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PJ18 4DTM

4D TRAJECTORY MANAGEMENT

Abstract

This document contains the report of the TRL6 technical validation activities that were undertaken in the context of SESAR 2020 PJ18-02b for basic Flight Object Interoperability (FO IOP).

Even though, the focus laid on the validation of the technical requirements, the operational experts assessed the potential and confirmed the overall acceptability of the FO IOP concept for certain topics.

The validation objectives' success criteria and technical requirements were validated either by means of RTS or by means of expert judgement.

The solution 18-02b has reached TRL6.

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1 Executive summary

Solution PJ18-02b in general aimed at maturing FO IOP up to TRL6 for basic FO IOP[1] scope focusing on ENR-ENR and TMA aspects.

Technical validation exercises for basic FO IOP were:

- **EXE-18-02b-TRL6-001_IOP (EXE-IOP-01)**
  This validation exercise aimed to validate the operational concept and the technical requirements for basic FO IOP under nominal conditions in en-route airspace by means of Real Time Simulations (RTS).

- **EXE-18-02b-TRL6-002_IOP (EXE-IOP-02)**
  This validation exercise aimed to validate the basic FO IOP technical requirements additionally under non-nominal conditions and with further use cases and enlarged traffic scenarios by means of RTS.

- **EXE-18-02b-TRL6-003_IOP (EXE-IOP-03)**
  This validation exercise aimed to validate the basic FO IOP use cases and technical requirements, that were not validated in the before mentioned RTS exercises, by means of expert judgement. It was conducted in parallel to the RTS exercises.

Even though, anomalies existed during the conduct of the RTS validation exercises, the ATCOs and operational experts were able to assess the FO IOP concept and confirmed its overall acceptability concerning the following topics:

- Improvement of IOP over OLDI (current system);
- Increased situation awareness;
- Seamless operations (for instance change of route spanning several centres);
- Expectations that Conflict Detection & Resolution tools will benefit from IOP data.

Further, the experts were able to validate the use cases and technical requirements for basic FO IOP.

The maturity of the basic FO IOP technical requirements in scope has reached TRL6.

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[1] Requirements considered necessary to be compliant to the PCP.

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2 Introduction

2.1 Purpose of the document

Solution 18-02b in general aimed at maturing FO IOP up to TRL6 for basic FO IOP scope focusing on ENR-ENR and TMA aspects.

The solution delivered the stakeholder's needs defined and formalised as a set of operational (INTEROP [6]) and technical requirements (TS and IRS [7]), and of operational and technical use cases.

The Technical Validation Plan (TVALP) [8] describes how to validate basic FO IOP by means of

- Real Time Simulations (RTS) in the granted validation exercises EXE-18-02b-TRL6-001_IOP (abbreviated: EXE-IOP-01) and EXE-18-02b-TRL6-002_IOP (EXE-IOP-02) and

- expert judgement in validation exercise EXE-18-02b-TRL6-003_IOP (EXE-IOP-03)

The present technical validation report documents the results of the exercises described in the TVALP.

2.2 Intended readership

The intended readership for the technical validation plan is as follows:

- PJ18-02b Team

- PJ19-02 Management Staff

- PJ19-04 Management Staff

2.3 Background

The PJ18-02b work built upon the FO IOP work executed during the SESAR 1 programme in the WP03, WP04.03, WP04.05/05.05.01, WP10.02.05 and WP14.09.02.

In SESAR 1 FO IOP validation activities for solution #28 were matured to TRL4. Work helping to ensure a higher maturity during SESAR 2020 started in the transition phase between SESAR 1 and SESAR 2020 already.

Solution 18-02b considered as much as possible the recommendations and lessons learnt from validation reports of SESAR 1 validation exercises EXE-04.03-VP-022 [3], EXE-04.03-VP-711 [4] and EXE-04.03-VP-841 [5] in order to improve the situation in SESAR 2020.

The present *SESAR 2020 18-02b-TRL6-TVALR* updates the intermediate deliverable D3.3.075 *SESAR 2020 18-02b-TRL6-TVALR after IOP#1 [9]*.

2.4 Structure of the document

The document is composed of the following main sections:

- Section 3 describes the IOP technical validation context.
- Section 4 describes the consolidated technical validation results.
- Section 5 contains conclusions and recommendations.
- Section 6 provides references to main documentation.
- Appendices A to C contain the detailed reports of the validation exercises.

2.5 Glossary of terms

Term	Definition	Source of the definition
Basic FO IOP	Requirements considered necessary to be compliant to the PCP.	SESAR 2020 PJ18-02b – Intermediate TS/IRS [7]
Build	Incremental software builds for FO IOP prototypes with defined functionalities	SESAR 2020 18-02b-TRL6 – Final TVALP [8]
Factory Readiness Test	Review of factory test with ANSP witnesses at industry premises.	SESAR 2020 18-02b-TRL6 – Final TVALP [8]
Integrated Factory Test	Test of interconnected prototypes at industry premises conducted by industry	SESAR 2020 18-02b-TRL6 – Final TVALP [8]
Integration Test	Test of interconnected IBPs at ANSP premises conducted by industry	SESAR 2020 18-02b-TRL6 – Final TVALP [8]
Operational Acceptance	Operational acceptance after final operational dry run of a validation exercise. The availability note has to be delivered at this milestone.	SESAR 2020 18-02b-TRL6 – Final TVALP [8]
Operational Dry Run	Dry run with operational experts / ATCOs to assure the operational aspects and use cases for a validation exercise	SESAR 2020 18-02b-TRL6 – Final TVALP [8]
Technical Acceptance	Technical acceptance after the final technical dry run of a validation exercise. The initial availability note has to be delivered at this milestone.	SESAR 2020 18-02b-TRL6 – Final TVALP [8]
Technical Dry Run	Dry run with simulator and test scenarios	SESAR 2020 18-02b-TRL6 – Final TVALP [8]
Technical Validation Report	Assessment of the validation exercise	SESAR 2020 18-02b-TRL6 – Final TVALP [8]

Term	Definition	Source of the definition
Unscripted Operational Assessment	OPS experts to assess the operational aspects of a build by testing the operational use cases in an unscripted way with a medium size scenario.	SESAR 2020 18-02b-TRL6 – Final TVALP [8]

Table 1: Glossary of terms

2.6 Acronyms and Terminology

Term	Definition
*	Test is significant
AIM	Aeronautical Information Management
AIRAC	Aeronautical Information Regulation and Control
ANSP	Air Navigation Service Provider
AoI	Area of Interest
AoR	Area of Responsibility
ATC	Air Traffic Control
ATCO	Air Traffic Controller
ATM	Air Traffic Management
CAP	Controller Awareness Phase
CWP	Controller Working Position
EATMA	European Air Traffic Management Architecture
ED	EUROCAE Document
eDEP	Early Demonstration & Evaluation Platform
ENR	En-route
E-OCVM	European Operational Concept Validation Methodology
EUROCAE	European Organization for Civil Aviation Equipment
EXE-IOP-01	EXE-18-02b-TRL6-001_IOP
EXE-IOP-02	EXE-18-02b-TRL6-002_IOP
EXE-IOP-03	EXE-18-02b-TRL6-003_IOP

Term	Definition
FDMP	Flight Data Manager Publisher
FDPS	Flight Data Processing System
FO	Flight Object
FOM	Flight Object Management / Manager
GA	Grant Agreement
GAT	General Air Traffic (civil)
IBP	Industry-Based Platform
iCAS	iTEC Centre Automation System
ICD	Interface Control Document
IFPL	Individual Flight Plan message
IFPS	Integrated Initial Flight Plan Processing System
IFR	Instrument Flight Rules
INTEROP	Interoperability Requirements
IOP	Interoperability
IOP TVALP	Collective abbreviation for SESAR 2020 18-02b-TRL6 - Initial TVALP for IOP#1 [8] and SESAR 2020 18-02b-TRL6 - Initial TVALP for IOP#2
IRS	Interface Requirements Specification
iTEC	Interoperability Through European Collaboration
MANTIS	Eurocontrol Anomaly Reporting Tool
n.s.	Test is not significant
NM	Network Manager
NOK	The validation result does not match the specification.
NOT	The validation has not been performed.
NP	Negotiation Phase
OA	Operational Acceptance
OAT	Operational Air Traffic

Term	Definition
ODR	Operational Dry Run
OK	The validation result matches the specification.
OLDI	On-Line Data Interchange
OSED	Operational Service and Environment Definition
PENS	Pan-European Network Service
PMP	Project Management Plan
RBT	Reference Business Trajectory
RDPS	Radar Data Processing System
RTS	Real Time Simulation
SAP	System Awareness Phase
SESAR	Single European Sky ATM Research Programme
SJU	SESAR Joint Undertaking (Agency of the European Commission)
SPR	Safety and Performance Requirements
SUT	System Under Test
SVS	Shared Virtual Sky
SWIM	System-Wide Information Management
TA	Technical Acceptance
TBO	Trajectory Based Operations
TDR	Technical Dry Run
TMA	Terminal Manoeuvring Area
TRL	Technology Readiness Level
TS	Technical Specification
TVALP	Technical Validation Plan
TVALR	Technical Validation Report
UAC	Upper Area Control Centre
UC	Use Case

Term	Definition
UNCLEAR	The validation result is ambiguous. In some occurrences the result was OK, in some it was NOK.
V&V	Validation and Verification
V&VI	V&V Infrastructure
VALS	Validation Strategy
VFR	Visual Flight Rules
VPN	Virtual Private Network

Table 2: Acronyms and terminology

3 Context of the Technological Validation

3.1 SESAR Technological Solution 18-02b: a summary

The following enablers applied for the validation exercises in the frame of solution PJ.18-02b[2]:

SESAR Technological Solution ID	SESAR Technological Solution Description	Master or Contributing (M or C)	Contribution to the SESAR Solution short description	Enabler ref. (from EATMA)
PJ.18-02b — 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.	M	N/A	POI-0016-IS: • ATC-STD-01 • ER APP ATC 160a • ER ATC 176 • SVC-035 • SWIM-APS-05a • SWIM-INFR-01a POI-0016-IS: • APP ATC 177 ATC-STD-01

Table 3: SESAR technological solution under validation

Note:

> *For enabler ATC-STD-01 only the ATSU/ATSU interoperability is in scope of the TVALP. The ATSU/NM interoperability is out of scope. A change request asking to split the solution 18-02b accordingly has been initiated by the solution lead.*

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[2] According to eATM Portal DS 21 Draft retrieved on 12th of November 2020.

3.2 Summary of the Technological Validation Plan

3.2.1 Validation Plan Purpose

The TVALP [8] describes how the solution 18-02b was going to be validated by means of the technical validation exercises EXE-18-02b-TRL6-001_IOP, EXE-18-02b-TRL6-002_IOP and EXE-18-02b-TRL6-003_IOP.

The purpose of the technical validation exercises was to validate that the technical requirements are fit for purpose i.e. that they are meaningful and complete considering the development and target architecture for the standardisation, industrialisation and deployment.

As a side effect, the operational experts could stabilise the operational use cases and requirements as defined in the INTEROP [6].

The flight object is an enabler for Trajectory Based Operations (TBO) that aims to achieve that ANSPs will be able to create, maintain and share a common 4D trajectory (called Reference Business Trajectory (RBT) in the SESAR target concept) for every single flight throughout the execution phase. The flight object provides a consistent view of the predicted 4D trajectory of each flight and it considers all applicable ATC constraints and some airspace user preferences.

Flight Object Interoperability (FO IOP) activities technically validated in solution 18-02b are an evolution of SESAR 1 solution #28 and a continuation of validation activities conducted in SESAR 1.

The main purpose of the technical validation activities concerning FO IOP in the context of SESAR 2020 programme was to reach TRL6 in order to be ready for the standardisation, industrialisation and deployment.

The following figure shows how 18-02b covered the IOP Scope:

Figure 1: IOP Scope coverage by 18-02b

Basic FO IOP validation exercises were based on input delivered by tasks of technological solution PJ18-02b such as:

- INTEROP [6] document comprising operational requirements and use case definitions for FO IOP

- Technical Specification (TS) and Interface Requirement Specification (IRS) [7] derived from the INTEROP

- System prototypes delivered by the industry partners that implemented the TS/IRS in several builds[3] and that were integrated at ANSP IBPs

- TVALP [8]

FO IOP validation activities in SESAR 1 aimed to validate the EUROCAE Document ED-133 "Flight Object Interoperability Specification". Thus, there has been a strong link to standardisation activities in the context of this technological solution. The results, i.e. the validated technical requirements, are an important input for EUROCAE WG-59 responsible for the revision of ED-133 [13].

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[3] Incremental software builds for FO IOP prototypes with defined functionality.

While in SESAR 1 the validation of seamless coordination in en-route environment was based on non-regression of OLDI functionalities, the technical validation exercises of SESAR 2020 PJ.18-02b were based on a new FO IOP concept that was developed by the analysis team and aimed to reach TRL6.

Validation Exercises EXE-IOP-01 and EXE-IOP-02

As validation technique for EXE-IOP-01 and EXE-IOP-02 served real time simulations with human in the loop (ATCOs or operational experts) on distributed Industry-Based Validation Platforms (IBPs) that were interconnected by SWIM blue profile services via PENS/NewPENS to achieve flight object sharing.

During the FO IOP validations, various scenarios were executed in order to facilitate the defined use cases.

In current operations, each ACC builds its own 4D trajectory for a flight within its area of interest (AoI) based on the individual flight plan message (IFPL) received from the Integrated Initial Flight Plan Processing System (IFPS) before the flight enters the execution phase. Once the flight becomes airborne, each tactical intervention due to sector congestions, conflicts, delays, weather, etc. is typically not shared with all affected ACCs. This causes inconsistent 4D trajectories of the flight, which leads to an increased workload of the operational staff within the downstream ACCs, because they need to apply the changes they have missed during the coordination of the affected flights.

The flight object will enable a common 4D trajectory across all ACCs involved in a flight within the entire airspace of those ACCs. Each change to it will be shared in real time between all units involved. This will solve the problem of inconsistent 4D trajectories, and it will avoid the associated additional workload on the operational staff.

Basic FO IOP capabilities in the scope of the TVALP were validated in the upper airspace of the control centres of Karlsruhe[4], Maastricht, Reims (including Geneva and Zurich airspace) and Paduva (including Milan airspace) by using FO IOP equipped IBPs during several RTS trials.

Validation Exercises EXE-IOP-03

As validation technique for validation exercise EXE-IOP-03 served workshops, web conferences and an e-mail workflow process with operational and technical experts.

The following organisations took part in the validation exercises: COOPANS, DFS, DSNA, ENAIRE, ENAV, Eurocontrol, INDRA, LEONARDO, MUAC, NATS and THALES.

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[4] For the bilateral technical activity between ENAIRE and MUAC, ENAIRE used an iCAS prototype with Karlsruhe airspace adaptation.

3.2.2 Summary of Technological Validation Objectives and success criteria

Use cases that were developed accompanied by the INTEROP creation were used as success criteria for the validation objectives. The titles of the use cases mentioned in the success criteria can be looked up in Appendix D in the TVALP [8].

Technical validations of use cases were performed by means of RTS and/or expert judgement.

In the following [OBJ Suc] sections of the validation objectives the success criteria are formulated in the way "*The technical requirements associated to the UC#nnnn have been validated technically.*"

Possible results of a technical validation are:

- that the present technical requirements are fit for purpose.
- that it is known that and how the present technical requirements need to be revised.

[OBJ]

Identifier	OBJ-18.02b-TRL6-TVALP-001
Title	Coordination and Transfer
Objective	Validate coordination and transfer for basic FO IOP.
Category	<Technical Feasibility>
Key Environment Conditions	Nominal and non-nominal conditions, traffic sample 200 flights
TRL Phase	TRL6

[OBJ Trace]

Relationship	Linked Element Type	Identifier
<COVERS>	<SESAR Solution>	18-02b

[OBJ Suc]

Identifier	Success Criterion
CRT-18.02b-TRL6-TVALP-001.001	The technical requirements associated to UC#0101 have been validated technically.
CRT-18.02b-TRL6-TVALP-001.002	The technical requirements associated to UC#0102 have been validated technically.
CRT-18.02b-TRL6-TVALP-001.003	The technical requirements associated to UC#0103 have been validated technically.
CRT-18.02b-TRL6-TVALP-001.005	The technical requirements associated to UC#0105 have been validated technically.
CRT-18.02b-TRL6-TVALP-001.006	The technical requirements associated to UC#0106 have been validated technically.

CRT-18.02b-TRL6-TVALP-001.009	The technical requirements associated to UC#0109 have been validated technically.
CRT-18.02b-TRL6-TVALP-001.012	The technical requirements associated to UC#0112 have been validated technically.
CRT-18.02b-TRL6-TVALP-001.013	The technical requirements associated to UC#0113 have been validated technically.
CRT-18.02b-TRL6-TVALP-001.015	The technical requirements associated to UC#0115 have been validated technically.
CRT-18.02b-TRL6-TVALP-001.018	The technical requirements associated to UC#0118 have been validated technically.
CRT-18.02b-TRL6-TVALP-001.020	The technical requirements associated to UC#0120 have been validated technically.
CRT-18.02b-TRL6-TVALP-001.024	The technical requirements associated to UC#0124 have been validated technically.
CRT-18.02b-TRL6-TVALP-001.026	The technical requirements associated to UC#0126 have been validated technically.
CRT-18.02b-TRL6-TVALP-001.027	The technical requirements associated to UC#0127 have been validated technically.
CRT-18.02b-TRL6-TVALP-001.028	The technical requirements associated to UC#0128 have been validated technically.
CRT-18.02b-TRL6-TVALP-001.033	The technical requirements associated to UC#0133 have been validated technically.
CRT-18.02b-TRL6-TVALP-001.036	The technical requirements associated to UC#0136 have been validated technically.

Relationship	Linked Element Type	Identifier
<COVERS>	<SESAR Solution>	18-02b: FO IOP – Basic IOP
<COVERS>	<ATMS Requirement>	REQ-18-02b-TS-COTR.0001, REQ-18-02b-TS-COTR.0004, REQ-18-02b-TS-COTR.0008, REQ-18-02b-TS-COTR.0009, REQ-18-02b-TS-COTR.0010, REQ-18-02b-TS-COTR.0011, REQ-18-02b-TS-COTR.0016, REQ-18-02b-TS-COTR.0028, REQ-18-02b-TS-COTR.0029, REQ-18-02b-TS-COTR.0037, REQ-18-02b-TS-COTR.0038, REQ-18-02b-TS-COTR.0040, REQ-18-02b-TS-COTR.0047, REQ-18-02b-TS-COTR.0111, REQ-18-02b-TS-COTR.0120, REQ-18-02b-TS-COTR.0122, REQ-18-02b-TS-COTR.0130, REQ-18-02b-TS-COTR.0131, REQ-18-02b-TS-COTR.0135, REQ-18-02b-TS-COTR.0139, REQ-18-02b-TS-COTR.0140, REQ-18-02b-TS-COTR.0143, REQ-18-02b-TS-COTR.0149, REQ-18-02b-TS-COTR.0150, REQ-18-02b-TS-COTR.0152, REQ-18-02b-TS-COTR.0153, REQ-18-02b-TS-COTR.0154, REQ-18-02b-TS-COTR.0157, REQ-18-02b-TS-COTR.0158, REQ-18-02b-TS-COTR.0161, REQ-18-02b-TS-COTR.0162, REQ-18-02b-TS-COTR.0200, REQ-18-02b-TS-COTR.0201, REQ-18-02b-TS-COTR.0202, REQ-18-02b-TS-COTR.0205, REQ-18-02b-TS-COTR.0206, REQ-18-02b-TS-COTR.0207, REQ-18-02b-TS-FSMG.0001, REQ-18-02b-TS-FSMG.0003, REQ-18-02b-TS-FSMG.0004, REQ-18-02b-TS-FSMG.0009, REQ-18-02b-TS-FSMG.0028, REQ-18-02b-TS-FSMG.0061, REQ-18-02b-TS-FSMG.0076, REQ-18-02b-TS-FSMG.0084, REQ-18-02b-TS-FSMG.0086, REQ-18-02b-TS-FSMG.0120, REQ-18-02b-TS-FSMG.0129, REQ-18-02b-TS-FSMG.0155, REQ-18-02b-TS-INFO.1100, REQ-18-02b-TS-INFO.1120, REQ-18-02b-TS-INFO.1130, REQ-18-02b-TS-INFO.1140, REQ-18-02b-TS-INFO.1150, REQ-18-02b-TS-INFO.1160, REQ-18-02b-TS-INFO.1170, REQ-18-02b-TS-MECH.0008, REQ-18-02b-TS-MECH.0205, REQ-18-02b-TS-MECH.0207, REQ-18-02b-TS-MECH.0303, REQ-18-02b-TS-MECH.0305, REQ-18-02b-TS-MECH.0309, REQ-18-02b-TS-MECH.0315, REQ-18-02b-TS-MECH.0316, REQ-18-02b-TS-MECH.0319, REQ-18-02b-TS-MECH.0320, REQ-18-02b-TS-MECH.0336, REQ-18-02b-TS-MECH.0365, REQ-18-02b-TS-MECH.0375, REQ-18-02b-TS-MECH.0407, REQ-18-02b-TS-MECH.0408, REQ-18-02b-TS-SEQM.1014,

		REQ-18-02b-TS-SEQM.1020, REQ-18-02b-TS-SEQM.1041, REQ-18-02b-TS-SEQM.1042, REQ-18-02b-TS-SEQM.1044, REQ-18-02b-TS-SEQM.1070, REQ-18-02b-TS-SWIM.0028, REQ-18-02b-TS-SWIM.0030, REQ-18-02b-TS-WIFO.0001, REQ-18-02b-TS-WIFO.0005, REQ-18-02b-TS-WIFO.0007, REQ-18-02b-TS-WIFO.0016, REQ-18-02b-TS-WIFO.0017, REQ-18-02b-TS-WIFO.0027, REQ-18-02b-TS-WIFO.0028, REQ-18-02b-TS-WIFO.0029, REQ-18-02b-TS-WIFO.0031, REQ-18-02b-TS-WIFO.0032, REQ-18-02b-TS-WIFO.0033, REQ-18-02b-TS-WIFO.0037, REQ-18-02b-TS-WIFO.0038, REQ-18-02b-TS-WIFO.0040, REQ-18-02b-TS-WIFO.0041, REQ-18-02b-TS-WIFO.0042, REQ-18-02b-TS-WIFO.0043, REQ-18-02b-TS-WIFO.0046, REQ-18-02b-TS-WIFO.0048, REQ-18-02b-TS-WIFO.0049, REQ-18-02b-TS-WIFO.0052, REQ-18-02b-TS-WIFO.0057, REQ-18-02b-TS-WIFO.0058.

[OBJ]

Identifier	OBJ-18.02b-TRL6-TVALP-002
Title	Management of the FO Flight Script
Objective	Validate the management of the FO flight script for basic FO IOP.
Category	<Technical Feasibility>
Key Environment Conditions	Nominal and non-nominal conditions, traffic sample 200 flights
TRL Phase	TRL6

[OBJ Trace]

Relationship	Linked Element Type	Identifier
<COVERS>	<SESAR Solution>	18-02b

[OBJ Suc]

Identifier	Success Criterion
CRT-18.02b-TRL6-TVALP-002.001	The technical requirements associated to UC#0201 have been validated technically.
CRT-18.02b-TRL6-TVALP-002.010	The technical requirements associated to UC#0210 have been validated technically.
CRT-18.02b-TRL6-TVALP-002.014	The technical requirements associated to UC#0214 have been validated technically.
CRT-18.02b-TRL6-TVALP-002.024	The technical requirements associated to UC#0224 have been validated technically.
CRT-18.02b-TRL6-TVALP-002.026	The technical requirements associated to UC#0226 have been validated technically.
CRT-18.02b-TRL6-TVALP-002.028	The technical requirements associated to UC#0228 have been validated technically.

CRT-18.02b-TRL6-TVALP-002.031	The technical requirements associated to UC#0231 have been validated technically.
CRT-18.02b-TRL6-TVALP-002.034	The technical requirements associated to UC#0234 have been validated technically.
CRT-18.02b-TRL6-TVALP-002.035	The technical requirements associated to UC#0235 have been validated technically.
CRT-18.02b-TRL6-TVALP-002.040	The technical requirements associated to UC#0240 have been validated technically.
CRT-18.02b-TRL6-TVALP-002.043	The technical requirements associated to UC#0243 have been validated technically.
CRT-18.02b-TRL6-TVALP-002.044	The technical requirements associated to UC#0244 have been validated technically.
CRT-18.02b-TRL6-TVALP-002.045	The technical requirements associated to UC#0245 have been validated technically.

