WIFO.

The negotiated data updates in the WIFO define the negotiation flows and this is the information that is subject of the agreement. The use of the consequences computed by the system that makes the proposal and shared together with the negotiation data is considered a local topic and therefore out of the scope of this specification.

The information that is to be negotiated should be identified at any time. From technical point of view, WIFOs are designed to allow the negotiation of any information in the FO.

Negotiations are defined in different contexts such as coordination data at a boundary between two SIs or release conditions in a skipped SI or a route change or any other information. Notice that available electronic negotiations may be defined in LoAs between each pair of IOP SIs. It is not required for every IOP partner to support any negotiation kind defined in any other IOP SI. It is a local decision to reject a non-obligatory proposed electronic negotiation that is not supported by the local SI.

[REQ]

Identifier	REQ-18-02b-TS-WIFO.0005
Title	WIFO Negotiation Data Identifying
Requirement	The WIMP shall indicate in the WIFO the type of data to be negotiated.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed in order to easily identify proposed changes inside the WIFO. There can be one or more negotiable data in a WIFO. The data that two partners can negotiate is defined in LoAs between the partners, not all the negotiable data will be obligatory for all. Refer to the traced INTEROP requirements for the list of negotiable data. ICD Note: The type of data to be negotiated is indicated in WifoData (negotiatedDataList). The data that is being negotiated is defined directly in the coordination cluster.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0176
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0177
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0178
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0179
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0180
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0181
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0119
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0082
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Create and Distribute WIFO
<ALLOCATED_TO>	<Function>	Update and Distribute WIFO

[REQ]

Identifier	REQ-18-02b-TS-COTR.0160
Title	C&T Modified Data Urgent Application
Requirement	A receiving SI requesting the modification of a C&T Direct, Heading or Speed that requires its transferring SI to clear as soon as possible the aircraft to the new agreed C&T value shall set the flag associated with the modified data to the value 'UrgentNegotiatedDataApplicationFlag'.
Status	<In Progress>
Maturity Level	TRL4
Rationale	In some cases, the modified C&T Direct, Heading or Speed is needed to be instructed to the aircraft as soon as possible. This flag is used by the transferring SI to highlight this situation. This flag is not reset.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a

<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage WIFO

Example of Negotiation Data Identification Mechanism

The additional information included in a WIFO created for negotiation includes the negotiated data.

Negotiated data are provided in structures of the data model that allows a unique identification of the WIFO attribute that is expected to be negotiated.

Let's suppose the following case: two IOP SIs A & B negotiate a TFL update in their boundary. A is the FDMP and is controlling the flight. B (FDC) wants to propose a new TFL to A.

- A (FDMP) publishes a FO1 with TFL1.
- B (WIMP) creates WIFO1 for FO1 to propose an update to TFL2. WIFO1 contains the following:
 - An alternative FO1 that implements TFL2 at the boundary between A & B. That is, a complete alternative is computed, including the consequences known by the WIMP (B) when creating the proposal, i.e. any modified data in the WIFO as a consequence of applying TFL 2 is published.
 - The WIFO additional data structure that identifies the negotiated information for TFL is enough to:
 - identify the involved Transition (transferring_SI, receiving_SI),
 - Identify the coordination data under negotiation (TFL)
- A (WIC) looks for the proposed value in the WIFO coordination data as indicated by the negotiated information structure.

The negotiated data structures are extensible and can be defined for different kind of negotiations between pair of stakeholders without forcing other systems to support it. The negotiation structures that are to be commonly specified are driven by the requirements defined in other IOP features (Coordination or Crossed and Control Sequence Management etc.).

In this version of the specification, data under negotiation are Transition data (TFL, SFL or DIRECT).

4.2.2.2.3 WIFO Proposal and Distribution

There is no technical limit to the number of negotiations between SIs that a FO is involved into or to the number of negotiations that a SI may be handling on the same FO. Any limitation, whenever exist, depends on the logic of those negotiations and it may be defined locally.

WIFOs as described above have a unique identifier composed by the FO identifier plus a What-if context. The WIMP may create as many WIFOs it needs to negotiate changes, make probes, etc. as long as they are kept unique. It is the WIMP responsibility to prevent the creation of two WIFOs for the same FOs with the same What-if Context.

Upon creation of the WIFO, its distribution list is populated only with the SIs identified as WIC. In the case of WIFOs created for negotiation, these WICs will be the consulted ones determined by the WIMP.

[REQ]

Identifier	REQ-18-02b-TS-WIFO.0043
Title	WIFO initial status
Requirement	The WIMP creating a negotiation-type WIFO shall set the WIFO status to

	"Proposed".
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement states the original status of a newly created WIFO. ICD note: The status of the WIFO is stored in the FO field: "IOPIInformationCluster.wifoData.type".
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0087
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Create and Distribute WIFO

4.2.2.2.4 WIFO Acceptance

The WIFO distributed by the WIMP is notified to the consulted WIC(s) which can accept the proposed changes.

[REQ]

Identifier	REQ-18-02b-TS-WIFO.0027
Title	WIFO Acceptance (WIC)
Requirement	When receiving a negotiation-type WIFO with status "proposed" and it accepts the proposal, a WIC shall inform the WIMP when it accepts the proposed changes.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement specifies the WIC actions to accept a WIFO. ICD Note: the service used to accept the WIFO is "srv_wifo_response".
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0214
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0204
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage WIFO

When the WIMP receives the acceptance from the WIC, the WIMP is expected to publish this acceptance in the WIFO.

[REQ]

Identifier	REQ-18-02b-TS-WIFO.0029
Title	WIFO acceptance (WIMP)
Requirement	When receiving a positive response from the WIC within SP-IOP-WIFO_Acceptance_Time since the last update of the negotiated items, the WIMP shall publish a WIFO update with the WIFO status set to "accepted".

Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement describes the condition for a WIFO to transit from the “proposed” status to the “accepted” status.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0098
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage WIFO

4.2.2.2.5 WIFO Commit

When the WIMP receives the acceptance for a distributed WIFO, the accepted negotiation will be updated in the FO. The WIMP use the nominal mechanism to communicate an update to the FO depending on its current role (FDMP / FDC).

Once the WIFO is published with accepted status the WIMP is expected to implement automatically the agreed negotiated values in the FO. The mechanism to implement the agreements in the FO will be the applicable one according to the role of the WIMP regarding the FO.

[REQ]

Identifier	REQ-18-02b-TS-WIFO.0038
Title	WIFO Commit
Requirement	<p>When the WIFO status is accepted, the WIMP shall:</p> <ul style="list-style-type: none"> • update the FO to apply the accepted changes, • indicate in the FO that they have been agreed in a negotiation, • identify the negotiation in which the agreement has been reached.
Status	<Validated>
Maturity Level	TRL6
Rationale	<p>Once agreed the WIFO proposal, the tagged changes have to be reported in the FO by FDMP, as for verbally agreed request.</p> <p>ICD Note: For C&T the update reached in a negotiation agreement will be tagged in the “agreement” field of the ActiveCoordination class.</p>
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0098
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0214
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage WIFO

4.2.2.2.6 WIFO Rejection

The WIFO distributed by the WIMP is notified to the consulted WIC(s) who can reject the proposed changes.

[REQ]

Identifier	REQ-18-02b-TS-WIFO.0031
Title	WIFO Rejection (WIC)
Requirement	When receiving a negotiation-type WIFO with status “proposed” and it cannot accept the proposal, a WIC shall inform the WIMP that it rejects the proposed changes indicating the reason for the rejection.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement specifies the WIC actions to reject a WIFO. ICD Note: the service used to reject the WIFO is “srv_wifo_response”.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0214
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0204
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage WIFO

When a SI (WIMP or WIC) needs to indicate the reason to close or reject a negotiation, apart from a field for free text, it can use one of the following values:

- **Rejected:** The negotiation has been rejected by an ATCO (human decision) or automatically by the system.
- **Outdated:** The negotiation has been rejected because there negotiation is not aligned with the last available information.
- **Not Supported Negotiation and Not Supported Negotiation Type:** The negotiation has been rejected because the WIC does not support the negotiation capability or the type of negotiation (see details in section 4.2.2.1.2).

When the WIMP receives a rejection to its proposal, it ends the negotiation by publishing a last update of the WIFO with this result. This last publication is not performed in case the WIC indicated that it was not supporting the negotiation capability.

[REQ]

Identifier	REQ-18-02b-TS-WIFO.0032
Title	WIFO rejection processing (WIMP)
Requirement	When receiving a negative response from the WIC within SP-IOP-WIFO_Acceptance_Time since the last update of the negotiated items, and the rejection is not due to the non-support of the WIFO capability, the WIMP shall publish a WIFO update with the WIFO status set to “rejected”.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement describes the conditions for a WIFO to transit from the “proposed” status to the “rejected” status.

	In case the SI has rejected the WIFO because it does not support the WIFO capability, this requirement does not apply to avoid sending again the WIFO to the SI (see REQ-18-02b-TS-WIFO.0056 in section 4.2.2.1.2). ICD Note: WIFO reject reason may be provided through service request and shared via WIFO update by the WIMP.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0090
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0214
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage WIFO

4.2.2.2.7 Request WIFO update from the WIC

WIFOs are handled as normal FOs so there may be updates triggered by other reasons than to modify the negotiated items.

WIFOs may be updated by the WICs by using the same services available to update a FO. When the WIFO is created for negotiation, this update may be generated for different reasons:

- **WIFO alignment:** update the WIFO with the local consequences of the proposal at the WIC.
- **Counter proposal:** update the WIFO to provide a new proposal (counter-proposal) to the WIMP on the same flight.
- **WIFO Alignment with FO:** Update the WIFO with the last available FO version.

The WIFO alignment update is considered a local decision of the WIC. It uses the same services that are used in the FO. Notice that a WIFO alignment update cannot be used if it modifies any of the items under negotiation.

Example:

- SI A (WIMP) creates a WIFO to negotiate a new TFL with SI B (WIC).
- SI B processes the new TFL and as a result of the new TFL it identifies a new set of constraints that are to be applied in its AoR in addition to the proposed TFL with A.
- SI B (WIC) uses :
 - the `srv_wifo_response` (“accepted”) service to notify the WIMP about the WIC acceptance of the proposal, and
 - the IOP services (originally defined to update a FO) in order to update the WIFO with the new set of constraints (`srv_modify_constraints` service).
- SI A updates the WIFO with the new constraints provided by B and publishes a new version of the WIFO.

The main characteristic of this alignment update are the following:

- The specific WIFO data structures are not modified along any alignment updates.

- The values being negotiated are not modified from the original proposal.
- The service implementation on a WIFO is the same than in a FO.

A counterproposal update follows the same rules than in a WIFO alignment update but in addition it has to update the items under negotiation. A new service is to be provided in order to modify the WIFO structures determining the items under negotiation.

Example:

- SI A (WIMP) creates a WIFO to negotiate a new TFL with SI B (WIC).
- SI B (WIC) counter proposes a different TFL by using:
 - the `srv_wifo_response` (“counter-proposal”) service to :
 - notify the WIMP about the WIC counter-proposal,
 - identify the Negotiated Data (TFL). In this case, this value does not change since the proposal does not modify the category of the information that is being negotiated.
 - The `srv_set_downstream_coordination_information_at_entry` service to update the TFL value at B entry (Counterproposal).
 - The `srv_modify_constraints` to include the new TFL constraint at the entry.
- SI A (WIMP) updates the WIFO with the new constraints, coordination value and updated WIFO data provided by B and publishes a new version of the WIFO indicating the last proposal origin set to the WIC identifier.

4.2.2.2.7.1 WIFO Counter-Proposal

On reception of a WIFO, the WIC may provide counter-proposals to the WIMP.

A counter-proposal is an alternative proposal to the data proposed by the WIMP. The counter-proposal is provided by the WIC as a request to update the WIFO. The WIFO is then distributed by the WIMP with that counter-proposal.

The counter proposal is to be accepted or rejected by the WIMP. Note that the WIC may request WIFO updates that are only intended to communicate the impact of the WIMP proposal in the local system. In order to consider a WIFO update request as a counter proposal, such update should identify the new set of WIFO items that are under negotiation.

[REQ]

Identifier	REQ-18-02b-TS-WIFO.0033
Title	WIFO counter proposal - identify negotiated data (WIC)
Requirement	When receiving a negotiation-type WIFO with status “proposed”, if the WIC makes a counter-proposal, it shall indicate in the counter-proposal the set of data to be negotiated.
Status	<Validated>
Maturity Level	TRL6
Rationale	Note: This change is called counter-proposal. Negotiated data have to be agreed among WIMP and consulted WICs. ICD Note: The counter proposal is notified by the use of the “ <code>srv_wifo_response</code> ” service identifying the set of data under negotiation

	together with service(s) proposing the actual changes (e.g. <code>srv_set_coordination_at_entry()</code>).
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0205
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage WIFO

Note that counter-proposals on WIFOs are expected to be handled as any other FO update from a contributor. Nevertheless, as in the case of a WIFO distribution, the counter-proposal should allow to identify which are the items under negotiation in that proposal. The mechanism used by the WIC to make a counter-proposal consists of a request to modify the WIFO in which the same services used to update a FO are used plus an additional service to modify the WIFO specific data.

Upon reception of a counter-proposal, the WIMP is expected to send a final update of the WIFO containing an acceptance or rejection of that counter-proposal in order to consider the negotiation to be completed.

Note that the items under negotiation may have been updated in the counter-proposal but in this case the WIMP is still not able to change them by sending a new proposal. They are to be updated or rejected by publishing a new update with accepted / rejected status.

[REQ]

Identifier	REQ-18-02b-TS-WIFO.0049
Title	WIFO Counter-proposal (WIC)
Requirement	A WIC shall inform the WIMP when it proposes a counter-proposal to the proposed changes received in a WIFO for negotiation.
Status	<Validated>
Maturity Level	TRL6
Rationale	Any proposed WIFO can be counter-proposed by the WIC(s). ICD Note: Service to answer the WIMP from the WIC: “ <code>srv_wifo_response</code> ”.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0205
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage WIFO

[REQ]

Identifier	REQ-18-02b-TS-WIFO.0052
Title	WIFO update when counter-proposal (WIMP)
Requirement	When receiving a counter-proposal response from the WIC within <code>SP-IOP-WIFO_Acceptance_Time</code> since last update of the negotiated items, the

	WIMP shall publish a WIFO update with: <ul style="list-style-type: none"> the WIFO status set to “counter-proposed”, and the identifier of the WIC as new origin of the proposal.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is intended to allow identifying at any time if a WIFO is currently being used as a proposal or as a counter-proposal. Therefore, there is no ambiguity regarding the SIs that is expected to accept/reject the proposal. In the ICD the last proposal origin is the identifier of the last SI that updated the set of negotiated data. It will be the WIMP in the case of a proposal or the WIC in a counter proposal.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0214
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute WIFO

[REQ]

Identifier	REQ-18-02b-TS-WIFO.0037
Title	WIFO Counter-proposal answer (WIMP)
Requirement	The WIMP shall notify its rejection or acceptance to a counter-proposal by publishing a WIFO update with the WIFO status set to “rejected” or “accepted”.
Status	<Validated>
Maturity Level	TRL6
Rationale	The counter-proposal is to be accepted or rejected. But no further update/change of the negotiation items is allowed without starting a new dialogue. ICD Note: The status of the WIFO is indicated in WifoData (status).
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0214
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0205
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFlightObjectControl
<ALLOCATED_TO>	<Function>	Manage WIFO

4.2.2.2.7.2 WIFO Alignment with FO

The WIFO alignment with FO updates is a decision of the SIs involved in the negotiation (WIMP or WICs).

Since WIFOs are handled as FOs, there is nothing that prevents the WIMP to send updates to the WIC according to its own needs. If the WIMP wants to change its proposal (e.g.: because of FO modification / context update), the WIMP is forced to cancel that WIFO and if needed, start a new negotiation by creating another WIFO (See WIFO Cancellation section). Therefore any WIFO update from the WIMP that does not imply a WIFO status update (accepted, rejected, cancelled or time out) is considered an alignment of the WIFO with the FO.

When the receiver of a negotiation considers it appropriate, it may request the alignment of the context of the negotiation with the last FO version.

[REQ]

Identifier	REQ-18-02b-TS-WIFO.0051
Title	WIFO realignment management
Requirement	Upon reception of a WIFO realignment request from a WIC, the WIMP shall either; <ul style="list-style-type: none"> publish a realigned WIFO, or cancel the negotiation.
Status	<In Progress>
Maturity Level	TRL4
Rationale	This requirement is needed to define the WIMP behaviour upon WIFO realignment request.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0215
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0203
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage WIFO

The WIMP is responsible to indicate to which FO version the WIFO is aligned with.

[REQ]

Identifier	REQ-18-02b-TS-WIFO.0048
Title	WIFO synchronized with FO
Requirement	The WIMP shall indicate in the WIFO with which version of the FO the WIFO is aligned.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to allow the entities involved in a negotiation to know with which FO version the negotiation is aligned with. ICD Note: The associated FO version is indicated in WifoData (syncWithFo).
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b

<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0215
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute WIFO
<ALLOCATED_TO>	<Function>	Create and Distribute WIFO

4.2.2.2.7.3 WIFO Stabilization

The WIMP that creates a WIFO for negotiation provides the negotiated data as well as the result of the computed impact of its proposal in the WIFO.

The WIC that receives a proposal will be able to evaluate locally the actual impact of the proposal, as a result of the local evaluation it may identify additional changes that would modify the WIFO in addition to what has been computed by the WIMP.

As long as the negotiated values themselves are not modified, it is a local decision in the WIC to request the WIFO update or not to reflect those changes. Whenever the changes are provided, the WIMP will implement them in the WIFO (as with any other FO) and distribute them to the WIC.

4.2.2.2.8 WIFO Cancellation

The WIFO cancellation is the mechanism that allows a WIMP to terminate an ongoing negotiation. The reasons for terminating a negotiation by the WIMP are defined locally.

Following are examples of cases that may trigger this cancellation:

- the FO the WIFO is linked to, evolves in a way that the negotiated data is not applicable any more, or
- the ATCO that triggered the negotiation decides to cancel it manually.

Whenever the WIMP would wish to change the negotiation data, it should cancel the current WIFO and create a new one.

Note that WIFO cancellation is being defined as the mechanism for the WIMP to terminate a negotiation before it receives an answer to its proposal. This cancellation mechanism is not available for the WIC which is only able to terminate it by accepting or rejecting the proposal.

The WIMP can decide to manually cancel a WIFO due to negotiated data obsolescence or not valid conditions. From IOP technical point of view, the ATCO manual cancellation or SI automatic cancellation have the same effects.

Note that the WIFO cancellation by the WIMP is a local decision, there are no requirements forcing the WIMP to cancel a WIFO on concrete events.

[REQ]

Identifier	REQ-18-02b-TS-WIFO.0045
Title	WIFO Cancellation
Requirement	To cancel an on-going negotiation (the WIFO status is 'proposed' or 'counter proposed'), the WIMP shall publish a WIFO update with the WIFO status set to "cancelled".
Status	<In Progress>

Maturity Level	TRL4
Rationale	This requirement specifies the WIMP actions to cancel a WIFO. A negotiation can be cancelled only when still on-going, i.e. the WIFO must be in status “proposed” or “counter-proposed”. ICD Note: The status of the WIFO is indicated in WifoData (status).
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0090
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0203
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute WIFO

4.2.2.2.9 WIFO Expiration

Once the proposal or the counter-proposal is sent (WIFO published to the WIC), both SIs are given a time to react to the proposal. This timer is referred as ST-IOP-WIFO_Acceptance_Time.

The SP-IOP-WIFO_Acceptance_Time is defined as the time allowed to react to the consulted SI in a negotiation after a modification of the negotiated items. The value of this timer is locally defined.

A negotiation-type WIFO is considered as expired in two cases:

- If no answer is provided by a consulted WIC on a distributed proposal within the WIFO Acceptance Time, and
- If the WIMP does not accept or reject the WIC counter-proposal before the WIFO Acceptance Time.

In both cases, the WIMP publishes a new WIFO update with status “time-out”.

[REQ]

Identifier	REQ-18-02b-TS-WIFO.0028
Title	WIFO Timeout
Requirement	When the WIMP does not receive an acceptance, rejection or a counter-proposal to a negotiation WIFO within SP-IOP-WIFO_Acceptance_Time, it shall publish a WIFO update with the WIFO status set to “time-out”.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement requires the WIMP to monitor the response from the WIC and act in case of no response is received. Note that the SP-IOP-WIFO_Acceptance_Time is referred to a WIFO update of the items under negotiation. ICD Note: The status of the WIFO is indicated in WifoData (status).
Category	<Interoperability><safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management

<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0214
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute WIFO

[REQ]

Identifier	REQ-18-02b-TS-WIFO.0046
Title	WIFO Counter-proposal answer time-out
Requirement	If the WIMP does not answer to a WIC's counter-proposal before SP-IOP-WIFO_acceptance_time, it shall end the current negotiation by publishing a WIFO update with the WIFO status set to "time-out".
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement requires the WIMP to monitor the local response from a WIC counter-proposal and act in case of no response is received. It is needed to establish a time to answer back a counter-proposal before considering the dialogue terminated. ICD Note: The status of the WIFO is indicated in WifoData (status).
Category	<Interoperability><safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0090
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage WIFO

4.2.2.2.10 WIFO Deletion

The conditions for deleting a WIFO depend on the reason for which it was created. This section only addresses the deletion of negotiation-type WIFOs.

The WIFO is deleted by the WIMP once the negotiation is over, i.e.

- when the negotiation has been completed (accepted or rejected, including or not a counter proposal) and all involved WICs have explicitly indicated they have been informed about the result of the negotiation, or
- upon timeout when the WIMP does not receive any acceptance / rejection or counter-proposal.

The negotiation is considered completed when the WIFO status has reached one of the final statuses ("accepted", "rejected", "cancelled" or "timeout").

The indication that a WIC has been informed of that completion is performed using the basic FO 'end of service' mechanism. For that purpose, when the WIMP publishes the WIFO with one of the final statuses, it set the distribution reason for all WICs to 'end of service'. The WICs are expected to acknowledge the end of distribution. Once all WICs have acknowledged the end of the negotiation, the WIMP performs the actual deletion of the WIFO from the network. In case a WIC takes too much time to acknowledge and does not acknowledge at all, the WIMP deletes unilaterally the WIFO from the network.

[REQ]

Identifier	REQ-18-02b-TS-WIFO.0058
Title	WIFO Deletion Request (WIMP)
Requirement	<p>When publishing a negotiation-type WIFO with one of the final statuses (“accepted”, “cancelled”, “rejected” or “time-out”), the WIMP shall start the WIFO deletion phase by:</p> <ul style="list-style-type: none"> • setting the distribution reason of all the WIC to ‘end_of_service’, and • monitoring the reception of the end of service acknowledgement from the WIC by setting a locally defined timer.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement specifies the WIMP actions when it wishes to delete the WIFO once the negotiation is over.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0090
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0098
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute WIFO

[REQ]

Identifier	REQ-18-02b-TS-WIFO.0042
Title	WIFO deletion triggers
Requirement	<p>The WIMP shall request the SWIM layer to delete a negotiation-type WIFO:</p> <ol style="list-style-type: none"> 1. if the WIC(s) indicates after the initial publication of the WIFO that it does not support the WIFO functionality, 2. when it has been published with a final status and the end of service acknowledgement messages have been received from all WICs, or 3. after expiration of the locally defined timer set when publishing the WIFO with a final status. <p>Whatever event comes first.</p>
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement specifies at what time the WIFO is actually deleted from the network, i.e. once it has reached a final status and this was acknowledged by all WICs. If for any reason all acknowledgements are not received after a pre-defined time, the WIFO is deleted. Finally, if the WIC indicate to the FDMP after the initial publication of the WIFO that it does not support the WIFO functionality, the WIFO is also deleted.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
--------------	---------------------	------------

<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0090
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0098
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute WIFO

When the WIC receives a WIFO created for negotiation with any of the final status described above (accepted, cancelled, rejected or time-out), it will assume that the negotiation is completed.

[REQ]

Identifier	REQ-18-02b-TS-WIFO.0040
Title	WIFO Deletion Acknowledge (WIC)
Requirement	When receiving a WIFO with one of the final status (“accepted”, “cancelled”, “rejected” or “time-out”) and the reason for distribution set to “end_of_service”, the WICs shall : <ul style="list-style-type: none"> consider the negotiation as complete, acknowledge the deletion by sending an end of service acknowledgement request to the WIMP.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement describes when a WIC considers a negotiation as complete and requests it to acknowledgment the WIFO deletion. ICD Note: Sending the end of service is performed by using <code>srv_end_of_serviced_ack()</code> .
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0090
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0098
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Read WIFO Update

4.2.2.2.11 Others

In some cases, the negotiated transition data (C&T Direct, Heading or Speed) is needed to be instructed to the aircraft as soon as possible. The receiving SI acting as WIMP can request the transferring SI (WIC) to clear the aircraft to the agreed coordination data as soon as possible.

[REQ]

Identifier	REQ-18-02b-TS-WIFO.0057
Title	C&T Negotiated Data Urgent Application
Requirement	A receiving SI negotiating a C&T Direct, Heading or Speed shall indicate whether it requires its transferring SI to clear as soon as possible the aircraft to the new agreed C&T value.
Status	<Validated>
Maturity Level	TRL6

Rationale	This requirement allows the receiving SI to request the transferring SI to clear the aircraft with the negotiation transition data as soon as the negotiation is positive and completed. ICD Note. The indication is made by setting the flag associated with the negotiated data to 'UrgentNegotiatedDataApplicationFlag'
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0163
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage WIFO

4.2.2.3 FO requirements applicable to WIFO

Although most of the requirements applicable to FO are applicable to WIFO as well there are a few exceptions. Below the requirements that are not applicable to WIFOs will be outlined, these requirements are easily identified by the sections they are located in.

The requirements included in sections other than the ones identified below are applicable to both FO and WIFO.

4.2.2.3.1 IOP Roles handling

The SI that uses a WIFO is given roles as it is done with the FO. But this role is not modified along the life time of a WIFO, it is static. The requirements defining the WIFO roles usage are included in the 4.2.2.1.1 WIFO Creation and Role Assignment section.

4.2.2.3.2 FO Deletion from the network

The rules to remove a FO from the network by the FDMP are based on the flight status itself. The WIFOs are created for a temporary purpose that is normally completed before the flight leaves the IOP area (or lands). Therefore the rules to delete a WIFO are specific and can be found in WIFO Deletion section.

4.2.2.3.3 IOP Data Distribution

This section defines the reasons to populate the list of SIs that are going to receive a FO. Those reasons are different in the WIFO. The reason for the WIFO distribution depends on the WIFO type (creation, probe...) and it is not strongly coupled to the distribution reason of the related FO. The requirements applicable to identify the SIs in this list can be found in the WIFO General Requirements

WIFO Creation and Role Assignment section as well as (for negotiation WIFO) in WIFO proposal and distribution.

4.2.3 Coordination and Transfer

The granularity of the information shared in the Flight Object, for what pertains to Coordination & Transfer is, unless explicitly stated, the System Instance (SI).

The coordination data, states and crossing described in this section are related to the last ATSU of upstream SI and the first ATSU of the downstream SI.

Note. The crossing between two sectors of different ATSUs belonging to the same SI is out of the scope of IOP.

4.2.3.1 Managing SI Boundaries

4.2.3.1.1 Description of the concept of phases

The IOP concept on coordination and transfer introduces three phases depending on the position of a flight between different systems. These phases are:

- System Awareness Phase (SAP),
- Controller Awareness Phase (CAP),
- Negotiation Phase (NP).

4.2.3.1.1.1 Behaviour during SAP (for a given SI)

During the SAP for a given SI, the IOP exchanges occur between the FDMP and SIs silently. The SIs request, the FDMP accepts or rejects the requests; but the ATCO are not informed explicitly of any changes. On the other side, the other human operators can have full access, display and feedback on a flight in this phase.

4.2.3.1.1.2 Behaviour during CAP (for a given transition)

While in CAP, an ATCO can modify the flight unilaterally. He can also consult an ATCO of another SI before making a change using the WIFO mechanism (electronic dialogue) or using verbal/telephonic coordination (no system support). The way the ATCO is informed of the changes is a pure local implementation issue.

4.2.3.1.1.3 Behaviour during NP (for a given transition)

As the negotiation can be done either with system support (WIFO) or without (verbally), the system cannot verify in all the cases that a negotiation has occurred.

It is a local implementation issue to define the system behaviour at this point. Some possible (non-limitative) behaviours are listed below:

- Force the use of system support (WIFO),
- Force to confirm that a verbal coordination occurred,
- Trust the ATCO's input (no system verification).

The requirements related to coordination and transfer in this document are applicable to all the phases, unless explicitly stated.

4.2.3.1.1.4 SI State and Coordination Phase transitions

The conditions for transitioning from one phase to another are illustrated in Figure 9 for both the entry crossing (left side) and the exit crossing (right side).

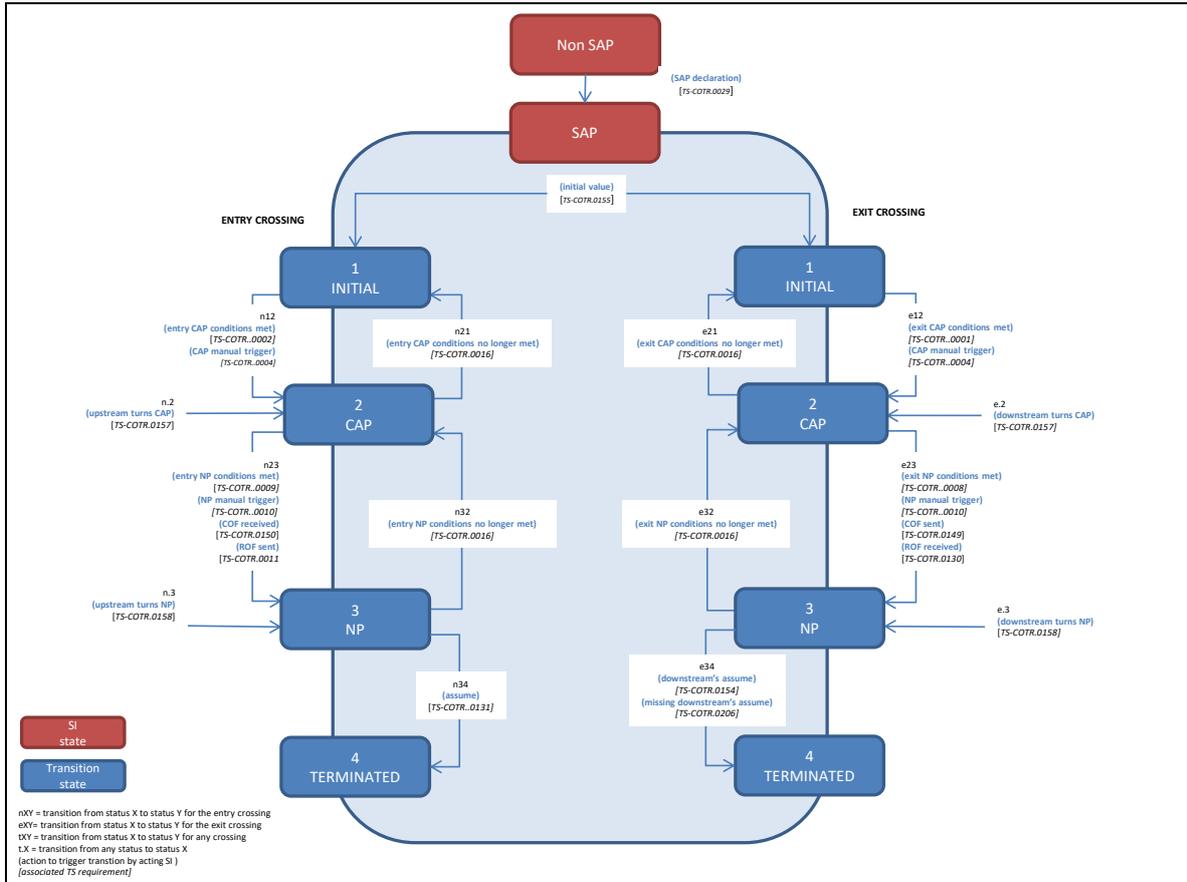


Figure 9: SI State and Coordination Phase transitions

4.2.3.1.2 System Awareness Phase

The System Awareness Phase (SAP) is the phase specific to each IOP stakeholder, when this stakeholder decides to locally create an SFPL that corresponds to the FO. An IOP Stakeholder entering the SAP phase becomes able to enrich the FO with its local information (in particular its local constraints) and to maintain its local view (SFPL) aligned with the changes to the FO resulting from the other IOP stakeholders. The number of SIs in SAP provides an idea of the level of confidence in the content of the FO.

Note. The SAP phase is not specific to a boundary. It is a system SAP. It must not be confused with the INTEROP “SAP” that is related only to a given SI transition. This later is referred to as the INITIAL state of the coordination phase.

The SAP is defined for a flight and is related to the whole SI. In particular in case of re-entrances, the SAP starts at the same time for each of them.

The FDMP considers by default that a SI is not in SAP phase until this SI notifies of its transition to SAP. Any SI that is distributed with the flight has to share its SAP information whatever its role is (FDMP, FDC or FDU).

[REQ]

Identifier	REQ-18-02b-TS-COTR.0029
Title	Sharing SAP information

Requirement	As soon as a local SFPL exists in the SI and a FO representing the same flight exists, the SI shall indicate in the FO that it has entered the SAP phase.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to share the SAP start. ICD note: The service called by an FDC to share it is in SAP is <i>srv_phase_sap()</i> . ICD note: the FO attribute indicating a SI is in SAP is the <i>awarenessPhase</i> in the Distribution list.
Category	<Interoperability><safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0001
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

4.2.3.1.3 Initial Phase

At FO creation, the FDMP set by default the coordination phase to INITIAL. This means that the CAP phase has not started for that transition.

[REQ]

Identifier	REQ-18-02b-TS-COTR.0155
Title	INITIAL coordination phase
Requirement	At FO creation, the FDMP shall maintain the coordination phase of the SIs involved in the different SI transitions to INITIAL until it is notified of a CAP start by another SI.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to initialize the coordination phase at FO creation.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0001
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Create and Distribute FO

4.2.3.1.4 Controller Awareness Phase

The Controller Awareness Phase (CAP) is the time where the flight is displayed on at least one CWP of the SIs downstream to a boundary. The CAP exists only for the SIs that are predicted to be FDCs for the flight.

The decision to enter the CAP for a given SI boundary can be triggered:

- According to a System Parameter (time/distance/level) before the boundary, defined in the applicable bilateral agreement,
- Manually through a specific ATCO action (force-CAP),
- As the consequence of another action (e.g. involvement of a SI in a negotiation, skip proposal), or
- By other events (locally defined in each SI).

The transition to the CAP for a SI boundary crossing is marked by setting the CAP information related to that crossing within the FO.

The processing of making the ATCO aware of the start of the CAP is locally defined (out of IOP but will be visible at CWP level).

[REQ]

Identifier	REQ-18-02b-TS-COTR.0001
Title	CAP from LoA (upstream)
Requirement	When the trigger defined in the LoA for CAP start of a given SI crossing occurs, the upstream SI shall set in the FO the indication that it reached the CAP phase for this exit crossing.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to inform other SIs of the CAP start at the exit crossing. ICD note: The service called by an upstream SI to inform it enters CAP for a given transition is <i>srv_set_CAP_phase_at_exit()</i> . ICD note: the FO attribute indicating an upstream SI is in CAP is the <i>coordinationPhase</i> if the upstream SI traversal in the Active Coordination list.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0006
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0007
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

[REQ]

Identifier	REQ-18-02b-TS-COTR.0002
Title	CAP from LoA (downstream)
Requirement	When the trigger defined in the LoA for CAP start of a given SI crossing occurs, the downstream SI shall set in the FO the indication that it reached the CAP phase for this entry crossing.
Status	<Validated>

Maturity Level	TRL6
Rationale	This requirement is needed to inform other SIs of the CAP start at the entry crossing. ICD note: The service called by a downstream SI to inform it enters CAP for a given transition is <i>srv_set_CAP_phase_at_entry()</i> . ICD note: the FO attribute indicating a downstream SI is in CAP is the <i>coordinationPhase</i> if the downstream SI traversal in the Active Coordination list.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0006
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0007
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

In case an ATCO anticipates that he will have to contact the other ATCO about a given flight, he can provoke the start of the CAP (regardless if this ATCO belongs upstream or downstream to the boundary).

The system may also anticipate the CAP as consequence of some ATCO actions (the CAP is meaningful only for ATCOs (Executive and Planning), not for FMPs who need a wider time horizon).

Note: If the pointed SI is a third party (outside the control sequence list), it will not enter the CAP.

[REQ]

Identifier	REQ-18-02b-TS-COTR.0004
Title	Local CAP trigger
Requirement	A SI shall be able to trigger the CAP phase at any of its SI boundary for an FO.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to allow manual trigger of CAP.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0013
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0014
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0122
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0169
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

The above requirement states nothing about the state of the upstream crossings that may not yet be in CAP while some downstream crossing gets triggered into the CAP. It will be a local implementation issue, if a given SI wants to anticipate, in such a case, the start of the CAP to its entry crossings.

[REQ]

Identifier	REQ-18-02b-TS-COTR.0157
Title	CAP alignment between upstream and downstream SI.
Requirement	The SI (upstream or downstream to a SI transition) that observes that its partner for the SI transition has entered the CAP phase shall trigger its CAP for this transition, if not yet done and as soon as local conditions allow.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to get a common view on the coordination phase CAP at a given boundary. It may happen that even the partner has entered CAP, the SI needs to wait that local conditions are met to go itself to CAP.
Category	<Interoperability><safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0006
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

4.2.3.1.5 Negotiation Phase

The Negotiation Phase (NP) is the phase when it is bilaterally agreed (LoA) that any change to the flight are expected to be negotiated and agreed between the transferring and receiving controllers. The LoA defines the start of the NP phase.

The transition to the NP for an SI boundary is marked by setting this information in the FO related to that crossing.

[REQ]

Identifier	REQ-18-02b-TS-COTR.0008
Title	NP from LoA (upstream)
Requirement	When the trigger defined in the LoA for NP start of a given SI transition occurs, the upstream SI shall set in the FO the indication that it reached the NP phase for its exit crossing.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to inform other SIs of the NP start at exit crossing. ICD note: The service called by an upstream SI to inform it enters NP for a given transition is <i>srv_set_NP_phase_at_exit()</i> . ICD note: the FO attribute indicating an upstream SI is in NP is the <i>coordinationPhase</i> if the upstream SI traversal in the Active Coordination list.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
--------------	---------------------	------------

<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0016
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0017
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

[REQ]

Identifier	REQ-18-02b-TS-COTR.0009
Title	NP from LoA (downstream)
Requirement	When the trigger defined in the LoA for NP start of a given SI crossing occurs, the downstream SI shall set in the FO the indication that it reached the NP phase for its entry crossing.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to inform other SIs of the NP start at entry crossing. ICD note: The service called by a downstream SI to inform it enters NP for a given transition is <i>srv_set_NP_phase_at_entry()</i> . ICD note: the FO attribute indicating a downstream SI is in NP is the <i>coordinationPhase</i> if the downstream SI traversal in the Active Coordination list.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0016
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0017
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

In case an ATCO wants to indicate to the other ATCOs that the crossing conditions should now be manually negotiated between them, he can anticipate the start of the negotiation phase, regardless of the crossing conditions (standard or non-standard).

Once the negotiation phase is started (automatically or manually), the ATCOs at that crossing should be aware of this.

[REQ]

Identifier	REQ-18-02b-TS-COTR.0010
Title	Local NP trigger
Requirement	An SI shall be able to trigger the Negotiation Phase at any of its SI boundary for an FO.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to allow manual trigger of NP.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0021
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0022
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

[REQ]

Identifier	REQ-18-02b-TS-COTR.0011
Title	NP on Request On Frequency (downstream)
Requirement	The downstream SI shall , upon issuing a request on frequency, start the Negotiation Phase for its entry boundary and notify the FDMP of that.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to ensure that SI at each side of a SI boundary is in NP.
Category	<Interoperability><safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0103
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0043
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0135
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

The NP phase is automatically triggered when a ROF or a COF is sent or received.

[REQ]

Identifier	REQ-18-02b-TS-COTR.0130
Title	NP on Request On Frequency (upstream)
Requirement	The upstream SI shall , upon reception of request on frequency by its downstream SI, start the Negotiation Phase for its exit boundary.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to ensure that SI at each side of a SI boundary is in NP.
Category	<Interoperability><safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0043
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0135
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

[REQ]

Identifier	REQ-18-02b-TS-COTR.0149
Title	NP on a Change On Frequency (upstream)
Requirement	The upstream SI shall , upon instructing the frequency change to downstream, start the Negotiation Phase for its downstream boundary.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to ensure that SI at each side of a SI boundary is in NP.
Category	<Interoperability><safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0103
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0135
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0048
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

[REQ]

Identifier	REQ-18-02b-TS-COTR.0150
Title	NP on a Change On Frequency (downstream)
Requirement	The downstream SI shall , upon reception of the frequency change from upstream, start the Negotiation Phase for its upstream boundary.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to ensure that SI at each side of a SI boundary is in NP.
Category	<Interoperability><safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0103
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0135
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

[REQ]

Identifier	REQ-18-02b-TS-COTR.0158
Title	NP alignment between upstream and downstream SI
Requirement	The SI (upstream or downstream to a SI transition) that observes that its partner for the SI transition has entered the NP phase, shall trigger its Negotiation Phase for this transition, if not yet done and as soon as local conditions allow.
Status	<Validated>

Maturity Level	TRL6
Rationale	This requirement is needed to get a common view on the coordination phase NP at a given boundary. It may happen that even the partner has entered NP, the SI needs to wait that local conditions are met to go itself to NP.
Category	<Interoperability><safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0016
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

4.2.3.1.6 Terminated Phase

[REQ]

Identifier	REQ-18-02b-TS-COTR.0131
Title	TERMINATED on Assume (downstream)
Requirement	The downstream SI shall , upon assumption within the SI, end the Negotiation Phase for its upstream boundary.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to ensure that SI at each side of a SI boundary is no longer in NP. ICD note: The service called by a downstream SI that it exits NP for a given transition is <i>srv_set_TERMINATE_phase_at_entry()</i> . ICD note: the FO attribute indicating an upstream SI is in TERMINATED is the <i>coordinationPhase</i> if the upstream SI traversal in the Active Coordination list.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0020
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

[REQ]

Identifier	REQ-18-02b-TS-COTR.0154
Title	TERMINATED on Assume (upstream)
Requirement	The upstream SI shall , upon reception of the assumption by its downstream SI, end the Negotiation Phase for its exit boundary and set it in the FO.
Status	<Validated>
Maturity Level	TRL6

Rationale	This requirement is needed to ensure that SI at each side of a SI boundary is no longer in NP. ICD note: The service called by an upstream SI that it exits NP for a given transition is <i>srv_set_TERMINATE_phase_at_exit()</i> . ICD note: the FO attribute indicating an upstream SI is in TERMINATED is the <i>coordinationPhase</i> if the upstream SI traversal in the Active Coordination list.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0020
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

[REQ]

Identifier	REQ-18-02b-TS-COTR.0156
Title	Stop NP when no assumption by downstream SI
Requirement	The transferring SI that has transferred the flight but has not received the confirmation of the assumption by the receiving SI and once local conditions are met (e.g. time-out, ATCO action, conditions monitoring (e.g. the aircraft leaves the AoR), ...) shall : <ul style="list-style-type: none"> • end the Negotiation Phase for its exit boundary, • indicate that it is no longer the controlling SI, and • keep the FDMP role.
Status	<In Progress>
Maturity Level	TRL4
Rationale	This requirement is needed to ensure that the transferring SI is not blocked in NP in case of failure of the receiving SI.
Category	<Interoperability><safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0020
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

Consequently, for IOP, there is no limitation regarding the changes that can be requested to FDMP or applied by the FDMP if they are manual inputs (originating from ATCO's).

4.2.3.1.7 Regression of CAP/NP for a crossing

The regression of CAP or NP for a SI occurs when a flight is significantly delayed to enter in that SI (delay at departure or later). In this case, each SI involved in the crossing will re-assess if its conditions to trigger automatically the CAP are still fulfilled and if its conditions to trigger automatically the NP are still fulfilled. If the CAP conditions of a given SI are no longer met, this SI will declare that it is back to INITIAL, if just its NP conditions are no longer met, this SI will declare that it is back to CAP.

The Table 14 below lists the different possibilities for a given crossing of a given SI:

New situation such that:	Current phase NP	Current phase CAP
NP conditions no longer met	CAP	CAP
NP and CAP conditions no longer met	INITIAL	INITIAL

Table 14 CAP/NP Regression

To obtain the operational perception of the coordination phase, the technical phase of the upstream and downstream SI must be combined. Related OPS requirement (Cf. satisfied INTEROP requirements of TS-COTR.0016) expresses that the coordination phase must be considered as reverted to CAP, only if both partners have assessed that a regression to CAP is justified.

The Table 15 below represents this combination of the 2 coordination phases of a given crossing:

Upstream \ Downstream	NP	CAP
NP	NP	NP
CAP	NP	CAP

Table 15 Coordination Phases Combinations

This regression will occur even if the CAP or NP had been triggered manually. It has to be stressed that this regression is evaluated independently by the downstream SI of each SI transition.

The decision to consult an ATCO to regress the on- going CAP is local process.

[REQ]

Identifier	REQ-18-02b-TS-COTR.0016
Title	Reversion from CAP/NP to SAP
Requirement	<p>Upon changes of the entry/exit conditions for a given SI transition, as instructed by Table 14 the system shall:</p> <ul style="list-style-type: none"> revert to CAP when the conditions triggering the NP are no longer met, and revert to INITIAL when the conditions triggering the CAP are no longer met.
Status	<Validated>
Maturity Level	TRL6
Rationale	<p>This requirement is needed to inform other SIs of the reversion to CAP or INITIAL.</p> <p>When a SI transition is neither in CAP nor in NP, the state is INITIAL. This state represents the SAP (specific to a transition) that the INTEROP introduces.</p>
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0023
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0131
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

4.2.3.2 Managing Coordination and Transfer Data

4.2.3.2.1 Coordination and Transfer Data Creation and Confirmation

The FDMP creates the coordination and transfer data (C&T data) for each pair of consecutive SIs present in the control sequence, even if it has only partial or no information about their transitions. This is applicable for IOP holes and unknown portions of the control sequence.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1003
Title	Calculation of coordination data (FDMP)
Requirement	The FDMP shall create the coordination and transfer data for each pair of consecutive SIs in the FO Control Sequence.
Status	<Validated>
Maturity Level	TRL6
Rationale	The requirement is needed to create the coordination and transfer data based on the control sequence. ICD Note: The coordination data are stored in an ActiveCoordination in the Coordination cluster.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0004
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

Once created, the C&T data can be updated by the FDMP and other SIs as long as the modification is not forbidden by the transferring or the receiving SI associated with the data. Once the transferring or receiving SI set the Confirmed Indication to true, neither the FDMP nor other SI can modify these data.

By default, the FDMP set in the FO the Confirmation Indication to false for any information for which the confirmation information is not available.

[REQ]

Identifier	REQ-18-02b-TS-COTR.0143
Title	No modification of transition Confirmed fields
Requirement	The FDMP shall populate the items of valid coordination crossing data at each predicted SI transition using its own local prediction, except for the items related to a SI transition that have been confirmed by one of the SI involved in that SI transition, for which it will preserve the current value.
Status	<Validated>

Maturity Level	TRL6
Rationale	It includes the case that any modification perform by an upstream system may modify the coordination data predicted at entry of a given system instance and that this SI silently accepts these changes.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0207
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0137
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0138
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0139
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0140
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0141
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0109
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0186
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0110
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0153
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0154
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0155
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0121
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0030
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0149
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0150
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0151
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

[REQ]

Identifier	REQ-18-02b-TS-COTR.0159
Title	Coordination Data frozen after a frequency change
Requirement	The FDMP shall prevent any update of the C&T data of a transition with the status DONE, with the exception of the Coordination Phase.
Status	<In Progress>
Maturity Level	TRL4
Rationale	This requirement is needed to avoid unnecessary service requests and FO publication related to changes of transitions in the past. The Coordination Phase presents in the C&T Data remains modifiable (e.g. to allow to set it to TERMINATED)
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0207
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0137
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0138
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0139
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0140
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0141
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0109

<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0186
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0110
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0153
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0154
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0155
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0121
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0030
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0149
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0150
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0151
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

4.2.3.2.2 Entry and Exit Coordination and Transfer Data

Once in the SAP state, SIs manage C&T data for their entry when acting as a receiving SI and their exit crossing when acting as transferring SI. The C&T data are made of:

- entry crossing data only managed by the receiving SI: receiving RE and frequency, IOP Downstream SSR code,
- exit crossing data only managed by the transferring SI: transferring RE and frequency, IOP Transfer SSR code,
- common crossing data managed by both the transferring and the receiving SI: type of agreement, TFL information (level(s), geometry), clearances, expanded route points before and after the transition.

[REQ]

Identifier	REQ-18-02b-TS-COTR.0200
Title	Initialization and maintenance of exit crossing data
Requirement	A transferring SI shall from the start of the SAP onwards initialize and update the following set of information related to its exit crossing: <ul style="list-style-type: none"> - Transferring RE, - Transferring RE Confirmed indication, - Transferring Frequency, - Transferring Frequency Confirmed indication, and - IOP Transfer SSR Code (if any).
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement instructs any transferring SI once in the SAP state to initialize and maintain C&T data related to its exit crossing and only managed by the transferring SI. ICD Note: The service used by an FDC for setting exit coordination data is <code>srv_set_upstream_coordination_information_at_exit()</code> .
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0004
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0109
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0186

<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0201
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0202
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SSRC.0002
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

[REQ]

Identifier	REQ-18-02b-TS-COTR.0201
Title	Initialization and maintenance of entry crossing data
Requirement	A receiving SI shall from the start of the SAP onwards initialize and update the following set of information related to its entry crossing: <ul style="list-style-type: none"> - Receiving RE, - Receiving RE Confirmed indication, - Receiving Frequency, and - Receiving Frequency Confirmed indication.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement instructs any receiving SI once in the SAP state to initialize and maintain C&T data related to its entry crossing and only managed by the receiving SI. ICD Note: The service used by an FDC for setting exit coordination data is <code>srv_set_downstream_coordination_information_at_entry()</code> .
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0004
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0109
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0186
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0190
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0200
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SSRC.0004
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SSRC.0005
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SSRC.0006
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

[REQ]

Identifier	REQ-18-02b-TS-COTR.0202
Title	Maintenance of other crossing data
Requirement	A receiving or transferring SI shall from the start of the SAP onwards initialize and update the following set of common information related to its entry or exit crossing: <ul style="list-style-type: none"> - Type of Agreement (Manual or Automatic), - Transfer FL and TFL Origin (LoA, manually set or derived from the current aircraft trajectory), - TFL Confirmed indication and TFL Origin Confirmed indication, - Supplementary FL,

	<ul style="list-style-type: none"> - Supplementary FL Confirmed indication, - The geometry of the crossing (wall or a ceiling/floor), - The geometry Confirmed indication, - Clearances : Direct, Heading, Speed and/or Rate of climb/descent, - The last point of the expanded route before the reference point and the related Confirmed indication, and - The first point of the expanded route after the reference point and the related Confirmed indication.
Status	<Validated>
Maturity Level	TRL6
Rationale	<p>This requirement instructs any SI once in the SAP state to initialize and maintain C&T data related to its entry and/or exit crossings and managed by both the transferring and the receiving SI.</p> <p>ICD Note: The services used by an FDC for setting entry and exit coordination data are <code>srv_set_downstream_coordination_information_at_entry()</code> and <code>srv_set_upstream_coordination_information_at_exit()</code>.</p>
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0004
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0027
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0137
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0138
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0139
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0140
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0141
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0028
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0183
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0148
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0184
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0030
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0189
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0149
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0150
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0151
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0153
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0154
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0155
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0208
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0209
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SSRC.0005
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SSRC.0006
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SSRC.0007
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

[REQ]

Identifier	REQ-18-02b-TS-COTR.0220
Title	C&T Data Direct Negotiation
Requirement	When negotiating a DCT the SI that makes the proposal shall identify if the

	DCT is expected to be implemented from the track or from a predetermined point.
Status	<Validated>
Maturity Level	TRL6
Rationale	All the data related to the DCT has to be indicated in coordination cluster to identify what type of DCT is being negotiated.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0208
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0209
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

[REQ]

Identifier	REQ-18-02b-TS-COTR.0221
Title	DCT from Current Position Agreement
Requirement	Upon agreement of a DCT from the track the SI that makes the proposal shall update the coordination data in the FO.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to ensure the FO is updated with the agreement reached and according to the type of DCT.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0209
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

[REQ]

Identifier	REQ-18-02b-TS-COTR.0222
Title	DCT from Route Point Agreement
Requirement	Upon agreement of a DCT from a route point the SI that makes the proposal shall update the coordination data and the expanded route as requested by the DCT from the point.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to ensure the FO is updated with the agreement reached and according to the type of DCT.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0208
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

4.2.3.2.3 Type of Agreement for Coordination and Transfer Data

The service to make a negotiation will contain the information that the change is already agreed or not. Depending on the local policy of each SI, a SI submitting a change may, for example, set the “already agreed” information:

- Without requesting the involved human, or
- Based on information from the involved human.

The system initiated changes are not applied directly on the flight during NP. They must be confirmed and agreed by the involved ATCOs. Depending on local implementation, ATCOs can be involved:

- By electronic support, or
- Verbally.

[REQ]

Identifier	REQ-18-02b-TS-COTR.0207
Title	Initialization of Contractual C&T data Agreement
Requirement	Upon FO creation, the FDMP shall set the agreement indication of the Contractual C&T data (TFL, SFL, Heading, Direct, Speed, ROC/ROD) to “set_without_negotiation”.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement ensures the correct initialization of the C&T agreement indications. ICD note. The acknowledgment for <data item> is indicated in the <data item>Agreement flag.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<SATISFIES>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0019
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

[REQ]

Identifier	REQ-18-02b-TS-COTR.0135
Title	Indication of C&T data change - Manual agreement
Requirement	While the coordination is in CAP or NP, for any contractual C&T data (TFL, SFL, Heading, Direct, Speed, ROC/ROD), the SI that has obtained the agreement verbally or following a WIFO negotiation from the other SI shall

	indicate in the FO that this element has been set after negotiation (manual or automatic).
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to inform other SIs of the manual agreement. ICD Note: the nature of agreement is stored in ActiveCoordination (Agreement). ICD Note: The services used by an FDC for setting the type of agreement are <code>srv_set_downstream_coordination_information_at_entry()</code> and <code>srv_set_upstream_coordination_information_at_exit()</code> .
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0019
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0210
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

4.2.3.2.3 Exit time

[REQ]

Identifier	REQ-18-02b-TS-COTR.0204
Title	Maintenance of time related crossing data from SAP onward
Requirement	A transferring SI shall from the start of the SAP onwards, initialize and update the following set of time information related to its exit crossing: <ul style="list-style-type: none"> - Time at the boundary, - Time at the boundary Confirmed indication, - Reference point of the coordination, and - Reference point Confirmed indication.
Status	<Validated>
Maturity Level	TRL6
Rationale	Share through the FO the time related coordination data at its exit.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0004
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0001
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

[REQ]

Identifier	REQ-18-02b-TS-COTR.0205
Title	Exit time update in case of delay

Requirement	In case of delay, if possible, each SI shall update the coordination time at its exit.
Status	<Validated>
Maturity Level	TRL6
Rationale	Coordination time need to be up to date with the progress of the flight. SIs who are not in SAP or who have very less information about the flight are not obliged to update at their exit (when they are unable to calculate its exit time). This updated time information is used to keep up to date the coordination phase (e.g. as specified in REQ-18-02b-TS-COTR.0016 the coordination phase could need to be reverted back to INITIAL).
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0012
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

4.2.3.2.4 Standard/Non-standard Crossing Conditions

When the CAP starts for an SI boundary, the involved SIs have to inform their respective ATCOs if the crossing conditions are non-standard for at least one of them. The way to inform the ATCO is a local choice; hence, out of the scope of IOP. It has to be noted that the assessment of the crossing conditions should be the same for upstream and downstream in most cases. But in some cases like error of LoA modelling, or difference in trajectories, this can be different. No explicit proposal/acceptance of the crossing conditions, even if non-standard, is expected from the partners of the boundary.

The transferring and receiving SIs assess independently the crossing conditions as per the LoA defined between them and publish their respective assessment.

[REQ]

Identifier	REQ-18-02b-TS-COTR.0139
Title	Assessment of non-standard crossing conditions.
Requirement	Once locally assessed, a SI, for which the NP phase is not yet completed, shall set in the FO that its entry or exit conditions for a given SI transition, are non-standard and provide a reason for this assessment.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to inform other SIs of the non-standard assessment. Note: It is possible for a transition in CAP in particular, but also in NP as long as the transfer is not completed. ICD note: the assessment of each partner at the SI transition is available separately. As soon as one of the two reports the conditions as non-standard, both local systems are expected to present to their ATCO the transition as non-standard, regardless of the local assessment.

Category	<Interoperability>	
[REQ Trace]		
Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0096
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0120
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

[REQ]

Identifier	REQ-18-02b-TS-COTR.0140
Title	Assessment of standard crossing conditions
Requirement	Once locally assesses, a SI, for which the NP phase is not yet completed, shall set in the FO that its entry or exit conditions, for a given SI transition previously assessed as non-standard, are now standard.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is requested to inform other SIs of the standard assessment. Note: It is possible for a transition in CAP in particular, but also in NP as long as the transfer is not completed.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0096
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0120
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

4.2.3.2.5 Other Crossing Data

Editor's note. Some other crossing data will be managed in more advanced IOP. They are not in the scope of this technical specification (Cf G.3 for more information).

[REQ]

Identifier	REQ-18-02b-TS-COTR.0147
Title	Maintenance of other crossing data from SAP onward
Requirement	An SI shall from the start of the SAP onward, initialize the following set of information (when available) related to each of its crossings and set the subsequent changes in the FO: <ul style="list-style-type: none"> - Release for climb/descent and kind of release (upstream, downstream) (only for the downstream release of the entry crossing and for the upstream release of the exit crossing).
Status	<Validated>
Maturity Level	TRL6

Rationale	This requirement is needed to cover the release data in scope of this specification.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0060
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

[REQ]

Identifier	REQ-18-02b-TS-COTR.0203
Title	Maintenance of release condition
Requirement	A SI shall provide and update when modified, the release conditions applicable to each portion of its AoR that is going to be controlled by an external SI and share this information in FO.
Status	<Validated>
Maturity Level	TRL6
Rationale	Necessary to make the release conditions available to the SI that will control the flight. Only no release and full release are included in scope of this specification.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0060
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0129
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0130
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0164
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0084
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

[REQ]

Identifier	REQ-18-02b-TS-COTR.0209
Title	Replacement of release condition
Requirement	When a SI needs to set the applicable releases in its AoR it shall overwrite the previous releases, if any.
Status	<Validated>
Maturity Level	TRL6
Rationale	Rationale Necessary to ensure new release conditions supersede previous set ones, if any.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a

<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0167
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

4.2.3.3 Transferring Flight Responsibility

Although IOP granularity is the SI, the transfer at an SI boundary is managed at the granularity of the Responsibility Entity (RE). Due to this, the receiving SI's, sector and frequency and the transferring SI's, sector and frequency are shared in the FO.

The transfer of responsibility can be triggered by the upstream SI (COF) or the downstream SI (ROF) and is terminated once the downstream SI has assumed the flight. The RECLAIM procedure allows the downstream SI to request back the flight responsibility. The COF, ROF and ASSUME can be undone under certain conditions. Figure 10 presents the status flow of the Transfer Status which is updated jointly by the upstream SI (SI A) and the downstream SI (SI B) during the course of the execution.

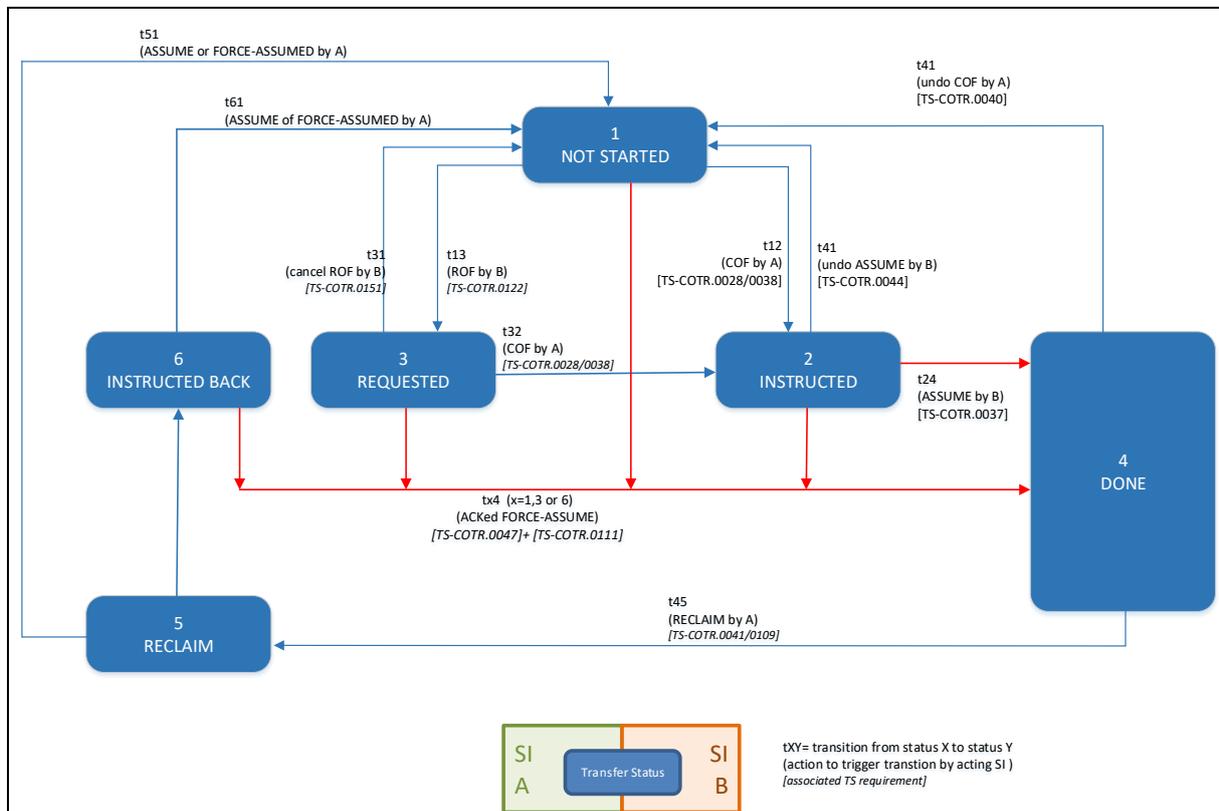


Figure 10: TransferStatus transitions

Editor’s note. The RECLAIM capability is not in scope of this technical specification (Cf G.3 for more information).