Relationship	Linked Element Type	Identifier
<COVERS>	<SESAR Solution>	18-02b: FO IOP – Basic IOP
<COVERS>	<ATMS Requirement>	REQ-18-02b-TS-COTR.0001, REQ-18-02b-TS-COTR.0002, REQ-18-02b-TS-COTR.0200, REQ-18-02b-TS-COTR.0201, REQ-18-02b-TS-COTR.0202, REQ-18-02b-TS-COTR.0204, REQ-18-02b-TS-FSMG.0001, REQ-18-02b-TS-FSMG.0002, REQ-18-02b-TS-FSMG.0003, REQ-18-02b-TS-FSMG.0004, REQ-18-02b-TS-FSMG.0006, REQ-18-02b-TS-FSMG.0009, REQ-18-02b-TS-FSMG.0010, REQ-18-02b-TS-FSMG.0011, REQ-18-02b-TS-FSMG.0017, REQ-18-02b-TS-FSMG.0018, REQ-18-02b-TS-FSMG.0028, REQ-18-02b-TS-FSMG.0029, REQ-18-02b-TS-FSMG.0030, REQ-18-02b-TS-FSMG.0032, REQ-18-02b-TS-FSMG.0038, REQ-18-02b-TS-FSMG.0046, REQ-18-02b-TS-FSMG.0047, REQ-18-02b-TS-FSMG.0050, REQ-18-02b-TS-FSMG.0051, REQ-18-02b-TS-FSMG.0054, REQ-18-02b-TS-FSMG.0056, REQ-18-02b-TS-FSMG.0061, REQ-18-02b-TS-FSMG.0064, REQ-18-02b-TS-FSMG.0068, REQ-18-02b-TS-FSMG.0069, REQ-18-02b-TS-FSMG.0071, REQ-18-02b-TS-FSMG.0072, REQ-18-02b-TS-FSMG.0073, REQ-18-02b-TS-FSMG.0074, REQ-18-02b-TS-FSMG.0076, REQ-18-02b-TS-FSMG.0077, REQ-18-02b-TS-FSMG.0080, REQ-18-02b-TS-FSMG.0081, REQ-18-02b-TS-FSMG.0082, REQ-18-02b-TS-FSMG.0083, REQ-18-02b-TS-FSMG.0084, REQ-18-02b-TS-FSMG.0086, REQ-18-02b-TS-FSMG.0087, REQ-18-02b-TS-FSMG.0088, REQ-18-02b-TS-FSMG.0106, REQ-18-02b-TS-FSMG.0107, REQ-18-02b-TS-FSMG.0121, REQ-18-02b-TS-FSMG.0122, REQ-18-02b-TS-FSMG.0124, REQ-18-02b-TS-FSMG.0125, REQ-18-02b-TS-FSMG.0129, REQ-18-02b-TS-FSMG.0133, REQ-18-02b-TS-FSMG.0135, REQ-18-02b-TS-FSMG.0136, REQ-18-02b-TS-FSMG.0137, REQ-18-02b-TS-FSMG.0139, REQ-18-02b-TS-FSMG.0140, REQ-18-02b-TS-FSMG.0143, REQ-18-02b-TS-FSMG.0149, REQ-18-02b-TS-FSMG.0150, REQ-18-02b-TS-FSMG.0151, REQ-18-02b-TS-FSMG.0152, REQ-18-02b-TS-FSMG.0153, REQ-18-02b-TS-FSMG.0160, REQ-18-02b-TS-FSMG.0161, REQ-18-02b-TS-FSMG.0162, REQ-18-02b-TS-MECH.0002, REQ-18-02b-TS-MECH.0306, REQ-18-02b-TS-MECH.0321, REQ-18-02b-TS-MECH.0344, REQ-18-02b-TS-MECH.0347, REQ-18-02b-TS-MECH.0360, REQ-18-02b-TS-MECH.0365, REQ-18-02b-TS-MECH.0398, REQ-18-02b-TS-MECH.0401, REQ-18-02b-TS-MECH.0403, REQ-18-02b-TS-MECH.0412, REQ-18-02b-TS-SCTJ.0107, REQ-18-02b-TS-SEQM.0100, REQ-18-02b-TS-SEQM.0101, REQ-18-02b-TS-SEQM.1001.

[OBJ]

Identifier	OBJ-18.02b-TRL6-TVALP-003
Title	Informative Distribution between System Instances
Objective	Validate the informative distribution between system instances for basic FO IOP.
Category	<Technical Feasibility>
Key Environment Conditions	Nominal and non-nominal conditions, traffic sample 200 flights
TRL Phase	TRL6

[OBJ Trace]

Relationship	Linked Element Type	Identifier
<COVERS>	<SESAR Solution>	18-02b

[OBJ Suc]

Identifier	Success Criterion
CRT-18.02b-TRL6-TVALP-003.001	The technical requirements associated to UC#0301 have been validated technically.
CRT-18.02b-TRL6-TVALP-003.004	The technical requirements associated to UC#0304 have been validated technically.
CRT-18.02b-TRL6-TVALP-003.006	The technical requirements associated to UC#0306 have been validated technically.

Relationship	Linked Element Type	Identifier
<COVERS>	<SESAR Solution>	18-02b: FO IOP – Basic IOP
<COVERS>	<ATMS Requirement>	REQ-18-02b-TS-COTR.0200, REQ-18-02b-TS-COTR.0201, REQ-18-02b-TS-COTR.0202, REQ-18-02b-TS-FSMG.0017, REQ-18-02b-TS-FSMG.0051, REQ-18-02b-TS-FSMG.0061, REQ-18-02b-TS-FSMG.0072, REQ-18-02b-TS-FSMG.0133, REQ-18-02b-TS-FSMG.0135, REQ-18-02b-TS-FSMG.0138, REQ-18-02b-TS-INFO.0016, REQ-18-02b-TS-MECH.0001, REQ-18-02b-TS-MECH.0002, REQ-18-02b-TS-MECH.0018, REQ-18-02b-TS-MECH.0201, REQ-18-02b-TS-MECH.0202, REQ-18-02b-TS-MECH.0312, REQ-18-02b-TS-MECH.0330, REQ-18-02b-TS-MECH.0331, REQ-18-02b-TS-MECH.0332, REQ-18-02b-TS-MECH.0336, REQ-18-02b-TS-MECH.0339, REQ-18-02b-TS-MECH.0340, REQ-18-02b-TS-MECH.0341, REQ-18-02b-TS-MECH.0344, REQ-18-02b-TS-MECH.0347, REQ-18-02b-TS-MECH.0348, REQ-18-02b-TS-MECH.0350, REQ-18-02b-TS-MECH.0360, REQ-18-02b-TS-MECH.0397, REQ-18-02b-TS-MECH.0398, REQ-18-02b-TS-MECH.0399, REQ-18-02b-TS-MECH.0410, REQ-18-02b-TS-MECH.0411, REQ-18-02b-TS-MECH.0413, REQ-18-02b-TS-SEQM.0100, REQ-18-02b-TS-SEQM.0101, REQ-18-02b-TS-SEQM.1001, REQ-18-02b-TS-SEQM.1003, REQ-18-02b-TS-SEQM.1004, REQ-18-02b-TS-SEQM.1005.

[OBJ]

Identifier	OBJ-18.02b-TRL6-TVALP-004
Title	FO protocol failures
Objective	Validate the FO protocol failures for basic FO IOP.
Category	<Technical Feasibility>
Key Environment Conditions	Non-nominal conditions, traffic sample 200 flights
TRL Phase	TRL6

[OBJ Trace]

Relationship	Linked Element Type	Identifier
<COVERS>	<SESAR Solution>	18-02b

[OBJ Suc]

Identifier	Success Criterion
CRT-18.02b-TRL6-TVALP-004.001	The technical requirements associated to UC#0401 have been validated technically.
CRT-18.02b-TRL6-TVALP-004.003	The technical requirements associated to UC#0403 have been validated technically.
CRT-18.02b-TRL6-TVALP-004.004	The technical requirements associated to UC#0404 have been validated technically.

Relationship	Linked Element Type	Identifier
<COVERS>	<SESAR Solution>	18-02b: FO IOP – Basic IOP
<COVERS>	<ATMS Requirement>	REQ-18-02b-TS-COTR.0047, REQ-18-02b-TS-COTR.0155, REQ-18-02b-TS-MECH.0307, REQ-18-02b-TS-MECH.0308, REQ-18-02b-TS-MECH.0310, REQ-18-02b-TS-MECH.0322, REQ-18-02b-TS-MECH.0344, REQ-18-02b-TS-MECH.0414, REQ-18-02b-TS-MECH.1001, REQ-18-02b-TS-MECH.1002, REQ-18-02b-TS-MECH.1003, REQ-18-02b-TS-MECH.1004, REQ-18-02b-TS-MECH.1005, REQ-18-02b-TS-MECH.1006, REQ-18-02b-TS-MECH.1007, REQ-18-02b-TS-MECH.1008, REQ-18-02b-TS-MECH.1015.

[OBJ]

Identifier	OBJ-18.02b-TRL6-TVALP-005

Title	Control Sequences Handling
Objective	Validate the control sequences handling for basic FO IOP.
Category	<Technical Feasibility>
Key Environment Conditions	Nominal and non-nominal conditions, traffic sample 200 flights
TRL Phase	TRL6

[OBJ Trace]

Relationship	Linked Element Type	Identifier
<COVERS>	<SESAR Solution>	18-02b

[OBJ Suc]

Identifier	Success Criterion
CRT-18.02b-TRL6-TVALP-005.001	The technical requirements associated to UC#0501 have been validated technically.
CRT-18.02b-TRL6-TVALP-005.003	The technical requirements associated to UC#0503 have been validated technically.
CRT-18.02b-TRL6-TVALP-005.004	The technical requirements associated to UC#0504 have been validated technically.
CRT-18.02b-TRL6-TVALP-005.006	The technical requirements associated to UC#0506 have been validated technically.
CRT-18.02b-TRL6-TVALP-005.010	The technical requirements associated to UC#0510 have been validated technically.
CRT-18.02b-TRL6-TVALP-005.018	The technical requirements associated to UC#0518 have been validated technically.
CRT-18.02b-TRL6-TVALP-005.021	The technical requirements associated to UC#0521 have been validated technically.
CRT-18.02b-TRL6-TVALP-005.022	The technical requirements associated to UC#0522 have been validated technically.

Relationship	Linked Element Type	Identifier
<COVERS>	<SESAR Solution>	18-02b: FO IOP – Basic IOP
<COVERS>	<ATMS Requirement>	REQ-18-02b-TS-COTR.0001, REQ-18-02b-TS-COTR.0008, REQ-18-02b-TS-COTR.0028, REQ-18-02b-TS-COTR.0029, REQ-18-02b-TS-COTR.0037, REQ-18-02b-TS-COTR.0047, REQ-18-02b-TS-COTR.0147, REQ-18-02b-TS-COTR.0200, REQ-18-02b-TS-COTR.0201, REQ-18-02b-TS-COTR.0203, REQ-18-02b-TS-COTR.0209, REQ-18-02b-TS-FSMG.0154, REQ-18-02b-TS-FSMG.0155, REQ-18-02b-TS-MECH.0304, REQ-18-02b-TS-SEQM.1006, REQ-18-02b-TS-SEQM.1007, REQ-18-02b-TS-SEQM.1008, REQ-18-02b-TS-SEQM.1009, REQ-18-02b-TS-SEQM.1010, REQ-18-02b-TS-SEQM.1011, REQ-18-02b-TS-SEQM.1015, REQ-18-02b-TS-SEQM.1016, REQ-18-02b-TS-SEQM.1018, REQ-18-02b-TS-SEQM.1019, REQ-18-02b-TS-SEQM.1022, REQ-18-02b-TS-SEQM.1024, REQ-18-02b-TS-SEQM.1025, REQ-18-02b-TS-SEQM.1027, REQ-18-02b-TS-SEQM.1029, REQ-18-02b-TS-SEQM.1030, REQ-18-02b-TS-SEQM.1033, REQ-18-02b-TS-SEQM.1034,

		REQ-18-02b-TS-SEQM.1036, REQ-18-02b-TS-SEQM.1037, REQ-18-02b-TS-SEQM.1041, REQ-18-02b-TS-SEQM.1042, REQ-18-02b-TS-SEQM.1043, REQ-18-02b-TS-SEQM.1044, REQ-18-02b-TS-SEQM.1047, REQ-18-02b-TS-SEQM.1051, REQ-18-02b-TS-SEQM.1060, REQ-18-02b-TS-SEQM.1061, REQ-18-02b-TS-SEQM.1062, REQ-18-02b-TS-SEQM.1063, REQ-18-02b-TS-SEQM.1064, REQ-18-02b-TS-SEQM.1065, REQ-18-02b-TS-SEQM.1066, REQ-18-02b-TS-SEQM.1068, REQ-18-02b-TS-SEQM.1115, REQ-18-02b-TS-SEQM.1116, REQ-18-02b-TS-SEQM.1117, REQ-18-02b-TS-SEQM.1118, REQ-18-02b-TS-SEQM.1119, REQ-18-02b-TS-SEQM.1120, REQ-18-02b-TS-SEQM.1121, REQ-18-02b-TS-SEQM.1122, REQ-18-02b-TS-SEQM.1123, REQ-18-02b-TS-SEQM.1124.

[OBJ]

Identifier	OBJ-18.02b-TRL6-TVALP-006
Title	IOP Recovery
Objective	Validate the IOP recovery for basic FO IOP.
Category	<Technical Feasibility>
Key Environment Conditions	Nominal and non-nominal conditions, traffic sample 200 flights
TRL Phase	TRL6

[OBJ Trace]

Relationship	Linked Element Type	Identifier
<COVERS>	<SESAR Solution>	18-02b

[OBJ Suc]

Identifier	Success Criterion	
CRT-18.02b-TRL6-TVALP-006.002	The technical requirements associated to UC#0602 have been validated technically.	
Relationship	Linked Element Type	Identifier
<COVERS>	<SESAR Solution>	18-02b: FO IOP – Basic IOP
<COVERS>	<ATMS Requirement>	REQ-18-02b-TS-MECH.0010, REQ-18-02b-TS-MECH.0012, REQ-18-02b-TS-MECH.0013, REQ-18-02b-TS-SWIM.0040, REQ-18-02b-TS-SWIM.0042, REQ-18-02b-TS-SWIM.0048, REQ-18-02b-TS-SWIM.0050, REQ-18-02b-TS-SWIM.0052, REQ-18-02b-TS-SWIM.0054.

[OBJ]

Identifier	OBJ-18.02b-TRL6-TVALP-008
Title	SSR Code Management
Objective	Validate the SSR code management for basic FO IOP.
Category	<Technical Feasibility>
Key Environment Conditions	Nominal and non-nominal conditions, traffic sample 200 flights
TRL Phase	TRL6

[OBJ Trace]

Relationship	Linked Element Type	Identifier
<COVERS>	<SESAR Solution>	18-02b

[OBJ Suc]

Identifier	Success Criterion
CRT-18.02b-TRL6-TVALP-008.001	The technical requirements associated to UC#0801 have been validated technically.
CRT-18.02b-TRL6-TVALP-008.005	The technical requirements associated to UC#0805 have been validated technically.
CRT-18.02b-TRL6-TVALP-008.007	The technical requirements associated to UC#0807 have been validated technically.

Relationship	Linked Element Type	Identifier
<COVERS>	<SESAR Solution>	18-02b: FO IOP – Basic IOP
<COVERS>	<ATMS Requirement>	REQ-18-02b-TS-SSRC.0005, REQ-18-02b-TS-SSRC.0006, REQ-18-02b-TS-SSRC.0009, REQ-18-02b-TS-SSRC.0010, REQ-18-02b-TS-SSRC.0011, REQ-18-02b-TS-SSRC.0012, REQ-18-02b-TS-SSRC.0013, REQ-18-02b-TS-SSRC.0014, REQ-18-02b-TS-SSRC.0015, REQ-18-02b-TS-SSRC.0016, REQ-18-02b-TS-SSRC.0017, REQ-18-02b-TS-SWIM.0046.

[OBJ]

Identifier	OBJ-18.02b-TRL6-TVALP-009
Title	FO Mechanism
Objective	Validate the FO Mechanism for basic FO IOP.
Category	<Technical Feasibility>

Key Environment Conditions	Nominal and non-nominal conditions
TRL Phase	TRL6

[OBJ Trace]

Relationship	Linked Element Type	Identifier
<COVERS>	<SESAR Solution>	18-02b

[OBJ Suc]

Identifier	Success Criterion
CRT-18.02b-TRL6-TVALP-009.005	The technical requirements associated to UC#0905 have been validated technically.
CRT-18.02b-TRL6-TVALP-009.006	The technical requirements associated to UC#0906 have been validated technically.

Relationship	Linked Element Type	Identifier
<COVERS>	<SESAR Solution>	18-02b: FO IOP – Basic IOP
<COVERS>	<ATMS Requirement>	REQ-18-02b-TS-MECH.0208, REQ-18-02b-TS-MECH.0209, REQ-18-02b-TS-MECH.0210, REQ-18-02b-TS-MECH.0323, REQ-18-02b-TS-MECH.0324, REQ-18-02b-TS-MECH.0398, REQ-18-02b-TS-WIFO.0054, REQ-18-02b-TS-WIFO.0055, REQ-18-02b-TS-WIFO.0056.

[OBJ]

Identifier	OBJ-18.02b-TRL6-TVALP-010
Title	Scope and Management of the FO trajectory
Objective	Validate the scope and management of the FO trajectory.
Category	<Technical Feasibility>
Key Environment Conditions	Nominal and non-nominal conditions
TRL Phase	TRL6

[OBJ Trace]

Relationship	Linked Element Type	Identifier
<COVERS>	<SESAR Solution>	18-02b

[OBJ Suc]

Identifier	Success Criterion
CRT-18.02b-TRL6-TVALP-010.001	The technical requirements associated to UC#1001 have been validated technically.
CRT-18.02b-TRL6-TVALP-010.002	The technical requirements associated to UC#1002 have been validated technically.

Relationship	Linked Element Type	Identifier
<COVERS>	<SESAR Solution>	18-02b: FO IOP – Basic IOP
<COVERS>	<ATMS Requirement>	REQ-18-02b-TS-COTR.0200, REQ-18-02b-TS-COTR.0201, REQ-18-02b-TS-FSMG.0001, REQ-18-02b-TS-FSMG.0017, REQ-18-02b-TS-FSMG.0051, REQ-18-02b-TS-FSMG.0061, REQ-18-02b-TS-FSMG.0072, REQ-18-02b-TS-FSMG.0135, REQ-18-02b-TS-FSMG.0143, REQ-18-02b-TS-FSMG.0144, REQ-18-02b-TS-FSMG.0145, REQ-18-02b-TS-FSMG.0160, REQ-18-02b-TS-FSMG.0161, REQ-18-02b-TS-FSMG.0162, REQ-18-02b-TS-FSMG.0163, REQ-18-02b-TS-FSMG.0164, REQ-18-02b-TS-FSMG.0165, REQ-18-02b-TS-MECH.0001, REQ-18-02b-TS-MECH.0002, REQ-18-02b-TS-MECH.0201, REQ-18-02b-TS-MECH.0202, REQ-18-02b-TS-MECH.0312, REQ-18-02b-TS-MECH.0330, REQ-18-02b-TS-MECH.0331, REQ-18-02b-TS-MECH.0344, REQ-18-02b-TS-MECH.0347, REQ-18-02b-TS-MECH.0360, REQ-18-02b-TS-MECH.0398, REQ-18-02b-TS-MECH.0399, REQ-18-02b-TS-MECH.0410, REQ-18-02b-TS-MECH.0411, REQ-18-02b-TS-SEQM.0100, REQ-18-02b-TS-SEQM.0101, REQ-18-02b-TS-SEQM.1001.

[OBJ]

Identifier	OBJ-18.02b-TRL6-TVALP-011
Title	Arrival and Departure management
Objective	Validate the arrival and departure management for basic FO IOP.
Category	<Technical Feasibility>
Key Environment Conditions	Nominal conditions
TRL Phase	TRL6

[OBJ Trace]

Relationship	Linked Element Type	Identifier
<COVERS>	<SESAR Solution>	18-02b

[OBJ Suc]

Identifier	Success Criterion
CRT-18.02b-TRL6-TVALP-011.001	The technical requirements associated to UC#1101 have been validated technically.
CRT-18.02b-TRL6-TVALP-011.002	The technical requirements associated to UC#1102 have been validated technically.
CRT-18.02b-TRL6-TVALP-011.003	The technical requirements associated to UC#1103 have been validated technically.
CRT-18.02b-TRL6-TVALP-011.009	The technical requirements associated to UC#1109 have been validated technically.

Relationship	Linked Element Type	Identifier
<COVERS>	<SESAR Solution>	18-02b: FO IOP – Basic IOP
<COVERS>	<ATMS Requirement>	REQ-18-02b-TS-ADMG.0001, REQ-18-02b-TS-ADMG.0002, REQ-18-02b-TS-ADMG.0003, REQ-18-02b-TS-ADMG.0004, REQ-18-02b-TS-ADMG.0005, REQ-18-02b-TS-FSMG.0061, REQ-18-02b-TS-FSMG.0115, REQ-18-02b-TS-FSMG.0139, REQ-18-02b-TS-FSMG.0161, REQ-18-02b-TS-MECH.0413, REQ-18-02b-TS-SCTJ.0107.

3.2.3 Technological Validation Assumptions

Identifier	Title	Description	Justification	Impact on Assessment
A1	IOP Holes	IOP holes are not part of the RTS validation	Holes in the IOP area cannot be handled with existing FO-Managers.	Medium
A2	AIM Data	IOP area has to be consistent regarding the airspace for all participating partners	Agreement on an appropriate AIRAC cycle has to be reached and a process for the provision of consistent operational AIM data needs to be defined and followed	High
A4	TMA	TMA use cases are not part of the RTS validation exercises	TMA use cases' validation is conducted by means of expert judgement.	Medium
A5	MET	MET use cases are not part of the RTS validation exercises	The MET use case has been deleted as there is only one MET TECH requirement.	Low
A6	CWP and FDPS	CWPs and FDPS are not a system/service under test	It shall be clearly mentioned that CWPs were not a system/service under test, although being part of the validation	Low

			platforms. They were a means to verify that the FO is properly managed during the use case execution.	

Table 4: Technological Validation Assumptions overview

Note: *Assumption A3 has been removed from the table because NM use cases are out of scope for solution 18-02b. They are now subject for solution 18-02b1.*

3.2.4 Technological Validation Exercises List

Identifier	EXE-18-02b-TRL6-001_IOP
Title	EXE-IOP-01: ENR-ENR Basic Scope
Description	To validate FO IOP solution 18-02b can provide seamless operation between ATC Centres in en-route airspace, including initial what-if: • based on new coordination phases • according to the use cases and features described in the INTEROP and TS/IRS documents
Expected achievements	Demonstrate technical feasibility
TRL	TRL6
T. Validation Technique	Distributed real time simulation with human in the loop
Start Date	08.04.2019
End Date	12.04.2019
T. Validation Coordinator	DFS
T. Validation Platform	DFS iCAS IBP DSNA S2020 IOP-IBP ENAIRE iTEC IBP ENAV S2020 IBP MUAC S2020 IOP-IBP#1
T. Validation Location	Langen Toulouse Madrid Rome Maastricht
Status	\<validated\>
Dependencies	Prototypes and technical validation platforms are reused in EXE-18-02b-TRL6-002_IOP.

[EXE Trace]

Linked Element Type	EXE-18-02b-TRL6-001_IOP	
<SESAR Solution>	18-02b	
Linked Element Type	Identifier	
<SESAR Solution>	18-02b	
<V&V Objective>	OBJ-18.02b-TRL6-TVALP-001 OBJ-18.02b-TRL6-TVALP-002 OBJ-18.02b-TRL6-TVALP-003 OBJ-18.02b-TRL6-TVALP-004	

Table 5: Technical validation exercise EXE-18-02b-TRL6-001_IOP

Identifier	EXE-18-02b-TRL6-002_IOP
Title	EXE-IOP-02: ENR-ENR Enhanced Scope and Maturity
Description	To validate FO IOP solution 18-02b can provide seamless operation between ATC centres in upper (en-route/en-route) airspace, including initial what-if: • based on new coordination phases • covering additional use cases in ENR-ENR for basic FO IOP scope • covering IOP non-functional requirements in order to reach a higher level of completeness
Expected achievements	Demonstrate technical feasibility
TRL	TRL6
T. Validation Technique	Distributed real time simulation with human in the loop
Start Date	25.05.2019
End Date	19.06.2019
T. Validation Coordinator	DFS
T. Validation Platform	DFS iCAS IBP DSNA S2020 IOP-IBP ENAIRE iTEC IBP ENAV S2020 IBP MUAC S2020 IOP-IBP#1
T. Validation Location	Langen Toulouse Madrid Rome Maastricht
Status	<validated>
Dependencies	EXE-18-02b-TRL6- 001_IOP

[EXE Trace]

Linked Element Type	EXE-18-02b-TRL6-002_IOP
<SESAR Solution>	18-02b

Linked Element Type	Identifier
<SESAR Solution>	18-02b
<V&V Objective>	OBJ-18.02b-TRL6-TVALP-001 OBJ-18.02b-TRL6-TVALP-002 OBJ-18.02b-TRL6-TVALP-003 OBJ-18.02b-TRL6-TVALP-004 OBJ-18.02b-TRL6-TVALP-005 OBJ-18.02b-TRL6-TVALP-009 OBJ-18.02b-TRL6-TVALP-010

Table 6: Technical validation exercise EXE-18-02b-TRL6-002_IOP

Identifier	EXE-18-02b-TRL6-003_IOP
Title	EXE-IOP-03: Expert judgement of basic FO IOP
Description	To validate FO IOP solution 18-02b can provide seamless operation between ATC centres considering: • upper (en-route/en-route) airspace and • TMA.
Expected achievements	Analyse technical feasibility
TRL	TRL6
T. Validation Technique	Expert Group (Judgement Analysis)
Start Date	01.12.2019
End Date	15.10.2020
T. Validation Coordinator	Eurocontrol
T. Validation Platform	N/A
T. Validation Location	N/A
Status	<validated>
Dependencies	EXE-18-02b-TRL6- 001_IOP EXE-18-02b-TRL6- 002_IOP

[EXE Trace]

Linked Element Type	EXE-18-02b-TRL6-003_IOP
<SESAR Solution>	18-02b

Linked Element Type	Identifier
<SESAR Solution>	18-02b
<V&V Objective>	OBJ-18.02b-TRL6-TVALP-001 OBJ-18.02b-TRL6-TVALP-002 OBJ-18.02b-TRL6-TVALP-003 OBJ-18.02b-TRL6-TVALP-004 OBJ-18.02b-TRL6-TVALP-005 OBJ-18.02b-TRL6-TVALP-006 OBJ-18.02b-TRL6-TVALP-008 OBJ-18.02b-TRL6-TVALP-009 OBJ-18.02b-TRL6-TVALP-010 OBJ-18.02b-TRL6-TVALP-011

Table 7: Technical validation exercise EXE-18-02b-TRL6-003_IOP

3.3 Deviations

3.3.1 Deviations with respect to the SJU Project Handbook

Deviations from the SJU project handbook [1] are not noted.

3.3.2 Deviations with respect to the Technological Validation Plan

Note: *Deviations with numbers A1 to A10 stem from EXE-IOP-01, while C1 to C4 stem from EXE-IOP-03.*
The deviations to the TVALP as listed below do not necessarily have a negative impact on the validation results of the solution. In EXE-IOP-02 many problems that appeared in EXE-IOP-01 were fixed.