Note: An ATCO can set and modify the information about sector and frequency as per his needs and not necessarily at the request of frequency.

4.2.3.3.1 Instructing the Frequency Change (Send)

[REQ]

Identifier	REQ-18-02b-TS-COTR.0028
Title	COF manual input
Requirement	On frequency transfer input, the FDMP shall set in the FO that the frequency transfer has been instructed for a given exit SI transition.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to allow a frequency change. ICD note: the removal of the previous ROF indication does not require any further information from the issuer of the COF. The attribute transferStatus will be changed by FDMP from NOT_STARTED or REQUESTED to INSTRUCTED.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0032
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0044
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

4.2.3.3.2 Undoing a Frequency Change (Undo-send)

In some cases, the ATCO that enters the input for the change of frequency in his system must take back the flight on frequency before the next SI confirms the contact, i.e., before it assumes the flight. This can happen in some of the following cases:

- The pilot was not yet instructed to contact downstream (he did the input in his system and changes his mind before contacting the pilot),
- Following a phone call from upstream controller to downstream, the pilot has been instructed to contact upstream again,
- The pilot contacted again the upstream controller because of some problems in contacting downstream (wrong frequency ...).

[REQ]

Identifier	REQ-18-02b-TS-COTR.0040
Title	Undo-frequency change processing
Requirement	Upon undo of an instructed frequency change, the SI shall indicate that the transfer has been cancelled provided the next SI has not yet assumed the flight. ICD note: the attribute transferStatus will be changed by FDMP from REQUESTED to NOT_STARTED.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to allow the undo of an instructed frequency change

Category	<Interoperability>	
[REQ Trace]		
Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0036
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

4.2.3.3.3 Confirming contact with pilot (Assume)

[REQ]

Identifier	REQ-18-02b-TS-COTR.0037
Title	Assumption of a flight in a SI
Requirement	<p>Upon assumption of a flight by a SI, this SI shall set in the FO:</p> <ul style="list-style-type: none"> - The indication that the flight has been assumed, - The identity of new controlling SI, the new controlling sector and frequency, - Reset any STOLEN information, - When the assume is a consequence of a frequency transfer, the indication that the current transfer and all upstream transfer are over,
Status	<Validated>
Maturity Level	TRL6
Rationale	<p>This requirement is needed to allow the assumption. Other changes are tracked in distinct requirements: REQ-18-02b-TS-COTR.0131 for terminating the NP.</p> <p>The indication that all upstream transfers are over is needed to cover the No_Contact case.</p> <p>ICD note. To indicate that the transfer is over, the attribute transferStatus will be changed by the FDMP from INSTRUCTED to DONE.</p>
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0020
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0034
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0054
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

If the new controlling ATCO assumed the flight before the aircraft actually left the AOR of the previous SI, this create a situation where a controller is controlling the flight while it is in the AOR of another one. Operationally the flight behaviour should remain as the one at time of assume until the flight enters the new SI. Nonetheless, the controller of the previous SI can authorize some evolutions for the flight.

4.2.3.3.4 Undo Assume

Editor's note. The Undo Assume capability is not in scope of this technical specification (Cf G.3 for more information).

4.2.3.3.5 Requesting the frequency change to the controlling unit

[REQ]

Identifier	REQ-18-02b-TS-COTR.0038
Title	Request on Frequency by a SI (FDMP)
Requirement	Upon request on frequency by an FDC to the controlling SI, the FDMP shall set in the FO that a request on frequency has been requested in the Frequency-transfer information of the related SI transition and update if needed the C&T data.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to allow the request on frequency
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0041
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0040
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

[REQ]

Identifier	REQ-18-02b-TS-COTR.0122
Title	Availability conditions for ROF input
Requirement	The request on frequency functionality shall be available for an SI if and only if it is in CAP or in NP for its entry boundary.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to define when request on frequency is possible
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0042
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

4.2.3.3.6 Undo Request Of Frequency

Editor's note. The Undo ROF capability is not in scope of this technical specification (Cf. G.3 for more information).

4.2.3.3.7 Requesting back the frequency change to the former controlling unit (Reclaim)

Editor's note. The RECLAIM capability is not in scope of this technical specification (Cf. G.3 for more information).

4.2.3.3.8 Force-Assume of a flight

The force-assume operation is available to allow to recover from a failure during the nominal transfer process.

[REQ]

Identifier	REQ-18-02b-TS-COTR.0047
Title	Force Assume Processing
Requirement	When triggered to do a force-assume, the SI shall set: <ul style="list-style-type: none"> the new controlling SI as itself, set in the stolen information of the previously controlling SI the indication that the force assume is not acknowledged yet
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to define the processing of force assume and to provide the stolen information to concerned SI.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0052
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0106
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0056
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0110
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0216
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

The SI that lost the responsibility on a flight following a force-assume will make aware its ATCO that the flight was stolen and by whom.

The SI that gains the responsibility on a flight following a force-assume will make aware its ATCO that the flight was stolen and from whom.

All SIs between the current controlling SI and the SI that forced assumed the flight are informed of the STOLEN information. This is a local processing to make ATCOs aware on these SIs. So it is not reflected in this document.

4.2.3.3.9 Force Assume Acknowledgement

In case the flight is force-assumed, the former controlling SI informs the new controlling SI that it agrees the force assume

[REQ]

Identifier	REQ-18-02b-TS-COTR.0111
Title	Force Assume acknowledgement
Requirement	The SI that lost the responsibility on a flight following a force-assume shall be able to declare it agrees with the loss of responsibility and acknowledge the stolen information in the FO.
Status	<Validated>
Maturity Level	TRL6
Rationale	ICD note: the acknowledgement is sent by using the <code>srv_acknowledge_force_assume</code> service.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0053
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

[REQ]

Identifier	REQ-18-02b-TS-COTR.0120
Title	Force Assume acknowledgement processing
Requirement	Upon receipt of the force assume acknowledgement from the SI that lost the responsibility on a flight following a force-assume, the FDMP shall reflect the acknowledgement in the FO.
Status	<Validated>
Maturity Level	TRL6
Rationale	ICD note: the attribute <code>stolenStatus</code> is changed to <code>ACKNOWLEDGED</code> in the entry of the control sequence that corresponds to the one that has lost the flight.
Category	<Interoperability><safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0053
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

4.2.3.3.10 Undo Force-Assume

Editor's note. The Undo Force-Assume capability is not in scope of this technical specification (Cf G.3 for more details).

4.2.4 SSR Code Management

The following SSR codes are shared through the FO:

IOP Assigned SSR Code (IOP_ASSR)	<p>The SSR code instructed to the aircraft by a controlling IOP Unit (the controlling one or a previous controlling one).</p> <p>There is only one IOP_ASSR common for all IOP Units.</p>
IOP Current SSR Code (IOP_CSSR)	<p>The SSR code broadcast by the aircraft and received by the controlling IOP Unit</p> <p>There is only one IOP_CSSR common for all IOP Units at any one time.</p> <p>In nominal cases, the IOP_CSSR equals the IOP_ASSR.</p>
IOP Following SSR Code (IOP_FSSR)	<p>This is the SSR code that is planned to be assigned to the aircraft after the IOP_ASSR. The sharing of this code gives no information about which SI will be responsible to request the pilot to change code. There's only one IOP_FSSR common for all IOP Units. This code, with the TSSR, covers the operational concept of NSSR.</p>
IOP Transfer SSR Code (IOP_TSSR)	<p>The SSR Code with which the aircraft is going to be transferred to the receiving IOP Unit. There is one IOP_TSSR per coordination. This code, with the FSSR, covers the operational concept of NSSR.</p>
IOP Downstream SSR Code (IOP_DSSR)	<p>The SSR code that each receiving IOP Unit plans to give to the aircraft once controlling it.</p> <p>The IOP_DSSR of an IOP Unit could be blank if the IOP Unit doesn't plan to give a specific SSR code to the aircraft and expects to maintain the IOP_TSSR (if any, otherwise the IOP_ASSR) in his airspace. On the other hand, there could be as many IOP_DSSR as expected controlling IOP Units. The IOP_DSSR of an IOP Unit can be flagged as "requested" when its transferring IOP Unit wants him to provide it.</p>

4.2.4.1 IOP_ASSR Code Management by FDMP

This section describes the way the FDMP manages the IOP Assigned SSR Code.

[REQ]

Identifier	REQ-18-02b-TS-SSRC.0012
Title	IOP Assigned SSR Code Management by the FDMP
Requirement	The FDMP shall maintain updated in the FO IOP ASSR Code the SSR code currently assigned to the aircraft, if known.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to ensure a correct management of the IOP_ASSR by the FDMP
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SSRC.0001
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage SSR Code Data

4.2.4.2 IOP_CSSR Code Management by FDMP

This section describes the way the FDMP manages the IOP Current SSR Code.

The sharing of the IOP Current SSR Code (when it is different of the IOP Assigned SSR Code) allows each IOP unit to be aware that according to the FDMP, the flight is not squawking the code that it is supposed to, and which code it is squawking.

[REQ]

Identifier	REQ-18-02b-TS-SSRC.0005
Title	IOP Current SSR Code Management by the FDMP
Requirement	The FDMP shall maintain updated in the FO IOP Current SSR Code, if known.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to state the process to share and change IOP_CSSR Code value in IOP environment; it prevents that every SI can change IOP_CSSR Code value.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SSRC.0003
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SSRC.0009
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage SSR Code Data

4.2.4.3 IOP_FSSR Code Management by FDMP

This section describes the way the FDMP manages the IOP Following SSR Code.

[REQ]

Identifier	REQ-18-02b-TS-SSRC.0010
Title	IOP Following SSR Code Management by FDMP (setting)
Requirement	The FDMP shall maintain in the FO IOP Following SSR Code the next SSR code that will be assigned to the aircraft.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement ensures that only the FDMP manages the IOP_FSSR Code value. This code is mandatory to be filled when the next code is known (It has to be taken into account that the DSSR usage is optional, therefore it will be possible that some systems do not determine FSSR even when the DSSR was

	provided from downstream unit). The sharing of this code dose not means that it is the FDMP that will be asking the aircraft to squawk this new code.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SSRC.0002
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage SSR Code Data

[REQ]

Identifier	REQ-18-02b-TS-SSRC.0017
Title	IOP Following SSR Code Management by FDMP (unsetting)
Requirement	The FDMP shall delete the SSR Code indicated as the FO IOP Following SSR Code once this code has been assigned to the aircraft.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement ensure the correct unsetting of the FSSR Code.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SSRC.0002
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage SSR Code Data

4.2.4.4 IOP_TSSR Code Management

This section describes the way the Transferring SIs manage the IOP Transfer SSR Code at their exit boundary.

The IOP Transfer SSR data is expected to be shared by each control SIs in order to warn the next IOP unit of the code at transfer, and help retention process.

[REQ]

Identifier	REQ-18-02b-TS-SSRC.0014
Title	IOP Transfer SSR Sharing
Requirement	Each IOP SI shall set its own IOP_TSSR for an occurrence at the latest at the initiation of the transfer to its receiving.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to ensure that the receiving is aware on which code to expect the flight. The code is expected to be shared as soon as it is known, without waiting for the initiation of the transfer.

Category	<Interoperability>
----------	--------------------

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SSRC.0002
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage SSR Code Data

4.2.4.5 IOP_DSSR Code Management

This section describes the way the SIs manage the IOP Downstream SSR Code at their entry and exit boundary.

4.2.4.5.1 IOP DSSR Code Request

At every moment while FO live cycle, every transferring SI is able to request to its receiving SI the SSR code that this last unit is going to assign to the aircraft when assume it, trying to assign this SSR code as soon as possible.

[REQ]

Identifier	REQ-18-02b-TS-SSRC.0006
Title	IOP DSSR Code request Management
Requirement	When a transferring SI requires its receiving SI to provide a SSR code to be assigned to the aircraft it shall indicate the request for the IOP DSSR Code
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement specifies the process for a transferring SI to request its receiving SI to provide the IOP Downstream Code
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SSRC.0006
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage SSR Code Data

[REQ]

Identifier	REQ-18-02b-TS-SSRC.0016
Title	IOP DSSR Management by Receiving SI
Requirement	If a request for a Downstream SSR code has been received from the transferring SI, the receiving SI shall advertise the SSR code it intends to use as soon as it is locally known.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement ensures that the receiving SI will be able to provide its own IOP_DSSR Code whenever requested by its transferring SI.

	The receiving SI will provide the IOP_DSSR Code if the SI already knows the value.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SSRC.0007
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage SSR Code Data

[REQ]

Identifier	REQ-18-02b-TS-SSRC.0015
Title	IOP DSSR request answer Management
Requirement	A SI that provides a IOP_DSSR on request of its transferring shall unset the IOP DSSR Code request indication
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement specifies the process to answer an SSR Code to the transferring through IOP_DSSR.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SSRC.0006
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage SSR Code Data

4.2.4.5.2 IOP_DSSR Code assignment

Every receiving unit can request the assignment of the SSR Code, which it plans to assign to the aircraft, to its transferring unit.

[REQ]

Identifier	REQ-18-02b-TS-SSRC.0009
Title	IOP DSSR assignment
Requirement	A receiving SI that requires the assignment of a new SSR Code by its transferring SI shall provide this SSR code to its transferring SI as the IOP_DSSR.
Status	<Validated>
Maturity Level	TRL6
Rationale	The IOP_DSSR in this case is intended to be instructed to the aircraft to squawk before the transfer; normally on request of a receiving partner to enable early correlation.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SSRC.0005
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage SSR Code Data

Once the Transferring Unit receives a Downstream SSR code, this value is set as IOP_DSSR, IOP_TSSR and/or IOP_FSSR under the following conditions:

- the code is set as IOP_DSSR for that transition,
- If the Transferring Unit is controlling the flight, the code is set as IOP_FSSR,
- If the Transferring Unit is going to instruct the code, the code is set as IOP_TSSR

[REQ]

Identifier	REQ-18-02b-TS-SSRC.0013
Title	Positive response to a IOP DSSR assignment
Requirement	When a transferring SI wants to answer positively to an IOP_DSSR assignment request from its receiving SI this transferring SI shall set the IOP_DSSR as its IOP_TSSR
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to allow the transferring SI to confirm that it will instruct the aircraft the proposed DSSR code.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SSRC.0005
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage SSR Code Data

4.2.4.6 Mode S Flight ID Sharing by FDMP

[REQ]

Identifier	REQ-18-02b-TS-SSRC.0011
Title	Mode S Flight ID Sharing
Requirement	The FDMP shall share the Mode S Flight ID and Mode S address when available.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to fully implement Mode S capabilities and share the aircraft call-sign derived from radar tracks.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SSRC.0008
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO

4.2.5 Flight Script Management

4.2.5.1 Flight Script Definition

The Flight Script (FS) is the main piece of information shared by the FDMP to the IOP Stakeholder to help them to compute the aircraft trajectory. The Flight Script contains the following data:

- the “Initial Conditions” data is set by the FDMP to inform all IOP Stakeholders about the aircraft position information used by its TP to generate the IOP Trajectory;
- the “Current Assigned Data” data reflects the current set of tactical instructions/constraints;
- the “Expanded Route” data describes the lateral path of the aircraft as computed by the FDMP after application of all accepted constraints;
- the “List of Constraints” data contains all the vertical, lateral and longitudinal constraints set by the FDMP and the FDCs impacted by the flight. Each constraint is either accepted by the FDMP (and therefore used in the computation of the IOP Trajectory) or rejected by the FDMP (and stored for information or later use).

4.2.5.1.1 FS Scope

The Route Expansion Area includes the 2D projection of the IOP Area.

The FDMP will provide the FO Expanded Route according to the IOP Route Expansion Scope.

FDCs will provide modification to the FO Expanded Route according to the IOP Route Expansion Scope.

As constraints of the List of Constraints in the FO Flight Script and the FO trajectory both reference the FO Expanded Route, they will be also limited by the IOP Route Expansion Scope.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0001
Title	FO Flight Script Scope (FDMP)
Requirement	The FDMP shall consider the IOP Route Expansion Scope as the scope of the FO Flight Script information.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement defines the scope of the FO Flight Script, mainly for the FO Expanded Route and constraints shared on IOP.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0002

<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0161
Title	FO Trajectory Scope (FDMP)
Requirement	The FDMP shall consider the IOP Area as the minimum scope for the FO Trajectory.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement defines the minimum scope of the FO Trajectory, that is the IOP Area.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0002
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO

4.2.5.1.2 FS Initial Conditions

The FS Initial Conditions specifies the 4D position, the ground speed and track or heading of the aircraft used as starting point by the FDMP to calculate the trajectory of the flight.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0002
Title	Update aircraft position in the FO Flight Script
Requirement	<p>The FDMP shall include in the FO Flight Script Initial Conditions :</p> <ul style="list-style-type: none"> • the updated aircraft 4D position that can be either: <ul style="list-style-type: none"> ○ the last overflown point, obtained by projecting the last track position on the Trajectory, with Actual Time Over (ATO) and level, or ○ when the flight has not yet entered the IOP area, a point in the trajectory before or at the entry of the IOP area, with Estimated Time Over (ETO) and level. • the speed and track/heading related to the reported point, when available, and • the aircraft weight, when available.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement instructs the FDMP to share in the Flight Script the aircraft initial position used to compute the IOP Trajectory and specifies what this position is depending on whether the aircraft is inside or outside the IOP area. Note. A change of the track position does not trigger systematically the publication of a new FO. See REQ-18-02b-TS-MECH.0405 and REQ-18-02b-TS-MECH.0406 which defines the position/time thresholds triggering the publication.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO

4.2.5.1.3 FS Current Assigned Data

The FS Current Assigned Data reflect any of the current assigned level, heading, speed, rate of climb/descent values. These values are stored in the FS in executive constraints.

The Current Assigned Data (especially in case they have been assigned by the upstream controller) are useful information for the next controller.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0003
Title	Updating the Current Assigned Data in the FO Flight Script
Requirement	The FDMP shall maintain in the FS Current Assigned Data the current applicable clearances, when available, for: <ul style="list-style-type: none"> • Cleared Flight Level, • Cleared Speed, • Cleared Heading, • Cleared Direct, • Cleared Holding, • Cleared VRCD, • Cleared Offset, and • Weather avoidance.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement instructs the FDMP to share in a specific data block of the Flight Script the current cleared instructions followed by the flight crew.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0034
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0035
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO

4.2.5.1.4 FS Expanded Route

4.2.5.1.4.1 Introduction to Expanded Route

The FO Trajectory is computed on top of the 2D shape of the FO Expanded Route and may have a smaller extension, that is the IOP Area scope.

It initially results from the expansion of the ICAO field 15c.

It contains the departure and destination aerodrome identifiers (if applicable), a set of route points that can be Published Significant Points (named points) or Geographical Points (points defined by their lat/long) derived from:

- the ICAO F15c route on creation and update of the SFPL,
- the expansion of airways portions or standard procedures (SID, STAR, Instrument Approach Procedure and Missed Instrument Approach Procedure) as intermediate point among procedure legs,
- any accepted route change specified by a set of Published Significant Points and/or Geographical Points, or
- specific points modifying the original 2D path, e.g. the immediate Application Point of an open heading (or a go-offset), and the related re-join starting position as shown in **Figure 11**.

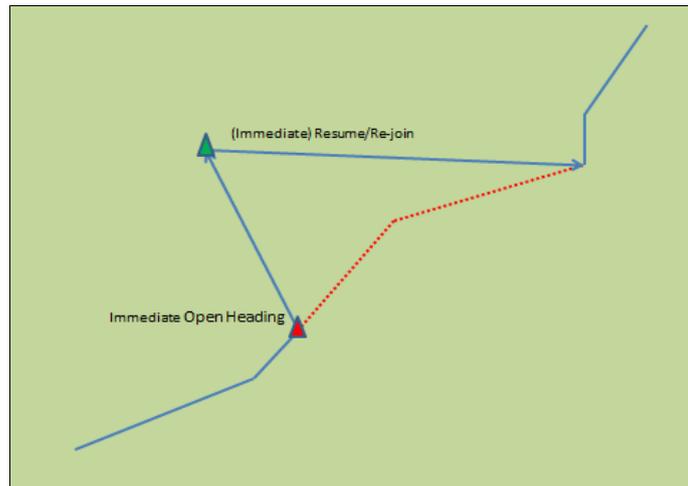


Figure 11: Expanded Route in case of route change

The FO Expanded Route might include some items unknown in the FDMP adaptation data. These unknown items can include portion of ICAO F15c or Flight Plan data such as ADEP, SID, airway or fix name, STAR, IAP, or ADES. Any IOP Stakeholder having information for those items in its adaptation data will contribute to substitute an unknown item with known Expanded Route Points, and, if any, still a reduced unknown item.

The Expanded Route may contain also some “route across” points, which represent expanded route points that have been removed due to a route change. Those points are kept for information, with “route across” tagging, and not considered for the processing of the 2D path of 4D trajectory.

The Expanded Route points also include, when applicable:

- the indication of the applicable Flight Type (GAT/OAT), indicating the Flight Type in force from this point until the next point including a Flight Type indication,
- the indication of the applicable Flight Rules (IFR/VFR), indicating the Flight Rules in force from this point until the next point including a Flight Rules indication,
- the Cruising Speed and Cruising Level values derived from ICAO item 15(a)/15(b), Speed Level Groups included in ITEM 15(c), both from the initial flight plan and from route amendments,
- STAY indicators, derived from the initial flight plan reference route and from route amendments,
- the geographical position of the point,
- an expanded route point identifier unique for the FS,
- the indication that an expanded route is representing an aerodrome. Indeed, it is necessary to identify the aerodromes on the expanded route that remains on it, but not being the ADEP nor the ADES (e.g.: after a missed approach),
- the indication that an expanded route is representing an across point, which is a point not constraining the 2D trajectory but only present for informative reason,
- the origin of the point (airway, significant point, SID, STAR, ADEP, ADES, Instrument Approach Procedure, Missed Instrument Approach Procedure), and

- the indication that the point has been impacted by a route amendment that is not yet cleared to the flight crew.
- the linkToNext it is a mandatory attribute. The “linkToNext” attribute identifies the way (procedure/mode) a pair of route points are connected between themselves (either by DCT, SID, AIRWAY, STAR, IAP, MAPP or UNKNOWN), plus the name of the procedure they belong to, if any, in order to help the FDPs systems to assess correctly those portions of the expanded route in their internal computations. The “linkToNext” is completely independent from the “routePointOrigin” of each pair of route points, meaning that their procedure/mode linkage could be different from both their origin. e.g.: A (routePointOrigin: SID01) connected to B (routePointOrigin: AIRWAY04) via linkToNext(DCT). When a SI creates or modifies the expanded route it will be responsible for establishing these links and the maintenance of them. This attribute only determines the link established between two points by the SI that has created/updated that portion of the expanded route. Link to next usage:
 - In creation: The points shall be linked in the FO according to the SI that was responsible for the expansion of those procedures.
 - Upon update: The SI that is modifying the route will be responsible to establish the new links of the updated portion of the expanded route.

The values assigned to the LinkToNext attribute will be provided as follow:

- DCT: when the connection with the following point is a direct segment that is considered as not belonging to any predefined procedure.
- SID, AIRWAY, STAR, IAP, MAPP: when the connection with the following point is considered to be following a predefined procedure. In these cases, the name of the procedure is also indicated.
- UNKNOWN: When the connection with the next route point does not belong to any of the above categories. It includes the following cases:
 - The next element of the route is an unknown item, or when the FO Expanded Route is truncated and followed by another FO Expanded Route segment.
 - When there is Holding or Stay with and exit different from the entry, the entry point will be connected with the UNKNOWN keyword with the exit.

The Flight Type, Flight Rule, Cruising Speed and Cruising Level values derived from switches in the Reference Route, may be moved on other points of the FO Expanded Route due to the capability managing the IOP Route Expansion Scope.

The Expanded Route is defined as a sequence of Route Elements. Each Route Element is either a Route Point or an unknown item.

In order to allow a non-ambiguous identification of the points, each route point is given a unique identifier based on the SI identifier as follows:

- upon create/modification SFPL/FO, the FDMP assigns a unique route ID based on the FDMP identifier,

- upon acceptance of a route modification requested by an FDC or the FDMP, the FDMP assigns a unique route point ID based on the FDC or FDMP identifier.

This identification scheme allows at any time to relate any point in the Expanded Route to the SI.

On any route change from local stimulus or acceptance of a FDC route change request, the FDMP will update in the FO Flight Script the horizontal path of the trajectory using a set of expanded route points.

Route across points in the FO Expanded Route

As mentioned above, the FO Expanded Route may contain “route across” points.

They are shared “for information”, identified by a “route across” tag. They have the same attributes of any other route point, but are not “real” route points, and do not constrain the processing of the 2D path of the flight. It means that these points are not suitable to be reference expanded route point for constraint points AP/TSP/TEP. Any route points set as “Across Point” is usually not suitable to be the start/end point of a route change, but this is not mandatory, with the following meaning.

When a start point of a route change is an “Across Point”, the real start point of the route change is the first not across point before the provided one. When an end-point of a route change is an “Across Point”, the real route change end-point is the first not across point after the provided one.

The “information” that these points represent is mainly of two kinds:

- a. They existed in a previous version of the FO Expanded Route, removed from the “real” FO Expanded Route because of a route modification. They remain, as not “real”, “across”, points to remind which the previous route was. An information that helps reminding the original flow. Usually, further route modification including “across points” would clean old “across” points, but this is not mandatory.
- b. They are points belonging to an airway including two consecutive FO Expanded Route points, not consecutive in the definition of that airway itself. They are added between the two consecutive FO Expanded Route points, to remind that the airway is an alternative to the direct connection between those two points.

4.2.5.1.4.2 Managing the Expanded Route

The scope of the route used by different systems that belong to the IOP network may be basically quite variable, due to local requirements and needs.

Some systems might expand and use the whole route of a flight, as much as possible according to local adaptation data, from ADEP to ADES, some other might expand the whole route, as much as possible according to local adaptation data, but use and maintain locally only a portion of it, e.g. a quite wide portion of it including their own AOI.

Nevertheless, the FO Expanded Route shared on IOP needs to be synchronized among all the different IOP Stakeholders, as comparing the local expanded route of any receiving system and the shared FO Expanded Route must be a simple and precise processing, that should easily allow identifying any route modification applied by the IOP Stakeholders crossed by the flight.

Regarding the expansion in the FO of the airways and other standard procedures (SID/STAR/AIRWAY/MAPP/IAP), each one of them needs to be treated by all IOP stakeholder as a dynamical set of point connected by the “linkToNext” attribute instead of a whole unchangeable structure. The composition commonly shared as part of the standard procedure may be altered by the SIs that are modifying the expanded route.

The same rules applicable for updating the expanded route will apply to these particular portions of the route. That is, once expanded by a SI in the FO route, each IOP stakeholder should have the means to manually add, delete or perform DCTs within their limits as in any other part of the expanded route while still being considered standard procedures. The “linkToNext” attribute will define the way the aircraft will be crossing between points (via the same standard procedure or DCT). E.g.: DCT from STAR point S1 to STAR point S3 linked as DCT; DCT from STAR point S2 to STAR point S4 linked as STAR; new point X1 added between STAR point S7 and AIRWAY point A1 linked as STAR (or DCT) from S7 to X1 and DCT (or AIRWAY or even STAR) between X1 and A1.

Therefore, no IOP stakeholders should automatically amend those edited procedures due to internal misalignments with their local adaptation data.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0164
Title	Connection between the Expanded Route Points management.
Requirement	Any SI expanding or updating any portion of the Expanded Route shall connect the points belonging to that portion according to local SIs rule.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirements instruct the need to link every Expanded Route point by means of the “linkToNext” attribute with its subsequent point, if any.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0046
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0047
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFlightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0165
Title	Assignment of Expanded Route Point Origin.
Requirement	Any SI expanding or updating any portion of the Expanded Route shall assign the origin attribute of any added route point according to local SIs rule.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirements instruct the need to keep unchanged the origin attribute of any expanded route point once assigned by the SI that added it, on first route expansion or subsequent route modification.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0047
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

The best way to synchronize the FO Expanded Route of all IOP Stakeholders is identifying a common scope for its sharing.

This common scope is named **IOP Route Expansion Scope**.

The Route Expansion Area need to include the IOP Area, as the IOP Area is identified as the union of the AOIs of all the IOP Stakeholders.

As the route is a 2D geodetic polyline, the Route Expansion Area is a 2D polygon.

To minimize that risk of re-entrances of the FO Expanded Route respect to the Route Expansion Area, the 2D polygon will be convex.

The Route Expansion Area will include all AORs/AOIs of the IOP Stakeholders, and due to its convex nature, it will include also some other non IOP AORs/AOIs.

Any SI responsible to create the FO will expand the IOP route in the IOP Route Expansion Scope, using known points, and in case keeping some unknown items.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0143
Title	FO Expanded Route scope (FDMP)
Requirement	The FDMP shall publish the FO Expanded Route being exactly the portion of the expanded route from the first known and not across point before entering the Route Expansion Area, or known ADEP internal to it, to the first known and not across point after exiting the Route Expansion Area, or known ADES internal to it.
Status	<Validated>
Maturity Level	TRL6
Rationale	Unknown items are not explicitly mentioned here, but they are already managed in another sections of this TS for Flight Script management. Known and not across means that the first FO Expanded Route point is a “real” point, that can be used for trajectory processing. Know ADEP/ADES internal to the Route Expansion Area refers to the case the flight starts/ends within the Route Expansion Area, so not respectively inbound/outbound to it.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b

<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO

Any IOP system receiving the FO Expanded Route, that may of course include route modifications, will be able to apply it on a corresponding portion of its local expanded route.

Not only the IOP Stakeholder having FDMP role will share the FO Expanded Route within the IOP Route Expansion Scope. Also FO service requests to modify the route will be constrained to be within the same scope.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0144
Title	Modify route scope (FDC)
Requirement	Any IOP Stakeholder shall request to modify the route only within the IOP Route Expansion Scope.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement applies to IOP Stakeholders being FDC, but also FDMP. Details about the IOP Route Expansion Scope for FO service requests to modify route are the same than those for the FO Expanded Route. Route modification local to an IOP Stakeholder, translated in FO service requests to modify the route, will be limited to the IOP Route Expansion Scope too. ICD note: The modification of the first point before entering the Route Expansion Area and/or of the first point after exiting the route expansion area will have respectively no "from IOP Route Point ID" and/or no "to IOP Route Point ID".
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0047
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

Any IOP system will accept resolutions within the IOP Route Expansion Scope for:

- unknown items substitution with one or more known points

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0004
Title	Updating the Expanded Route (FDMP)
Requirement	On any accepted route change, the FDMP shall update the Expanded Route of the FO Flight Script to reflect those changes.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement instructs the FDMP to reflect in the Expanded Route data block of the Flight Script any applicable route change.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0047
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0048
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0066
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0074
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0125
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0212
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0208
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0061
Title	Creating/updating the Expanded Route (FDMP)
Requirement	<p>When creating or updating the route, the FDMP shall:</p> <ul style="list-style-type: none"> • insert in the Expanded Route field of the FO Flight Script, one or more of the following items: <ul style="list-style-type: none"> ○ Departure and Destination Aerodrome Points, ○ Published Significant Points and Geographical Points from the F15c route, including expanded airway portions, having optional attributes of Flight Type (OAT/GAT), Flight Rules (VFR/IFR), Cruising Speed/Cruising Level values, STAY indicators, derived from ICAO item 15, associated to those points. ○ Published Significant Points from the expansion of airways and Standard Procedures (SID, STAR, Instrument Approach Procedure and Missed Instrument Approach Procedure), ○ Geographical Points used to modify the original 2D path, ○ Geographical Points derived from Range and Bearing points, ○ Points resulting from the re-assessment of points in case of route amendment (Published Significant Points or Geographical Points), ○ Route Across Points, ○ Unknown items from the flight plan route, and • indicate for each point when applicable the origin of the point. • Indicate for each point whether it has been cleared or not.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement identifies all the route elements that the FDMP must include in the Expanded Route data block when the route is created from the filed flight plan and then modified. In this requirement references to ICAO Item 15 or F15c apply to any filed route, for any message protocol, format, or manual input.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0004
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0005
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0009
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0025
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0026
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0066
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0074
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0139
Title	Cleared route indication setting
Requirement	Any SI performing a route amendment shall set on the expanded route points of the new route portion, whether the route change has been cleared to the flight crew.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement instructs any SI performing a route amendment to provide indications about which portions of the route amendment has not yet been cleared to the pilot. The indication is set on any expanded route point of the amended route as the system might have already cleared the route amendment.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0105
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0106
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0209
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0140
Title	Cleared route indication un-setting
Requirement	Any SI clearing to the flight crew a route portion shall unset on the expanded route points belonging to the cleared route portion the indication that the route change was “not yet cleared”.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement instructs any SI performing the clearance of a route portion to the flight crew to provide indications that all points of that route portion have been cleared, resetting the “not yet cleared” indication for all involved points.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0106
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0209
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0106
Title	Expanded Route point identifiers
Requirement	Any IOP Stakeholder creating or adding a point in the expanded route shall univocally assign it a route point identifier shared within a FO Flight Script including: <ul style="list-style-type: none"> • a unique identifier for their SI, • a unique local numeric expanded route point identifiers for a given flight, never re-using any local numeric point identifiers in case of removed and new added points.
Status	<Validated>
Maturity Level	TRL6
Rationale	Expanded route points must always have a unique and never re-used route point identifier within the same flight.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0066
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0047
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0115
Title	Flagging SID and STAR modification
Requirement	On any route change impacting expanded route points derived from a SID or a STAR, the affected procedure shall be set “incomplete”.
Status	<Validated>
Maturity Level	TRL6
Rationale	The impacted SID or STAR will be set “incomplete” respectively in the Departure or Arrival cluster.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0005
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

4.2.5.1.4.3 Impact of Route Expansion Area on the FO Flight Script

The Route Expansion Area impacts the FO Expanded Route but also some other information included in the FO Flight Script, such as the shared constraints and the switches derived from the reference route.

The following information included in the reference route, corresponding to the ICAO flight plan fields 15 (a/b/c), and field 8, have to be taken to the FO Expanded Route and maintained upon route updates.

- RFL
- Cruise SPEED
- Flight type (Civil or Military)
- Flight rules (IFR or VFR)

This information is inserted in the FO Expanded route by associating the applicable values on the first point of any of the FO Expanded route segments, identified according to the IOP Route Expansion Scope.

These four values on the first point of each FO Expanded route segment are mandatory, and can be pure values, or values with a switch indicator.

After the first point of any FO Expanded route segment, the following FO Expanded Route points will only bear values with a switch indicator.

The switch indicator is set when the corresponding value derives from a switch existing in the reference route, maintained or added upon route updates.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0145
Title	FLIGHT_PLAN constraints at first Expanded Route point
Requirement	In case the first point of any FO Expanded Route segment falls before entering the Route Expansion Area, this point shall be the reference point for the AP of the former last applicable RFL and CRUISE_SPEED switch, or initial values, whose related point is not part of the FO Expanded Route.
Status	<Validated>
Maturity Level	TRL6
Rationale	At least RFL and CRUISE_SPEED FLIGHT_PLAN constraints need to be shared with AP having reference point the first point of any FO Expanded Route segment before entering the Route Expansion Area. “be the reference point for the AP” means that the AP will be that point or a positive distance from that point.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0009
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0160
Title	Flight Plan information at first Expanded Route point
Requirement	The first point of any FO Expanded Route segment shall include the applicable values at that point for: <ul style="list-style-type: none"> - RFL - Cruise Speed - Flight Type (GAT / OAT) - Flight Rules (IFR / VFR) and related switch indicators when the values are derived from a switch in the reference route exactly on that first point
Status	<Validated>
Maturity Level	TRL6
Rationale	It is needed to know the initial values of the four flight plan information at the first point of any FO Expanded Route segment
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0009
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0162
Title	Flight plan information at the points following the first Expanded Route point
Requirement	Route points following the first point of a FO Expanded Route segment shall include values and related switch indicators for: <ul style="list-style-type: none"> - RFL - Cruise Speed - Flight Type (GAT / OAT) - Flight Rules (IFR / VFR) whenever any route point bears a flight plan switch in the reference route
Status	<Validated>
Maturity Level	TRL6
Rationale	It is needed to set values and related switch indicators on any route point of a FO Expanded Route segment following the first one
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0009

<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

A time-space discontinuity indicator is set among two contiguous FO Expanded Route segments included in the FO Expanded Route.

In case of two contiguous FO Expanded Route segments having a time-space discontinuity indicator among them we are in the case of a “re-entrant route” in the IOP Route Expansion Scope.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0163
Title	Time-space discontinuity among contiguous FO Expanded Route segments
Requirement	Whenever the FO Expanded Route includes contiguous FO Expanded Route segments, the last route point of any former FO Expanded Route segment shall have a time-space discontinuity indicator set.
Status	<Validated>
Maturity Level	TRL6
Rationale	It is needed to indicate whether a FO Expanded Route segment ends, when followed by another FO Expanded Route segment, representing a re-entrant segment of the FO Expanded Route in the IOP Route Expansion Scope.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0009
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

4.2.5.1.4.4 Overflow Points in Expanded Route Management

Any system may need that the overflow part of the flight, local overflow trajectory and overflow crossed responsibilities list, is not modified.

In IOP the change that can impact the overflow portion of the flight is the change of the FO Expanded Route.

Local surveillance data source might be slightly misaligned among the IOP Stakeholders crossed by a flight, so FDMP and FDCs might have different local view on overflow portions of the flight.

The FDMP will distribute the Last Overflow FO Expanded Route Point (FDMP-LORP).

FDCs will locally consider the FDMP-LORP, and will not request route changes before the FDMP-LORP.

If an FDC has a local last overflow route point onward respect to the FDMP-LORP, any request to modify route points, before its last overflow route point, received in the FO Expanded Route will need to be locally managed.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0149
Title	Last Overflown Point (FDMP)
Requirement	The FDMP shall publish the Last Overflown FO Expanded Route Point.
Status	<Validated>
Maturity Level	TRL6
Rationale	FDMP will publish its own last overflown route point as the overflown reference for all systems.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0150
Title	Route change after Last Overflown Point (FDC)
Requirement	FDCs shall request route changes only impacting the FO Expanded Route after the Last Overflown FO Expanded Route Point of FDMP.
Status	<Validated>
Maturity Level	TRL6
Rationale	FDCs will respect the Last Overflown FO Expanded Route Point published by FDMP, being the overflown reference for all systems. FDCs will never modify the route before that overflown reference for all systems.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0047
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0208
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0155
Title	Preserving the Last Overflown FO Expanded Route Point published by FDMP
Requirement	On FDMP role handover, the new FDMP shall publish a modified Last Overflown FO Expanded Route Point only if it is after the Last Overflown FO Expanded Route Point currently present in the FO.
Status	<Validated>
Maturity Level	TRL6
Rationale	When an FDC takes the FDMP role, it will preserve the already published Last Overflown FO Expanded Route Point by the former FDMP.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0047
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO

4.2.5.1.5 FS Constraints

4.2.5.1.5.1 Introduction to Constraints

The FO Flight Script contains an ordered list of constraints that characterize the vertical, lateral (e.g. heading) and longitudinal information used to calculate the trajectory (levels, speed or time at a given location).

Rules are defined to allow the IOP Stakeholders understanding the same way the constraints shared in the FO Flight Script. However, as the IOP stakeholders use those constraints through different Trajectory Prediction (TP) engines and performance data bases, the resulting trajectories computed by the IOP Stakeholders might be slightly different.

Constraints represent the purpose of its owner regarding the planned trajectory of a flight. These intentions are ruled by each system needs and internal operational procedures.

The information included in the Flight Script constraints is complete to understand the constraint owner intention. Nevertheless, different strategies used in the local systems may prevent the FDMP to respect the owner intention when computing the trajectory.

Whenever the trajectory computed by the FDMP does not respect the constraint owner intention, then the owner will have to correct the impact of the trajectory in the coordination and control sequence data in the FO as described in the corresponding sections. The correction is transparent for the controller.

4.2.5.1.5.2 Constraint Attributes

4.2.5.1.5.2.1 Introduction to Constraint Attributes

Constraints are defined by:

- “non-variable attributes” specified at the creation of the constraint by an FDC or the FDMP and that can never be modified; and

- “variable attributes” that can be modified by the FDMP, the FDCs and/or the constraint owner during the lifetime of the constraint under certain conditions.

The constraints attributes are described in section 4.2.5.1.5.2.

Table 16 identifies the non-variable and variable attributes and specifies under which conditions and by which authorized SI the modification of a constraint is allowed.

	Attribute Name	Who can modify the attribute	When can the attribute be modified	Comment
Non-variable attributes	Constraint Identifier Strategic Constraint Identifier Constraint Owner Constraint Type Constraint Category Constraint Origin Relevant Points Identification Non variable target values (Table 19) Coordination Data references s immediate flagLevel Constraint Maintenance (by time/distance/constraint) Strategic constraint mode (CLIMB/DESCEND/CRUISE) Level Constraint ‘Reach Mode’ (FORCED/TENTATIVE/BEST EFFORT) Level constraint ‘Level Change Mode’ (ASAP/ALAP)	Nobody	Never	These attributes cannot be changed by anyone at any time. A new constraint must be created if needed. The FDMP rejects the constraint modification.
Variable attributes	Linked constraint reference Constraint correction tag (CORRECTED)	Constraint owner only	At any time	
	Computed AP, TSP, TEP Constraint Status (accepted rejected (reason))	FDMP only	At any time	
	Variable target values (Table 19) AP, TSP, TEP value Handling (CLOSE/OPEN) Strategic Constraint Status (ACTIVE/INACTIVE) Last updating SI	FDMP or FDC	If constraint is not CORRECTED or If constraint is CORRECTED and the modification is a result of a route change or a manual input	FDMP checks the constraint correction tag before modifying the constraint
		Constraint Owner	At any time	

Table 16: Identification of Variable and Non-Variable Constraint Attributes

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0006
Title	Non modifiable constraint attributes
Requirement	Upon receipt of a request from an FDC to modify an existing constraint identified by its constraint identifier, the FDMP shall reject that request if it modifies one of the non-variable constraint attributes identified in Table 16.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement requires the FDMP to perform additional checks when receiving a request to modify an existing constraint to ensure that the issuer does not attempt to modify non-variable attributes.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0062
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

4.2.5.1.5.2.2 Constraint 'Type' Attribute

The constraints defined in IOP are specified in Table 17. The constraint dimension, i.e. the unit of the Target Value, is provided for each constraint. IOP Stakeholders can support a locally-defined subset of this list.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0076
Title	Constraint Types
Requirement	When it needs to share a constraint, the IOP Stakeholder shall create or request to create in the FO Flight Script the associated constraint as defined in Table 17.
Status	<Validated>
Maturity Level	TRL6
Rationale	This generic requirement is created to identify all the constraints that are made available in the Flight Script. It clearly makes optional the support and the use of these constraints by each IOP Stakeholder. This requirement is associated with the definition of the list of constraints in the ICD model.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0046
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0047
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0074
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0092

<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0094
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

	Constraint Type	Description	Dimension
Level Constraints	CFL	Cleared Flight Level (Clear, Climb, Descent) Flight Level or Flight Level Band at or to which an aircraft is authorized to proceed under conditions specified by an ATC Unit.	Level
	ECL	En-route Cruising Level Constraint The target level of the flight during a significant part of the flight. <u>Note 1.</u> The ECL constraint is also used in the FO Flight Script to reflect Requested Flight Level(s) (RFL) defined in the Flight Plan and in the Flight Plan route as Speed/Level Groups. <u>Note 2.</u> There may be multiple en-route cruise levels associated to different portions of the route.	
	TFL	Transfer Flight Level Constraint Flight level or Flight Level Band at which a flight is planned to be cleared on transfer from the current responsibility to the next responsibility. From the upstream SI, the TFL is an Exit Flight Level (XFL). From the downstream SI, the TFL is an Entry Flight Level (EFL). The TFL can be complemented with a Supplementary Flight Level (SFL). TFL constraints are only required whenever they are needed to modify the flight trajectory. That is, a TFL coordination agreement that is not expected to influence the trajectory profile does not require inserting a constraint.	
	Strategic Level	Level constraint resulting from off-line defined restrictions and default level coordination constraints.	
	Planning Level	Level constraint resulting from level ATC planning constraints (FMP, EAP, etc.).	
	Tactical Level	Level constraint derived from ATCO input. An altitude constraint is a tactical input which requires the pilot to be within a level window over a point.	
Speed Constraints	ECS	En-route Cruise Speed constraint, from flight plan route (Speed/Level group) or flight plan data.	Speed
	Strategic Speed	Speed constraint resulting from off-line defined restrictions, e.g. ATC speed constraints or default speed constraints from SIDs/STARs.	
	Planning Speed	Speed constraint resulting from planning restrictions (Integrated Network management and ATC Planner (INAP), AMAN, etc.).	
	Tactical Speed	Speed constraint derived from an ATCO input e.g. assigned speed, the current speed clearance which has been passed and acknowledged by the pilot, the speed restriction coordinated among adjacent SIs.	

	Constraint Type	Description	Dimension
VRCD Constraints	Strategic VRCD	Vertical Rate Of Climb/Descent 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.	Rate of Climb/Descent
	Planning VRCD	Vertical Rate Of Climb/Descent constraint resulting from planning restrictions (Integrated Network management and ATC Planner (INAP), AMAN...).	
	Tactical VRCD	Vertical Rate Of Climb/Descent tactical constraint derived from ATCO input, e.g. assigned vertical rate, the current vertical rate instruction which has been passed and acknowledged by the pilot, or the VRCD coordinated among adjacent SIs.	
Gradient Constraints	Gradient	Constant slope constraint requesting the aircraft to climb or descent along a vertical view straight line. It is an enhanced case of the VRCD constraint.	
Time Constraint	Planning Time	Time constraint resulting from planning restrictions (FMP, Integrated Network management and ATC Planner (INAP), AMAN, Network Manager Calculated Take Off Time, and/or target times ...)	Time
	Tactical Time	Time constraint (typically "cross position [position] at time [time]") derived from ATCO input (Controlled Time of Arrival/Controlled Time Over).	
Offset Constraint	Offset	Constraint that does not impact the Expanded Route when handling is OPEN. It is given as a lateral offset from the Expanded Route, starting from the given AP. It can be also coordinated among adjacent SIs.	Offset
Heading Constraint	Planning Heading	Heading tactical constraint resulting from planning restrictions	Heading
	Tactical Heading	Heading tactical constraint derived from ATCO input, also coordinated among adjacent SIs.	
Holding STACK & AMA (Aerial Manoeuvring Area) Constraints	Planning Holding	Complex holding constraint, including a Time constraint, and possibly a space and level discontinuity resulting from planning restrictions.	Time
	Tactical Holding	Complex holding constraint, including a Time constraint, and possibly a space and level discontinuity derived from ATCO input.	

	Constraint Type	Description	Dimension
STAY	FLIGHT_PLAN STAY	<p>Flight Plan category STAY constraint that induces a time delay on a point, or among two distinct Entry and Exit Points.</p> <p>E.g. From ADEXP format:</p> <p>'-' "STAY" stayIdent time ((adid adid) (ptid ptid) (adid ptid) (ptid adid)) [ptspeed] [ptrfl]</p> <p>e.g.</p> <ul style="list-style-type: none"> - FURTHRTE BABIT DIMLO STAY1 GRZ ERKIR KOGOL KPT - STAY - STAYIDENT STAY1 - TIME 0025 - PTID DIMLO - PTID GRZ - ADES LSZH 	Duration

Table 17 : Constraint Types

Whenever a constraint type is not supported by a system, it will be stored and shared as a not supported constraint (status: rejected, reason: not supported).

4.2.5.1.5.2.3 Constraint 'Category' Attribute

For each type of constraint, the Constraint Category provides information about the conditions that led to the creation of the constraint. It may be used together with the Constraint Type to identify the exact source of the constraint (e.g. a 'flight plan' RFL is an ECL).

The constraints included in the FO Flight Script can be of one of the following categories:

- **Flight Plan:** These constraints are derived from the original flight plan information (e.g. flight plan RFL).

Flight Plan constraints are created on the filed Flight Plan and any changes made to the flight plan. Note that the FO Flight Plan Cluster is also aligned to the set of Flight Plan constraints, and is then never modified. Once the flight is activated, new constraints can be accepted and invalidate the Flight Plan constraints.

- **Executive:** These constraints reflect controller's orders or clearances given to the flight crew (e.g. CFL).

Executive constraints are always indicated to the flight crew through the use of clearances (voice or data link). Clearances can be either 'immediate' (e.g. CLIMB now) or 'deferred' (e.g. AT time/position/level CLIMB). Immediate clearances start at the actual position of the aircraft, whereas deferred clearances start at the point associated with the AT condition.

- **Planning:** These constraints reflect planner's controller input, e.g. ECL or TFLs.

Planning constraints are not exchanged nor cleared with the pilots but they are negotiated amongst inter- or intra-SI ATCOs and inserted in the local system.

- **Strategic:** These constraints applicable on a flight are selected based on crossed geographical element (aerodrome, published point or geographical area) with further criteria based on flight plan data. A strategic constraint is defined by a target segment or by a point (null segment).

The Strategic Constraints may be used:

- to reflect operational procedures to manage the flow of traffic within an SI or between SIs,
- to reflect airspace use restrictions, such as noise reduction procedures,
- to reflect default coordination constraints as stated in operational Letter Of Agreements (LOAs) between SIs or responsibilities.

Strategic constraints can be defined also on initial climb and final approach portions of route.

Only some of the strategic constraints are shared between System Instances through the Adaptation Data. When not shared (private), those constraints are not defined in the Adaptation Data of different SIs, they are locally managed by the SI as they usually represent ATC restrictions (level, speed, etc.) inside its AoR. Strategic constraints whose definition is shared by different SIs are mainly those contemporary impacting the AOR of more than a unique SI, e.g. those derived by LoAs. Both shared and private strategic constraints are published in the FO Flight Script.

The SIs sharing strategic constraints must have a common understanding on when and how to activate and process these constraints. The applicability rules, the constraint parameters, as well as the off-line defined environment data are maintained for those constraints locally in the System Instances in the 'Adaptation Data' database.

The IOP stakeholder creating a constraint will assign to it the category as per Table 18.

Constraint Category	CFL	ECL	TFL	Level	Cruise Speed	Speed	VRCD	Time	Heading	Offset	Holding	STAY
Executive	✓	-	-	✓	-	✓	✓	✓	✓	✓	✓	
Planning	-	✓	✓		-		✓	✓	✓	✓	✓	
Strategic	-	-	-	✓	-	✓	✓	-	-	✓	-	-
Flight Plan	-	✓	-	-	✓	-	-	-	-	-	-	✓

Table 18 : Possible Category per constraint type

It is not allowed to modify the category of an existing constraint. When a constraint needs to be replaced by another one with a different category, the previous one must be removed and a new one added.

Constraints with Flight Plan category

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0135
Title	Flight Plan Constraints
Requirement	The IOP SI, for each Cruising Level switch, Cruising Speed switch, and STAY indicator included in the Flight Plan Route (ICAO F15 (a), (b), (c)) and in route

	amendment route portions, shall create respectively an ECL, ECS and STAY constraint with Flight Plan category.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement states the need to create ECL, ECS, STAY constraints with Flight Plan category for each Cruising Speed switch, Cruising Level switch, and STAY indicator existing in the ICAO F15, and further route portions provided by any route amendment.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0092
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0094
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

Referring to ECL constraints mentioned by this requirement REQ-18-02b-TS-FSMG.0135, it can be noted that although ECL constraints are created for each filed Cruising Level constraint with Flight Plan category, any system may locally adapt the ECL usage according to local rules within its own AOR.

- An ECL can be de-activated using the “filed-local-usage”, REJECTED / NOT_TO_BE_USED, indication, and
- complemented by additional ECL constraints with Planning category:
 - The entry ECL to a system's AOR, if locally needed, can be overloaded by a Planning ECL with AP near to the system's AOR entry.
 - The exit ECL from a system's AOR can be restored to the initial value of the exit filed ECL level, adding a Planning ECL having that same level, with AP near to the system's AOR exit.

The essential rule for any local processing of ECLs by a system within its own AOR is that the adjacent systems will not be affected by the local ECL re-configuration.

4.2.5.1.5.2.4 Constraint ‘Target Value’ Attribute

At creation time, each constraint is assigned one or more target values:

- The **Main Target Value** (mandatory) provides a quantitative value of the constraint. This value is typically a level, a speed, a vertical rate of climb/descent, a time, a duration, etc. according to the constraint type. The target value can represent a discrete value ([at]) or a band ([at or above]/[at or below]/[band]).
- **Additional target values** (optional) can be complementary to the main target value. For instance, an XFL constraint can be associated with a Supplementary Flight Level (SFL) constraint.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0009
Title	Constraint Target Values
Requirement	An IOP stakeholder creating a constraint or updating its variable attributes shall provide target values as per Table 19.
Status	<Validated>
Maturity Level	TRL6
Rationale	This generic requirement is created to specify the data that needs to be provided by an IOP Stakeholder when creating a constraint. This requirement is associated with the definition of each constraint in the ICD model.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0017
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0019
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0037
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0049
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0051
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0053
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0107
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0086
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0087
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0091
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

Constraint Category	Constraint Type											
	CFL	ECL	TFL	Level	Cruise Speed	Speed	VRCD / Gradient	Time	Offset	Heading	Holding	STAY
Main Target Value												

Level	C ₁	✓	C ₁	C ₁								
Level Band	C ₁		C ₁ [S]	C ₁								
Level qualifier (at, at or below, at or above)	C ₃		C ₃	C ₃								
CFL Type (Climb, Clear, Descent)	✓											
Type of Transition (wall, up/down)			0									
Speed					✓	C ₁						
Speed Band						C ₁						
Speed Qualifier (at, at or less, at or greater, at the lowest, at the highest)						C ₃						
VRCD (value, highest possible) + VRCD Qualifier (at, at or less, at or greater)							C ₁					
Gradient + Gradient Qualifier (at or less, at or greater)							C ₁					
Time Type (CTOT, CTA, CTO, TTA, TTO, EOBT, ETOT, ETA)								0 [V]				
Time								C ₁				
Time Band								C ₁				
Time Qualifier (at, at or later, at or before)								C ₃				
Heading or Track										✓		
Vectoring qualifier (heading or track)										✓		
Point of Resume									0 [V]	0 [V]		
Entry Point											✓	✓
Holding Level											0 [V]	
Exit Point											0	0
Exit Level											0 [V]	
Time to Spend											C ₄ [V]	✓ [V]
Exit time											C ₄ [V]	0 [V]
Offset side (left, right)										✓		
Lateral Offset										✓		
Optional Constraint Parameters												
Level Constraint Change Mode (As soon as possible or As late as possible)		0	0	0								
Constraint Mode (tentative, best effort, forced)			0									
Time for maintenance of constraint	0	0	0	0								

Distance for maintenance of constraint	O	O	O	O								
Next Constraint ID for maintenance of constraint	O	O	O	O			O					
Master constraint ID			O	O			O					

Table 19 : Target Values defined per constraint Type

- ✓ Mandatory
- O: Optional
- C₁ Only one.
- C₂ Mandatory for closed heading constraint
- C₃ Mandatory for a single value, not a band, for Level, Speed, Time
- C₄ At least one must be provided when the handling is closed (for open handling they may be both missing)
- [S] It includes also the SFL.
- [V] It can be modified during its lifecycle (so “variable attribute”).

Offset Constraint

In case of an aircraft being cleared to offset, the FS Expanded Route contains the initial cleared route (the blue route) whereas the constraint specifies the offset (offset distance and offset direction (left/right)).

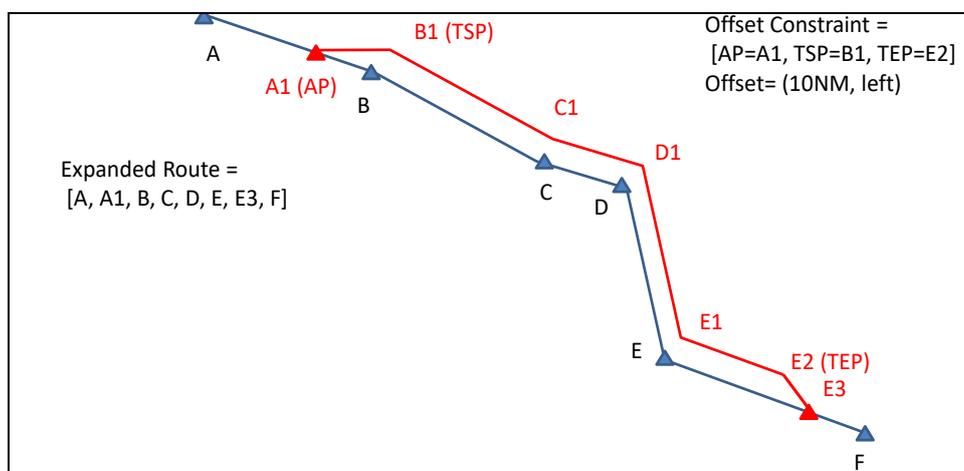


Figure 12: Offset Constraint

4.2.5.1.5.2.5 Constraint Points Attribute

The segment of the route on which the constraint applies is determined by three main points:

- the “**Application Point**” (AP) is the point at which the flight is requested to start the manoeuvres in order to accomplish the constraint;
- the “**Target Start Point**” (TSP) is the point at which the constraint is required to be fulfilled;
- the “**Target End Point**” (TEP) is the point after which the constraint is not applicable any more.

The **Application Scope** of a constraint is the segment between the AP and the TEP.

Two distinct sets of constraint points are associated with the constraints:

- the **“Input Points”** set specifies the AP, TSP and/or TEP points initially computed by the constraint owner.

The three input points are normally all provided by the constraint owner, but this is not always possible for all implementations. However, for level strategic constraint and TFL (wall) constraint, the minimum provision of some of the input points is demanded to ensure the proper interpretation by the remote SIs.

The “Input Point” can be modified by the constraint owner and by any SI under certain conditions (i.e. as long as the constraint modification has not been restricted by the constraint owner, or the modification is forbidden but that modification is the result of a route change or a manual input).

- the **“Computed Points”** set specifies the AP, TSP and/or TEP points as computed by the FDMP when applying the constraint during the trajectory computation. The computed points may differ from the input points depending on the way the constraint is applied by the FDMP.

The provision of the computed points by FDMP is optional.

The “Computed points” are modified any time the trajectory is computed again by the FDMP. They cannot be modified by other SIs.

At constraint creation time, the constraint owner can additionally indicate which of the input AP, TSP, and/or TEP must be considered as main target(s) for the trajectory computation. The “input constraint points” identified as “relevant” are the parameters that give the meaning to the constraint whereas the remaining ones complement the information. Those points are identified as **“Relevant Input Points”**. At least one relevant point must be specified for each constraint.

The identification of the relevant input points is made by the constraint creator at constraint creation time.

The SI that creates a constraint will complement as much as possible the missing input constraint points using its local corresponding calculated constraint points.

For convention, in this document we will no more mention “calculated constraint points” by the constraint owner as a subset of “input constraint points”. We will always use “input constraint points” by the constraint owner, and the additional set of “computed constraint points” by the FDMP.

This rule applies also in case of constraint updates by the SI that owns the constraint.

Following the general optimization rule to limit IOP updates for small changes, “input constraint points” and “computed constraint points” (by the FDMP) are subject to filtering, using shared thresholds, to avoid continuous modification and sharing of constraints.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0010
Title	Constraint Relevant Point Identification (Owner)

Requirement	The IOP stakeholder creating a constraint shall indicate in the constraint at least one relevant constraint point amongst the application point, the target start point and the target end point.
Status	<Validated>
Maturity Level	TRL6
Rationale	<p>This requirement instructs the IOP Stakeholder creating a constraint to explicitly describe how it expects the other IOP Stakeholder to implement the constraint. This requirement specifically addresses the overall IOP objective to allow all IOP Stakeholders to locally create a trajectory that would take into account as much as possible the constraints as experienced by other IOP Stakeholders.</p> <p><i>Note 1. These points are identified as the 'relevant' constraint points.</i></p> <p><i>Note 2: Relevant Constraint Point(s) are indicators that will be set in the constraint upon creation, together with all the available Input Constraint Points (position values), computed by the IOP stakeholder that creates it.</i></p>
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0060
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0151
Title	Constraint Input Points for level strategic constraints (Owner)
Requirement	<p>The IOP stakeholder creating or modifying a level strategic constraint shall provide for segment-based and point-based strategic constraint:</p> <ul style="list-style-type: none"> • the Target Start Point (TSP), and • the Target end Point (TEP), and • the indication whether TSP, TEP or both is relevant, and • optionally, the Application Point (AP) when available.
Status	<Validated>
Maturity Level	TRL6
Rationale	<p>This requirement allows the strategic constraint owner to represent both categories of strategic constraint.</p> <p>TSP and TEP are always included for strategic constraints:</p> <ul style="list-style-type: none"> • When they are equal it is considered a point based constraint, • When they are different, it is considered a segment based constraint. <p>AP is not relevant for strategic constraint although it may be provided to help other systems to identify when the owner of the strategic constraint has started to perform the manoeuvre.</p>
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
--------------	---------------------	------------

<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0060
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0152
Title	Constraint Input Point for TFL(wall) constraints (Owner)
Requirement	<p>The IOP stakeholder creating or modifying a TFL(wall) constraint shall provide:</p> <ul style="list-style-type: none"> • One of the Target Start Point (TSP) or a Target end Point (TEP), and • Optionally, an Application Point (AP) when available.
Status	<Validated>
Maturity Level	TRL6
Rationale	<p>This requirement allows the owner to represent a TFL(wall) constraint. At least TSP or TEP is always included for TFL(wall) constraints. Examples of TFL(wall) usage by receiving systems: Whenever TSP is given by the constraint owner but not the TEP, a local default value for TEP might be used by other SIs.</p> <p>Whenever TEP is given by the constraint owner but not the TSP, the TSP might be considered equal to the TEP locally.</p> <p>AP provision is very helpful to ensure a correct trajectory alignment between the systems, especially for SI traversal sequence computation. For that purpose, all IOP systems will provide this point when available.</p> <p>However, some systems may not always be capable of providing it and such a case will be handled with a default value computed locally by the other systems.</p>
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0060
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0011
Title	Constraint Points Management (FDMP)
Requirement	<p>For each constraint, the FDMP shall include in the FO Flight Script:</p> <ul style="list-style-type: none"> • the indication of which constraint point(s) is a relevant point as indicated at the creation of the constraint, • the input points as indicated at the creation of the constraint, and • the FDMP computed constraint points, for accepted closed constraints, when available.
Status	<Validated>

Maturity Level	TRL6
Rationale	This requirement instructs the FDMP to reflect in the Flight Script the description of the constraint as expressed by the constraint owner (input points) and when possible include in the FO Flight Script the way the FDMP has actually implemented it (computed points).
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0060
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0088
Title	Constraint Input Point Assignment (Owner)
Requirement	The IOP stakeholder owner of a constraint, once assigned any Input Point not defined Relevant Constraint Point of that constraint, shall keep unchanged that Input Point, unless impacted by a route modification.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement instructs the IOP Stakeholder owner of a constraint to minimize the modification of Input Points not indicated as Relevant Constraint Points, keeping those points unchanged once assigned, unless repositioned because of a route modification. This will minimize the constraints updates among Sis.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0060
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

4.2.5.1.5.2.6 Constraint 'Origin' Attribute

The constraint Origin provides information about the way the constraint has been set:

- **MANUAL** when the constraint is triggered following a Controller/Operator input;
- **AUTOMATIC** when the constraint is triggered based on an off-line defined configuration rules (LoAs rules, Strategic Constraints rules);
- **FILED** origin when the constraint is derived by an AFTN or OLDI message;
- **OTHER** when the previous origins are not applicable.