No.	Deviation	Refer TVALP	Justification
1	**Technological Validation Assumptions** A2. AIM Data IOP area has to be consistent regarding the airspace for all participating partners. AIM use cases' validation is conducted by means of expert judgement. A3. NM NM use cases are not part of the validation exercises.	§4.4	In addition to the organisation of a consistent AIM dataset for the execution of the conducted RTS the solution has defined use cases for a common AIM service, which will be an enabler for FO IOP implementation and operation. NM use cases are planned to be validated in an own solution 18-02b1 (cf. section 5.2.2).
A1	TDR#3 has been postponed from October 2018 to January 2019.	§4.6	The solution has experienced delay in doing the planned developments and testing.
A2	ODR#1 did not take place. Tests between IBPs using ALPHA and BRAVO scenario have been performed instead.	§4.6	The solution has experienced delay in doing the planned developments and testing, and the impact of the adaptation change has been larger than anticipated. This was the main cause for the delay of the activities. We have focused the effort on the software reliability improvement and chosen to maintain testing of ALPHA/BRAVO traffic on IBP's at the end

No.	Deviation	Refer TVALP	Justification
			of December in order to run a test session similar to an ODR#1.
A3	Technical Acceptance After the last official technical dry run (TDR#3) the technical acceptance has not been declared. Accordingly, the initial availability note **Error! Reference source not found.**~~Fehler! Verweisquelle konnte nicht gefunden werden.~~ (solution internal document) has not been delivered.	§5.1.1, §5.1.9.2.2	Due to delays in development and testing and prioritisation of use case implementations there was no finalisation of the Build 3 functionalities until directly before the conduct of the validation exercise.
A4	Validation platforms datasets have not been coherent	§5.1.4.2.1	Due to timely constraints during the preparation process, the final version of harmonised adaptation data (volumes and AIM) has not been implemented into the system prototypes. Harmonisation of adaptation data has been slower than expected due to missing tools supporting the process and the absence of an AIM distribution service. We also realised that the IOP prototype platforms datasets were not fully aligned, introducing limitations
A5	Exercise success criterion EX1-CRT-18.02b-TRL6-TVALP-002.045 (UC#0245) has not been validated technically.	§5.1.3	Due to delays in development and testing and prioritisation of use case implementations.
A6	ATCO CWP rotation did not take place.	§5.1.8.1 §5.1.9.1.1.2	The size and the complexity of the used traffic scenarios did not necessitate to staff multiple sectors and further a rotation of ATCOs at the CWPs.
A7	Operational Free Play sessions did not take place.	§5.1.8.2.2	The focus of the validation exercise was laid on testing the Go-/No-Go criteria. As the operational free play session results were not intended to be used for these criteria the activity has been replaced by

No.	Deviation	Refer TVALP	Justification
			further tests of the triangles (KUAC-MUAC-REIMS and KUAC-LIPU-REIMS).
A8	Operational acceptability from ATCO of the IOP operational concept has not been assessed.	§5.1.8.2.3	The validators could not assess the Basic IOP concept due the maturity of the prototypes used which affected scenarios (only +/- 10 tuned flights per boundary) and traffic sample were thus not very realistic
A9	Quadrangle legs have not been tested in the factories.	§5.1.9.1.1.1	The focus was laid on testing the Go-/No-Go criteria, which were defined for bilateral legs only.
A10	Software elements were not frozen for deployment phase.	§5.1.9.1.1.1	Due to the status of the prototype maturity industry tried to improve them through continuous updates and late deployments.
C1	TS/IRS was not delivered before the final TVALP submission.	§5.3.5	TS/IRS was not ready before the end of EXE-IOP-03. The assignment of the ATMS requirements to the validation objectives is documented within the present TVALR.
C2	Expert judgement activities were planned to be organised as moderated workshops. These workshops have been partly replaced by a corresponding e-mail workflow process (see section C.6 for the process description).	§5.3.9.1	Due to Corona crisis circumstances the face to face workshops were not appropriate.
C3	UC#1104 has been removed.	§4.3 ff	Not necessary anymore.
C4	UC#1105 has been removed.	§4.3 ff	Has been shifted to Full IOP.
C5	UC#0403 could not be validated.	§4.3 ff	The partners could not agree on a limited solution in the scope of PJ18. A more complex solution is on the table, but cannot be described in time frame of PJ18-02b.

Table 8: Deviations with respect to the TVALP

4 SESAR Technological Solution 18-02b Validation Results

4.1 Summary of SESAR Technological Solution 18-02b Validation Results

The solution assessed the validation results of the success criteria:

- OK: If the average use case success is >= 80%

- Partially OK: If the average use case success is between >50% and < 80%

- NOK: If the average use case success is <= 50 %, not statistically significant or not tested

The solution assessed the validation results of the success criteria and analysed the issues in post-exercise activities. The outcome of this analysis was that every issue stemmed from software implementation problems and not from inmature technical requirements specified in the TS/IRS. Therefore, all RTS validated success criteria can be rated as OK, with regards to the status of the validation objectives. This approach is in line with the TVALP.

Note: Results in the column Validation Results that contain a number in % are validated by means of RTS exercises while those without a number are validated by means of expert judgement. The percentage indicates the average use case success.

As the following table shows, the statuses of 9 from 10 validation objectives are OK, one validation objective is partially OK. This leads to an overall solution status of OK.

SESAR Technological Solution Technological Validation Objective ID	SESAR Technological Solution Technological Validation Objective Title	SESAR Technological Solution Success Criterion ID	SESAR Technological Solution Success Criterion	SESAR Technological Solution Validation Results	SESAR Technological Solution Technological Val. Objective Status
OBJ-18.02b-TRL6-TVALP-001	Coordination and Transfer	CRT-18.02b-TRL6-TVALP-001.001	The technical requirements associated to UC#0101 have been validated technically.	OK [99%]	OK
		CRT-18.02b-TRL6-TVALP-001.002	The technical requirements associated to UC#0102 have	OK [88%]	

SESAR Technological Solution Technological Validation Objective ID	SESAR Technological Solution Technological Validation Objective Title	SESAR Technological Solution Success Criterion ID	SESAR Technological Solution Success Criterion	SESAR Technological Solution Validation Results	SESAR Technological Solution Technological Val. Objective Status
			been validated technically.		
		CRT-18.02b-TRL6-TVALP-001.003	The technical requirements associated to UC#0103 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-001.005	The technical requirements associated to UC#0105 have been validated technically.	OK [85%]	
		CRT-18.02b-TRL6-TVALP-001.006	The technical requirements associated to UC#0106 have been validated technically.	OK [82%]	
		CRT-18.02b-TRL6-TVALP-001.009	The technical requirements associated to UC#0109 have been validated technically.	OK [94%]	
		CRT-18.02b-TRL6-TVALP-001.012	The technical requirements associated to UC#0112 have been validated technically.	OK [80%]	
		CRT-18.02b-TRL6-TVALP-001.013	The technical requirements associated to UC#0113 have	Partially OK [78%]	

SESAR Technological Solution Technological Validation Objective ID	SESAR Technological Solution Technological Validation Objective Title	SESAR Technological Solution Success Criterion ID	SESAR Technological Solution Success Criterion	SESAR Technological Solution Validation Results	SESAR Technological Solution Technological Val. Objective Status
			been validated technically.		
		CRT-18.02b-TRL6-TVALP-001.015	The technical requirements associated to UC#0115 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-001.018	The technical requirements associated to UC#0118 have been validated technically.	Partially OK [77%]	
		CRT-18.02b-TRL6-TVALP-001.020	The technical requirements associated to UC#0120 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-001.024	The technical requirements associated to UC#0124 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-001.026	The technical requirements associated to UC#0126 have been validated technically.	Partially OK [73%]	
		CRT-18.02b-TRL6-TVALP-001.027	The technical requirements associated to UC#0127 have	OK	

SESAR Technological Solution Technological Validation Objective ID	SESAR Technological Solution Technological Validation Objective Title	SESAR Technological Solution Success Criterion ID	SESAR Technological Solution Success Criterion	SESAR Technological Solution Validation Results	SESAR Technological Solution Technological Val. Objective Status
			been validated technically.		
		CRT-18.02b-TRL6-TVALP-001.028	The technical requirements associated to UC#0128 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-001.033	The technical requirements associated to UC#0133 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-001.036	The technical requirements associated to UC#0136 have been validated technically.	OK	
OBJ-18.02b-TRL6-TVALP-002	Management of the FO Flight Script	CRT-18.02b-TRL6-TVALP-002.001	The technical requirements associated to UC#0201 have been validated technically.	OK [86%]	OK
		CRT-18.02b-TRL6-TVALP-002.010	The technical requirements associated to UC#0210 have been validated technically.	Partially OK [72%]	
		CRT-18.02b-TRL6-TVALP-002.014	The technical requirements associated to UC#0214 have	OK [84%]	

SESAR Technological Solution Technological Validation Objective ID	SESAR Technological Solution Technological Validation Objective Title	SESAR Technological Solution Success Criterion ID	SESAR Technological Solution Success Criterion	SESAR Technological Solution Validation Results	SESAR Technological Solution Technological Val. Objective Status
			been validated technically.		
		CRT-18.02b-TRL6-TVALP-002.024	The technical requirements associated to UC#0224 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-002.026	The technical requirements associated to UC#0226 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-002.028	The technical requirements associated to UC#0228 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-002.031	The technical requirements associated to UC#0231 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-002.034	The technical requirements associated to UC#0234 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-002.035	The technical requirements associated to UC#0235 have	OK	

SESAR Technological Solution Technological Validation Objective ID	SESAR Technological Solution Technological Validation Objective Title	SESAR Technological Solution Success Criterion ID	SESAR Technological Solution Success Criterion	SESAR Technological Solution Validation Results	SESAR Technological Solution Technological Val. Objective Status
			been validated technically.		
		CRT-18.02b-TRL6-TVALP-002.040	The technical requirements associated to UC#0240 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-002.043	The technical requirements associated to UC#0243 have been validated technically.	OK [98%]	
		CRT-18.02b-TRL6-TVALP-002.044	The technical requirements associated to UC#0244 have been validated technically.	NOK [n.s. 55%]	
		CRT-18.02b-TRL6-TVALP-002.045	The technical requirements associated to UC#0245 have been validated technically.	NOK [n.s. 57%]	
OBJ-18.02b-TRL6-TVALP-003	Informative Distribution between System Instances	CRT-18.02b-TRL6-TVALP-003.001	The technical requirements associated to UC#0301 have been validated technically.	OK [85%]	OK
		CRT-18.02b-TRL6-TVALP-003.004	The technical requirements associated to UC#0304 have	OK	

SESAR Technological Solution Technological Validation Objective ID	SESAR Technological Solution Technological Validation Objective Title	SESAR Technological Solution Success Criterion ID	SESAR Technological Solution Success Criterion	SESAR Technological Solution Validation Results	SESAR Technological Solution Technological Val. Objective Status
			been validated technically.		
		CRT-18.02b-TRL6-TVALP-003.006	The technical requirements associated to UC#0306 have been validated technically.	OK	
OBJ-18.02b-TRL6-TVALP-004	FO protocol failures	CRT-18.02b-TRL6-TVALP-004.001	The technical requirements associated to UC#0401 have been validated technically.	OK [100%]	Partially OK
		CRT-18.02b-TRL6-TVALP-004.003	The technical requirements associated to UC#0403 have been validated technically.	NOK	
		CRT-18.02b-TRL6-TVALP-004.004	The technical requirements associated to UC#0404 have been validated technically.	OK	
OBJ-18.02b-TRL6-TVALP-005	Control Sequences Handling	CRT-18.02b-TRL6-TVALP-005.001	The technical requirements associated to UC#0501 have been validated technically.	OK	OK
		CRT-18.02b-TRL6-TVALP-005.003	The technical requirements associated to UC#0503 have	OK	

SESAR Technological Solution Technological Validation Objective ID	SESAR Technological Solution Technological Validation Objective Title	SESAR Technological Solution Success Criterion ID	SESAR Technological Solution Success Criterion	SESAR Technological Solution Validation Results	SESAR Technological Solution Technological Val. Objective Status
			been validated technically.		
		CRT-18.02b-TRL6-TVALP-005.004	The technical requirements associated to UC#0504 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-005.006	The technical requirements associated to UC#0506 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-005.010	The technical requirements associated to UC#0510 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-005.018	The technical requirements associated to UC#0518 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-005.021	The technical requirements associated to UC#0521 have been validated technically.	Partially OK [69%]	
		CRT-18.02b-TRL6-TVALP-005.022	The technical requirements associated to UC#0522 have	OK [96%]	

SESAR Technological Solution Technological Validation Objective ID	SESAR Technological Solution Technological Validation Objective Title	SESAR Technological Solution Success Criterion ID	SESAR Technological Solution Success Criterion	SESAR Technological Solution Validation Results	SESAR Technological Solution Technological Val. Objective Status
			been validated technically.		
OBJ-18.02b-TRL6-TVALP-006	IOP Recovery	CRT-18.02b-TRL6-TVALP-006.002	The technical requirements associated to UC#0602 have been validated technically.	OK	OK
OBJ-18.02b-TRL6-TVALP-008	SSR Code Management	CRT-18.02b-TRL6-TVALP-008.001	The technical requirements associated to UC#0801 have been validated technically.	OK	OK
		CRT-18.02b-TRL6-TVALP-008.005	The technical requirements associated to UC#0805 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-008.007	The technical requirements associated to UC#0807 have been validated technically.	OK	
OBJ-18.02b-TRL6-TVALP-009	FO Mechanism	CRT-18.02b-TRL6-TVALP-009.005	The technical requirements associated to UC#0905 have been validated technically.	OK	OK
		CRT-18.02b-TRL6-TVALP-009.006	The technical requirements associated to UC#0906 have	OK [100%]	

SESAR Technological Solution Technological Validation Objective ID	SESAR Technological Solution Technological Validation Objective Title	SESAR Technological Solution Success Criterion ID	SESAR Technological Solution Success Criterion	SESAR Technological Solution Validation Results	SESAR Technological Solution Technological Val. Objective Status
			been validated technically.		
OBJ-18.02b-TRL6-TVALP-010	Scope and Management of the FO trajectory	CRT-18.02b-TRL6-TVALP-010.001	The technical requirements associated to UC#1001 have been validated technically.	OK [96%]	OK
		CRT-18.02b-TRL6-TVALP-010.002	The technical requirements associated to UC#1002 have been validated technically.	OK	
OBJ-18.02b-TRL6-TVALP-011	Arrival and Departure management	CRT-18.02b-TRL6-TVALP-011.001	The technical requirements associated to UC#1101 have been validated technically.	OK	OK
		CRT-18.02b-TRL6-TVALP-011.002	The technical requirements associated to UC#1102 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-011.003	The technical requirements associated to UC#1103 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-011.009	The technical requirements associated to UC#1109 have	OK	

SESAR Technological Solution Technological Validation Objective ID	SESAR Technological Solution Technological Validation Objective Title	SESAR Technological Solution Success Criterion ID	SESAR Technological Solution Success Criterion	SESAR Technological Solution Validation Results	SESAR Technological Solution Technological Val. Objective Status
			been validated technically.		

Table 9: Summary of Technological Validation Exercises Results

4.2 Detailed analysis of SESAR Technological Solution Validation Results per Validation objective

Each of the following sub-sections represents a validation objective. For each validation objective we first provide an overview of its success criteria and the applied validation methods (real time simulation or expert judgement).

Then, for each success criterion the validation result is shown.

More analysis details for the validation results can be found in appendixes A.7.2, B.7.2 and C.7.2.

A detailed analysis on technical requirements' level will be provided in Appendix A of this document.

4.2.1 OBJ-18-02b-TRL6-TVALP-001 Results

This objective deals with the validation of the coordination and transfer use cases:

Use Case ID	Succ. Crit. ID	Validation Method		Use Case Title
		RTS	Expert Judgement	
UC#0101	CRT-18.02b-TRL6-TVALP-001.001	X		Automatic Triggering of SAP/CAP/NP - compliance with LOA's
UC#0102	CRT-18.02b-TRL6-TVALP-001.002	X		Manual Triggering of CAP/NP
UC#0103	CRT-18.02b-TRL6-TVALP-001.003		X	Automatic Reversion from CAP/NP to SAP
UC#0105	CRT-18.02b-TRL6-TVALP-001.005	X		Change of coordination data or trajectory during SAP
UC#0106	CRT-18.02b-TRL6-TVALP-001.006	X		Change of coordination data or trajectory during CAP
UC#0109	CRT-18.02b-TRL6-TVALP-001.009	X		Change of C&T data or trajectory in NP without electronic negotiation
UC#0112	CRT-18.02b-TRL6-TVALP-001.012	X		Request on Frequency
UC#0113	CRT-18.02b-TRL6-TVALP-001.013	X		Change of Frequency /Assume
UC#0115	CRT-18.02b-TRL6-TVALP-001.015		X	Undo-Send

Use Case ID	Succ. Crit. ID	Validation Method		Use Case Title
		RTS	Expert Judgement	
UC#0118	CRT-18.02b-TRL6-TVALP-001.018	X		Force-assume by the Receiving RE
UC#0120	CRT-18.02b-TRL6-TVALP-001.020		X	Force-assume by a further downstream unit
UC#0124	CRT-18.02b-TRL6-TVALP-001.024		X	Point and Point cancellation
UC#0126	CRT-18.02b-TRL6-TVALP-001.026	X		Negotiation of C&T contractual data other than DCT between Transferring RE and Receiving RE
UC#0127	CRT-18.02b-TRL6-TVALP-001.027		X	Negotiation of DCT contractual data between Transferring RE and Receiving RE
UC#0128	CRT-18.02b-TRL6-TVALP-001.028		X	Negotiation of C&T Contractual data by 2 FDC's
UC#0133	CRT-18.02b-TRL6-TVALP-001.033		X	Force-assume from a skipped Unit
UC#0136	CRT-18.02b-TRL6-TVALP-001.036		X	Reversion from NP to CAP

Table 10: Validation Method for Success Criteria / Use Cases of OBJ-18.02b-TRL6-TVALP-001

4.2.1.1 CRT-18.02b-TRL6-TVALP-001.001 (UC#0101)

UC Title: **Automatic Triggering of SAP/CAP/NP - compliance with LOA's**

UC Result: The technical requirements associated to UC#0101 have been validated technically by means of RTS.

In 99 % of the test cases (604) the system reacted as defined in the use case.

Leg	Leg	UC#0101					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	52	0	52	100%	100%	*
MUAC ↔ REIM	MR	111	1	112	99%	100%	*
KUAC ↔ MUAC	KM	47	2	49	96%	100%	*
ENAIRE ↔ MUAC	EM	3	0	3	100%	100%	*
LIPU ↔ REIM	RL	61	0	61	100%	100%	*
KUAC ↔ LIPU	KL	21	2	23	91%	100%	*
KUAC↔ MUAC ↔ REIM	KMR	56	3	59	95%	100%	*
KUAC↔ LIPU ↔ REIM	KLR	53	1	54	98%	100%	*
KUAC↔ LIPU ↔ MUAC ↔ REIM	KLMR	191	0	191	100%	100%	*
	Total:	595	9	604	99%	100%	*
Average use case success / Significance:		99% / *					

Table 11: Overall Validation Result of CRT-18.02b-TRL6-TVALP-001.001 (UC#0101)

4.2.1.2 CRT-18.02b-TRL6-TVALP-001.002 (UC#0102)

UC Title: **Manual Triggering of CAP/NP**

UC Result: The technical requirements associated to UC#0102 have been validated technically by means of RTS.

In 88 % of the test cases (50) the system reacted as defined in the use case.

Leg	Leg	UC#0102					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	8	0	8	100%	100%	*
MUAC ↔ REIM	MR	7	2	9	78%	98%	*
KUAC ↔ MUAC	KM	7	1	8	88%	100%	*
ENAIRE ↔ MUAC	EM	4	0	4	100%	100%	*
LIPU ↔ REIM	RL	7	0	7	100%	100%	*
KUAC ↔ LIPU	KL	9	1	10	90%	100%	*
KUAC↔ MUAC ↔ REIM	KMR	0	2	2	0%	25%	n.s.

Leg	Leg	UC#0102					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC↔ LIPU ↔ REIM	KLR	2	0	2	100%	100%	*
KUAC↔ LIPU ↔ MUAC ↔ REIM	KLMR	0	0	0	-	-	-
	Total:	44	6	50	88%	100%	*
Average use case success / Significance:		88% / *					

Table 12: Overall Validation Result of CRT-18.02b-TRL6-TVALP-001.002 (UC#0102)

4.2.1.3 CRT-18.02b-TRL6-TVALP-001.003 (UC#0103)

UC Title: **Automatic Reversion from CAP/NP to SAP**

UC Result: The technical requirements associated to UC#0103 have been technically validated by means of expert judgement during workshop on 12/12/2019.

4.2.1.4 CRT-18.02b-TRL6-TVALP-001.005 (UC#0105)

UC Title: **Change of coordination data or trajectory during SAP**

UC Result: The technical requirements associated to UC#0105 have been technically validated by means of RTS.

In 85% of the test cases (65) the system reacted as defined in the use case.

Leg	Leg	UC#0105					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	3	0	3	100%	100%	*
MUAC ↔ REIM	MR	10	0	10	100%	100%	*
KUAC ↔ MUAC	KM	12	1	13	92%	100%	*
ENAIRE ↔ MUAC	EM	1	0	1	100%	100%	*
LIPU ↔ REIM	RL	8	1	9	89%	100%	*
KUAC ↔ LIPU	KL	15	7	22	68%	97%	*
KUAC↔ MUAC ↔ REIM	KMR	6	0	6	100%	100%	*

Leg	Leg	UC#0105					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC↔ LIPU ↔ REIM	KLR	0	1	1	0%	50%	n.s.
KUAC↔ LIPU ↔ MUAC ↔ REIM	KLMR	0	0	0	-	-	-
	Total:	55	10	65	85%	100%	*
Average use case success / Significance:		85% / *					

Table 13: Overall Validation Result of CRT-18.02b-TRL6-TVALP-001.005 (UC#0105)

4.2.1.5   CRT-18.02b-TRL6-TVALP-001.006 (UC#0106)

UC Title: **Change of coordination data or trajectory during CAP**

UC Result: The technical requirements associated to UC#0106 have been technically validated by means of RTS.

In 82% of the test cases (107) the system reacted as defined in the use case.

Leg	Leg	UC#0106					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	16	5	21	76%	100%	*
MUAC ↔ REIM	MR	12	2	14	86%	100%	*
KUAC ↔ MUAC	KM	11	0	11	100%	100%	*
ENAIRE ↔ MUAC	EM	7	0	7	100%	100%	*
LIPU ↔ REIM	RL	20	3	23	87%	100%	*
KUAC ↔ LIPU	KL	11	6	17	65%	93%	n.s.
KUAC↔ MUAC ↔ REIM	KMR	3	2	5	60%	81%	n.s.
KUAC↔ LIPU ↔ REIM	KLR	8	1	9	89%	100%	*
KUAC↔ LIPU ↔ MUAC ↔ REIM	KLMR	0	0	0	-	-	-
	Total:	88	19	107	82%	100%	*
Average use case success / Significance:		82% / *					

Table 14: Overall Validation Result of CRT-18.02b-TRL6-TVALP-001.006 (UC#0106)

4.2.1.6 CRT-18.02b-TRL6-TVALP-001.009 (UC#0109)

UC Title: **Change of C&T data or trajectory in NP without electronic negotiation**

UC Result: The technical requirements associated to UC#0109 have been technically validated by means of RTS.

In 94% of the test cases (35) the system reacted as defined in the use case.

Leg	Leg	UC#0109					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	3	1	4	75%	94%	n.s.
MUAC ↔ REIM	MR	9	1	10	90%	100%	*
KUAC ↔ MUAC	KM	8	0	8	100%	100%	*
ENAIRE ↔ MUAC	EM	1	0	1	100%	100%	*
LIPU ↔ REIM	RL	4	0	4	100%	100%	*
KUAC ↔ LIPU	KL	3	0	3	100%	100%	*
KUAC↔ MUAC ↔ REIM	KMR	2	0	2	100%	100%	*
KUAC↔ LIPU ↔ REIM	KLR	3	0	3	100%	100%	*
KUAC↔ LIPU ↔ MUAC ↔ REIM	KLMR	0	0	0	-	-	-
	Total:	33	2	35	94%	100%	*
Average use case success / Significance:		94 % / *					

Table 15: Overall Validation Result of CRT-18.02b-TRL6-TVALP-001.009 (UC#0109)

4.2.1.7 CRT-18.02b-TRL6-TVALP-001.012 (UC#0112)

UC Title: **Request on Frequency**

UC Result: The technical requirements associated to UC#0112 have been technically validated by means of RTS.

In 80% of the test cases (216) the system reacted as defined in the use case.

Leg	Leg	UC#0112					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	17	4	21	81%	100%	*
MUAC ↔ REIM	MR	45	7	52	87%	100%	*
KUAC ↔ MUAC	KM	18	8	26	69%	99%	*
ENAIRE ↔ MUAC	EM	7	1	8	88%	100%	*
LIPU ↔ REIM	RL	18	1	19	95%	100%	*
KUAC ↔ LIPU	KL	11	3	14	79%	99%	*
KUAC↔ MUAC ↔ REIM	KMR	30	9	39	77%	100%	*
KUAC↔ LIPU ↔ REIM	KLR	17	9	26	65%	96%	*
KUAC↔ LIPU ↔ MUAC ↔ REIM	KLMR	10	1	11	91%	100%	*
	Total:	173	43	216	80%	100%	*
Average use case success / Significance:		80% / *					

Table 16: Overall Validation Result of CRT-18.02b-TRL6-TVALP-001.012 (UC#0112)

4.2.1.8 CRT-18.02b-TRL6-TVALP-001.013 (UC#0113)

UC Title: **Change of Frequency /Assume**

UC Result: The technical requirements associated to UC#0113 have been technically validated by means of RTS.

In 78% of the test cases (405) the system reacted as defined in the use case.

Leg	Leg	UC#0113					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	50	21	71	70%	100%	*
MUAC ↔ REIM	MR	62	11	73	85%	100%	*
KUAC ↔ MUAC	KM	29	9	38	76%	100%	*
ENAIRE ↔ MUAC	EM	14	0	14	100%	100%	*
LIPU ↔ REIM	RL	52	11	63	83%	100%	*
KUAC ↔ LIPU	KL	20	2	22	91%	100%	*
KUAC↔ MUAC ↔ REIM	KMR	36	23	59	61%	97%	*

Leg	Leg	UC#0113					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC↔ LIPU ↔ REIM	**KLR**	33	12	45	73%	100%	*
KUAC↔ LIPU ↔ MUAC ↔ REIM	**KLMR**	18	2	20	90%	100%	*
	Total:	314	91	405	78%	100%	*
Average use case success / Significance:		78 % / *					

Table 17: Overall Validation Result of CRT-18.02b-TRL6-TVALP-001.013 (UC#0113)

4.2.1.9 CRT-18.02b-TRL6-TVALP-001.015 (UC#0115)

UC Title: **Undo-Send**

UC Result: The technical requirements associated to UC#0115 have been technically validated by means of expert judgement during workshop on 12/12/2019.

4.2.1.10 CRT-18.02b-TRL6-TVALP-001.018 (UC#0118)

UC Title: **Force-assume by the Receiving RE**

UC Result: The technical requirements associated to UC#0118 have been technically validated by means of RTS.

In 77% of the test cases (135) the system reacted as defined in the use case.

Leg	Leg	UC#0118					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	**KR**	6	3	9	67%	91%	n.s.
MUAC ↔ REIM	**MR**	22	4	26	85%	100%	*
KUAC ↔ MUAC	**KM**	14	3	17	82%	100%	*
ENAIRE ↔ MUAC	**EM**	3	1	4	75%	94%	n.s.
LIPU ↔ REIM	**RL**	12	3	15	80%	100%	*
KUAC ↔ LIPU	**KL**	11	3	14	79%	99%	*
KUAC↔ MUAC ↔ REIM	**KMR**	18	7	25	72%	99%	*

Leg	Leg	UC#0118					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC↔ LIPU ↔ REIM	KLR	10	7	17	59%	83%	n.s.
KUAC↔ LIPU ↔ MUAC ↔ REIM	KLMR	8	0	8	100%	100%	*
	Total:	104	31	135	77%	100%	*
Average use case success / Significance:		77% / *					

Table 18: Overall Validation Result of CRT-18.02b-TRL6-TVALP-001.018 (UC#0118)

4.2.1.11   CRT-18.02b-TRL6-TVALP-001.020 (UC#0120)

UC Title: **Force-assume by a further downstream unit**

UC Result: The technical requirements associated to UC#0120 have been technically validated by means of expert judgement with e-mail workflow process finished on 22/9/2020.

4.2.1.12   CRT-18.02b-TRL6-TVALP-001.024 (UC#0124)

UC Title: **Point and Point cancellation**

UC Result: The technical requirements associated to UC#0124 have been technically validated by means of expert judgement with e-mail workflow process finished on 2/10/2020.

4.2.1.13   CRT-18.02b-TRL6-TVALP-001.026 (UC#0126)

UC Title: **Negotiation of C&T contractual data other than DCT between Transferring RE and Receiving RE**

UC Result: The technical requirements associated to UC#0126 have been technically validated by means of RTS.

In 73% of the test cases (178) the system reacted as defined in the use case.

Leg	Leg	UC#0126					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	14	9	23	61%	89%	n.s.
MUAC ↔ REIM	MR	27	6	33	82%	100%	*
KUAC ↔ MUAC	KM	16	4	20	80%	100%	*
ENAIRE ↔ MUAC	EM	11	1	12	92%	100%	*
LIPU ↔ REIM	RL	20	7	27	74%	100%	*
KUAC ↔ LIPU	KL	14	3	17	82%	100%	*
KUAC↔ MUAC ↔ REIM	KMR	13	10	23	57%	80%	n.s.
KUAC↔ LIPU ↔ REIM	KLR	5	7	12	42%	39%	n.s.
KUAC↔ LIPU ↔ MUAC ↔ REIM	KLMR	10	1	11	91%	100%	*
	Total:	130	48	178	73%	100%	*
Average use case success / Significance:		73% / *					

Table 19: Overall Validation Result of CRT-18.02b-TRL6-TVALP-001.0126 (UC#0126)

4.2.1.14 CRT-18.02b-TRL6-TVALP-001.027 (UC#0127)

UC Title: **Negotiation of DCT contractual data between Transferring RE and Receiving RE**

UC Result: The technical requirements associated to UC#0127 have been technically validated by means of expert judgement with e-mail workflow process finished on 24/9/2020.

4.2.1.15 CRT-18.02b-TRL6-TVALP-001.028 (UC#0128)

UC Title: **Negotiation of C&T Contractual data by 2 FDC's**

UC Result: The technical requirements associated to UC#0128 have been technically validated by means of expert judgement during workshop on 12/12/2019.

4.2.1.16 CRT-18.02b-TRL6-TVALP-001.033 (UC#0133)

UC Title: **Force-assume from a skipped Unit**

UC Result: The technical requirements associated to UC#0133 have been technically validated by means of expert judgement during workshop on 12/12/2019.

4.2.1.17 CRT-18.02b-TRL6-TVALP-001.036 (UC#0136)

UC Title: **Reversion from NP to CAP**

UC Result: The technical requirements associated to UC#0136 have been technically validated by means of expert judgement during web conference on 20/02/2020.

4.2.2 OBJ-18.02b-TRL6-TVALP-002 Results

This objective deals with the validation of the Management of the FO Flight Script use cases.

Succ. Crit. ID	Succ. Crit. ID	Validation Method		Use Case Title
		RTS	Expert Judgement	
UC#0201	CRT-18.02b-TRL6-TVALP-002.001	X		Creation and sharing of a constraint
UC#0210	CRT-18.02b-TRL6-TVALP-002.010	X		Modification of 2D Route
UC#0214	CRT-18.02b-TRL6-TVALP-002.014	X		En route cruising level management
UC#0224	CRT-18.02b-TRL6-TVALP-002.024		X	Management of holding & stay constraint
UC#0226	CRT-18.02b-TRL6-TVALP-002.026		X	Modification of IFR/VFR and OAT/GAT
UC#0228	CRT-18.02b-TRL6-TVALP-002.028		X	Level band clearance
UC#0231	CRT-18.02b-TRL6-TVALP-002.031		X	Closed heading management
UC#0234	CRT-18.02b-TRL6-TVALP-002.034		X	Management of active/inactive states of constraints
UC#0235	CRT-18.02b-TRL6-TVALP-002.035		X	Management of Diversion (new destination airport)
UC#0240	CRT-18.02b-TRL6-TVALP-002.040		X	Information associated to bypassed points

Succ. Crit. ID	Succ. Crit. ID	Validation Method		Use Case Title
		RTS	**Expert Judgement**	
UC#0201	CRT-18.02b-TRL6-TVALP-002.001	X		Creation and sharing of a constraint
UC#0243	CRT-18.02b-TRL6-TVALP-002.043	X		Sharing of executive constraints (CFL, Speed, Heading, Rate)
UC#0244	CRT-18.02b-TRL6-TVALP-002.044	X		Route amendment inside a downstream's airspace
UC#0245	CRT-18.02b-TRL6-TVALP-002.045	X		Transfer of a constraint impacted by a route change

Table 20: Validation Method for Success Criteria / Use Cases of OBJ-18.02b-TRL6-TVALP-002

4.2.2.1 CRT-18.02b-TRL6-TVALP-002.001 (UC#0201)

UC Title: **Creation and sharing of a constraint**

UC Result: The technical requirements associated to UC#0201 have been technically validated by means of RTS.

In 86% of the test cases (57) the system reacted as defined in the use case.

Leg	Leg	UC#0201					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	**KR**	9	4	13	69%	95%	*
MUAC ↔ REIM	**MR**	9	2	11	82%	99%	*
KUAC ↔ MUAC	**KM**	9	0	9	100%	100%	*
ENAIRE ↔ MUAC	**EM**	2	0	2	100%	100%	*
LIPU ↔ REIM	**RL**	6	1	7	86%	99%	*

Leg	Leg	UC#0201					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ LIPU	**KL**	7	0	7	100%	100%	*
KUAC↔ MUAC ↔ REIM	**KMR**	3	1	4	75%	94%	n.s.
KUAC↔ LIPU ↔ REIM	**KLR**	4	0	4	100%	100%	*
KUAC↔ LIPU ↔ MUAC ↔ REIM	**KLMR**	0	0	0	-	-	-
	Total:	49	8	57	86%	100%	*
Average use case success / Significance:		86% / *					

Table 21: Overall Validation Result of CRT-18.02b-TRL6-TVALP-002.001 (UC#0201)

4.2.2.2 CRT-18.02b-TRL6-TVALP-002.010 (UC#0210)

UC Title: **Modification of 2D Route**

UC Result: The technical requirements associated to UC#0210 have been technically validated by means of RTS.

In 72% of the test cases (152) the system reacted as defined in the use case.

Leg	Leg	UC#0210					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	**KR**	11	8	19	58%	82%	n.s.
MUAC ↔ REIM	**MR**	12	14	26	46%	42%	n.s.
KUAC ↔ MUAC	**KM**	21	5	26	81%	100%	*
ENAIRE ↔ MUAC	**EM**	1	0	1	100%	100%	*
LIPU ↔ REIM	**RL**	25	1	26	96%	100%	*
KUAC ↔ LIPU	**KL**	12	5	17	71%	98%	*
KUAC↔ MUAC ↔ REIM	**KMR**	14	4	18	78%	100%	*
KUAC↔ LIPU ↔ REIM	**KLR**	9	6	15	60%	85%	n.s.
KUAC↔ LIPU ↔ MUAC ↔ REIM	**KLMR**	4	0	4	100%	100%	*
	Total:	109	43	152	72%	100%	*
Average use case success / Significance:		72% / *					

Table 22: Overall Validation Result of CRT-18.02b-TRL6-TVALP-002.010 (UC#0210)

4.2.2.3 CRT-18.02b-TRL6-TVALP-002.014 (UC#0214)

UC Title: **En route cruising level management**

UC Result: The technical requirements associated to UC#0214 have been technically validated by means of RTS.

In 84% of the test cases (75) the system reacted as defined in the use case.

Leg	Leg	UC#0214					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	**KR**	2	4	6	33%	34%	n.s.
MUAC ↔ REIM	**MR**	6	0	6	100%	100%	*
KUAC ↔ MUAC	**KM**	11	1	12	92%	100%	*
ENAIRE ↔ MUAC	**EM**	0	0	0	-	-	-
LIPU ↔ REIM	**RL**	10	1	11	91%	100%	*
KUAC ↔ LIPU	**KL**	5	1	6	83%	98%	*
KUAC↔ MUAC ↔ REIM	**KMR**	3	0	3	100%	100%	*
KUAC↔ LIPU ↔ REIM	**KLR**	1	0	1	100%	100%	*
KUAC↔ LIPU ↔ MUAC ↔ REIM	**KLMR**	0	0	0	-	-	-
	Total:	38	7	45	84%	100%	*
Average use case success / Significance:		84% / *					

Table 23: Overall Validation Result of CRT-18.02b-TRL6-TVALP-002.014 (UC#0214)

4.2.2.4 CRT-18.02b-TRL6-TVALP-002.024 (UC#0224)

UC Title: **Management of holding & stay constraint**

UC Result: The technical requirements associated to UC#0224 have been technically validated by means of expert judgement during workshop on 12/12/2019.

4.2.2.5 CRT-18.02b-TRL6-TVALP-002.026 (UC#0226)

UC Title: **Modification of IFR/VFR and OAT/GAT**

UC Result: The technical requirements associated to UC#0226 have been technically validated by means of expert judgement e-mail workflow on 28/04/2020.

4.2.2.6 CRT-18.02b-TRL6-TVALP-002.028 (UC#0228)

UC Title: **Level band clearance**

UC Result: The technical requirements associated to UC#0228 have been technically validated by means of expert judgement e-mail workflow on 24/06/2020.

4.2.2.7 CRT-18.02b-TRL6-TVALP-002.031 (UC#0231)

UC Title: **Closed heading management**

UC Result: The technical requirements associated to UC#0231 have been technically validated by means of expert judgement during workshop on 12/12/2019.

4.2.2.8 CRT-18.02b-TRL6-TVALP-002.034 (UC#0234)

UC Title: **Management of active/inactive states of constraints**

UC Result: The technical requirements associated to UC#0234 have been technically validated by means of expert judgement e-mail workflow on 31/08/2020.

4.2.2.9 CRT-18.02b-TRL6-TVALP-002.035 (UC#0235)

UC Title: **Management of Diversion (new destination airport)**

UC Result: The technical requirements associated to UC#0235 have been technically validated by means of expert judgement during workshop on 12/12/2019.

4.2.2.10 CRT-18.02b-TRL6-TVALP-002.040 (UC#0240)

UC Title: **Information associated to bypassed points**

UC Result: The technical requirements associated to UC#0240 have been technically validated by means of expert judgement with e-mail workflow process finished on 15/10/2020.

4.2.2.11 CRT-18.02b-TRL6-TVALP-002.043 (UC#0243)

UC Title: **Sharing of executive constraints (CFL, Speed, Heading, Rate)**

UC Result: The technical requirements associated to UC#0243 have been technically validated by means of RTS.

In 98% of the test cases (51) the system reacted as defined in the use case.

Leg	Leg	UC#0243					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	**KR**	6	1	7	86%	99%	*
MUAC ↔ REIM	**MR**	4	0	4	100%	100%	*
KUAC ↔ MUAC	**KM**	11	0	11	100%	100%	*
ENAIRE ↔ MUAC	**EM**	0	0	0	-	-	-
LIPU ↔ REIM	**RL**	18	0	18	100%	100%	*
KUAC ↔ LIPU	**KL**	5	0	5	100%	100%	*
KUAC↔ MUAC ↔ REIM	**KMR**	1	0	1	100%	100%	*
KUAC↔ LIPU ↔ REIM	**KLR**	5	0	5	100%	100%	*
KUAC↔ LIPU ↔ MUAC ↔ REIM	**KLMR**	0	0	0	-	-	-
	Total:	50	1	51	98%	100%	*
Average use case success / Significance:		98% / *					

Table 24: Overall Validation Result of CRT-18.02b-TRL6-TVALP-002.043 (UC#0243)

4.2.2.12 CRT-18.02b-TRL6-TVALP-002.044 (UC#0244)

UC Title: **Route amendment inside a downstream's airspace**

UC Result: The technical requirements associated to UC#0244 have been technically validated by means of RTS.

In 55% of the test cases (42) the system reacted as defined in the use case.

Leg	Leg	UC#0244					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	5	6	11	45%	50%	n.s.
MUAC ↔ REIM	MR	1	2	3	33%	50%	n.s.
KUAC ↔ MUAC	KM	4	3	7	57%	77%	n.s.
ENAIRE ↔ MUAC	EM	0	0	0	-	-	-
LIPU ↔ REIM	RL	10	0	10	100%	100%	*
KUAC ↔ LIPU	KL	1	2	3	33%	50%	n.s.
KUAC↔ MUAC ↔ REIM	KMR	1	3	4	25%	31%	n.s.
KUAC↔ LIPU ↔ REIM	KLR	1	3	4	25%	31%	n.s.
KUAC↔ LIPU ↔ MUAC ↔ REIM	KLMR	0	0	0	-	-	-
	Total:	23	19	42	55%	78%	*
Average use case success / Significance:		55% / n.s.					

Table 25: Overall Validation Result of CRT-18.02b-TRL6-TVALP-002.044 (UC#0244)

4.2.2.13   CRT-18.02b-TRL6-TVALP-002.045 (UC#0245)

UC Title: **Transfer of a constraint impacted by a route change**

UC Result: The technical requirements associated to UC#0245 have been technically validated by means of RTS.

In 57% of the test cases (7) the system reacted as defined in the use case.

Leg	Leg	UC#0245					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	2	0	2	100%	100%	yes
MUAC ↔ REIM	MR	1	1	2	50%	75%	no
KUAC ↔ MUAC	KM	1	0	1	100%	100%	yes
ENAIRE ↔ MUAC	EM	0	0	0	-	-	-
LIPU ↔ REIM	RL	0	0	0	-	-	-
KUAC ↔ LIPU	KL	0	0	0	-	-	-
KUAC↔ MUAC ↔ REIM	KMR	0	1	1	0%	50%	no

Leg	Leg	UC#0245					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC↔ LIPU ↔ REIM	**KLR**	0	1	1	0%	50%	n.s.
KUAC↔ LIPU ↔ MUAC ↔ REIM	**KLMR**	0	0	0	57%	100%	*
	Total:	4	3	7	57%	78%	*
Average use case success / Significance:	57% / n.s.						

Table 26: Overall Validation Result of CRT-18.02b-TRL6-TVALP-002.045 (UC#0245)

4.2.3 OBJ-18.02b-TRL6-TVALP-003 Results

This objective deals with the validation of the Informative Distribution between System Instances use cases.

Use Case ID	Succ. Crit. ID	Validation Method		Use Case Title
		RTS	Expert Judgement	
UC#0301	CRT-18.02b-TRL6-TVALP-003.001	X		FO creation & sharing
UC#0304	CRT-18.02b-TRL6-TVALP-003.004		X	Distribution on bilateral rules (General information)
UC#0306	CRT-18.02b-TRL6-TVALP-003.006		X	Manual subscription/unsubscription to FO

Table 27: Validation Method for Success Criteria / Use Cases of OBJ-18.02b-TRL6-TVALP-003

4.2.3.1 CRT-18.02b-TRL6-TVALP-003.001 (UC#0301)

UC Title: **FO creation & sharing**

UC Result: The technical requirements associated to UC#0301 have been technically validated by means of RTS.

In 85% of the test cases (1039) the system reacted as defined in the use case.

Leg	Leg	UC#0301					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	69	4	73	95%	100%	*
MUAC ↔ REIM	MR	118	19	137	86%	100%	*
KUAC ↔ MUAC	KM	43	0	43	100%	100%	*
ENAIRE ↔ MUAC	EM	70	0	70	100%	100%	*
LIPU ↔ REIM	RL	80	2	82	98%	100%	*
KUAC ↔ LIPU	KL	20	1	21	95%	100%	*
KUAC↔ MUAC ↔ REIM	KMR	59	21	80	74%	100%	*
KUAC↔ LIPU ↔ REIM	KLR	54	16	70	77%	100%	*

Leg	Leg	UC#0301					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC↔ LIPU ↔ MUAC ↔ REIM	**KLMR**	374	89	463	81%	100%	*
	Total:	887	152	1039	85%	100%	*
Average use case success / Significance:		85% / *					

Table 28: Overall Validation Result of CRT-18.02b-TRL6-TVALP-003.001 (UC#0301)

4.2.3.2 CRT-18.02b-TRL6-TVALP-003.004 (UC#0304)

UC Title: **Distribution on bilateral rules (General information)**

UC Result: The technical requirements associated to UC#0304 have been technically validated by means of expert judgement e-mail workflow on 31/08/2020.

4.2.3.3 CRT-18.02b-TRL6-TVALP-003.006 (UC#0306)

UC Title: **Manual subscription/unsubscription to FO**

UC Result: The technical requirements associated to UC#0304 have been technically validated by means of expert judgement during workshop on 12/12/2019.

4.2.4 OBJ-18.02b-TRL6-TVALP-004 Results

This objective deals with the validation of the FO protocol failures use cases.

Use Case ID	Succ. Crit. ID	Validation Method		Use Case Title
		RTS	Expert Judgement	
UC#0401	CRT-18.02b-TRL6-TVALP-004.001	X		Management of discrepancies with local view
UC#0403	CRT-18.02b-TRL6-TVALP-004.003		X	FO stabilization and protection against multiple successive FO updates
UC#0404	CRT-18.02b-TRL6-TVALP-004.004		X	De-synchronization and Re-synchronization

Table 29: Validation Method for Success Criteria / Use Cases of OBJ-18.02b-TRL6-TVALP-004

4.2.4.1 CRT-18.02b-TRL6-TVALP-004.001 (UC#0401)

UC Title: **Management of discrepancies with local view**

UC Result: The technical requirements associated to UC#0401 have been technically validated by means of RTS.

In 100% of the test cases (12) the system reacted as defined in the use case.

Leg	Leg	UC#0401					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	1	0	1	100%	100%	*
MUAC ↔ REIM	MR	0	0	0	-	-	-
KUAC ↔ MUAC	KM	0	0	0	-	-	-
ENAIRE ↔ MUAC	EM	0	0	0	-	-	-
LIPU ↔ REIM	RL	1	0	1	100%	100%	*
KUAC ↔ LIPU	KL	4	0	4	100%	100%	*
KUAC↔ MUAC ↔ REIM	KMR	3	0	3	100%	100%	*
KUAC↔ LIPU ↔ REIM	KLR	3	0	3	100%	100%	*
KUAC↔ LIPU ↔ MUAC ↔ REIM	KLMR	0	0	0	-	-	-

Leg	Leg	UC#0401					
		OK	NOK	Total	OK [%]	Binom. Test	Significa nce
Total:		12	0	12	100%	100%	*
Average use case success / Significance:		100% / *					

Table 30: Overall Validation Result of CRT-18.02b-TRL6-TVALP-004.001 (UC#0401)

4.2.4.2 CRT-18.02b-TRL6-TVALP-004.003 (UC#0403)

UC Title: **FO stabilization and Protection against multiple successive FO updates**

UC Result: The technical requirements associated to UC#0403 have not been technically validated by lack of time to provide a complete solution. [5]

4.2.4.3 CRT-18.02b-TRL6-TVALP-004.004 (UC#0404)

UC Title: **De-synchronization and Re-synchronization**

UC Result: The technical requirements associated to UC#0404 have been technically validated by means of expert judgement with e-mail workflow process finished on 26/10/2020.

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[5] UC#0403 was not validated: no agreement on a limited solution in the scope of PJ18. A more complex solution is on the table, but cannot be described in time frame of PJ18-02b.

4.2.5 OBJ-18.02b-TRL6-TVALP-005 Results

This objective deals with the validation of the Control Sequences Handling use cases.

Use Case ID	Succ. Crit. ID	Validation Method		Use Case Title
		RTS	Expert Judgement	
UC#0501	CRT-18.02b-TRL6-TVALP-005.001		X	Automatic Skip of an IOP Unit in favour of the upstream
UC#0503	CRT-18.02b-TRL6-TVALP-005.003		X	Manual Unskip of an IOP Unit skipped in favour of the upstream
UC#0504	CRT-18.02b-TRL6-TVALP-005.004		X	Manual Skip of an IOP Unit in favour of the upstream
UC#0506	CRT-18.02b-TRL6-TVALP-005.006		X	Internal Resp Entity-Skip/Unskip (control remains in same Unit)
UC#0510	CRT-18.02b-TRL6-TVALP-005.010		X	Manual partial delegation, and cancellation
UC#0518	CRT-18.02b-TRL6-TVALP-005.018		X	"No Contact" implementation
UC#0521	CRT-18.02b-TRL6-TVALP-005.021	X		Re-entrant flight going through other IOP ATSU
UC#0522	CRT-18.02b-TRL6-TVALP-005.022	X		Correction of ATSU sequence list

Table 31: Validation Method for Success Criteria / Use Cases of OBJ-18.02b-TRL6-TVALP-005

4.2.5.1 CRT-18.02b-TRL6-TVALP-005.001 (UC#0501)

UC Title: **Automatic Skip of an IOP Unit in favour of the upstream**

UC Result: The technical requirements associated to UC#0501 have been technically validated by means of expert judgement during workshop on 12/12/2019.

4.2.5.2 CRT-18.02b-TRL6-TVALP-005.003 (UC#0503)

UC Title: **Manual Unskip of an IOP Unit skipped in favour of the upstream**

UC Result: The technical requirements associated to UC#0503 have been technically validated by means of expert judgement during workshop on 12/12/2019.

4.2.5.3 CRT-18.02b-TRL6-TVALP-005.004 (UC#0504)

UC Title: **Manual Skip of an IOP Unit in favour of the upstream**

UC Result: The technical requirements associated to UC#0504 have been technically validated by means of expert judgement with e-mail workflow process finished on 24/9/2020.

4.2.5.4 CRT-18.02b-TRL6-TVALP-005.006 (UC#0506)

UC Title: **Internal Resp Entity-Skip/Unskip (control remains in same Unit)**

UC Result: The technical requirements associated to UC#0506 have been technically validated by means of expert judgement e-mail workflow on 31/08/2020.

4.2.5.5 CRT-18.02b-TRL6-TVALP-005.010 (UC#0510)

UC Title: **Manual partial delegation, and cancellation**

UC Result: The technical requirements associated to UC#0510 have been technically validated by means of expert judgement during web conference on 20/02/2020.

4.2.5.6 CRT-18.02b-TRL6-TVALP-005.018 (UC#0518)

UC Title: **"No Contact" implementation**

UC Result: The technical requirements associated to UC#0518 have been technically validated by means of expert judgement e-mail workflow on 04/06/2020.

4.2.5.7 CRT-18.02b-TRL6-TVALP-005.021 (UC#0521)

UC Title: **Re-entrant flight going through other IOP ATSU**

UC Result: The technical requirements associated to UC#0521 have been technically validated by means of RTS.

In 69% of the test cases (29) the system reacted as defined in the use case.

Leg	Leg	UC#0521					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	8	0	8	100%	100%	*
MUAC ↔ REIM	MR	0	9	9	0%	0%	n.s.
KUAC ↔ MUAC	KM	8	0	8	100%	100%	*
ENAIRE ↔ MUAC	EM	4	0	4	100%	100%	*
LIPU ↔ REIM	RL	0	0	0	-	-	-
KUAC ↔ LIPU	KL	0	0	0	-	-	-
KUAC↔ MUAC ↔ REIM	KMR	0	0	0	-	-	-
KUAC↔ LIPU ↔ REIM	KLR	0	0	0	-	-	-
KUAC↔ LIPU ↔ MUAC ↔ REIM	KLMR	0	0	0	-	-	-
Total:		20	9	29	69%	100%	*
Average use case success / Significance:		69% / *					

Table 32: Overall Validation Result of CRT-18.02b-TRL6-TVALP-005.021 (UC#0521)

4.2.5.8 CRT-18.02b-TRL6-TVALP-005.022 (UC#0522)

UC Title: **Correction of ATSU sequence list**

UC Result: The technical requirements associated to UC#0522 have been technically validated by means of RTS.

In 96% of the test cases (243) the system reacted as defined in the use case.

Leg	Leg	UC#0522					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	41	0	41	100%	100%	*
MUAC ↔ REIM	MR	0	0	0	-	-	-

Leg	Leg	UC#0522					
		OK	NOK	Total	OK [%]	Binom. Test	Significa nce
KUAC ↔ MUAC	**KM**	0	0	0	-	-	-
ENAIRE ↔ MUAC	**EM**	0	0	0	-	-	-
LIPU ↔ REIM	**RL**	54	0	54	100%	100%	*
KUAC ↔ LIPU	**KL**	34	1	35	97%	100%	*
KUAC↔ MUAC ↔ REIM	**KMR**	0	0	0	-	-	-
KUAC↔ LIPU ↔ REIM	**KLR**	42	3	45	93%	100%	*
KUAC↔ LIPU ↔ MUAC ↔ REIM	**KLMR**	141	6	147	96%	100%	*
	Total:	312	10	322	97%	100%	*
Average use case success / Significance:		97% / *					

Table 33: Overall Validation Result of CRT-18.02b-TRL6-TVALP-005.022 (UC#0522)

4.2.6 OBJ-18.02b-TRL6-TVALP-006 Results

This objective deals with the validation of the IOP Recovery use cases.