Table 20 lists all possible origins for each constraint type.

Constraint Origin	Constraint Type															
	CFL	ECL	TFL	Strategic level	Planning/Tactical Level	Cruise Speed	Strategic Speed	Planning/Tactical speed	strategic VRCD	Planning/Tactical VRCD	Time	Strategic Offset	Planning/Tactical Offset	Heading	Holding	STAY
MANUAL	✓	✓	✓	-	✓	-	-	✓	-	✓	✓	-	✓	✓	✓	✓
AUTOMATIC	-	-	✓	✓	-	-	✓	-	✓	-	-	✓	-	-	-	-
FILED	-	✓	-	-	-	✓	-	-	-	-	-	-	-	-	-	✓
OTHER	-	✓	✓	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 20 : Possible Constraint Origin per constraint type

- ✓: Can be the origin of that constraint.
 - Cannot be the origin of that constraint

4.2.5.1.5.2.6 Constraint 'Owner' Attribute

The owner of the constraint is the SI allowed to prevent further modification of a constraint it owns in some conditions, and the one stating the status of strategic constraints.

The ownership could be assigned:

- to the requester of the constraint (default case),
- to one of the impacted SIs as defined by bilateral agreement in the LoAs in case of shared strategic constraints, or
- the SI that contains the application point of a Flight Pan constraint according to the constraint creator.

The owner of the constraint is assigned at creation of the constraint.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0080
Title	Constraint Owner
Requirement	<p>The creator of a constraint shall assign an owner to the constraint according to the following rules :</p> <ul style="list-style-type: none"> • for any Executive, Planning or private Strategic constraint, the creator of the constraint, • for any Flight Plan constraint : <ul style="list-style-type: none"> ○ the SI in which is the AP according to the creator, if this SI is IOP-capable, ○ else the first IOP-capable SI following, if any, in the control sequence the instance of the SI in which is the AP according to the creator. ○ else the first IOP-capable SI preceding, in the control sequence the instance of the SI in which is the AP according to the creator. • for any shared Strategic constraint, the off-line defined owner.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement ensures that the constraint is associated to the right owner in case the constraint requester is not the initial owner.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0070
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

4.2.5.1.5.2.7 Constraint 'Identifier' Attribute

Constraints are identified by a Constraint Identifier. The Constraint Identifier identifies the SI that creates the constraint and includes a dynamically assigned number unique to that SI. The owning SI of the constraint may be different from the creating SI in case of shared strategic constraints or constraints with Flight Plan category.

The constraint identifiers provided by all SIs impacted by a Flight Plan and shared within a FO Flight Script will be unique, as:

- the identifiers of all SIs (SI Names) in the IOP Area will be unique,
- the local numeric identifier within each SI will be guaranteed to be unique.

Moreover local numeric identifiers will be never reused in case of removed and new added constraints, to avoid inconsistency of relationships among FO Flight Script constraints and other topics of the FO (this is already expected as a normal local system behaviour).

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0107
Title	Constraint identifiers
Requirement	All IOP Stakeholders contributing to a FO shall univocally assign the constraint identifiers shared within a FO Flight Script by: <ul style="list-style-type: none"> • providing a unique identifier for their SI, according to adaptation data, • providing unique local numeric constraint identifiers for a given flight, and • never re-using any local numeric constraint identifier in case of removed and new added constraints.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement provides general rules to guarantee that constraint identifiers are univocally assigned for a given FO.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0009
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0010
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

In addition to the Constraint Identifier, some constraints may have a constraint name, such as Strategic Constraint Name for strategic constraints (an off-line defined name in the adaptation data), Stay Name for stay constraints (name defined for the specific flight), Holding Name for holding constraints (when holding is off-line defined in the adaptation data).

4.2.5.1.5.2.8 Constraint 'Handling' Attribute

The Constraint Handling attribute is set at the creation of the constraint and can be modified later on by the Constraint Eligible Stakeholders. This attribute has the following meaning:

- **CLOSED** when the constraint has a direct impact on the trajectory and should be used by the FDMP for the IOP trajectory computation;
- **OPEN** when the constraint has no direct impact on the trajectory and should not be used by the FDMP for the IOP trajectory computation.

For instance, a heading constraint or an offset constraint with no clear instruction on how to re-join the agreed trajectory cannot be used for trajectory computation and is included in the FS as an open constraint. Target time constraints are always open constraint. For other time constraint, they are open until they are transmitted to the aircrew and acknowledged.

Time constraints may be used for other needs, often with closed handling.

Both closed and open constraints are included in the constraint list.

Open constraints have the following properties:

- a) an open constraint may deactivate another closed constraint, so it may have an indirect impact on trajectory computation (e.g. an ‘open’ climb CFL may set INACTIVE a ‘closed’ Level Strategic constraint in the overall Climb phase of flight);
- b) Open constraints may contain information useful during the transfer phase (e.g. an upstream open heading);
- c) Open constraints may be managed as ‘closed’ constraints by a downstream system (e.g. an open heading that would need to be closed by a downstream system).

Table 21 represents possible constraint handling attributes assignments, provided for information only, not forcing the systems to its content.

Constraint Handling	Constraint Type																
	CFL	ECL	TFL	Strategic level	Planning Level	Tactical Level	Cruise Speed	Strategic Speed	Planning speed	Tactical speed	Strategic VRCD	Tactical/Planning VRCD	Time	Heading	Offset	Holding	STAY
OPEN	C ₁	-	C ₁	-	-	-	-	-	-	C ₁	-	C ₁	C ₁	C ₁	C ₁	C ₁	-
CLOSED	C ₁	✓	C ₁	✓	✓	✓	✓	✓	✓	C ₁	✓	C ₁	C ₁	C ₁	C ₁	C ₁	✓

Table 21 : Possible Constraint Handling attribute per constraint type

- ✓: Only valid value for that type of constraint.
- C₁: Open or Closed as stated by the constraint owner/eligible stakeholder.
- : Invalid value for that type of constraint.

4.2.5.1.5.2.9 Constraint 'Last Updating SI' Attribute

This attribute identifies the SI which is at the origin of the last constraint change.

This attribute is set to the SI that creates the constraint at its creation and is modified when any variable attribute is modified with the exceptions of the computed points and the constraint status.

It is set in the constraint data by the FDMP when the change is initiated by the FDMP itself or when receiving any `srv_modify_constraint()` service for the addition or the modification of that constraint.

4.2.5.1.5.2.10 Constraint 'Coordination' Attribute

When the constraint is associated with a transition (e.g. a TFL constraint), the two SIs and related occurrences associated with the transition are explicitly identified in the Constraint Coordination attribute. The SIs identified can be either IOP-capable or not.

This attribute is set by the constraint owner at constraint creation time and is never modified.

4.2.5.1.5.2.11 Level Constraint 'Level Change Mode' Attribute

This attribute helps to compute the trajectory but its use is not mandatory. The FDMP / other SIs may disregard it and make their own assumptions on the constraint intention.

It includes the following values:

- **ASAP:** It indicates that the constraint is expected to be reached as soon as the precedent constraint allows it. This attribute can be combined with the AP constraint point in order to provide additional indications about the constraint intention by the owner.
- **ALAP:** It indicates that the constraint is expected to be reached as late as possible. That is, the precedent constraint will be applied as much as possible before moving to this constraint. This attribute can be combined with the AP and/or TSP in order to provide additional indications about the constraint intention by the owner.

This attribute is set by the constraint owner at constraint creation time and is never modified.

4.2.5.1.5.2.12 Level Constraint 'Maintenance' Attribute

This attribute characterizes all kind of level constraints in order to help modelling correctly the trajectory but its use is not mandatory. The FDMP / other SIs may disregard it and make their own assumptions on the constraint intention.

It may be included by the constraint owner to indicate its explicit intention of maintaining the constraint (the flight level at which the aircraft should be flying) until the following active constraint needs to be achieved (according to the owner of the following constraint) or at a given condition (a determined time or distance).

It can be represented in only one of the following forms:

- **By Time:** The time duration by which the constraint has to be maintained.

When a constraint is to be maintained for a time, the trajectory processing will not take into account any non-relevant constraint point of the next level constraint before the requested maintenance time.

- **By ID:** the identifier of the constraint up to which the level constraint has to be maintained.
- **By distance:** the distance by which the constraint has to be maintained.

When a constraint is to be maintained for a distance, the trajectory processing will not take into account any non-relevant constraint point of the next level constraint before the requested maintenance distance.

This attribute is set by the constraint owner at constraint creation time and is never modified.

4.2.5.1.5.2.13 Level Constraint 'Reach Mode' Attribute

The owner of the level constraint may provide additional information on how the level constraint is expected to be computed.

The following values may be included:

- **FORCED:** If the requested Target Level cannot be reached due to aircraft performances, the trajectory is forced to reach anyway the Target Level, with unrealistic performances, if any. Not all systems might be able to apply the FORCED mode to reach the Target Level of a constraint in all flight phases, as FORCED mode may induce vertical steps in the resulting FO trajectory. BEST_EFFORT / Maximum performances would be locally used instead.
- **TENTATIVE:** With economic performances.
- **BEST_EFFORT:** Maximum performances are used to reach the target.

4.2.5.1.5.2.14 Executive Constraint 'Immediate Applicability Flag' Attribute

The owner of an executive constraint indicates whether or not the order at the origin of the constraint was given expecting immediate application (versus 'deferred' application). It is set by the executive constraint owner at constraint creation time, and it is never modified.

4.2.5.1.5.2.15 Strategic Constraints 'Status' Attribute

The strategic constraint is characterized with an additional status attribute:

- **ACTIVE** strategic constraints are taken into account to compute the FO Trajectory,
- **INACTIVE** strategic constraints included in the FO Flight Script are not used to compute the FO Trajectory.

INACTIVE constraints are constraints that are theoretically impacting the flight but are temporarily not applicable for whatever reason (e.g. a non-active military zone).

The SI owner of a strategic constraint, on any context change, local or by IOP, will re-assess if the flight is still impacted by the constraint. When the flight is considered as definitively outside the scope of the constraint, the SI modifies, or requests the FDMP to modify, the Strategic Constraint Status to INACTIVE in the FO Flight Script.

4.2.5.1.5.2.16 Strategic Constraint 'Mode' Attribute

The owner of a strategic constraint indicates in this attribute the way it intends to apply the strategic constraint. This attribute is mandatory for strategic constraints and is not modified once specified by the constraint owner.

The possible values for the Strategic Constraint Mode are:

- **CLIMB:** The owner of the strategic constraint expects it to be fulfilled as soon as possible and the flight is released from this constraint after it reaches the last relevant point.
- **DESCEND:** The owner of these constraints expects to reach the level as late as possible after the previous constraint. The target level is expected to be maintained (the flight should not go to the ECL) until the next constraint AP.
- **CRUISE:** The owner of these constraints expect to reach the level as late as possible and then maintain that level for a while. The maintenance will be determined by an explicit TEP or by the next constraint application point.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0153
Title	Strategic constraints mode
Requirement	The IOP stakeholder creating a level strategic constraint shall provide the strategic constraint mode (CLIMB, DESCEND, CRUISE) attribute associated to that strategic constraint.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement instructs the IOP Stakeholder creating a level strategic constraint to explicitly describe how it expects the other IOP Stakeholders to implement that constraint according to its mode and the previous and next constraints.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0010
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

4.2.5.1.5.3 FDMP FO Flight Script Constraints Ordering

When publishing the FO, the FDMP will include all the constraints in the FS ordering them according to increasing alphanumerical order of their identifiers resulting from the concatenation of the SI stakeholder ID and the numerical identifier translated into a 4-character string.

For instance, the constraints will be ordered as follows: "EBBU0001", "EBBU0013", "EBBU0015", "EDBB0013", "EDBB0015", "EDBB0032", "EDWW0001", "LFBB0007", "LFBB0013", "LFBB0030", "LIMM0001", "LIMM0002", "LIMM0003", "LIMM0004".

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0046
Title	Constraints ordering (FDMP)
Requirement	The FDMP shall order all the constraints in the Flight Script by the increasing alphanumeric order of the concatenation of the SI stakeholder ID string with the numerical identifier translated into a 4-character string, both part of the constraint identifier.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement instructs the FDMP to logically order the constraints in the Flight Script to ease processing of the list by all IOP Stakeholders.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

4.2.5.1.5.4 Constraint Linkage

Editor's note: the Constraint Linkage functionality is not in scope of this Technical Specification (Cf. G.3 for more details).

4.2.5.1.5.5 Constraint Life-cycle

Once a constraint is inserted or changed locally in the FDMP, inserted or changed by an FDC constraint FO service request accepted by the FDMP, the FDMP includes the constraint in the FS with an 'accepted' or a 'rejected' status.

In addition, an ACCEPTED or REJECTED constraint can have a correction status, never present at creation of the constraint. This correction status set to CORRECTED means that the constraint cannot be modified nor removed unless the requester is the constraint owner, the modification/removal is not derived from a manual input or a route change, or the owner of that constraint is not a FDC/FDMP anymore.

ACCEPTED constraints can be assigned a qualifier and REJECTED ones are provided together with a rejection reason as follows:

- **ACCEPTED** means the constraint was used by the FDMP for its computation. Open constraints may fall into this category too as they may have side effect on the trajectory processing. Optionally an acceptance qualifier is provided:
 - No qualifier means the constraint has been fully applied by the FDMP;
 - **NOT_IMPLEMENTED_AS_REQUESTED** means the constraint has only partially been applied by the FDMP, i.e. the way to implement the computed trajectory was not exactly satisfied respect to its relevant constraint points or to the specified constraint handling;

- **REJECTED** is used by the FDMP to indicate in the FS that the constraint has not been used for its computation. Open constraints may fall into this category too independently of their explicit usage for trajectory processing. A reason for rejection is also provided:
 - **NOT_TO_BE_MAINTAINED** is used by the FDMP to indicate that the removal of the constraint has been requested by a SI (or directly by the FDMP) that is not the owner of the constraint, if the owner is still an FDC. It is an indication to that owner to request the removal, if deemed correct.
 - **NOT_SUPPORTED** means that the FDMP does not support this kind of constraint.
 - **NOT_APPLICABLE** means that according to the FDMP, the constraint is not achievable, or inconsistent with other constraints.
 - **NOT_TO_BE_USED** is used by the FDMP to indicate if a flight plan constraint, inserted by itself or from a FDC request, was not used to modify the trajectory computation because of local requirements. If the constraint owner request the use in the trajectory computation of a flight plan constraint that was not used, and the FDMP is not able to do it, the FDMP will reject the constraint again but with the NOT_APPLICABLE rejection reason.

The life cycle of the IOP constraints is explained below.

States:

- 1) *“Void”*: the constraint is not accepted / rejected yet or is deleted. Actions starting in this state are creation and actions ending in this state are deletions.
- 2) *“Accepted”*: the constraint is accepted by the FDMP and published in the FO as accepted. Note that for all the actions ending in this status, if the FDMP computation of the constraint does not reach all the relevant points as requested, the qualifier “not implemented as requested” will be added (, REQ-18-02b-TS-FSMG.0030).
- 3) *“Rejected – not supported”*: the FDMP does not support this type of constraint.
- 4) *“Rejected – not applicable”*: the FDMP considers the constraints as not achievable, or inconsistent with other constraints.
- 5) *“Rejected – not to be maintained”*: the constraint is proposed for removal by an SI not owning the constraint. Only the owner can effectively remove it.
- 6) *“Rejected – not to be used”*: set by the owner of a flight plan constraint that was is not to be used to modify the trajectory computation because of local requirements (only for flight plan constraints).

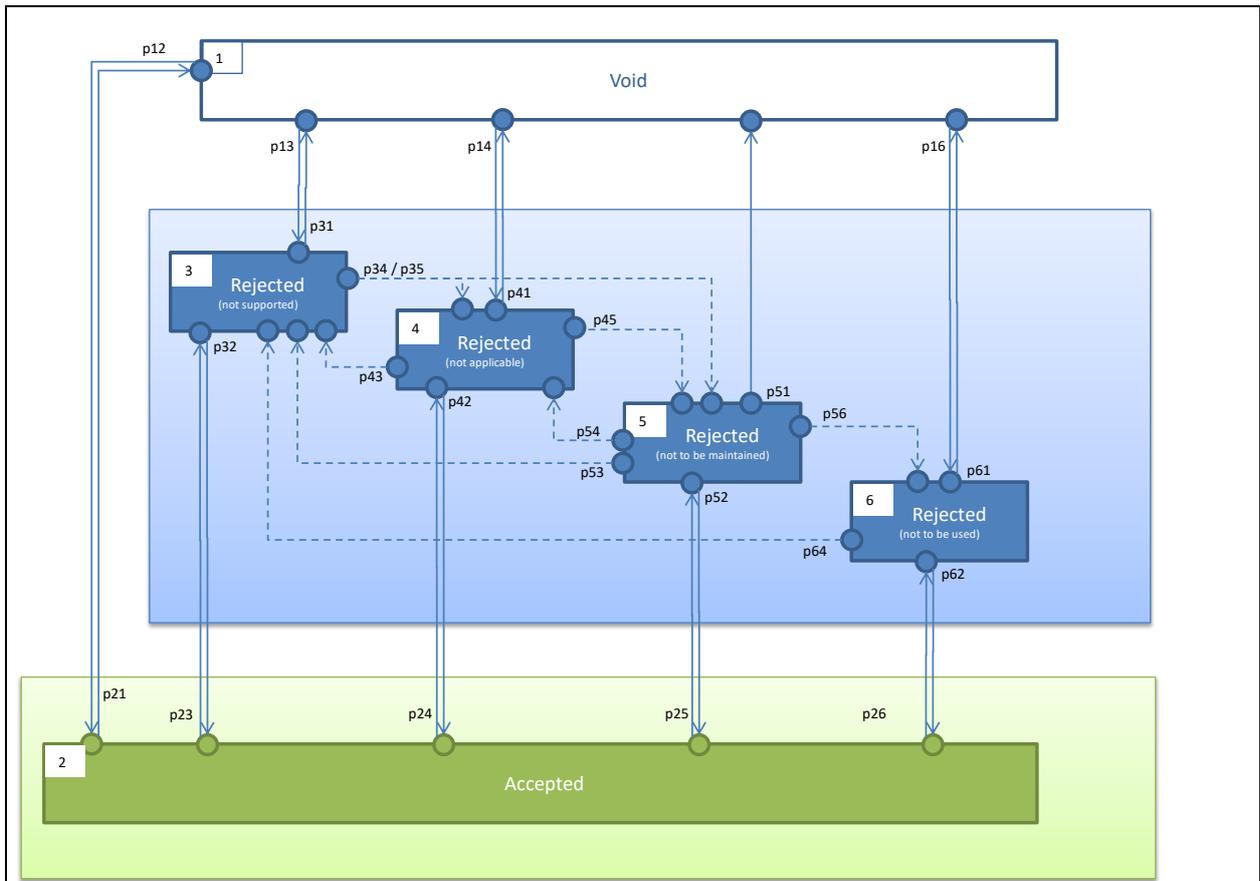


Figure 13: Constraint Life-cycle

Predicates:

Note1: pXY is the predicate for transiting from State X to State Y (e.g. p34 from 3 to 4).

Note2: when a constraint is CORRECTED, not all the transitions involving a non-owner are possible. Only when the modification or removal is derived from a route change, a manual input or the owner is not FDC/FDMP anymore (REQ-18-02b-TS-FSMG.0124, REQ-18-02b-TS-FSMG.0081).

p12: "Void" to "Accepted":

- created by owner SI (REQ-18-02b-TS-FSMG.0028), or
- created by FDMP (owner is FDMP) (REQ-18-02b-TS-MECH.0360), or
- created by adjacent non-owner SI (strategic constraints) (REQ-18-02b-TS-FSMG.0028, REQ-18-02b-TS-FSMG.0051), or
- created by non-owner SI (active flight plan constraints only) (REQ-18-02b-TS-FSMG.0028),
- and applied by FDMP.

p13: "Void" to "Rejected – not supported":

- created by owner or non-owner (strategic constraints) and not supported by FDMP (flight plan constraints always supported) (REQ-18-02b-TS-FSMG.0029, REQ-18-02b-TS-FSMG.0051).

p14: "Void" to "Rejected – not applicable":

- Created by owner or non-owner (strategic constraints) and considered not applicable by FDMP (REQ-18-02b-TS-FSMG.0029, REQ-18-02b-TS-FSMG.0051).

p15: "Void" to "Rejected - not to be maintained"

- Not possible at creation. A constraint cannot be created ask the owner to delete it.

p16: "Void" to "Rejected – not to be used":

- Flight plan constraint created by owner or non-owner with no local usage (REQ-18-02b-TS-FSMG.0028, REQ-18-02b-TS-FSMG.0138).

p21: "Accepted" to "Void":

- Deleted by owner SI (REQ-18-02b-TS-FSMG.0077, REQ-18-02b-TS-FSMG.0082).
- Deleted by non-owner and owner is not FDC/FDMP (REQ-18-02b-TS-FSMG.0077, REQ-18-02b-TS-FSMG.0082).

p23: "Accepted" to "Rejected – not supported":

- Constraint already created is now not supported by the new FDMP after a FDMP change (no requirement).

p24: "Accepted" to "Rejected – not applicable":

- Modification of the flight script resulting in the FDMP considering the constraint is not applicable anymore.
- Constraint already created is now considered not applicable by the new FDMP after a FDMP change (no requirement).
- Modified by owner or non-owner and the FDMP now considers the constraint not applicable after the modification (REQ-18-02b-TS-FSMG.0029).

p25: "Accepted" to "Rejected – not to be maintained":

- Deleted by non-owner and the owner still being FDC/FDMP (REQ-18-02b-TS-FSMG.0056, REQ-18-02b-TS-FSMG.0082).

p26: "Accepted" to "Rejected – not to be used":

- Flight plan constraint modified by owner with no local usage (REQ-18-02b-TS-FSMG.0028).

p31: "Rejected – not supported" to "Void":

- Deleted by owner SI (REQ-18-02b-TS-FSMG.0082).
- Deleted by non-owner and the owner is not FDC/FDMP (REQ-18-02b-TS-FSMG.0082).

p32: "Rejected – not supported" to "Accepted":

- Constraint already created is now supported by the new FDMP after a FDMP change (no requirement).

p34: "Rejected – not supported" to "Rejected – not applicable":

- Constraint already created is now supported by the new FDMP but considered not applicable after a FDMP change (no requirement).

p35: "Rejected – not supported" to "Rejected – not to be maintained":

- Deleted by non-owner and the owner still being FDC (REQ-18-02b-TS-FSMG.0056, REQ-18-02b-TS-FSMG.0082).

p36: "Rejected – not supported" to "Rejected – not to be used":

- Not possible. Flight plan constraints are always supported.

p41: "Rejected – not applicable" to "Void":

- Deleted by owner SI (REQ-18-02b-TS-FSMG.0082, REQ-18-02b-TS-FSMG.0077).
- Deleted by non-owner and the owner is not FDC/FDMP (REQ-18-02b-TS-FSMG.0082).

p42: "Rejected – not applicable" to "Accepted":

- Modification of the flight script resulting in the FDMP considering the constraint is now applicable.
- Constraint already created is now considered applicable by the new FDMP after a FDMP change (no requirement).
- Modified by owner or non-owner and the FDMP now considers the constraint applicable after the modification (REQ-18-02b-TS-FSMG.0028).

p43: "Rejected – not applicable" to "Rejected – not supported":

- Constraint already created is now not supported by the new FDMP after a FDMP change (no requirement).

p45: "Rejected – not applicable" to "Rejected – not to be maintained":

- Deleted by non-owner and the owner still being FDC (REQ-18-02b-TS-FSMG.0056, REQ-18-02b-TS-FSMG.0082).

p46: "Rejected – not applicable" to "Rejected – not to be used":

- Not possible. Once a flight plan constraint gets “Rejected – not supported” (p64), it will not return to “Rejected – not to be used” in order to avoid loops.

p51: “Rejected – not to be maintained” to “Void”:

- Deleted by owner SI (REQ-18-02b-TS-FSMG.0082).
- Deleted by non-owner and the owner is not FDC/FDMP (REQ-18-02b-TS-FSMG.0082).

p52: “Rejected – not to be maintained” to “Accepted”:

- Restored by the owner SI and accepted by the FDMP (REQ-18-02b-TS-FSMG.0122).

p53: “Rejected – not to be maintained” to “Rejected – not supported”:

- Restored by the owner SI and not supported by FDMP (REQ-18-02b-TS-FSMG.0122).

p54: “Rejected – not to be maintained” to “Rejected – not applicable”:

- Restored by the owner SI and considered not applicable by FDMP (REQ-18-02b-TS-FSMG.0122).

p56: “Rejected – not to be maintained” to “Rejected – not to be used”:

- Flight plan constraint restored by owner with no local usage (REQ-18-02b-TS-FSMG.0122).

p61: “Rejected – not to be used” to “Void”:

- Deleted by owner SI (REQ-18-02b-TS-FSMG.0082, REQ-18-02b-TS-FSMG.0077).
- Deleted by non-owner and the owner is not FDC/FDMP (REQ-18-02b-TS-FSMG.0082).

p62: “Rejected – not to be used” to “Accepted”:

- Flight plan constraint modified by owner (only) with local usage (REQ-18-02b-TS-FSMG.0028).

p63: “Rejected – not to be used” to “Rejected – not supported”:

- Not possible. Flight plan constraints are always supported.

p64: “Rejected – not to be used” to “Rejected – not applicable”:

- Flight plan constraint modified by owner (only) with local usage but calculated by the FDMP with no local usage. Once in “Rejected – not applicable” is not possible to request local usage again in order to avoid loops (REQ-18-02b-TS-FSMG.0029).

p65: “Rejected – not to be used” to “Rejected – not to be maintained”:

- Deleted by non-owner and the owner still being FDC (REQ-18-02b-TS-FSMG.0056, REQ-18-02b-TS-FSMG.0082).

4.2.5.1.5.6 Relationship between Constraints and Expanded Route

Any constraint must be associated with points of the Expanded Route of the FO Flight Script.

When the constraint does not modify the route, the input AP, TSP and TEP and computed AP, TSP and TEP, when provided, must be defined by referring to existing points of the Expanded Route plus optionally a positive distance.

When the constraint points cannot be positioned on the existing Expanded Route (e.g. see Figure 11) because the Expanded Route is amended, the constraint points are added as new points in the Expanded Route.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0018
Title	Constraint Computed Points linkage to Expanded Route (FDMP)
Requirement	The FDMP shall link the computed AP, TSP and TEP of a constraint with the Expanded Route by associating them with the nearest existing Expanded Route point before the constraint point, plus an optional positive distance.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement instructs the FDMP to associate the constraint computed points with an existing point of the Expanded Route.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0136
Title	Constraint Input Points linkage to the Expanded Route (requester)
Requirement	The SI creating a constraint shall link the provided input AP, TSP and TEP with the Expanded Route by associating them: <ul style="list-style-type: none"> - with the nearest existing Expanded Route point before the point, plus an optional positive distance, when the constraint does not modify the route, - with a new Expanded Route point, shared as well in a route change, otherwise.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement instructs the SI creating a constraint to associate the input constraint points with existing or a new point of the Expanded Route. A constraint with no link to the Expanded Route would not be understood by the other IOP Stakeholders.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162

<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFlightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

4.2.5.2 General Operations on the FO Flight Script

The FDMP is responsible for updating the FO Flight Script when alignment with its trajectory local view is needed or upon request of a FDC.

4.2.5.2.1 FO Creation

At FO creation, all the applicable constraints known by the FDMP must be integrated in the FO Flight Script as an Expanded Route Point and/or as a constraint. Those constraints may come from the filed flight plan (Cruise Speed, Cruise Level, Speed/Level switches, etc.) and from the local system. The elements of the filed flight plan that are not known by the FDMP are included in the FS Expanded route as 'unknown' elements. They will be replaced in the Expanded Route as explicit route points by the SI systems that are aware of them.

The FDMP must insert in the constraints list all constraints with both status accepted /rejected.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0072
Title	Constraint at FO Creation (FDMP)
Requirement	When creating a FO, the FDMP shall include in the Flight Script both accepted and rejected constraints coming from: <ul style="list-style-type: none"> the filed flight plan, and the local constraints used to compute the IOP Trajectory.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement instructs the FDMP at the creation of the FO to initiate the list of constraints with the constraints issued from the filed flight plan and optionally the local constraints of interest for the other IOP Stakeholder.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0003
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0009
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Create and Distribute FO

Flight Plan Constraints

According to REQ-18-02b-TS-FSMG.0135, the FDMP when creating the FO has to insert every flight plan constraint. Nevertheless, it does not mean that they will be used in the flight plan computation. The use of these flight plans constraints will be determined by the local policy of that SI. If the FDMP determines that a flight plan constraint is not taken into account in the trajectory computation, it will insert it in the flight script as REJECTED / NOT_TO_BE_USED.

Upon reception of the new FO, the FDCs will have to apply their own policy to re-evaluate the applicability of the flight plan constraints for which they are the owners (See Constraint owner section). If the FDC did not follow the same policy for a constraint of its own, it will request the FDMP to modify that constraint applicability with the proper service for constraint update. The constraint will be moved from ACCEPTED to REJECTED or vice-versa according to the local rules of the system that owns that constraint.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0138
Title	Un-used flight plan constraints at FO creation (FDMP)
Requirement	When creating a FO, the FDMP shall insert the flight plan constraints that were not used for trajectory computation as REJECTED / NOT_TO_BE_USED.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement allows to cover the cases in which a SI decides that the original flight plan constraints will not be used for trajectory computation. The ACCEPTED case does not need a specific requirement since it is covered by the nominal behaviour.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0003
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0092
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0094
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0063
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Create and Distribute FO

Expanded Route Expansion

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0100
Title	Expanded Route including unknown route item
Requirement	On route expansion of the initial Flight Plan route, for any token or sequence of tokens of the Flight Plan route that cannot be translated in Route Points, the FDMP shall insert it in the Expanded Route of the FO Flight Script an unknown Expanded Route Item including the unknown route portion, and continue the route expansion processing of the whole Flight Plan route.
Status	<In Progress>
Maturity Level	TRL4
Rationale	This requirement instructs the FDMP to insert an unknown Expanded Route item whenever not able to translate any route portion including one or more tokens of the flight plan route in its adaptation data. The FDMP will always expand the whole route into the Expanded Route.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0004
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Create and Distribute FO

4.2.5.2.2 FO Modification triggered by FDMP

FDMP local stimulus

The FDMP is responsible for keeping aligned its flight internal representation (SFPL) and the trajectory specified in the FO. When an internal stimulus creates or modifies the SFPL and this change and its consequences needs to be reflected in the FO, the FDMP updates the FO Flight Script Expanded Route and/or Constraints List, and publish it to interested IOP stakeholders.

Stimulus can be for instance local controller input, modification of local conditions to activate local constraints, estimated time or level associated with a deferred clearance (e.g. AT time/level CLIMB TO level) does not correspond to the intended time or level), etc.

This behaviour is general for IOP and it is included in the “General Mechanisms” capability requirements.

Surveillance data stimulus

Surveillance information is a special case of internal stimulus. This information does not always lead to a change in the predicted trajectory. It reflects the real position of the aircraft which does not need to be systematically updated in the FO Flight Script. The FO Flight Script is only updated when there is a

significant discrepancy between the predicted position and the measured position. The discrepancy is to be evaluated against the FDMP exit conditions in the Coordination and Transfer items.

4.2.5.2.3 FO Modification triggered by FDC

FDC local stimulus impacting the Flight Script

When the FDC SFPL is updated, the FDC can request the FDMP to align the FO accordingly.

This behaviour is general for IOP and it is included in the “General Mechanisms” capability requirements.

FDMP Processing of the FS change request (general process)

When a request to change the route or a constraint is received from a FDC, the FDMP performs first the eligibility, syntactical and semantic checks.

Semantic checks include:

- consistency between the request parameters,
- consistency of the request parameters with the existing FO,
- no concurrent FO service requests (just one FO service request will be accepted for each FO version (will be processed)).

The following processing applies to valid FS service requests from FDCs that have succeeded the eligibility, syntactic and semantic checks by the FDMP.

FDMP Processing of the FS change request (resulting in an ACCEPTED constraint)

When a request to add or modify a constraint is received from a FDC and the FDMP succeeds to integrate it in its SFPL, the constraint is included in the FS with an indication it has been accepted. The FO aligned with the FDMP internal view is published along with the IOP Trajectory.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0028
Title	Accepted constraints processing
Requirement	Upon receipt of a valid FS service request from an FDC to insert or update constraints in the FO Flight Script and if the FDMP is able to implement the requested update, the FDMP shall include the requested change in the FO Flight Script in an accepted constraint.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement instructs the FDMP to apply locally a received FDC’s request to add or modify a constraint before accepting it and including it in the Flight Script as accepted.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFlightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

FDMP Processing of the FS change request (resulting in a REJECTED constraint)

When a request to change a constraint is received from a FDC and the FDMP decides to not integrate it in its SFPL, the constraint is included in the FS as REJECTED / NOT_SUPPORTED or REJECTED / NOT_APPLICABLE. The FO aligned with the FDMP internal view is published.

When the request to disregard a flight plan constraint is received from the owner of that constraint, the FDMP also stores the constraint as REJECTED / NOT_TO_BE_USED. Note that the reason of such a rejected constraint might be changed to NOT APPLICABLE upon request by the owner of the flight plan constraint to activate it and the FDMP is not able to accomplish it.

When the request to remove a constraint is not from the constraint owner, the FDMP stores the constraint as REJECTED / NOT_TO_BE_MAINTAINED. This is addressed later in the document in REQ-18-02b-TS-FSMG.0082.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0029
Title	Not supported or not applicable constraints processing (FDMP)
Requirement	Upon receipt of a valid FS service request from an FDC to insert or update a constraint in the FO Flight Script and the FDMP cannot apply in its local flight (SFPL) the requested change, the FDMP shall include the proposed change in the FO Flight Script in a rejected constraint with the reason for the rejection (NOT_SUPPORTED or NOT_APPLICABLE).
Status	<Validated>
Maturity Level	TRL6
Rationale	<p>This requirement instructs the FDMP to include any received FDC's request to insert or update a constraint in the Flight Script as a rejected constraint when it cannot and does not want to apply it locally. This allows IOP Stakeholder to detect that the constraint request has been processed by the FDMP and later on to next FDMPs to re-evaluate it.</p> <p>ICD Note: reason for rejections must be set according to the following meaning:</p> <ul style="list-style-type: none"> - NOT_SUPPORTED: means that the FDMP does not support this kind of constraint (but anyway stores it for distribution) - NOT_APPLICABLE: means that according to the FDMP, the constraint is not achievable, or inconsistent with other constraints.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0063
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFlightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0137
Title	Processing a Flight Plan constraint deletion request (FDMP)
Requirement	Upon receipt of a valid FS service request from an FDC to disregard a flight plan constraint it owns, the FDMP shall insert the flight plan constraint not used for trajectory computation as REJECTED / NOT_TO_BE_USED.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement instructs the FDMP to include any received FDC's request to disregard a flight plan constraint in the Flight Script as a rejected constraint with the reason NOT_TO_BE_USED. It means that the constraint is not used in the trajectory computation.

	It is not a real rejection of that constraint but an attribute that may be updated by the constraint owner. When the FDMP is not able to update this attribute as requested by the owner it will have to set a real rejection reason such as NOT_APPLICABLE. <u>ICD note.</u> The FDC requests to disregard a fight plan constraint by using the <code>srv_modify_constraint</code> (operation=update constraint, attribute FiledLocalUsage).
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0063
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

When the FDMP modifies its SFPL when processing a FDC change request, the FDMP can have to incorporate additional constraints in the SFPL. These new constraints must in turn be published in the Flight Object.

FDMP Processing of the FS change request (partial application)

It is possible that a valid constraint requested by a FDC cannot be fully achieved by the FDMP, i.e. the computed trajectory did not implement exactly the constraint relevant points, or the constraint handling indicated by the constraint creator, or did not match exactly the requested target values of that constraint.

This situation may be caused by the use of different TP algorithms.

Examples of Requested Target Value that cannot be totally achieved are:

- an Exit FL that on the input Target Start Point is below or above the Target Value of the constraint, or
- the Target Value of a Time constraint, that cannot be fully satisfied at its input Target Start Point because, starting from the input Application Point, the needed speed change to satisfy that constraint cannot be provided by the aircraft in the specific context of Level, wind, temperature, etc.

In this case, the FDMP indicates in the FO Flight Script that its trajectory calculation did not fully achieve what was required by the constraint, although it tried to fulfil it.

The acceptance qualifier value NOT_IMPLEMENTED_AS_REQUESTED means the constraint has only partially been applied by the FDMP, i.e. the computed trajectory does not match exactly the requested target values of that constraint or the way to implement it was not exactly satisfied. This value also applies when the FDMP has not used in the IOP Trajectory computation a constraint the same way it was intended, as described in Table 22.

Requested Constraint Handling Used by FDMP in its IOP trajectory computation as...	OPEN	CLOSED
OPEN	OPEN (nominal) Constraint is accepted and not used in trajectory computation	OPEN Constraint is accepted with reason NOT_IMPLEMENTED_AS_REQUESTED but not used in trajectory computation.
CLOSED	CLOSED Constraint is accepted with reason NOT_IMPLEMENTED_AS_REQUESTED but is used in trajectory computation.	CLOSED (nominal) Constraint is accepted and used in trajectory computation

Table 22 : Constraint Handling Usage by FDMP

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0030
Title	Constraint partially reached
Requirement	If a constraint proposed by a FDC is accepted but the requested target value or the way to implement it is not as expected, the FDMP shall include that constraint in the FO Flight Script as ACCEPTED / NOT_IMPLEMENTED_AS_REQUESTED.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement allows the FDMP to partially implement a requested constraint but instructs the FDMP to clearly indicate it in the Flight Script (e.g. relevant point or constraint handling not implemented as requested).
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0063
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

FDC Processing of the FS change request processed by FDMP (negative)

When the FDMP includes a constraint requested by an FDC tagged as ‘rejected’, the requesting FDC may retain the proposed constraint in its local image when according to its own algorithms it is acceptable.

It is the responsibility of the FDC to remove the constraints that FDMP rejected, that it owns and which are considered as not valid any longer.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0032
Title	Constraint removal (request) (FDC)
Requirement	The FDC shall request the FDMP to remove the rejected constraints that it owns from the FO Flight Script when it considers according to its own logic that they are not valid and removed from its SFPL.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement instructs the FDC to remove from the Flight Script any constraint it previously set but now considers as obsolete for the flight. <i>Editor's note. This requirement might be extended to cover the case of 'old' constraints.</i>
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0010
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFlightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

FDC Check the FDMP processing of its constraint request

When an FDC has sent an add, modify or remove constraint request service to the FDMP, if then it receives a service request acceptance (the operation has been successfully performed by FDMP) but then receives a FO whose Flight Script does not reflect that request, it can optionally repeat the request. The number of retries (0 or more) is limited to avoid endless loops.

This behaviour is general for IOP and it is included in the “General Mechanisms” capability requirements.

No FDC request retry in case of service rejection

When an FDC has performed a constraint request to the FDMP, and received a service request rejection, it will not repeat the request, as the FDC must not retry sending an invalid request. The way to recover this error by an FDC is a local system behaviour.

This behaviour is general for IOP and it is included in the “General Mechanisms” capability requirements.

4.2.5.2.4 FO Reception

FO Expanded Route Processing for Unknown Items

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0062
Title	FO Expanded Route Refinement of Unknown Items

Requirement	When receiving a FO, all IOP Stakeholder identifying in the FS Expanded Route an unknown Expanded Route item for which they know the corresponding set of one or more route points, shall request the FDMP to substitute in the FS Expanded Route the unknown item by a sequence of known route points, each known route point referring to the item it has been derived from if any, and if any a remaining reduced set of unknown tokens within a new unknown item.
Status	<In Progress>
Maturity Level	TRL4
Rationale	This requirement instructs all SIs receiving a Flight Object to substitute as much as they can the unknown element items present in the Expanded Route by the sequence of known route points. The reference to the item the points have been derived from (e.g. a STAR) is associated to the new known route points.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0004
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0005
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

Change detection

When the FDC receives a Flight Object update (which might be the result of a Flight Object change from the FDMP or from another FDC), it analyses the received FO Flight Script, identifies the differences with its local view and assess whether those differences are locally acceptable.

Alignment of the FDC SFPL (constraints)

Upon receipt of an FO from FDMP, the FDC will reflect in its SFPL the added, modified and/or removed constraints and any Expanded Route change provided in the FO Flight Script, as long as these changes are compatible with the local rules for constraint and route management and have an acceptable impact on trajectory.

The FDC will incorporate in its SFPL the changes to the Constraint List and the Expanded Route of the FO Flight Script published by the FDMP, when these changes are compatible with the local rules for constraint and route management and have an acceptable impact on trajectory.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0068
Title	SFPL alignment with FO
Requirement	<p>Upon receipt of a FO from the FDMP, if any constraint included in the FO FS owned by the FDC is accepted by the FDMP but has been modified, the FDC shall re-assess its own constraint, and:</p> <ul style="list-style-type: none"> • if the constraint is still applicable, request the FDMP to update the constraint with the new input constraint point(s) processed, • otherwise request the FDMP to remove that constraint.
Status	<Validated>
Maturity Level	TRL6
Rationale	<p>This requirement supports on the FDC side the mechanism of constraint re-assessment, used in case of re-route when the FDMP projects an existing constraint on the new route according to its local rules. The FDC will be able to evaluate its own projection, or repositioning, of the constraint input points, or requests its full removal.</p> <p>As per REQ-18-02b-TS-FSMG.0087, the FDC can also set the constraint as CORRECTED.</p>
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0076
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

When the FDMP does not succeed to properly re-assess a constraint in case of route modification, or in case of conflict with a newly inserted / modified constraint, it distributes the FO with the constraint status REJECTED and reason for rejection NOT_TO_BE_MAINTAINED.

The owner FDC will manage this notification and react according to its own rules, either sending a FO request for update of its own constraint (e.g. re-positioned/projected somewhere else, or anyhow modified), or requesting the removal of its constraint.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0069
Title	Constraint removal (assessment) (FDC)
Requirement	<p>Upon receipt of a FO from the FDMP, if any constraint included in the FO FS owned by the FDC is rejected by the FDMP with the reason NOT_TO_BE_MAINTAINED, the FDC shall re-assess the constraint, and:</p> <ul style="list-style-type: none"> • if the constraint is still applicable, request the FDMP to update the constraint with the new input constraint point(s) processed, • otherwise request the FDMP to remove that constraint.
Status	<Validated>

Maturity Level	TRL6
Rationale	This requirement supports on the FDC side the mechanism of constraint re-assessment, used for instance in case of re-route when the FDMP does not manage to project an existing constraint on the new route and requests the constraint owner to perform it itself and remove the constraint if needed. As per REQ-18-02b-TS-FSMG.0087, the FDC can also set the constraint as CORRECTED.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0076
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0066
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

4.2.5.2.5 FO Flight Script de-synchronization

Any IOP SI receiving a FO is able to share a significant de-synchronization status of the local constraints list and expanded route with the constraints list and expanded route published within the FO.

This will happen when other attempts to recover that significant de-synchronization fail, trying to adapt the local view to match with the IOP Trajectory, or modifying the list of constraints or the expanded route, if possible.

This behaviour is general for IOP and it is included in the “General Mechanisms” capability requirements.

4.2.5.3 Specific Operations on Constraints and Expanded Route

4.2.5.3.1 FDMP Operations

The FDMP is granted all rights to create, modify and remove constraint in the Flight Script.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0038
Title	FDMP operations on constraints in the Flight Script
Requirement	The FDMP shall be able to insert, modify or remove any constraint in the Flight Script, according to its local input and rules, or due to requests coming from the FDCs, as long as the conditions to perform these operations are fulfilled.

Status	<Validated>
Maturity Level	TRL6
Rationale	<p>This requirement specifies the rights of the FDMP in terms of constraint management. Ultimately, it is always the FDMP's choice to execute the add, modify or remove constraints action in the Flight Script.</p> <p>As a general rule any IOP SI must be able to modify, add or remove multiple constraints at the same time.</p> <p>Note. Whether this should be a requirement or just a text need to be confirmed before standardization.</p>
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0010
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFlightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

On any change from local stimulus or FDC request, the FDMP will update in the FO Flight Script the vertical, longitudinal and lateral intent of a flight using a set of constraints.

FDMP modification of an FDC requested constraint

The FDCs are allowed to request Flight Script changes that affect the upstream Systems Instances, including the one that is currently controlling the flight. The FDMP should try to apply the constraint as requested by the FDC.

Nevertheless, the FDMP should be protected against downstream changes that lead to a local inconsistency in its own AoR. In order to avoid this inconsistency, the FDMP is authorized to apply the constraint at a different position. This allows the FDMP to confirm the use of the FDC constraint but it does not guarantee that the profile computed by the FDMP actually fulfils the constraint as intended by the FDC.

The same logic applies between two FDCs, when the second FDC requests to apply a constraint that starts in its upstream (the first FDC).

The adaptation of the computed constraint points to the need of the upstream system will avoid the need to set 'rejected' the downstream constraint. The FDMP will accept the constraint and indicate that it has not implemented it as requested as per REQ-18-02b-TS-FSMG.0030.

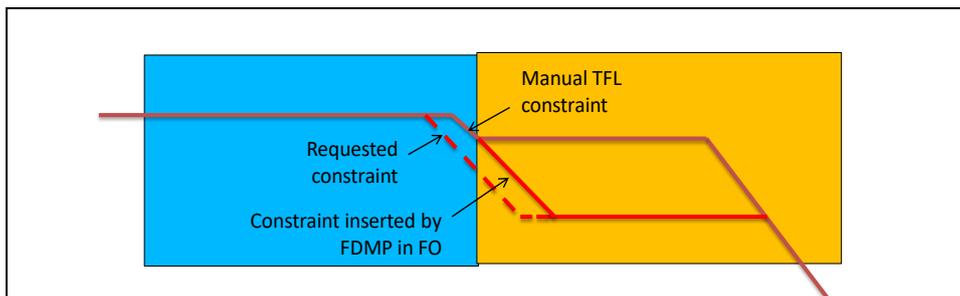


Figure 14: FDMP modification of a FDC constraint

4.2.5.3.2 FDC Operations

The FDC is granted all rights to request the creation, modification and removal constraint in the Flight Script when it is owner of the constraint.

FDC Constraint Retrieval

IOP stakeholders use different TPs and implement heterogeneous local system requirements. It is likely that the FDMP will tag 'rejected' or will not apply in the IOP Trajectory constraints exactly as requested by the FDC.

The FDC may later be unable to recognize its own constraint and request again the insertion of the same constraint. In order to avoid multiple requests from the FDC concerning the same constraint, the criteria defined to retrieve a constraint is based on static attributes rather than on computed values.

Non variable constraint attributes are identified in § 4.2.5.1.5.2.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0047
Title	Constraint identification
Requirement	When receiving a Flight Script update, the owner of a constraint shall verify if it has been included in the flight script by using the Constraint Identifier.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement specifies the means by which an IOP Stakeholder can retrieve a specific constraint by using the Constraint Identifier. Note. Whether this should be a requirement or just a text need to be confirmed before standardization.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Read FO Update

For shared strategic constraint, a common additional identifier off-line defined is used, the Strategic Constraint Common identifier. This identifier allows the IOP stakeholders impacted by the constraint to easily assess if the strategic constraint has been already included by the FDMP, optionally upon request of another FDC.

4.2.5.3.3 Eligibility for Operations on Constraints and Route Modification

The eligibility to modify or remove a constraint is defined by a “forbidden” approach. I.e. any SI that does not own a constraint is allowed to modify or remove it, except if the owner has expressly indicated not to do it.

The CORRECTED indication of a constraint indicates that the constraint modification or removal operations are allowed only under certain conditions.

By default, all FDCs can request to modify or remove a constraint. When the owner of the constraint modifies it, it can set the CORRECTED indication to limit further the modification and removal by other SIs. This prevents the SIs not owning the constraint from applying any direct change or from removing the constraint, except in case of a new route change or the result of a manual input.

In addition, although removing a constraint is always allowed unless it is explicitly forbidden by the owner of that constraint, the actual deletion of a constraint from the flight script is only performed when it is actually requested by its owner. Removing a constraint by a SI different than its owner will set the constraint in a temporary status in which the constraint is not used for trajectory computation (REJECTED / NOT TO BE MAINTAINED) and forces the owner to request its complete removal or to request its re-application again.

4.2.5.3.3.1 Setting and Un-setting the Eligibility for Constraint Modification and Removal

The restriction of the eligibility for constraint modification and removal can only be performed by the owner of the constraint when it modifies it.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0087
Title	CORRECTED constraint (setting tag)
Requirement	Only when modifying a constraint it owns, a SI shall indicate if the constraint is “corrected”.
Status	<Validated>
Maturity Level	TRL6
Rationale	The CORRECTED indication prevents loops. In specific cases the constraint change might be the CORRECTED indication change itself.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0070
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162

<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

The CORRECTED indication can be unset as a result of a new route change or a manual input modifying the constraint.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0083
Title	CORRECTED constraint (un-setting tag)
Requirement	When a SI modifies a CORRECTED tagged constraint that it does not own, if the FDMP accepts the modification, it shall remove the CORRECTED indication of the constraint.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement defines the conditions allowing to unset the CORRECT indication of a constraint. A CORRECTED tagged constraint can be modified in case of any accepted route change impacting the constraint, or as the consequence of a manual input modifying the constraint.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0070
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

4.2.5.3.3.2 Eligibility for Constraint Modification

When receiving a request to modify a constraint, the FDMP will first check if the requester is allowed to do it according whether the constraint is set “corrected” or not.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0124
Title	Constraint modification (not CORRECTED)
Requirement	The FDMP shall permit the modification of the variable attributes of any constraint not tagged as CORRECTED.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement covers the basic cases of constraint modification when the constraint is not tagged as CORRECTED.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0081
Title	CORRECTED constraint (tag modification)
Requirement	The FDMP shall accept to process a request to modify the variable attributes of a CORRECTED tagged constraint only if: <ul style="list-style-type: none"> - the requester is the owner, - the owner is not anymore an FDC or FDMP, - the constraint modification is the consequence of an accepted route change, or - the constraint modification is the result of a manual input.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement ensures that a constraint tagged as CORRECTED by its owner is not modified by any stakeholder not being the owner of that constraint, except in case of a route change or manual input, and therefore prevents loops.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0070
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

When a constraint is modified, for instance when a route change is proposed, the identity of the modification requester is stored for information in the constraint.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0129
Title	Setting the author of the constraint modification
Requirement	The FDMP shall log in the constraint the identifier of the latest SI who modified the constraint.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement ensures that the SIs that has last modified the constraint is known by everybody.

	At constraint creation, the last modifying SI is the creator of the constraint.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0070
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

4.2.5.3.3.3 Eligibility for Constraint Removal

When receiving a request to remove a constraint, the FDMP will first check if the requester is allowed to do it according whether the constraint is set CORRECTED or not.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0121
Title	CORRECTED constraint (tag removal)
Requirement	<p>The FDMP shall accept any request to remove a CORRECTED tagged constraint, only if:</p> <ul style="list-style-type: none"> - the requester is the owner, - the owner is not anymore an FDC or FDMP, - the constraint removal is the consequence of a route change, or - the constraint removal is the consequence of a manual input.
Status	<Validated>
Maturity Level	TRL6
Rationale	<p>This requirement instructs the FDMP in which cases the request for removal of a constraint will be accepted (to allow the “accepted removal request” management).</p> <p>Requesting to remove a constraint refers as well to request that has been originated locally, that is, the FDMP itself is constrained to the same policies that determine the eligibility conditions to remove a constraint.</p> <p>The actions expected to be performed by the FDMP once the constraint removal request is accepted are described in REQ-18-02b-TS-FSMG.0082.</p>
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0063
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

Once the requester is authorized to request the removal of a constraint and the request is accepted, the FDMP assesses whether the requester owns the constraint or not. If it does, the constraint is actually deleted from the Flight Script, if not it is appended to the list of rejected constraints with reason NOT_TO_BE_MAINTAINED in order to request the constraint owner to confirm the removal. Note that this is the only situation where a constraint is effectively deleted.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0082
Title	Constraint removal (request) (FDMP)
Requirement	When accepting a request to remove a constraint, the FDMP shall : <ul style="list-style-type: none"> - if the constraint is owned by the requester, or if the owner is not anymore an FDC or FDMP, delete the constraint from the Flight Script, - if the requester is FDMP or FDC but it is not the owner of the constraint then set the constraint as REJECTED / NOT_TO_BE_MAINTAINED.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement instructs the FDMP to delete a constraint only if the removal is requested by its owner (FDMP or FDCs) or if the owner is no more an FDC, otherwise to keep the constraint as REJECTED / NOT_TO_BE_MAINTAINED.
Category	<Interoperability><safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

In the case the constraint removal was requested by an SI not owning the constraint and the request was processed by the FDMP, it is then up to the constraint owner to request the actual removal of the constraint. The owner of the removed constraint will receive a FO update and it will have to reassess if the constraint is to be removed or restored. That is, the status of a constraint as REJECTED / NOT_TO_BE_MAINTAINED is temporary and it is expected to evolve as soon as the owner of the constraint receives its constraint in this status.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0120
Title	Constraint removal (assessment)
Requirement	The owner of a constraint received with the status REJECTED / NOT_TO_BE_MAINTAINED shall either: <ul style="list-style-type: none"> - confirm its removal from the flight script, or - request the constraint again with the CORRECTED indication.
Status	<Validated>

Maturity Level	TRL6
Rationale	A constraint requested to be removed by a SI not owning this constraint is set to REJECTED / NOT_TO_BE_MAINTAINED. The constraint owner is requested to confirm (or not) the removal. The confirmation of the constraint removal is performed by the owner by requesting the FDMP to remove it.
Category	<Interoperability><safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0010
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0122
Title	Constraint removal (restoration) (FDMP)
Requirement	The FDMP shall accept the request to restore a REJECTED / NOT_TO_BE_MAINTAINED constraint owned by the requesting SI, and set the indication that the constraint as CORRECTED.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement states that the owner of a constraint REJECTED / NOT_TO_BE_MAINTAINED is able to restore the constraint, providing updated attributes if needed.
Category	<Interoperability><safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0010
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

4.2.5.3.3.4 Eligibility for Trajectory Modification

REQ-18-02b-TS-MECH.0305 requires the FDMP to reject service requests from SIs when they are not allowed to invoke those services. This section specifies the eligibility rules regarding the requests for trajectory modifications.

When receiving a request that modifies the flight trajectory, the FDMP will first check if the requester is allowed to do it according to its role.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0141
Title	Eligibility rules for trajectory modification (FDMP)
Requirement	If the FDMP receives a request to modify flight script information or coordination data from a SI that is not included in the crossed and control sequence list, it shall reject the request.
Status	<In Progress>
Maturity Level	TRL4
Rationale	<p>This requirement specifies the specific eligibility checks to be performed by the FDMP when receiving a request likely to impact the flight trajectory, i.e. a flight script modification request (expanded route, constraints, etc...) or a coordination data modification.</p> <p>This behaviour is also in line with REQ-18-02b-TS-MECH.0305.</p> <p>Authorized SIs are the controlling, crossed, no_contact, skipped, delegated and delegator SIs which are all included in the crossed and control sequence list.</p> <p>ICD Note. Requests to modify flight script are <code>srv_modify_constraint</code> and <code>srv_modify_route</code>. Requests to modify coordination data are <code>srv_set_upstream_coordination_data_at_exit</code> and <code>srv_set_upstream_coordination_data_at_entry</code>.</p>
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0011
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

4.2.5.3.4 Constraint Propagation Rules

The application of a constraint by an IOP stakeholder receiving the Flight Script depends on the operational concept, the internal requirements and the internal data bases (e.g. aircraft performance data base) operated by each system. In order to increase the probability that all IOP Stakeholders apply a constraint the way the constraint owner has applied it, the values which determine the “shape” of the constraint are included in the constraint.

The information provided for each constraint in the Flight Script will have two different sources, depending on the specific request:

- extracted without further processing from the command given by the controller or a flight restriction,
- the result of the trajectory calculation process that was generated in each system.

The retention of a constraint depends on the other downstream constraints. Several scenarios are identified:

- 1) the constraint owner has stated when created the constraint how long the constraint must be maintained by indicating a distance, or a time, or a downstream constraint (see section “Constraint maintenance”),
- 2) there is no downstream constraint,
- 3) the next downstream constraint of the same dimension has an AP relevant point,
- 4) the next downstream constraint of the same dimension has a TSP relevant point,
- 5) the next downstream constraint of the same dimension becomes not applicable,
- 6) a relevant Target End Point is specified.

The applicable segment of a constraint can be dynamically modified based on tactical clearances entered by the ATCO (e.g. a RESUME NORMAL SPEED clearance can affect the TEP of an existing speed constraint).

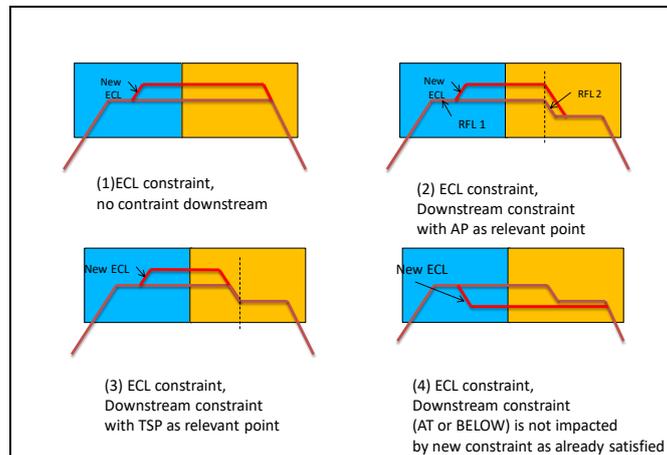


Figure 15: Examples of Constraint Propagation

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0054
Title	Constraint conflict resolution
Requirement	When the SI adding or modifying a constraint detects that it conflicts with other existing constraints, it shall request as well the modification or the removal of the existing constraints in order to solve the conflict.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement ensures that, as much as possible, the flight object is published without conflictual data. Note. The constraint modifications are done if eligible, according to the chapter “Eligibility for Constraint Modification and Removal”
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0065
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0093
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

To solve this conflict, the requester should mainly use the maintenance indication if any, and some local rules, such as considering that a constraint is ending at the first relevant point of the following conflicting one.

4.2.5.3.5 Constraint and Expanded Route Management in case of re-route

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0133
Title	Error handling (inconsistent points)
Requirement	The FDMP shall reject any route amendment request modifying an expanded route point, having the same route point name but different geographical position.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement prevents loops of geographical position modification of Expanded Route points defined by the same name but having not aligned geographical positions in the adaptation data of IOP stakeholders. Note. Whether this should be a requirement or just a text need to be confirmed before standardization.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

In case of route change, if any Expanded Route point bearing a Flight Type or Flight Rule, Cruising Level, Cruising Speed switch is impacted, the route change requester will project or re-position those points on the amended route, when requested by its local rules.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0073
Title	Re-route (route point with switches or indicator) (FDC)
Requirement	When the FDC requests a route change and any of the points bearing at least a Flight Type, Flight Rule, Cruising Level, Cruising Speed switch, or STAY indicator, is bypassed by the route modification, if any of those switches or indicators needs to be preserved on the amended route according to local rules, the FDC shall project, or re-position, or set planned for processing, the route information from the bypassed point to the amended route, and provide this information to the FDMP, together with the corresponding updated FLIGHT_PLAN constraints.
Status	<Validated>
Maturity Level	TRL6
Rationale	<p>This requirement instructs the FDC, in case of re-route, to remove, re-position, or set planned for processing, route information existing in any bypassed point, to the amended route portion.</p> <p>Route information is any Flight Type, Flight Rule, Cruising Level, Cruising Speed switch, or STAY indicator.</p> <p>Removal, re-positioning, set planned to be processed is applied according to local rules, and provide to the FDMP.</p> <p>“Planned for processing” information is recommended to be set on the start point of the route change, but this position is not mandatory.</p> <p>FLIGHT_PLAN category constraints corresponding to switches and indicators in the Expanded Route will be kept aligned.</p> <p>Note. Whether this should be a requirement or just a text need to be confirmed before standardization.</p>
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0120
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0121
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0122
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0123
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0066
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162

<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0074
Title	Re-route (route point with switches or indicator) (FDMP)
Requirement	When the FDMP performs a route change and any of the points bearing at least a Flight Type, Flight Rule, Cruising Level, Cruising Speed switch, or STAY indicator is bypassed by the route modification, if any of those switches or indicators needs to be preserved on the amended route according to local rules, the FDMP shall project or re-position route information from bypassed points to the updated Expanded Route, together with the corresponding updated FLIGHT_PLAN constraints, or set such route information planned for processing on the route change start point.
Status	<Validated>
Maturity Level	TRL6
Rationale	<p>This requirement instructs the FDMP, in case of re-route, to remove, re-position, or set planned for processing, route information existing in any bypassed point, to the amended route portion.</p> <p>Route information is any Flight Type, Flight Rule, Cruising Level, Cruising Speed switch, or STAY indicator.</p> <p>Removal, re-positioning, set planned to be processed is applied according to local rules.</p> <p>“Planned for processing” information is recommended to be set on the start point of the route change, but this position is not mandatory.</p> <p>FLIGHT_PLAN category constraints corresponding to switches and indicators in the Expanded Route will be kept aligned.</p> <p>Note. Whether this should be a requirement or just a text need to be confirmed before standardization.</p>
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0120
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0121
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0122
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0123
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0066
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0125
Title	Management of switches and STAY indicator in expanded route (FDC)
Requirement	When an SI requests a route change including in the amended route portion points bearing a Flight Type, Flight Rule, Cruising Level or Cruising Speed switch, or STAY indicator, the SI shall add the existing switches or indicators to the corresponding points of the amended portion of the Expanded Route, together with the corresponding added FLIGHT_PLAN constraints.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement instructs the FDMP implementing a route amendment requested by any IOP SI to add in the new amended route portion values derived from any Flight Type, Flight Rule, Cruising Level, Cruising Speed switch, and STAY indicator, existing in the route amendment request itself. FLIGHT_PLAN category constraints corresponding to switches and indicators in the Expanded Route will be kept aligned. Note. Whether this should be a requirement or just a text need to be confirmed before standardization.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0066
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

In case a re-route is proposed, there are constraints impacted by the route modification, if some of those constraints are still applicable for the flight:

- a) The FDC requesting the route modification can optionally propose at the same time the modification of the constraint(s) that it owns. For that purpose, the FDC extrapolates the constraint input relevant points by re-assessing the constraint on the new route (e.g. by positioning them on the new route according to a distance proportionality algorithm).