Use Case ID	Succ. Crit. ID	Validation Method		Use Case Title
		RTS	Expert Judgement	
UC#0602	CRT-18.02b-TRL6-TVALP-006.002		X	Full IOP Recovery mechanism

Table 34: Validation Method for Success Criteria / Use Cases of OBJ-18.02b-TRL6-TVALP-006

4.2.6.1 CRT-18.02b-TRL6-TVALP-006.002 (UC#0602)

UC Title: **Full IOP Recovery mechanism**

UC Result: The technical requirements associated to UC#0602 have been technically validated by means of expert judgement during web conference on 20/02/2020.

4.2.7 OBJ-18.02b-TRL6-TVALP-008 Results

This objective deals with the validation of the SSR Code Management use cases.

Use Case ID	Succ. Crit. ID	Validation Method		Use Case Title
		RTS	**Expert Judgement**	
UC#0801	CRT-18.02b-TRL6-TVALP-008.001		X	Modifying & Sharing the IOP_NSSR, IOP_ASSR, IOP_CSSR
UC#0805	CRT-18.02b-TRL6-TVALP-008.005		X	To request and provide the IOP_DSSR
UC#0807	CRT-18.02b-TRL6-TVALP-008.007		X	Sharing the Mode S flight Id

Table 35: Validation Method for Success Criteria / Use Cases of OBJ-18.02b-TRL6-TVALP-008

4.2.7.1 CRT-18.02b-TRL6-TVALP-008.001 (UC#0801)

UC Title: **Modifying & Sharing the IOP_NSSR, IOP_ASSR, IOP_CSSR**

UC Result: The technical requirements associated to UC#0801 have been technically validated by means of expert judgement during web conference on 20/02/2020.

4.2.7.2 CRT-18.02b-TRL6-TVALP-008.005 (UC#0805)

UC Title: **To request and provide the IOP_DSSR**

UC Result: The technical requirements associated to UC#0805 have been technically validated by means of expert judgement during web conference on 20/02/2020.

4.2.7.3 CRT-18.02b-TRL6-TVALP-008.007 (UC#0807)

UC Title: **Sharing the Mode S flight Id**

UC Result: The technical requirements associated to UC#0807 have been technically validated by means of expert judgement e-mail workflow on 28/04/2020.

4.2.8   OBJ-18.02b-TRL6-TVALP-009 Results

This objective deals with the validation of the FO Mechanism use cases.

Use Case ID	Succ. Crit. ID	Validation Method		Use Case Title
		RTS	**Expert Judgement**	
UC#0905	CRT-18.02b-TRL6-TVALP-009.005		X	Flight Object Removal
UC#0906	CRT-18.02b-TRL6-TVALP-009.006	X		Management of non-supported features

Table 36: Validation Method for Success Criteria / Use Cases of OBJ-18.02b-TRL6-TVALP-009

4.2.8.1   CRT-18.02b-TRL6-TVALP-009.005 (UC#0905)

UC Title: **Flight Object Removal**

UC Result: The technical requirements associated to UC#0905 have been technically validated by means of expert judgement during web conference on 20/02/2020.

4.2.8.2   CRT-18.02b-TRL6-TVALP-009.006 (UC#0906)

UC Title: **Management of non-supported features**

UC Result: The technical requirements associated to UC#0906 have been technically validated by means of RTS.

In 100% of the test cases (3) the system reacted as defined in the use case.

Leg	Leg	UC#0906					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	**KR**	1	0	1	100%	100%	*
MUAC ↔ REIM	**MR**	1	0	1	100%	100%	*
KUAC ↔ MUAC	**KM**	0	0	0	-	-	-
ENAIRE ↔ MUAC	**EM**	0	0	0	-	-	-

Leg	Leg	UC#0906					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
LIPU ↔ REIM	RL	0	0	0	-	-	-
KUAC ↔ LIPU	KL	1	0	1	100%	100%	*
KUAC↔ MUAC ↔ REIM	KMR	0	0	0	-	-	-
KUAC↔ LIPU ↔ REIM	KLR	0	0	0	-	-	-
KUAC↔ LIPU ↔ MUAC ↔ REIM	KLMR	0	0	0	-	-	-
	Total:	3	0	3	100%	100%	*
Average use case success / Significance:		100% / *					

Table 37: Overall Validation Result of CRT-18.02b-TRL6-TVALP-009.006 (UC#0906)

4.2.9 OBJ-18.02b-TRL4-TVALP-010 Results

This objective deals with the validation of the trajectory management use cases.

Use Case ID	Succ. Crit. ID	Validation Method		Use Case Title
		RTS	**Expert Judgement**	
UC#1001	CRT-18.02b-TRL6-TVALP-0010.001	X		Trajectory Management and Scope
UC#1002	CRT-18.02b-TRL6-TVALP-0010.002		X	Advanced Trajectory Management and Scope

Table 38: Validation Method for Success Criteria / Use Cases of OBJ-18.02b-TRL6-TVALP-010

4.2.9.1 CRT-18.02b-TRL6-TVALP-010.001 (UC#1001)

UC Title: **Trajectory Management and Scope**

UC Result: The technical requirements associated to UC#1001 have been technically validated by means of RTS.

In 96% of the test cases (317) the system reacted as defined in the use case.

Leg	Leg	UC#1001					
		OK	**NOK**	**Total**	**OK [%]**	**Binom. Test**	**Significance**
KUAC ↔ REIM	**KR**	41	1	42	98%	100%	*
MUAC ↔ REIM	**MR**	0	0	0	-	-	-
KUAC ↔ MUAC	**KM**	0	0	0	-	-	-
ENAIRE ↔ MUAC	**EM**	0	0	0	-	-	-
LIPU ↔ REIM	**RL**	54	1	55	98%	100%	*
KUAC ↔ LIPU	**KL**	32	2	34	94%	100%	*
KUAC↔ MUAC ↔ REIM	**KMR**	0	1	1	0%	50%	n.s.
KUAC↔ LIPU ↔ REIM	**KLR**	47	0	47	100%	100%	*
KUAC↔ LIPU ↔ MUAC ↔ REIM	**KLMR**	205	12	217	94%	100%	*
	Total:	379	17	396	96%	100%	*

Leg	Leg	UC#1001					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
Average use case success / Significance:		96% / *					

Table 39: Overall Validation Result of CRT-18.02b-TRL6-TVALP-010.001 (UC#1001)

4.2.9.2 CRT-18.02b-TRL6-TVALP-010.002 (UC#1002)

UC Title: **Advanced Trajectory Management and Scope**

UC Result: The technical requirements associated to UC#1002 have been technically validated by means of expert judgement during web conference on 20/02/2020.

4.2.10 OBJ-18.02b-TRL4-TVALP-011 Results

This objective deals with the validation of the Arrival and Departure management use cases.

Use Case ID	Succ. Crit. ID	Validation Method		Use Case Title
		RTS	Expert Judgement	
UC#1101	CRT-18.02b-TRL6-TVALP-011.001		X	Departure Time update
UC#1102	CRT-18.02b-TRL6-TVALP-011.002		X	SID definition and change
UC#1103	CRT-18.02b-TRL6-TVALP-011.003		X	STAR definition and change (& Arrival transitions)
UC#1109	CRT-18.02b-TRL6-TVALP-011.009		X	AMAN (indication of TTL / TTG & XMAN delay sharing)

Table 40: Validation Method for Success Criteria / Use Cases of OBJ-18.02b-TRL6-TVALP-011

4.2.10.1   CRT-18.02b-TRL4-TVALP-011.001 (UC#1101)

UC Title: **Departure Time update**

UC Result: The technical requirements associated to UC#1101 have been technically validated by means of expert judgement with e-mail workflow process finished on 23/10/2020.

4.2.10.2   CRT-18.02b-TRL4-TVALP-011.002 (UC#1102)

UC Title: **SID definition and change**

UC Result: The technical requirements associated to UC#1102 have been technically validated by means of expert judgement with e-mail workflow process finished on 23/10/2020.

4.2.10.3   CRT-18.02b-TRL4-TVALP-011.003 (UC#1103)

UC Title: **STAR definition and change (& Arrival transitions)**

UC Result: The technical requirements associated to UC#1103 have been technically validated by means of expert judgement with e-mail workflow process finished on 29/10/2020.

4.2.10.4   CRT-18.02b-TRL4-TVALP-011.009 (UC#1109)

UC Title: **AMAN (indication of TTL / TTG & XMAN delay sharing)**

UC Result: The technical requirements associated to UC#1109 have been technically validated by means of expert judgement with e-mail workflow process finished on 19/10/2020.

4.3 Confidence in the Validation Results

4.3.1 Limitations of Technological Validation Results

The setup of the technical validation exercises (RTS) has already covered a core part of Europe and the results can be extrapolated to the ECAC level. The validation results have shown the technical feasibility of the FO IOP specification, although there are still open questions as you can see in the recommendations for the next phase (see 5.2.1).

The more air traffic service units participate and the less IOP holes exist, the more the ATM community will gain from the FO IOP benefits such as seemless coordination.

4.3.1.1 Quality of Technological Validation Exercises Results

Regarding accuracy the quality of the technical validation results can be rated as good for the RTS validation exercise. During the RTS validation exercises conduct, validation teams on all sites noted the results of the use cases and the anomalies that occurred. At the end of each day, a de-briefing was organised where the results and observations were consolidated.

Technical observations from industry partners were documented in the MANTIS tool that allows the allocation and tracing of anomalies.

The confidence in the results is statistically given for all success criteria that were validated technically during the RTS validation exercises.

The confidence in the results of the expert judgement validation can be rated as satisfying. Validated use cases have been "executed" on paper describing for each step the ICD exchanges and the TS Requirements involved. This "paper" exercise has been thoroughly reviewed by all industrial and operational partners.

4.3.1.2 Significance of Technological Validation Exercises Results

The statistical significance is listed in the tables comprising the overall validation results for each success criterion. They can be looked up in section 4.2. The results are significant for all use cases, which were validated through the RTS, except two (UC#0244 and UC#0245).

For testing the statistical significance, a binomial test was used. Assumption was that there is a 50% chance for each flight / use case to be passed or not. The level of significance was a priori set to 5% (α = 0,05).

Significant tests are marked with an asterisk "*" and not significant ones with "n.s.".

5 Conclusions and recommendations

5.1 Conclusions

5.1.1 Conclusions on SESAR Technological Solution maturity

The different vendor's implementations of basic FO IOP (comprising 21 out of the 58 basic FO IOP use cases) could be tested and assessed in realistic technical validation environment. The IBPs located at four ANSP premises covered an airspace representing a core part of Europe, which allows the continuous management of flights via up to four ATSUs.

The experts were able to validate the use cases and technical requirements for basic FO IOP either by means of RTS (21 use cases) or by means of expert judgement (37 use cases).

The maturity of the basic FO IOP technical requirements in scope has reached TRL6.

5.1.2 Conclusions on technological feasibility

The validation results have confirmed the functional and non-functional requirements documented in the TS/IRS. Issues detected during the RTS validation exercises were analysed and used to improve the requirements where necessary. Functional and non-functional requirements that were not implemented in any system prototype were analysed by expert judgement.

We proved that basic FO IOP is technologically feasible.

5.1.3 Conclusions on performance assessments

Even though, anomalies existed during the conduct of the RTS validation exercises, the ATCOs and operational experts were able to assess the principles of the FO IOP concept and confirmed its overall acceptability concerning the following topics:

- Improvement of IOP over OLDI (current system);
- Increased situation awareness;
- Seamless operations (for instance change of route spanning several centres);
- Expectations that Conflict Detection & Resolution tools will benefit from IOP data.

5.2 Recommendations

5.2.1 Recommendations for next phase

For the industrialisation and deployment phases we recommend paying attention to the technical validation of those use cases / technical requirements that have been validated in EXE-IOP-03 by expert judgement.

In principle the results achieved during the exercises demonstrate that the FO is a suitable mechanism to implement the interoperability concepts being validated. Anomalies found during the RTS were assessed to be software implementation problems and not to be specification (TS/IRS) problems.

The observations and experience made during the project can be used to identify the following recommendations to mitigate future development risks:

1. AIM data alignment:
   The experience from the preparation of the RTS exercises showed that the process to align the AIM data between the four ACCs was effortful and complex. The availability of aligned and consistent AIM data is currently a key prerequisite for deployment, under the assumption that every FDMP needs coherent AIM data for the whole IOP area in order to calculate the 4D trajectory.

2. Scalability:
   The bigger the scale of FO IOP equipped ACCs the bigger is the complexity of the FO IOP exchange that must be managed by the solution (see also C.9 and 4.2.4.2).

   a. To mitigate this risk we recommend to further investigate the behaviour of FO IOP enabled systems in larger networks with an increased number of system instances.

   b. To ensure scalability of IOP deployment in the future, it is also recommended to further develop the solution ensuring a quick FO stabilization and efficient protection against multiple successive FO updates.

3. Synchronisation with local view:
   During the preparation of the RTS exercises we frequently experienced that system prototypes lost their synchronisation for a flight object during test steps in factory and at the IBPs (see B.7.3 and C.9). The correct translation between the FO and the local view is a crucial part in order to avoid the degraded mode.
   We recommend to further validate the degraded mode of the FO and the related system behaviour.

4. IOP Holes:
   As mentioned in section 3.2.3 IOP holes were not part of the RTS validation exercises. Even though, technical requirements for IOP hole handling have been defined, they were not validated by means of any use case within this solution.
   We recommended to further vnvestigate the unvalidated requirements during the nexrt phase (see Table 110Table 110).

The recommendations mentioned above do not have an impact on the validated TS/IRS requirements.

For UC#0403 there is a need to create new requirements, e.g. in the frame of EUROCAE WG-59 (see deviation C5 in section 3.3.2).

For more implementation project related recommendations that are out of the scope of this TVALR refer to the Soltution 18-02b contextual note, which will be finished after the present TVALR.

5.2.2 Recommendations for updating ATM Master Plan Level 2

For enabler ATC-STD-01 only the ATSU/ATSU interoperability is in scope of the 18-02b validation exercises. ATSU/NM interoperability is out of scope. Accordingly, we suggest splitting the enabler into two parts.

Also, the solution lead has issued a change request to the applicable dataset in EATMA in order to split the solution into solutions 18-02b (En-route and TMA) and 18-02b1 (NM).

The ATM Master Plan shall be changed with regard to the IOC and FOC dates.

5.2.3 Recommendations on regulation and standardisation initiatives

A revision of EUROCAE Document ED-133 (as released in 2009) is needed for the deployment of basic FO IOP.

The solution PJ18-02b can hand over useful material (especially use cases and technical requirements) to EUROCAE WG-59 in order to revise ED-133.

The validation exercises have shown that some technical requirements are still worth to be improved in order to be less subject to interpretation.

We recommend to maintain the SESAR working method with the dedicated operational and technical teams within the working group.

6 References

6.1 Applicable Documents

This TVALR complies with the requirements set out in the following documents:

[1]   SESAR JU Project Handbook, Ed01.00.01 FINAL, 27th April 2017

[2]   European Operational Concept Validation Methodology (E-OCVM), v3.0, February 2010

6.2 Reference Documents

The following documents were used to provide input / guidance / further information / other:

[3]   SESAR 1, IOP-G VP-022 Validation Report, D103, v00.01.00, 28th February 2014

[4]   SESAR 1, Validation Report EXE-04.03-VP-711, D77, v00.01.00, 30th November 2015

[5]   SESAR 1, Validation Report EXE-04.03- VP-841, D127, v00.02.00, 8th November 2016

[6]   SESAR Solution 18.02b SPR-INTEROP/OSED - Part I, D3.3.070, v01.05.00, 9th October 2020

[7]   SESAR 2020 PJ18-02b-TRL6 –TS/IRS – Final TRL6 Spec Basic IOP Scope, D3.3.080, v03.00.01, 5[h] October 2020

[8]   SESAR 2020 18-02b-TRL6 – Final TVALP, D3.3.025, v00.01.06, 13th August 2020

[9]   SESAR 2020 18-02b-TRL6-TVALR after IOP#1, D3.3.075, v00.01.01, 14th October 2019

[10]   SESAR 2020 PJ18-02b, IOP Use cases master list (1.26), retrieved 28th October 2020 from Stellar (PJ18 4DTM)

[11]   SESAR 2020 PJ18-02b, USECASE-TS per build-UC (1.4), retrieved 26th October 2020 from Stellar (PJ18 4DTM)

[12]   SESAR 2020 PJ18-02b, TS req not validated in EXE (1.2)), retrieved 23th October 2020 from Stellar (PJ18 4DTM)

[13]   EUROCAE ED-133 FLIGHT OBJECT INTEROPERABILTIY SPECIFICATION, June 2009

Appendix A   Technological Validation Exercise #01 Report

A.1   Summary of the Technological Validation Exercise #01 Plan

As in the TVALR for solution 18-02b.

A.2   Technological Validation Exercise #01 description and scope

The key objective was the validation of basic FO IOP in en-route environment up to TRL6 under nominal conditions.

Technological solution 18-02b validation exercise EXE-IOP-01 validated FO IOP in en-route airspace by means of the following phases:

- **Technically driven preparation**
  was performed by technical experts executing tests according to STDs supported by a small size technical scenario (ca. 15 flights). It aimed at demonstrating the functional maturity of the validation platforms under nominal conditions. Finally, it ended with a technical acceptance tests (at the end of TDR#3) at the IBPs that should lead to the Technical Acceptance (TA) of the validation platform.

- **Operationally driven preparation**
  was performed by ATCOs or operational experts executing operational use cases as described in the operational use case documents supported by medium size scenarios (ca. 50 flights). It aimed at demonstrating the initial stability and performance of the validation platforms under nominal conditions. This was a prerequisite for the operational assessment of the FO IOP concept in the validation exercise. Finally, it ended with an operational dry run that should lead to the Operational Acceptance (OA) of the validation platform.

- **Validation exercise execution**
  was performed by ATCOs and operational experts using freely the platforms and systems, under nominal conditions and without being limited concerning the order of the use case execution. The goal was the assessment of the basic FO IOP use cases' implementation supported by medium size scenarios (ca. 50 flights). It ended with an assessment that is documented in the present appendix of this technical validation report (TVALR).

The phases above are linked to the Go/No-Go criteria described in section 5.1.8.2 of the TVALP [8].

The validation exercise used real time simulation techniques with human in the loop. This means that Air Traffic Controllers (ATCOs) or operational experts operated working positions that were part of the IBPs. They performed daily operational procedures and communicated with a local simulator pilot to issue any tactical clearance for a simulated aircraft. All system coordination between the measured sectors of the four participating ACCs was achieved by means of FO IOP.

The IBPs were interconnected by SWIM blue profile services in order to achieve flight object sharing. Each IBP comprised a local simulator that computed the local air traffic and stimulated the industry prototype. All simulators were connected by means of simulator interoperability services that allowed to synchronously start the validation exercise and to transfer the control for a simulated aircraft from one simulator to another.

Founding Members

The following figure shows the high-level architecture of the exercise:
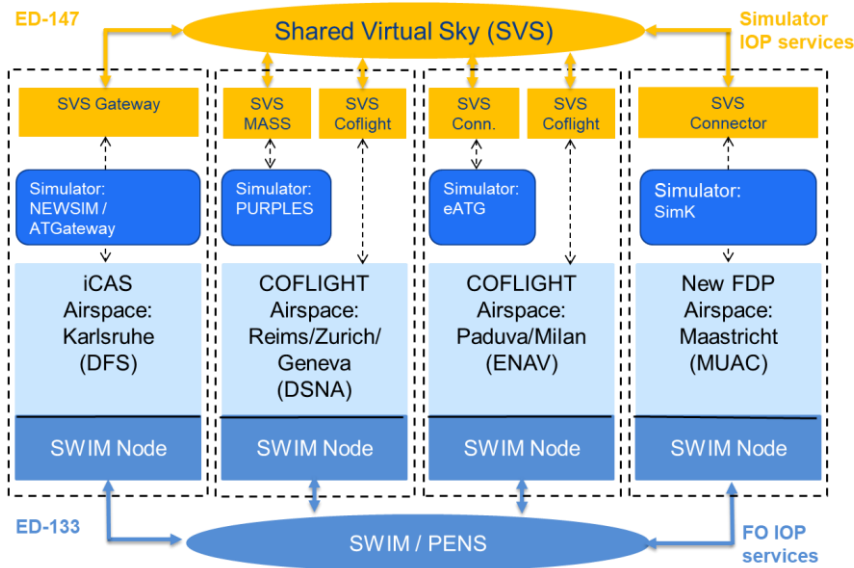
Figure 2: IBPs high level architecture- example EXE-IOP-01

Each IBP included several components as shown in the figure below:
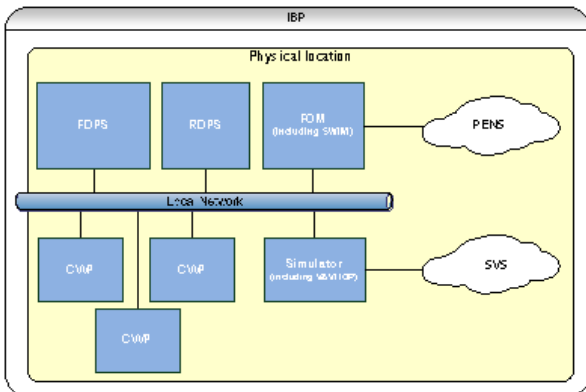
Figure 3: IBP components

IBP Component	Component Description
CWP	Controller working position capable to support the FO IOP information and phases to the ATCO.
FDPS	Flight data processing system capable to exchange FO with the FOM and to compute the information received by means of FO.
FOM	Flight object manager capable to send and receive FOs via SWIM and to exchange the information with the FDPS.
RDPS	Radar data processing system producing track data for each aircraft.
Simulator	Air traffic generator capable to: • feed RDPS with radar plots, • feed FDPS with initial flight plan information and to • emulate adjacent OLDI partners for feeding ATSUs, • support simulator interoperability services.
SVS	Providing simulator interoperability services to the connected simulators.
PENS	Pan European network services providing the means to connect the SWIM nodes of all IBPs and to exchange SWIM blue profile messages.

Table 41: IBP components description

ENAIRE and MUAC conducted an additional bilateral technical activity with the following added value regarding the described main technical exercise:

- Four use cases of EXE IOP-01: UC#0106, UC#0112, UC#0113 and UC#0126.

- One use case of EXE IOP-02: UC#0521.

- Increased number of flights[6] with respect to the EXE IOP-01 execution, in order to demonstrate progress on the performance of the systems.

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[6] The scenario used for this exercise is the HOTEL scenario used during TDR#1 of EXE-IOP-02 for the MUAC-KUAC leg.

A.3 Summary of Exercise #01 Technological Validation Objectives and success criteria

The table below shows how the validation objectives are covered by technical validation exercise EXE-IOP-01.

Additional information to the referenced success criteria can be seen in Appendix D of the TVALP [8].

Note: *The main reason for the partly coverage of the solution validation objectives is that we conducted the success criteria under nominal conditions only.*

SESAR Solution Validation Objective	SESAR Solution Success Criteria	Coverage and Comments on the Coverage of SESAR Solution Validation Objective in Exercise 001	Exercise Validation Objective	Exercise Success Criteria[7]
OBJ-18.02b-TRL6-TVALP-001	CRT-18.02b-TRL6-TVALP-001.001 CRT-18.02b-TRL6-TVALP-001.002 CRT-18.02b-TRL6-TVALP-001.005 CRT-18.02b-TRL6-TVALP-001.006 CRT-18.02b-TRL6-TVALP-001.009 CRT-18.02b-TRL6-TVALP-001.012	Partly covered	EX1-OBJ-18.02b-TRL6-TVALP-001 same description as OBJ-18.02b-TRL6-TVALP-001	EX1-CRT-18.02b-TRL6-TVALP-001.001 EX1-CRT-18.02b-TRL6-TVALP-001.002 EX1-CRT-18.02b-TRL6-TVALP-001.005 EX1-CRT-18.02b-TRL6-TVALP-001.006 EX1-CRT-18.02b-TRL6-TVALP-001.009 EX1-CRT-18.02b-TRL6-TVALP-001.012

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[7] The contents of the exercise success criteria are identical to the equally numbered SESAR solution success criteria (2nd column).

Founding Members

SESAR Solution Validation Objective	SESAR Solution Success Criteria	Coverage and Comments on the Coverage of SESAR Solution Validation Objective in Exercise 001	Exercise Validation Objective	Exercise Success Criteria[7]
	CRT-18.02b-TRL6-TVALP-001.013 CRT-18.02b-TRL6-TVALP-001.018 CRT-18.02b-TRL6-TVALP-001.026			EX1-CRT-18.02b-TRL6-TVALP-001.013 EX1-CRT-18.02b-TRL6-TVALP-001.018 EX1-CRT-18.02b-TRL6-TVALP-001.026
OBJ-18.02b-TRL6-TVALP-002	CRT-18.02b-TRL6-TVALP-002.001 CRT-18.02b-TRL6-TVALP-002.010 CRT-18.02b-TRL6-TVALP-002.014 CRT-18.02b-TRL6-TVALP-002.043 CRT-18.02b-TRL6-TVALP-002.044 CRT-18.02b-TRL6-TVALP-002.045	Partly covered	EX1-OBJ-18.02b-TRL6-TVALP-002 same description as OBJ-18.02b-TRL6-TVALP-002	EX1-CRT-18.02b-TRL6-TVALP-002.001 EX1-CRT-18.02b-TRL6-TVALP-002.010 EX1-CRT-18.02b-TRL6-TVALP-002.014 EX1-CRT-18.02b-TRL6-TVALP-002.043 EX1-CRT-18.02b-TRL6-TVALP-002.044 EX1-CRT-18.02b-TRL6-TVALP-002.045
OBJ-18.02b-TRL6-TVALP-003	CRT-18.02b-TRL6-TVALP-003.001	Partly covered	EX1-OBJ-18.02b-TRL6-TVALP-003 same description as	EX1-CRT-18.02b-TRL6-TVALP-003.001

SESAR Solution Validation Objective	SESAR Solution Success Criteria	Coverage and Comments on the Coverage of SESAR Solution Validation Objective in Exercise 001	Exercise Validation Objective	Exercise Success Criteria[7]
			OBJ-18.02b-TRL6-TVALP-003	
OBJ-18.02b-TRL6-TVALP-004	CRT-18.02b-TRL6-TVALP-004.001	Partly covered	EX1-OBJ-18.02b-TRL6-TVALP-004 same description as OBJ-18.02b-TRL6-TVALP-004	EX1-CRT-18.02b-TRL6-TVALP-004.001

Table 42: Validation objectives addressed in technical validation exercise #01

A.4 Summary of Technological Validation Exercise #01 Validation scenarios

A.4.1 Reference Scenario(s)

One main aspect of the validation was to prove that FO IOP can replace the OLDI communication between ATSUs.

A.4.2 Solution Scenario(s)

The EXE-IOP-01 validation environment was focused on the boundaries between Karlsruhe UAC (Rhein), Maastricht UAC, Reims UAC and Paduva UAC. Beside Reims DSNA added to its Coflight system instance the ATSUs Geneva and Zurich UAC. ENAV took a similar approach by adding the ATSU Milan UAC to its Coflight system instance. Extending the airspace by introducing the ATSUs ZURICH, GENEVA and MILAN opened the opportunity

- to have a common boundary between two Coflight systems instances and

- to increase the number of flights between DSNA Coflight system and DFS iCAS due to the traffic flows between Germany and Switzerland.

The validation was performed considering different simulation scenarios, with airspaces of consolidated sectors. Airspace was commonly defined between exercise partners according to **AIRAC cycle 27th April 2017**.

The following figure shows the airspace covered by the IOP area:
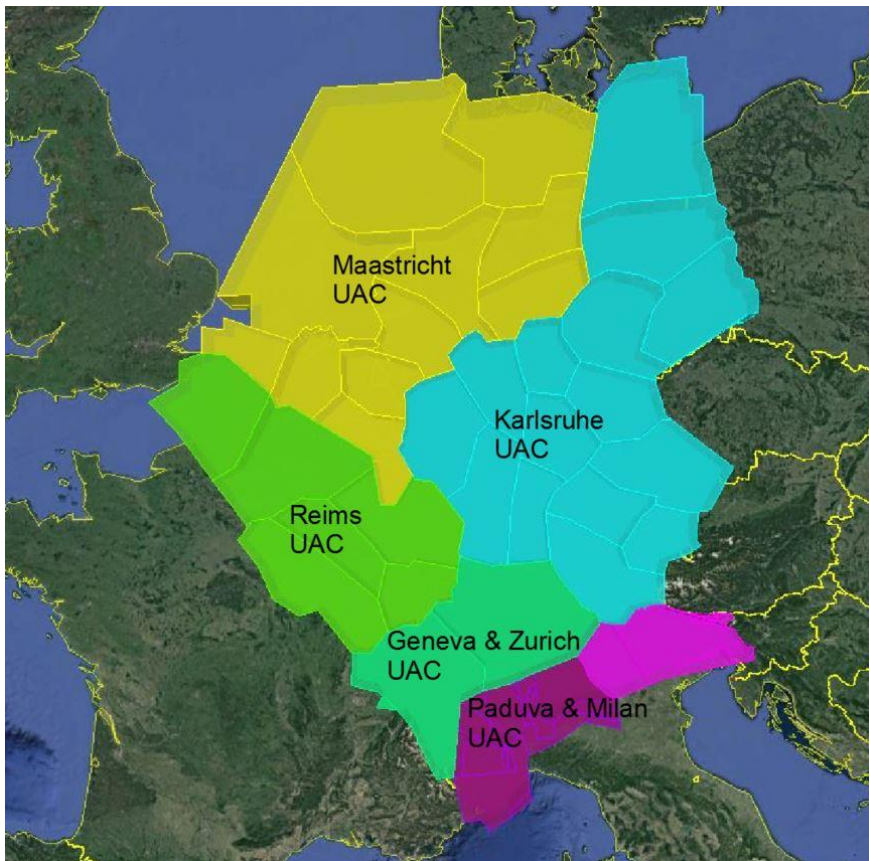
Figure 4: Graphical representation of IOP area

A.4.2.1 Adaptation Data

Definition of adaptation data is on three different levels: IOP adaptation, FDP adaptation and simulator adaptation.

- IOP adaptation is the common and coherent dataset description and covers the airspace of all ACCs involved in the validation exercise. It includes the areas of responsibility and the areas of interest and is used by the Flight Object Manager (FOM). This IOP adaptation description is the minimum set of data to be injected in the systems part of the simulations.

- FDP adaptation needs to be coherent with the IOP adaptation. It comprises the airspace design for the system instances' ACC(s) and covers the definition of airspace volumes, AIM data (like

e.g. sector boundaries, waypoints, airways) and further information needed for the operation of the ATM system (like e.g. Letters of Agreement (LoA) that exist for each neighbour facility).

- Simulator adaptation needs to be coherent with the IOP adaptation as well. It further needs to be aligned with the FDP adaptation regarding the various FDP interfaces that the simulator needs to stimulate (e.g. NM emulation, OLDI partners etc.).

The following steps were applied to secure consistent adaptation data sets necessary for this exercise:

- DSNA coordinated the initial IOP adaptation and kept it up to date.

- Each ANSP checked the coherence of the IOP adaptation with its local FDP adaptation and simulator adaptation and provided feedback to DSNA.

- DSNA disseminated the consolidated IOP adaptation to the industry partners.

- Each ANSP provided its local FDP adaptation data to its industry partner.

- Industry provided the adaptation data for all system components (e.g. CWP, FDP, FOM etc.).

The content of the IOP adaptation was as follows:

- Volume descriptions of Maastricht, Karlsruhe, Reims, Geneva, Zurich, Paduva and Milan airspace

- Significant points (Waypoints, VORs, NDBs)

- Airports

- Airways

A.4.2.2 Traffic Information

The traffic scenarios were based on recorded traffic from AIRAC cycle 27th April 2017.

Different traffic samples that supported the validation needs were developed in coordination between exercise partners.

During the technically driven preparation small and medium size traffic scenarios were used to support integration and software tests.

- The IFTs and FRTs were executed by means of a small size traffic scenario (15 flights) comprising one flight for each leg and direction.

- The execution of scripted tests during TDRs were supported by the medium size traffic scenarios with up to 50 flights:

    o ALPHA - 3 IOP System Instances (KUAC/MUAC/REIM)

    o BRAVO - 3 IOP System Instances (KUAC/LIPU/REIM)

    o CHARLIE - 2 IOP System Instances (KUAC/MUAC)

- o DELTA - 2 IOP System Instances (LIPU/REIM)

- o ECHO - 2 IOP System Instances (KUAC/LIPU)

A.5   Summary Technological Validation Exercise #01 Assumptions

General validation assumptions are provided in section 3.2.3.

Additionally, it was assumed that the input deliverables from solution 18-02b (INTEROP and use cases, TS, ICD, Prototypes) are delivered in time.

A.6   Deviation from the planned activities

No.	Deviation	Refer TVALP	Justification
A1	TDR#3 has been postponed from October 2018 to January 2019.	§4.6	The solution has experienced delay in doing the planned developments and testing.
A2	ODR#1 did not take place. Tests between IBPs using ALPHA and BRAVO scenario have been performed instead.	§4.6	The solution has experienced delay in doing the planned developments and testing, and the impact of the adaptation change has been larger than anticipated. This was the main cause for the delay of the activities. We have focused the effort on the software reliability improvement and chosen to maintain testing of ALPHA/BRAVO traffic on IBP's at the end of December in order to run a test session similar to an ODR#1.
A3	Technical Acceptance After the last official technical dry run (TDR#3) the technical acceptance has not been declared. Accordingly, the initial availability note **Error! Reference source not found.Fehler! Verweisquelle konnte nicht gefunden werden.** (solution internal document) has not been delivered.	§5.1.1, §5.1.9.2.2	Due to delays in development and testing and prioritisation of use case implementations there was no finalisation of the Build 3 functionalities until directly before the conduct of the validation exercise.

No.	Deviation	Refer TVALP	Justification
A4	Validation platforms datasets have not been coherent	§5.1.4.2.1	Due to timely constraints during the preparation process, the final version of harmonised adaptation data (volumes and AIM) has not been implemented into the system prototypes. Harmonisation of adaptation data has been slower than expected due to missing tools supporting the process and the absence of an AIM distribution service. We also realised that the IOP prototype platforms datasets were not fully aligned, introducing limitations
A5	Exercise success criterion EX1-CRT-18.02b-TRL6-TVALP-002.045 (UC#0245) has not been validated technically.	§5.1.3	Due to delays in development and testing and prioritisation of use case implementations.
A6	ATCO CWP rotation did not take place.	§5.1.8.1 §5.1.9.1.1.2	The size and the complexity of the used traffic scenarios did not necessitate to staff multiple sectors and further a rotation of ATCOs at the CWPs.
A7	Operational Free Play sessions did not take place.	§5.1.8.2.2	The focus of the validation exercise was laid on testing the Go-/No-Go criteria. As the operational free play session results were not intended to be used for these criteria the activity has been replaced by further tests of the triangles (KUAC-MUAC-REIMS and KUAC-LIPU-REIMS).
A8	Operational acceptability from ATCO of the IOP operational concept has not been assessed.	§5.1.8.2.3	The validators could not assess the Basic IOP concept due the maturity of the prototypes used which affected scenarios (only +/- 10 tuned flights per boundary) and traffic sample were thus not very realistic
A9	Quadrangle legs have not been tested in the factories.	§5.1.9.1.1.1	The focus was laid on testing the Go-/No-Go criteria, which were defined for bilateral legs only.
A10	Software elements were not frozen for deployment phase.	§5.1.9.1.1.1	Due to the status of the prototype maturity industry tried to improve them

No.	Deviation	Refer TVALP	Justification
			through continuous updates and late deployments.

Table 43: Deviations of validation exercise 1 with respect to the TVALP

A.7 Technological Validation Exercise #01 Validation Results

A.7.1 Summary of Technological Validation Exercise #01 Results

Note: *The main reason for setting the validation objective status to "Partially OK" was that we conducted the success criteria under nominal conditions only.*

Technological Val. Exe. #01 Technological Validation Objective ID	Technological Val. Exe. #01 Technological Validation Objective Title	Technological Val. Exe. #01 Success Criterion ID	Technological Val. Exe. #01 Success Criterion	Technological Val. Exe. #01 Validation Results	Technological Val. Exe. #01 Technological Val. Objective Status
OBJ-18.02b-TRL6-TVALP-001	Coordination and Transfer	CRT-18.02b-TRL6-TVALP-001.001	The technical requirements associated to UC#0101 have been validated technically.	OK [96%]	Partially OK
		CRT-18.02b-TRL6-TVALP-001.002	The technical requirements associated to UC#0102 have been validated technically.	OK [83%]	
		CRT-18.02b-TRL6-TVALP-001.005	The technical requirements associated to UC#0105 have been validated technically.	OK [82%]	
		CRT-18.02b-TRL6-TVALP-001.006	The technical requirements associated to UC#0106 have been validated technically.	OK [76%]	

Technological Val. Exe. #01 Technological Validation Objective ID	Technological Val. Exe. #01 Technological Validation Objective Title	Technological Val. Exe. #01 Success Criterion ID	Technological Val. Exe. #01 Success Criterion	Technological Val. Exe. #01 Validation Results	Technological Val. Exe. #01 Technological Val. Objective Status
		CRT-18.02b-TRL6-TVALP-001.009	The technical requirements associated to UC#0109 have been validated technically.	OK [93%]	
		CRT-18.02b-TRL6-TVALP-001.012	The technical requirements associated to UC#0112 have been validated technically.	OK [79%]	
		CRT-18.02b-TRL6-TVALP-001.013	The technical requirements associated to UC#0113 have been validated technically.	OK [70%]	
		CRT-18.02b-TRL6-TVALP-001.018	The technical requirements associated to UC#0118 have been validated technically.	OK [78%]	
		CRT-18.02b-TRL6-TVALP-001.026	The technical requirements associated to UC#0126 have been validated technically.	OK [69%]	
OBJ-18.02b-TRL6-TVALP-002	Management of the FO Flight Script	CRT-18.02b-TRL6-TVALP-002.001	The technical requirements associated to UC#0201 have been validated technically.	OK [82%]	Partially OK

Technological Val. Exe. #01 Technological Validation Objective ID	Technological Val. Exe. #01 Technological Validation Objective Title	Technological Val. Exe. #01 Success Criterion ID	Technological Val. Exe. #01 Success Criterion	Technological Val. Exe. #01 Validation Results	Technological Val. Exe. #01 Technological Val. Objective Status
		CRT-18.02b-TRL6-TVALP-002.010	The technical requirements associated to UC#0210 have been validated technically.	OK [69%]	
		CRT-18.02b-TRL6-TVALP-002.014	The technical requirements associated to UC#0214 have been validated technically.	OK [79%]	
		CRT-18.02b-TRL6-TVALP-002.043	The technical requirements associated to UC#0243 have been validated technically.	OK [98%]	
		CRT-18.02b-TRL6-TVALP-002.044	The technical requirements associated to UC#0244 have been validated technically.	NOK [n.s. 54%]	
		CRT-18.02b-TRL6-TVALP-002.045	The technical requirements associated to UC#0245 have been validated technically.	NOK [Planned but not validated]	
OBJ-18.02b-TRL6-TVALP-003	Informative Distribution between System Instances	CRT-18.02b-TRL6-TVALP-003.001	The technical requirements associated to UC#0301 have been validated technically.	OK [72%]	Partially OK

Technological Val. Exe. #01 Technological Validation Objective ID	Technological Val. Exe. #01 Technological Validation Objective Title	Technological Val. Exe. #01 Success Criterion ID	Technological Val. Exe. #01 Success Criterion	Technological Val. Exe. #01 Validation Results	Technological Val. Exe. #01 Technological Val. Objective Status
OBJ-18.02b-TRL6-TVALP-004	FO protocol failures	CRT-18.02b-TRL6-TVALP-004.001	The technical requirements associated to UC#0401 have been validated technically.	OK [100%]	Partially OK

Table 44: Technological Validation Results Exercise #01

A.7.1.1 Results on technological feasibility

Results of technical tests at factories and Industry Based Platforms demonstrated the technical feasibility of the FO IOP concept implementation.

The measurements concerning the

- Functional Maturity and the
- Initial Stability and Performance

were above the success criteria thresholds as defined in the TVALP (see section §5.1.8.2 [8]).

A.7.1.2 Results per KPA

Not applicable – KPAs have not been defined for solution PJ.18-02b.

A.7.2 Analysis of Exercise #01 Results per Technological Validation objective

The detailed analysis of the SESAR Technological Solution Validation Results of section 4.1 followed the approach described in section 5.1.8.2 of the TVALP [8]. Two demonstration criteria were defined:

1. Functional Maturity demonstration criteria
   The functional maturity was demonstrated at the factories of the industry partners.
   The results comprise a snapshot of the industry tests before EXE-IOP-01.

2. Initial Stability and Performance demonstration criteria
   The initial stability and performance was demonstrated at the IBPs of the ANSPs.
   The results are a summary of the ODRs and the integration test for EXE-IOP-01.

Additionally, detailed results were collected during the conduct of the technical validation exercise.

The detailed results regarding the demonstration criteria are shown in the following embedded document:

Detailed analysis of
EXE-IOP-01 results

The consolidated results for the validation exercise are shown in the following sub-sections.

Only the validation objectives and success criteria, which were planned to be technically validated in EXE-IOP-01 according to the TVALP, are analysed here. The rest was validated in EXE-IOP-02 or EXE-IOP-03.

The validation results are marked as follows:

OK: The validation result matches the specification.

NOK: The validation result does not match the specification.

A.7.2.1 OBJ-18.02b-TRL6-TVALP-001 Results

This objective deals with the validation of the coordination and transfer use cases:

Use Case ID	Succ. Crit. ID	Use Case Title
UC#0101	CRT-18.02b-TRL6-TVALP-001.001	Automatic Triggering of SAP/CAP/NP - compliance with LOA's
UC#0102	CRT-18.02b-TRL6-TVALP-001.002	Manual Triggering of CAP/NP
UC#0105	CRT-18.02b-TRL6-TVALP-001.005	Change of coordination data or trajectory during SAP
UC#0106	CRT-18.02b-TRL6-TVALP-001.006	Change of coordination data or trajectory during CAP
UC#0109	CRT-18.02b-TRL6-TVALP-001.009	Change of C&T data or trajectory in NP without electronic negotiation
UC#0112	CRT-18.02b-TRL6-TVALP-001.012	Request on Frequency
UC#0113	CRT-18.02b-TRL6-TVALP-001.013	Change of Frequency /Assume
UC#0118	CRT-18.02b-TRL6-TVALP-001.018	Force-assume by the Receiving RE
UC#0126	CRT-18.02b-TRL6-TVALP-001.026	Negotiation of C&T contractual data other than DCT between Transferring RE and Receiving RE

Table 45: Validated Success Criteria / Use Cases of OBJ-18.02b-TRL6-TVALP-001 in EXE-IOP-01

A.7.2.1.1   CRT-18.02b-TRL6-TVALP-001.001 (UC#0101)

UC Title: **Automatic Triggering of SAP/CAP/NP - compliance with LOA's**

UC Result: The technical requirements associated to UC#0101 have been validated technically by means of RTS.

In 99 % of the test cases (103) the system reacted as defined in the use case.

Leg	Leg	UC#0101					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	**KR**	0	0	0	-	-	-
MUAC ↔ REIM	**MR**	59	0	59	100%	100%	*
KUAC ↔ MUAC	**KM**	4	2	6	67%	89%	n.s.
ENAIRE ↔ MUAC	**EM**	3	0	3	100%	100%	*
LIPU ↔ REIM	**RL**	11	0	11	100%	100%	*
KUAC ↔ LIPU	**KL**	2	1	3	67%	88%	n.s.
KUAC↔ MUAC ↔ REIM	**KMR**	13	1	14	93%	100%	*
KUAC↔ LIPU ↔ REIM	**KLR**	7	0	7	100%	100%	*
	Total:	99	4	103	96%	100%	*
Average use case success / Significance:		99% / *					

Table 46: Validation Result of CRT-18.02b-TRL6-TVALP-001.001 (UC#0101)

A.7.2.1.2   CRT-18.02b-TRL6-TVALP-001.002 (UC#0102)

UC Title: **Manual Triggering of CAP/NP**

UC Result: The technical requirements associated to UC#0102 have been validated technically by means of RTS.

In 85% of the test cases (34) the system reacted as defined in the use case.

Leg	Leg	UC#0102					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	**KR**	5	0	5	100%	100%	*
MUAC ↔ REIM	**MR**	1	2	3	33%	50%	n.s.
KUAC ↔ MUAC	**KM**	5	1	6	83%	98%	*
ENAIRE ↔ MUAC	**EM**	4	0	4	100%	100%	*
LIPU ↔ REIM	**RL**	4	0	4	100%	100%	*
KUAC ↔ LIPU	**KL**	9	0	9	100%	100%	*
KUAC↔ MUAC ↔ REIM	**KMR**	0	2	2	0%	25%	n.s.
KUAC↔ LIPU ↔ REIM	**KLR**	1	0	1	100%	100%	*
	Total:	29	5	34	85%	100%	*
Average use case success / Significance:		85% / *					

Table 47: Validation Result of CRT-18.02b-TRL6-TVALP-001.002 (UC#0102)

A.7.2.1.3 CRT-18.02b-TRL6-TVALP-001.005 (UC#0105)

UC Title: **Change of coordination data or trajectory during SAP**

UC Result: The technical requirements associated to UC#0105 have been validated technically by means of RTS.

In 85% of the test cases (34) the system reacted as defined in the use case.

Leg	Leg	UC#0105					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	**KR**	3	0	3	100%	100%	*
MUAC ↔ REIM	**MR**	5	0	5	100%	100%	*
KUAC ↔ MUAC	**KM**	9	1	10	90%	100%	*
ENAIRE ↔ MUAC	**EM**	8	1	9	89%	100%	*
LIPU ↔ REIM	**RL**	15	7	22	68%	97%	*
KUAC ↔ LIPU	**KL**	1	0	1	100%	100%	*
KUAC↔ MUAC ↔ REIM	**KMR**	6	0	6	100%	100%	*
KUAC↔ LIPU ↔ REIM	**KLR**	0	1	1	0%	50%	n.s.

Leg	Leg	UC#0105					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
Total:		29	5	34	85%	100%	*
Average use case success / Significance:		85% / *					

Table 48: Validation Result of CRT-18.02b-TRL6-TVALP-001.005 (UC#0105)

A.7.2.1.4   CRT-18.02b-TRL6-TVALP-001.006 (UC#0106)

UC Title: **Change of coordination data or trajectory during CAP**

UC Result: The technical requirements associated to UC#0106 have been validated technically by means of RTS.

In 79% of the test cases (61) the system reacted as defined in the use case.

Leg	Leg	UC#0106					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	7	1	8	88%	100%	*
MUAC ↔ REIM	MR	4	2	6	67%	89%	n.s.
KUAC ↔ MUAC	KM	7	0	7	100%	100%	*
ENAIRE ↔ MUAC	EM	14	2	16	88%	100%	*
LIPU ↔ REIM	RL	4	6	10	40%	38%	n.s.
KUAC ↔ LIPU	KL	7	0	7	100%	100%	*
KUAC↔ MUAC ↔ REIM	KMR	1	1	2	50%	75%	n.s.
KUAC↔ LIPU ↔ REIM	KLR	4	1	5	80%	97%	*
Total:		48	13	61	79%	100%	*
Average use case success / Significance:		79% / *					

Table 49: Validation Result of CRT-18.02b-TRL6-TVALP-001.006 (UC#0106)

A.7.2.1.5   CRT-18.02b-TRL6-TVALP-001.009 (UC#0109)

UC Title: **Change of C&T data or trajectory in NP without electronic negotiation**

UC Result: The technical requirements associated to UC#0109 have been validated technically by means of RTS.

In 93% of the test cases (29) the system reacted as defined in the use case.

Leg	Leg	UC#0109					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	2	1	3	67%	88%	n.s.
MUAC ↔ REIM	MR	6	1	7	86%	99%	*
KUAC ↔ MUAC	KM	6	0	6	100%	100%	*
ENAIRE ↔ MUAC	EM	1	0	1	100%	100%	*
LIPU ↔ REIM	RL	4	0	4	100%	100%	*
KUAC ↔ LIPU	KL	3	0	3	100%	100%	*
KUAC↔ MUAC ↔ REIM	KMR	2	0	2	100%	100%	*
KUAC↔ LIPU ↔ REIM	KLR	3	0	3	100%	100%	*
	Total:	27	2	29	93%	100%	*
Average use case success / Significance:		93% / *					

Table 50: Validation Result of CRT-18.02b-TRL6-TVALP-001.009 (UC#0109)

A.7.2.1.6   CRT-18.02b-TRL6-TVALP-001.012 (UC#0112)

UC Title: **Request on Frequency**

UC Result: The technical requirements associated to UC#0112 have been validated technically by means of RTS.

In 80% of the test cases (114) the system reacted as defined in the use case.

Leg	Leg	UC#0112					
		OK	NOK	Total	OK [%]	Binom. Test	Significa nce
KUAC ↔ REIM	KR	11	0	11	100%	100%	*
MUAC ↔ REIM	MR	17	3	20	85%	100%	*
KUAC ↔ MUAC	KM	12	4	16	75%	99%	*
ENAIRE ↔ MUAC	EM	12	1	13	92%	100%	*
LIPU ↔ REIM	RL	5	3	8	63%	86%	n.s.
KUAC ↔ LIPU	KL	7	1	8	88%	100%	*
KUAC↔ MUAC ↔ REIM	KMR	19	3	22	86%	100%	*
KUAC↔ LIPU ↔ REIM	KLR	8	8	16	50%	60%	n.s.
	Total:	91	23	114	80%	100%	*
Average use case success / Significance:		80% / *					

Table 51: Validation Result of CRT-18.02b-TRL6-TVALP-001.012 (UC#0112)

A.7.2.1.7 CRT-18.02b-TRL6-TVALP-001.013 (UC#0113)

UC Title: **Change of Frequency /Assume**

UC Result: The technical requirements associated to UC#0113 have been validated technically by means of RTS.

In 72% of the test cases (163) the system reacted as defined in the use case.

Leg	Leg	UC#0113					
		OK	NOK	Total	OK [%]	Binom. Test	Significa nce
KUAC ↔ REIM	KR	16	12	28	57%	83%	n.s.
MUAC ↔ REIM	MR	25	3	28	89%	100%	*
KUAC ↔ MUAC	KM	14	8	22	64%	93%	n.s.
ENAIRE ↔ MUAC	EM	10	0	10	100%	100%	*
LIPU ↔ REIM	RL	16	4	20	80%	100%	*
KUAC ↔ LIPU	KL	4	1	5	80%	97%	*
KUAC↔ MUAC ↔ REIM	KMR	18	12	30	60%	90%	n.s.
KUAC↔ LIPU ↔ REIM	KLR	14	6	20	70%	98%	*

Leg	Leg	UC#0113					
		OK	NOK	Total	OK [%]	Binom. Test	Significa nce
Total:		117	46	163	72%	100%	*
Average use case success / Significance:		72% / *					

Table 52: Validation Result of CRT-18.02b-TRL6-TVALP-001.013 (UC#0113)

A.7.2.1.8   CRT-18.02b-TRL6-TVALP-001.018 (UC#0118)

UC Title: **Force-assume by the Receiving RE**

UC Result: The technical requirements associated to UC#0118 have been validated technically by means of RTS.

In 78% of the test cases (82) the system reacted as defined in the use case.

Leg	Leg	UC#0118					
		OK	NOK	Total	OK [%]	Binom. Test	Significa nce
KUAC ↔ REIM	KR	3	0	3	100%	100%	*
MUAC ↔ REIM	MR	16	2	18	89%	100%	*
KUAC ↔ MUAC	KM	12	2	14	86%	100%	*
ENAIRE ↔ MUAC	EM	3	1	4	75%	94%	n.s.
LIPU ↔ REIM	RL	10	1	11	91%	100%	*
KUAC ↔ LIPU	KL	8	2	10	80%	99%	*
KUAC↔ MUAC ↔ REIM	KMR	6	5	11	55%	73%	n.s.
KUAC↔ LIPU ↔ REIM	KLR	6	5	11	55%	73%	n.s.
Total:		64	18	82	78%	100%	*
Average use case success / Significance:		78% / *					

Table 53: Validation Result of CRT-18.02b-TRL6-TVALP-001.018 (UC#0118)

A.7.2.1.9   CRT-18.02b-TRL6-TVALP-001.026 (UC#0126)

UC Title: **Negotiation of C&T contractual data other than DCT between Transferring RE and Receiving RE**

UC Result: The technical requirements associated to UC#0126 have been validated technically by means of RTS.