This step allows the owner of the impacted constraint to modify accurately the constraint avoiding the FDMP to do it with its own rules.

If the re-assessment is allowed and succeeds, the FDC sends to the FDMP the route change and the constraint modification request. In case it does not succeed (i.e. the constraint is no longer on the modified route), the FDC sends to the FDMP a request to remove that constraint.

- b) Upon receipt of the route modification, if the FDC has not sent the modified impacted constraint, the FDMP extrapolates the constraints input relevant points itself.

As the FDMP is not aware of any specific re-assessment needed by the owner of the constraint, only a generic re-assessment is performed, independently from the specific constraint type and category (e.g. any XFL in a downstream SI, being at the boundary between sectors known only by the owning SI, will be re-assessed by FDMP according to its local rules, then usually positioned again at the boundary among those sectors, if still applicable).

The FDC owning the impacted constraint must re-assess that constraint and modify, remove or re-insert it (if it was removed by the FDMP as it was not able to achieve any kind of re-positioning) in case of significant discrepancy detected or maintenance policy disregarded respectively (see REQ-18-02b-TS-FSMG.0068).

The re-assessment processing mentioned is still a quite generic processing, and might be an orthogonal projection, or a positioning according to proportional distances along the 2D path in the previous and modified route portion.

The constraint owner will be able to apply a much more precise constraint points re-assessment of its own constraint points, according to local adaptation data and local rules.

The FDMP and the FDC must remove the constraint in case its constraint maintenance policy does not allow it (e.g. the maintenance of time, heading, holding constraints is not applicable anymore and no constraint re-assessment must be performed).

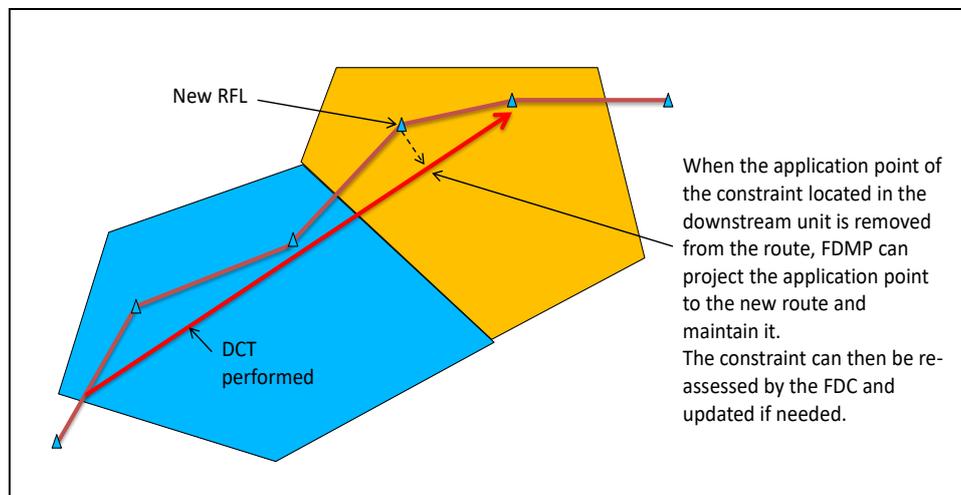


Figure 16: Constraint Maintenance in case of re-route

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0071
Title	Re-route (constraint projection) (FDC)
Requirement	<p>When the FDC requests a route change and a constraint is modified by the route modification, the FDC shall:</p> <ul style="list-style-type: none"> • if its local maintenance policies for that specific constraint request to maintain it, <ul style="list-style-type: none"> ○ re-assess the input constraint points on the modified route, ○ if the re-assessment succeeds, <ul style="list-style-type: none"> ▪ update the input constraint points with the re-assessed points, ▪ send to the FDMP the route change and the constraint modification request • if the maintenance policies for the specific constraint type do not request to maintain it or the re-assessment does not succeed: <ul style="list-style-type: none"> ○ send to the FDMP the route change, with a request to remove that constraint.
Status	<Validated>
Maturity Level	TRL6
Rationale	<p>This requirement instructs the FDC when requesting a route modification to consider the global and the local maintenance policies to decide whether a constraint must be preserved and projected on the new route or not.</p> <p>Note. Whether this should be a requirement or just a text need to be confirmed before standardization.</p>
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0066
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

When the FDMP needs to reposition input constraint points no more on the route due to a route change, it will process new input constraint points on the new route, if allowed by its local policies for the specific constraint type, using its local rules for the re-assessment.

In case re-assessing input constraint points happens, the FDMP will update them, and publish the updated constraint within a new FO Flight Script, so that the owner of the constraint will be able to update the changed constraint points according to its local rules, if needed.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0056
Title	Re-route (FDC constraint projection) (FDMP)
Requirement	<p>When the FDMP applies a local route change and removes from the expanded route the input constraint points of a constraint belonging to an FDC, the FDMP shall:</p> <ul style="list-style-type: none"> • if its local maintenance policies for that specific constraint type request to maintain it: <ul style="list-style-type: none"> ○ re-assess input constraint points on the expanded route according to its own rules, and ○ if that computation is correctly achieved: <ul style="list-style-type: none"> ▪ update the constraint in the Flight Script, with status accepted, and with the re-processed input constraint points, so that its owner will be able to re-assess it ○ otherwise: <ul style="list-style-type: none"> ▪ update the constraint in the Flight Script as rejected, with reason for rejection 'not-to-be-maintained', so that its owner will be able to re-assess it, • otherwise add the constraint in the FS as a rejected constraint with reason for rejection 'not-to-be-maintained'.
Status	<Validated>
Maturity Level	TRL6
Rationale	<p>This requirement instructs the FDMP, when applying a route modification, to use its local maintenance policies to decide whether a constraint must be preserved and projected on the new route or not, on behalf of an FDC owner of that constraint.</p> <p>Note. Whether this should be a requirement or just a text need to be confirmed before standardization.</p>
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0066
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

When the FDMP needs to reposition input constraint points no more on the route due to a route change, it will process new input constraint points on the new route, if allowed by its local policies, and using its local rules for the re-assessment. In case the constraint owner is an FDC, the FDMP will set the constraint status to 'rejected' with reason 'not-to-be-maintained', so that the input constraint points re-assessment will be put in charge of the FDC constraint owner.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0077
Title	Re-route (FDMP constraint projection) (FDMP)
Requirement	<p>When the FDMP applies a route change and removes from the expanded route the input constraint points of a constraint belonging to itself or with owner no longer FDC, the FDMP shall:</p> <ul style="list-style-type: none"> • if its local maintenance policies for that specific constraint type request to maintain it: <ul style="list-style-type: none"> ○ re-assess the input constraint points on the expanded route according to its own rules, ○ if the computation is correctly achieved: <ul style="list-style-type: none"> ▪ update the input constraint points with the projected points, ○ otherwise remove that constraint from the Flight Script. • otherwise remove that constraint from the Flight Script.
Status	<Validated>
Maturity Level	TRL6
Rationale	<p>This requirement instructs the FDMP when applying a route modification to consider its local maintenance policies to decide whether a constraint belonging to itself, or with owner no longer FDC, must be preserved and projected on the new route or not.</p> <p>Note. Whether this should be a requirement or just a text need to be confirmed before standardization.</p>
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0066
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

4.2.5.3.6 Strategic Constraint Management

A shared strategic constraint is a strategic constraint known by more than one SI and having:

- a common identifier,
- a commonly agreed impact on the FO Flight script and, as a consequence, a similar impact on trajectory processing,
- a commonly agreed responsible SI (owner),
- a shared application rule.

The owner of a shared strategic constraint is off-line defined and included in the adaptation data.

By definition of shared applicability rules, for strategic constraints, all IOP Stakeholders will process the same result in terms of applicable strategic constraint in the FO Flight Script.

Setting Strategic Constraints

All existing strategic constraints defined in the IOP area cannot be shared between all IOP stakeholders. Nevertheless, the standard crossing conditions between different SIs are normally agreed in Letters of Agreements (LoAs). They are usually modelled in the form of strategic constraints.

The strategic constraints that are used to model the LoAs are usually known by the affected SIs and shared as common adaptation data (off-line defined environmental data, also including the definition of mandatory and optional parameters for both shared and local strategic constraints and their applicability rules) between both SIs. When the FDMP (or any FDC) determines that a strategic constraint is applicable to a given flight, it can create this constraint, even in the case the constraint is owned by another IOP Stakeholder.

“Applicable” means that the evaluation of the shared applicability rules for that strategic constraint provide that the constraint must exist in the FO FS Constraint List.

Shared strategic constraints must have the same definition in the adaptation data and associated to the same applicability rules. Those rules must be processed in the same manner in every system sharing those constraints.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0051
Title	Shared strategic constraint creation
Requirement	An IOP Stakeholder shall include, or request to include, in the FO Flight Script any strategic activated constraint evaluated applicable, using its applicability rules, not yet existing in the FO Flight Script, being off-line shared and existing in its adaptation data, even if owned by another SI.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement instructs any IOP Stakeholder aware of an active shared strategic constraint not already included the Flight Script to request its insertion in the Flight Script.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0010
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

Strategic Constraint Re-assessment by a SI with any IOP role and by the Constraint Owner

A strategic constraint is applied upon a number of conditions that need to be re-evaluated when the FO changes.

Upon any FO update, any SI re-evaluates if the strategic constraints in the Flight Script are still applicable.

When the SI is the owner of the strategic constraint, it is able alone to properly re-asses the applicability rules of the constraint.

For the strategic constraint owned by a downstream system, even if another SI shares its applicability rules, it has not always all the information to precisely determine if the constraint is still applicable or not. That SI can only make a general assessment. This is then up to the IOP Stakeholder owner of the constraint to locally confirm if the strategic constraint is still applicable or not. In case a not owner SI has re-evaluated the strategic constraint as not applicable while the owner still evaluates it as applicable, the not owner SI will locally tag that constraint as rejected and INACTIVE, while the owner will set it as applied and ACTIVE in its SFPL.

In case the strategic constraint which has been included by any SI is actually not currently applicable for the flight, according to owner local additional rules not shared with other IOP stakeholders or local conditions, the owner of the strategic constraint can request its status to be set INACTIVE. This INACTIVE status allows all IOP Stakeholder to be aware that the constraint has been taken into account, is considered not active by its owner and therefore there is no need to ask again to apply it. The strategy to keep inactive constraints that cannot be removed according to shared applicability rules will avoid possible loops due to requests by other SIs to reinsert a shared strategic constraint. The Strategic Constraint Status (active/inactive) is imposed by the constraint owner.

An INACTIVE Strategic Constraint may revert back to the ACTIVE status again, according to a local change of conditions that are relevant to local rules. The same processing of local rules must allow toggling the strategic constraint status from INACTIVE to ACTIVE and vice-versa. Strategic Constraints are the only constraint that may be set INACTIVE and then ACTIVE again.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0017
Title	ACTIVE/INACTIVE status management (Strategic Constraint Owner)
Requirement	<p>Upon reception of a FO update or on any change of local conditions to a SI being owner of a strategic constraint, applicable for a given flight according to shared applicability rules evaluation, that SI shall:</p> <ul style="list-style-type: none"> – Re-assess any additional local rule to evaluate the strategic constraint ACTIVE/INACTIVE state, – change, or request the FDMP to change that state, if needed, according to the result.
Status	<Validated>
Maturity Level	TRL6
Rationale	<p>This requirement instructs the owner of a strategic constraint to periodically re-assess the validity of the constraint and manage accordingly the ‘active’/’inactive’ status of that constraint.</p> <p>Note. Whether this should be a requirement or just a text need to be confirmed before standardization.</p>
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0070
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

Strategic Constraint Removal

When the SI owner of a strategic constraint not shared with other SIs in the adaptation data is aware that the constraint it previously set is not able to impact the flight any longer, then it can request the FDMP to remove it.

A strategic constraint not owned by the FDMP may be requested to be removed only by its owner when, according to the shared definition of the constraint in the adaptation data, including applicability rules, the strategic constraint is not applicable anymore because of rerouting, or other flight attributes changed.

As each IOP stakeholder is responsible for keeping its own constraints up-to-date, it has to include in the FO any modification needed to align its internal view of the flight and to remove any constraint that it does not use anymore.

Only private strategic constraints can be removed by its owner. Shared strategic constraints are never removed; instead they are set inactive when they are temporarily or permanently not applicable. This prevents loops when an SI inserts again a shared strategic constraint previously added by another SI.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0050
Title	Shared strategic constraint removal (Owner)
Requirement	The IOP Stakeholder owner of a private strategic constraint shall remove (or request the removal of) the constraint from the FO Flight Script when the flight no more satisfies the strategic constraint applicability rules.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement instructs the owner of a private strategic constraint to remove it from the flight script when it becomes obsolete.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0010
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

4.2.5.3.7 Coordination Data relationship with Constraints and Expanded Route

Constraints associated to coordination data are identified as such. The SIs are requested to align the coordination data with their associated constraints, in case of modification of the coordination data or when the coordination disappears after a change in the control sequence.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0084
Title	Associate Coordination Data with Constraints
Requirement	<p>For any of the following coordinated data between adjacent SIs, manually input or automatically assigned by LOA:</p> <ul style="list-style-type: none"> - Transfer flight level, with optional Supplementary flight level, - Speed restriction, and - Rate of Climb/Descent. <p>the requesting SI of any coordinated data shall provide, if relevant, one or several constraints in the FO FS constraint list and define those constraint as associated with the coordination among the two adjacent SIs, if not already covered by an existing constraint.</p>
Status	<Validated>
Maturity Level	TRL6
Rationale	<p>This requirement provides a relationship among Coordination Data and constraints and/or the expanded route.</p> <p>ICD Note: the association among coordinated data and derived constraints will be implemented storing in each of those constraints the couple (upstreamSi, downstreamSi).</p> <p>This information will allow managing later update/remove of those constraints on coordinated data change.</p>
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0104
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0114
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0115
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0116
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0086
Title	FO Flight Script and Coordinated Data Alignment
Requirement	<p>The requester of any change or removal of coordinated data shall keep aligned the coordinated data and any derived constraint(s) of the FO Flight Script by:</p> <ul style="list-style-type: none"> • modifying the associated constraint(s), if any, when coordinated data are modified, and • remove the associated constraint(s), if any, when coordinated data are removed.
Status	<Validated>
Maturity Level	TRL6
Rationale	<p>Any constraint impacted by relevant Coordinated Data will be kept dynamically aligned by the requester of their change or removal.</p> <p>ICD Note: This requirement will be implemented using the information (upstreamSi, downstreamSi). Whenever a coordination item linked to the two lopSild, relevant constraints will be updated, or removed if any.</p>
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0104
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0114
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0115
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0116
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

4.2.5.3.8 Constraint Management in Case of Skip

In case of skip, depending on the operational requirements, the IOP system will either keep or remove the coordination constraints that were in place at the time of the skip. The IOP systems must be flexible enough to allow remote systems to behave either case.

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0154
Title	Maintenance of the constraint in case of skip
Requirement	<p>At the time of the skip, the skipping SI shall:</p> <ul style="list-style-type: none"> • re-assess the coordination constraints in place between the skipping and the skipped SI; • and either: <ul style="list-style-type: none"> ○ keep the constraints as applicable, or ○ remove (or request the removal of) the constraints.
Status	<Validated>

Maturity Level	TRL6
Rationale	This requirement explicitly addresses the management of the coordination constraints in place between the skipping and the skipped SIs by allowing either the maintenance or the removal of these constraints.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0118
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0022
<ALLOCATED_TO>	<Function>	G/G IOP Management
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

4.2.5.4 Supporting Flight Script Requirements on Adaptation Data

[REQ]

Identifier	REQ-18-02b-TS-FSMG.0064
Title	Shared strategic constraint off-line definition
Requirement	The shared strategic constraints shall be defined offline in the adaptation data and agreed amongst the IOP stakeholders that manage them.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement requests the IOP Stakeholder sharing strategic constraint to consistently define the contents and the management of these constraints in local data bases.
Category	<Interoperability><Data>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0010
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0070
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

4.2.6 Trajectory Management

This section describes the Trajectory Management in terms of the behaviour according to the IOP roles (FDMP, FDC) already defined in the previous sections.

The Trajectory Prediction of all the SIs sharing a flight plan (FDMP and FDCs) will process the planned trajectories, starting from the identified reference point (usually the last point reported, having assigned an Actual Time Over/ATO and/or an Actual Level Over/ALO), applying all the constraints following that start processing reference point, using the relevant constraint points provided by the owner of each constraint, i.e. the application point, target start point, target end point, or a combination of them (e.g. when application point and target start point are both relevant constraint points) to compute the effect on the trajectory, if not incompatible with the local context.

The TP of the FDMP will use the FO Flight Script constraints as the source for the prediction. Downstream FDCs will select the source of the information to be use as the source of trajectory prediction. (Example, an FDC may not be able to properly understand certain FO Flight Script constraints and therefore it may decide to rely on the coordination data provided at the upstream or downstream boundaries rather than the result of the trajectory prediction made by the FDMP or even its own trajectory prediction from the FO Flight Script).

[REQ]

Identifier	REQ-18-02b-TS-SCTJ.0101
Title	FDMP trajectory processing when FO Expanded Route includes unknown route items
Requirement	Whenever any unknown Expanded Route item is found while processing the FO Trajectory, the FDMP shall : <ul style="list-style-type: none"> • set a time-space discontinuity indicator on the last trajectory point corresponding to the last FO Expanded Route point before the unknown Expanded Route item, • resume the FO Trajectory processing activity from the next Expanded Route point
Status	<In Progress>
Maturity Level	TRL4
Rationale	This requirement instructs FDMP to process the FO trajectory for any known sequence of FO Expanded Route points separated by any unknown Expanded Route items, up to the end of the FO Expanded Route.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

[REQ]

Identifier	REQ-18-02b-TS-SCTJ.0107
Title	FO Expanded route points references in FO trajectory

Requirement	On FO trajectory processing FDMP shall set on trajectory points a reference to any related known expanded route point.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement instructs FDMP to reference in the trajectory points the IOP route point identifier of corresponding known expanded route points, used to add any specific trajectory point.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

4.2.7 IOP Data Distribution

The FDMP is responsible for identifying the list of stakeholders to whom the flight information will be distributed. An SI can be distributed for one or more reasons (up to five).

The possible reasons for the distribution of an FO to an SI are the following:

- 1) “Control” for SIs that are included in the control sequence;
- 2) “Vicinity” for SIs whose AoIs are crossed, as identified as a result of trajectory computation by the FDMP;
- 3) “Traversed” for SIs whose AoRs are crossed, as identified as a result of trajectory computation by FDMP;
- 4) “Point” for SIs towards whom a point has been performed;
- 5) “Subscribed” for the SIs when an ATCO requests subscription for a specific flight;
- 6) “General information” for SIs those are interested in receiving the information about a flight;
- 7) “End of Service” set for SIs who have no more any reason to receive the FO.

Anytime the FO is updated by the FDMP, the FDMP publishes the modified clusters to the SI included in the FO distribution list.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0347
Title	Distribution of the FO upon new release available
Requirement	When a new release of the FO is available, the FDMP shall distribute it to the SIs included in the FO Distribution List.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement ensures that the FDMP sends any new FO release to all the SIs identified in the distribution list.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO

4.2.7.1 Distribution for Control

The FDMP is requested to send the FO any subsequent FO updates to any SI likely to control the flight.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0344
Title	Distribution for reason 'Control'
Requirement	The FDMP shall include in the FO Distribution List for reason "Control" any SI as long as that SI: <ul style="list-style-type: none"> - is controlling the flight, - is involved in a valid coordination not set to TERMINATED by both partners, or - has transferred the flight to the current controlling SI and the reclaim is still allowed.
Status	<Validated>
Maturity Level	TRL6
Rationale	The requirement ensures that any SI controlling or likely to control the flight will be included in the FO Distribution List.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0014
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO
<ALLOCATED_TO>	<Function>	Create and Distribute FO

4.2.7.2 Distribution for Vicinity

The FDMP is requested to send the FO and any subsequent FO updates to any SI whose the Area Of Interest is crossed by the flight.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0312
Title	Distribution for reason 'Vicinity'
Requirement	The FDMP shall include in the FO Distribution List for reason 'Vicinity' any SI as long as <ul style="list-style-type: none"> the SI's AoI is crossed by the portion of the FO trajectory that starts from the initial conditions, and the SI is not already distributed for reason 'traversed'.
Status	<Validated>
Maturity Level	TRL6
Rationale	The requirement ensures that any SI whose AoI will only be crossed will be included in the FO Distribution List.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0006
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO
<ALLOCATED_TO>	<Function>	Create and Distribute FO

4.2.7.3 Distribution for Traversed

The FDMP is requested to send the FO and any subsequent FO updates to any SI whose the Area Of Responsibility is crossed by the flight.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0399
Title	Distribution for reason 'Traversed'
Requirement	The FDMP shall include in the FO Distribution List for reason 'Traversed' any SI as long as the SI's AoR is crossed by the portion of the FO trajectory that starts from the initial conditions.
Status	<Validated>
Maturity Level	TRL6
Rationale	The requirement ensures that any SI whose AoR will be crossed will be included in the FO Distribution List.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0011
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject

<ALLOCATED_TO>	<Function>	Update and Distribute FO
<ALLOCATED_TO>	<Function>	Create and Distribute FO

4.2.7.4 Distribution for Point

The FDMP is requested to send the FO and subsequent FO updates to any SI that has been pointed for that FO.

A point can be performed towards an SI which is already in the distribution list, as well as towards a new SI which is not in the distribution list. In this case, the FDMP will first add the new pointed SI in the distribution list and then add the reason of distribution as 'Point'.

The "Point Establishment" and "Point Cancellation" operations are 'one-shot' operations, i.e. there is no Point related information kept in the FO between the two operations. In order to implement this one-shot mechanism, a third operation "Point Clean" is used to request the FDMP to remove any point related information from the FO when the point establishment or cancellation is considered completed.

4.2.7.4.1 Point Establishment

A Point can be triggered by an ATCO on the CWP (Point Initiator) to identify a specific flight to another ATCO. A text for display on the receiver side (Point Receiver) can be optionally provided.

Note: As a consequence of the Point, the flight is highlighted on the CWP of the requesting ATCO and on the CWP of the target ATCO (the Point Receiver). The displaying way and the duration the flight is highlighted are a local matter.

[REQ]

Identifier	REQ-18-02b-TS-INFO.1100
Title	Initiating a Point (FDC and FDMP)
Requirement	Upon the ATCO action triggering a Point, the Point Initiator shall set the Point indicating the concerned flight, the pointing SI and Responsibility Entity, the pointed SI and associated Responsibility Entity, and optionally, the reason for the point
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to support the establishment of a Point by the Point Initiator (FDC or FDMP). The way the flight is highlighted on the Point Initiator HMI is a local matter. <u>ICD Note:</u> In this requirement 'set the point' is implemented : <ul style="list-style-type: none"> - if the Point Initiator is not the FDMP, as a <code>srv_point()</code> - if the Point Initiator is the FDMP as a FO (new <i>PointOperation</i> in <i>Point Operation List</i>) with <i>PointOperationType</i> set to POINT.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0085
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0107
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
----------------	------------	--

[REQ]

Identifier	REQ-18-02b-TS-INFO.1120
Title	Receiving a Point Establishment (FDMP)
Requirement	Upon receipt of the Point establishment service, the FDMP shall : <ul style="list-style-type: none"> - publish a FO including the Point information received in the request, and include the Pointed SI in the Distribution List for reason 'Point' - publish any update to the Pointed SI.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to instruct the FDMP to reflect the Point in the Point Operation List. <u>ICD Note:</u> The service received is <i>srv_point()</i> . <u>ICD Note:</u> A <i>PointOperation</i> element the <i>PointOperationList</i> is created with point operation type set to POINT.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0207
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO
<ALLOCATED_TO>	<Function>	Create and Distribute FO

4.2.7.4.2 Point Cancellation

Any of the two CWP's concerned by an active Point can cancel the Point (Unpoint Initiator), either at any time at the initiative of the ATCO or by the system event such as a timer expiration.

Note 1: As a consequence of the Unpoint, the flight highlight is switched-off on the Unpoint Initiator's CWP. On the Unpoint Receiver's CWP, the highlight switch-off depends on the system configuration:

- *"synchronized unpoint": the flight highlight is also switched-off;*
- *"un-synchronized unpoint": the flight highlight is not switched-off but will be later on an ATCO action or a system time-out.*

Note 2: The Unpoint Initiator is therefore not aware whether the flight highlight will be (or not) removed on the peer ATCO's CWP.

[REQ]

Identifier	REQ-18-02b-TS-INFO.1130
Title	Cancelling a Point (FDC and FDMP)

Requirement	Upon the ATCO action cancelling a Point, the Unpoint Initiator shall unset the Point indicating the concerned flight, the pointing SI and Responsibility Entity, and the pointed SI and associated Responsibility Entity.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to support the cancellation of a Point by the Point Initiator or Receiver (FDC or FDMP). ICD Note: In this requirement, 'unset the point' is implemented : <ul style="list-style-type: none"> if the Point Initiator is not the FDMP, as a <code>srv_unpoint()</code> if the Point Initiator is the FDMP as a FO (new <i>PointOperation</i> in <i>PointOperationList</i>) with <i>PointOperationType</i> set to UNPOINT.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0108
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0168
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List

[REQ]

Identifier	REQ-18-02b-TS-INFO.1140
Title	Receiving a Point Cancellation (FDMP)
Requirement	Upon receipt of the Point cancellation service, the FDMP shall publish a FO including the UnPoint information received in the request.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to instruct the FDMP to reflect the UnPoint in the Point Operation List. Whether the point indication on the HMI is removed or not is a local decision. If not removed, a local action from the local ATCO will be necessary. ICD Note: The service received is <code>srv_unpoint()</code> . ICD Note: A <i>PointOperation</i> element the <i>PointOperationList</i> is created with point operation type set to UNPOINT.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0168
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List

4.2.7.4.3 FO Cleaning after Point Establishment and Cancellation

There is no resilient information in the FO related after an established Point. Once the Point Establishment is confirmed, the FDMP removes from the FO all the Point related information.

There is no resilient information in the FO related after a cancelled Point. Once the Point Cancellation is confirmed, the FDMP removes from the FO all the Point related information.

In order to address the 3 possible situations for a point (FDC points an FDC, FDC points the FDMP, FDMP point an PDC), the FO cleaning is requested depending on who the pointed SI is:

- by the pointed FDC when the FO is received with the point/unpoint information, if the pointed SI is an FDC ;
- by the pointing FDC when the FO is received with the point/unpoint information and confirmed by the FDMP, if the pointed SI is the FDMP.

[REQ]

Identifier	REQ-18-02b-TS-INFO.1150
Title	Clean the Point (Point receiver is FDC)
Requirement	Upon receipt of a FO indicating that a Point or Unpoint was requested, the pointed FDC shall clean the Point.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to instruct the FDMP to clean the FO from the point information after a Point or Unpoint operation towards a FDC. ICD Note: The service used is <i>srv_point_clean</i> ().
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0108
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0085
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List

[REQ]

Identifier	REQ-18-02b-TS-INFO.1160
Title	Clean the Point (Point receiver is FDMP)
Requirement	Upon receipt of a FO indicating that a Point or Unpoint and the pointed SI is the FDMP, the pointing FDC shall clean the Point.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to instruct the FDMP to clean the FO from the point information after a Point or Unpoint operation towards the FDMP. ICD Note: The service used is <i>srv_point_clean</i> ().
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
--------------	---------------------	------------

<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0108
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0085
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List

[REQ]

Identifier	REQ-18-02b-TS-INFO.1170
Title	Processing a Point Clean (FDMP)
Requirement	Upon receipt of a Point Clean service, the FDMP shall publish the FO removing the associated Point information and removing the 'Point' reason from the FO Distribution List for the pointing SI.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to clean the FO from the point information. ICD Note: The service received is <i>srv_point_clean</i> (operation=point/unpoint). ICD Note: The associated Point information is a <i>PointOperation</i> element in the <i>PointOperationList</i> .
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0108
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0085
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List

4.2.7.5 Distribution for Subscribed

An SI can request the FDMP to receive FOs for a given flight by subscribing to the FDMP. This subscription is not resulting from an LoA.

This reason is also used for the SIs included in the Distribution List of the WIFOs.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0350
Title	Distribution for reason 'Subscribed'
Requirement	The FDMP shall include in the FO Distribution List for reason 'Distributed' any SI that has requested a subscription to the FO.
Status	<Validated>
Maturity Level	TRL6
Rationale	The requirement ensures that any SI having subscribed to a flight will be included in the FO Distribution List.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b

<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0009
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List

It is possible for a subscribed SI to unsubscribe itself if it is no more interested in receiving the information about this flight. The reason will be set to 'End_Of_Service' for this SI if this SI is served for no other reason.

[REQ]

Identifier	REQ-18-02b-TS-INFO.0016
Title	Unsubscribe a flight
Requirement	If an SI requests to end the subscription for a flight for which it is subscribed to, the FDMP shall remove the subscription reason from the FO Distribution List for this SI.
Status	<Validated>
Maturity Level	TRL6
Rationale	The FDMP removes the subscription reason for the concerned SI and set the reason as End_Of_Service if there is no other reason set. ICD note: the service used to unsubscribe to the FO distribution is srv_complementary_distribution_end.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0010
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List

4.2.7.6 Distribution for General Information

SIs can be distributed for general information if defined in LOAs. It covers the maintained duplication functionality.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0348
Title	Distribution for reason 'General Information'
Requirement	The FDMP shall include in the FO Distribution list for reason 'General Information' any SI that has requested to receive the FO for general Information.
Status	<Validated>
Maturity Level	TRL6
Rationale	The requirement ensures that any SI identified as being interested in the flight will be included in the FO Distribution List.

Category	<Interoperability>
----------	--------------------

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0007
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List

An SI initiating a General Information distribution identifies the sector of the pointing and pointed SIs.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0397
Title	General Information request
Requirement	When requesting to distribute the FO to a given SI for General Information, the FDC shall provide the FDMP with: <ul style="list-style-type: none"> the SI proposed for distribution, and if available, the associated RE(s).
Status	<Validated>
Maturity Level	TRL6
Rationale	The requirement states the information to be provided when subscribing another SI to the FO Distribution for General Information purpose. ICD note: the service used is srv_complementary_distribution_establish (“general_information”).
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0007
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List

4.2.7.7 Distribution for End of Service

At some point of time, when a flight is no longer of interest for an SI which was in the distribution list, the FDMP can remove this SI by sending an end of service notification to this SI indicating that this will be the last time this SI will be receiving an FO related to that flight.

This also includes the cases when:

- there is a rerouting and the SI is no more traversed,
- an SI requests for unsubscription, or
- for any other kind of removal as long as there is no other reason for distribution.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0339
Title	Distribution for reason ‘End of Service’.
Requirement	The FDMP shall set the reason for distribution for an SI as “End of Service” if this SI is distributed for no other reason.

Status	<Validated>
Maturity Level	TRL6
Rationale	If there is no other reason for distribution, the FDMP should send them an end of distribution.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0096
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO
<ALLOCATED_TO>	<Function>	Create and Distribute FO

An SI in the distribution has to acknowledge that it agrees not to receive FO anymore if it receives an end of distribution from FDMP. Otherwise, it does not send the acknowledgment and will continue to be distributed.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0340
Title	Acknowledgement of end of distribution
Requirement	When an SI receives an end of distribution from the FDMP and it agrees to not receive any longer the FOs for that flight, it shall acknowledge this reception to the FDMP.
Status	<Validated>
Maturity Level	TRL6
Rationale	When receiving an end of distribution message from FDMP, the concerned SI has to acknowledge this. ICD note: the service used will be <code>srv_end_of_service_ack</code> .
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0096
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List

The actual removal of the SI from the FO distribution list is only performed at reception of the end of service acknowledgement.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0341
Title	Removal of an SI from the Distribution List (FDMP)
Requirement	Upon receipt of the end of distribution acknowledgment from an SI, the FDMP shall remove this SI from the FO Distribution list.
Status	<Validated>

Maturity Level	TRL6
Rationale	If an SI agrees to be removed from the distribution list, the FDMP has the right to remove it completely, i.e. no more distribution of any info related to this flight will be done towards this SI.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0096
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List

4.2.8 Crossed and Control Sequence Management

The main objective of having a sequence list, control and crossed, is to ensure that the to-be-crossed and controlling centres for a flight receive up to date information about that flight. The control list ensures the correct coordination between the different SIs, hence keeping the IOP stakeholders synchronized. Each SI will appear as many times as it is expected to assume the control of the flight. This reflects the case of re-entrances. The crossed and control sequence list can dynamically be evolved at each FDMP's computation or can also be corrected and updated on the request of different FDCs.

4.2.8.1 Calculation of initial Crossed and Controlling SI List by the FDMP

Initially the only criterion available to the FDMP for identifying the list of controlling SIs is the calculated crossings of the flight with the AoR of the downstream SIs. As the flight progresses, this list can be updated by downstream systems' request of correction of the sequence and by application of the different operational rules for the flight.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1001
Title	Crossed sequence computation
Requirement	The FDMP shall calculate, update and publish in the FO, the sequence of SIs that according to its own trajectory computation are going to be AoR crossed by the flight.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement states that the crossed SI management is under the responsibility of the FDMP.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0011
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0012
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0040
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
----------------	------------	--

In order to calculate a correct sequence, the AoR and AoI of IOP stakeholders must be shared.

[REQ]

Identifier	REQ-18-02b-TS-MECH.0018
Title	Defining IOP-capable SI offline
Requirement	The list of the IOP-capable SIs shall be defined offline and shared between the IOP stakeholders.
Status	<Validated>
Maturity Level	TRL6
Rationale	Each IOP capable SI must know a minimal set of IOP capable stakeholders.
Category	<Interoperability><Data>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List

[REQ]

Identifier	REQ-18-02b-TS-SEQM.0100
Title	Offline list of volumes of responsibility (AoR)
Requirement	All the IOP stakeholders shall know the AoR of other IOP stakeholders.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is a pre requisite for control sequence determination
Category	<Interoperability><Data>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

[REQ]

Identifier	REQ-18-02b-TS-SEQM.0101
Title	Off-line list of volumes of interest (AoI)
Requirement	All the IOP stakeholders shall know the AoI of other IOP stakeholders.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement requests the IOP Stakeholders to share the list of interest volume to be crossed by a particular flight in their airspace.
Category	<Interoperability><Data>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

4.2.8.2 Calculation of control sequence in case of unknown points resulting in some unknown traversal IOP or non-IOP volumes

It is sometimes possible that the FDMP does not know few points of the route which can introduce some discontinuity in the trajectory. In this case, the FDMP might not be able to calculate a correct control sequence. This is illustrated in Figure 18.

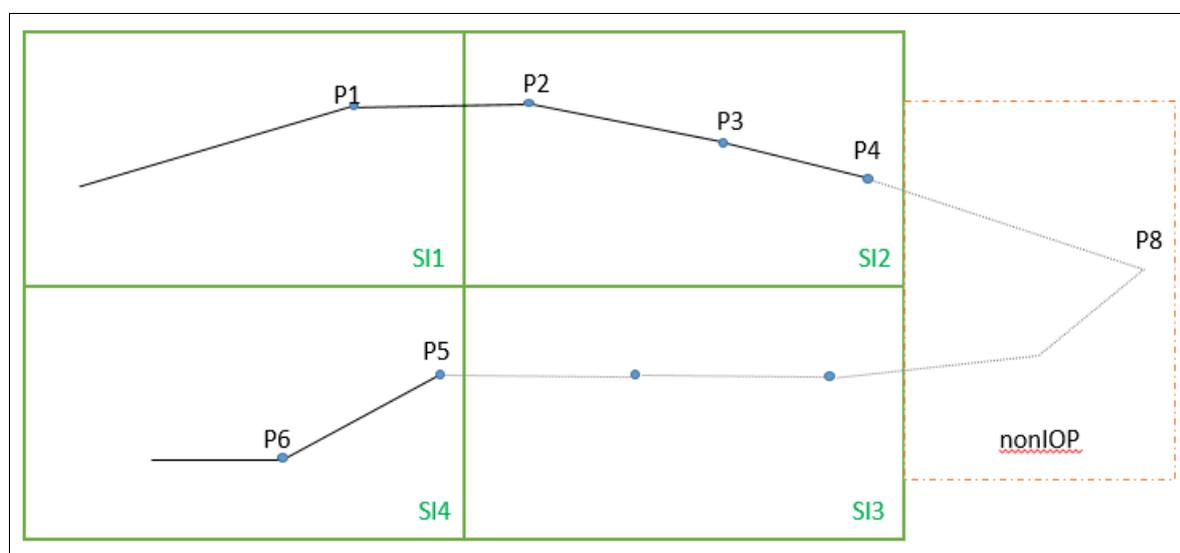


Figure 18: Unknown IOP traversal or non-IOP volumes

Here, SI1, SI2, SI3 and SI4 are four different system instances. Let’s suppose that SI1 is the FDMP

Ideally, the control sequence should be *SI1 SI2 nonIOP SI3 SI4*

But not all the route points are known by SI1. SI1 is familiar with the points P1, P2, P3, P4, P5 and P6 and henceforth, their volume. Also, it knows that there are some unknown points which introduce discontinuity in the trajectory. As a result, on the first calculation, it will publish the sequence as *SI1 SI2 nonIOP SI4*

SI2 is aware of few more points (e.g. – P8) so it asks FDMP to enrich the control sequence. As there is no new points discovered in SI3 by any of the SI, SI3 remains excluded from the control sequence until some SI includes it in the sequence. There can arise two cases:

Case 1: The last SI before IOP hole considers that the flight has exited the IOP area forever and hence, deletes the FO for this flight. In this case, if the flight re-enters the IOP area, the first traversed IOP SI will again create an FO and will declare itself as FDMP.

Case2: The last SI before IOP hole considers that the flight will re-enter the IOP area after the IOP hole and hence, does not delete the FO for this flight. In this circumstance, if the flight re-

enters the IOP area, one of the traversed IOP SI will correct the FO (whoever has the information) and the appropriate SI will declare itself as FDMP.

The following requirement addresses the control sequence calculation in case of IOP hole(s).

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1004
Title	IOP hole(s) management (FDMP)
Requirement	The FDMP shall indicate in the crossed and control sequence if a flight is or will be controlled by a non IOP system instance.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to ensure that IOP holes are associated in the crossed and control list to non-IOP SIs. This indication of IOP hole can even be in the beginning and end of the control sequence depending on whether the flight is coming from IOP hole or going out of the IOP area.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0040
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

The following requirement addresses the control sequence calculation in case of unknown points.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1005
Title	Unknown SIs inclusion (FDMP)
Requirement	The FDMP shall include an unknown SI in the Crossed and Controlling SI List each time that it detects an unknown portion of the volume traversed by the flight.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to ensure that the unknown portions of the route are associated in the crossed and control list unknown SIs.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0040
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

4.2.8.3 Computation and correction of the crossed and control sequence

Due to different algorithms of trajectory calculation and unknown local rules for different systems, it is possible that the sequence calculation by FDMP might not be perfect. In this case, the control sequence can be corrected on the requests of different FDCs based on the following situations:

- Including the SI(s) foreseen to control a flight as per the FDC calculation but not included by the FDMP;
- Discarding the SI(s) not foreseen any longer to control a flight as per the FDC calculation but included by the FDMP.

As each transferring system knows to whom it is going to transfer the flight, it has the last word about whom the flight will be transferred to. Any FDC can ask for a correction in the control sequence, depending on if its request is eligible. But the last word will be of the FDC who confirms its receiving SI occurrence. During correction, the FDC may also provide the related coordination data to FDMP as the FDMP will be unaware of this new transition. Once published, the correction to the predicted control sequence needs to be maintained until some significant change in the traversed sequence calculated by the FDMP occurs. The rules to reapply the corrections are defined later in the document.

4.2.8.3.1 SI Occurrence Identifiers

The occurrence identifier is a numeric value allocated by the FDMP at any time the sequence is created and modified. The occurrence identifier value represents the position of the occurrence in the sequence, for a given Stakeholder.

For instance: A1, A2, B1, C1, B2, C2, D1

When SI occurrences are added or removed in the sequence, the SI occurrence identifiers are recalculated by the FDMP.

In the example above,

- B2 is partially skipped at its entry => new sequence is A1, A2, B1, C1, B2s, B3a, C2, D1
- Then B1 is removed => new sequence is A1, A2, B1r, C1, B2s, B3a, C2, D1
- Then C is added after A1 => new sequence is A1, C1a, A2, B1r, C2, B2s, B3a, C3, D1
- Then A1 confirms A2 => new sequence is A1, A2c, B1r, C1, B2s, B3a, C2, D1.

The suffix a stands for “added”, r for “removed”, c for “confirmed” and s for “skipped”.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1060
Title	SI Occurrence Identifier management (FDMP)
Requirement	The FDMP shall update the SI occurrence identifier in such a way that it always represents the position of that SI occurrence within the sequence, for a given Stakeholder.
Status	<Validated>
Maturity Level	TRL6

Rationale	This requirement specifies how the SI Occurrence Identifiers are managed by the FDMP. This requirement implies a possible re-numbering of the occurrences in case of re-entrance. The definition of occurrence applies to all SIs in the sequence independently of the ADDED/REMOVED tags.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

As a consequence of the SI occurrence identifiers re-numbering, the references to the SI occurrences in the flight Script (e.g. in the coordination data or the TFLs constraint) might need to be updated as well.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1061
Title	SI Occurrence Identifier consistency in the Flight Script (FDMP)
Requirement	When updating an SI occurrence identifier, the FDMP shall update any reference in the Flight Script to that SI occurrence.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement ensures the consistency of the SI Occurrence identifiers when the FDMP re-numbers an identifier.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

4.2.8.3.2 SI Qualifiers

Each SI element in the sequence (referred as SI occurrence) has the following qualifiers:

- **Controlling qualifiers** to show how the control of the flight is handed over between the SI in the control sequence.
- **Technical correction qualifiers** indicate a modification of the crossed and control sequence that did not correspond to an operational modification.
- **Confirmation qualifier** is provided in each SI that has been confirmed as the next downstream SI occurrence by the upstream controlling SI.

- **Operational modifiers** of the sequence used to highlight identify changes in the expected control sequence that are not derived from trajectory computation differences, i.e., Skips or Delegations. Whatever the origin of this change, that is, it may be the result of a LoA or a manual action from an ATCO.

4.2.8.3.2.1 SI Controlling Qualifiers

Each SI occurrence contains an SI Controlling Qualifier including one of these values:

- **TRANSFERRED:** the flight has been assumed by its receiving SI,
- **CONTROLLING:** the SI who is currently controlling the flight,
- **EMPTY:** None of the above applies.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1041
Title	Transferring SI status update
Requirement	The FDMP shall set the status of all the SI occurrences upstream to the controlling SI to TRANSFERRED in the FO.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to show the state of upstream SIs once the flight has been assumed by a downstream SI. This includes the transferred status set in case of skip and delegate as well.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0034
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1042
Title	Receiving SI status update
Requirement	The FDMP shall set the status of the latest SI occurrence having assumed the flight to CONTROLLING in the FO.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to show that the flight has been assumed by a downstream SI. It has to be noted that this status will only be set for the IOP SIs.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a

<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0059
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0097
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

4.2.8.3.2.2 SI Technical Correction Qualifiers

Each SI occurrence can have technical correction qualifiers.

The technical qualifiers in the Control sequence highlight corrections to the FDMP computed sequence that does not correspond to operational modification.

To show a technical correction in the control sequence, the FDMP use one of the following values for the Technical Correction Qualifier:

- **ADDED:** It indicates that the SI occurrence has been added after another one in the control sequence. This can be requested by any FDC as well as used by the FDMP in case FDMP doesn't want its changes to be over-written.
- **REMOVED:** It indicates that an SI occurrence predicted to control the flight by the FDMP has been removed from the control sequence. This can be requested by any involved SI.

4.2.8.3.2.3 SI Confirmation Qualifier

Every SI that is expected to control the flight can confirm, for each of their controlled occurrences, the next SI occurrence in the sequence. Once a confirmation is made in the list, unless a correction is requested to amend the exit of the requester, the FDMP will prevent technical corrections (addition or removal between a confirmed SI occurrence and its previous one.

The following qualifier is set by the FDMP when an SI occurrence has been confirmed by its upstream SI occurrence:

- **CONFIRMED:** It indicates that an SI has been confirmed by its upstream.

The downstream SI (when any) of the controlling SI must always be confirmed (REQ-18-02b-TS-SEQM.1043).

4.2.8.3.2.4 SI Operational Qualifiers

Each SI occurrence can have operational qualifiers.

The operational qualifiers for the control sequence allow the SIs to modify the nominal control sequence in case of some local rules unknown by the FDMP or other SIs (and not as the result of a different trajectory computation).

To show an operational action in the control sequence, the following values are used:

- **SKIP:** It indicates that the SI has been skipped. This can be requested by any involved or traversed SI if the request is based on the LoAs, pre-defined rules, manual input or resulting from a negotiation.

- **UNSKIP:** It indicates that the skip has been cancelled by the skipping or the skipped SI. It is to avoid loops and make sure that this unskipped SI is not automatically skipped again by any other SI.
- **DELEGATION:** It indicates that the control of the SI's airspace has been delegated to another SI which is not in the sequence. This can be requested by any involved or traversed SI or the concerned SI even if not involved or traversed if the request is based on the LoAs, manual input, some pre-defined rules or resulting from a negotiation.
- **UNDELEGATION:** It indicates that a delegation has been cancelled by the delegator SI or the delegatee SI. It is to avoid loops and make sure that this undelegated SI occurrence is not automatically delegated again by any other SI.

At any time, the SI who is or will control the flight is indicated in the SI occurrence, taking into account the on-going operational actions identified above (skip, delegation).

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1044
Title	Identification of SI in charge of controlling the flight in each SIs occurrence
Requirement	The FDMP shall indicate the identifier of the SI who will control the flight in each SI occurrence in the FO except if this SI occurrence SI has been removed.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to know who controls the flight in whose AoR. If there is no operational modification, the FDMP will indicate the non-removed SIs as the SI in charge of the flight in its own airspace. The SI Identifier is the Stakeholder Id (no occurrence).
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0097
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

It has to be noted that a valid operational correction over an existing technical correction is possible. For example, an added and confirmed SI can be skipped; a flight can be delegated to a removed SI.

4.2.8.3.3 Transition Data Qualifier

4.2.8.3.3.1 Nature of Transition

As a consequence of the removal of an SI occurrence, some existing transition data have to be removed as well. As long as the SI occurrence to which these transitions are related, are still in the Crossed and Controlling SI List, the transition data structures are not physically removed from the list but are maintained in the list with an INVALID indication. The data in INVALID coordination data cannot be modified. It is the responsibility of the FDMP to ensure that they are not modified locally or upon request from an FDC.

To indicate the status of the transition, the following values are used:

- **VALID:** The transition is active and contains valid information about the coordination of the two SIs specified in the data structure.
- **INVALID:** The transition is not active (following for instance a short-cross or a skip). The data present in the data structure reflect the coordination before the transition has been invalidated and cannot be modified. This allows to restore applicable coordination data if the transition is restored.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1062
Title	Coordination Data frozen as long as the transition is invalid
Requirement	The FDMP shall prevent and reject any FDC's request to modify the coordination data of a transition marked as INVALID.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to ensure the data in an invalid transition are frozen and can be restored in case the transition is set back to VALID.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0096
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0015
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0218
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

4.2.8.4 Technical Qualifiers usage

4.2.8.4.1 Correcting the sequence

This section describes the different corrections requests by FDCs (addition, removal and confirmation) and their implementation by the FDMP.

The FDMP may fail to implement a constraint properly which can have an impact on the crossed SI sequence for further downstream systems. In those cases, it is expected that the downstream SIs that have a better knowledge of their vicinity will request corrections to the FDMP after having submitted all the constraints they need to share with the FDMP. These corrections are done by adding and/or removing a set of consecutive SI occurrences after a given SI occurrence.

In addition, the upstream SI occurrence expected to control the flight is always considered as the SI that has the priority determining to whom it is going to hand-over the flight. An upstream controlling SI is allowed to confirm its downstream SI, avoiding further modification by other SIs.

Once a correction is performed, the FDMP will try to maintain the correction according to the rules described in the *Maintaining technical corrections in the control sequence* section.

4.2.8.4.1.1 SI Addition

When an FDC requests the FDMP to add one or more new SI(s) after an SI in the control sequence, it is termed as addition.

Table 23 provides an example of the addition an SI occurrence.

FDMP (A) Local Crossed Sequence List	FO Crossed and Controlling SI List	Xa = SI X added Xr = SI X removed <u>X1</u> = SI X1 is confirmed B1 = SI B1 is controlling
1. Initial Step		
A B C D E	A1 B1 <u>C1</u> D1 E1	
	A1 B1 B1 C1 C1 D1 D1 E1	
2. D requests to add F as C's downstream		
	A1 B1 <u>C1</u> F1a D1 E1	
	A1 B1 B1 C1 C1 F1 F1 D1 D1 E1	

Table 23: SI Addition Example

When requesting to correct the Control Sequence by adding one or several SIs, the FDC must provide the FDMP information to perform the addition in the right place.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1006
Title	Control Sequence correction request by an FDC (addition)
Requirement	<p>When an FDC requests the correction of the crossed and control sequence by adding one or more SI(s), it shall provide the following information to the FDMP:</p> <ul style="list-style-type: none"> the identification of the upstream SI occurrence after whom the addition will be done, the identification of the added SI(s), optionally, the coordination data at the entry of the newly added SI, optionally, the coordination data at the exit of the newly added SI, and optionally, the coordination data between all the newly added SIs
Status	<Validated>
Maturity Level	TRL6
Rationale	The requirement is needed to give the freedom to any FDC to request for the addition of one or more new SI in the control sequence. The requester of the addition can provide the coordination data in an associated service if it has them.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a

<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0040
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0015
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

The FDMP must accept all addition requests coming from the FDCs for the correction in the control sequence if they are valid and do not contradict the defined rules. However, in order to avoid loops correcting the SIs sequence, the FDMP will not allow additional corrections to the portions of the sequence that were already corrected but not yet confirmed (see examples in 4.2.8.4.1.4)

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1045
Title	SI addition refusal (FDMP)
Requirement	The FDMP shall reject an FDC's request to add an SI if this SI is: <ul style="list-style-type: none"> located immediately before an ADDED SI, except if the originator is the upstream SI occurrence to that added SI, located immediately before or after a REMOVED SI, except if the originator is the upstream SI occurrence to that removed SI, or located immediately before a CONFIRMED SI, except if the originator is the upstream SI occurrence to that confirmed SI.
Status	<In Progress>
Maturity Level	TRL4
Rationale	This requirement explains the eligibility rules and the protection by FDMP when performing a correction related to addition.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0040
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0096
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0099
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

As a consequence of the addition of one or several SIs, the FDMP will update the FO Crossed and Controlling SI List.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1007
Title	SI addition: impact on FO Control Sequence (FDMP)
Requirement	On an accepted request from an FDC to add one or more SI(s) in the crossed and control sequence, the FDMP shall insert the set of SI occurrences after the indicated upstream SI including the following information: <ul style="list-style-type: none"> an SI Identifier and occurrence Id, an empty SI State, the SI Technical Correction Qualifier to ADDED, and none of the other optional fields.
Status	<Validated>

Maturity Level	TRL6
Rationale	This requirement defines the impact on the Crossed and Controlling List when the FDMP processes a valid FDC request to add one or more SI.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0040
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0015
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

As a consequence of the addition of one or several SIs, the FDMP will update the FO Coordination data.

The inclusion of new SIs in the crossed and control sequence implies that new coordination structures are to be created. The FDMP is responsible for creating those structures. Since these corrected crossings were not detected by the FDMP, it would only be able to identify the transferring and receiving occurrences in those coordination, if additional information would not be provided in the request. The SIs involved in that coordination are then responsible for updating the coordination data for the concerned transition.

When a transition is re-used for a different SI, the previous coordination information must be reset to avoid use of obsolete coordination information.

For instance,

FDMP's initial calculation	A	B	C	D		
	A B	B C	C D			
New sequence published by FDMP with either choice of the coordination data	A	B	Ea	Fa	C	D
	A B	B(reset) E	E F	F C	C D	
	A B	B E	E F	F C(reset)	C D	

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1063
Title	SI addition: impact on FO Coordination Data (FDMP)
Requirement	<p>On an accepted request from an FDC to add one or more SI(s) in the crossed and control sequence, the FDMP shall:</p> <ul style="list-style-type: none"> • create the missing coordination transitions between each new crossed SI occurrence, setting <ul style="list-style-type: none"> ○ when present in the request, the coordination data provided by the requester, ○ otherwise the default values for Nature of Transition (VALID), transfer status (NOT STARTED), and coordination phase of upstream and downstream (INITIAL), • erase the existing coordination transition data when they are re-used for a different pair of upstream/downstream.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement specifies how the active coordination are set by the FDMP when SI(s) are added in the FO Control Sequence.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0040
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

As a consequence of the addition of one or several SIs, the FDMP will update the FO Distribution List.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1064
Title	SI Addition: Impact on FO Distribution List (FDMP)
Requirement	<p>On an accepted request from an FDC to add one or more SI(s) in the crossed and control sequence, the FDMP shall include in the FO distribution list the SI Id when it was not already in the list with the following information:</p> <ul style="list-style-type: none"> • SI Id, • the awareness phase to NOT_SAP, and • the distribution Reason to CONTROL.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement specifies how the Distribution List is managed by the FDMP when SI(s) are added in the FO Control Sequence.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0040
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List

<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
----------------	-----------	------------------------

4.2.8.4.1.2 SI Removal

When an FDC requests the FDMP to remove one or more consecutive SI(s) which are in the control sequence as per FDMP’s calculation, it is termed as removal.

Note. The term ‘remove’ means that the SI data is kept in the FO crossed and control sequence marked as REMOVED whereas ‘delete’ means the physical deletion of an SI in the sequence.

Table 24 provides an example of the removal an SI occurrence.

FDMP (A) Local Crossed Sequence List	FO Crossed and Controlling SI List	Xa = SI X added Xr = SI X removed <u>X1</u> = SI X1 is confirmed B1 = SI B1 is controlling
	Coordination Data List	
1. Initial Step		
A B C D E	A1 B1 <u>C1</u> D1 E1	
	A1 B1 B1 C1 C1 D1 D1 E1	
2. E requests the FDMP to remove D (and to keep D’s exit coordination data valid)		
	A1 B1 <u>C1</u> D1r E1	
	A1 B1 B1 C1 C1 D1(I) C1 E1	(I)Stands for invalid transition

Table 24: SI Removal Example

When requesting to correct the Control Sequence by removing one or several SIs, the FDC must provide the relevant information to the FDMP to perform the removal at the right place and order.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1008
Title	Control Sequence correction request by an FDC (removal)
Requirement	When an FDC requests the correction of the crossed and control sequence by removing one or a sequence of subsequent SI(s) occurrences, it shall provide the following information to the FDMP: <ul style="list-style-type: none"> the identification of the SI(s) occurrences to be removed, the reason of the removal (in case of short-cross), and the identification of the coordination structure that will remain valid (entry or exit of the removed section).
Status	<Validated>
Maturity Level	TRL6
Rationale	The requirement is needed to give the freedom to any FDC to request for the removal of any SI from the control sequence. The flexibility is allowed to choose which coordination data will be valid because it depends on the situation. Hence, it is neither fixed to upstream nor to downstream.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0015
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0040
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0014
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0099
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0101
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

The FDMP must accept all deletion requests coming from the FDCs for the correction in the control sequence if they are valid and do not contradict the defined rules. However, in order to avoid loops correcting the crossed SIs sequence, the FDMP will not allow additional corrections to the portions of the sequence that were already corrected but not yet confirmed (see examples in 4.2.8.4.1.4).

It is irrelevant for an FDC to request the removal of an SI if this results in two subsequent SI occurrences controlled by the same stakeholder (e.g. in case of re-entrance and C1 is short-crossed [A1(A) B1(B) C1(C) B2(B) D1(D)], if B1 requests to remove C1, this will result in a transition between B and itself [B1(B) C1r B2(B)]). In that case, it must request the removal of both C1 and B2).

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1046
Title	SI removal refusal (FDMP)
Requirement	The FDMP shall reject the request to remove an SI if the: <ul style="list-style-type: none"> removed SI is ADDED, except if the originator is the upstream SI occurrence to that added SI, removed SI is CONFIRMED, except if the originator is the upstream SI occurrence to that confirmed SI, or removal results in two SIs being controlled by the same stakeholder.
Status	<In Progress>
Maturity Level	TRL4
Rationale	This requirement explains the eligibility rules and the protection by FDMP when doing a removal correction.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0040
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0096
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0099
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

As a consequence of the removal of one or several SIs, the FDMP will update the FO Crossed and Controlling SI List. SIs initially computed in the Crossed Sequence are never deleted from the list but just marked as REMOVED. Only ADDED SIs that are subsequently deleted from the list.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1009
Title	SI removal: Impact on FO Control Sequence (FDMP)
Requirement	On an accepted request from an FDC to remove one or more existing subsequent SI(s) occurrences from the crossed and control sequence, the FDMP shall : <ol style="list-style-type: none"> 1. for each of the requested SI occurrences that were not indicated as ADDED, <ul style="list-style-type: none"> • indicate the SI occurrence as REMOVED • remove the Controlling SI identifier, • unset the CONFIRMED tag, if set 2. delete the requested SI occurrences that were indicated as ADDED, 3. set the reason of removal, if provided.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement defines the impact on the Crossed and Controlling List when the FDMP processes a valid FDC request to remove one or more SIs. The reason of the removal is useful in case of short-cross.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0099
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0101
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

As a consequence of the removal of one or several SIs, the FDMP will update the FO Coordination data. Some transitions are not applicable anymore, so they are set to INVALID. When a transition is re-used for a different SI, the previous coordination information must be reset to avoid use of obsolete coordination information.

For instance, A FDC requests to remove C and D (keeping either the exit or the entry valid). The entry (or exit) transition and the transition between C and D are invalidated. The data in the re-used transition are reset.

FDMP's initial calculation	A	B	C	D	E
	A B	B C	C D	D E	
New sequence published by FDMP with either choice of the coordination data	A	B	Cr	Dr	E
	A B	B C(I)	C D(I)	B(reset) E(reset)(exit valid)	
	A B	B(reset) E(reset)	C D(I)	D E(I) (entry valid)	

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1065
Title	SI removal: impact on FO Coordination Data (FDMP)
Requirement	<p>On an accepted request from an FDC to remove one or more existing subsequent SI(s) occurrences from the crossed and control sequence, the FDMP shall:</p> <ul style="list-style-type: none"> • set to INVALID the coordination data between two removed SIs, • indicate which coordination data (only one) between the upstream and the first removed or deleted SI occurrence, and between last removed or deleted SI occurrence and its downstream is to be invalidated or deleted as requested by FDC, and • erase the existing coordination transition data when they are re-used for a different pair of upstream/downstream.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement specifies how the active coordinations are set by the FDMP when SI(s) are removed in the FO Control Sequence.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0040
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

As a consequence of the removal of one or several SIs, the FDMP should update the FO Distribution List.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1066
Title	SI Removal: impact on FO Distribution List (FDMP)
Requirement	<p>On an accepted request from an FDC to remove one or more existing subsequent SI(s) occurrences from the crossed and control sequence, the FDMP shall:</p> <ul style="list-style-type: none"> - keep the removed SI(s) in the Distribution List with the distribution reason unchanged and - delete the added SIs if they are requested to remove
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement specifies how the Distribution List is managed by the FDMP when SI(s) are removed in the FO Control Sequence.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0096
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

4.2.8.4.1.3 SI Confirmation

If an SI does not want its immediate downstream SI occurrence in the sequence to be changed by anyone, it can confirm it to ensure no further changes are done between them, unless required by itself (the requester FDC). Every SI expected to control the flight can confirm its next SI occurrence in the Crossed and Controlling SI List.

This is also applicable in the case when an SI disagrees with an existing correction for its downstream.

As a consequence of the confirmation of a downstream SI by its upstream SI:

- All the SIs occurrences included by the FDMP computation in the middle will be marked as REMOVED,
- All the SIs included because of a former correction (ADDED) are deleted from the crossed and control sequence along with its coordination.

Table 25 provides an example of the confirmation an SI occurrence.

FDMP (A) Local Crossed Sequence List	FO Crossed and Controlling SI List	Xa = SI X added Xr = SI X removed X1 = SI X1 is confirmed B1 = SI B1 is controlling
	Coordination Data List	
1. Initial Step (F1 was previously added by E1)		
A B C D E	A1 B1 C1 F1a D1 E1	
	A1 B1 B1 C1 C1 F1 F1 D1 D1 E1	
2. C1 confirms E1 as its downstream		
	A1 B1 C1 D1r E1	D1 is removed, F1 is deleted
	A1 B1 B1 C1 C1 D1(l) C1 E1	

Table 25: SI Confirmation Example

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1043
Title	Automatic next SI confirmation (FDMP)
Requirement	The FDMP shall confirm the next SI crossed in the sequence for all the occurrences it is expected to control.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to ensure automatic confirmation by the FDMP. Only an SI present in the crossed and control sequence can be confirmed.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a

<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0040
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1010
Title	Confirmation of an SI
Requirement	When an FDC performs a confirmation request, it shall provide the identification of the SI occurrence for which it is confirming its exit, to the FDMP.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement states the information and FDC should provide to confirm its downstream SI occurrence.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0015
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

The confirmation can take place only on existing SI in the sequence. If a new SI occurrence has to be confirmed, first it should be added in the sequence. It is irrelevant for an FDC to confirm a downstream SI belonging to the same stakeholder (e.g. in case of re-entrance and C1 is short-crossed [A1(A) B1(B) C1(C) B2(B) D1(D)], B1 cannot confirm B2, it can confirm D1).

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1067
Title	FDC's confirmation request rejection
Requirement	The FDMP shall reject the FDC request to confirm a SI if: <ul style="list-style-type: none"> the indicated confirmed SI is not in the control sequence, or the indicated confirmed SI is controlled by the same stakeholder than the requester.
Status	<In Progress>
Maturity Level	TRL4
Rationale	This requirement is needed to ensure the protection by FDMP when performing a confirmation.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0040
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1011
Title	Next SI confirmation request processing (FDMP)
Requirement	<p>On acceptance of a request from an FDC to confirm a SI occurrence in the sequence, the FDMP shall:</p> <ul style="list-style-type: none"> • indicate this SI occurrence as CONFIRMED and reset the removal indicator, if the confirmed SI is marked as removed, • if another SI occurrence was previously CONFIRMED by the same FDC, remove the CONFIRMED indicator, • indicate as REMOVED the SIs computed by the FDMP placed between both SI occurrences included in the request, and • delete from the sequence any SI occurrence added in a previous correction placed between both SI occurrences included in the request.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement ensure the FDMP implementation of confirmation request by an FDC for its downstream.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0014
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

4.2.8.4.1.4 Short-cross

A short-cross is a corrective mechanism intending to remove a stakeholder from the control sequence who is crossed for a very limited period of time.