In 71% of the test cases (112) the system reacted as defined in the use case.

Leg	Leg	UC#0126					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	**KR**	11	9	20	55%	75%	n.s.
MUAC ↔ REIM	**MR**	13	5	18	72%	98%	*
KUAC ↔ MUAC	**KM**	12	2	14	86%	100%	*
ENAIRE ↔ MUAC	**EM**	11	1	12	92%	100%	*
LIPU ↔ REIM	**RL**	15	5	20	75%	99%	*
KUAC ↔ LIPU	**KL**	9	2	11	82%	99%	*
KUAC↔ MUAC ↔ REIM	**KMR**	7	6	13	54%	71%	n.s.
KUAC↔ LIPU ↔ REIM	**KLR**	2	2	4	50%	69%	n.s.
Total:		80	32	112	71%	100%	*
Average use case success / Significance:		71% / *					

<div align="center">Table 54: Validation Result of CRT-18.02b-TRL6-TVALP-001.026 (UC#0126)</div>

A.7.2.2 OBJ-18.02b-TRL6-TVALP-002 Results

This objective deals with the validation of the Management of the FO Flight Script use cases.

Use Case ID	Succ. Crit. ID	Use Case Title
UC#0201	CRT-18.02b-TRL6-TVALP-002.001	Creation and sharing of a constraint
UC#0210	CRT-18.02b-TRL6-TVALP-002.010	Modification of 2D Route
UC#0214	CRT-18.02b-TRL6-TVALP-002.014	En route cruising level management

Use Case ID	Succ. Crit. ID	Use Case Title
UC#0243	CRT-18.02b-TRL6-TVALP-002.043	Sharing of executive constraints (CFL, Speed, Heading, Rate)
UC#0244	CRT-18.02b-TRL6-TVALP-002.044	Route amendment inside a downstream's airspace
UC#0245	CRT-18.02b-TRL6-TVALP-002.045	Transfer of a constraint impacted by a route change

Table 55: Validated Success Criteria / Use Cases of OBJ-18.02b-TRL6-TVALP-002 in EXE-IOP-01

A.7.2.2.1   CRT-18.02b-TRL6-TVALP-002.001 (UC#0201)

UC Title: **Creation and sharing of a constraint**

UC Result: The technical requirements associated to UC#0201 have been validated technically by means of RTS.

In 82% of the test cases (11) the system reacted as defined in the use case.

Leg	Leg	UC#0201					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	0	0	0	-	-	-
MUAC ↔ REIM	MR	1	2	3	33%	50%	n.s.
KUAC ↔ MUAC	KM	5	0	5	100%	100%	*
ENAIRE ↔ MUAC	EM	2	0	2	100%	100%	*
LIPU ↔ REIM	RL	0	0	0	-	-	-
KUAC ↔ LIPU	KL	0	0	0	-	-	-
KUAC↔ MUAC ↔ REIM	KMR	1	0	1	100%	100%	*
KUAC↔ LIPU ↔ REIM	KLR	0	0	0	-	-	-
	Total:	9	2	11	82%	99%	*
Average use case success / Significance:		82% / *					

Table 56: Validation Result of CRT-18.02b-TRL6-TVALP-002.001 (UC#0201)

A.7.2.2.2 CRT-18.02b-TRL6-TVALP-002.010 (UC#0210)

UC Title: **Modification of 2D Route**

UC Result: The technical requirements associated to UC#0210 have been validated technically by means of RTS.

In 69% of the test cases (75) the system reacted as defined in the use case.

Leg	Leg	UC#0210					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	6	4	10	60%	83%	n.s.
MUAC ↔ REIM	MR	5	5	10	50%	62%	n.s.
KUAC ↔ MUAC	KM	9	3	12	75%	98%	*
ENAIRE ↔ MUAC	EM	1	0	1	100%	100%	*
LIPU ↔ REIM	RL	16	1	17	94%	100%	*
KUAC ↔ LIPU	KL	7	5	12	58%	81%	n.s.
KUAC↔ MUAC ↔ REIM	KMR	3	1	4	75%	94%	n.s.
KUAC↔ LIPU ↔ REIM	KLR	5	4	9	56%	75%	n.s.
	Total:	52	23	75	69%	100%	*
Average use case success / Significance:	69% / *						

Table 57: Validation Result of CRT-18.02b-TRL6-TVALP-002.010 (UC#0210)

A.7.2.2.3 CRT-18.02b-TRL6-TVALP-002.014 (UC#0214)

UC Title: **En route cruising level management**

UC Result: The technical requirements associated to UC#0214 have been validated technically by means of RTS.

In 79% of the test cases (34) the system reacted as defined in the use case.

Leg	Leg	UC#0214					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	1	4	5	20%	19%	n.s.
MUAC ↔ REIM	MR	5	0	5	100%	100%	*
KUAC ↔ MUAC	KM	8	1	9	89%	100%	*
ENAIRE ↔ MUAC	EM	0	0	0	-	-	-
LIPU ↔ REIM	RL	9	1	10	90%	100%	*
KUAC ↔ LIPU	KL	3	1	4	75%	94%	n.s.
KUAC↔ MUAC ↔ REIM	KMR	1	0	1	100%	100%	*
KUAC↔ LIPU ↔ REIM	KLR	0	0	0	-	-	-
	Total:	27	7	34	79%	100%	*
Average use case success / Significance:		79% / *					

Table 58: Validation Result of CRT-18.02b-TRL6-TVALP-002.014 (UC#0214)

A.7.2.2.4   CRT-18.02b-TRL6-TVALP-002.043 (UC#0243)

UC Title: **Sharing of executive constraints (CFL, Speed, Heading, Rate)**

UC Result: The technical requirements associated to UC#0243 have been validated technically by means of RTS.

In 98% of the test cases (45) the system reacted as defined in the use case.

Leg	Leg	UC#0243					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	6	1	7	86%	99%	*
MUAC ↔ REIM	MR	4	0	4	100%	100%	*
KUAC ↔ MUAC	KM	11	0	11	100%	100%	*
ENAIRE ↔ MUAC	EM	0	0	0	-	-	-
LIPU ↔ REIM	RL	13	0	13	100%	100%	*
KUAC ↔ LIPU	KL	4	0	4	100%	100%	*
KUAC↔ MUAC ↔ REIM	KMR	1	0	1	100%	100%	*
KUAC↔ LIPU ↔ REIM	KLR	5	0	5	100%	100%	*

Founding Members

Leg	Leg	UC#0243					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
Total:		44	1	45	98%	100%	*
Average use case success / Significance:		98% / *					

Table 59: Validation Result of CRT-18.02b-TRL6-TVALP-002.043 (UC#0243)

A.7.2.2.5   CRT-18.02b-TRL6-TVALP-002.044 (UC#0244)

UC Title: **Route amendment inside a downstream's airspace**

UC Result: The technical requirements associated to UC#0244 have been validated technically by means of RTS.

In 54% of the test cases (35) the system reacted as defined in the use case.

Note: The result of the bionomical test is not significant.

Leg	Leg	UC#0244					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	**KR**	3	6	9	33%	25%	n.s.
MUAC ↔ REIM	**MR**	0	1	1	0%	50%	n.s.
KUAC ↔ MUAC	**KM**	3	3	6	50%	66%	n.s.
ENAIRE ↔ MUAC	**EM**	0	0	0	-	-	-
LIPU ↔ REIM	**RL**	10	0	10	100%	100%	*
KUAC ↔ LIPU	**KL**	1	2	3	33%	50%	n.s.
KUAC↔ MUAC ↔ REIM	**KMR**	1	2	3	33%	50%	n.s.
KUAC↔ LIPU ↔ REIM	**KLR**	1	2	3	33%	50%	n.s.
Total:		19	16	35	54%	75%	n.s.
Average use case success / Significance:		54% / n.s.					

Table 60: Validation Result of CRT-18.02b-TRL6-TVALP-002.044(UC#0244)

A.7.2.3 OBJ-18.02b-TRL6-TVALP-003 Results

This objective deals with the validation of the Informative Distribution between System Instances use cases.

Use Case ID	Succ. Crit. ID	Use Case Title
UC#0301	CRT-18.02b-TRL6-TVALP-003.001	FO creation & sharing

Table 61: Validated Success Criterion / Use Case of OBJ-18.02b-TRL6-TVALP-003 in EXE-IOP-01

A.7.2.3.1   CRT-18-02b-TRL6-TVALP-003.001 (UC#0301)

UC Title: **FO creation & sharing**

UC Result: The technical requirements associated to UC#0301 have been validated technically by means of RTS.

In 80% of the test cases (217) the system reacted as defined in the use case.

Leg	Leg	UC#0301					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	0	2	2	0%	25%	n.s.
MUAC ↔ REIM	MR	56	12	68	82%	100%	*
KUAC ↔ MUAC	KM	0	0	0	-	-	-
ENAIRE ↔ MUAC	EM	64	0	64	100%	100%	*
LIPU ↔ REIM	RL	30	2	32	94%	100%	*
KUAC ↔ LIPU	KL	0	0	0	-	-	-
KUAC↔ MUAC ↔ REIM	KMR	15	16	31	48%	50%	n.s.
KUAC↔ LIPU ↔ REIM	KLR	9	11	20	45%	41%	n.s.
Total:		174	43	217	80%	100%	*
Average use case success / Significance:		80% / *					

Table 62: Validation Result of CRT-18.02b-TRL6-TVALP-003.001 (UC#0301)

A.7.2.4 OBJ-18.02b-TRL6-TVALP-004 Results

This objective deals with the validation of the FO protocol failures use cases.

Use Case ID	Succ. Crit. ID	Use Case Title
UC#0401	CRT-18.02b-TRL6-TVALP-004.001	Management of discrepancies with local view

Table 63: Validated Success Criterion / Use Case of OBJ-18.02b-TRL6-TVALP-004 in EXE-IOP-01

A.7.2.4.1 CRT-18.02b-TRL6-TVALP-004.001 (UC#0401)

UC Title: **Management of discrepancies with local view**

UC Result: The technical requirements associated to UC#0401 have been validated technically by means of RTS.

In 100% of the test cases (6) the system reacted as defined in the use case.

Leg	Leg	UC#0401					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	0	0	0	-	-	-
MUAC ↔ REIM	MR	0	0	0	-	-	-
KUAC ↔ MUAC	KM	0	0	0	-	-	-
ENAIRE ↔ MUAC	EM	0	0	0	-	-	-
LIPU ↔ REIM	RL	1	0	1	100%	100%	*
KUAC ↔ LIPU	KL	4	0	4	100%	100%	*
KUAC↔ MUAC ↔ REIM	KMR	0	0	0	-	-	-
KUAC↔ LIPU ↔ REIM	KLR	1	0	1	100%	100%	*
Total:		6	0	6	100%	100%	*
Average use case success / Significance:		100% / *					

Table 64: Validation Result of CRT-18.02b-TRL6-TVALP-004.001 (UC#0401)

A.7.3 Unexpected Behaviours/Results

The following table contains the open anomalies found during the preparation and conduct of the validation exercise.

A more detailed analysis is given in the trouble ticket system MANTIS where the IOP analysis team jointly provided more information and possible solutions to resolve the anomalies.

The anomaly severity was assigned after mutual agreement of ANSPs and industry and is defined as follows:

- **Critical (Priority urgent):**
  The systems are not working properly, making the continuation of the execution of the exercise unfeasible (repetitive crash).
- **Blocking (Priority urgent):**
  The flight cannot be controlled by one of the partners anymore (e.g. flight cannot be created, updates not transmitted to the FDC, updates from FDMP not reflected on the FDC, not possible to issue a clearance, flight plan not correlated)
- **Major (Priority high):**
  The core of the expected processing in a UC is not met. The flight cannot be controlled as usual but a workaround that could be used in current operations is possible (e.g. electronic coordination fails but can be done via voice and the downstream can assume the flight, cannot transfer electronically but it can be done via voice and the downstream can become FDMP, flight is created with erroneous fields that can be updated manually, coordination not abrogated on the downstream after change of route). The purpose should not be to force-assume all flights as a backup, it is that the expected steps are executed correctly. "Major" should reflect this.
- **Minor (Priority normal):**
  The core of the expected processing in a UC is met, but side effects are not as expected. The flight can be controlled but there are incorrect behaviours (e.g. erroneous field value, wrong colour code) "minor":
  - o visualization is not perfect although at IOP and local view level the processing is OK"
  - o a less important step of a UC has not run correctly (a non-core one)
- **Trivial (Priority low):**
  A minor unexpected system behaviour not effecting the processing of a flight.

ID	Severity	Status	Owner	LEG	Summary
747	minor	assigned	Leonardo	KUAC&gt	
741	minor	assigned	Leonardo	LIPU&gt	
740	minor	assigned	Leonardo	LIPU&gt	
739	major	assigned	Coflight	KUAC&gt	
738	minor	assigned	Leonardo	LIPU&gt	
737	block	assigned	Coflight	MUAC&gt	
735	major	confirmed	Indra	MUAC&gt	
734	minor	assigned	DSNA	KUAC-MUAC-REIM	Coflights rejects the creation of some flights by FO received due to incorrect FPL values
729	major	confirmed	Indra	REIM&gt	

ID	Severity	Status	Owner	LEG	Summary
728	minor	assigned	Thales	KUAC-MUAC-REIM	REIM cannot see on its HMI a TFL change
727	major	assigned	Coflight	KUAC&gt	
726	major	assigned	LIPU	REIM-KUAC-LIPU	The ROF send by Kuac it is not processed by LIPU
724	minor	assigned	Coflight	REIM-KUAC-LIPU	KUAC (upstream) does not process the desynchronization request from LIPU (downstream)
723	major	assigned	Leonardo	REIM-KUAC-LIPU	Error when applying a route change received from a FO
722	major	assigned	Indra	KUAC&gt	
721	minor	assigned	Thales	REIM&gt	
720	major	assigned	Thales	KUAC-MUAC-REIM	Old_FO_version answered by REIM to MUAC requests
719	major	assigned	Leonardo	KUAC-MUAC-REIM	Coflight does not send SAP request (issue when creating the local SFPL from IOP)
718	major	assigned	Coflight	LIPU&gt	
717	minor	assigned	Indra	KUAC-MUAC-REIM	MUAC does not publish FO upon certain inputs are performed
715	minor	assigned	Adapt	KUAC-MUAC-REIM	REIM does not receive any FO upon force activation by KUAC (Airway UN491 inconsistent definition)
713	major	assigned	Indra	KUAC&gt	
712	minor	assigned	Thales	MUAC&gt	
711	major	assigned	Thales	MUAC&gt	
710	major	assigned	Indra	LIPU&gt	
708	major	assigned	Thales	KUAC&gt	
707	major	assigned	Leonardo	KUAC&gt	
706	minor	assigned	Indra	KUAC&gt	
705	minor	assigned	Indra	MUAC&gt	
703	major	assigned	Thales	REIM&gt	
702	minor	assigned	Indra	MUAC&gt	
700	major	assigned	Indra	MUAC&gt	
699	major	assigned	Indra	MUAC&gt	
698	major	assigned	Indra	KUAC&gt	
695	major	assigned	Indra	MUAC&gt	
692	major	assigned	Indra	MUAC&gt	
687	major	assigned	Indra	KUAC&gt	
686	major	assigned	Indra	MUAC&gt	
685	major	assigned	Coflight	KUAC-MUAC-REIM	After KUAC acceptance (FL330) WIFO, REIM sees the value automatically changing to FL350)
684	major	assigned	Indra	KUAC&gt	
683	major	assigned	Indra	KUAC&gt	
682	major	assigned	Indra	KUAC&gt	
681	major	confirmed	Coflight	REIM&gt	
680	major	assigned	Indra	KUAC&gt	
679	major	assigned	Indra	KUAC&gt	
678	major	assigned	Indra	KUAC&gt	

ID	Severity	Status	Owner	LEG	Summary
677	minor	assigned	Leonardo	REIM-KUAC-LIPU	Loop on constraint addition requests (LIPU, 10)
676	major	assigned	Indra	KUAC&gt	
675	major	assigned	Leonardo	REIM-KUAC-LIPU	Wifo issue on ELY324
673	major	assigned	Leonardo	REIM&gt	
671	major	assigned	Indra	KUAC&gt	
670	major	assigned	indra	KUAC&gt	
668	minor	confirmed	Leonardo	LIPU&gt	
667	minor	confirmed	Leonardo	LIPU&gt	
665	major	assigned	Leonardo	LIPU&gt	
664	minor	confirmed	Leonardo	LIPU&gt	
663	minor	assigned	Thales	LIPU&gt	
660	major	confirmed	Indra	MUAC&gt	
656	major	confirmed	Leonardo	MUAC&gt	
654	major	confirmed	Leonardo	KUAC&gt	
653	major	assigned	Thales	MUAC&gt	
649	minor	assigned	Thales	MUAC&gt	
624	major	assigned	Indra	KUAC&gt	
622	major	assigned	Coflight	KUAC&gt	
621	major	confirmed	Indra	KUAC&gt	
620	minor	confirmed	Indra	REIM&gt	
618	major	assigned	Indra	KUAC&gt	
616	major	assigned	Thales	KUAC&gt	
613	major	assigned	Indra	KUAC&gt	
612	major	assigned	Thales	KUAC&gt	
608	major	assigned	Coflight	KUAC&gt	
607	major	assigned	Thales	KUAC&gt	
605	major	assigned	Thales	REIM&gt	
604	major	assigned	Thales	REIM&gt	
603	major	assigned	Indra	REIM&gt	
599	major	assigned	Leonardo	KUAC&gt	
597	major	assigned	Indra	MUAC&gt	
595	major	feedback	Dataset	LIPU&gt	
594	major	assigned	Thales		REIM starts a loop sending multiple times the same "srv_modify_constraint" service which is processed by the FDMP
591	major	assigned	Coflight	MUAC&gt	
589	major	assigned	Thales	MUAC&gt	
581	major	assigned	Leonardo	LIPU&gt	
578	major	assigned	Leonardo	KUAC&gt	
574	major	assigned	Indra	KUAC&gt	
573	minor	assigned	SE	KUAC&gt	
572	major	assigned	Thales	KUAC&gt	
571	major	assigned	Coflight	REIM&gt	
569	block	assigned	indra	REIM&gt	
567	major	assigned	Indra	KUAC&gt	
565	major	assigned	Indra	LIPU&gt	
558	major	assigned	Adapt	MUAC&gt	

ID	Severity	Status	Owner	LEG	Summary
557	major	assigned	Thales	MUAC&gt	
549	minor	assigned	Indra	MUAC&gt	
505	minor	assigned	Indra	MUAC&gt	
502	major	assigned	Leonardo	LIPU&gt	
500	major	assigned	Indra	LIPU&gt	
499	minor	assigned	Leonardo	LIPU&gt	
497	major	pending	Leonardo	KUAC&gt	
495	trivial	assigned	Leonardo	LIPU&gt	
491	minor	assigned	Thales	REIM&gt	
490	major	assigned	Thales	REIM&gt	
489	minor	assigned	Indra	MUAC&gt	
487	minor	assigned	Industry	MUAC&gt	
480	minor	assigned	Leonardo	KUAC&gt	
478	minor	assigned	Indra	KUAC&gt	
475	major	assigned	Thales	KUAC&gt	
473	major	assigned	Coflight	KUAC&gt	
472	major	pending	Industry	KUAC&gt	
471	major	assigned	Indra	KUAC&gt	
466	trivial	assigned	Thales	KUAC&gt	
459	major	assigned	Indra	KUAC&gt	
458	minor	assigned	Indra	REIM&gt	
455	major	assigned	Indra	MUAC&gt	
454	major	assigned	Thales	REIM&gt	
445	trivial	assigned	Indra	REIM&gt	
441	minor	assigned	Thales	KUAC&gt	
430	minor	pending	Thales	MUAC&gt	
414	major	assigned	Leonardo	LIPU&gt	
412	minor	assigned	SE	KUAC&gt	
393	minor	confirmed	Syst_Eng	KUAC&gt	
392	minor	assigned	Leonardo	LIPU&gt	
387	major	pending	Industry	KUAC&gt	
385	trivial	assigned	Thales	KUAC&gt	
377	minor	assigned	Leonardo	LIPU&gt	
357	minor	assigned	Indra	REIM&gt	
339	trivial	assigned	Thales	REIM&gt	
309	block	pending	Syst_Eng	KUAC&gt	

Table 65: Anomalies of Validation Exercise #01

A.7.4 Confidence in Results of Validation Exercise #01

A.7.4.1 Level of significance/limitations of Technological Validation Exercise Results

The validation results obtained between all simulation environments in the technical validation exercise were sufficiently representative, since all RTS validated use cases but one (UC#0244) were validated with significance. Currently, the results are not ready to be integrated at the SESAR Technology Solution level, because we only validated the nominal conditions in the first step. Readiness will be given after the conduct of EXE-IOP-02 where the use cases will be validated under nominal and non-nominal conditions.

The validation environment was simplified with regards to traffic size, traffic flows and flight plan realism.

The validating controllers were not able to manage the traffic as in real operations because of the present maturity level of the validation environment.

Only if we can repeat the good results under the more realistic conditions in EXE-IOP-02, then the validated functions can be seen as ready for deployment (TRL 6).

A.7.4.2 Quality of Technological Validation Exercises Results

Regarding accuracy, the quality of the technical validation results can be rated as excellent. During the validation exercise conduct, validation teams on all sites noted the results of the use cases and the anomalies that occurred. At the end of each day, a de-briefing was organised where the results and observations were consolidated.

Technical observations from industry partners were documented in the MANTIS tool that allows the allocation and tracing of anomalies.

The confidence in the results is statistically given for all use cases but one that were validated technically during EXE-IOP-01. Nevertheless, there were a few flight/leg combinations where the validation results were ambiguous. Sometimes a use case worked, sometimes not. This behaviour had a negative impact in the trust of the ATCOs and operational experts in the validation platform.

Nevertheless, the overall result of EXE-IOP-01 is an important milestone on the way towards a full validation of the basic FO IOP. Also, ATCOs and operational experts could gather first impressions how the FO IOP will change future operations.

The quality of EXE-IOP-01 results leaves room for improvement due to the following limiting factors:

- Traffic sample (see appendix A.6 deviation number 4)
    - Size (only small to medium size scenarios could be used) and
    - Realism

- System prototype maturity (see appendix A.6 deviation number 4 and 9)
  Validation results were not always reliable
  The status UNCLEAR reflects this situation were flights of a specific leg (same-vendor as well as cross-vendor) did sometimes work and sometimes not.

- Validation platform datasets incoherency (see appendix A.6 deviation number 5)

- Lack of quadrangle leg tests (see s appendix A.6 deviation number 10)

The number of participating controllers was sufficient for EXE-IOP-01. Apart from local controllers, controllers and operational experts from the OPS Team supported the validation exercise.

A.7.4.3 Significance of Technological Validation Exercises Results

A.7.4.3.1   Statistical significance of the results

The statistical significance is listed in the tables of appendix A.7.2.

For testing the statistical significance, a binomial test was used. Assumption was, that there is a 50% chance for each flight / use case to be passed or not. The level of significance was a priori set to 5% (α = 0,05).

Significant tests are marked with an asterisk "*" and not significant ones with "n.s."

A.7.4.3.2   Operational significance of the results

In general, the validators acknowledged the added value of:

- FO IOP compared with OLDI
- Seamless operations between the ATSUs
- Improved situation awareness

The operational significance of the validated use cases could not be assessed in detail due to the limitations already described in appendix A.6 and appendix A.7.4.2.

A.8   Conclusions

The results achieved at the end of the validation exercise EXE-IOP-01 show progress of the technical readiness level towards TRL 6. The different vendor's implementations of the FO IOP concept could be tested and assessed in a realistic validation environment. The IBPs located at four ANSP premises covered an airspace representing a core part of Europe, which allows the continuous management of flights via up to three ATSUs.

A.8.1 Conclusions on Technological feasibility

Basically, no showstoppers were identified that disturbed the conduct of the validation activities.

Nevertheless, the big number of major and blocking anomalies that could be observed during the execution of the tests and the validation exercise runs shows that not all technical problems could be solved before the validation exercise conduct.

The main issues for a successful test and usage of FO IOP in the scope of EXE-IOP-01 remain in:

- the problematic interconnection amongst systems:
  systems are too critical and not always flexible enough in accepting shared data, which leads to the appearance of de-synchronisations;
- the differences in the management of vertical constraints;
- the different route expansion rules outside the IOP area;
- the differences in the expanded route information;
- the different understanding and handling of strategic constraints;
- the appearance of misalignments between FO IOP and local view.

However, we are confident that during the remaining validation exercises it will be possible to prove the technical feasibility of basic FO IOP.

0 lists the anomalies found during the preparation and conduct of the validation exercise.

A.8.2 Conclusions on performance assessments

Even though anomalies still existed during the validation exercise conduct, the ATCOs and operational experts were able to assess the potential of the FO IOP concept and confirmed its overall acceptability concerning the following topics:

- Improvement of IOP over OLDI (current system);
- Increased situation awareness;
- Seamless operations (for instance change of route spanning several centres);
- Expectations that Conflict Detection & Resolution tools will benefit from IOP data.

A.9   Recommendations

A.9.1 Recommendations for Technical Validation Exercise #02

We recommend to:

- Improve the synchronisation of environmental data across the FIRs (AIM data and volumes);
- Fix software anomalies linked to IOP prototypes and/or validation platform;
  with priority on the following issues:
    - the problematic interconnection amongst systems
    - the differences in the management of vertical constraints
    - the different route expansion rules outside the IOP area
    - the differences in the expanded route information
- Increase the traffic sample for Exercise #02;
- Extend the factory testing before deploying the prototypes to the IBPs and reduce number of dry runs at IBPs;
- Improve the factory simulator capabilities with regard to V&VI IOP in order to have synchronised tracks;
- Usage of original initial flight plans from agreed AIRAC cycle.

A.9.2 Recommendations on regulation and standardisation initiatives

A revision of EUROCAE Document ED-133 [13] is needed for the industrialisation and deployment of basic FO IOP.

The solution PJ18-02b has to decide which technical requirements are mature enough to be handed over in advance (prior to the end of solution 18-02b) to EUROCAE WG-59 in order to start the revision of EUROCAE Document ED-133.

Appendix B   Technological Validation Exercise #02 Report

B.1   Summary of the Technological Validation Exercise #02 Plan

As in the TVALR for solution 18-02b.