In case there is a short-cross triggered by a bilateral agreement between two SIs (a LoA which determines a crossed time/distance parameter), the “short-crossing” SI will take out of the sequence the “short-crossed” SI by either removing it (using a removal request) or by confirming the downstream SI of that short-crossed SI (using the confirmation request).

Table 26 provides an example of short-cross.

FDMP (A) Local Crossed Sequence List	FO Crossed and Controlling SI List	Xa = SI X added Xr = SI X removed X1 = SI X1 is confirmed B1 = SI B1 is controlling
	Coordination Data List	
1. Initial Step – D1 is within the threshold (time or distance) to be short-crossed.		
A B C D E	A1 B1 C1 D1 E1	
	A1 B1 B1 C1 C1 D1 D1 E1	
2. (a) C1 short-crosses D1 (by removing D1)		
	A1 B1 C1 D1r E1	

	A1 B1 B1 C1 C1 D1(I) C1 E1	
2. (b) C1 short-crosses D1 (by confirming E1)		
	A1 B1 <u>C1</u> D1r <u>E1</u>	D1 is removed, F1 is deleted
	A1 B1 B1 C1 C1 D1(I) C1 E1	

Table 26: Short-cross Example

4.2.8.4.1.5 Examples of combined operations

Table 27 provides an example of the combined operations adding, removing and confirming SI occurrences. The table applies the rules limiting the modifications on the already corrected section of the sequence and identifies which SI is allowed to perform further modifications.

FDMP (A) Local Sequence List	FO Crossed and Controlling SI List	Xa = SI X added Xr = SI X removed X1 = SI X1 is confirmed B1 = SI B1 is controlling
	Coordination Data List	
1. Initial Step		
A B C D E	A1 B1a C1r D1a E1r F1 A1 B1 B1 C1(I) B1 D1 D1 E1(I) D1 F1	The non-confirmed corrected section is [C1r D1a E1r] can only be corrected as follows as B1 is already confirmed, even if added: => B1 can add a SI after B1 or C1 => B1 can remove D1 => D1 can add a SI after D1 or E1
2. SI B adds G1 after its own SI occurrence.		
	A1 B1a G1a C1r D1a E1r F1 A1 B1 B1 G1 B1 C1(I) G1 D1 D1 E1(I) D1 F1	The non-confirmed corrected section is [G1a C1r D1a E1r]
3. SI B confirms SI G1.		
	A1 B1a <u>G1a</u> C1r D1a E1r F1 A1 B1 B1 G1 B1 C1(I) G1 D1 D1 E1(I) D1 F1	The non-confirmed corrected section is [C1r D1a E1r] can only be corrected as follows: => G1 can add a SI after G1 or C1 => G1 can remove D1 => D1 can add a SI after D1 or E1
4. SI G confirms E1.		
	A1 B1a <u>G1a</u> C1r <u>E1</u> F1 A1 B1 B1 G1 G1 E1 D1 E1(I) E1 F1	D1a is deleted The non-confirmed corrected section [C1r] can only be corrected as follows:

		=> G1 can add a SI after G1 or C1
5. SI G confirms C1.		
	A1 B1a G1a C1r E1 F1	There is no non-confirmed corrected section
	A1 B1 B1 G1 G1 E1 D1 E1(I) E1 F1	

Table 27: Example of combined operations

4.2.8.4.2 Maintaining technical corrections in the crossed and control sequence

This section deals with the way to maintain the corrections of the crossed and control sequence, after the FDMP computation of the crossed sequence is modified.

The modification of the crossed sequence can be the result of, among others, the application of a route change, a readjustment of the trajectory, a change of FDMP for one that do not have the same trajectory processing as the previous one, etc. When the IOP trajectory is modified, this possibly affects the predicted sequence of SIs that are involved in this flight; some new SIs may be included into the sequence whereas some others may disappear or appear somewhere else in the sequence.

Definitions:

- The “Local Crossed Sequence List” is the sequence of crossed SIs locally computed by each SIs.
- The “FO Crossed and Controlling SI List” is the sequence of crossed and controlling SIs computed by the FDMP and included in the Crossed and Control Sequence FO Cluster. In case corrections have been made on request of FDCs, the FO Crossed and Controlling SI List may be different from the FDMP’s Local Crossed Sequence List. A “corrected section” is a continuous sequence of modified SIs (e.g. added or remove).
- The “corrected section ([X (Aa* Br*)Y])” is an ordered sequence of added and removed SIs between an upstream SI X and a downstream SI Y. A corrected section can exist at the end of the sequence ([X -]).

4.2.8.4.2.1 Conditions for sequence correction re-application

In case the FDMP computation of its Local Crossed Sequence List results in the same sequence as the previous one, the FO Crossed and Controlling SI List sent in the previous FO is re-used in the new FO to be published. If the computation results in a different sequence, the FDMP will try to maintain the previously performed corrections that are still possible to apply.

When an SI takes over the FDMP role, it will also try to maintain the corrections performed by other FDCs before becoming the FDMP.

Table 28 illustrates those 2 situations.

	FDMP Local Crossed Sequence List	FO Crossed and Controlling SI List Xa = SI X added Xr = SI X removed <u>X1</u> = SI X1 is confirmed B1 = SI B1 is controlling [X Y] = corrected section identified by its	B Local Crossed Sequence List / corrections
--	--	---	---

		upstream X and downstream Y Xr = SI X removed	
(1) FO creation	A B C D	A1 B1 C1 D1	
(2) FO reception / correction request			A B E D Replace C by E
(3) Processing correction request		A1 B1 (E1a C1r) D1	
(4a) Exact same sequence is computed by FDMP	A B C D	the whole FO Crossed and Controlling SI List is kept A1 B1 (E1a C1r) D1	
(4b) A different sequence is computed by the FDMP	A B C D H A B C D A D E H Etc...	The re-application rules apply. See req REQ-18-02b-TS- SEQM.1034	

Table 28: Conditions for sequence list re-application

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1068
Title	Conditions for correction re-application
Requirement	When the FDMP re-calculates the Local Crossed Sequence List for an FO update, it shall set in the published FO Crossed and Controlling SI List: <ul style="list-style-type: none"> the previous and unchanged FO Crossed and Controlling SI List when the local sequence of crossed SI is the same as the one computed for the previous FO, or the Local Crossed Sequence List re-applying the previous accepted changes otherwise.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement specifies the conditions for re-applying the previous corrections performed on the FO Crossed and Controlling List. When a new FO is published but the sequence of crossed SIs is not different of what was calculated for the previous FO, the FO Crossed and Controlling List is kept unchanged. Otherwise, if the new sequence is different, the FDMP is requested to re-apply as much as possible the corrections previously performed. The “as much as possible” re-application is specified in requirement REQ-18-02b-TS-SEQM.1034. This requirement is applicable to a new SI taking over the role of FDMP.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0040
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

4.2.8.4.2.2 Sequence correction re-application mechanism

When the FDMP computes a new Local Crossed Sequence List which is different from the previous one, it will try to restore in the FO Crossed and Controlling SI List the corrections that were previously performed. The similar rule applies in case an SI takes the FDMP role.

When one or several corrections have been made between a given pair of SIs (let's say X and Y) and this pair of SI is still present in the new Local Crossed Sequence List, then the FDMP will fully re-apply the corrections when the sections are compatible, i.e.

1. No SIs are present between X and Y in the Local Crossed Sequence List;
2. One or more of the previously added or removed SI are present between X and Y in the Local Crossed Sequence List.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1034
Title	Re-application of control sequence correction (FDMP)
Requirement	<p>When the FDMP has computed the Local Crossed Sequence List and re-applies the control sequence corrections, or the SI has taken over the FDMP role, it shall:</p> <ol style="list-style-type: none"> 1. For each corrected section in the previous FO Crossed and Controlling SI List (identified by an upstream X and a downstream Y), 2. check that a matching section with an upstream X and a downstream Y still exists in the Local Crossed Sequence List, and 3. For those matching sections, restore all the corrections between X and Y when, in the Local Crossed Sequence List,: <ul style="list-style-type: none"> • there is no SI between X and Y, or • there are SIs between X and Y and they correspond to an ordered sub-list of the previous FO corrected section.
Status	<Validated>
Maturity Level	TRL6
Rationale	<p>This requirement specifies the logic which allows (or not) the FDMP to re-apply a previously applied change, in case of any change in the local crossed sequence list, e.g. a route change, and diversion etc.</p> <p>When in the Local Crossed Sequence List the previously corrections can be applied without ambiguity, then the corrections are restored, otherwise those corrections are</p> <p>If the same matching section appears two times in the crossed list, the correction is applied to the first one.</p> <p>This requirement is applicable to an SI that takes over the FDMP role.</p>
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a

<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0040
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

Once the re-application of the corrections is performed, the FDMP **shall** also restore the confirmation indication that was set before by any upstream SI, as long as the downstream SI in the new FO sequence is the same.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1047
Title	Re-application of next SI confirmation (FDMP)
Requirement	After re-application of the addition and removal, the FDMP shall re-apply the confirmation for any confirmed SI occurrence where the SI expected to control in its upstream SI has not been modified after the sequence re-computation.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed in case of any change in the control sequence, example- route change, diversion etc., when the sequence is impacted. The confirm indication need to be applied after the removal and addition as it depend of its result.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0040
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

4.2.8.4.2.3 Examples

Table 29 provides an example where previous corrections are re-applied or not.

FDMP (A) Local Crossed Sequence List	FO Crossed and Controlling SI List	Xa = SI X added Xr = SI X removed <u>X1</u> = SI X1 is confirmed B1 = SI B1 is controlling [X (Aa* Br*) Y] = corrected section identified by its upstream X and downstream Y
Initial Step		
A B C D	A1 <u>B1</u> C1 D1	B requests to replace C1 by E1. B1 confirms E1.
	A1 B1 (<u>E1a</u> C1r) D1	The corrected section is [B1 D1].
Case 1a: FDMP finds a matching [B1,D1] section in the local sequence. The corrections can be re-applied without ambiguity.		

The corrections are restored.		
A B D	A1 B1 (<u>E1a</u> C1r) D1	No SI between B and D
A B C D		One or more removed SIs between B and D
A B E D		One or more added SIs between B and D
A B E C D		Several removed and/or added SI between B and D
Case 1b: FDMP finds a matching [B1,D1] section in the local sequence. The corrections cannot be apply The corrections are not restored. The FO Crossed and Controlling SI List reflects the FDMP Local Crossed Sequence List.		
A B J D	A1 B1 J1 D1	B will have to confirm J1 or to replace J1 by E1.
A B C J D	A1 B1 C1 J1 D1	B will have to confirm C1 or to replace C1 by E1.
A B C E D	A1 B1 C1 E1 D1	B1 will have to confirm C1 or E1.
Case 2a: A new SI takes over the FDMP role. The same rules apply.		
A B C D	A1 B1 (<u>E1a</u> C1r) D1	

Table 29: Example of Control Sequence Correction Re-application (Addition, Removal)

Table 30 illustrates the confirmation re-application mechanisms.

FDMP (A) Local Crossed Sequence List	FO Crossed and Controlling SI List	Xa = SI X added Xr = SI X removed <u>X1</u> = SI X1 is confirmed B1 = SI B1 is controlling [X Y] = corrected section identified by its upstream X and downstream Y
Initial Step		
A B C D	A1 B1 C1 D1	B requests to replace C1 by E1. B1 confirms E1
	A1 B1 (<u>E1a</u> C1r) D1	The corrected section is [B1 D1].
Step 1: FDMP finds a matching [B1,D1] section in the local sequence. The corrections can be re-applied without ambiguity. The corrections are restored.		
A B D	A1 B1 (E1a C1r) D1	No SI between B and D
A B C D		One or more removed SIs between B and D

A B E D		One or more added SIs between B and D
A B E C D		Several removed and/or added SI between B and D
Step 2: FDMP re-apply E1 confirmation by B1		
	A1 B1 (<u>E1a</u> C1r) D1	

Table 30: Example of Control Sequence Correction Re-application (Confirmation)

Table 31 illustrates the addition, deletion and confirmation re-application mechanisms.

FDMP (A) Local Crossed Sequence List	FO Crossed and Controlling SI List	Xa = SI X added Xr = SI X removed <u>X1</u> = SI X1 is confirmed B1 = SI B1 is controlling [X Y] = corrected section identified by its upstream X and downstream Y
Initial Step		
A B C D E	A1 B1 C1 D1 E1	There is no corrected section.
A confirms B1, B confirms D1. B removes E1 and adds F1.		
	A1 B1 C1r D1 E1r F1a	This automatically removes C1. The corrected sections are [B1 D1] and [D1 -]
A confirms C1		
	A1 B1r C1 D1 E1r F1a	This automatically removes the confirmation of B1 by A1 and the confirmation of D1 by B1). The corrected sections are [A1 C1] and [D1 -]
FDMP calculates locally a new sequence.		
A C D F	A1 B1r C1 D1 E1r F1a	Corrections on [A1 C1] are re-applied Corrections on [D1 -] are re-applied The corrected sections are [A1 C1] and [D1 -]
A confirms B1		
	A1 B1 C1 D1 E1r F1a	This automatically removes the confirmation of C1 by A1. The corrected section is [D1 -]

Table 31: Example of Control Sequence Correction Re-application (Addition, Removal, Confirmation)

4.2.8.5 Operational Qualifiers usage

A sequence of crossed SIs (including any possible corrections provided by the FDCs) may not represent the real sequence of the SIs that are expected to control the flight. The list of SIs that are controlling the flight will be modified upon establishing skip, or delegation.

4.2.8.5.1 Skip Mechanism

If an SI present in the crossed and control sequence decides not to control a flight, it can decide to skip itself in the control sequence list. This SI is called “skipped SI”. The SI who will control the flight on its behalf is called “skipping SI”. The same concept can be applied if another SI, either upstream or downstream to it, decides to skip this SI. The SI who skips another SI is called “skipping SI” and the SI that is skipped is called “skipped SI”.

During the skip, the skipping SI is responsible for the coordination data between the occurrences of:

- the skipped SI and its downstream (in case of skip in favour of upstream), and
- The skipped SI and its upstream (in case of skip in favour of downstream).

Implementation of a Skip

A skip can take place in two ways- downstream skip or upstream skip.

Figure 19 below illustrates a **downstream skip** (or skip in favour of upstream) where the upstream SI (A) controls the airspace of the skipped downstream SI (B). SI A is responsible for the coordination data between B and C according to the release(s) provided by B.

The transition between A and B is marked INVALID and the one between B and C is updated with new exit conditions in B (e.g., transferring frequency and concerned entity (CE) is that of A, TFL and other common data are maintained as they are). In the diagram below, each system A, B and C consists of one ATSU only.

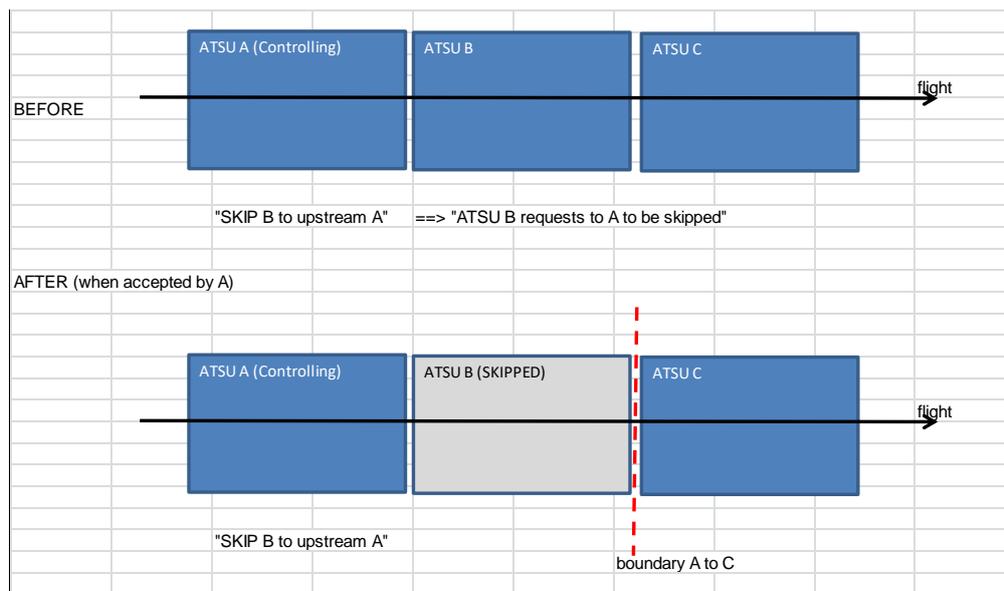


Figure 19: Downstream skip

Similarly, Figure 20 below illustrates an **upstream skip** (or skip in favour of downstream) where the downstream SI (C) controls the airspace of the skipped upstream SI (B). SI C is responsible for managing the coordination data between the transition A and B according to the release(s) provided by B.

The transition between B and C is marked INVALID and the one between A and B is updated with new entry conditions in B (e.g., receiving frequency and concerned entity (CE) is that of C, TFL and other common data are maintained as they are).

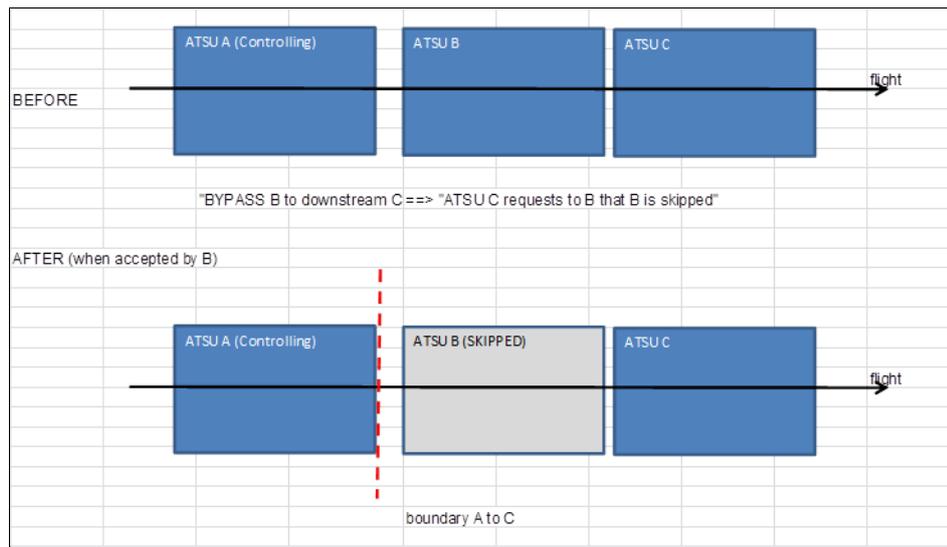


Figure 20: Upstream skip

Origin of Skip

A skip can be triggered either automatically by a system or manually. There are two origins. They are:

- Manual Skip: It is either result of a manual action (direct skip input) or result of a negotiation.
- Automatic Skip: It is triggered by an SI resulting from the implementation of a LoA. There is no human involvement in this.

Once established, the skip can be cancelled or removed given in certain conditions. The situations are explained in the *Skip cancellation and removal* section.

Types of Skip

Operationally, a Skip can be established over the whole AoR of the Skipped SI (Full Skip) or just a portion of its AoR (Partial Skip).

When a partial Skip is established, it is needed to reflect in the FO that there are two different SIs controlling in an AoR, in which there was only one before. In the FO crossed and control sequence, this is dealt by splitting the SI and updating the control attribute according to the type of partial skip (at the entry, in the middle or at the exit).

In order to allow flexibility on the use of these terms within the scope of the crossed & control sequence, the term full and partial skip in this specification will refer to the AoR of a concrete SI occurrence in the crossed and control sequence. That is, an SI occurrence may not be responsible for

the whole AoR if a partial skip or delegation is already in place. In addition, in order to understand where a PARTIAL skip is to be applied on a concrete occurrence, we will further classify it at its entry or exit.

Full Skip

A full skip takes place by skipping an SI occurrence who does not intend to have the flight on frequency for any of its concerned entities.

Example:

FDMP (A) Local Sequence List	Crossed Sequence List	FO Crossed and Controlling SI List	X1 (Y) = occurrence X1 is controlled by Y stakeholder X1s = X1 is skipped X1us = X1 is unskipped B1 = SI B1 is controlling
1. Initial Step			
A B C D E	A1(A) B1(B) C1(C) D1(D) E1(E)		
	A1 B1 B1 C1 C1 D1 D1 E1		
2. C skips D (Full Skip)			
	A1(A) B1(B) C1(C) D1s(C) E1(E)		It is indicated that D's airspace will be controlled by C and D is skipped by C
	A1 B1 B1 C1 C1 D1(I) D1 E1		

Table 32: Full Skip Example

Partial skip at the Entry

It is the skip of the beginning portion of the traversed AoR of an SI occurrence. In this case, the flight is controlled by its transferring SI. It is possible for a system to skip its concerned entities internally. It is up to each system whether they request FDMP to skip its entity or do it locally by updating the coordination data.

In the FO, each time that an entry partial skip is established, the skipped SI occurrence is split. These two consecutive occurrences of the same SI are updated so the first one is being identified as controlled by the upstream SI (skipping) and the remaining one remains under control of the skipped SI.

Example:

FDMP (A) Local Sequence List	Crossed Sequence List	FO Crossed and Controlling List	X1 (Y) = occurrence X1 is controlled by Y stakeholder B1 = SI B1 is controlling
1. Initial Step			
A B C D E	A1(A) B1(B) C1(C) D1(D) E1(E)		
	A1 B1 B1 C1 C1 D1 D1 E1		

2. D skips a portion of its AoR in favour of C (Skip at the entry AoR of an SI occurrence)		
	A1(A) <u>B1(B)</u> C1(C) <u>D1s(C)</u> <u>D2(D)</u> E1(E)	Another occurrence of D is created to indicate that D will also control the flight.
	A1 B1 B1 C1 C1 D1(l) D1 D2 D2 E1	

Table 33: Partial Skip Example

Note 1: A full skip in favour of the downstream may be requested for the portion of the AoR that is still under control of a SI in which a partial entry skip is established. In that case, no new occurrence will be created as two occurrences already exist, the first one under control of the upstream and the second one under control of the downstream.

Note 2: A partial skip may be requested for the portion of the AoR that is still under control of an SI in which a partial entry skip is established. As a partial skip request implies splitting the SI occurrence, it will result in three consecutive SI occurrences of the same SI. The first will be under control of the transferring SI, the second one is still under control of the nominal SI and the last one is under control of the downstream SI.

Partial skip at the Exit

It is the skip of the last portion of the traversed AoR of an SI occurrence. In this case, the flight is controlled by its receiving SI. It is possible for a system to skip its concerned entities internally. It is up to each system whether they request FDMP to skip its entity or do it locally by updating the coordination data.

In the FO, each time an exit partial skip is established, the skipped SI occurrence is to be split. These two consecutive occurrences of the same SI are updated so the first one remains under control of the skipped SI and the last one is identified as controlled by the downstream (skipping) SI.

FDC triggers the Skip process

The FDC that triggers a skip must provide the FDMP with the required information to update the sequence according to the skip intention. When available, the FDC may provide additional information related to the skipped SI such as the affected concerned entity, release conditions etc.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1015
Title	Skip request implementation (FDC)
Requirement	<p>When requesting a skip, the FDC shall provide the following information to the FDMP:</p> <ul style="list-style-type: none"> • the origin of skip (manual/automatic), • the identification of the skipped SI occurrence , • the identification of the skipping SI, • the type of skip (full/entry/exit), • optionally, the identification of skipped concerned entities, and • optionally, the applicable release for this skip.
Status	<Validated>

Maturity Level	TRL6
Rationale	This requirement states the input that the FDC needs to provide while requesting a skip to FDMP. The origin of skip can be from either a LoA or Manual Input. Manual input can be either a direct human input (considering the negotiation was performed via telephone) or a result of skip negotiation via WIFO. ICD note- Origin of skip = AutomationType= Manual or LoA.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0021
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0044
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0094
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0095
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0146
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0098
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0018
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0105
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

FDMP implementation of a Skip

The FDMP can implement a skip triggered locally, or by LoA or by a request from an FDC.

The FO is modified by the FDMP according to the kind of skip as follows:

- The origin of the skip is identified: manually triggered or automatically triggered (LoA). This information is provided by the SI that triggers the skip, which can either be skipped or skipping SI.
- The release conditions are updated, when available.
- The type of skip (full or partial (entry or exit)) is identified
 - o For a full skip:
 - The element of the sequence representing the SI occurrence being skipped will be identified as skipped.
 - The identification of the skipping SI that will control in the skipped SI occurrence will be provided.
 - o For a partial skip (entry or exit):
 - It will split the SI occurrence affected by the skip resulting in two consecutive occurrence of the SI.
 - Depending on the type of partial skip (entry or exit) the FDMP will identify as skipped the first one (entry skip) or the last one (exit skip).
 - The identification of the skipping SI will be provided as responsible for controlling the skipped SI occurrence.
 - o The coordination data structures will be updated to grant any coordination between SI occurrences that are now controlled by the same SI are marked as invalid.

- If the skip is partial, then a new SI occurrence will be created along with a new coordination structure to represent the coordination between the SI occurrence that was not skipped and the upstream (entry) or downstream (exit) SI. In addition, the former coordination between the SI occurrence of the skipping and the skipped SI occurrence is now identified as invalid.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1016
Title	FDMP implementation of a full skip
Requirement	<p>When implementing a full skip of an involved element of the crossed and control sequence list (either by itself or at the request of an FDC), the FDMP shall indicate:</p> <ul style="list-style-type: none"> • that the flight will be controlled by skipping SI in that occurrence of skipped SI, • the skipped status of the skipped SI as SKIPPED, • the coordination data between the skipping SI and skipped SI as INVALID, • the origin of the skip (manual/automatic), and • the provided release(s), or Full release if no release is provided.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement states a skip implementation by the FDMP in case an FDMP detects it or at the request of an FDC. In this case, it is also possible to modify the provided release.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0040
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0094
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0095
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0052
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0022
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0098
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0146
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0187
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

Automatic Skip limitation

To avoid loops, an unskipped SI cannot be skipped again automatically.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1018
Title	Automatic Skip Limitation
Requirement	The FDMP shall reject the automatic skip of an SI if it is indicated as UNSKIPPED.
Status	<Validated>

Maturity Level	TRL6
Rationale	This requirement ensures that automatic skip by a system takes place only for the SIs that are not marked as unskipped.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0094
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

Confirmation management in case of Skip

All the SI occurrences resulting from a partial skip of a confirmed SI becomes automatically confirmed.

This functionality is not in scope of this specification (Cf. G.3.4)

Skip Cancellation and Removal

Unskip can take place in two ways: Skip cancellation and Skip removal. The Skip removal happens either in the case when the transfer of frequency is done towards the skipped SI or a force assumption by the skipped SI. In all other cases, it is the cancellation of skip.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1049
Title	Unskip cancellation eligibility
Requirement	The FDMP shall reject an unskip request when not initiated by either the skipped or the skipping SI.
Status	<In Progress>
Maturity Level	TRL4
Rationale	This requirement is needed to restrict the SIs, who can initiate the unskip, to the ones involved in the skip.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0002
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0080
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0100
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

When a partial Skip of an SI occurrence takes place, an artificial split is performed to represent the actual split of the AoR of that SI occurrence. If that partial skip were cancelled, the two consecutive SI occurrences of the same SI would remain in the sequence. In order to avoid that meaningless situation, the sequence will be corrected by removing one element. The element that is kept should be marked as UNSKIP so any other automatic skip is prevented for that SI occurrence.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1019
Title	Skip cancellation processing (FDMP)
Requirement	<p>When implementing an unskip (either by itself or at the request of an FDC), the FDMP shall:</p> <ul style="list-style-type: none"> • set the skip status of the skipped SI occurrence to UNSKIPPED, • update the coordination data between the skipped SI and its transferring SI as per the current position of the aircraft, • update the coordination data between the skipped SI and its receiving SI as per the current position of the aircraft and • remove the implemented release.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement states the cancellation of skip by FDMP either by itself or on a request.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0002
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0100
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0080
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0081
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0106
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1020
Title	Skip cancellation in case of force assume
Requirement	If a flight is force assumed by the Skipped SI, the FDMP shall reset the skip indicator.
Status	<Validated>
Maturity Level	TRL6
Rationale	<p>If a flight is force-assumed by the Skipped SI, the skip will automatically be cancelled.</p> <p>The skip information, stolen information, coordination data and control sequence will be reset accordingly.</p> <p>Reset means setting of skip indicator to default value as this SI will then be controlling the flight and hence will not be marked as unskipped.</p>
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0050
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List

<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
----------------	-----------	------------------------

Examples

Table 34 illustrates the skip mechanisms.

FDMP (A) Local Sequence List	FO Crossed and Controlling List	X1 (Y) = occurrence X1 is controlled by Y stakeholder X1s = X1 is skipped X1us = X1 is unskipped B1 = SI B1 is controlling
1. Initial Step		
A B C D E	A1(A) <u>B1(B)</u> C1(C) D1(D) A1 B1 B1 C1 C1 D1	
2. C1 performs two partial skip of itself (“Entry” and “Exit”).		
	A1(A) <u>B1(B)</u> C1s(B) C2(C) C3s(D) D1(D) A1 B1 B1 C1(I) C1 C2 C2 C3 C1 D1(I)	A C occurrence is added at the upstream position and at the downstream position.
3. Both partial skip are unskipped		
	A1(A) <u>B1(B)</u> C1us(C) C2(C) C3us(C) D1(D) A1 B1 B1 C1) C1 C2(I) C2 C3(I) C3 D1	The SI occurrences remain split.

Table 34: Skip Example

4.2.8.5.2 Delegation Mechanism

Delegation takes place when a flight is controlled by a system whose AoR is not physically crossed by the flight or it is farther in the sequence. This can take place due to various reasons such as bilateral agreement between the two boundaries, traffic load, closure of a sector in an airspace, manual request etc. In each case, a system assigns its AoR (completely or partially) to be controlled by other system which is not predicted to take control of the flight. The system which receives this charge is known as delegatee SI while the system which authorizes this is called delegator SI.

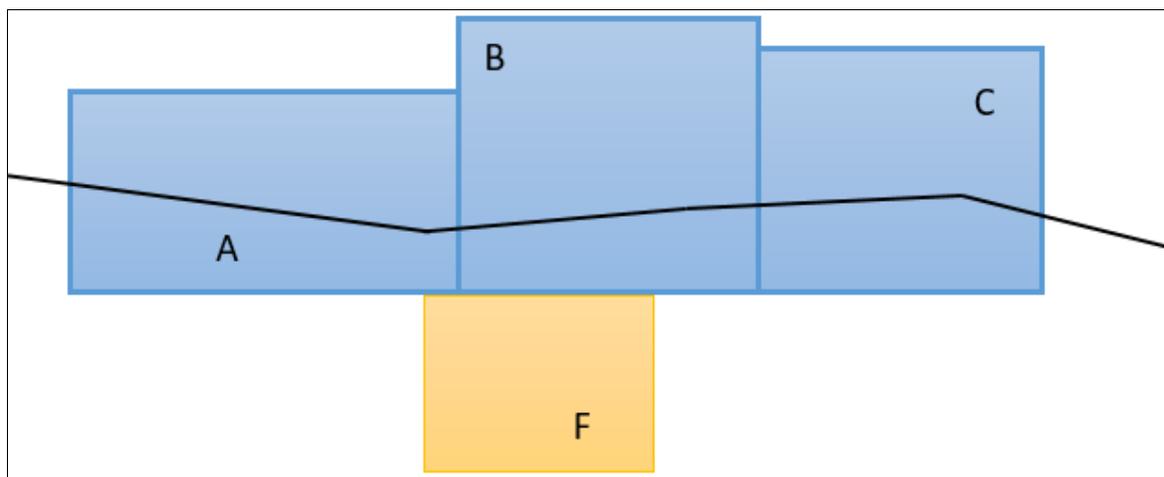


Figure 21: Delegation Mechanism

In the above figure, flight crosses A B C and is controlled by the same. B decides to delegate the flight to F. So B becomes delegator SI while F is delegatee SI.

4.2.8.5.2.1 Implementation of a Delegation

The delegation can be implemented either manually or based on a letter of agreement or other internal rules. If a delegation is electronically negotiated, the negotiation should be done via WIFO. In this case, all the WIFO mechanisms will be applicable.

4.2.8.5.2.2 Types of Delegation

Delegation can be implemented in various ways. It can be either a ‘partial’ delegation or a ‘full’ delegation of one’s airspace.

4.2.8.5.2.2.1 Full delegation

Table 35 illustrates a full delegation.

FDMP (A) Local Crossed Sequence List	FO Crossed and Controlling List	X1 (Y) = occurrence X1 is controlled by Y stakeholder X1d = X1 is delegated X1ud = X1 is undelegated B1 = SI B1 is controlling
1. Initial Step		
A B C D	A1(A) <u>B1(B)</u> C1(C) D1(D) A1 B1 B1 C1 C1 D1	
2. C delegates its full airspace to F		
A B C D	A1(A) <u>B1(B)</u> C1d(F) D1(D) A1 B1 B1 C1 C1 D1	The coordination data between B and C and C and D will be inherited by F and updated by the FDMP.

Table 35: Full Delegation Example

4.2.8.5.2.2.2 Partial delegation

This type of delegation can be performed in various ways.

4.2.8.5.2.2.2.1 Delegation of beginning of airspace

This case refers to the scenario when an SI decides to delegate the flight only for the beginning of its airspace and later will control the flight. In this case, a new occurrence of delegator SI will be created.

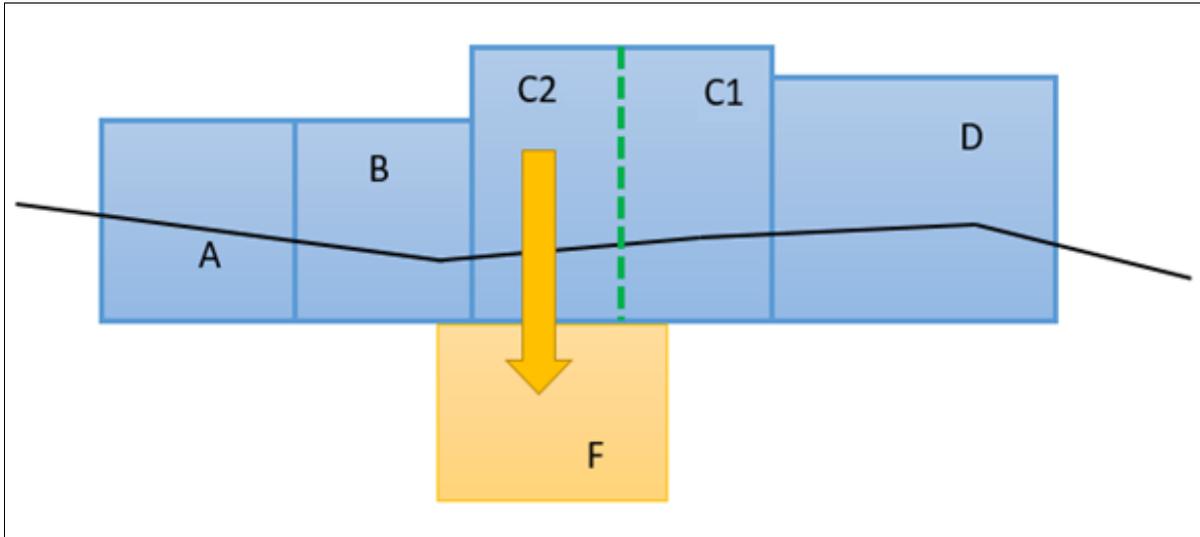


Figure 22: Delegation of beginning of airspace

Table 36 illustrates the impact on the FO of a delegation at the beginning of the airspace.

FDMP (A) Local Sequence List	Crossed Sequence List	FO Crossed and Controlling List	X1 (Y) = occurrence X1 is controlled by Y stakeholder X1d = X1 is delegated X1ud = X1 is undelegated B1 = SI B1 is controlling
1. Initial Step			
A B C D E		A1(A) <u>B1(B)</u> C1(C) D1(D)	
		A1 B1 B1 C1 C1 D1	
2. C delegates its entry airspace to F.			
A B C D E		A1(A) <u>B1(B)</u> C1d(F) C2(C) D1(D)	A new occurrence of C is created indicating that F will control the flight in this part of its airspace.
		A1 B1 B1 C1 C1 C2 C2 D1	

Table 36 Delegation of beginning of airspace Example

4.2.8.5.2.2.2.2 Delegation in the middle of airspace

This case refers to the scenario when an SI decides to delegate the flight only for the sector(s) in the middle after controlling for some time and intends to take back the control before the flight is transferred to the next SI. In this case, the FDMP will create a re-entrance of the delegator SI through

delegatee SI(s). It means that the two new occurrences of delegating will be created, one before and one after the delegating and the coordination data will be populated accordingly.

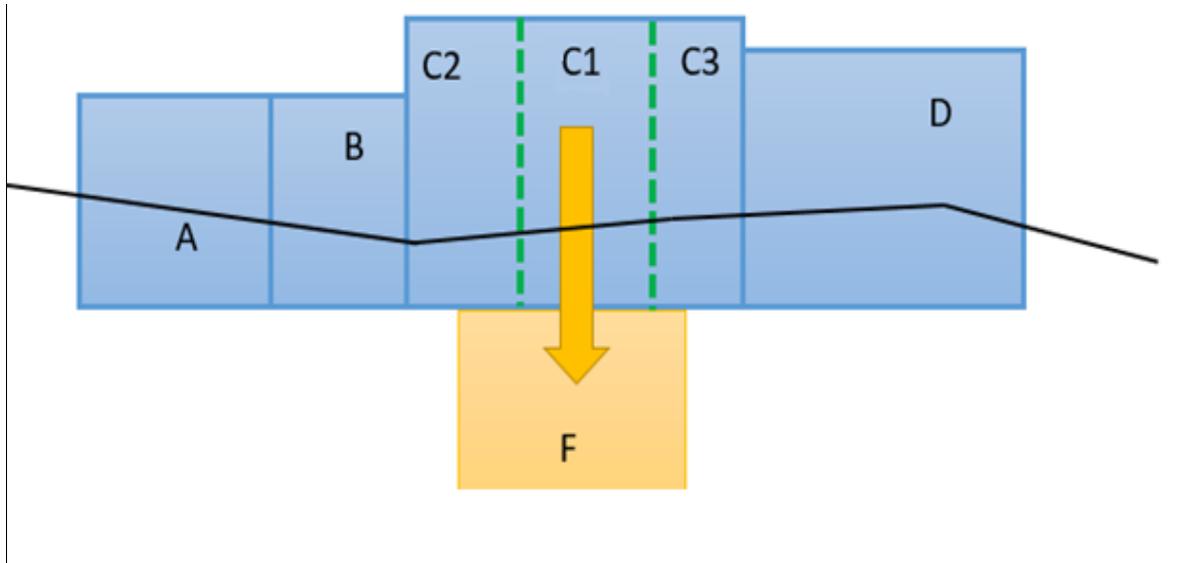


Figure 23: Delegation in the middle of airspace

Table 37 illustrates the impact on the FO of a delegation in the middle of the airspace.

FDMP (A) Local Sequence List	Crossed Sequence List	FO Crossed and Controlling List	X1 (Y) = occurrence X1 is controlled by Y stakeholder X1d = X1 is delegated X1ud = X1 is undelegated B1 = SI B1 is controlling
1. Initial Step			
A B C D E		A1(A) <u>B1(B)</u> C1(C) D1(D)	
		A1 B1 B1 C1 C1 D1	
2. C delegates the middle of its airspace to F.			
A B C D E		A1(A) <u>B1(B)</u> C1(C) C2d(F) C3(C) D1(D)	Two new occurrences of C are created indicating that F will control the flight in the middle.
		A1 B1 B1 C1 C1 C2 C2 C3 C3 D1	

Table 37: Delegation in the middle of airspace

4.2.8.5.2.2.3 Delegation at the end of the airspace

This case refers to the scenario when an SI decides to delegate the flight for its last sector(s) and does not intend to take back the control. In this case, a new occurrence of delegator SI will be created.

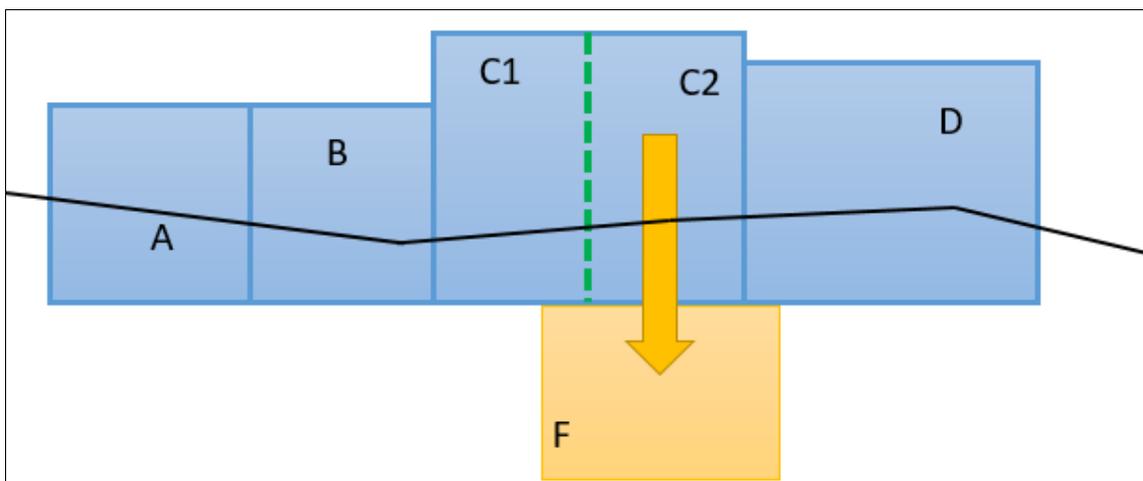


Figure 24: Delegation at the end of the airspace

Table 38 illustrates the impact on the FO of a delegation at the end of the airspace.

FDMP (A)		FO Crossed and Controlling List	X1 (Y) = occurrence X1 is controlled by Y stakeholder X1d = X1 is delegated X1ud = X1 is undelegated B1 = SI B1 is controlling
Local	Crossed		
Sequence List	Sequence List		
1. Initial Step			
A B C D		A1(A) <u>B1(B)</u> C1(C) D1(D)	
		A1 B1 B1 C1 C1 D1	
2. C delegates its exit airspace to F.			
A B C D		A1(A) <u>B1(B)</u> C1(C) C2d(F) D1(D)	A new occurrence of C is created indicating that F will control the flight in this part of its airspace.
		A1 B1 B1 C1 C1 C2 C2 D1	

Table 38: Delegation at the end of the airspace

4.2.8.5.2.3 FDC triggers the Delegation process

The FDC that triggers a delegation must provide the FDMP with the required information to update the sequence according to the delegation intention. When available, the FDC may provide additional information related to the delegatee SI such as the affected CE or the provided release conditions.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1024
Title	Delegation request
Requirement	<p>When requesting a delegation, the FDC shall provide the following information to the FDMP:</p> <ul style="list-style-type: none"> • the identification of delegatee SI occurrence, • the identification of delegator SI and CE(s), • the origin of delegation (manual/automatic), • the type of delegation (full/entry/middle/exit), • optionally, the release information by the delegator SI, and • optionally, the affected CE(s).
Status	<Validated>
Maturity Level	TRL6
Rationale	<p>This requirement is needed to ensure that FDMP receives the basic delegation information to publish if the delegation is requested from either delegatee SI or delegator SI.</p> <p>Origin- Manual or LoA</p> <p>Type- Full or partial (entry/exit/middle) delegation</p> <p>Note- To check in ICD if the request from FDU has been allowed/covered in services.</p>
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0004
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0030
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0067
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0069
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0070
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0084
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0147
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0188
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

4.2.8.5.2.4 FDMP implementation of a Delegation

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1025
Title	Full delegation processing
Requirement	<p>When implementing a full delegation (either by itself or on the request of another SI), the FDMP shall indicate/update:</p> <ul style="list-style-type: none"> • the delegation status of the delegator SI occurrence as DELEGATED, • the origin of the delegation (manual/automatic), • that the flight will be controlled by delegatee SI in the delegator SI occurrence, • the release conditions, if provided by the delegator SI, • both entry and exit coordination affected by the delegation.
Status	<Validated>
Maturity Level	TRL6
Rationale	<p>This requirement states how FDMP will implement a delegation and coordination related to the boundaries.</p> <p>This requirement is needed to ensure that FDMP receives the basic delegation information to publish if the delegation is requested either from delegated or delegating.</p> <p>Origin- Manual or LoA Type- Full or partial (entry/exit/middle) delegation</p>
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0014
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0040
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0067
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0068
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0069
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0070
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0147
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0083
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1027
Title	Partial delegation processing at the entry of the airspace
Requirement	<p>On receiving a request of partial delegation at the beginning of the airspace, the FDMP shall:</p> <ol style="list-style-type: none"> 1. add a new occurrence of the delegator SI between the delegator SI occurrence and its upstream SI occurrence, 2. set the following information in the FO: <ul style="list-style-type: none"> • identification of delegatee SI as controlling the first occurrence of delegator SI, • identification of delegator SI occurrence and, if provided, its CE(s), • origin of delegation (manual/automatic), • the release provided by the delegator SI, and 3. create a new structure coordination at the exit of the new SI occurrence.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement states how FDMP will implement a partial delegation at the beginning of the airspace.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0014
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0040
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0067
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0068
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0069
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0070
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0147
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1036
Title	Partial delegation processing in the middle of the airspace
Requirement	<p>On receiving a request of partial delegation in the middle of airspace, the FDMP shall:</p> <ol style="list-style-type: none"> 1. create an occurrence of the delegator SI between the delegator SI occurrence and its upstream SI occurrence, 2. create an occurrence of the delegator SI occurrence between the delegator SI occurrence and its downstream SI occurrence, 3. set the following information in the FO: <ul style="list-style-type: none"> • identification of delegatee SI as controlling the middle occurrence of the delegator SI, • identification of delegator SI occurrence and, if provided, its CE(s), • origin of delegation (manual/automatic), • the release provided by the delegator SI, and 4. create both entry and exit coordination structures of the delegatee SI occurrence.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement states how FDMP will implement a partial delegation at the middle of the airspace.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0014
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0040
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0067
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0068
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0069
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0070
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0147
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1037
Title	Partial delegation processing at the exit of the airspace
Requirement	<p>On receiving a request of partial delegation at the end of the airspace, the FDMP shall:</p> <ol style="list-style-type: none"> 1. create an occurrence of the delegator SI between the delegator SI occurrence and its downstream SI occurrence, 2. set the following information, whenever available, in the FO: <ul style="list-style-type: none"> • identification of delegatee SI as controlling the last occurrence of delegator SI, • identification of delegator SI occurrence and, if provided, its CE(s), • origin of delegation (manual/automatic), • the release provided by the delegator SI, and 3. create a new structure coordination at the entry of the new SI occurrence.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement states how FDMP will implement a partial delegation at the exit of the airspace.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0014
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0040
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0067
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0068
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0069
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0147
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

4.2.8.5.2.5 Confirmation management in case of Delegation

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1051
Title	Confirmation management in case of partial delegation
Requirement	If a confirmed SI is partially delegated, each newly created occurrence of this SI shall automatically be confirmed.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to address the management of existing confirmation tag in case of partial delegation.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0067
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

4.2.8.5.2.6 Delegation cancellation

Either delegatee SI or the delegator SI can initiate the request of undelegation.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1050
Title	Undelegation request
Requirement	The FDMP shall reject an undelegation request when not initiated by either the delegating or the delegatee SI.
Status	<In Progress>
Maturity Level	TRL4
Rationale	This requirement is needed to restrict the SIs who can initiate the undelegation to the ones involved in the delegation.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0076
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

The cancellation of delegation is only possible if the delegatee SI has not assumed the flight. Resulting from this, the status of the delegatee SI will be set to undelegated. Nevertheless, if the delegatee SI has assumed the flight, the normal procedures will be followed to control the flight.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1030
Title	End of delegation upon Frequency change
Requirement	The FDMP shall reject an undelegation request after the frequency change is initiated towards the delegatee SI.
Status	<Validated>
Maturity Level	TRL6
Rationale	This is possible until the FrequencyTransfer= "NOT_STARTED". After the request, the Delegation Status will be "UNDELEGATED" in the FO model.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0005
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0064
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

The following requirement states the automatic actions by which a delegation can be cancelled.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1029
Title	Delegation cancellation processing
Requirement	On receiving a request to undelegate a delegatee SI occurrence, the FDMP shall : <ul style="list-style-type: none"> • indicate that the flight will be controlled by the delegator SI in this SI occurrence, • set the Delegation Status of the delegatee SI(s) to UNDELEGATED, and • update the coordination information between the delegator SI and its transferring and receiving SIs.
Status	<Validated>
Maturity Level	TRL6
Rationale	A delegatee SI can request FDMP to undelegate the flight given to it. A delegator SI can request FDMP to undelegate the flight given by it to another SI that is not predicted to take control of the flight. This is in case when the delegatee SI is not yet controlling the flight. The status "undelegated" is kept to avoid loops.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0078
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

In case of delegation cancellation, the FDMP will keep the undelegated SIs in the control sequence list to avoid loops.

Table 39 illustrates some delegation mechanisms.

FDMP (A)	FO Crossed and Controlling List	X1 (Y) = occurrence X1 is controlled by Y stakeholder X1d = X1 is delegated X1ud = X1 is undelegated B1 = SI B1 is controlling
1. Initial Step		
A B C D E	A1(A) <u>B1(B)</u> C1(C) D1(D)	
	A1 B1 B1 C1 C1 D1	
2. C1 entry is partially delegated to G and C1 exit is partially delegated to K		
A B C D E	A1(A) <u>B1(B)</u> C1d(G) C2(C) C3d(K) D1(D)	
	A1 B1 B1 C1 C1 C2 C2 C3 C3 D1	
3. Both partial delegations are undelegated		
A B C D E	A1(A) <u>B1(B)</u> C1ud(C) C2(C) C3ud(C) D1(D)	

	A1 B1 B1 C1 C1 C2 C2 C3 C3 D1
--	-------------------------------

Table 39: Delegation Examples

4.2.8.5.2.7 Release during delegation

A delegator SI has to define some release in its airspace when it is controlled by another SI. The delegatee SI does not have any right to go beyond this release. However, this release can be modified by the delegator SI.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1033
Title	Release during delegation
Requirement	A delegator SI shall set in the FO the release information.
Status	<Validated>
Maturity Level	TRL6
Rationale	The release will be defined either in the letter of agreement, or by the delegator SI.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0069
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0070
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0084
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

Note: Any monitoring of the release conditions should be done locally by avoiding more workload to FDMP when it is of no interest to him. The decision to display the release in case of its breaching should be local.

4.2.8.5.3 No Contact Mechanism

The No_Contact is an indication that a System Instance (the 'no_contacted' SI) will not take the aircraft on frequency (channel). After a No_Contact input by an SI, the flight will be transferred directly from the SI controlling the flight upstream of the 'no_contacted' to its next downstream SI that is going to control the flight.

4.2.8.5.3.1 Implementation of a No Contact

This functionality is implemented unilaterally by the SI to avoid the aircraft being transferred on its frequency. The SI that does not want to have the aircraft in frequency must identify in which of its occurrences it wants to implement the functionality. It is not allowed for an SI to identify as no contacted an SI occurrence not belonging to itself.

The No_Contacted SI is fully responsible of the flight in terms of separation and maintenance of both entry and exit coordination. The No_Contacted SI will maintain equal its entry and exit coordination phase so its upstream and downstream SIs are aware of any change in the transfer phase.

When a SI declares one of its occurrences as No_Contact, this will only be implemented if the upstream unit supports the functionality, as it will have to be able to get the frequency of the unit downstream of the No_Contact to transfer the flight. As the upstream unit supports the functionality, there is no

need to modify any coordination data due to the fact that it is able to get information from the coordination between the No_Contacted Unit and its downstream. The unit downstream of the No_Contacted Unit does not need to support the functionality.

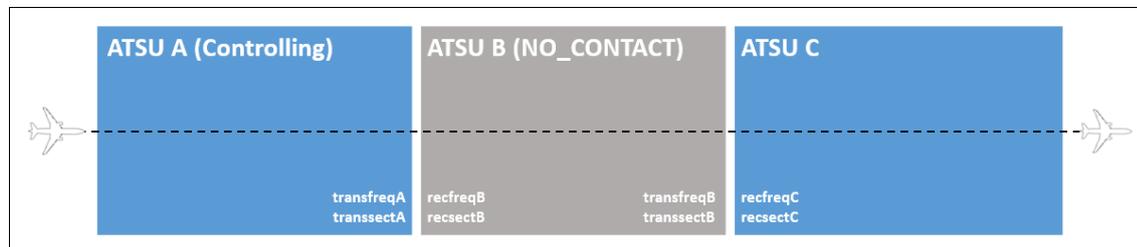


Figure 25: No Contact Mechanism

In the situation presented in Figure 25, the information displayed in ATSU’s A HMI will be the receiving frequency and sector of ATSU C (recfreqC and recsectC respectively), so the flight will be directly transferred from ATSU A to ATSU C. While the flight is in the AoR of ATSU B, it is still fully responsible of the flight and it can cancel the No Contact when needed.

This functionality is used for flights when the No_Contact SI presumes that there is no action required on its airspace.

In the airspace of the No_contact SI, any clearance to be issued will be coordinated with the ‘no_contacted’ SI.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1115
Title	Establishing No_Contact by an FDC
Requirement	When an FDC, planned to control the flight, wants to start the No_Contact state for any of its occurrences, it shall request the FDMP the start of the No_Contact state and provide the identification of the requesting SI occurrence.
Status	<Validated>
Maturity Level	TRL6
Rational	FDCs can trigger no contact status by using a specific service. FDMP will have to notify this status in the FO so upstream and downstream SIs to the FDC that will not be contacted becomes aware of this situation.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0089
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1116
Title	FDMP processing of a No_Contact request
Requirement	When the FDMP receives a request for No_Contact from a FDC planned to control the flight, the FDMP shall update the Crossed and Control

	sequence to identify the SI occurrence that has requested No_Contact and set to: <ul style="list-style-type: none"> • NO_CONTACT the SI occurrence,
Status	<Validated>
Maturity Level	TRL6
Rational	A SI occurrence that is in No_Contact state needs to be identified since its Transferring SI needs to look for the frequency that is going to be used to transfer the flight in the one applicable to the downstream coordination of the no contacted SI occurrence.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0089
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1124
Title	FDMP establishing one of its occurrences as No_Contact
Requirement	When the FDMP wants to start the No_Contact state for any of its occurrences, it shall set the desired occurrence as NO_CONTACT in the FO.
Status	<Validated>
Maturity Level	TRL6
Rational	This requirement is needed to allow the FDMP set any of its occurrences as No_Contact.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0089
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0090
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List

4.2.8.5.3.2 No Contact Termination

An SI is able to cancel the No Contact by using the following methods:

- requesting to the FDMP the termination of the No Contact,
- requesting the aircraft on frequency,
- force assuming the flight,
- receiving a change of frequency from the controlling unit.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1117
------------	-------------------------

Title	Ending the No_Contact by the FDC
Requirement	When a FDC wants to end the No_Contact state for any of its occurrences in the control sequence, it shall request FDMP the end of the No_Contact state and indicate the number of the occurrence.
Status	<Validated>
Maturity Level	TRL6
Rational	At any time the no contacted SI may need to get the control of a flight before it is transferred to its downstream.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0090
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1118
Title	Ending the No_Contact by requesting the flight on frequency
Requirement	When a FDC in No_Contact state performs a manual input to request the flight on frequency the FDC shall request the end of the No_Contact to the FDMP at the same time.
Status	<Validated>
Maturity Level	TRL6
Rational	At any time the no contacted SI may need to get the control of a flight before it is transferred to its downstream performing a ROF.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0102
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1121
Title	Ending the No_Contact by force-assume
Requirement	When a non_contacted FDC performs a force-assume, it shall remove the No_Contact state from its SI occurrence.
Status	<Validated>
Maturity Level	TRL6
Rational	If the flight is force-assumed by a non_contacted SI, the No_Contact must be undone.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0092
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1122
Title	Ending the No_Contact by a change of frequency
Requirement	When a non_contacted FDC receives a transfer request, it shall remove the No_Contact state from its SI occurrence.
Status	<Validated>
Maturity Level	TRL6
Rational	If a non_contacted SI receives a transfer status, the No_Contact must be undone.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0091
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1119
Title	FDMP processing of No_Contact termination
Requirement	When the FDMP receives a request for No_Contact termination from a FDC, the FDMP shall update the Crossed and Control sequence to remove the No_Contact state from the requested SI occurrence.
Status	<Validated>
Maturity Level	TRL6
Rational	At any time the no contacted SI may need to get the control of a flight before it is transferred to its downstream performing a ROF.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0090
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0092
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0102
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List

4.2.8.5.3.3 Data maintenance during No Contact

During a No Contact operation, there are some coordination data to be maintained equal for both entry and exit coordination of the SI in No Contact.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1120
Title	FDMP maintenance of both entry/exit coordination of the no_contact
Requirement	The FDMP shall maintain updated, as for any other SI, both entry and exit coordination's of a 'No_Contacted' SI not being already TRANSFERRED, and equal the Transfer Status whenever it is modified.
Status	<Validated>
Maturity Level	TRL6
Rational	The "non_contacted" Si is still responsible of its both coordinations. Both entry/exit of the "non_contacted" need to have the same values for some specific attributes.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0121
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0157
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0170
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0172
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0173
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0174
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0175
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1123
Title	Coordination Phase alignment by a no contacted FDC
Requirement	A no contacted FDC shall update and equal its entry and exit coordination phase as per normal rules.
Status	<Validated>
Maturity Level	TRL6
Rational	The "non_contacted" Si is still responsible of its both coordinations. Both entry/exit coordination phase of the "non_contacted" need to have the same values.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0119
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0122
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0132
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0135
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0169

<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

4.2.8.5.4 Calculation of Control Sequence in Case of Force assume

The SI that force-assumes a flight is responsible as new FDMP for updating the Crossed and Control sequence and the Coordination according to the new operational situation.

The elements of the Crossed and Control sequence remain the same but the identifier of the Control SI attribute is modified.

Case 1) The force assume is triggered by a SI downstream to the FDMP (immediate or not)

The new FDMP replaces the Control SI attribute of the former controlling SI by itself and updates likewise the Control SI value of every SI occurrence that is found until the first occurrence of the SI that has force-assumed the flight, if any. It implies that until further change, the flight is under control of the SI from the track position until the already planned exit.

The nature of transition for all the coordinations between the new and the former FDMP are marked INVALID.

It is important to highlight that even in this case, the Force assumption should not be considered a delegation and therefore it should not be tagged with the DELEGATION indicator. Delegation requirements and its operational meaning is described in the Operational qualifiers usage section.

Case 2) The force assume is triggered by an SI not in the control sequence list

The new FDMP will update the control attribute of the former FDMP only.

Case 3) The force-assume is undone by the stolen SI in case the flight was taken by error.

The new FDMP will undo the actions performed in Case 1) or Case 2) above.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1014
Title	Crossed & Control Sequence change in case of force-assume by a downstream SI
Requirement	If a flight is force-assumed by a downstream SI, the new controlling SI shall : <ol style="list-style-type: none"> 1. update the Control attribute of the former controlling SI and any SI in the middle (if any) with its SI identification, 2. set to INVALID all the coordination data between the new and the former controlling SI.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to show the impact on crossed & control sequence in case of force assume by the next adjacent downstream SI and by a next non adjacent downstream SI. Nominal actions expected from a SI taking the role of FDMP are still valid (e.g. REQ-18-02b-TS-SEQM.1041).
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b

<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0097
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1069
Title	Crossed & Control Sequence change in case of force-assume by a SI not identified in the C&C Sequence
Requirement	If a flight is force-assumed by an SI not identified in the C&C Sequence, the new controlling SI shall update the Control attribute of the former controlling SI.
Status	<In Progress>
Maturity Level	TRL4
Rationale	This requirement is needed to show the impact on crossed & control sequence in case of force assume by a SI not identified as a former or expected crossed and controlling SI.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0097
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1070
Title	Crossed & Control Sequence change in case of force-assume by the stolen SI
Requirement	If a flight is force-assumed by the stolen SI, the new controlling SI shall : <ol style="list-style-type: none"> 1. reset its Control attribute with its own SI identification, 2. update the Control attribute of the former controlling SI and any SI in the middle (if any) with their SI identification, 3. reset to VALID all the coordination data between the new and the former controlling SI 4. unset the TRANSFERRED flag of the Sis between the new and the former controlling SI".
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to show the impact on crossed & control sequence in case of force-assume is undone by the stolen SI by force-assuming again the flight. The effect of this requirement is to undo the actions specified in REQ-18-02b-TS-SEQM.1014 or REQ-18-02b-TS-SEQM.1069.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0097

<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

4.2.8.5.5 Maintaining operational qualifier SIs in the control sequence

In case of any change- for example- route modification, diversion, FDMP change etc., the crossed and control sequence can be impacted. In this case, the changes which were previously done by FDMP should be carried out as it is if there is no change in the adjacent crossed SIs.

[REQ]

Identifier	REQ-18-02b-TS-SEQM.1022
Title	Reapplication of the control sequence correction by FDMP
Requirement	On any update that modifies the crossed sequence computed by the FDMP, the FDMP shall maintain every operational qualifier (skip, unskip, delegation, undelegation) defined in the sequence as long as the upstream and downstream SI occurrences of the SI occurrences affected by the operational qualifiers are the same.
Status	<Validated>
Maturity Level	TRL6
Rationale	Update does not mean that the operational corrections will be lost. This is needed for all the operational corrections. The issue is to avoid a batch of updates each time the FO is published to reach again the consensus on control sequence It is based on the optimistic assumption that previous corrections are still applicable, if not the relevant SI will request for a (single) change
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0040
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

Note: If this re-application/re-calculation is not the right one, FDC will correct the sequence through requests. The purpose of such a re-application is to cover most of the cases (where there is no change in trajectory) avoiding useless requests, maintaining the updated information, publications of FOs and associated oscillations.

4.2.9 Air/Ground

This version of the IOP protocol supports the following data link capabilities:

- Data Link Initiation (DLIC), and
- ATC Communication Management.

4.2.9.1 Data Link Initiation

The DLIC service exchanges information between an aircraft and a data link ground system to identify the data link applications that both support and provide addressing and version information.

Once the aircraft has logged on once to one data-link ATSU, the logon information is distributed in the FO. The data link equipped SI will use this information to establish CPDLC connection (in scope of this specification) or ADS-C contract (not in scope of this specification) with the aircraft.

The logon information is intrinsic to the aircraft. The logon information is therefore included in the Aircraft FO Cluster.

[REQ]

Identifier	REQ-18-02b-TS-COTR.0152
Title	Sharing the logon parameters
Requirement	The FDMP shall set in the FO the logon parameters to be used for data link operations.
Status	<Validated>
Maturity Level	TRL6
Rationale	Data link operations are CPDLC, plus ADS-C. Only CPDLC is in scope of this specification. This requirement is needed to ensure downstream SI have access to the data link information they need to establish CPDLC and ADS-C connections with the aircraft. ICD note: the logon information is included in the Aircraft cluster.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0100
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

4.2.9.2 ATC Communication Management

The ACM service provides automated assistance to the flight crew and current and next controllers to manage ATC communications. The ACM service encompasses the transfer of voice communication and the transfer of CPDLC data authority.

Once a CPDLC connection is activated with the aircraft, the current ATS Unit becomes the CDA. There is no CDA anymore as soon as the active CPDLC connection with the aircraft is normally released (last ATSU or next ATSU is not data link equipped) or aborted.

The FDMP maintains in the FO the identity of the CDA. Note that the FDMP does not perform data link activities. The FDMP role is only to reflect in the FO the CDA information as provided by the data link manager.

[REQ]

Identifier	REQ-18-02b-TS-COTR.0161
Title	Share the Current Data Authority (CDA) Identifier
Requirement	The FDMP shall maintain in the FO the identity of the Current Data Authority.
Status	<Validated>
Maturity Level	TRL6
Rationale	Note. The conditions for setting or unsetting the CDA are monitored by the Data Link Manager and are therefore outside the scope of this IOP specification. This requirement is needed to share the aircraft is CPDLC connected. This requirement is not applicable when the current controlling SI is not datalink equipped. ICD note: the attribute is currentDataAuthority attribute in the Aircraft cluster.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0101
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

Before the transfer of frequency takes place, and if the transferring and the receiving ATS Units are not served by the same Data Authority, the transferring ATS Unit informs the aircraft about the identity of the receiving Data authority.

The FDMP maintains in the FO the identity of the NDA. Note that the FDMP does not perform data link activities. The FDMP role is only to reflect in the FO the NDA information as provided by the data link manager.

[REQ]

Identifier	REQ-18-02b-TS-COTR.0153
Title	Share and maintain the Next Data Authority (NDA) Identifier
Requirement	The FDMP shall maintain the identity of the NDA in the FO as long as one is identified by the Controlling ATS Unit and sent to the aircrew. -
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to ensure the NDA identifier is shared with the transferring SI. Note. The conditions for setting or unsetting the NDA are monitored by the Data Link Manager and are therefore outside the scope of this IOP specification.

	ICD note: the attribute is the nextDataAuthority attribute in the Aircraft cluster
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0101
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

Some time before the actual transfer of communication, the transferring ATSU sends a notification to the receiving ATSU to trigger the establishment of a passive CPDLC connection with the aircraft.

Note 1. The notification is equivalent to the OLDI NAN message.

Note 2. In case the transferring and the receiving ATSU Units are served by the same Data Authority, the notification is useless and is not present.

Note 3. The time this notification is sent is defined in LoA between the transferring and receiving ATSUs.

The FDMP conveys in the FO the indication that the NDA has been notified to establish a CPDLC connection with the aircraft. Note that the FDMP does not perform data link activities. The FDMP role is only to reflect in the FO the message sent by the data link manager.

[REQ]

Identifier	REQ-18-02b-TS-COTR.0162
Title	Set the Next Data Authority Notified Indicator
Requirement	The FDMP shall set the Next Data Authority Indicator when the downstream SI is authorized to establish a CPDLC connection with the aircraft.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to signal the future receiving SI that it can establish a CPDLC connection with the aircraft. This requirement is not applicable when the receiving ATSU is not data link equipped or is served by the same Data authority. ICD note: the attribute is in the CoordinationAndTransfer cluster in active Coordination: it is the attribute nextAuthorityNotified.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0101
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

At the time of the transfer of communication, the controlling ATCO requests the aircrew to contact or monitor the frequency of the receiving SI. The type of instruction (contact vs. monitor) is shared in the FO.

[REQ]

Identifier	REQ-18-02b-TS-COTR.0206
Title	Set the type of Voice Contact Instruction sent to the aircrew
Requirement	When the Current Data Authority sends a CPDLC Voice Contact Instruction to the aircrew, it shall indicate in the Flight Object whether the instruction is a CONTACT or a MONITOR.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to share with the receiving ATCO what kind of voice contact instruction has been sent to the aircrew. ICD note: the indication is the VoiceContactInstructed attribute of the Active Coordination in the CoordinationandTransfer cluster.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-COTR.0136
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

4.2.10 Handling of IOP Protocol Failure

4.2.10.1 Degraded IOP Modes

Editor's Note. The Degraded IOP Modes capacity specifies on the one hand the FDC/FDMP requirements signaling that an SI has entered/exited a degraded mode, and on the other hand, requirements describing the behavior of the other SIs when an SI has entered a degraded mode. This version of the document address only the first aspect.

IOP is fundamentally underpinned by the alignment of IOP systems local view of Flight data with that held in the shared FO. Unfortunately, there are scenarios when this alignment can be fully or partially lost.

IOP is not only a mechanism to exchange messages that are to be used by external systems, but provides strategies to support different FDPs (with different requirements, operational philosophy, etc.) to work on the same pieces of data. Despite these differences in handling flight plan / flight trajectory related data, the systems are required to fulfil a minimum set of operational features in any circumstances, therefore should they become misaligned this should not prevent the ATCOs from reaching the necessary coordination agreements to maintain effective and safe operations.

When an SI is not able to align its local view with the FO, it still needs to read the FO and to update certain local information in order to support critical exchange of operational data with its partners.

Conversely, any SI (to minimize failsafe mode triggering by side effect such as change of FDMP role and to minimize Flight Object corruption) must update a minimum set of FO data.

In the event of a misalignment between the local view and the FO, a system can operate in two different degraded IOP modes (one of them further subdivided), depending on the severity of the misalignment:

- **Coordination Failsafe Mode:** The system is not able to align some flight information between the FO and its local view. The SI is able to update coordination data but it is not able to align other additional data such as Flight Script or Trajectory information. Coordination Failsafe mode can be triggered in two different sub-states:
 - **Synchronized boundaries:** the SI is able to align coordination data with the FO in all its transitions despite not aligned with some other information in the FO. This is indicated as part of coordination data.
 - **Desynchronized boundary/ies:** the SI is not able to align coordination data in one or more of its transitions, so verbal communication with its partner is needed for that boundary. This is indicated as part of coordination data.
- **Severe Desynchronization:** This mode can be triggered by both FDMP and FDC when a complete misalignment occurs and the system is completely desynchronized. In that case, the system is not able to perform any action on the FO.

Both degraded modes have in common that a lack of coherency between local and FO information has taken place. Nevertheless, the consequences and the process to overcome this situation will be different.

4.2.10.1.1 Coordination Failsafe Mode

A SI enters in Coordination Failsafe mode when a misalignment between the local view and the FO occurs for some set of data, but the SI is still able to perform some specific actions defined in this section. A SI in Coordination Failsafe mode is still able to process FO updates and request some specific services to the FDMP, even if they are inconsistent with other information in the FO. The FDMP and their partners will be able to deal with this lack of consistency according to local rules, which means all the partners will have to process these “partial” updates but the reaction to that will be defined locally. For example, a SI in Coordination Failsafe mode may request a change of TFL for a transition without adding the corresponding constraint nor modifying the trajectory, so its partner would add this missing information in the FO, if needed.

This mode allows coordination data alignment between two IOP Stakeholders when a desynchronization of information that is non-coordination related takes place. Each IOP SI has to agree with its partner which information needs to be coherent at the boundary in order to consider that boundary as coordinated.

A system that is not able to update its local flight plan data with the information in the FO will declare itself in Coordination failsafe mode. If the information that cannot be updated affects to the information agreed with its partner as Coordination related for that boundary, that SI will not only be in Coordination failsafe but it also will declare that boundary as desynchronized.

Note that the information at the boundary related with coordination is to be bilaterally agreed, for example, two partners may agree that only the coordination contractual data (as defined in the INTEROP) is required to consider that boundary synchronized. In this case, a SI in failsafe mode can

request only that coordination contractual data and if its partner properly updates that information the boundaries will be kept coordinated regardless the discrepancies in other flight plan information such as the route.

However, if those SIs consider that in addition to the coordination contractual data, at least the route points before and after the boundary should be the same, then, the SI is not only in failsafe mode but also with its boundary desynchronized. That is, partial updates (such as a TFL) will not solve the coordination problem, as the route portion in that boundary is desynchronized. The updates of a SI in failsafe mode should request every information required to realign what is agreed as relevant between those two partners for that coordination. If those updates are successfully processed by its partner the boundary desynchronization will be solved otherwise the boundary desynchronization will remain.

[REQ]

Identifier	REQ-18-02b-TS-MECH.1001
Title	Coordination Failsafe mode notification (FDC)
Requirement	When entering the Coordination Failsafe mode, the FDC shall notify to the FDMP the new status and provide relevant information.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to notify the FDMP that a FDC is not working in nominal conditions. ICD note: the service used is <code>srv_local_desynchronization_update()</code> . The relevant information can be provided using the attribute <code>desynchronizationReason</code> . This relevant information can be for example where the desynchronization starts.
Category	<Interoperability><Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0078
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

[REQ]

Identifier	REQ-18-02b-TS-MECH.1002
Title	Coordination Failsafe mode notification (FDMP)
Requirement	Upon reception of a request indicating a FDC is in Coordination Failsafe Mode, the FDMP shall update the FO to reflect this situation.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to notify other Sis that a system is in Coordination Failsafe Mode. ICD note: a flag in the distribution list is set for the system in Coordination Failsafe mode
Category	<Interoperability><Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0078
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

[REQ]

Identifier	REQ-18-02b-TS-MECH.1003
Title	Coordination Failsafe mode removal (FDC)
Requirement	When a SI recovers from Coordination Failsafe mode it shall notify the FDMP.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to notify the FDMP that the system is recovered and working under nominal conditions. ICD note: the service used is srv_local_desynchronization_update()
Category	<Interoperability><Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0078
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0082
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

[REQ]

Identifier	REQ-18-02b-TS-MECH.1004
Title	Coordination Failsafe mode removal (FDMP)
Requirement	Upon reception of a request indicating that a FDC is no longer in Coordination Failsafe mode, the FDMP shall update the FO to reflect this situation.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to notify other Sis that a system is recovered and working under nominal conditions again. ICD note: the Failsafe flag from distribution list is removed.
Category	<Interoperability><Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0078
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0082
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

[REQ]

Identifier	REQ-18-02b-TS-MECH.1005
Title	Desynchronized boundaries notification (FDC)
Requirement	Once in Coordination Failsafe mode, if a FDC is not able to align the C&T Data defined in a LoA with its partners in one or more of its transitions it shall notify the FDMP and provide relevant information.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement ensures that a FDC notifies a misalignment in any of its transitions. The misalignment will depend on what is considered a boundary misalignment at that boundary. That is to be defined in LoAs between those two partners. ICD note: the service used is srv_local_desynchronization_update(). The relevant information can be provided using the attribute desynchronizationReason. This relevant information can be for example where the desynchronization starts.
Category	<Interoperability><Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001

<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0078
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

[REQ]

Identifier	REQ-18-02b-TS-MECH.1006
Title	Desynchronized boundaries notification (FDMP)
Requirement	Upon reception of a request from a FDC indicating it is not able to align one or more transitions, the FDMP shall update the FO to reflect this situation.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to notify other Sis that a system has a problem aligning its transitions. ICD note: The synchronizationStatus for the indicated boundary/ies is set to DESYNCHRONIZED_BY_UPSTREAM, DESYNCHRONIZED_BY_DOWNSTREAM or DESYNCHRONIZED_BY_BOTH (depending on the position of the SI in that transition) in Coordination cluster
Category	<Interoperability><Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0078
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

[REQ]

Identifier	REQ-18-02b-TS-MECH.1007
Title	Desynchronized boundaries removal (FDC)
Requirement	When a SI is able to realign its desynchronized boundary/ies it shall notify the FDMP.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to notify the FDMP that the system transition/s are aligned. ICD note: the service used is srv_local_desynchronization_update()
Category	<Interoperability><Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001

<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0078
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0082
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

[REQ]

Identifier	REQ-18-02b-TS-MECH.1008
Title	Desynchronized boundaries removal (FDMP)
Requirement	Upon reception of a request indicating that a FDC has its boundary/ies realigned, the FDMP shall update the FO to reflect this situation.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to notify other Sis that a system transitions are realigned. ICD note: the DESYNCHRONIZED flag for the boundary/ies is removed.
Category	<Interoperability><Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0078
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0082
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

A SI entering in Coordination Failsafe mode, in order to grant accurate information, is only allowed to perform the following actions defined as Failsafe Functionalities:

- Add, remove or update C&T Data, for the synchronized transitions,
- Assume the flight,
- Force assume the flight and acknowledge a force assume,
- Correct the control sequence.
- Request the aircraft on frequency and cancel this request, when supported.

This set of actions will be performed by a SI in Coordination Failsafe mode with incoherencies with the Flight Script and Trajectory data, but the FDMP has to process these inconsistent requests and update the corresponding information.

When a SI is in Failsafe mode it is always able to request FO updates, those updates may have two objectives:

- Updating only the information agreed between those two partners as related with their coordination while non coordination related data is kept desynchronized

- Updating information that is desynchronized trying to restore the synchronization. Depending on the level of desynchronization the following options may occur:
 - The SI in Failsafe mode has some boundary desynchronized, in this case this request is requesting an update of that boundary, and when successfully processed by its partner, the boundary will become synchronized again.
 - The SI in Failsafe mode may have all its boundaries desynchronized, in this case, its request will be processed again by the FDMP and if it is successfully inserted in the FO, the system will exit from the Failsafe mode.

[REQ]

Identifier	REQ-18-02b-TS-MECH.1015
Title	Coordination actions by SI in Failsafe mode with a desynchronized boundary
Requirement	A SI in Failsafe mode with a desynchronized boundary shall be able to add, modify or delete Coordination data.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement allows SI in Failsafe mode with one or more desynchronized boundaries to attempt to re-synchronize.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0083
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

4.2.10.1.2 Severe Desynchronization

A severe desynchronization has two different effects depending on the role of the system that is affected:

- If the system is the FDMP, it will declare itself not FDMP eligible for that FO, and therefore becomes not eligible to remain FDMP. General mechanisms are specified to allow other SIs to take the FDMP role until the situation is recovered.
- If the system is the FDC, it will notify this situation and will be identified as desynchronized in the FO.

In both cases, all SIs involved in the FO are warned that an SI is in severe desynchronization. Each SI (upstream / downstream to the desynchronized SI) will determine the operational procedure to grant that the coordination information stored in the FO remains valid, as phone is the only communication method while the problem persist.

[REQ]

Identifier	REQ-18-02b-TS-MECH.1009
Title	Severe Desynchronization notification (FDC)
Requirement	When entering into Severe Desynchronization, the SI shall notify to the FDMP the new status and provide relevant information.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to notify the FDMP that the system is completely desynchronized. ICD note: the service used is <code>srv_local_desynchronization_update()</code> . The relevant information can be provided using the attribute <code>desynchronizationReason</code> . This relevant information can be for example where the desynchronization starts.
Category	<Interoperability><Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0078
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

[REQ]

Identifier	REQ-18-02b-TS-MECH.1010
Title	Severe Desynchronization notification (FDMP)
Requirement	Upon reception of a request indicating a FDC is in Severe Desynchronization, the FDMP shall update the FO to reflect this situation.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is needed to notify other Sis that a system is completely desynchronized. ICD note: a flag in the distribution list is set for the system in Severe Desynchronization
Category	<Interoperability><Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0078
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

[REQ]

Identifier	REQ-18-02b-TS-MECH.1011
Title	Severe Desynchronization removal (FDC)
Requirement	When a SI recovers from Severe Desynchronization it shall request the FDMP to remove the Desynchronization indicator.
Status	<In Progress>
Maturity Level	TRL4
Rationale	This requirement is needed to notify the FDMP that the system is recovered and working under nominal conditions. ICD note: the service used is srv_local_desynchronization_update()
Category	<Interoperability><Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0078
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0082
<ALLOCATED_TO>	<Enabler>	ER APP ATC 160
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

[REQ]

Identifier	REQ-18-02b-TS-MECH.1012
Title	Severe Desynchronization removal (FDMP)
Requirement	Upon reception of a request indicating that a FDC is no longer in Severe Desynchronization, the FDMP shall update the FO to remove the indicator.
Status	<In Progress>
Maturity Level	TRL4
Rationale	This requirement is needed to notify other Sis that a system is recovered and working under nominal conditions again. ICD note: the Desynchronized flag from distribution list is removed.
Category	<Interoperability><Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0078
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0082
<ALLOCATED_TO>	<Enabler>	ER ATC 160a
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

[REQ]

Identifier	REQ-18-02b-TS-MECH.1013
Title	Severe Desynchronization triggering (FDMP)
Requirement	When the FDMP enters in Severe Desynchronization, it shall declare itself not FDMP eligible.
Status	<In Progress>
Maturity Level	TRL4
Rationale	This requirement ensures the FDMP role is not affected by a desynchronization. ICD note: The FDMP eligibility attribute in the IOP information cluster is set to FDMP_NOT_ELIGIBLE
Category	<Interoperability><Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-FSMG.0078
<ALLOCATED_TO>	<Enabler>	ER APP ATC 160
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Service>	SharedFlightObject

4.2.11 TMA Requirements

This section specifies the requirements ensuring proper sharing of data related to departure and arrival management.

4.2.11.1 Departure Data sharing

[REQ]

Identifier	REQ-18-02b-TS-ADMG.0004
Title	Departure Times Sharing
Requirement	An SI shall share the following departure times when received: <ul style="list-style-type: none"> • Actual Take Off Time (ATOT), • Target Take Off Time (TTOT), • Calculated Take Off Time (CTOT), • Estimated Take Off Time (ETOT), • Surface departure events, • Take-Off events.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement ensures the information regarding different departure times and events is shared when provided. Surface departure events refer to START-UP, PUSHBACK, TAXI on-ground clearances been given to the aircraft. Take-Off events refer to take-off CLEARED, take-off ABORTED, or flight being AIRBORNE.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	APP ATC 177
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-ADMG.0002
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-ADMG.0003
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-ADMG.0004
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-ADMG.0005
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-ADMG.0006
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-ADMG.0009
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-ADMG.0010
<ALLOCATED_TO>	<Service>	SharedFlightObject

[REQ]

Identifier	REQ-18-02b-TS-ADMG.0005
Title	Sharing Departure Data
Requirement	The SI receiving the following departure information shall share it with all IOP Unit: <ul style="list-style-type: none"> • the Departure Runway, • the assigned SID, • other Departure Aerodrome
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement ensures sharing available Departure Data information.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	APP ATC 177
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-ADMG.0011
<ALLOCATED_TO>	<Service>	SharedFlightObject

4.2.11.2 Arrival Data sharing

[REQ]

Identifier	REQ-18-02b-TS-ADMG.0001
Title	Sharing AMAN Arrival Sequence Information
Requirement	The SI receiving the following arrival sequence information from the AMAN shall share it with all IOP Unit: <ul style="list-style-type: none"> • Metering Fix and Time over Metering Fix, • Total Time to Lose or Gain at the Metering Fix, • Significant Point and time over that point, • AMAN Arrival Sequence Number, • AMAN assigned speed and associated application point.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement ensures the arrival sequence information received from the AMAN is shared.

	ICD note: if set by a FDC, the service used is srv_set_AMAN_data().
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	APP ATC 177
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-ADMG.0007
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-ADMG.0008
<ALLOCATED_TO>	<Service>	SharedFlightObject

[REQ]

Identifier	REQ-18-02b-TS-ADMG.0002
Title	Sharing AMAN Delay Information
Requirement	<p>The SI receiving the following delay information from the AMAN shall share it with all IOP Unit:</p> <ul style="list-style-type: none"> • A speed advisory expressed as an absolute speed request or a speed change request, or • A time advisory expressed as a Time-to-lose/time-to-gain (TTL/TTG) or a target time at a specified waypoint.
Status	<Validated>
Maturity Level	TRL6
Rationale	<p>This requirement ensures the delay information received from the AMAN is shared allowing controlling actions to be taken by units that are some distance upstream from the ADES.</p> <p>ICD note: if set by a FDC, the service used is srv_set_AMAN_data().</p>
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	APP ATC 177
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-ADMG.0007
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-ADMG.0008
<ALLOCATED_TO>	<Service>	SharedFlightObject

[REQ]

Identifier	REQ-18-02b-TS-ADMG.0003
Title	Sharing Arrival Data
Requirement	<p>The SI aware of the applicable arrival information shall share it with all IOP Unit:</p> <ul style="list-style-type: none"> • the Arrival Runway, • the assigned STAR, • the Instrument Approach Procedure, • the Alternate Aerodrome for Arrival
Status	<Validated>
Maturity Level	TRL6

Rationale	This requirement ensures sharing available Arrival Data information. ICD note: if set by a FDC, the service used is <code>srv_set_arrival_specific_data()</code> .
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<ALLOCATED_TO>	<Enabler>	APP ATC 177
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-ADMG.0011
<ALLOCATED_TO>	<Service>	SharedFlightObject

4.2.12 SWIM for IOP

This section specifies the requirements set on the IOP Applications to ensure proper use of the SWIM middleware and the requirements set on the SWIM middleware by the IOP Applications.

Note. The SWIM Technical Layer is specified in Appendix B.

4.2.12.1 Collisions or Concurrent updates of FO releases

As there is no explicit negotiation between stakeholders to elect an FDMP for a flight object, two or more SIs may update the flight object concurrently and the updates may conflict with each other.

When a flight object is updated independently at multiple locations, the FO release information may not follow the correct ordering that allows the receiving FDCs to order the updates and discard old FO releases. This conflicting situation is referred to as a collision of FO updates.

The SWIM Technical Layer may detect such collisions based on the FO release information published in the FO Summary.

4.2.12.1.1 Loss of FO Clusters

[REQ]

Identifier	REQ-18-02b-TS-SWIM.0028
Title	SWIM-TI notification upon old FO detection
Requirement	The SWIM Technical Layer of the FDCs and FDUs shall raise a warning when the SWIM Technical Layer detects that the locally stored Flight Object release is posterior to the release identification sent by the FDMP.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement triggers the automatic indication to the IOP application that FO Clusters have been lost.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER ATC 176
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Read FO Update

4.2.12.1.2 Concurrent FO Updates

Once a collision is detected, the SWIM Technical Layer (Appendix B) will notify the application layer providing the FO release and reason (collision). The SWIM Technical Layer will not update its locally stored clusters.

At application level, the FDC is not expected to react since the FDMP will have to republish FO update.

The FDMP will republish FO with 'corrected/adapted' FO release to make sure all FDC/FDU SI converge to the same FO release (as they may have received updates in different order).

[REQ]

Identifier	REQ-18-02b-TS-SWIM.0030
Title	SWIM-TI notification upon FO collision detection
Requirement	Upon FO collision detection, the SWIM Technical Layer shall notify the application layer providing the FO release and the reason (fo_version_collision).
Status	<Validated>
Maturity Level	TRL6
Rationale	The application layer will only receive the cluster release numbers and not the content of the clusters.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER ATC 176
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Read FO Update

[REQ]

Identifier	REQ-18-02b-TS-SWIM.0032
Title	FDMP action upon FO collision
Requirement	Upon FO collision notification from the SWIM Technical Layer, the FDMP shall increase the release numbers for the conflicting clusters beyond the received release numbers, increase the release numbers for all the other clusters, and republish the complete FO.
Status	<In Progress>
Maturity Level	TRL4
Rationale	Republishing the complete FO ensures all stakeholders receive the complete FDMP view of the FO and update their own local copies.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER ATC 176
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Manage FO Update Collision

During a handover and to decrease likelihood of residual updates that may come from previous FDMP incrementing a cluster release by 1, the new FDMP may choose to increase all the FO clusters by a 'fixed step' and publish the complete FO.

4.2.12.2 Distribution Failure

There are multiple reasons that may make the distribution fails, as for instance:

- Failure to distribute because of problem in local Messaging infrastructure,
- Loss of connectivity to WAN and isolation from IOP network, or
- A problem detected in the cluster payload (due to version mismatch/problem for example).

SWIM node isolation/loss of connectivity to WAN can be detected locally, while a distribution failure due to a problem within the payload (excluding checks that may be detected locally via XML schema validation) requires notifications from other System Instances (SI).

4.2.12.2.1 Problem in local Messaging infrastructure

Upon a problem in the local messaging infrastructure, the SWIM Technical Layer detects the problem and notifies the IOP application. The notification can be done the following way:

- **Synchronous notification:** If the failure happens while the SWIM Technical Layer is processing a (synchronous) request from the application, it will respond with a Report with appropriate *ExceptionKind* in the *report_value* (isolated_stakeholder, timeout, middleware_failure, critical_errors).
- **Asynchronous notification:** If the failure did not happen while the SWIM Technical Layer is processing a (synchronous) request from the application, the SWIM Technical Layer may report the problem to the application via one of the existing mechanisms: *NotifyException*

with an appropriate value in reason (*isolated_stakeholder*, *middleware_failure*, *critical_errors*), or via *API_APP_MiddlewareStatus(IopStatus:not_enable)*.

- **Abort/Restart IOP-MDW:** For safety reasons (and depending on the problem in the messaging infrastructure), it is mandatory to abort/stop and restart the SWIM TI software and/or hardware. This may be required when communication between SWIM Technical Layer and application is no more possible.

Depending on the how critical the problem is, the SWIM-TI will be able to trigger IOP-disabled (*mdw_status: false*). In case of IOP-MDW abort, the IOP application and remote SIs will detect a middleware failure and hence an IOP disabled state.

4.2.12.2.2 Isolation/Loss of WAN connectivity

In case of isolation for the SWIM network (WAN), the SWIM-TI will not receive the *IOP_STATUS* publications from the other SIs and will inform the application via *API_APP_IopAreaStatus*.

If all SIs are *not_enabled*¹ then the IOP Application will trigger IOP-disabled (*app_status:false*).

4.2.12.2.3 Problem in payload (version mismatch)

In case of an incompatibility of versions in the FO cluster content, the FDC/WIC will notify the FDMP/WIMP via a call to *API_MDW_RejectFo*. This will generate a call to *WIRE_MDW_RejectFo* at the SWIM Technical Layer level to request the rejection of the flight object, giving the reason for the rejection to the current FDMP together with the FO release. At FDMP side, the SWIM Technical Layer will call *API_APP_RejectFo* to notify application of the FO rejection (the SWIM Technical Layer forwards the call to the IOP application).

When there are at least 2 FDC/WIC in the distribution list and all the IOP stakeholders reject the [WI]FO then the FDMP/WIMP may consider this a distribution failure for the [WI]FO and report this to the operator.

[REQ]

Identifier	REQ-18-02b-TS-SWIM.0034
Title	Distribution failure (FDMP)
Requirement	When there are at least 2 FDCs in the distribution list and all the IOP stakeholders reject the FO then the FDMP system instance shall consider this a distribution failure for the FO.
Status	<In Progress>
Maturity Level	TRL4
Rationale	When there are at least 2 FDC/WIC in the distribution list and all the IOP stakeholders reject the [WI]FO then the FDMP/WIMP may consider this a distribution failure for the [WI]FO and report this to the operator.
Category	<Interoperability>

[REQ Trace]

¹ Special attention is given to the first IOP-capable SI as it will not receive *IOP_STATUS* publications.

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER ATC 176
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Manage Distribution Failure
<ALLOCATED_TO>	<Function>	Reject Flight Object

At FDC/WIC/FDU side, the [WI]FO is desynchronised and this is reported to the operator.

[REQ]

Identifier	REQ-18-02b-TS-SWIM.0036
Title	FDC action upon ICD incompatibility
Requirement	When an FDC system instance cannot process an FO update because of an ICD version incompatibility, the FDC system instance shall reject the FO and inform the FDMP.
Status	<In Progress>
Maturity Level	TRL4
Rationale	At FDC/WIC/FDU side, the [WI]FO is desynchronised and this is reported to the operator.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER ATC 176
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Distribution Failure
<ALLOCATED_TO>	<Function>	Reject Flight Object

4.2.12.3 FO Recovery

4.2.12.3.1 Introduction to FO Recovery

The following definitions apply:

- a “failed node” is an IOP node that has abruptly stopped working;
- A failed node becomes a “recovering node” when it re-starts IOP operation and is not back to a full operational state;
- a “starting node” is a node that is introduced the first time in the IOP network or a node that stopped normally operation (e.g. for maintenance or a not switching from IOP-disabled to IOP-enabled) and re-integrate the IOP network.

The IOP system is made of active IOP nodes that interact each others to maintain locally in each node a shared view of the flight objects. It may happen that some IOP nodes accidentally stop working. In such a case, general mechanisms exist to ensure that the network continues to:

- provide the IOP service without the failed nodes (service continuity) and,
- allow nodes that experienced the failure to start again and re-enter the IOP network smoothly and recover an up-to-date knowledge of the flight objects and takes back their legitimate role for each FO (FDMP, FDC, FDU).

Recovery mechanisms are the technical procedures followed by the starting/recovering IOP nodes to allow successfully and efficiently to re-enter the IOP network, without impacting the normal operation of the IOP network nor degrading the performances.

Mechanisms to allow the IOP protocol at the FO level to continue working without the failed nodes have been described in section 4.2.1 General Mechanisms (e.g. FDMP role take over). Basic mechanisms operated by the SWIM layer to allow SWIM nodes to retrieve FOs when they are back are described in the IS part of this document (through the SUMMARY item mechanism).

This section presents an additional mechanism, called the FO Recovery, which allows to better control and make more efficient the recovery phase of a recovering IOP node. This mechanism is also used by starting nodes.

The FO Recovery process is a co-operative procedure involving:

- the SWIM layer operated in the IOP nodes,
- the IOP Application of the recovering IOP Node,
- the IOP Application of other IOP Nodes that have taken the FDMP role of the FOs from the failed IOP Application, and
- the IOP Application of other IOP Nodes that are legitimately the FDMP of others FOs.

The FO Recovery process is based on the concept of “Recovery Tier”. A Recovery Tier defines the priority given to the re-publication of a given FO that was managed by the node before the failure. The Recovery Tier is defined by the FDMP for each FO and for each SI that receives that FO.

The assignment logic for the Tiers is the following:

- Tier 0 is associated to the IOP Node controlling the flight,
- Tier 1 is associated to IOP Nodes crossed by the flight, and
- Tier 2 is associated to other IOP Nodes.

This assignment will allow to receive in 3 separate batches the FOs, starting with the FOs assigned with the highest Tier (Tier 0).

The recovering SI is able to start processing FOs as soon as they are received. The SI does not wait the end of each batch to start processing the received FOs.

The Tiers are passed by the IOP Application to the SWIM-TI at the creation and each publication of the FO in the distribution list parameter. Note that the Tiers are not included in the IOP Distribution List of the Crossed and Control Sequence FO cluster.

In case of re-entrance, the same SI can have different role over different segments (e.g. FDMP on [SI,1] and FDC on [SI,2]). In that case, the highest Tier is allocated to the SI.

This tiered approach allows to:

- perform the recovery process in sequential steps in order to prevent storms of updates on the recovering SWIM Node side, and
- ensure that the most critical Flight Objects are recovered first.

When the Node is recovering, the FO Recovery mechanism is either triggered explicitly by the IOP application or triggered automatically by the SWIM-TI without involvement of the IOP Application:

- In the “IOP Application driven” recovery mode, the IOP application triggers the SWIM interface to start and stop the FO Recovery steps,
- In the “automatic” recovery mode, the SWIM-TI controls itself the FO Recovery steps on behalf of the IOP application. In that mode, the order to recover FOs according to their Tier is defined in the recovery policy.

Note. The support of the recovery mode is a local decision taken at the level of each node. There is no need to negotiation or advertise the selected mode with other nodes.

A “recovery context” is used to avoid unnecessary FO re-publications. The recovering node advertises periodically that it is recovering, so the “Context ID” is sent with each recovering notification but the other IOP nodes will start the recovering process only at the receipt of the first notification including this context ID. The next recovering notifications are ignored, except if any other recovery context is included, meaning that the failing node has starting a new recovery phase.

To support the FO Recovery process, the IOP application and the SWIM-TI share the following responsibilities:

- The IOP Application is responsible for:
 - starting and ending the recovery process,
 - defining and providing the SWIM-TI with the Tier for the FO for which it is FDMP,
 - monitor the recovery is completed during a specific time,
 - managing a recovery context, and
 - initiate on-demand recovery if the recovery has not been completed within the dedicated time.
- The SWIM-TI is responsible for:
 - the recovering node: sending a RECOVERY topic to all IOP nodes when an IOP Application declares it is starting or ending a recovery process,
 - all nodes:
 - monitoring the nodes that are recovering and re-publish eligible FOs, according with the Tier when acting as FDMP,
 - control the recovery context to stop aborted previous recovery, and
 - sending FOs upon explicit recovery request.

4.2.12.3.2 FO Recovery Use Cases

This section presents use cases for the FO Recovery. The IOP area contains 5 SIs (A to E) and manage 4 flights (FO1 to FO4).

FO1 is published by FDMP A (controlling the flight) with the associated Tiers (A,0), (B,1), (C,1), (D,1) (E,2).

FO2 is published by FDMP A (controlling the flight) with (A,0), (B,1), (C,2), (D,1) (E,2).

FO3 is published by FDMP C (controlling the flight) with (C,0), (D,1) (E,1).

FO4 is published by FDMP B (controlling the flight) with (B,0), (C,1), (D,1) (E,2).

	A	B	C(running)	D	E
FO1	FDMP controlling SI Tier0	FDC distributed (traversed) Tier1	FDC distributed (traversed) Tier1	FDC distributed (traversed) Tier1	FDU distributed (vicinity) Tier2
FO2	FDMP controlling SI Tier0	FDC distributed (traversed) Tier1	FDU distributed (general info) Tier2	FDC distributed (traversed) Tier1	FDU distributed (vicinity) Tier2
FO3		-	FDMP controlling SI Tier0	FDC distributed (traversed) Tier1	FDC distributed (traversed) Tier1
FO4		FDMP controlling SI Tier0	FDC distributed (traversed) Tier1	FDC distributed (traversed) Tier1	FDU distributed (vicinity) Tier2

Use case #1 – No transfer of control during the recovering period

When C fails, D takes over the FDMP role for FO3. D re-assesses the Tier allocation for FO3, as there was no transfer of control, the Tier allocation stays the same.

	A	B	C(failed)		
FO3		-	(controlling) (Tier0)	FDMP distributed (traversed) Tier1	FDC distributed (traversed) Tier1

When C recovers,

- C advertises being recovering Tier 0 (C,0), meaning it wants to recover the FOs of the flights it is actually controlling. FDMP D will submit FO3.
- Then, C advertises recovering Tier1 (C,1), meaning it wants to recover the FOs of the flights that cross its AoI. FO1 FDMP A will send FO1 and FDMP B will send FO4.
- Finally, it advertises recovering Tier2 (C,2) for all the other FOs. FO2 FDMP A will send FO2.

Use case #2 – Transfer of control occurs during the recovering period

When C fails, D takes over the FDMP role for FO3. A transfer of control is performed between C and D. D re-assesses the Tier allocation as follows:

	A	B	C(failed)	D	E
FO3		-		FDMP controlling SI Tier0	FDC distributed (traversed) Tier1

When C recovers,

- C advertises being recovering Tier 0 (C,0), meaning it wants to recover the FOs of the flights it is actually controlling. As D is now controlling the flight, it will not send FO3 to C,
- The other steps are unchanged.

4.2.12.3.3 Nominal FO Recovery Scenario

The FO Recovery process is mainly handled by the SWIM layer of the IOP Nodes. Refer to 18-02b IRS document for the description of the recovery mechanisms operated by the SWIM-TI. The IOP Applications are only expected to define the way the recovery will be performed, trigger the SWIM layer to start and stop the recovery process, and eventually to perform itself the recovery of specific FO if deemed necessary. The requirements below address those expected actions.

The nominal scenario for the recovery follows the following steps:



- STEP. 1: The recovery process is initiated either triggered by the IOP Application (application driven mode), or automatically depending of the supported recovery mode.
- STEP. 2: The recovering SWIM Node sets its FO Recovery Status to “TRUE” and the recovering Tier(s) as requested by the IOP Application (application driven mode) or specified in the local automatic recovery policy (automatic mode), and publishes periodically a RECOVERY_STATUS information on the network.
- STEP. 3: Upon receipt of a RECOVERY_STATUS, every SWIM Node on the network checks the Tier(s) associated to the recovering SWIM Node for each Flight Object it acts as FDMP. It publishes to the recovering SWIM Node the FOs for which the node appears in the Distribution List with the requested Tier (s). The SWIM Node re-publishes the FOs only upon receipt of the first RECOVERY_STATUS containing a given context id.
- STEP. 4: The recovering SWIM Node receives all the FOs for which it appeared as “Tier T(s)” in the distribution list.
- Optional on-demand recovery step: if some Flight Objects are not received after some predefined time duration, the application may use the FO Recovery service provided by the SWIM-TI to recover explicitly the missing Flight Object(s).
- STEP 5: Upon completion of the “Tier T(s)” recovery, the recovering SWIM Node updates the published RECOVERY_STATUS information with the next Tier(s) to recover.
- STEP. 6: The process continues iteratively until the recovery is completed. The recovering SWIM Node will then change its FO Recovery Status to “FALSE” and will terminate the periodic publications of RECOVERY_STATUS information.

4.2.12.3.4 Functional Interfaces involved in FO Recovery

Figure 26 identifies the logical interfaces involved during the FO Recovery. The services used for the recovery process are identified in red, either at the IOP Application / SWIM Node interface level or at the SWIM Node / SWIM Node interface level. Services that can be triggered by the FDMP only are marked with an asterisk.

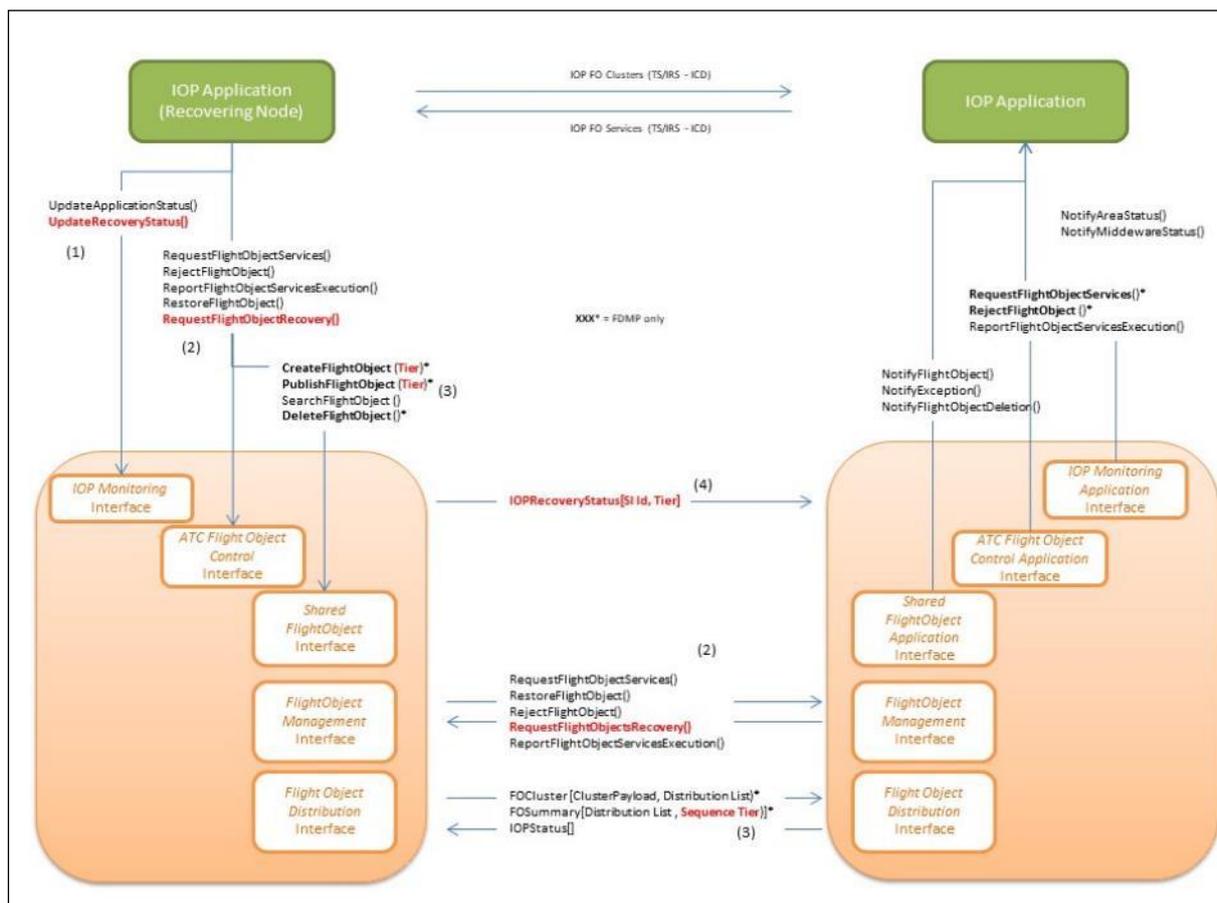


Figure 26: Functional Interfaces involved in FO Recovery

The sequence of events during a nominal FO recovery process is as follows:

- (1) The *UpdateRecoveryStatus()* operation is used by an IOP Application to request the SWIM node to start/end the recovery process for a given Tier or set of Tiers.
- (2) The *RequestFlightObjectRecovery()* operation is used by a recovering IOP Application to initiate an on-demand recovery. The request is sent to the relevant node through the RequestFOsRecoveryFO service.
- (3) The Tiers are passed by the FDMP to the SWIM-TI in the CreateFO() and PublishFO(); The Tiers are sent to the remote nodes by the SWIM-TI as FOCluster parameters. The Tiers are not part of the IOP FO cluster payload.
- (4) The SWIM-TI nodes advertise the Recovery Status in an FO RecoveryStatus topic.

4.2.12.3.5 FO Recovery Requirements

4.2.12.3.5.1 Tier Allocation Management

The Recovery process allows to request the recovery of FOs in different batches. The Recovering Node indicates dynamically which sets of FOs are expected to be re-sent. Each set is associated with a “Recovery Tier”. The allocation of Tiers to SIs is described in the “IOP Tier Management Policy”.

[REQ]

Identifier	REQ-18-02b-TS-SWIM.0040
Title	Common use of an IOP Tier Management Policy
Requirement	<p>At the time for FO publication, the FDMP shall use rules specified in the IOP Tier Management Policy to dynamically assign Tier to the SI associated with an FO:</p> <ul style="list-style-type: none"> • Tier 0 associated to the IOP Node controlling the flight, • Tier 1 is associated to IOP Nodes crossed by but not controlling the flight, and • Tier 2 is associated to other IOP Nodes
Status	<Validated>
Maturity Level	TRL6
Rationale	<p>The IOP Tier Management Policy is used by the FDMP at creation or update of the FO.</p> <p>The IOP Tier Management Policy is defined</p>
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER ATC 176
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO
<ALLOCATED_TO>	<Function>	Update and Distribute WIFO
<ALLOCATED_TO>	<Function>	Create and Distribute FO
<ALLOCATED_TO>	<Function>	Create and Distribute WIFO

The Tier assessment is performed by the FDMP before the publication of the FO.

[REQ]

Identifier	REQ-18-02b-TS-SWIM.0042
Title	Tier re-allocation triggering events (FDMP)
Requirement	When the FDMP is about to publish an FO (at creation of update), it shall : <ul style="list-style-type: none"> - Re-assess the Tier allocation in compliance with the IOP Tier Management Policy, - Provide the SWIM-TI with the resulting Tiers when publishing the FO.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement ensures the Tier re-allocation by the FDMP any time before an FO is published. It covers also the initial FDMP case at FO creation. The Tiers are provided to the SWIM-TI in the CreateFO() and PublishFO() interfaces to the SWIM-TI.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER ATC 176
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO
<ALLOCATED_TO>	<Function>	Update and Distribute WIFO
<ALLOCATED_TO>	<Function>	Create and Distribute FO
<ALLOCATED_TO>	<Function>	Create and Distribute WIFO

[REQ]

Identifier	REQ-18-02b-TS-SWIM.0046
Title	Tier re-allocation in case of distribution list modification (FDMP)
Requirement	When the FDMP insert a new SI in the distribution list, it shall allocate a Tier to the added SI in compliance with the IOP Tier Management Policy.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement triggers the automatic Tier re-allocation when the FDMP modify the distribution list. The Tiers are provided to the SWIM-TI in the PublishFO() interface to the SWIM-TI.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER ATC 176
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	Update and Distribute FO
<ALLOCATED_TO>	<Function>	Update and Distribute WIFO
<ALLOCATED_TO>	<Function>	Create and Distribute FO
<ALLOCATED_TO>	<Function>	Create and Distribute WIFO

4.2.12.3.5.2 Recovery Process Initiation

The recovery process is initiated within an SI either:

- triggered by the IOP Application (application driven mode), or
- automatically by the SWIM Node when certain conditions are met, e.g. reconnection after an isolation from the IOP network (automatic mode). In this mode the rules to operate the recovery are described in the Tier Management Policy.

[REQ]

Identifier	REQ-18-02b-TS-SWIM.0048
Title	Recovery Process Initiation (Recovering Node)
Requirement	When an SI triggers an FO recovery step, it shall : <ul style="list-style-type: none"> - request the SWIM-TI to advertise the other IOP Node that it is starting a recovering phase for one or several Tier(s), - assign a Recovery Context for that step. - monitor that this recovering step is performed within a limited time (SP-IOP-Max_Recovery_Step_Time_Tier_x where x is the 0, 1 or 2 depending on the recovering Tier).
Status	<Validated>
Maturity Level	TRL6
Rationale	The IOP stakeholder may require FO Recovery when it becomes “IOP-enabled” again after isolation for example. The decision to recover one Tier at a time or several Tiers is a local decision and is described in the Tier Management Policy. The advertising of the recovering status is made by the SWIM-TI layer by broadcasting a RECOVERY STATUS item. The Recovery Context is used to avoid unnecessary re-publications of FOs. SWIM-TI interface note: the recovery initiation step is performed through the invocation of the UpdateRecoveryStatus (status=TRUE) operation.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER ATC 176
<ALLOCATED_TO>	<Service>	IOPMonitoring
<ALLOCATED_TO>	<Function>	Recover FO

In the “IOP Application driven” recovery mode, once a recovery step is completed, the IOP Application chooses to continue with the next step or to stop the whole recovery process.

Note. In the “automatic” recovery mode, it is up to the SWIM node to trigger the next recovery step when the previous step is completed. The way the SWIM node detect the end of a recovery step is outside the scope of this specification.

[REQ]

Identifier	REQ-18-02b-TS-SWIM.0050
Title	Recovery Steps iterations (Recovering Node)
Requirement	In the “IOP Application driven” recovery mode, when the recovering IOP Application has triggered a recovery step for a given Tier(s) and all the FOs have been received in time (SP-IOP-Max_Recovery_Step_Time_Tier_x where x is the 0, 1 or 2 depending on the recovering Tier), it shall decide to either: <ul style="list-style-type: none"> - trigger another recovery step for another Tier(s), or - end the recovery.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement applies only when the recovery steps are driven by the IOP Application. It is up to the IOP Application to decide whether the recovery is over or should continue. SWIM-TI interface note: the recovery initiation/end step is performed through the invocation of the UpdateRecoveryStatus operation.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER ATC 176
<ALLOCATED_TO>	<Service>	IOPMonitoring

4.2.12.3.5.3 IOP Application Driven Recovery Requests

In case the Tier-based mechanism did not allow the recovering node to retrieve all the expected FOs, the IOP Application will request the missing FOs from the FDMPs of these FOs.

[REQ]

Identifier	REQ-18-02b-TS-SWIM.0052
Title	Direct recovery step (recovering node)
Requirement	<p>In the “IOP Application driven” recovery mode, when</p> <ul style="list-style-type: none"> - a recovery step for a given Tier(s) has been performed and not all the FOs have been received in time (i.e. within SP-IOP- Max_Recovery_Step_Time_Tier_x where x is the 0, 1 or 2 depending on the recovering Tier), and - the missing FOs still need to be recovered by another way, <p>the recovering IOP Application shall request the SWIM-TI to request the FDMPs of the missing FOs to publish these FO and monitor the reception of these FO.</p>
Status	<Validated>
Maturity Level	TRL6
Rationale	<p>This requirement applies only when the recovery steps are driven by the IOP Application.</p> <p>When the automatic recovery performed by the SWIM-TI has not been completed in time, the IOP Application can decide to retrieve directly some FOs from their FDMP.</p> <p>The monitoring of the reception of the FOs will allow the IOP Application to request again several times the publication from the FDMPs. The number of retries is a local matter.</p> <p>SWIM-TI interface note: the FO recovery step is performed through the invocation of the requestFORecovery() operation.</p>
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER ATC 176
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage FO Recovery

4.2.12.3.5.4 Recovery Process Termination

The process continues iteratively until the IOP Application (application driven mode) considers the recovery process completed. This can be either because all missing Flight Objects have been recovered or the still missing Flight Objects are considered not in interest.

[REQ]

Identifier	REQ-18-02b-TS-SWIM.0054
Title	Recovery Process Termination (Recovering Node)
Requirement	In the “IOP Application driven” recovery mode, when the recovering IOP Application decides to end the recovery process, it shall request the SWIM Technical Layer to stop recovery operations and advertise the IOP Nodes that it is not in a recovering status any longer.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement applies only when the recovery steps are driven by the IOP Application. The IOP application can decide to stop the recovery process either when all FOs have been correctly retrieved, or when only a part of them have been retrieved (e.g. from Tier 1 and 2 only). SWIM-TI interface note: the recovery end step is performed through the invocation of the UpdateRecoveryStatus (status=FALSE)
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER ATC 176
<ALLOCATED_TO>	<Service>	IOPMonitoring
<ALLOCATED_TO>	<Function>	Recover FO

4.2.12.3.5.5 Recovery alignment (FO / Local SFPL integration)

When a SI is recovering, it receives updated FOs that need to be integrated in its local SFPL. This process is similar to the nominal FO/SFPL alignment but with some specificities.

When the recovering SI was IOP disabled, its local SFPL was still evolving. In some cases, the local SFPL information is more accurate than the one received from the updated FO received after the recovery.

Although the FO/SFPL alignment process depends on the local design and is not specified in this standard, some rules are recommended to be taken into account when defining this local process. These rules are different according to whether the FO being processed corresponds to a flight that is under control of the recovering SI or not.

If the FO corresponds to a flight that is under control of the recovering SI, the SI should give priority to:

- the local SFPL data for the flight data information running up to the exit coordination (included),
- the FO data for the flight data information beyond the exit coordination, as long as it does not affect the exit coordination.

If the FO corresponds to a flight that is not under control of the recovering SI,

- If the upstream SI is IOP-enabled, the SI should consider the upstream FO data are valid and therefore give priority to:
 - the FO data for the flight data information before the entry coordination (included),
 - the local SFPL data for the flight data information running from the entry coordination (excluded) up to the exit coordination (included),
 - the FO data for the flight data information running beyond the exit coordinated, as long as it does not affect the exit coordination.
 -
- If the upstream SI is not IOP-enabled, the SI should give priority to:
 - the FO data for the flight data information before the entry coordination (excluded),
 - the local SFPL data for the flight data information running from the entry coordination (included) up to the exit coordination (included),
 - the FO data for the flight data information running beyond the exit coordinated, as long as it does not affect the exit coordination.

4.2.13 Design Objectives

The IOP safety assessment (operational level see appendix B in INTEROP (Ref.: [33]), and technical level see Appendix H) allowed to analyse the various IOP failures, assess their operational effects and identify the corresponding operational hazards and severity.

For a significant number of IOP failures, adequate mitigations have been specified as safety requirements (requirements of category <safety> in previous chapters of this specification) on the IOP design in order to either prevent failure occurrence or to limit their operational effect (to a severity not higher than MAC-SC4b with IM≤10).

However, the risk mitigation related to the following categories of IOP failures need to be addressed in a different manner:

- A set of IOP errors or corruptions: as their worst still credible effect might display a severity MAC-SC3 (operational hazards Hz#02: Late tactical conflict detection due to uncoordinated flight at horizontal ATSU boundary and Hz#04: Wrong correlation with potential for erroneous coordination or late tactical conflict detection), an adequate software assurance must apply to IOP;
- The Loss of IOP at multiple SI involves an operational effect of severity MAC SC4b with impact modification factor IM=20; that requires adequate mitigation at IOP network level in order to minimize frequency of that occurrence

[REQ]

Identifier	REQ-18-02b-TS-SAFE.0001
Title	Design objective
Requirement	Due to the safety critical nature of IOP, it is expected that the IOP should be implemented with the appropriate Software Assurance Level.
Status	<Validated>
Maturity Level	TRL6
Rationale	This requirement is necessary to mitigate the risk identified in the safety assessment analysis. This could be achieved by following applicable guidelines (e.g.: EUROCAE ED-153, RTCA DO-278/ EUROCAE ED-109A) depending on local regulation. Application of SWAL3 assurance level is recommended.
Category	<Design><Safety>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-GENE.0001
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER ATC 176
<ALLOCATED_TO>	<Enabler>	
<ALLOCATED_TO>	<Enabler>	ER ATC 177
<ALLOCATED_TO>	<Enabler>	SVC-035

4.2.14 Security

The present specification for IOP does rely on the security assessment that has been performed while developing the annexed IRS document (Cf.: Appendix E) that has been developed in SESAR 1. This IRS annexe contains the security requirements applicable to the SWIM Blue Profile middleware covering the security needs for the IOP solution described in this specification. In the case the IOP solution is deployed on top of another middleware, it is recommended to reconsider the security assessment.

4.2.15 Optional functionalities

The functionalities described in the INTEROP (Ref.: [33]) are not all mandatory.

A SI (as FDMP or FDC) can be designed or configured to not trigger an optional functionality. However, an SI acting as FDMP is always requested to implement the requirements allowing other FDCs to trigger an optional functionality.

The Table 40 lists the optional IOP functionalities identified in the INTEROP. Some functionalities are broken down into sub-functionalities (column Level1/Level2).

The optionality status is described as followed:

- **O**: the support of the functionality/requirement is optional.
- **o**: the optional parent functionality is supported and the support of this functionality/requirement is optional.
- **m**: the optional parent functionality is supported and the support of this functionality/requirement is mandatory.

- **M:** the support of this functionality/requirement is mandatory regardless whether the parent functionality is optional or not.

The support of the functionalities not identified in the table is by default mandatory (M).

Option #	Level 1 Functionality	Level 2 Functionality	OPS Support (INTEROP)	TECH Support (TS/IRS)	Meaning...	TECH Support	Meaning
				Initiator		Receptor	
	C&T						
#1	Negotiation (WIFO)		O	O	A SI is allowed to never initiate a negotiation as a WIMP	O	A SI is allowed to never accept a negotiation as a WIC.
#1.1		Counter-proposal	O	o	A WIMP is allowed to never accept a counter-proposal	o	A WIC is allowed to never initiate a counter-proposal.
#2	Flight Phase: Manual trigger (force-CAP, force-NP)		O	O	A controlling SI is allowed to never manually - force the CAP - force the NP	N/A	
#3	Release Management		O	O	A delegator SI is allowed to never specify release for turn, corridor, speed or ROCD (always full release).	M	The FDMP must be able to: - process the release related services, - manage the release information in the FO crossed and controlled SI list.
#4	Flight Transfer: ROF		O	O	A receiving SI is allowed to never offer a downstream ATCO the possibility to perform a ROF.	M	The FDMP must be able to: - process the ROF service, - manage the ROF information in the FO Coordination Data.
#5	Flight Transfer: Undo COF		O	O	A controlling SI (after a COF) is allowed to never offer a transferring ATCO the possibility to undo a COF.	M	The receiver should be prepared to process the COF undo when it is executed by the transferring SI
	Control Sequence						
#6	Skip		O	O	A SI (as FDC or FDMP) is	M	The FDMP must be able to:

Option #	Level 1 Functionality	Level 2 Functionality	OPS Support (INTEROP)	TECH Support (TS/IRS)	Meaning...	TECH Support	Meaning
				Initiator		Receptor	
					allowed to never: - request to skip an SI, - be skipped.		- process the skip related services, - manage the skip information in the FO crossed and controlled SI list.
#7	Delegation		O	O	A SI (as FDC or FDMP) is allowed to never: - request to delegate an SI, - be delegated.	M	The FDMP must be able to: - process the delegation related services, - manage the delegation information in the FO crossed and controlled SI list.
#8	Short-cross		O	O	A SI is allowed to never short-cross an SI.	M	The FDMP must be able to 'remove' the short-crossed SI on request of the short-crossing SI.
#9	Point		O	O	A SI is allowed to not provide the ATCO with the capability to point an SI.	M	The FDMP must be able to: - process the point related services, - manage the pointing information in the FO Distribution SI list.
#10	No Contact		O	O	A SI is allowed to not support the No-Contact procedure.	M	The FDMP must be able to: - process the No-Contact related services, - maintain the entry/exit coordination of the no-contact SI.
	Flight Script						
#11	Constraint Management: Advanced constraints (activation/desactivation strategic constraint)		O	O	A SI is allowed to never deactivate / activate a strategic constraint	M	The FDMP must be able to: - process the activation/deactivation of a strategic constraint requested by the constraint owner, - manage the Strategic Constraint Status attribute.
#12	Route Management: Indication of cleared route		O	O	A SI is allowed to set the cleared status of a route change.	M	The FDMP must be able to manage the FO route cleared indication.

Option #	Level 1 Functionality	Level 2 Functionality	OPS Support (INTEROP)	TECH Support (TS/IRS)	Meaning...	TECH Support	Meaning
				Initiator		Receptor	
	TMA						
#13	TMA Data Sharing		M (For TMA UNIT)	O	The sharing of TMA data is optional, but becomes mandatory for system serving a TMA Unit.	M	The FDMP must be able to process the request to add TMA related data in the FO.

Table 40 Optional functionalities

The following tables associate the options identified in Table 40 with the TS/IRS requirements. The optionality is defined as described in previous chapter.

4.2.15.1 Option #1: Support of “Negotiation”

In Table 41, the “Default Behaviour” Functionality contains the mandatory requirements that all system must implement even if the Negotiation functionality is not used.

The “Negotiation” functionality contains all requirements that needs to be implemented by any system that want to implement the electronic negotiation by FO (WIFO).

Note that if the system implement the WIFO, all the requirements in the below table must be implemented.

Functionality	O/M	Requirement ID	O/M	Title
Default behaviour	M			
		REQ-18-02b-TS-WIFO.0031	M	WIFO Rejection (WIC)
		REQ-18-02b-TS-WIFO.0032	M	WIFO rejection processing (WIMP)
		REQ-18-02b-TS-WIFO.0054	M	Reject in case of WIFO not supported
		REQ-18-02b-TS-WIFO.0056	M	Stopping WIFO publication to SI not supporting negotiation
Negotiation	O			
		REQ-18-02b-TS-COTR.0160	m	C&T Modified Data Urgent Application
		REQ-18-02b-TS-WIFO.0001	m	WIFO Support (WIMP)
		REQ-18-02b-TS-WIFO.0005	m	WIFO Negotiation Data Identifying
		REQ-18-02b-TS-WIFO.0007	m	WIMP role declaration at WIFO creation
		REQ-18-02b-TS-WIFO.0016	m	WIFO Distribution List Content (WIMP)
		REQ-18-02b-TS-WIFO.0017	m	WIFO unique identification (WIMP)
		REQ-18-02b-TS-WIFO.0027	m	WIFO Acceptance (WIC)
		REQ-18-02b-TS-WIFO.0028	m	WIFO Timeout
		REQ-18-02b-TS-WIFO.0029	m	WIFO acceptance (WIMP)

		REQ-18-02b-TS-WIFO.0038	m	WIFO Commit
		REQ-18-02b-TS-WIFO.0040	m	WIFO Deletion Acknowledge (WIC)
		REQ-18-02b-TS-WIFO.0041	m	Stating WIFO purpose as negotiation
		REQ-18-02b-TS-WIFO.0042	m	WIFO deletion triggers
		REQ-18-02b-TS-WIFO.0043	m	WIFO initial status
		REQ-18-02b-TS-WIFO.0045	m	WIFO Cancellation
		REQ-18-02b-TS-WIFO.0048	m	WIFO synchronized with FO
		REQ-18-02b-TS-WIFO.0051	m	WIFO realignment management
		REQ-18-02b-TS-WIFO.0055	m	Reject in case of negotiation type not supported
		REQ-18-02b-TS-WIFO.0057	m	C&T Negotiated Data Urgent Application
		REQ-18-02b-TS-WIFO.0058	m	WIFO Deletion Request (WIMP)

Table 41: Negotiation Option

4.2.15.2 Option #1.1 Support of “Negotiation Counter Proposal”

The Counter Proposal functionality is an optional part of the Negotiation. System having implemented the Negotiation functionality can decide to also implement the Counter Proposal. This system can choose to support this functionality as initiator (WIMP) and optionally as participant (WIC). The requirements marked with ‘m’ in Table 42 are mandatory to support counter proposal and apply to the WIMP.

Functionality	O/M	Requirement ID	O/M	Title
Negotiation.Counter proposal	O			
		REQ-18-02b-TS-WIFO.0033	m	WIFO counter proposal - identify negotiated data (WIC)
		REQ-18-02b-TS-WIFO.0037	m	WIFO Counter-proposal answer (WIMP)
		REQ-18-02b-TS-WIFO.0046	m	WIFO Counter-proposal answer time-out
		REQ-18-02b-TS-WIFO.0049	m	WIFO Counter-proposal (WIC)
		REQ-18-02b-TS-WIFO.0052	m	WIFO update when counter-proposal (WIMP)

Table 42: Negotiation.Counter Proposal Option

4.2.15.3 Option #2: Support of “Flight Phase Manual Trigger”

The manual trigger of the flight phase is an optional functionality. If a system implements it, it must satisfy all requirements in below Table 43.

Functionality	O/M	Requirement ID	O/M	Title
C&T.Flight phase.Manual trigger	O			
		REQ-18-02b-TS-COTR.0004	o	Local CAP trigger
		REQ-18-02b-TS-COTR.0010	o	Local NP trigger

Table 43: Flight Phase Manual Trigger Option

4.2.15.4 Option #3: Support of “Release Management”

The Release functionality is optional. The Table 44 gives the requirements to implement to support the release functionality.

Functionality	O/M	Requirement ID	O/M	Title
C&T.Coordination data.Release	O			
		REQ-18-02b-TS-COTR.0147	m	Maintenance of other crossing data from SAP onward
		REQ-18-02b-TS-COTR.0203	m	Maintenance of release condition
		REQ-18-02b-TS-COTR.0209	m	Replacement of release condition

Table 44: Release Option

4.2.15.5 Option #4: Support of “Flight Transfer.ROF”

The Request of Frequency functionality is optional. As described in Table 45, all systems must implement the TS-COTR.0038 which specify the behaviour of a system being FDMP for a flight for which another system want to use the ROF functionality, and the requirement TS-COTR.0122 is implemented only by system where the ATCO is using the ROF.

Functionality	O/M	Requirement ID	O/M	Title
C&T.Flight transfer.ROF	O			
		REQ-18-02b-TS-COTR.0038	M	Request on Frequency by a SI (FDMP)
		REQ-18-02b-TS-COTR.0122	m	Availability conditions for ROF input

Table 45: Flight Transfer.ROF Option

4.2.15.6 Option #5: Support of “Undo Actions”

The Undo Actions functionality does cover optional Undo for COF, Assume, Force-Assume and ROF functionalities. From these functionalities only Undo COF is in the scope of this specification and it is the only one that is listed in the Table 46.

Functionality	O/M	Requirement ID	O/M	Title
C&T.Flight transfer.Undo-actions	O			
		REQ-18-02b-TS-COTR.0040	O	Undo-frequency change processing

Table 46: Undo Actions Option

4.2.15.7 Option #6: Support of “Skip”

The Skip functionality is optional. All systems must implement all requirements marked with “M” in Table 47. These “M” requirements are specifying the behaviour of the FDMP of a flight for which another system requests the implementation of a Skip. The requirement TS-SEQM.1015 must be implemented only by the system where the Skip functionality is used.

Functionality	O/M	Requirement ID	O/M	Title
Control Sequence.Skip	O			
		REQ-18-02b-TS-FSMG.0154	M	Maintenance of the constraint in case of skip
		REQ-18-02b-TS-SEQM.1015	m	Skip request implementation (FDC)
		REQ-18-02b-TS-SEQM.1016	M	FDMP implementation of a full skip
		REQ-18-02b-TS-SEQM.1018	M	Automatic Skip Limitation
		REQ-18-02b-TS-SEQM.1019	M	Skip cancellation processing (FDMP)
		REQ-18-02b-TS-SEQM.1020	M	Skip cancellation in case of force assume
		REQ-18-02b-TS-SEQM.1049	M	Unskip cancellation eligibility

Table 47: Skip Option

4.2.15.8 Option #7: Support of “Control Sequence.Delegation”

The Delegation functionality is optional. All systems must implement all requirements marked with “M” in Table 48. These “M” requirements are specifying the behaviour of the FDMP of a flight for which another system requests the implementation of a Delegation. The requirements marked with “m” must all be implemented only by the system where the Delegation functionality is used.

Functionality	O/M	Requirement ID	O/M	Title
Control Sequence.Delegation	O			
		REQ-18-02b-TS-SEQM.1024	m	Delegation request
		REQ-18-02b-TS-SEQM.1025	M	Full delegation processing
		REQ-18-02b-TS-SEQM.1027	M	Partial delegation processing at the entry of the airspace
		REQ-18-02b-TS-SEQM.1029	M	Delegation cancellation processing
		REQ-18-02b-TS-SEQM.1030	M	End of delegation upon Frequency change
		REQ-18-02b-TS-SEQM.1033	m	Release during delegation
		REQ-18-02b-TS-SEQM.1036	M	Partial delegation processing in the middle of the airspace
		REQ-18-02b-TS-SEQM.1037	M	Partial delegation processing at the exit of the airspace
		REQ-18-02b-TS-SEQM.1050	m	Undelegation request
		REQ-18-02b-TS-SEQM.1051	M	Confirmation management in case of partial delegation

Table 48: Delegation Option

4.2.15.9 Option #8: Support of “Control Sequence.Shortcross”

The Short-cross functionality is optional. This optional operational functionality is satisfied in the TS by the requirements listed in Table 49. These requirements are part of the Control Sequence.CS Correction specification and are all mandatory. Therefore this optional functionality is available in all systems in the IOP layer. Each ATC system has the possibility to use or not this functionality.

Requirement ID	O/M	Title
REQ-18-02b-TS-SEQM.1008	M	Control Sequence correction request by an FDC (removal)
REQ-18-02b-TS-SEQM.1009	M	SI removal: Impact on FO Control Sequence (FDMP)
REQ-18-02b-TS-SEQM.1045	M	SI addition refusal (FDMP)
REQ-18-02b-TS-SEQM.1046	M	SI removal refusal (FDMP)

Table 49: Shortcross Option

4.2.15.10 Option #9: Support of “Point”

The Point functionality is optional. All systems must implement all requirements marked with “M” in Table 50. These “M” requirements are specifying the behaviour of the FDMP of a flight for which another system requests the implementation of a Point. The requirements marked with “m” must all be implemented only by the system where the Point functionality is used.

Functionality	O/M	Requirement ID	O/M	Title
Control Sequence.Point	O			
		REQ-18-02b-TS-INFO.1100	m	Initiating a Point (FDC and FDMP)
		REQ-18-02b-TS-INFO.1120	M	Receiving a Point Establishment (FDMP)
		REQ-18-02b-TS-INFO.1130	o	Cancelling a Point (FDC and FDMP)
		REQ-18-02b-TS-INFO.1140	M	Receiving a Point Cancellation (FDMP)
		REQ-18-02b-TS-INFO.1150	m	Clean the Point (Point receiver is FDC)
		REQ-18-02b-TS-INFO.1160	m	Clean the Point (Point receiver is FDMP)
		REQ-18-02b-TS-INFO.1170	M	Processing a Point Clean (FDMP)

Table 50 : Point Option

4.2.15.11 Option #10: Support of “No Contact”

The No Contact functionality is optional. All systems must implement all requirements marked with “M” in Table 51. These “M” requirements are specifying the behaviour of the FDMP of a flight for which another system requests the implementation of a No Contact. The requirements marked with “m” must all be implemented only by the system where the No Contact functionality is used.

Functionality	O/M	Requirement ID	O/M	Title
Control Sequence.No_contact	O			
		REQ-18-02b-TS-SEQM.1115	m	Establishing No_Contact by an FDC
		REQ-18-02b-TS-SEQM.1116	M	FDMP processing of a No_Contact request
		REQ-18-02b-TS-SEQM.1117	m	Ending the No_Contact by the FDC
		REQ-18-02b-TS-SEQM.1118	m	Ending the No_Contact by requesting the flight on frequency

		REQ-18-02b-TS-SEQM.1119	M	FDMP processing of No_Contact termination
		REQ-18-02b-TS-SEQM.1120	M	FDMP maintenance of both entry/exit coordination of the no_contact
		REQ-18-02b-TS-SEQM.1121	m	Ending the No_Contact by force-assume
		REQ-18-02b-TS-SEQM.1122	m	Ending the No_Contact by a change of frequency
		REQ-18-02b-TS-SEQM.1123	m	Coordination Phase alignment by a no contacted FDC
		REQ-18-02b-TS-SEQM.1124	m	FDMP establishing one of its occurrences as No_Contact

Table 51: No Contact Option

4.2.15.12 Option #11: Support of “Activation/Deactivation of Strategic Constraints”

The Activation/Deactivation of Strategic Constraints functionality is optional. The FDMP support for this functionality is covered by the Basic Constraints Management requirements being implemented by all systems. The systems where the Activation/Deactivation of Strategic Constraints is supported must implement the requirement from Table 52.

Functionality	O/M	Requirement ID	O/M	Title
Flight Script.Constraint Management.Advanced Constraints Mgmt	O			
		REQ-18-02b-TS-FSMG.0017	O	ACTIVE/INACTIVE status management (Strategic Constraint Owner)

Table 52: Activation/Deactivation of Strategic Constraints Option

4.2.15.13 Option #12: Support of “Route Management.Cleared Route Indication”

The Cleared Indication for route change is optional. System where Cleared Route Indication is used must implement the requirements marked as ‘O’ in Table 53. The mandatory FDMP support of this functionality is ensured by the other mandatory Route Management requirements (Cf. Table 53).

Functionality	O/M	Requirement ID	O/M	Title
Flight Script.Route Management	M			
		REQ-18-02b-TS-FSMG.0139	O	Cleared route indication setting
		REQ-18-02b-TS-FSMG.0140	O	Cleared route indication un-setting

Table 53: Cleared Route Indication Option

4.2.15.14 Option #13: Support of “TMA Data sharing”

The TMA Data sharing is optional. System serving a TMA Unit must implement the requirements marked as ‘m’ in Table 54. The mandatory FDMP support of this functionality is ensured by other mandatory basic requirements for executing FDC requests.



Functionality	O/M	Requirement ID	O/M	Title
TMA Data Sharing	O			
		REQ-18-02b-TS-ADMG.0001	m	Sharing AMAN Arrival Sequence Information
		REQ-18-02b-TS-ADMG.0002	m	Sharing AMAN Delay Information
		REQ-18-02b-TS-ADMG.0003	m	Sharing Arrival Data
		REQ-18-02b-TS-ADMG.0004	m	Departure Times Sharing
		REQ-18-02b-TS-ADMG.0005	m	Sharing Departure Data

Table 54: TMA Data Sharing Option



5 Implementation Options

Not applicable.

6 Assumptions

6.1 MET Data

To ensure consistent trajectory calculation through the all IOP area, it is recognised that there is a need to have access to MET data for the whole IOP area with similar quality and resolution, but not necessarily from the same source.

Therefore it is assumed that Every IOP Unit will use MET data providing Wind Temperature and QNH data covering the whole IOP area. This is necessary to ensure a consistent four dimensional trajectory calculation among all IOP Unit.

It is recommended that the data should be with as good a resolution as the WAFC data, in terms of Lat/Long, layer and time increment. WAFC data resolution planned by November 2022 is as followed:

- Vertical resolution of 1000ft
- Grid resolution of 0.25°
- Time increment from T+6 to T+120 with 1 hour step from T+6 T+24, 3 hours steps from T+24 to T+48, 6 hours step from T+48 to T+120.

7 References and Applicable Documents

7.1 Applicable Documents

Content Integration

- [1] B.04.01 D138 EATMA Guidance Material
- [2] EATMA Community pages
- [3] SESAR ATM Lexicon

Content Development

- [4] B4.2 D106 Transition Concept of Operations SESAR 2020

System and Service Development

- [5] 08.01.01 D52: SWIM Foundation v2
- [6] 08.01.01 D49: SWIM Compliance Criteria
- [7] 08.01.03 D47: AIRM v4.1.0
- [8] 08.03.10 D45: ISRM Foundation v00.08.00
- [9] B.04.03 D102 SESAR Working Method on Services
- [10] B.04.03 D128 ADD SESAR1
- [11] B.04.05 Common Service Foundation Method

Validation

- [12] 03.00 D16 WP3 Engineering methodology
- [13] Transition VALS SESAR 2020 - Consolidated deliverable with contribution from Operational Federating Projects
- [14] European Operational Concept Validation Methodology (E-OCVM) - 3.0 [February 2010]

System Engineering

- [15] SESAR Requirements and V&V guidelines

Safety

- [16] SESAR, Safety Reference Material, Edition 4.0, April 2016
- [17] SESAR, Guidance to Apply the Safety Reference Material, Edition 3.0, April 2016

[18] SESAR, Final Guidance Material to Execute Proof of Concept, Ed00.04.00, August 2015

[19] SESAR, Resilience Engineering Guidance, May 2016

Security

[20] 16.06.02 D103 SESAR Security Ref Material Level

[21] 16.06.02 D137 Minimum Set of Security Controls (MSSCs).

[22] 16.06.02 D131 Security Database Application (CTRL_S)

7.2 Reference Documents

[23] EUROCAE Working Group 59, Flight Object Interoperability Specification **ED-133** V1.0, June 2009

[24] SESAR Deliverable **P10.02.05-D02** - IOP ATC System Requirements Baseline- Phase 1

[25] SESAR Deliverable **P05.05.01-D846** - TMF INTEROP for Step 1 - Final Release

[26] SESAR Deliverable **P10.02.05-D55** IOP ATC System Requirements (Final IOP TS) edition 00.03.00

[27] SESAR Deliverable **P10.01.07-D120** edition 00.01.00 Technical Architecture Description – Cycle 2015

[28] SESAR Deliverable **P10.07.01-D03** AGDL System Architecture Design- Phase 1.

[29] SESAR Deliverable **P10.02.05-D34** edition 00.01.00 (VP-714)“IOP ATC System Requirements

[30] SESAR Deliverable **P14.01.04-D44-005** SWIM-TI Blue Profile Technical Specification

[31] EUROCONTROL Specification of the Initial Flight Plan; Edition 1.2; 05/03/2017

[32] 08.03.10 - D65 - European ATM Service Description for the ATCFlightObjectControl Service, Edition 00.02.01, 20/07/2016

[33] SESAR2020 Deliverable D3.3.070 - 18-02b SPR-INTEROP/OSED

[34] SESAR2020 Deliverable D3.3.050 – 18-02b-TVALR

[35] FOIPS_MOD-D7-MsWord Issue 1.4 Released, 2004

[36] P14.1.3-D35-SWIM Architectural Definition for Iteration 3.0 (recommendations on Blue Profile and development of FO Overlay for multicast usage on PENS)

Appendix A SharedFlightObject Service Description Document (SDD)

A.1 Introduction

The SharedFlightObject publishing service allows the FDMP to distribute the Flight Object Clusters and Summary to all systems being identified in the list of addressees. A System is present in this list either by the result of the FDMP trajectory calculation determining the airspace volumes being traversed and applying the rules of distribution or because being explicitly requested by the System to be included in the distribution using the ATCFlightObjectControl service.

A.2 Service Identification

Name of the Service	SharedFlightObject (PJ.18-02b)
Identifier	de3x8OmWQP04
Version	EATMA Draft
Architect(s)	PAQUAY Christophe
Last Modification Date	10/12/2020 2:06:09 PM

Table 55: Service identification (I)

IOC	
FOC	11/30/2028

Table 56: Service identification (II)

A.3 Operational and Business Context

A.3.1 Operational Context

Supported Activity	Activity Description
Apply Proposal	After receiving 'the change proposal is proper and acceptable' information from the receiver unit, initiator unit apply the changes to their local ATC system and deliver clearance to the flight deck. Thanks to the IOP system, this information is shared and available for further downstream ATC units (informed units) as well.
Evaluate Proposal	After receiving a change proposal, the impact of the change is assessed by the receiver ATC unit. Either by system support or visual scan, the controllers decide whether to counter propose, accept or reject the proposal.
Medium Term Planning	The medium-term planning term usually used to point out a time horizon which is sufficient to detect the potential conflict between flights and manage capacity-demand balancing in its area of responsibility. Detection of infringement to the

	restricted airspace(s) can be the subject of medium-term planning term as well.
Monitor Traffic	<p>For any reason, any ATC unit(s) can consider that a flight might be potentially relevant to his sector and monitoring might be needed. Even if any further downstream unit which is not in the control sequence can subscribe to the distribution list and retrieve the information related to the evaluation of the flight</p> <p>In the IOP system, any further downstream ATC unit(s) that are not in the control sequence might be informed accordingly about the evaluation of the flight.</p>
Short Term Planning	The short-term planning term usually used to point out a time horizon which is sufficient to detect the most probable conflict between flights in its area of responsibility. Management of capacity-demand balancing is not a part of short-term planning activities. Detection of infringement to the restricted airspace(s) still can be the subject of short-term planning activities as well.
Start Negotiation	Prepare a proposal to change a route or ATS constraint and start negotiating with the concerned unit.

Information Exchange realized by the Service
[NOV] Flight Information Distribution
[NOV] Propose Coordination and Transfer
[NOV] Transferring Unit/Receiving Unit Exchange (PJ.18-02b)

A.3.2 Information Exchange Requirements

The following INTEROP (Cf. [33]) IER requirements are applicable to this service:

ID	Title
REQ-18-02b-SPRINTEROP-ADMG.0002	EOBT Processing
REQ-18-02b-SPRINTEROP-ADMG.0003	ETOT Processing
REQ-18-02b-SPRINTEROP-ADMG.0004	ATOT Processing
REQ-18-02b-SPRINTEROP-ADMG.0007	Sharing AMAN delay information
REQ-18-02b-SPRINTEROP-ADMG.0009	Estimate calculation based on take-off time (CDM Airport)
REQ-18-02b-SPRINTEROP-ADMG.0010	Estimate calculation based on take-off time (non-CDM Airport)
REQ-18-02b-SPRINTEROP-ADMG.0011	Share of Active Departure-Arrival runway Information
REQ-18-02b-SPRINTEROP-COTR.0027	C&T Contractual Data TFL
REQ-18-02b-SPRINTEROP-COTR.0032	Transfer of communication start

REQ-18-02b-SPRINTEROP-COTR.0056	Multiple RE's stolen information
REQ-18-02b-SPRINTEROP-COTR.0100	Datalink Parameters
REQ-18-02b-SPRINTEROP-COTR.0101	Notify the receiving unit
REQ-18-02b-SPRINTEROP-COTR.0107	Content of a Point
REQ-18-02b-SPRINTEROP-COTR.0109	C&T Unit RE Frequency Data
REQ-18-02b-SPRINTEROP-COTR.0110	Mandatory C&T Functional Data
REQ-18-02b-SPRINTEROP-COTR.0132	C&T Functional Data for No_Contact
REQ-18-02b-SPRINTEROP-COTR.0137	C&T Contractual Data SFL
REQ-18-02b-SPRINTEROP-COTR.0138	C&T Contractual Data Heading
REQ-18-02b-SPRINTEROP-COTR.0139	C&T Contractual Data Direct
REQ-18-02b-SPRINTEROP-COTR.0140	C&T Contractual Data Speed
REQ-18-02b-SPRINTEROP-COTR.0141	C&T Contractual Data Rate
REQ-18-02b-SPRINTEROP-COTR.0146	Skipped RE information
REQ-18-02b-SPRINTEROP-COTR.0147	Delegator information in C&T data
REQ-18-02b-SPRINTEROP-COTR.0168	Content of an Unpoint
REQ-18-02b-SPRINTEROP-COTR.0170	Interfering No_Contact REs
REQ-18-02b-SPRINTEROP-COTR.0186	C&T Unit RE Identification
REQ-18-02b-SPRINTEROP-COTR.0187	Sharing of Release information by skipped RE
REQ-18-02b-SPRINTEROP-COTR.0188	Release information sharing during delegation
REQ-18-02b-SPRINTEROP-COTR.0207	Flight information to support the point
REQ-18-02b-SPRINTEROP-FSMG.0001	4D Trajectory
REQ-18-02b-SPRINTEROP-FSMG.0010	Addition of Constraints
REQ-18-02b-SPRINTEROP-FSMG.0025	Flight Rule changes in the Flight Script
REQ-18-02b-SPRINTEROP-FSMG.0026	Flight Type change in the flight script
REQ-18-02b-SPRINTEROP-FSMG.0034	Minimum set of shared clearance
REQ-18-02b-SPRINTEROP-FSMG.0035	Other Shared clearances
REQ-18-02b-SPRINTEROP-FSMG.0037	Sharing of Level Block Clearance
REQ-18-02b-SPRINTEROP-FSMG.0107	Sharing of Closed vectoring clearance
REQ-18-02b-SPRINTEROP-GENE.0001	General sharing
REQ-18-02b-SPRINTEROP-GENE.0003	Filed FPL data sharing
REQ-18-02b-SPRINTEROP-SEQM.0006	Vicinity Distribution
REQ-18-02b-SPRINTEROP-SEQM.0007	Distribution outside AOI
REQ-18-02b-SPRINTEROP-SEQM.0097	Controlling RE publication
REQ-18-02b-SPRINTEROP-SSRC.0009	Linkage between CSSR and Flight Plan

A.3.3 Other Requirements

The following TS requirements are applicable to this service:

ID	Title
REQ-18-02b-TS-ADMG.0001	Sharing AMAN information
REQ-18-02b-TS-ADMG.0002	Sharing AMAN Delay Information
REQ-18-02b-TS-ADMG.0003	Sharing Arrival Data

REQ-18-02b-TS-ADMG.0004	Departure Times Sharing
REQ-18-02b-TS-ADMG.0005	Sharing Departure Data
REQ-18-02b-TS-COTR.0155	INITIAL coordination phase
REQ-18-02b-TS-FSMG.0001	FO Flight Script Scope (FDMP)
REQ-18-02b-TS-FSMG.0002	Update aircraft position in the FO Flight Script
REQ-18-02b-TS-FSMG.0003	Updating the Current Assigned Data in the FO Flight Script
REQ-18-02b-TS-FSMG.0047	Constraint identification
REQ-18-02b-TS-FSMG.0072	Constraint at FO Creation (FDMP)
REQ-18-02b-TS-FSMG.0100	Expanded Route including unknown route item
REQ-18-02b-TS-FSMG.0138	Un-used flight plan constraints at FO creation (FDMP)
REQ-18-02b-TS-FSMG.0143	FO Expanded Route scope (FDMP)
REQ-18-02b-TS-FSMG.0149	Last Overflow Point (FDMP)
REQ-18-02b-TS-FSMG.0155	Preserving the Last Overflow FO Expanded Route Point published by FDMP
REQ-18-02b-TS-FSMG.0161	FO Trajectory Scope (FDMP)
REQ-18-02b-TS-INFO.1120	Receiving a Point Establishment (FDMP)
REQ-18-02b-TS-MECH.0001	FO Creation Conditions
REQ-18-02b-TS-MECH.0002	FDMP role declaration at FO creation
REQ-18-02b-TS-MECH.0008	FDMP role for controlling SI
REQ-18-02b-TS-MECH.0010	FDMP role assessment
REQ-18-02b-TS-MECH.0012	FDMP role backup (first level)
REQ-18-02b-TS-MECH.0013	FDMP role backup (second level)
REQ-18-02b-TS-MECH.0014	Flight transferred to a non-IOP SI
REQ-18-02b-TS-MECH.0017	Reporting the loss of local view for a FO
REQ-18-02b-TS-MECH.0022	Flight coming back from a non-IOP SI
REQ-18-02b-TS-MECH.0201	FO unique identification
REQ-18-02b-TS-MECH.0202	Uniqueness of the FO_ID
REQ-18-02b-TS-MECH.0205	FO creation check
REQ-18-02b-TS-MECH.0207	Updating Operational Keys
REQ-18-02b-TS-MECH.0208	FO Deletion after leaving the AOI or after landing
REQ-18-02b-TS-MECH.0209	FO deletion due to a flight cancellation
REQ-18-02b-TS-MECH.0306	Local SFPL alignment
REQ-18-02b-TS-MECH.0312	Distribution for reason 'Vicinity'
REQ-18-02b-TS-MECH.0320	SI request identifier management (FDMP)
REQ-18-02b-TS-MECH.0330	Unique cluster identification
REQ-18-02b-TS-MECH.0331	FO identification distribution
REQ-18-02b-TS-MECH.0332	FO creation timer
REQ-18-02b-TS-MECH.0336	SFPL creation on FO reception
REQ-18-02b-TS-MECH.0339	Distribution for reason 'End of Service'.
REQ-18-02b-TS-MECH.0344	Distribution for reason 'Control'
REQ-18-02b-TS-MECH.0347	Distribution of the FO upon new release available
REQ-18-02b-TS-MECH.0360	FO alignment to the Local SFPL (FDMP)
REQ-18-02b-TS-MECH.0398	Distribution for one or more reasons
REQ-18-02b-TS-MECH.0399	Distribution for reason 'Traversed'

REQ-18-02b-TS-MECH.0401	Last Overflown Route Point update
REQ-18-02b-TS-MECH.0402	No publication for only current condition changes
REQ-18-02b-TS-MECH.0407	Asynchronous service response (FDMP)
REQ-18-02b-TS-MECH.0408	Positive Asynchronous service response (FDMP)
REQ-18-02b-TS-MECH.0409	Negative Asynchronous service response (FDMP)
REQ-18-02b-TS-MECH.0410	Unique FO identification to SWIM layer
REQ-18-02b-TS-MECH.0411	Initializing FO cluster release at FO creation
REQ-18-02b-TS-MECH.0412	Updating FO cluster release on update
REQ-18-02b-TS-MECH.0413	FPL Data sharing at creation
REQ-18-02b-TS-MECH.0414	Initial desynchronization state
REQ-18-02b-TS-MECH.1013	Severe Desynchronization triggering (FDMP)
REQ-18-02b-TS-SSRC.0011	Mode S Flight ID Sharing
REQ-18-02b-TS-SWIM.0028	SWIM-TI notification upon old FO detection
REQ-18-02b-TS-SWIM.0030	SWIM-TI notification upon FO collision detection
REQ-18-02b-TS-SWIM.0032	FDMP action upon FO collision
REQ-18-02b-TS-SWIM.0034	Distribution failure (FDMP)
REQ-18-02b-TS-SWIM.0040	Common use of an IOP Tier Management Policy
REQ-18-02b-TS-SWIM.0042	Tier re-allocation triggering events (FDMP)
REQ-18-02b-TS-SWIM.0046	Tier re-allocation in case of distribution list modification (FDMP)
REQ-18-02b-TS-WIFO.0001	WIFO Support (WIMP)
REQ-18-02b-TS-WIFO.0005	WIFO Negotiation Data Identifying
REQ-18-02b-TS-WIFO.0007	WIMP role declaration at WIFO creation
REQ-18-02b-TS-WIFO.0016	WIFO Distribution List Content (WIMP)
REQ-18-02b-TS-WIFO.0017	WIFO unique identification (WIMP)
REQ-18-02b-TS-WIFO.0028	WIFO Timeout
REQ-18-02b-TS-WIFO.0040	WIFO Deletion Acknowledge (WIC)
REQ-18-02b-TS-WIFO.0041	Stating WIFO purpose as negotiation
REQ-18-02b-TS-WIFO.0042	WIFO deletion triggers
REQ-18-02b-TS-WIFO.0043	WIFO initial status
REQ-18-02b-TS-WIFO.0045	WIFO Cancellation
REQ-18-02b-TS-WIFO.0048	WIFO synchronized with FO
REQ-18-02b-TS-WIFO.0052	WIFO update when counter-proposal (WIMP)
REQ-18-02b-TS-WIFO.0054	Reject in case of WIFO not supported
REQ-18-02b-TS-WIFO.0056	Stopping WIFO publication to SI not supporting negotiation
REQ-18-02b-TS-WIFO.0058	WIFO Deletion Request (WIMP)

A.4 Service Overview

A.4.1 Service Taxonomy

Supported Capability	Parent Capability	Level 1 Capability
Coordination and Transfer		
	Trajectory Management	

		Service Delivery Management
Trajectory Information Synchronisation		
	Trajectory Management	
		Service Delivery Management

A.4.2 Service Levels (NfRs)

ID	Title
REQ-18-02b-TS-MECH.0402	No publication for only current condition changes

A.4.3 Service Functions and Capabilities

N/A

A.4.4 Service Interfaces

Service Name	Description
SharedFlightObject (PJ.18-02b)	<p>The SharedFlightObject service allows the FDMP to create, publish, search and delete Flight Object.</p> <p>This support the publication of the Flight Object Clusters and Summary to all systems being identified in the list of addressees. A System is present in this list either by the result of the FDMP trajectory calculation determining the airspace volumes being traversed and applying the rules of distribution or because being explicitly requested by the System itself to be included in the distribution using the RequestFlightObjectServices service.</p>

Service Interface Definition	Description
FlightObjectPublisher	<p>The SharedFlightObject service interface provide the following operations:</p> <ul style="list-style-type: none"> CreateFlightObject PublishFlightObject SearchFlightObject DeleteFlightObject

A.5 Service interface specifications

(* indicates that the Data Entity has been created for the needs of this service, but is not yet part of AIRM)

A.5.1 SharedFlightObjectInterface

1. Operation publishFlightObject

Distributes the Flight Object to all system supporting units identified in the distribution list. The distribution list is calculated according to Crossed and Control Sequence Management requirements. In addition other units not directly involved/crossed by the flight can explicitly request the distribution of a given flight.

Input	Service Payload	Data Entity
	Flight Id	*FlightKey

Input	Service Payload	Data Entity
	Flight Object Identifier	*FlightObjectIdentifier

Input	Service Payload	Data Entity
	Tiers	*number

Input	Service Payload	Data Entity
	Distribution List	*DistributionList

Input	Service Payload	Data Entity
	Flight Object	*FlightObjectClusters

More details on the data entity definition can be found in the IRS Annex in Appendix E.

2. Operation **SharedFlightObject** (PJ.18-02b).SharedFlightObjectInterface.createFlightObject

Creation of a new FlightObject.

Input	Service Payload	Data Entity
	Flight Id	*FlightKey

Input	Service Payload	Data Entity
	Flight Object	*FlightObjectClusters

Input	Service Payload	Data Entity
	Flight Object Identifier	*FlightObjectIdentifier

Input	Service Payload	Data Entity
	Tiers	*number

Input	Service Payload	Data Entity
	Distribution List	*DistributionList
Return	Service Payload	Data Entity
	CreationReport	*CreationReport

More details on the data entity definition can be found in the IRS Annex in Appendix E.

3. Operation **SharedFlightObject** (PJ.18-02b).**SharedFlightObjectInterface.deleteFlightObject**

Deletion of a Flight Object.

Input	Service Payload	Data Entity
	Flight Object Identifier	*FlightObjectIdentifier
Return	Service Payload	Data Entity
	RequestResponses	*ServiceReports

More details on the data entity definition can be found in the IRS Annex in Appendix E.

4. Operation **SharedFlightObject** (PJ.18-02b).**SharedFlightObjectInterface.searchFlightObject**

Search a Flight Object matching with the provided FlightKey.

Input	Service Payload	Data Entity
	Flight Id	*FlightKey
Return	Service Payload	Data Entity
	SearchReport	*SearchReport

More details on the data entity definition can be found in the IRS Annex in Appendix E.

A.6 Payload Data Diagrams

Refer to ICD provided in Appendix D.

A.7 Payload Data Types

A.7.1 Payload Elements

Refer to ICD provided in Appendix D for more details.

Class	
*CreationReport	<p>Report on the Flight Object creation operation.</p> <p>Indicates if the creation was successful or not.</p> <p>If successful a FO Identifier is provided, if not the failure reason is provided.</p>
Class	
*DistributionList	<p>List of IOP partners to which the flight object is distributed.</p> <p>Each entry of the list contain the StakeholderId, DistributionReason</p>
Class	
*FlightKey	<p>Identification of a flight:</p> <p>Callsign</p> <p>ADEP</p> <p>ADES</p> <p>EOBD</p> <p>EOBT</p>
Class	
*FlightObjectClusters	<p>It defines the structure and content of the Flight Object.</p> <p>It is organized in clusters:</p> <ul style="list-style-type: none"> - Aircraft: aircraft characteristics of the flight including registration, 24bit address, aircraft type, atn/fans logon parameters - Arrival: arrival information of the flight including AMAN data, arrival routing

	<ul style="list-style-type: none"> - CoordinationAndTransfer: The Coordination Cluster contains 0 to 10 Active Coordination describing all the coordinations computed by the FDMP and optionally corrected by the FDCs, the Current Communication Sector. - CrossedAndControlSequence: The Crossed And Control Sequence Cluster contains: the distribution list, the crossed and controlling list, the point operation list. - Departure: departure information of the flight, when available including take-off status, take-off time, departure runway, SID, ... - FlightIdentification: The Flight Identification Cluster contains the identifier of the FO, an optional alternative identification of the FO, the full identification of the last released version of the FO, an optional data containing the result of the processing of the request from each FDC. - FlightScript: The Flight Script cluster contains all the needed information allowing FDPs to perform the trajectory computation. - InitialFlightPlanData: The Initial Flight Plan Data Cluster contains the filed initial flight plan data. - OperationalKey: The Operational Key Cluster is the identifier of the flight from an operational point of view. This identifier is compound by an aircraft identifier (ARCID), a departure airport (ADEP), a destination airport (ADES), an Estimated Off-Blocks Date (EOBD) and an Estimated Off-Blocks Time (EOBT). - SSR: The SSR Cluster contains assigned SSR code, the SSR Code currently assigned to the aircraft and instructed to the flight crew, current SSR code, the SSR Code squawked by the aircraft, the next SSR Code intended to be instructed to the aircraft. - Trajectory: The Trajectory Cluster contains the trajectoryData, including the list of points that actually compose the trajectory, the airborne status of the trajectory, and the index of the last overflown trajectory point in the trajectory points list. <p>FlightIdentification cluster is always present.</p> <p>When used to distribute the update to a FO, only the modified clusters are present.</p>
Class	
<p>*FlightObjectIdentifier</p>	<p>The fold is the identifier of a FO all over the IOP network.</p> <p>The uniqueness of the fold in the IOP area is ensured by composing it with:</p> <ul style="list-style-type: none"> - the identifier of the SI creating the FO (valid IOP System identifiers are shared in adaptation) - and a locally defined identifier that is built according to local SI rules (The SI will be responsible for using a local identifier that is unique within its own system). <p>This fold is filled on creation of the FO.</p>

	The modification of the fold is forbidden.
Class	
number	No Comment available.
Class	
*SearchReport	Return value including the result of the search operation. Including: acceptance/rejection and reason, an array of operational keys matching the input flight_id and an array of the Flight Object identifiers corresponding to the reported operational keys. In case of rejection both arrays are empty.
Class	
*ServiceReports	Response to each of the FO service requests with one of the following values: <ul style="list-style-type: none"> - SUCCESS (successful implementation), - FAILED (failed implementation) or - PENDING (an IOP Application report will be sent later).

A.8 Service dynamic behaviour

A.8.1 Service Interface FlightObjectPublisher

Refer to ICD documentation provided in Appendix D and to IRS Annex in Appendix E

Appendix B ATCFlightObjectControl Service Description Document (SDD)

B.1 Introduction

The ATC Flight Object Control query/reply service allows FDC to request a number of changes to a Flight Object, which is being managed by the FDMP, any SI involved with a FO exchange to report a failure, reject an FO, restore an FO or recover from an IOP failure.

It defines the following operations:

- RequestFlightObjectServices: This operation allows a system to request any kind of update/change to the Flight Object to the FDMP.
- ReportFlightObjectServicesExecution: This operation reports to an FDC, the result of the implementation of an already accepted RequestFlightObjectServices operation call.
- RejectFlightObject: This operation requests the rejection of a given Flight Object, reporting the reason for rejection to the current FDMP.
- RestoreFlightObject: This operation allows a system to restore the latest version of a specific Flight Object. This triggers the invocation of the RestoreFlightObject operation to the FDMP of the Flight Object to request its republication.
- RequestFlightObjectRecovery: This operation allows an application to request recovery of a subset or all of the Flight Objects.

B.2 Service Identification

Name of the Service	ATCFlightObjectControl (PJ.18-02b)
Identifier	Pg3xdEmWQH8Q
Version	EATMA Draft
Architect(s)	PAQUAY Christophe
Last Modification Date	8/18/2020 3:47:58 PM

Table 57: Service identification (I)

IOC	
FOC	11/30/2028

Table 58: Service identification (II)

B.3 Operational and Business Context

B.3.1 Operational Context

Supported Activity	Activity Description
Accept Proposal	After receiving a change proposal, the impact of the change is assessed by the receiver ATC unit. After the assessment, the controllers decide the change is proper and accept the

	proposal. The initiator ATC unit (where the proposal was received from) is informed.
Counter Propose	After receiving a change proposal, the impact of the change is assessed by the receiver ATC unit. After the assessment, the controllers decide the change is NOT proper under these circumstances and propose a new change that is proper for themselves. The initiator ATC unit (where the proposal was received from) is informed about the new proposal.
Modify Flight Route Locally	Update the flight route to reflect the unit's decision.
Reject Change	After receiving 'the change proposal is NOT proper and NOT acceptable' information from the receiver unit, controllers working in initiator unit acknowledge the information on their local ATC system. The negotiation process stops. There is no need to deliver a clearance (or information) to the flight deck.
Reject Proposal	After receiving a change proposal, the impact of the change is assessed by the receiver ATC unit. After the assessment, the controllers working in the receiver unit decide the change is NOT proper and reject the proposal.
Start Negotiation	Prepare a proposal to change a route or ATS constraint and start negotiating with the concerned unit.
Transfer Flight	<p>Transfer of a flight term is used to define "transfer of responsibility for providing air traffic control service".</p> <p>In a specific moment of the flight, while the 'controlling ATC unit' retains the communication and control responsibility of the aircraft, the aircraft be instructed to communicate with the next (receiving) ATC unit. Whereby that action, the responsibility for the separation of an aircraft is transferred from one controller to another.</p>

Information Exchange realized by the Service
[NOV] Change Route and Constraint
[NOV] Propose Coordination and Transfer

B.3.2 Information Exchange Requirements

The following INTEROP (Cf. [33]) IER requirements are applicable to this service:

ID	Title
----	-------

REQ-18-02b-SPRINTEROP-ADMG.0002	EOBT Processing
REQ-18-02b-SPRINTEROP-ADMG.0003	ETOT Processing
REQ-18-02b-SPRINTEROP-ADMG.0004	ATOT Processing
REQ-18-02b-SPRINTEROP-ADMG.0007	Sharing AMAN delay information
REQ-18-02b-SPRINTEROP-ADMG.0009	Estimate calculation based on take-off time (CDM Airport)
REQ-18-02b-SPRINTEROP-ADMG.0010	Estimate calculation based on take-off time (non-CDM Airport)
REQ-18-02b-SPRINTEROP-ADMG.0011	Share of Active Departure-Arrival runway Information
REQ-18-02b-SPRINTEROP-COTR.0001	SAP status of an IOP Unit
REQ-18-02b-SPRINTEROP-COTR.0034	Assumption
REQ-18-02b-SPRINTEROP-COTR.0041	ROF awareness
REQ-18-02b-SPRINTEROP-COTR.0056	Multiple RE's stolen information
REQ-18-02b-SPRINTEROP-COTR.0107	Content of a Point
REQ-18-02b-SPRINTEROP-COTR.0109	C&T Unit RE Frequency Data
REQ-18-02b-SPRINTEROP-COTR.0110	Mandatory C&T Functional Data
REQ-18-02b-SPRINTEROP-COTR.0132	C&T Functional Data for No_Contact
REQ-18-02b-SPRINTEROP-COTR.0137	C&T Contractual Data SFL
REQ-18-02b-SPRINTEROP-COTR.0138	C&T Contractual Data Heading
REQ-18-02b-SPRINTEROP-COTR.0139	C&T Contractual Data Direct
REQ-18-02b-SPRINTEROP-COTR.0140	C&T Contractual Data Speed
REQ-18-02b-SPRINTEROP-COTR.0141	C&T Contractual Data Rate
REQ-18-02b-SPRINTEROP-COTR.0146	Skipped RE information
REQ-18-02b-SPRINTEROP-COTR.0147	Delegator information in C&T data
REQ-18-02b-SPRINTEROP-COTR.0168	Content of an Unpoint
REQ-18-02b-SPRINTEROP-COTR.0170	Interfering No_Contact REs
REQ-18-02b-SPRINTEROP-COTR.0186	C&T Unit RE Identification
REQ-18-02b-SPRINTEROP-COTR.0187	Sharing of Release information by skipped RE
REQ-18-02b-SPRINTEROP-COTR.0188	Release information sharing during delegation
REQ-18-02b-SPRINTEROP-COTR.0207	Flight information to support the point
REQ-18-02b-SPRINTEROP-FSMG.0001	4D Trajectory
REQ-18-02b-SPRINTEROP-FSMG.0010	Addition of Constraints
REQ-18-02b-SPRINTEROP-FSMG.0025	Flight Rule changes in the Flight Script
REQ-18-02b-SPRINTEROP-FSMG.0026	Flight Type change in the flight script
REQ-18-02b-SPRINTEROP-SSRC.0009	Linkage between CSSR and Flight Plan

B.3.3 Other Requirements

The following TS requirements are applicable to this service:

ID	Title
REQ-18-02b-TS-COTR.0001	CAP from LoA (upstream)
REQ-18-02b-TS-COTR.0002	CAP from LoA (downstream)

REQ-18-02b-TS-COTR.0004	Local CAP trigger
REQ-18-02b-TS-COTR.0008	NP from LoA (upstream)
REQ-18-02b-TS-COTR.0009	NP from LoA (downstream)
REQ-18-02b-TS-COTR.0010	Local NP trigger
REQ-18-02b-TS-COTR.0011	NP on Request On Frequency (downstream)
REQ-18-02b-TS-COTR.0016	Reversion from CAP/NP to SAP
REQ-18-02b-TS-COTR.0028	COF manual input
REQ-18-02b-TS-COTR.0029	Sharing SAP information
REQ-18-02b-TS-COTR.0037	Assumption of a flight in a SI
REQ-18-02b-TS-COTR.0038	Request on Frequency by a SI (FDMP)
REQ-18-02b-TS-COTR.0040	Undo-frequency change processing
REQ-18-02b-TS-COTR.0047	Force Assume Processing
REQ-18-02b-TS-COTR.0111	Force Assume acknowledgement
REQ-18-02b-TS-COTR.0120	Force Assume acknowledgement processing
REQ-18-02b-TS-COTR.0122	Availability conditions for ROF input
REQ-18-02b-TS-COTR.0130	NP on Request On Frequency (upstream)
REQ-18-02b-TS-COTR.0131	TERMINATED on Assume (downstream)
REQ-18-02b-TS-COTR.0135	Indication of C&T data change - Manual agreement
REQ-18-02b-TS-COTR.0139	Assessment of non-standard crossing conditions.
REQ-18-02b-TS-COTR.0140	Assessment of standard crossing conditions
REQ-18-02b-TS-COTR.0143	No modification of transition Confirmed fields
REQ-18-02b-TS-COTR.0147	Maintenance of other crossing data from SAP onward
REQ-18-02b-TS-COTR.0149	NP on a Change On Frequency (upstream)
REQ-18-02b-TS-COTR.0150	NP on a Change On Frequency (downstream)
REQ-18-02b-TS-COTR.0152	Sharing the logon parameters
REQ-18-02b-TS-COTR.0153	Share and maintain the Next Data Authority (NDA) Identifier
REQ-18-02b-TS-COTR.0154	TERMINATED on Assume (upstream)
REQ-18-02b-TS-COTR.0156	Stop NP when no assumption by downstream SI
REQ-18-02b-TS-COTR.0157	CAP alignment between upstream and downstream SI.
REQ-18-02b-TS-COTR.0158	NP alignment between upstream and downstream SI
REQ-18-02b-TS-COTR.0159	Coordination Data frozen after a frequency change
REQ-18-02b-TS-COTR.0160	C&T Modified Data Urgent Application
REQ-18-02b-TS-COTR.0161	Share the Current Data Authority (CDA) Identifier
REQ-18-02b-TS-COTR.0162	Set the Next Data Authority Notified Indicator
REQ-18-02b-TS-COTR.0200	Initialization and maintenance of exit crossing data
REQ-18-02b-TS-COTR.0201	Initialization and maintenance of entry crossing data
REQ-18-02b-TS-COTR.0202	Maintenance of other crossing data
REQ-18-02b-TS-COTR.0203	Maintenance of release condition
REQ-18-02b-TS-COTR.0204	Maintenance of time related crossing data from SAP onward
REQ-18-02b-TS-COTR.0205	Exit time update in case of delay
REQ-18-02b-TS-COTR.0206	Set the type of Voice Contact Instruction sent to the aircrew
REQ-18-02b-TS-COTR.0207	Initialization of Contractual C&T data Agreement
REQ-18-02b-TS-COTR.0209	Replacement of release condition

REQ-18-02b-TS-COTR.0220	C&T Data Direct Negotiation
REQ-18-02b-TS-COTR.0221	DCT from Current Position Agreement
REQ-18-02b-TS-COTR.0222	DCT from Route Point Agreement
REQ-18-02b-TS-FSMG.0004	Updating the Expanded Route (FDMP)
REQ-18-02b-TS-FSMG.0006	Non modifiable constraint attributes
REQ-18-02b-TS-FSMG.0009	Constraint Target Values
REQ-18-02b-TS-FSMG.0010	Constraint Relevant Point Identification (Owner)
REQ-18-02b-TS-FSMG.0011	Constraint Points Management (FDMP)
REQ-18-02b-TS-FSMG.0017	ACTIVE/INACTIVE status management (Strategic Constraint Owner)
REQ-18-02b-TS-FSMG.0018	Constraint Computed Points linkage to Expanded Route (FDMP)
REQ-18-02b-TS-FSMG.0028	Accepted constraints processing
REQ-18-02b-TS-FSMG.0029	Not supported or not applicable constraints processing (FDMP)
REQ-18-02b-TS-FSMG.0030	Constraint partially reached
REQ-18-02b-TS-FSMG.0032	Constraint removal (request) (FDC)
REQ-18-02b-TS-FSMG.0038	FDMP operations on constraints in the Flight Script
REQ-18-02b-TS-FSMG.0046	Constraints ordering (FDMP)
REQ-18-02b-TS-FSMG.0050	Shared strategic constraint removal (Owner)
REQ-18-02b-TS-FSMG.0051	Shared strategic constraint creation
REQ-18-02b-TS-FSMG.0054	Constraint conflict resolution
REQ-18-02b-TS-FSMG.0056	Re-route (FDC constraint projection) (FDMP)
REQ-18-02b-TS-FSMG.0061	Creating/updating the Expanded Route (FDMP)
REQ-18-02b-TS-FSMG.0062	FO Expanded Route Refinement of Unknown Items
REQ-18-02b-TS-FSMG.0064	Shared strategic constraint off-line definition
REQ-18-02b-TS-FSMG.0068	SFPL alignment with FO
REQ-18-02b-TS-FSMG.0069	Constraint removal (assessment) (FDC)
REQ-18-02b-TS-FSMG.0071	Re-route (constraint projection) (FDC)
REQ-18-02b-TS-FSMG.0073	Re-route (route point with switches or indicator) (FDC)
REQ-18-02b-TS-FSMG.0074	Re-route (route point with switches or indicator) (FDMP)
REQ-18-02b-TS-FSMG.0076	Constraint Types
REQ-18-02b-TS-FSMG.0077	Re-route (FDMP constraint projection) (FDMP)
REQ-18-02b-TS-FSMG.0080	Constraint Owner
REQ-18-02b-TS-FSMG.0081	CORRECTED constraint (tag modification)
REQ-18-02b-TS-FSMG.0082	Constraint removal (request) (FDMP)
REQ-18-02b-TS-FSMG.0083	CORRECTED constraint (unsetting tag)
REQ-18-02b-TS-FSMG.0084	Associate Coordination Data with Constraints
REQ-18-02b-TS-FSMG.0086	FO Flight Script and Coordinated Data Alignment
REQ-18-02b-TS-FSMG.0087	CORRECTED constraint (setting tag)
REQ-18-02b-TS-FSMG.0088	Constraint Input Point Assignment (Owner)
REQ-18-02b-TS-FSMG.0106	Expanded Route point identifiers
REQ-18-02b-TS-FSMG.0107	Constraint identifiers
REQ-18-02b-TS-FSMG.0115	Flagging SID and STAR modification
REQ-18-02b-TS-FSMG.0120	Constraint removal (assessment)
REQ-18-02b-TS-FSMG.0121	CORRECTED constraint (tag removal)

REQ-18-02b-TS-FSMG.0122	Constraint removal (restoration) (FDMP)
REQ-18-02b-TS-FSMG.0124	Constraint modification (not CORRECTED)
REQ-18-02b-TS-FSMG.0125	Management of switches and STAY indicator in expanded route (FDC)
REQ-18-02b-TS-FSMG.0129	Setting the author of the constraint modification
REQ-18-02b-TS-FSMG.0133	Error handling (inconsistent points)
REQ-18-02b-TS-FSMG.0135	Flight Plan Constraints
REQ-18-02b-TS-FSMG.0136	Constraint Input Points linkage to the Expanded Route (requester)
REQ-18-02b-TS-FSMG.0137	Processing a Flight Plan constraint deletion request (FDMP)
REQ-18-02b-TS-FSMG.0139	Cleared route indication setting
REQ-18-02b-TS-FSMG.0140	Cleared route indication un-setting
REQ-18-02b-TS-FSMG.0141	Eligibility rules for trajectory modification (FDMP)
REQ-18-02b-TS-FSMG.0144	Modify route scope (FDC)
REQ-18-02b-TS-FSMG.0145	FLIGHT_PLAN constraints at first Expanded Route point
REQ-18-02b-TS-FSMG.0150	Route change after Last Overflow Point (FDC)
REQ-18-02b-TS-FSMG.0151	Constraint Input Points for level strategic constraints (Owner)
REQ-18-02b-TS-FSMG.0152	Constraint Input Point for TFL(wall) constraints (Owner)
REQ-18-02b-TS-FSMG.0153	Strategic constraints mode
REQ-18-02b-TS-FSMG.0154	Maintenance of the constraint in case of skip
REQ-18-02b-TS-FSMG.0160	Flight Plan information at first Expanded Route point
REQ-18-02b-TS-FSMG.0162	Flight plan information at the points following the first Expanded Route point
REQ-18-02b-TS-FSMG.0163	Time-space discontinuity among contiguous FO Expanded Route segments
REQ-18-02b-TS-FSMG.0164	Connection between the Expanded Route Points management.
REQ-18-02b-TS-FSMG.0165	Assignment of Expanded Route Point Origin.
REQ-18-02b-TS-INFO.0016	Unsubscribe a flight
REQ-18-02b-TS-INFO.1100	Initiating a Point (FDC and FDMP)
REQ-18-02b-TS-INFO.1120	Receiving a Point Establishment (FDMP)
REQ-18-02b-TS-INFO.1130	Cancelling a Point (FDC and FDMP)
REQ-18-02b-TS-INFO.1140	Receiving a Point Cancellation (FDMP)
REQ-18-02b-TS-INFO.1150	Clean the Point (Point receiver is FDC)
REQ-18-02b-TS-INFO.1160	Clean the Point (Point receiver is FDMP)
REQ-18-02b-TS-INFO.1170	Processing a Point Clean (FDMP)
REQ-18-02b-TS-MECH.0018	Defining IOP-capable SI offline
REQ-18-02b-TS-MECH.0210	FDC notification of flight cancellation
REQ-18-02b-TS-MECH.0302	Service requests received by an SI without FDMP role
REQ-18-02b-TS-MECH.0303	Request rejection: syntactical check
REQ-18-02b-TS-MECH.0304	Request rejection: semantic check
REQ-18-02b-TS-MECH.0305	Request rejection: sender eligibility check
REQ-18-02b-TS-MECH.0307	Notifying a desynchronization
REQ-18-02b-TS-MECH.0308	Local desynch in case of service negative result
REQ-18-02b-TS-MECH.0309	Synchronous service response (FDMP)
REQ-18-02b-TS-MECH.0310	SI desynchronization status updates notification

REQ-18-02b-TS-MECH.0315	Number of concurrent requests
REQ-18-02b-TS-MECH.0316	SI request identifier
REQ-18-02b-TS-MECH.0319	SFPL alignment (FDMP)
REQ-18-02b-TS-MECH.0321	FO update request sent to the FDMP
REQ-18-02b-TS-MECH.0322	Desynchronization termination
REQ-18-02b-TS-MECH.0323	Non-supported functionality indication
REQ-18-02b-TS-MECH.0324	Non-supported functionality request indication (FDMP)
REQ-18-02b-TS-MECH.0340	Acknowledgement of end of distribution
REQ-18-02b-TS-MECH.0341	Removal of an SI from the Distribution List (FDMP)
REQ-18-02b-TS-MECH.0348	Distribution for reason 'General Information'
REQ-18-02b-TS-MECH.0350	Distribution for reason 'Subscribed'
REQ-18-02b-TS-MECH.0365	Maximum time to implement a request (FDMP)
REQ-18-02b-TS-MECH.0375	Missing answer to a service request
REQ-18-02b-TS-MECH.0385	Maximum number of retries allowed upon missing implementation report
REQ-18-02b-TS-MECH.0397	General Information request
REQ-18-02b-TS-MECH.0403	FO Publication Threshold on constraint points
REQ-18-02b-TS-MECH.0404	FO Publication threshold on coordination data
REQ-18-02b-TS-MECH.0405	FO Publication threshold on trajectory point ETO
REQ-18-02b-TS-MECH.0406	FO Publication Threshold on trajectory point LEVEL
REQ-18-02b-TS-MECH.1001	Coordination Failsafe mode notification (FDC)
REQ-18-02b-TS-MECH.1002	Coordination Failsafe mode notification (FDMP)
REQ-18-02b-TS-MECH.1003	Coordination Failsafe mode removal (FDC)
REQ-18-02b-TS-MECH.1004	Coordination Failsafe mode removal (FDMP)
REQ-18-02b-TS-MECH.1005	Desynchronized boundaries notification (FDC)
REQ-18-02b-TS-MECH.1006	Desynchronized boundaries notification (FDMP)
REQ-18-02b-TS-MECH.1007	Desynchronized boundaries removal (FDC)
REQ-18-02b-TS-MECH.1008	Desynchronized boundaries removal (FDMP)
REQ-18-02b-TS-MECH.1015	Coordination actions by SI in Failsafe mode with a desynchronized boundary
REQ-18-02b-TS-MECH.1009	Severe Desynchronization notification (FDC)
REQ-18-02b-TS-MECH.1010	Severe Desynchronization notification (FDMP)
REQ-18-02b-TS-MECH.1011	Severe Desynchronization removal (FDC)
REQ-18-02b-TS-MECH.1012	Severe Desynchronization removal (FDMP)
REQ-18-02b-TS-MECH.1013	Severe Desynchronization triggering (FDMP)
REQ-18-02b-TS-SCTJ.0101	FDMP trajectory processing when FO Expanded Route includes unknown route items
REQ-18-02b-TS-SCTJ.0107	FO Expanded route points references in FO trajectory
REQ-18-02b-TS-SEQM.0100	Offline list of volumes of responsibility (AoR)
REQ-18-02b-TS-SEQM.0101	Off-line list of volumes of interest (AoI)
REQ-18-02b-TS-SEQM.1001	Crossed sequence computation
REQ-18-02b-TS-SEQM.1003	Calculation of coordination data (FDMP)
REQ-18-02b-TS-SEQM.1004	IOP hole(s) management (FDMP)

REQ-18-02b-TS-SEQM.1005	Unknown SIs inclusion (FDMP)
REQ-18-02b-TS-SEQM.1006	Control Sequence correction request by an FDC (addition)
REQ-18-02b-TS-SEQM.1007	SI addition: impact on FO Control Sequence (FDMP)
REQ-18-02b-TS-SEQM.1008	Control Sequence correction request by an FDC (removal)
REQ-18-02b-TS-SEQM.1009	SI removal: Impact on FO Control Sequence (FDMP)
REQ-18-02b-TS-SEQM.1010	Confirmation of an SI
REQ-18-02b-TS-SEQM.1011	Next SI confirmation request processing (FDMP)
REQ-18-02b-TS-SEQM.1014	Crossed & Control Sequence change in case of force-assume by a downstream SI
REQ-18-02b-TS-SEQM.1015	Skip request implementation (FDC)
REQ-18-02b-TS-SEQM.1016	FDMP implementation of a full skip
REQ-18-02b-TS-SEQM.1018	Automatic Skip Limitation
REQ-18-02b-TS-SEQM.1019	Skip cancellation processing (FDMP)
REQ-18-02b-TS-SEQM.1020	Skip cancellation in case of force assume
REQ-18-02b-TS-SEQM.1022	Reapplication of the control sequence correction by FDMP
REQ-18-02b-TS-SEQM.1024	Delegation request
REQ-18-02b-TS-SEQM.1025	Full delegation processing
REQ-18-02b-TS-SEQM.1027	Partial delegation processing at the entry of the airspace
REQ-18-02b-TS-SEQM.1029	Delegation cancellation processing
REQ-18-02b-TS-SEQM.1030	End of delegation upon Frequency change
REQ-18-02b-TS-SEQM.1033	Release during delegation
REQ-18-02b-TS-SEQM.1034	Re-application of control sequence correction (FDMP)
REQ-18-02b-TS-SEQM.1036	Partial delegation processing in the middle of the airspace
REQ-18-02b-TS-SEQM.1037	Partial delegation processing at the exit of the airspace
REQ-18-02b-TS-SEQM.1041	Transferring SI status update
REQ-18-02b-TS-SEQM.1042	Receiving SI status update
REQ-18-02b-TS-SEQM.1043	Automatic next SI confirmation (FDMP)
REQ-18-02b-TS-SEQM.1044	Identification of SI in charge of controlling the flight in each SIs occurrence
REQ-18-02b-TS-SEQM.1045	SI addition refusal (FDMP)
REQ-18-02b-TS-SEQM.1046	SI removal refusal (FDMP)
REQ-18-02b-TS-SEQM.1047	Re-application of next SI confirmation (FDMP)
REQ-18-02b-TS-SEQM.1049	Unskip cancellation eligibility
REQ-18-02b-TS-SEQM.1050	Undelegation request
REQ-18-02b-TS-SEQM.1051	Confirmation management in case of partial delegation
REQ-18-02b-TS-SEQM.1060	SI Occurrence Identifier management (FDMP)
REQ-18-02b-TS-SEQM.1061	SI Occurrence Identifier consistency in the Flight Script (FDMP)
REQ-18-02b-TS-SEQM.1062	Coordination Data frozen as long as the transition is invalid
REQ-18-02b-TS-SEQM.1063	SI addition: impact on FO Coordination Data (FDMP)
REQ-18-02b-TS-SEQM.1064	SI Addition: Impact on FO Distribution List (FDMP)
REQ-18-02b-TS-SEQM.1065	SI removal: impact on FO Coordination Data (FDMP)
REQ-18-02b-TS-SEQM.1066	SI Removal: impact on FO Distribution List (FDMP)
REQ-18-02b-TS-SEQM.1067	FDC's confirmation request rejection

REQ-18-02b-TS-SEQM.1068	Conditions for correction re-application
REQ-18-02b-TS-SEQM.1069	Crossed & Control Sequence change in case of force-assume by a SI not identified in the C&C Sequence
REQ-18-02b-TS-SEQM.1070	Crossed & Control Sequence change in case of force-assume by the stolen SI
REQ-18-02b-TS-SEQM.1115	Establishing No_Contact by an FDC
REQ-18-02b-TS-SEQM.1116	FDMP processing of a No_Contact request
REQ-18-02b-TS-SEQM.1117	Ending the No_Contact by the FDC
REQ-18-02b-TS-SEQM.1118	Ending the No_Contact by requesting the flight on frequency
REQ-18-02b-TS-SEQM.1119	FDMP processing of No_Contact termination
REQ-18-02b-TS-SEQM.1120	FDMP maintenance of both entry/exit coordination of the no_contact
REQ-18-02b-TS-SEQM.1121	Ending the No_Contact by force-assume
REQ-18-02b-TS-SEQM.1122	Ending the No_Contact by a change of frequency
REQ-18-02b-TS-SEQM.1123	Coordination Phase alignment by a no contacted FDC
REQ-18-02b-TS-SEQM.1124	FDMP establishing one of its occurrences as No_Contact
REQ-18-02b-TS-SSRC.0005	IOP Current SSR Code Management by the FDMP
REQ-18-02b-TS-SSRC.0006	IOP DSSR Code request Management
REQ-18-02b-TS-SSRC.0009	IOP DSSR assignment
REQ-18-02b-TS-SSRC.0010	IOP Following SSR Code Management by FDMP (setting)
REQ-18-02b-TS-SSRC.0012	IOP Assigned SSR Code Management by the FDMP
REQ-18-02b-TS-SSRC.0013	Positive response to a IOP DSSR assignment
REQ-18-02b-TS-SSRC.0014	IOP Transfer SSR Sharing
REQ-18-02b-TS-SSRC.0015	IOP DSSR request answer Management
REQ-18-02b-TS-SSRC.0016	IOP DSSR Management by Receiving SI
REQ-18-02b-TS-SSRC.0017	IOP Following SSR Code Management by FDMP (unsetting)
REQ-18-02b-TS-SWIM.0036	FDC action upon ICD incompatibility
REQ-18-02b-TS-SWIM.0052	Direct recovery step (recovering node)
REQ-18-02b-TS-WIFO.0027	WIFO Acceptance (WIC)
REQ-18-02b-TS-WIFO.0029	WIFO acceptance (WIMP)
REQ-18-02b-TS-WIFO.0031	WIFO Rejection (WIC)
REQ-18-02b-TS-WIFO.0032	WIFO rejection processing (WIMP)
REQ-18-02b-TS-WIFO.0033	WIFO counter proposal - identify negotiated data (WIC)
REQ-18-02b-TS-WIFO.0037	WIFO Counter-proposal answer (WIMP)
REQ-18-02b-TS-WIFO.0038	WIFO Commit
REQ-18-02b-TS-WIFO.0046	WIFO Counter-proposal answer time-out
REQ-18-02b-TS-WIFO.0049	WIFO Counter-proposal (WIC)
REQ-18-02b-TS-WIFO.0051	WIFO realignment management
REQ-18-02b-TS-WIFO.0055	Reject in case of negotiation type not supported
REQ-18-02b-TS-WIFO.0057	C&T Negotiated Data Urgent Application

B.4 Service Overview

B.4.1 Service Taxonomy

Supported Capability	Parent Capability	Level 1 Capability
Coordination and Transfer		
	Trajectory Management	
		Service Delivery Management
Trajectory Information Synchronisation		
	Trajectory Management	
		Service Delivery Management

B.4.2 Service Levels (NfRs)

ID	Title
REQ-18-02b-TS-MECH.0365	Maximum time to implement a request (FDMP)
REQ-18-02b-TS-MECH.0403	FO Publication Threshold on constraint points
REQ-18-02b-TS-MECH.0404	FO Publication threshold on coordination data
REQ-18-02b-TS-MECH.0405	FO Publication threshold on trajectory point ETO
REQ-18-02b-TS-MECH.0406	FO Publication Threshold on trajectory point LEVEL

B.4.3 Service Functions and Capabilities

N/A

B.4.4 Service Interfaces

Service Name	Description
ATCFlightObjectControl (PJ.18-02b)	<p>The ATC Flight Object Control query/reply service allows FDC to request a number of changes to a Flight Object, which is being managed by the FDMP, any SI involved with a FO exchange to report a failure, reject an FO, restore an FO or recover from an IOP failure.</p> <p>It defines the following operations:</p> <ul style="list-style-type: none"> - RequestFlightObjectServices: This operation allows a system to request any kind of update/change to the Flight Object to the FDMP. - ReportFlightObjectServicesExecution: This operation reports to an FDC, the result of the implementation of an already accepted RequestFlightObjectServices operation call.

	<ul style="list-style-type: none"> - RejectFlightObject: This operation requests the rejection of a given Flight Object, reporting the reason for rejection to the current FDMP. - RestoreFlightObject: This operation allows a system to restore the latest version of a specific Flight Object. This triggers the invocation of the RestoreFlightObject operation to the FDMP of the Flight Object to request its republication. - RequestFlightObjectRecovery: This operation allows an application to request recovery of a subset or all of the Flight Objects.
--	---

Service Interface Definition	Description
FlightObjectManagementInterface	<p>The FlightObjectManagement interface, as part of the ATCFlightObjectControl service physical architecture provides the following operations:</p> <ol style="list-style-type: none"> 1. RequestFOService, Flight Object Services Request operation (SRR-MEP), 2. ReportFOServiceFailure, Flight Object Services Request processing failure (SRR-MEP), 3. RejectFO , Flight Object Rejection operation (SRR-MEP), 4. RestoreFO, Flight Object Restoring operation (SRR-MEP), 5. RequestFORecovery, Flight Objects Recovery operation (SRR-MEP);

B.5 Service interface specifications

(* indicates that the Data Entity has been created for the needs of this service, but is not yet part of AIRM)

B.5.1 FlightObjectManagementInterface

1. Operation rejectFlightObject

This operation requests the rejection of a given Flight Object, reporting the reason for rejection to the current FDMP (from the locally stored Flight Object summaries). This triggers a calling of the *FlightObjectManagement* RejectFlightObject operation to the FDMP of the Flight Object to be rejected.

Input	Service Payload	Data Entity
	IopStakeHolderId	*IOPStakeHolderId

Input	Service Payload	Data Entity
	ClusterReleaseIdSequence	*ClusterReleaseIdSequence

Input	Service Payload	Data Entity
	Flight Object Identifier	*FlightObjectIdentifier

Input	Service Payload	Data Entity
	RejectReason	*Reason

More details on the data entity definition can be found in the IRS Annex in Appendix E.

2. Operation reportFlightObjectServicesFailure

This operation reports to an FDC, the result of the implementation of an already accepted RequestFlightObjectServices operation call.

Input	Service Payload	Data Entity
	Request ID	*RequestId

Input	Service Payload	Data Entity
	FDMP Id	*IOPStakeHolderId

Input	Service Payload	Data Entity
	RequestResponses	*ServiceReports

Input	Service Payload	Data Entity
	FDC Id	*IOPStakeHolderId

More details on the data entity definition can be found in the IRS Annex in Appendix E.

3. Operation requestFlightObjectRecovery

This operation allows an application to request recovery of a subset or all of the Flight Objects for which it is in a specific recovery tier.

Input	Service Payload	Data Entity
	Flight Object Identifier	*FlightObjectIdentifier

Input	Service Payload	Data Entity
	Tiers	*number

Input	Service Payload	Data Entity
	IopStakeHolderId	*IOPStakeHolderId
Return	Service Payload	Data Entity
	Flight Object Recovery Report	*FORRecoveryReport

More details on the data entity definition can be found in the IRS Annex in Appendix E.

4. Operation requestFlightObjectServices

This operation is used by a system to make a request on a Flight Object to its FDMP. This request can be related to following aspect of the FO:

- Coordination and Transfer Management
- Distribution Management
- Flight-Script Management
- WIFO Management
- Control Sequence Management

Input	Service Payload	Data Entity
	Flight Object Identifier	*FlightObjectIdentifier

Input	Service Payload	Data Entity
	ClusterReleaseIdSequence	*ClusterReleaseIdSequence

Input	Service Payload	Data Entity
	Flight Object Request	*FORRequest

Input	Service Payload	Data Entity
	IopStakeHolderId	*IOPStakeHolderId

Input	Service Payload	Data Entity
	Request ID	*RequestId

Input	Service Payload	Data Entity
	priority	*Qos
Return	Service Payload	Data Entity
	Complex Report	*ComplexReport

More details on the data entity definition can be found in the IRS Annex in Appendix E.

5. Operation restoreFlightObject

This operation allows an application to restore the latest version of a specific Flight Object. This triggers the invocation of the *FlightObjectManagement* RestoreFlightObject operation to the FDMP of the Flight Object to request its republication.

Input	Service Payload	Data Entity
	Flight Object Identifier	*FlightObjectIdentifier

Input	Service Payload	Data Entity
	IopStakeHolderId	*IOPStakeHolderId

More details on the data entity definition can be found in the IRS Annex in Appendix E.

B.6 Payload Data Diagrams

Refer to ICD provided in Appendix D

B.7 Payload Data Types

B.7.1 Payload Elements

Refer to ICD provided in Appendix D for more details.

Class	
*ClusterReleaseIdSequence	<p>This constitutes the FO release of the Flight Object.</p> <p>It contains all cluster identifiers and release numbers of the Flight Object.</p>
Class	

*ComplexReport	Return value for the acceptance or the rejection of the request. The Complex Report provide detailed reply for each request present in the Requests parameter.
Class	
*FlightObjectIdentifier	The fold is the identifier of a FO all over the IOP network. The uniqueness of the fold in the IOP area is ensured by composing it with: - the identifier of the SI creating the FO (valid IOP System identifiers are shared in adaptation) - and a locally defined identifier that is built according to local SI rules (The SI will be responsible for using a local identifier that is unique within its own system). This fold is filled on creation of the FO. The modification of the fold is forbidden.
Class	
*FORecoveryReport	Return value for the acceptance or the rejection of the request together with any failure to publish a missing Flight Object.
Class	
*FORequest	A FORequest allows a FDC or FDU to ask the FDMP to update the FO with proposed changes. The FORequest contains: • The identifier of the request • 1 to 20 service requests • (optional) the indication that the request is issued by an FDU • (optional) the identifier of the negotiation when the request is related to a WIFO. When the request is to update a FO: • the absence of fdu indicates that the requester is an FDC, • the absence of negotiationId indicates that the update is not related with a WIFO. When the request is to update a WIFO: • fdu must not be provided. • negotiationId identifies the negotiation to what the WIC is responding.
Class	

*IOPStakeholderId	It allow to identify an IOP stakeholder.
Class	
number	No Comment available.
Class	
*Qos	Priority that is assigned to the request delivery. It is one of the three possible classes of services offered by the SWIM-TI (d_1, d_2, d_3).
Class	
*Reason	A text entity used to describe reason of an action.
Class	
*RequestId	Unique request identification.
Class	
*ServiceReports	Response to each of the FO service requests with one of the following values: - SUCCESS (successful implementation), - FAILED (failed implementation) or - PENDING (an IOP Application report will be sent later).

B.8 Service dynamic behaviour

B.8.1 Service Interface FlightObjectManagementInterface

Refer to ICD documentation provided in Appendix D and to IRS Annex in Appendix E

Appendix C IOPMonitoring Service Description Document (SDD)

C.1 Introduction

The IOPMonitoring service is used by IOP system to provide to the SWIM layer the current state of the IOP Application.

Following operations are defined:

- UpdateRecoveryStatus: used during the recovery of an IOP node to indicate the current state of the recovery
- UpdateApplicationStatus: used to indicate the current state of the IOP application (enabled or not-enabled)

C.2 Service Identification

Name of the Service	IOPMonitoring (PJ.18-02b)
Identifier	if7VEc8zUjW0
Version	EATMA Draft
Architect(s)	PAQUAY Christophe
Last Modification Date	9/4/2020 2:49:44 PM

Table 59: Service identification (I)

C.3 Operational and Business Context

C.3.1 Operational Context

Supported Activity	Activity Description
Accept Proposal	After receiving a change proposal, the impact of the change is assessed by the receiver ATC unit. After the assessment, the controllers decide the change is proper and accept the proposal. The initiator ATC unit (where the proposal was received from) is informed.
Apply Proposal	After receiving 'the change proposal is proper and acceptable' information from the receiver unit, initiator unit apply the changes to their local ATC system and deliver clearance to the flight deck. Thanks to the IOP system, this information is shared and available for further downstream ATC units (informed units) as well.
Counter Propose	After receiving a change proposal, the impact of the change is assessed by the receiver ATC unit. After the assessment, the controllers decide the change is NOT proper under these circumstances and propose a new change that is proper for

	themselves. The initiator ATC unit (where the proposal was received from) is informed about the new proposal.
Reject Change	After receiving 'the change proposal is NOT proper and NOT acceptable' information from the receiver unit, controllers working in initiator unit acknowledge the information on their local ATC system. The negotiation process stops. There is no need to deliver a clearance (or information) to the flight deck.
Reject Proposal	After receiving a change proposal, the impact of the change is assessed by the receiver ATC unit. After the assessment, the controllers working in the receiver unit decide the change is NOT proper and reject the proposal.
Start Negotiation	Prepare a proposal to change a route or ATS constraint and start negotiating with the concerned unit.
Transfer Flight	<p>Transfer of a flight term is used to define "transfer of responsibility for providing air traffic control service".</p> <p>In a specific moment of the flight, while the 'controlling ATC unit' retains the communication and control responsibility of the aircraft, the aircraft be instructed to communicate with the next (receiving) ATC unit. Whereby that action, the responsibility for the separation of an aircraft is transferred from one controller to another.</p>

Information Exchange realized by the Service

None. Pure technical service, there is no operational information exchange.

C.3.2 Information Exchange Requirements

No Information Exchange Requirements identified for this service.

C.3.3 Other Requirements

The following TS requirements are applicable to this service:

ID	Title
REQ-18-02b-TS-SWIM.0048	Recovery Process Initiation (Recovering Node)
REQ-18-02b-TS-SWIM.0050	Recovery Steps iterations (Recovering Node)
REQ-18-02b-TS-SWIM.0054	Recovery Process Termination (Recovering Node)

C.4 Service Overview

C.4.1 Service Taxonomy

Supported Capability	Parent Capability	Level 1 Capability
Trajectory Information Synchronisation		
	Trajectory Management	
		Service Delivery Management

C.4.2 Service Levels (NfRs)

No NfRs identified for this service.

C.4.3 Service Functions and Capabilities

N/A

C.4.4 Service Interfaces

Service Name	Description
IOPMonitoring (PJ.18-02b)	<p>The IOPMonitoring service is used by IOP system to provide to the SWIM layer the current state of the IOP Application.</p> <p>Following operations are defined:</p> <ul style="list-style-type: none"> - UpdateRecoveryStatus: used during the recovery of an IOP node to indicate the current state of the recovery - UpdateApplicationStatus: used to indicate the current state of the IOP application (enabled or not-enabled)

Service Interface Definition	Description
IOPMonitoringInterface	<p>The IOPMonitoring interface, as part of the IOPMonitoring service physical architecture provides the following operations:</p> <ul style="list-style-type: none"> - UpdateRecoveryStatus: used during the recovery of an IOP node to indicate the current state of the recovery - UpdateApplicationStatus: used to indicate the current state of the IOP application (enabled or not-enabled)

C.5 Service interface specifications

(* indicates that the Data Entity has been created for the needs of this service, but is not yet part of AIRM)

C.5.1 IOPMonitoringInterface

1. Operation **IOPMonitoring** (PJ.18-02b).IOPMonitoringInterface.updateApplicationStatus

This operation update the IOP status of the application (enabled or not_enabled).

Input	Service Payload	Data Entity
	lopStatus	*IOPStatus

Input	Service Payload	Data Entity
	lopStakeHolderId	*IOPStakeHolderId

More details on the data entity definition can be found in the IRS Annex in Appendix E.

2. Operation **IOPMonitoring** (PJ.18-02b).IOPMonitoringInterface.updateRecoveryStatus

This operation update the IOP recovery status of the application.

Input	Service Payload	Data Entity
	Tiers	*number

Input	Service Payload	Data Entity
	RecoveryStatus	*RecoveryStatus

Input	Service Payload	Data Entity
	RecoveryContext	*RecoveryIdentifier

More details on the data entity definition can be found in the IRS Annex in Appendix E.

C.6 Payload Data Diagrams

Refer to ICD provided in Appendix D

C.7 Payload Data Types

C.7.1 Payload Elements

Refer to ICD provided in Appendix D for more details.

Class	
*IOPStakeHolderId	It allow to identify an IOP stakeholder.
Class	
*IOPStatus	Status of the IOP application. Can take two values: ENABLED: the system is IOP enabled and can participate to the IOP network NOT_ENABLED: the system is IOP not enable (e.g.: IOP layer down) and cannot participate to the IOP network
Class	
number	No Comment available.
Class	
*RecoveryIdentifier	This consists of a unique identifier for the on-going recovery.
Class	
*RecoveryStatus	This indicates that the SWIM node is currently performing a recovery or that the recovery process is completed.

C.8 Service dynamic behaviour

C.8.1 Service Interface IOPMonitoringInterface

Refer to ICD documentation provided in Appendix D and to IRS Annex Appendix E.

Appendix D Service Technical Design Document (STDD)

Refer to App A of the IRS SWIM annex provided in Appendix E for the mapping to relevant SWIM profile.

This appendix contains the description of the ICD for FO-IOP.

The maintenance of the ICD is done with the Enterprise Architect modelling tool. The model file is included below. The model has been used to generate the payload (XSD's) of the services. It is included here below as xsd files.

In addition a detailed documentation has been produced in order to help the implementation of the services. This documentation explains in detail how each classes and services operations must be used and implemented. The documentation is attached below.

ICD Documentation:



ICD_Documentation_
v3.8_PJ18_02b.docx

ICD Model²: This model has been developed with the Enterprise Architect modelling tool, it can be opened for reading with the free version of the tool that can be downloaded on this page: <https://www.sparxsystems.eu/enterprise-architect/ea-lite-edition/>



PJ18 FO
model_ICDv3.8_PJ18_

XSD's³: This zip file contains .xsd xml files that can be opened with any text editor tool like Notepad.



XSDs.zip

² Note that the documentation included in the model is not complete and up to date (work to be done). For model documentation only refer to the included word file.

³ Note that the documentation included in the XSD's generated from the model is not complete. For XSD's documentation only refer to the included ICD Documentation word file.



Appendix E SWIM-TI Blue Profile Specification

This appendix contains the IRS (Interface Requirements Specification) annex to the TS/IRS document. It addresses the functional, non-functional (performance, security, ...), applicable standards and interface requirements applicable for SWIM Technical Infrastructure (SWIM-TI) and applicable for the SWIM Blue Profile on which this specification is based upon.



IRS Annex to SESAR
2020 - 18-02b - TS IR

IRS Annex to this document:

Appendix F System Parameters

In the following table are listed the system parameters introduced in this document. The system parameters address any numerical reference that appears in the requirements. They are used for the sake of coherence and document maintainability.

The table indicates for each parameters either a single value, or a range and an initial value. When a single value is specified in column Value, (no Min/Max), it means that it is a fixed value that must be used by all SI's. When a range is specified in Min and Max columns, it means that each SI can choose its own value within the specified range. In this case the Value column specifies an initial value that can be used by any SI.

	Parameter name	Description	Min	Value	Max	Units
Capacity	SP-IOP- Max_Expanded_Route _Point	Maximum number of expanded route points in a FO	N/A	240	N/A	N/A
	SP-IOP- Max_FO_Summary	Maximum total number of FOs existing	N/A	12600	N/A	N/A
	SP-IOP- Max_FO_Active	Maximum number of FO active (at least one SI in SAP)	N/A	5320	N/A	N/A
	SP-IOP- Max_Number_Crossed _Elements	Maximum number of elements in the Crossed&Control sequence for any FO	N/A	20	N/A	N/A
	SP-IOP- Max_Number_Distribu tion_Systems	Maximum number of systems in distribution list	N/A	20	N/A	N/A
	SP-IOP- Max_Constraints	Maximum number of constraints in a FO	N/A	150	N/A	N/A
	SP-IOP- Max_Trajectory_Point s	Maximum number of trajectory points in a FO	N/A	400	N/A	N/A
	SP-IOP- Max_Coordinations_P er_FO	Maximum number of active coordinations in a FO	N/A	19	N/A	N/A
System Parameters	SP-IOP- Max_Manager_Chang e_Waiting_Time	Maximum time that an IOP stakeholder will wait for the next controlling ATSU to declare itself as the FDMP of the flight before it checks its eligibility to become the FDMP	N/A	600	N/A	sec.
	SP-IOP- Max_SFPL_Deprived_T ime	Maximum allowed time for the manager of a flight to be deprived of its SFPL. After that	N/A	30	N/A	sec.

	time, Manager status turns to NOT-AVAILABLE for that flight.				
SP-IOP- Waiting_time_before_ FO_creation	Time waited by a contributor for the creation of a Flight Object if it does not receive it from the eligible FDMP.	N/A	30	N/A	sec.
SP-IOP- waiting_time_before_ FO_deletion	Delay between the flight exiting the IOP area and the deletion of the Flight Object. Note, the exit can be a landing within the IOP area or transit beyond it.	120	150	180	min.
SP-IOP- Max_Contrib_Consequ ences_Waiting_Time	Maximum time interval that a FDC shall wait for the new FO implementing the FO change request of maximum priority to the FDMP.	N/A	30	N/A	sec.
SP-IOP- Max_Requests_Retries	Maximum number of times that a FDC is allowed to request a FO change to the FDMP.	N/A	3	N/A	N/A
SP-IOP- Max_Recovery_Step_T ime_Tier_0	Time response for a SI to receive all FO concerned for Tier 0	N/A	3	N/A	min.
SP-IOP- Max_Recovery_Step_T ime_Tier_1	Time response for a SI to receive all FO concerned for Tier 1	N/A	3	N/A	min.
SP-IOP- Max_Recovery_Step_T ime_Tier_2	Time response for a SI to receive all FO concerned for Tier 2	N/A	3	N/A	min.
SP-IOP- Input_Computed_Poin t_Threshold_Distance _Constraint_Update	Distance that must be exceeded between the current location of a constraint point and the location in the previous FO publication to update the associated constraint in the FO.	2	2	5	NM
SP-IOP- Threshold_Time_Coor dination_Data_Update	Time that must be exceeded between the time at a coordination boundary and the time at this coordination in the previous FO publication to update the coordination in the FO.	10	20	30	sec.

SP-IOP-Threshold_Time_Trajectory_Update	Time that must be exceeded between the time at a trajectory point and the time for the same point in the previous FO publication to update the trajectory in the FO.	N/A	60	N/A	sec.
SP-IOP-Threshold_Level_Trajectory_Update	Distance that must be exceeded between the level at a trajectory point and the level for the same point in the previous FO publication to update the trajectory in the FO.	1000	1500	2000	ft.
SP-IOP-WIFO_Acceptance_Time	Time a SI has to answer to a WIFO proposal	N/A	300	N/A	sec.

Table 60: System Parameters

Appendix G Future Work and recommendation.

G.1 Non or Partially Validated requirements.

This section is the result of an assessment of the non or partially validated requirements. It describes the risks and recommendations for each requirements in scope of this specification being in status <In Progress>.

ID	Reason	Assessment/Recommendations
REQ-18-02b-TS-COTR.0156	Robustness mechanism. The defined UC did not allowed to experiment this particular requirement.	This is a mechanism to unsure the robustness of the flight transfer mechanism. It uses mechanisms used in other validated requirements. It does not need extra operational validation, nevertheless technical verification is recommended.
REQ-18-02b-TS-COTR.0159	Performance mechanism. The defined UC did not allowed to experiment this particular requirement.	This is a mechanism to unsure the robustness and performance. Its implementation does not add operational risk, it allows to avoid unnecessary FO updates related to past events. It does not need extra operational validation, nevertheless technical verification is recommended.
REQ-18-02b-TS-COTR.0160	No Use Case covering this particular requirement.	This is about the setting of a flag in the Flight Object to inform a system of an urgent action. Although this is an operationally important information, the mechanism to share this kind of information has been validated with other flags and do not need extra validation. A technical verification is recommended
REQ-18-02b-TS-FSMG.0062	No Use Case covering this particular requirement. Note that UC#0301 and UC#1001 could have been extended to cover it.	The concept of unknown element in the FS is clear, well understood and modelled in the ICD, so implemented in the service interface. Therefore this is considered as low risk in term of validation. A technical verification is recommended
REQ-18-02b-TS-FSMG.0100	No Use Case covering this particular requirement. Note that UC#0301 and UC#1001 could have been extended to cover it.	The concept of unknown element in the FS is clear, well understood and modelled in the ICD, so implemented in the service interface. Therefore this is considered as low risk in term of validation. A technical verification is recommended
REQ-18-02b-TS-FSMG.0141	Robustness mechanism. The defined UC did not allowed to experiment this particular requirement.	This is a mechanism to unsure the protection of flight script and coordination data against unauthorized modification. This is a technical mechanism that does not need further operational validation, nevertheless technical verification is recommended.

ID	Reason	Assessment/Recommendations
REQ-18-02b-TS-MECH.0014	No Use Case covering this particular requirement.	This is about the setting of a status in the Flight Object. This has been experienced with many other statuses and has never been source of issues. The meaning of this controlling SI status is clear and has been used and validated when transferring flights from IOP to IOP SI. A technical verification is recommended.
REQ-18-02b-TS-MECH.0017	No Use Case covering this particular requirement.	This is a protection mechanism which does not need specific validation. Nevertheless it is recommended to run limited validation/trial to determine the correct value of the parameter.
REQ-18-02b-TS-MECH.0022	No Use Case covering this particular requirement.	The mechanism for an IOP Unit to take the FDMP role has been used and validated between IOP SI. Therefore the validation of this requirement is not considered at risk but it is recommended to run extra validation with IOP hole in the airspace configuration.
REQ-18-02b-TS-MECH.0302	Implemented in the prototype but no exercised during validation exercises.	This is a protection mechanism which does not need specific operational validation, nevertheless technical verification is recommended.
REQ-18-02b-TS-MECH.0385	Robustness/Performance mechanism. The defined UC did not allowed to experiment this particular requirement.	This is a mechanism to unsure the robustness/performance of the service request in case the FDMP does not reply in quickly enough. It does not need operational validation. It is recommended to run limited validation/trial to determine the correct value of the parameter.
REQ-18-02b-TS-MECH.0402	Performance mechanism. The defined UCs did not allowed to experiment this particular requirement.	This is a mechanism to unsure good performance of the service request by limiting the number of updates. It does not need operational validation. A technical verification is recommended.
REQ-18-02b-TS-MECH.0404	Performance mechanism. The defined UCs did not allowed to experiment this particular requirement.	This is a mechanism to unsure good performance of the service request by limiting the number of updates. It does not need operational validation. It is recommended to run limited validation/trial to determine the correct value of the parameter.
REQ-18-02b-TS-MECH.0405	Performance mechanism. The defined UCs did not allowed to experiment this particular requirement.	This is a mechanism to unsure good performance of the service request by limiting the number of updates. It does not need operational validation. It is recommended to run limited validation/trial to determine the correct value of the parameter.
REQ-18-02b-TS-MECH.0406	Performance mechanism. The defined UCs did not allowed to experiment this particular requirement.	This is a mechanism to unsure good performance of the service request by limiting the number of updates. It does not need operational validation. It is recommended to run limited validation/trial to determine the correct value of the parameter.

ID	Reason	Assessment/Recommendations
REQ-18-02b-TS-MECH.0409	Robustness mechanism. The defined UC did not allowed to experiment this particular requirement.	This is a mechanism to unsure the robustness of the service request in case some parts of a request cannot be performed by the FDMP. It does not need operational validation. A technical verification is recommended.
REQ-18-02b-TS-MECH.1011	Defined after validation mechanism to complete the desynchronization mechanism.	Although no validation risk are identified, it is recommended to further validate this mechanism that allow a system to declare itself re-synchronised from a FO to the other systems. This recommended validation should focus on the reaction of the other non-desynchronised systems.
REQ-18-02b-TS-MECH.1012	Defined after validation mechanism to complete the desynchronization mechanism.	Although no validation risk are identified, it is recommended to further validate this mechanism that allow a system to declare itself re-synchronised from a FO to the other systems. This recommended validation should focus on the reaction of the other non-desynchronised systems.
REQ-18-02b-TS-MECH.1013	Defined after validation mechanism to complete the desynchronization mechanism.	Although no validation risk are identified, it is recommended to further validate this mechanism that allow a system to declare itself not FDMP capable for a flight due to desynchronization and inform the other systems. This recommended validation should focus on the reaction of the other non-desynchronised systems. All mechanism allowing other systems to take over the FDMP role have been validated.
REQ-18-02b-TS-SCTJ.0101	No Use Case covering this particular requirement. Note that UC#0301 and UC#1001 could have been extended to cover it.	The concept of unknown element in the FS is clear, well understood and modelled in the ICD, so implemented in the service interface. Therefore this is considered as low risk in term of validation. A technical verification is recommended.
REQ-18-02b-TS-SEQM.1045	No Use Case covering this particular requirement.	This is a mechanism to protect any un-authorized modification/correction of the control sequence. It is part of the sequence correction mechanism that has been validated for nominal cases. Therefore this is considered as low risk in term of validation. A technical verification is recommended.
REQ-18-02b-TS-SEQM.1046	No Use Case covering this particular requirement.	This is a mechanism to protect any un-authorized modification/correction of the control sequence. It is part of the sequence correction mechanism that has been validated for nominal cases. Therefore this is considered as low risk in term of validation. A technical verification is recommended.

ID	Reason	Assessment/Recommendations
REQ-18-02b-TS-SEQM.1049	No Use Case covering this particular requirement.	This is a mechanism to protect any un-authorized skip cancellation. It is part of the SKIP cancellation functionality that has been validated for nominal cases. Therefore this is considered as low risk in term of validation. A technical verification is recommended.
REQ-18-02b-TS-SEQM.1050	No Use Case covering this particular requirement.	This is a mechanism to protect any un-authorized delegation cancellation. It is part of the DELEGATION cancellation functionality that has been validated for nominal cases. Therefore this is considered as low risk in term of validation. It is recommended to run a limited validation focussing on the non-nominal delegation cases.
REQ-18-02b-TS-SEQM.1067	No Use Case covering this particular requirement.	This is a mechanism to protect any un-authorized modification/correction of the control sequence. It is part of the SI Confirmation function of sequence handling that has been validated for nominal cases. Therefore this is considered as low risk in term of validation. A technical verification is recommended.
REQ-18-02b-TS-SEQM.1069	No Use Case covering this particular requirement.	This is a mechanism to ensure consistent information in the Crossed and Control sequence when a system not being identified in the crossed and control sequence. This is part of the management of the Crossed and Control sequence that has been validated for other cases. Therefore this is considered as low risk in term of validation. A technical verification is recommended.
REQ-18-02b-TS-SWIM.0032	Robustness mechanism. The defined UCs did not allowed to experiment this particular requirement.	This is a mechanism to ensure all stakeholders receive the complete FDMP view of the FO and update their own local copies. This is a pure technical requirement that does not require operational validation. Proper technical testing is recommended.
REQ-18-02b-TS-SWIM.0034	Robustness mechanism. The defined UCs did not allowed to experiment this particular requirement.	This is a pure technical mechanism to allow detection of distribution failure, it does not require operational validation. Proper technical testing is recommended.
REQ-18-02b-TS-SWIM.0036	Robustness mechanism. The defined UCs did not allowed to experiment this particular requirement.	This is a pure technical mechanism to allow detection of wrong payload version, it does not require operational validation. Proper technical testing is recommended.

ID	Reason	Assessment/Recommendations
REQ-18-02b-TS-WIFO.0045	No Use Case covering this particular requirement.	This is about the setting of a status in a WhatIf Flight Object when cancelling a WIFO. This has been experienced with many other statuses and has never been source of issues. The meaning of this status is clear and its usage does not need further operational validation. A technical verification is recommended.
REQ-18-02b-TS-WIFO.0051	No Use Case covering this particular requirement.	This requirement uses mechanisms that have been validated with other requirements (publish, cancel) and is not considered as risky. It is recommended to perform some limited validation on the re-alignment mechanism.

Table 61: Non-Validated requirements.

G.2 NM Related Requirement

The integration of NM in the IOP network is not in the scope of this specification and therefore has not been completely specified at technical level. This section provides a snapshot of the current status of the work done on this topic in preparation of future integration on NM in IOP.

G.2.1 In scope requirements applicable to NM

Find below the list of requirements in the scope of the solution PJ18-02b and likely to be applicable to NM if it is playing the role of FDMP. Note that the bellow requirements have been selected with our current knowledge and understanding of NM in IOP. This list will have to be re-evaluated when the integration of NM and all related UC's will be further analysed.

Id	Title
REQ-18-02b-TS-FSMG.0001	FO Flight Script Scope (FDMP)
REQ-18-02b-TS-FSMG.0002	Update aircraft position in the FO Flight Script
REQ-18-02b-TS-FSMG.0006	Non modifiable constraint attributes
REQ-18-02b-TS-FSMG.0009	Constraint Target Values
REQ-18-02b-TS-FSMG.0010	Constraint Relevant Point Identification (Owner)
REQ-18-02b-TS-FSMG.0011	Constraint Points Management (FDMP)
REQ-18-02b-TS-FSMG.0018	Constraint Computed Points linkage to Expanded Route (FDMP)
REQ-18-02b-TS-FSMG.0028	Accepted constraints processing
REQ-18-02b-TS-FSMG.0029	Not supported or not applicable constraints processing (FDMP)
REQ-18-02b-TS-FSMG.0032	Constraint removal (request) (FDC)
REQ-18-02b-TS-FSMG.0046	Constraints ordering (FDMP)
REQ-18-02b-TS-FSMG.0047	Constraint identification
REQ-18-02b-TS-FSMG.0061	Creating/updating the Expanded Route (FDMP)
REQ-18-02b-TS-FSMG.0062	FO Expanded Route Refinement of Unknown Items
REQ-18-02b-TS-FSMG.0072	Constraint at FO Creation (FDMP)
REQ-18-02b-TS-FSMG.0073	Re-route (route point with switches or indicator) (FDC)
REQ-18-02b-TS-FSMG.0074	Re-route (route point with switches or indicator) (FDMP)
REQ-18-02b-TS-FSMG.0076	Constraint Types
REQ-18-02b-TS-FSMG.0080	Constraint Owner
REQ-18-02b-TS-FSMG.0081	CORRECTED constraint (tag modification)

REQ-18-02b-TS-FSMG.0082	Constraint removal (request) (FDMP)
REQ-18-02b-TS-FSMG.0083	CORRECTED constraint (unsettag tag)
REQ-18-02b-TS-FSMG.0087	CORRECTED constraint (setting tag)
REQ-18-02b-TS-FSMG.0088	Constraint Input Point Assignment (Owner)
REQ-18-02b-TS-FSMG.0100	Expanded Route including unknown route item
REQ-18-02b-TS-FSMG.0106	Expanded Route point identifiers
REQ-18-02b-TS-FSMG.0107	Constraint identifiers
REQ-18-02b-TS-FSMG.0120	Constraint removal (assessment)
REQ-18-02b-TS-FSMG.0121	CORRECTED constraint (tag removal)
REQ-18-02b-TS-FSMG.0122	Constraint removal (restoration) (FDMP)
REQ-18-02b-TS-FSMG.0124	Constraint modification (not CORRECTED)
REQ-18-02b-TS-FSMG.0125	Management of switches and STAY indicator in expanded route (FDC)
REQ-18-02b-TS-FSMG.0129	Setting the author of the constraint modification
REQ-18-02b-TS-FSMG.0135	Flight Plan Constraints
REQ-18-02b-TS-FSMG.0136	Constraint Input Points linkage to the Expanded Route (requester)
REQ-18-02b-TS-FSMG.0137	Processing a Flight Plan constraint deletion request (FDMP)
REQ-18-02b-TS-FSMG.0138	Un-used flight plan constraints at FO creation (FDMP)
REQ-18-02b-TS-FSMG.0143	FO Expanded Route scope (FDMP)
REQ-18-02b-TS-FSMG.0144	Modify route scope (FDC)
REQ-18-02b-TS-FSMG.0145	FLIGHT_PLAN constraints at first Expanded Route point
REQ-18-02b-TS-FSMG.0149	Last Overflow Point (FDMP)
REQ-18-02b-TS-FSMG.0150	Route change after Last Overflow Point (FDC)
REQ-18-02b-TS-FSMG.0151	Constraint Input Points for level strategic constraints (Owner)
REQ-18-02b-TS-FSMG.0152	Constraint Input Point for TFL(wall) constraints (Owner)
REQ-18-02b-TS-FSMG.0153	Strategic constraints mode
REQ-18-02b-TS-FSMG.0160	Flight Plan information at first Expanded Route point
REQ-18-02b-TS-FSMG.0161	FO Trajectory Scope (FDMP)
REQ-18-02b-TS-FSMG.0162	Flight plan information at the points following the first Expanded Route point
REQ-18-02b-TS-FSMG.0163	Time-space discontinuity among contiguous FO Expanded Route segments
REQ-18-02b-TS-INFO.0016	Unsubscribe a flight
REQ-18-02b-TS-MECH.0002	FDMP role declaration at FO creation
REQ-18-02b-TS-MECH.0201	FO unique identification
REQ-18-02b-TS-MECH.0202	Uniqueness of the FO_ID
REQ-18-02b-TS-MECH.0205	FO creation check
REQ-18-02b-TS-MECH.0207	Updating Operational Keys
REQ-18-02b-TS-MECH.0208	FO Deletion after leaving the AOI or after landing
REQ-18-02b-TS-MECH.0209	FO deletion due to a flight cancellation
REQ-18-02b-TS-MECH.0210	FDC notification of flight cancellation
REQ-18-02b-TS-MECH.0302	Service requests received by an SI without FDMP role
REQ-18-02b-TS-MECH.0306	Local SFPL alignment
REQ-18-02b-TS-MECH.0309	Synchronous service response (FDMP)
REQ-18-02b-TS-MECH.0312	Distribution for reason 'Vicinity'
REQ-18-02b-TS-MECH.0315	Number of concurrent requests

REQ-18-02b-TS-MECH.0316	SI request identifier
REQ-18-02b-TS-MECH.0319	SFPL alignment (FDMP)
REQ-18-02b-TS-MECH.0320	SI request identifier management (FDMP)
REQ-18-02b-TS-MECH.0330	Unique cluster identification
REQ-18-02b-TS-MECH.0331	FO identification distribution
REQ-18-02b-TS-MECH.0336	SFPL creation on FO reception
REQ-18-02b-TS-MECH.0339	Distribution for reason 'End of Service'.
REQ-18-02b-TS-MECH.0340	Acknowledgement of end of distribution
REQ-18-02b-TS-MECH.0341	Removal of an SI from the Distribution List (FDMP)
REQ-18-02b-TS-MECH.0344	Distribution for reason 'Control'
REQ-18-02b-TS-MECH.0347	Distribution of the FO upon new release available
REQ-18-02b-TS-MECH.0348	Distribution for reason 'General Information'
REQ-18-02b-TS-MECH.0350	Distribution for reason 'Subscribed'
REQ-18-02b-TS-MECH.0360	FO alignment to the Local SFPL (FDMP)
REQ-18-02b-TS-MECH.0375	Missing answer to a service request
REQ-18-02b-TS-MECH.0385	Maximum number of retries allowed upon missing implementation report
REQ-18-02b-TS-MECH.0397	General Information request
REQ-18-02b-TS-MECH.0398	Distribution for one or more reasons
REQ-18-02b-TS-MECH.0399	Distribution for reason 'Traversed'
REQ-18-02b-TS-MECH.0401	Last Overflown Route Point update
REQ-18-02b-TS-MECH.0402	No publication for only current condition changes
REQ-18-02b-TS-MECH.0403	FO Publication Threshold on constraint points
REQ-18-02b-TS-MECH.0405	FO Publication threshold on trajectory point ETO
REQ-18-02b-TS-MECH.0406	FO Publication Threshold on trajectory point LEVEL
REQ-18-02b-TS-MECH.0407	Asynchronous service response (FDMP)
REQ-18-02b-TS-MECH.0408	Positive Asynchronous service response (FDMP)
REQ-18-02b-TS-MECH.0409	Negative Asynchronous service response (FDMP)
REQ-18-02b-TS-MECH.0410	Unique FO identification to SWIM layer
REQ-18-02b-TS-SCTJ.0101	FDMP trajectory processing when FO Expanded Route includes unknown route items
REQ-18-02b-TS-SCTJ.0107	FO Expanded route points references in FO trajectory

Table 62 Validated NM applicable requirements

G.2.2 Out of scope specific NM requirements

Technical requirements specific to NM satisfying the specific NM requirements from INTEROP (Ref.: [33]) and being allocated to solution PJ18-02b1, have not been completely specified (NM not being in the scope of this TS). This section provides this incomplete set of requirements produced at the beginning of the project based on PJ18-02b Technical team knowledge and before the INTEROP NM requirements (PJ18-02b1 part of INTEROP) were finalised, are provided for information and to serve as basis for further development.

Assessment of the FDMP role for a NM stakeholder

The IFPS specification 1.2[31] says at chapter 10.3 “Distribution to ATS unit in the IFPZ”: NM schedules the distribution to ATC a SP time before the calculated arrival of the flight in the AOR of that ATC. The SP is specified by each ATC and is held in the NM Environment database.

The above condition on time to distribute to ATC indicates that negotiations conducted by NM far before take-off are conducted outside IOP mechanisms, and IOP is used by NM to inform ATCs of an already consolidated release of the flight (although not final).

[REQ]

Identifier	REQ-18-02b1-TS-MECH.0003
Title	FDMP role for NM
Requirement	A NM SI shall assess it is the FDMP of a flight if: It is currently FDMP-eligible for this flight, and No ATC SI has declared itself FDMP yet.
Status	<In Progress>
Maturity Level	TRL2
Rationale	This requirement is needed to identify when NM SI can be holder of the FDMP role on a FO.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b1
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	G/G IOP Management

Assessment by a NM stakeholder that the flight is ready for switching to ATC FDMP

[REQ]

Identifier	REQ-18-02b1-TS-MECH.0004
Title	FDMP role readiness for NM to ATC transfer
Requirement	A NM SI shall indicate at SIT 2 in the FO of a flight departing from the IFPZ, if it is its FDMP, that the FO is ready for ATC.
Status	<In Progress>
Maturity Level	TRL2
Rationale	This requirement is needed to identify when ATC can take FDMP role according to NM view. It is not constraining for ATC SIs.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b1
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	G/G IOP Management

Notes:

- For flights departing within the IFPZ, this time is SIT 2 (Slot Issue Time 2), so a certain parameter before the CTOT, when the possible improvement to the initial slot have been done by CASA.
- For flights that depart outside IFPZ, there will be no equivalent indication.
- The information that NM provides regarding the status “ready for ATC” is informative:
- While the NM is IOP-disable, it is not able to indicate to ATC that they can take the FDMP role.
- An ATC stakeholder can take the FDMP role when it needs. The working procedures of controllers will ensure that the switch of FDMP role between NM and ATC occurs at an appropriate time.

FDMP role transfer between NM and ATC system instance

The ATC that will first give instruction to the flight will take the FDMP role at its convenience. At latest, this will occur at time of assumption (cf. MECH-0008).

The NM indication that the flight is “ready for ATC” is only informative.

The back-up mechanisms defined under § 4.2.1.1.1.3.1.2.1 and § 4.2.1.1.1.3.1.2.2 are applicable while NM is FDMP. It means that some ATC SI can take over the role of FDMP if NM becomes IOP-disable.

[REQ]

Identifier	REQ-18-02b1-TS-MECH.0006
Title	FDC role for NM
Requirement	When an ATC SI has taken the FDMP role from NM, the NM shall become a FDC of the FO.
Status	<In Progress>
Maturity Level	TRL2
Rationale	This requirement is needed to identify that NM is always at least FDC for a FO, so able to share changes on the flight. It means also that NM is continuously fed with the updated FO content. Then NM remains FDC during remaining life time of the FO.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b1
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	G/G IOP Management

Note: This ensures that NM remains able to make inputs to the flight, in particular further changes to the CTOT.

In case NM becomes IOP-disabled, an ATC takes the FDMP role indicating that it is the FDMP, but not controlling the flight.

[REQ]

Identifier	REQ-18-02b1-TS-MECH.0007
------------	--------------------------

Title	FDMP role take back by NM
Requirement	When the NM SI becomes “IOP-enabled” again, it shall take back the FDMP role if: It is not yet time (SIT 2), and No ATC has yet indicated it is controlling the flight.
Status	<In Progress>
Maturity Level	TRL2
Rationale	This requirement is needed to identify when NM can take back a FDMP role following some loss of IOP capability.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b1
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	G/G IOP Management

Change of route during the traversal of an IOP hole

The NM never takes back the FDMP role, even during the traversal of IOP holes. If NM receives during the traversal of the IOP hole some updated information of the flight, NM can share it with the other IOP stakeholders as FDC of the flight. So NM could provide to the FDMP the new route to the diversion airport.

Distribution for General Information

In the nominal case, the NM is the first FDMP but at a certain point in time the FDMP role is handed over to ATC. But the NM should always be included in the distribution list with the reason as general information.

[REQ]

Identifier	REQ-18-02b1-TS-MECH.0346
Title	NM inclusion in the Distribution list for general information
Requirement	The FDMP shall always add the NM to the FO Distribution List, indicating the reason for distribution as “General Information”.
Status	<In Progress>
Maturity Level	TRL2
Rationale	This requirement is needed to support the inclusion of the NM as a permanent receiver of the FO.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	PJ18-02b1
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	ER APP ATC 162
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Service>	SharedFlightObject
<ALLOCATED_TO>	<Function>	G/G IOP Management

G.3 IOP elements not in scope of this specification

The below elements are possible future enhancements of the IOP Technical Specification. This refers to the FULL IOP scope as described in section 2.2.

G.3.1 What-If FlightObject (WIFO) Management

REQ-18-02b-TS-WIFO.0001 partially satisfies also the following FULL IOP INTEROP requirements:

<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-COTR.0094
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-SEQM.0075

WIFO General Requirements

WIFO Creation and Role Assignment

REQ-18-02b-TS-WIFO.0007 partially satisfies also the following FULL IOP INTEROP requirement:

<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-COTR.0095
-------------	--------------------	--------------------------------

REQ-18-02b-TS-WIFO.0016 partially satisfies also the following FULL IOP INTEROP requirement:

<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-COTR.0095
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-SEQM.0075

...

Negotiation-type WIFO in negotiation between two SIs Requirements

...

Negotiated Data Identification

REQ-18-02b-TS-WIFO.0005 partially satisfies also the following FULL IOP INTEROP requirements:

<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-COTR.0128
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-COTR.0073
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-COTR.0074
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-COTR.0095
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-WIFO.0011
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-WIFO.0012
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-WIFO.0013
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-SEQM.0085
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-SEQM.0074
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-SEQM.0075

Request WIFO update from the WIC

WIFO Counter proposal

REQ-18-02b-TS-WIFO.0033 partially satisfies also the following FULL IOP INTEROP requirements:

<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-WIFO.0011
-------------	--------------------	--------------------------------

<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-WIFO.0012
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-WIFO.0013

WIFO Alignment with FO

REQ-18-02b-TS-WIFO.0051 partially satisfies also the following FULL IOP INTEROP requirements:

<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-WIFO.0007
-------------	--------------------	--------------------------------

WIFO Deletion

REQ-18-02b-TS-WIFO.0040 partially satisfies also the following FULL IOP INTEROP requirements:

<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-WIFO.0007
-------------	--------------------	--------------------------------

G.3.2 Coordination and Transfer

...

Managing Coordination and Transfer Data

Coordination and Transfer Data creation and Confirmation

REQ-18-02b-TS-COTR.0143 and REQ-18-02b-TS-COTR.0159 partially satisfies also the following FULL IOP INTEROP requirements:

<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-COTR.0111
-------------	--------------------	--------------------------------

...

Type Of Agreement

[REQ]

Identifier	REQ-xx-xx-TS-COTR.0210
Title	Management of the Agreement indication upon change of Contractual C&T data
Requirement	While the coordination is either CAP or NP, whenever a SI changes an element of the Contractual C&T data (TFL, SFL, Heading, Direct, Speed, ROC/ROD) without verbal or WIFO agreement from the other SI, the SI making the change shall reset the indication to “set_without_negotiation”.
Status	<In Progress>
Maturity Level	TRL2
Rationale	This requirement ensures that when a Contractual C&T data is modified with no agreement, the associated agreement indication is modified accordingly.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	xx
<SATISFIES>	<Enabler>	xx

<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-COTR.0127
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

...

Other Crossing Data

[REQ]

Identifier	REQ-xx-xx-TS-COTR.0211
Title	Maintenance of enhanced crossing data from SAP onward
Requirement	An SI shall from the start of the SAP onward, initialize the following set of information (when available) related to each of its crossings and set the subsequent changes in the FO: <ul style="list-style-type: none"> - Offset value and direction (right/left), - Release (for turn, speed, rate, related aircraft) and kind of release (upstream, downstream) (only for the downstream release of the entry crossing and for the upstream release of the exit crossing).
Status	<In Progress>
Maturity Level	TRL2
Rationale	This requirement is needed to cover the complete set of release data as well as offset. This comes in addition to the requirement TS-COTR.0147.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	
<ALLOCATED_TO>	<Enabler>	xx
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-COTR.0102
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-COTR.0066
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-COTR.0067
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-COTR.0069
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-COTR.0070
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-COTR.0073
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-COTR.0074
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-COTR.0114
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-COTR.0113
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

Transferring Flight Responsibility

...

Undo Assume

There can be situations when an ATCO either assumes a wrong flight or assumes it too early. In those cases, he can have option to undo the assume action he has performed on the flight.

[REQ]

Identifier	REQ-xx-xx-TS-COTR.0044
Title	Undo Assume Processing
Requirement	The SI that is doing an Undo Assume shall : <ul style="list-style-type: none"> • Re-assess if the Negotiation Phase should be started at its entry crossing, and • Indicate that the frequency-transfer has not yet been instructed at its entry crossing, <i>and</i> • Set the name of the controlling SI to the one before this assume.
Status	<In Progress>
Maturity Level	TRL2
Rationale	This requirement is needed to define the FO changes linked to undo of the assumption
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	xx
<ALLOCATED_TO>	<Enabler>	xx
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-COTR.0038
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-COTR.0039
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

Note: Undo assume can be performed manually only. There is no LoA corresponding to this. Once the undo assume has been performed, both ATCOs must be aware of this action. The mechanism to do this is local and out of scope of IOP.

...

Undo Request On Frequency

[REQ]

Identifier	REQ-xx-xx-TS-COTR.0151
Title	Availability conditions for ROF cancel input
Requirement	A system Instance that initiated a request of frequency shall be able to cancel this request as long as the upstream unit did not instruct the frequency change.
Status	<In Progress>
Maturity Level	TRL2
Rationale	This requirement is needed to define when cancel of request on frequency is possible.

	ICD note: the attribute transferStatus is changed from REQUESTED TO NOT_STARTED.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	xx
<ALLOCATED_TO>	<Enabler>	xx
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-COTR.0105
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

Requesting back the frequency change to the former controlling unit (Reclaim)

[REQ]

Identifier	REQ-xx-xx-TS-COTR.0041
Title	Reclaim processing
Requirement	When the previously controlling SI requests back a flight, the current controlling SI shall set the reclaim information in the FO for its entry crossing.
Status	<In Progress>
Maturity Level	TRL2
Rationale	This requirement is needed to allow the reclaim of a flight. Local processing should ensure : grant access to the Reclaim of a flight to the transferring sector of the immediately previous controlling SI
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	xx
<ALLOCATED_TO>	<Enabler>	xx
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-COTR.0045
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

[REQ]

Identifier	REQ-xx-xx-TS-COTR.0109
Title	No Reclaim eligibility after transfer to second controller in downstream SI
Requirement	The SI shall indicate in the FO when for its entry crossing that from now on a reclaim is no longer possible.
Status	<In Progress>
Maturity Level	TRL2
Rationale	Condition for acceptability of reclaim TRL2 pending OPS feedback about other reason to close possibility to reclaim a flight (a duration for example).
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	xx
<ALLOCATED_TO>	<Enabler>	xx
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-COTR.0047
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

Reclaim is a request to get back the flight. The next step would be that the controlling SI instructs the pilot to contact the previous SI and then this SI confirms the contact back with the pilot by an assume action.

[REQ]

Identifier	REQ-xx-xx-TS-COTR.0121
Title	COF manual input in a reclaim context
Requirement	On frequency transfer input toward the upstream SI, following a reclaim, the FDMP shall indicate in the FO that the frequency transfer has been instructed and remove the reclaim indication for this SI transition.
Status	<In Progress>
Maturity Level	TRL2
Rationale	This requirement is needed to allow a frequency change
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	xx
<ALLOCATED_TO>	<Enabler>	xx
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-COTR.0049
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

...

UNDO Force-Assume

The SI who has stolen the flight is allowed to undo the force assume before the previous controlling SI has acknowledged the force assume.

[REQ]

Identifier	REQ-xx-xx-TS-COTR.0049
Title	Undo Force Assume input
Requirement	When requested to undo a force assume, the SI shall : <ul style="list-style-type: none"> - Set the SI whom the flight was stolen as the new controlling SI, and - Reset the stolen information.
Status	<In Progress>

Maturity Level	TRL2
Rationale	This requirement is needed to allow the undo of a force assumption of a flight. It is done by the SI that stole the flight.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	xx
<ALLOCATED_TO>	<Enabler>	xx
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-COTR.0059
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-COTR.0159
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Coordination and Transfer Data

G.3.3 Flight Script Management

Flight Script Definition

FS Current Assigned Data

REQ-18-02b-TS-FSMG.0003 partially satisfies also the following FULL IOP INTEROP requirements:

<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-FSMG.0027
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-FSMG.0032
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-FSMG.0038

FS Expanded Route

Managing the Expanded Route

REQ-18-02b-TS-FSMG.0061 partially satisfies also the following FULL IOP INTEROP requirements:

<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-FSMG.0006
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-FSMG.0007
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-FSMG.0089

FS Constraints

Constraints Attributes

REQ-18-02b-TS-FSMG.0009 satisfies also partially the following FULL IOP INTEROP requirements:

<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-FSMG.0020
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-FSMG.0021
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-FSMG.0022
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-FSMG.0023
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-FSMG.0038
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-FSMG.0042
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-FSMG.0044
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-FSMG.0088
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-FSMG.0030

<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-FSMG.0031
-------------	--------------------	--------------------------------

Constraints Linkage

There are individual constraints that may be considered by some systems as only applicable when they are linked to another. As for example, the ROCD may need to be linked to a level constraint. Whenever these systems provide these bounded constraints, they identify one of them as the “master constraint” and the associated ones are linked through a master link identifier.

Notice that the link is established by the owner of the constraint upon inserting it in the flight script. Other IOP stakeholders that do not require such a link will not establish it when inserting the constraints in the Flight Script FO. It is up to the receiver of the constraints to establish the link locally when needed.

Another example of this linkage usage is when it is required to create ‘sub-constraints’ associated to a master constraint to describe in a more precise way how the master constraint must be implemented. For instance, a TFL could be associated to one or more level constraints to describe level step to follow before reaching the TFL.

In any case, when the master constraint is removed, the linked ones are to be removed as well, or the links need to be removed at least, to keep the constraints set consistent.

The optional removal of the linked constraints, or alternatively the links, depends on the double kind of constraint linkage:

- **Technical:** a set of constraint linked to a master one represent the way a SI implements the target constraint by a set of ‘manoeuvre’s’ defined by the linked constraints. In this case the removal of the master constraint would bring to the removal of the linked constraint, under the responsibility of the SI that requested the linked constraints.
- **Operational:** a constraint can be linked to another one for operational reasons, such as a VRCD linked to a CFL, a level constraint linked to a CFL, ... For these cases the removal of the linked constraint or of the constraint link will be managed on a case to case basis.

The responsibility to synchronize the status (accepted/rejected) of the linked constraints to the master one is in charge to the SI that requested the linked constraints.

[REQ]

Identifier	REQ-xx-xx-TS-FSMG.0126
Title	Removal of linked constraints
Requirement	In case a SI removes a master constraint, the requestor of the linked constraint shall either remove any constraint linked to it, or remove the link reference in any linked constraint.
Status	<In Progress>
Maturity Level	TRL2
Rationale	Linked constraints linked to a master constraint are used to provide a better profile of the computed trajectory for the master constraint. They have no meaning ones the master constraint is removed. Inconsistent linked constraints (e.g. linked to a no more existing master constraint) must not be applied.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	xx
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-FSMG.0038
<ALLOCATED_TO>	<Enabler>	xx
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl
<ALLOCATED_TO>	<Function>	Manage Flight Script

G.3.4 Crossed and Control Sequence Management

Operational Qualifier Usage

Skip Mechanism

[REQ]

Identifier	REQ-xx-xx-TS-SEQM.1023
Title	FDMP implementation of a partial skip
Requirement	When implementing a partial entry or exit skip, the FDMP shall : <ul style="list-style-type: none"> • create a new occurrence of this skipped SI between skipping and originally existing to-be-skipped SI, • indicate the SI by whom this new SI occurrence will be controlled, • indicate the new SI occurrence as SKIPPED, • update the previous coordination data between the skipping SI and skipped SI occurrence as INVALID, • create the new coordination between the skipping SI and the corresponding downstream or upstream SI, • set the origin of the skip (manual/automatic), and • set the provided release(s).
Status	<In Progress>

Maturity Level	TRL2
Rationale	This requirement is needed to address the control sequence change and coordination data update in case of partial skip.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	xx
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0040
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0052
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-SEQM.0086
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-SEQM.0087
<SATISFIES>	<ATMS Requirement>	REQ-18-02b-SPRINTEROP-SEQM.0098
<ALLOCATED_TO>	<Enabler>	xx
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

Delegation Mechanism

REQ-18-02b-TS-SEQM.1024 partially satisfies also the following FULL IOP INTEROP requirements:

<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-SEQM.0003
-------------	--------------------	--------------------------------

Confirmation management in case of Skip:

All the SI occurrences resulting from a partial skip of a confirmed SI becomes automatically confirmed.

[REQ]

Identifier	REQ-xx-xx-TS-SEQM.1048
Title	Confirmation management in case of partial skip
Requirement	When implementing a partial skip of a confirmed SI, the FDMP shall set each newly created occurrence to CONFIRMED.
Status	<In Progress>
Maturity Level	TRL2
Rationale	This requirement is needed to address the management of confirmation tag in case of skip.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	xx
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<ALLOCATED_TO>	<Enabler>	xx
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

Automatic delegation limitation

The automatic delegation is only possible if it is specified in a letter of agreement. To avoid loop, a un-delegatee SI cannot be delegated again automatically.

[REQ]

Identifier	REQ-xx-xx-TS-SEQM.1028
Title	Automatic delegation limitation
Requirement	The FDMP shall reject the automatic delegation of an SI occurrence if the latter is indicated as undelegated.
Status	<In Progress>
Maturity Level	TRL2
Rationale	This requirement ensures that the FDMP implements a delegation request from an FDC. The automatic requests are based on LoAs. Once undelegated, an automatic request should not be tried to delegate a flight again to the "undelegated" SI. This is the real use of keeping the undelegated status. The manual request can either be accepted or rejected depending on the local situations.
Category	<Interoperability>

[REQ Trace]

Relationship	Linked Element Type	Identifier
<ALLOCATED_TO>	<SESAR Solution>	xx
<ALLOCATED_TO>	<Functional block>	G/G IOP Management
<SATISFIES>	<ATMS Requirement>	REQ-XX-XX-SPRINTEROP-SEQM.0065
<ALLOCATED_TO>	<Enabler>	xx
<ALLOCATED_TO>	<Function>	Manage Distribution Crossed and Controlling List
<ALLOCATED_TO>	<Service>	ATCFLightObjectControl

Appendix H Protocol Failure Analysis

A failure analysis has been performed for each requirements of this specifications. For each requirements it has been described what can go wrong in case the system does not behave as specified and what is the mitigation. This analysis was used to make sure that the specification is complete and where necessary requirements have been adapted or new requirements added. It remains an action for few number of requirements, for creation of a new requirements or further analysis at the level of the ATC System, or directly in the IOP layer. These requirements are identified by a “Y” in “Requirement Required” column of bellow attached Excel sheet.

All described technical failures have been categorised in Operational Safety impact (OPS Grouping column in attached Excel sheet) together with the Safety Expert. The result of this work (attached bellow) has been used as an input for the Safety Assessment documented in the PJ-18.02b INTEROP (Cf. [33]).



IOP- Protocol

Assessment result is in this Excel file: Failures analysis - TS ,



Appendix I Cost Benefit Analysis

The result of the Cost and Benefit Analysis performed on the PJ.18-02b solution is provided as annex to this TS document:



PJ18-02b_CBA_v24.d
ocx

Appendix J Requirements Definitions Guidance

J.1 General Guidance

ED-133 [23], Sesar1 P05.05.01.D846 deliverable, [25] and Sesar1 10.02.05.D55 – IOP_ATC_System_Requirements [26] are the main input for IOP technical specifications. Most of concepts have been described with the reference to the Flight Object specification derived from ICOG I&II work [35].

The IOP functional requirements have been organized by the following decomposition:

- General Mechanism
- Coordination and Transfer
- Flight Script management
- What- if Flight Object
- Trajectory management
- Informative Distribution and Data Filtering
- System Wide Information Management
- Other Requirements

J.2 Naming Convention

The following requirements naming convention is used in this TS. The 4 letters descriptor (e.g. COTR) is coordinated with INTEROP document.

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

Topic	Requirement Id
Coordination and Transfer	REQ-18-02b-TS- COTR .000x
FO Flight Script management	REQ-18-02b-TS- FSMG .000x
Informative distribution between systems	REQ-18-02b-TS- INFO .000x
Control sequence handling	REQ-18-02b-TS- SEQM .000x
SSR codes	REQ-18-02b-TS- SSRC .000x
FO mechanism - general	REQ-18-02b-TS- MECH .000x
FO mechanism - WIFO	REQ-18-02b-TS- WIFO .000x
FO mechanism - SWIM	REQ-18-02b-TS- SWIM .000x
Scope and management of FO trajectory	REQ-18-02b-TS- SCTJ .000x
Arrival and departure management	REQ-18-02b-TS- ADMG .000x
Original FP data	REQ-18-02b-TS- FPMG .000x

Safety	REQ-18-02b-TS-SAFE.000x
--------	-------------------------

J.3 Requirements development style

The requirements developed in this TS are intended to support the IOP protocol. The sections are strongly related among them nevertheless, several partners were involved in their development. So it is necessary to establish common rules to grant a similar level of detail and coherency through the whole document. These rules are additional to the requirements development guideline provided in SESAR. The proposed rules are going to be presented in the following points:

1. Requirements should be testable
2. Local behaviour is not included in the requirements.

The requirements should only describe the information exchanged through the FO data model and the intended use of such information whenever its use is mandatory to any IOP stakeholders. The FO contains several structures of flight related information, but if such information does not have a common and mandatory process to be followed by all the stakeholders, that information should not be included within a requirement. Note that the available content of the FO is defined at FO model which complements the provided requirements.

The requirements should not force local implementations of functionalities that are not required by a stakeholder.

The fact that the FDMP SI **shall** support (at FOS level) functionalities that are not implemented by the local SI should be stated explicitly. It was decided to refer to SI in the requirements, meaning that the requirement may affect to FDP layer, FOs or both. It will be a local decision. Any requirement that affects FDP affects FOS as well otherwise it should not be defined in the common TS.

Sometimes, there could be recommendations or description of logical behaviours on the processing on information received via the FO but if such processing is not mandatory (it does not directly affects to other IOP stakeholder) then it should be described within a note or paragraph outside the requirements.

Example: The reception of a notification of an error processing a service request should not establish a requirement that forces the processing of that error locally. That is, there should not be requirements stating that the error **shall** be logged (It does not mean anything to the other IOP stakeholders). The concrete processing is to be defined locally.

Nevertheless, when a “concrete” error is defined and such error forces the receiver to declare it-self de-synchronized, then such processing should be defined in a requirement since other stakeholders should be aware of such behaviour.

3. SI Role

It is not needed to identify systematically the role of the SI that is performing a function. Only whenever it provides added value. Example: The SI **shall** set “Information” whenever... If a requirement is written like that then at ICD description (notes/rationale), we describe how it is done when we are FDMP (publish) and whenever we are FDC (request to FDMP). The service description at ICD will clarify how the service is to be implemented. We will only refer to FDMP/FDC/FDU roles whenever the above approach does not support the intended target.

4. Requirement and ICD

Together the requirement plus the note in the rational **shall** be enough to understand what is to be updated, provided, (and how) in the data structures.

5. The requirements are technical and cannot be used to define an operational concept.

TS requirements define the data (and its use) that is to be distributed between IOP stakeholders to accomplish a concrete operational functionality. These requirements are to be supported by the set of operational requirements that define its need within IOP. That is, requirements that define a system behaviour that affects the controller way of working should not be included unless they are supported by the corresponding operational requirements.

Example: A technical requirement to distribute the TFL should be based on an operational requirement that is clearly establishing this need. A requirement that establish the distribution of operational data without a complementary one that establishes the use of that data may not be complete.

J.4 Examples of requirement issues and suggested style

The following former requirement was aiming to grant that the SKIP functionality is supported at IOP level by any IOP stakeholder regardless their operational need/deployment of the “skip itself” functionality.

An SI (A) traversed by the flight shall be able to propose to skip itself (A) in the SI control sequence, in favour of its upstream or downstream SI.

The problems are the following:

- This requirement is not testable since there is no way to identify the set of functionalities that have to be verified to consider this requirement passed.
- SI in the current definition does refer to the whole SI (regardless the layer that is responsible for its implementation) and the current wording forces every IOP partner to implement the capability to SKIP itself.
- It is not possible to understand what is to be done to implement the requirement without a concrete explanation of the ICD usage (Which attributes are going to be used, when, what is the actual process that is to be used... in this case the SKIP functionality is linked with a dialog which according to the general principle is to be handled with a WIFO

J.4.1 Proposed workaround for each of the above problems.

Each of the above issues should be solved and at the same time we need to preserve its original target. Notice that the target is only understood for the people that were involved in the discussions, an external reader is not able to understand it.

To solve problem 3: FDMP should support the use of IOP functionalities that are not locally implemented.

Include the two following general requirements to cover the functionalities that are to be implemented by the FDMP.

“the FDMP **shall** implement any service request coming from an FDC as long as the service is provided with the agreed semantic and syntactic checks for that service”

“the FDMP **shall** preserve in the FO any data update that is not locally used but was provided by another IOP stakeholder”

Agreed way to write requirements to tackle issues 2 & 3:

- When we are describing a functionality that is mandatory to be implemented for the IOP to work we will use the following style: The SI **shall** do this when.....
- When the requirement is describing a functionality that is to be implemented upon local decision the requirement will be written in the following way: Upon request to do something the SI **shall** update this, and this.... Note: As FDMP we **shall** support any service requested by an FDC to update the FO that is, at FO level all the functionalities are to be supported by any SI.

To solve remaining issues, it is suggested the following approach:

Use the following style. (Note that the following reqs are an example that is only aiming to suggest the style, the wording can be improved)

Req 1:

“The FOS of a system that intends to be skipped **shall** request to SKIP itself downstream by asking downstream”

ICD Notes: Asking is implemented by creating a new WIFO with the attribute X set to value and the attribute Y to values....

Req 2:

“The FOs of a system that intends to be skipped **shall** request to SKIP itself upstream by asking the upstream”

ICD Notes: XXXXXXXX

Req 3:



“The SIs that receives a request to assume the AoR of a skipped SI **shall** accept or reject the proposal”

ICD Notes: This is done by the WIC of a WIFO by executing the service X with the value Y. If the WIMP is not the FDMP then it has create service request to the FDMP to update the attribute Z with,...

- Above requirements are testable (they are already outlining the process,.. a request and response...)
- The use of FOS layer whenever it is a pure FO functionality or SI when there is a clear “local business” logic decouples the need to implement a functionality with the fact that the FOS does something when it is requested to do so.
- The two generic requirements forces the FDMP to support (at FOS level) functionality that is not locally implemented.
- The ICD notes allows to provide this document to developers so they will now what to implement (and later on write the ICD requirements in a proper way)





-END OF DOCUMENT-