B.2   Technological Validation Exercise #02 description and scope

EXE-IOP-02 aimed to validate solution 18-02b FO IOP in en-route environment by adding further operational use cases and verifying an improved maturity of the FO IOP prototype implementations to TRL6 including non-nominal conditions.

Technological solution 18-02b validation exercise EXE-IOP-02 validated FO IOP in en-route airspace by means of the following phases:

- **Technically driven preparation**
  was performed by technical experts executing tests according to STDs supported by a small size technical scenario. It aimed at demonstrating the functional maturity of the validation platform by re-testing the flight-use case combinations that caused problems during EXE-IOP-01 and testing flight-use case combinations under non-nominal conditions. Finally, it ended with a technical acceptance test during the last TDR at the IBPs that led to the technical acceptance of the validation platform.

- **Operationally driven preparation**
  was performed by ATCOs or operational experts executing operational use cases as described in the operational use case documents supported by medium size scenarios. It aimed to demonstrate the stability and performance of the validation platform under nominal and non-nominal conditions. This was a prerequisite for the assessment of the operational and technical basic FO IOP requirements in the validation exercise. Finally, it ended with an operational dry run that led to the operational acceptance of the validation platform.

- **Validation exercise execution**
  was performed by ATCOs or operational experts using freely the platforms and systems, under nominal and non-nominal conditions and without being limited concerning the order of the use case execution. The main goal was the assessment of the technical basic FO IOP requirements supported by large size scenarios (ca. 200 flights). It ended with an assessment that is documented in the present appendix of this technical validation report (TVALR).

EXE-IOP-02 was performed by using real time simulation techniques with human in the loop on the same IBPs that were already used during EXE-IOP-01.

During the preparation of EXE-IOP-02 we switched from PENS to NewPENS (see Appendix A.2).

The recommendations described in A.9.1 were considered during the preparation of EXE-IOP-02:

- the synchronisation of environmental data across the FIRs (AIM data and volumes) were improved;
- software anomalies linked to IOP prototypes and/or validation platform were fixed/improved according to the given priorities,
- the traffic sample was increased.

- the factory testing before deploying the prototypes to the IBPs could not be extended due to the Corona crisis and the number of dry runs at IBPs was reduced
- the simulated tracks were manually synchronised during the factory tests,
- more original/realistic initial flight plans from agreed AIRAC cycle were used.

B.3 Summary of Exercise #02 Technological Validation Objectives and success criteria

The table below shows how the validation objectives were covered by technical validation exercise EXE-IOP-02.

Additional information to the referenced success criteria can be seen in Appendix D of the TVALP [8].

Note: The main reason for the partly coverage of the solution validation objectives is that some technical requirements need to be validated by expert judgement during EXE-IOP-03.

SESAR Solution Validation Objective	SESAR Solution Success Criteria	Coverage and Comments on the Coverage of SESAR Solution Validation Objective in Exercise 002	Exercise Validation Objective	Exercise Success Criteria[8]
OBJ-18.02b-TRL6-TVALP-001	CRT-18.02b-TRL6-TVALP-001.001 CRT-18.02b-TRL6-TVALP-001.002 CRT-18.02b-TRL6-TVALP-001.005 CRT-18.02b-TRL6-TVALP-001.006 CRT-18.02b-TRL6-TVALP-001.009	Partly covered	EX2-OBJ-18.02b-TRL6-TVALP-001 same description as OBJ-18.02b-TRL6-TVALP-001	EX2-CRT-18.02b-TRL6-TVALP-001.001 EX2-CRT-18.02b-TRL6-TVALP-001.002 EX2-CRT-18.02b-TRL6-TVALP-001.005 EX2-CRT-18.02b-TRL6-TVALP-001.006 EX2-CRT-18.02b-TRL6-TVALP-001.009

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[8] The contents of the exercise success criteria are identical to the equally numbered SESAR solution success criteria (2nd column).

SESAR Solution Validation Objective	SESAR Solution Success Criteria	Coverage and Comments on the Coverage of SESAR Solution Validation Objective in Exercise 002	Exercise Validation Objective	Exercise Success Criteria[8]
	CRT-18.02b-TRL6-TVALP-001.012 CRT-18.02b-TRL6-TVALP-001.013 CRT-18.02b-TRL6-TVALP-001.018 CRT-18.02b-TRL6-TVALP-001.026			EX2-CRT-18.02b-TRL6-TVALP-001.012 EX2-CRT-18.02b-TRL6-TVALP-001.013 EX2-CRT-18.02b-TRL6-TVALP-001.018 EX2-CRT-18.02b-TRL6-TVALP-001.026
OBJ-18.02b-TRL6-TVALP-002	CRT-18.02b-TRL6-TVALP-002.001 CRT-18.02b-TRL6-TVALP-002.010 CRT-18.02b-TRL6-TVALP-002.014 CRT-18.02b-TRL6-TVALP-002.043 CRT-18.02b-TRL6-TVALP-002.044 CRT-18.02b-TRL6-TVALP-002.045	Partly covered	EX2-OBJ-18.02b-TRL6-TVALP-002 same description as OBJ-18.02b-TRL6-TVALP-002	EX2-CRT-18.02b-TRL6-TVALP-002.001 EX2-CRT-18.02b-TRL6-TVALP-002.010 EX2-CRT-18.02b-TRL6-TVALP-002.014 EX2-CRT-18.02b-TRL6-TVALP-002.043 EX2-CRT-18.02b-TRL6-TVALP-002.044 EX2-CRT-18.02b-TRL6-TVALP-002.045

SESAR Solution Validation Objective	SESAR Solution Success Criteria	Coverage and Comments on the Coverage of SESAR Solution Validation Objective in Exercise 002	Exercise Validation Objective	Exercise Success Criteria[8]
OBJ-18.02b-TRL6-TVALP-003	CRT-18.02b-TRL6-TVALP-003.001	Partly covered	EX2-OBJ-18.02b-TRL6-TVALP-003 same description as OBJ-18.02b-TRL6-TVALP-003	EX2-CRT-18.02b-TRL6-TVALP-003.001
OBJ-18.02b-TRL6-TVALP-004	CRT-18.02b-TRL6-TVALP-004.001	Partly covered	EX2-OBJ-18.02b-TRL6-TVALP-004 same description as OBJ-18.02b-TRL6-TVALP-004	EX2-CRT-18.02b-TRL6-TVALP-004.001
OBJ-18.02b-TRL6-TVALP-005	CRT-18.02b-TRL6-TVALP-005.021 CRT-18.02b-TRL6-TVALP-005.022	Partly covered	EX2-OBJ-18.02b-TRL6-TVALP-005 same description as OBJ-18.02b-TRL6-TVALP-005	EX2-CRT-18.02b-TRL6-TVALP-005.021 EX2-CRT-18.02b-TRL6-TVALP-005.022
OBJ-18.02b-TRL6-TVALP-009	CRT-18.02b-TRL6-TVALP-009.006	Partly covered	EX2-OBJ-18.02b-TRL6-TVALP-009 same description as OBJ-18.02b-TRL6-TVALP-009	EX2-CRT-18.02b-TRL6-TVALP-009.006
OBJ-18.02b-TRL6-TVALP-010	CRT-18.02b-TRL6-TVALP-010.001	Partly covered	EX2-OBJ-18.02b-TRL6-TVALP-010 same description as OBJ-18.02b-TRL6-TVALP-010	EX2-CRT-18.02b-TRL6-TVALP-010.001

Table 66: Validation objectives addressed in technical validation exercise 2

B.4 Summary of Technological Validation Exercise #02 Validation scenarios

B.4.1 Reference Scenario(s)

EXE-IOP-01 was the reference scenario for EXE-IOP-02.

B.4.2 Solution Scenario(s)

EXE-IOP-02 aimed to enlarge the validation of basic FO IOP in en-route environment by:

- covering all relevant operational use cases and allocated technical requirements that are implemented in the system prototypes;

- adding the handling of non-nominal cases.

Generally, the airspace remained the same as defined for EXE-IOP-01, AIRAC cycle 27th April 2017. But the following changes can be highlighted here. For all details with regard to the adaptation data and traffic scenario please refer to 0.

B.4.2.1 Adaptation Data

The adaptation data have been reviewed to cope with the new traffic selection for the target scenario (see HOTEL configuration description hereafter).

In addition to the scope of data all Area of Interest have been defined for the ATSU involved, allowing to observe the distribution for vicinity in the flight objects.

Finally, the adaptation ATS route, airports and points have been rationalised with the new concept of route expansion areas (lesson learned from EXE01) implying to implement on platforms as a minimum all the data inside this area.
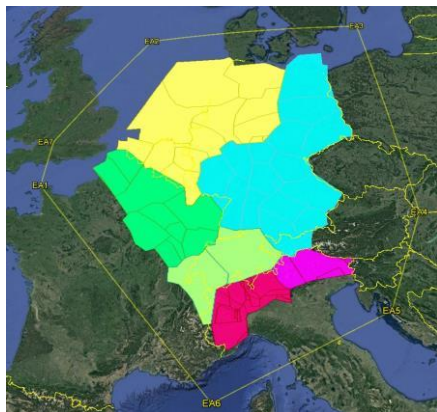
Figure 5: IOP EXE02 Route Expansion Area

To provide the reader an idea of the amount of extracted AIM data, the IOP area included (for more details refer to 0):

- 615 Airports(153 used by traffic samples)

- 1893 Airways (277 used by traffic samples)

- 9493 Navaids and published points (1204 used by traffic samples)

These AIM data correspond to a selection around the route expansion area with all the ATSU selected for the exercise and extra selections depending on the traffic scenario.

B.4.2.2 Traffic information

Following the correction of workarounds in IOP prototypes the traffic used for ALPHA and BRAVO configurations was first reset to the original flight plan data to remove the modifications done on operational data from EXE01 – and was then enlarged through several iterations.

A new configuration HOTEL involving the four system instances (six ATSU) was selected as a reference to select new flights on top of the previous selection and target traffic has been defined on this basis: 231 flights were available for replay on the platforms.
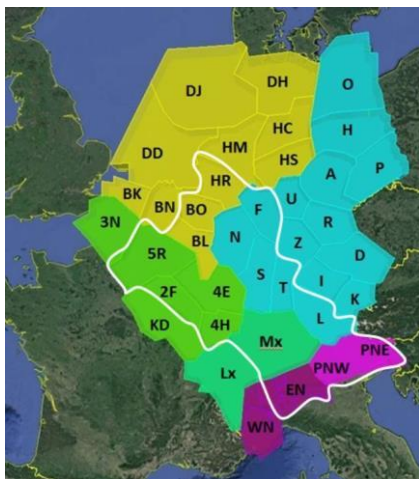
Figure 6: HOTEL airspace configuration

B.5   Summary Technological Validation Exercise #02 Assumptions

General validation assumptions are provided in section 3.2.3.

Additionally, it was assumed that the input deliverables from solution 18-02b (INTEROP, TS/IRS and system prototypes) are delivered before the final TVALP submission.

B.6   Deviation from the planned activities

No deviations from the planned activities were observed.

B.7   Technological Validation Exercise #02 Validation Results

B.7.1 Summary of Technological Validation Exercise #02 Results

Technological Val. Exe. #02 Technological Validation Objective ID	Technological Val. Exe. #02 Technological Validation Objective Title	Technological Val. Exe. #02 Success Criterion ID	Technological Val. Exe. #02 Success Criterion	Technological Val. Exe. #02 Validation Results	Technological Val. Exe. #03 Technological Val. Objective Status
OBJ-18.02b-TRL6-TVALP-001	Coordination and Transfer	CRT-18.02b-TRL6-TVALP-001.001	The technical requirements associated to UC#0101 have been validated technically.	OK [99%]	Partially OK
		CRT-18.02b-TRL6-TVALP-001.002	The technical requirements associated to UC#0102 have been validated technically.	OK [94%]	
		CRT-18.02b-TRL6-TVALP-001.005	The technical requirements associated to UC#0105 have been validated technically.	OK [100%]	
		CRT-18.02b-TRL6-TVALP-001.006	The technical requirements associated to UC#0106 have been validated technically.	OK [87%]	
		CRT-18.02b-TRL6-TVALP-001.009	The technical requirements associated to UC#0109 have been validated technically.	OK [100%]	

Technological Val. Exe. #02 Technological Validation Objective ID	Technological Val. Exe. #02 Technological Validation Objective Title	Technological Val. Exe. #02 Success Criterion ID	Technological Val. Exe. #02 Success Criterion	Technological Val. Exe. #02 Validation Results	Technological Val. Exe. #03 Technological Val. Objective Status
		CRT-18.02b-TRL6-TVALP-001.012	The technical requirements associated to UC#0112 have been validated technically.	OK [80%]	
		CRT-18.02b-TRL6-TVALP-001.013	The technical requirements associated to UC#0113 have been validated technically.	OK [81%]	
		CRT-18.02b-TRL6-TVALP-001.018	The technical requirements associated to UC#0118 have been validated technically.	OK [75%]	
		CRT-18.02b-TRL6-TVALP-001.026	The technical requirements associated to UC#0126 have been validated technically.	OK [76%]	
OBJ-18.02b-TRL6-TVALP-002	Management of the FO Flight Script	CRT-18.02b-TRL6-TVALP-002.001	The technical requirements associated to UC#0201 have been validated technically.	OK [87%]	Partially OK
		CRT-18.02b-TRL6-TVALP-002.010	The technical requirements associated to UC#0210 have been validated technically.	OK [74%]	

Technological Val. Exe. #02 Technological Validation Objective ID	Technological Val. Exe. #02 Technological Validation Objective Title	Technological Val. Exe. #02 Success Criterion ID	Technological Val. Exe. #02 Success Criterion	Technological Val. Exe. #02 Validation Results	Technological Val. Exe. #03 Technological Val. Objective Status
		CRT-18.02b-TRL6-TVALP-002.014	The technical requirements associated to UC#0214 have been validated technically.	OK [100%]	
		CRT-18.02b-TRL6-TVALP-002.043	The technical requirements associated to UC#0243 have been validated technically.	OK [100%]	
		CRT-18.02b-TRL6-TVALP-002.044	The technical requirements associated to UC#0244 have been validated technically.	NOK [n.s. 57%]	
		CRT-18.02b-TRL6-TVALP-002.045	The technical requirements associated to UC#0245 have been validated technically.	NOK [n.s. 57%]	
OBJ-18.02b-TRL6-TVALP-003	Informative Distribution between System Instances	CRT-18.02b-TRL6-TVALP-003.001	The technical requirements associated to UC#0301 have been validated technically.	OK [87%]	Partially OK
OBJ-18.02b-TRL6-TVALP-004	FO protocol failures	CRT-18.02b-TRL6-TVALP-004.001	The technical requirements associated to UC#0401 have been validated technically.	OK [100%]	Partially OK

Technological Val. Exe. #02	Technological Val. Exe. #02	Technological Val. Exe. #02	Technological Val. Exe. #02	Technological Val. Exe. #02	Technological Val. Exe. #03
Technological Validation Objective ID	Technological Validation Objective Title	Success Criterion ID	Success Criterion	Validation Results	Technological Val. Objective Status
OBJ-18.02b-TRL6-TVALP-005	Control Sequences Handling	CRT-18.02b-TRL6-TVALP-005.021	The technical requirements associated to UC#0521 have been validated technically.	OK [69%]	Partially OK
		CRT-18.02b-TRL6-TVALP-005.022	The technical requirements associated to UC#0522 have been validated technically.	OK [96%]	
OBJ-18.02b-TRL6-TVALP-009	FO Mechanism	CRT-18.02b-TRL6-TVALP-009.006	The technical requirements associated to UC#0906 have been validated technically.	OK [100%]	Partially OK
OBJ-18.02b-TRL6-TVALP-010	Scope and Management of the FO trajectory	CRT-18.02b-TRL6-TVALP-010.001	The technical requirements associated to UC#1001 have been validated technically.	OK [96%]	Partially OK

Table 67: Technological Validation Results Exercise #02

B.7.1.1 Results on technological feasibility

The overall result of EXE-IOP-02 demonstrated the technical feasibility of the validated basic FO IOP use cases, even though, two use case validation results were not statistically significant. They contributed to validate and mature the functional requirements documented in the TS/IRS [7].

B.7.1.2 Results per KPA

Not applicable – KPAs have not been defined for solution PJ.18-02b.

B.7.2 Analysis of Exercise #02 Results per Technological Validation objective

The consolidated results for the validation exercise are shown in the following sub-sections.

Only the validation objectives and success criteria, which were planned to be technically validated in EXE-IOP-02 according to the TVALP, are analysed here. The rest was validated in EXE-IOP-03.

The validation results are marked as follows:

OK: The validation result matches the specification.

NOK: The validation result does not match the specification.

B.7.2.1 OBJ-18.02b-TRL6-TVALP-001 Results

This objective deals with the validation of the coordination and transfer use cases:

Use Case ID	Succ. Crit. ID	Use Case Title
UC#0101	CRT-18.02b-TRL6-TVALP-001.001	Automatic Triggering of SAP/CAP/NP - compliance with LOA's
UC#0102	CRT-18.02b-TRL6-TVALP-001.002	Manual Triggering of CAP/NP
UC#0105	CRT-18.02b-TRL6-TVALP-001.005	Change of coordination data or trajectory during SAP
UC#0106	CRT-18.02b-TRL6-TVALP-001.006	Change of coordination data or trajectory during CAP
UC#0109	CRT-18.02b-TRL6-TVALP-001.009	Change of C&T data or trajectory in NP without electronic negotiation
UC#0112	CRT-18.02b-TRL6-TVALP-001.012	Request on Frequency
UC#0113	CRT-18.02b-TRL6-TVALP-001.013	Change of Frequency /Assume
UC#0118	CRT-18.02b-TRL6-TVALP-001.018	Force-assume by the Receiving RE
UC#0126	CRT-18.02b-TRL6-TVALP-001.026	Negotiation of C&T contractual data other than DCT between Transferring RE and Receiving RE

Table 68: Validated Success Criteria / Use Cases of OBJ-18.02b-TRL6-TVALP-001 in EXE-IOP-02

B.7.2.1.1   CRT-18-02b-TRL6-TVALP-001.001 (UC#0101)

UC Title: **Automatic Triggering of SAP/CAP/NP - compliance with LOA's**

UC Result: The technical requirements associated to UC#0101 have been validated technically by means of RTS.

In 99% of the test cases (501) the system reacted as defined in the use case.

Leg	Leg	UC#0101					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	52	0	52	100%	100%	*
MUAC ↔ REIM	MR	52	1	53	98%	100%	*
KUAC ↔ MUAC	KM	43	0	43	100%	100%	*
ENAIRE ↔ MUAC	EM	0	0	0	-	-	-
LIPU ↔ REIM	RL	50	0	50	100%	100%	*
KUAC ↔ LIPU	KL	19	1	20	95%	100%	*
KUAC↔ MUAC ↔ REIM	KMR	43	2	45	96%	100%	*
KUAC↔ LIPU ↔ REIM	KLR	46	1	47	98%	100%	*
KUAC↔ LIPU ↔ MUAC ↔ REIM	KLMR	191	0	191	100%	100%	*
	Total:	496	5	501	99%	100%	*
Average use case success / Significance:		99% / *					

Table 69: EXE-IOP-02 Validation Result of CRT-18.02b-TRL6-TVALP-001.001 (UC#0101)

B.7.2.1.2   CRT-18-02b-TRL6-TVALP-001.002 (UC#0102)

UC Title: **Manual Triggering of CAP/NP**

UC Result: The technical requirements associated to UC#0102 have been validated technically by means of RTS.

In 94% of the test cases (16) the system reacted as defined in the use case.

Leg	Leg	UC#0102					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	**KR**	3	0	3	100%	100%	*
MUAC ↔ REIM	**MR**	6	0	6	100%	100%	*
KUAC ↔ MUAC	**KM**	2	0	2	100%	100%	*
ENAIRE ↔ MUAC	**EM**	0	0	0	-	-	-
LIPU ↔ REIM	**RL**	3	0	3	100%	100%	*
KUAC ↔ LIPU	**KL**	0	1	1	0%	50%	n.s.
KUAC↔ MUAC ↔ REIM	**KMR**	0	0	0	0%	-	-
KUAC↔ LIPU ↔ REIM	**KLR**	1	0	1	100%	100%	*
KUAC↔ LIPU ↔ MUAC ↔ REIM	**KLMR**	0	0	0	0%	-	-
	Total:	15	1	16	94%	100%	*
Average use case success / Significance:		94% / *					

Table 70: EXE-IOP-02 Validation Result of CRT-18.02b-TRL6-TVALP-001.002 (UC#0102)

B.7.2.1.3   CRT-18-02b-TRL6-TVALP-001.005 (UC#0105)

UC Title: **Change of coordination data or trajectory during SAP**

UC Result: The technical requirements associated to UC#0105 have been validated technically by means of RTS.

In 100% of the test cases (8) the system reacted as defined in the use case.

Leg	Leg	UC#0105					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	**KR**	0	0	0	0%	-	-
MUAC ↔ REIM	**MR**	5	0	5	100%	100%	*
KUAC ↔ MUAC	**KM**	3	0	3	100%	100%	*
ENAIRE ↔ MUAC	**EM**	0	0	0	-	-	-
LIPU ↔ REIM	**RL**	0	0	0	0%	-	-
KUAC ↔ LIPU	**KL**	0	0	0	0%	-	-
KUAC↔ MUAC ↔ REIM	**KMR**	0	0	0	0%	-	-
KUAC↔ LIPU ↔ REIM	**KLR**	0	0	0	0%	-	-

Leg	Leg	UC#0105					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC↔ LIPU ↔ MUAC ↔ REIM	KLMR	0	0	0	0%	-	-
	Total:	8	0	8	100%	100%	*
Average use case success / Significance:		100% / *					

Table 71: EXE-IOP-02 Validation Result of CRT-18.02b-TRL6-TVALP-001.005 (UC#0105)

B.7.2.1.4   CRT-18-02b-TRL6-TVALP-001.006 (UC#0106)

UC Title: **Change of coordination data or trajectory during CAP**

UC Result: The technical requirements associated to UC#0106 have been validated technically by means of RTS.

In 87% of the test cases (46) the system reacted as defined in the use case.

Leg	Leg	UC#0106					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	9	4	13	69%	95%	*
MUAC ↔ REIM	MR	8	0	8	100%	100%	*
KUAC ↔ MUAC	KM	4	0	4	100%	100%	*
ENAIRE ↔ MUAC	EM	0	0	0	-	-	-
LIPU ↔ REIM	RL	6	1	7	86%	99%	*
KUAC ↔ LIPU	KL	7	0	7	100%	100%	*
KUAC↔ MUAC ↔ REIM	KMR	2	1	3	67%	88%	n.s.
KUAC↔ LIPU ↔ REIM	KLR	4	0	4	100%	100%	*
KUAC↔ LIPU ↔ MUAC ↔ REIM	KLMR	0	0	0	0%	-	-
	Total:	40	6	46	87%	100%	*
Average use case success / Significance:		87% / *					

Table 72: EXE-IOP-02 Validation Result of CRT-18.02b-TRL6-TVALP-001.006 (UC#0106)

B.7.2.1.5   CRT-18-02b-TRL6-TVALP-001.009 (UC#0109)

UC Title: **Change of C&T data or trajectory in NP without electronic negotiation**

UC Result: The technical requirements associated to UC#0109 have been validated technically by means of RTS.

In 100% of the test cases (6) the system reacted as defined in the use case.

Leg	Leg	UC#0109					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	1	0	1	100%	100%	*
MUAC ↔ REIM	MR	3	0	3	100%	100%	*
KUAC ↔ MUAC	KM	2	0	2	100%	100%	*
ENAIRE ↔ MUAC	EM	0	0	0	-	-	-
LIPU ↔ REIM	RL	0	0	0	0%	-	-
KUAC ↔ LIPU	KL	0	0	0	0%	-	-
KUAC↔ MUAC ↔ REIM	KMR	0	0	0	0%	-	-
KUAC↔ LIPU ↔ REIM	KLR	0	0	0	0%	-	-
KUAC↔ LIPU ↔ MUAC ↔ REIM	KLMR	0	0	0	0%	-	-
	Total:	6	0	6	100%	100%	*
Average use case success / Significance:		100% / *					

Table 73: EXE-IOP-02 Validation Result of CRT-18.02b-TRL6-TVALP-001.009 (UC#0109)

B.7.2.1.6   CRT-18-02b-TRL6-TVALP-001.012 (UC#0112)

UC Title: **Request on Frequency**

UC Result: The technical requirements associated to UC#0112 have been validated technically by means of RTS.

In 80% of the test cases (102) the system reacted as defined in the use case.

Leg	Leg	UC#0112					
		OK	NOK	Total	OK [%]	Binom. Test	Significa nce
KUAC ↔ REIM	**KR**	6	4	10	60%	83%	n.s.
MUAC ↔ REIM	**MR**	28	4	32	88%	100%	*
KUAC ↔ MUAC	**KM**	6	4	10	60%	83%	n.s.
ENAIRE ↔ MUAC	**EM**	0	0	0	-	-	-
LIPU ↔ REIM	**RL**	6	0	6	100%	100%	*
KUAC ↔ LIPU	**KL**	6	0	6	100%	100%	*
KUAC↔ MUAC ↔ REIM	**KMR**	11	6	17	65%	93%	n.s.
KUAC↔ LIPU ↔ REIM	**KLR**	9	1	10	90%	100%	*
KUAC↔ LIPU ↔ MUAC ↔ REIM	**KLMR**	10	1	11	91%	100%	*
	Total:	82	20	102	80%	100%	*
Average use case success / Significance:		80% / *					

Table 74: EXE-IOP-02 Validation Result of CRT-18.02b-TRL6-TVALP-001.012 (UC#0112)

B.7.2.1.7   CRT-18-02b-TRL6-TVALP-001.013 (UC#0113)

UC Title: **Change of Frequency /Assume**

UC Result: The technical requirements associated to UC#0113 have been validated technically by means of RTS.

In 81% of the test cases (242) the system reacted as defined in the use case.

Leg	Leg	UC#0113					
		OK	NOK	Total	OK [%]	Binom. Test	Significa nce
KUAC ↔ REIM	**KR**	34	9	43	79%	100%	*
MUAC ↔ REIM	**MR**	37	8	45	82%	100%	*
KUAC ↔ MUAC	**KM**	15	1	16	94%	100%	*
ENAIRE ↔ MUAC	**EM**	4	0	4	100%	100%	*
LIPU ↔ REIM	**RL**	36	7	43	84%	100%	*
KUAC ↔ LIPU	**KL**	16	1	17	94%	100%	*
KUAC↔ MUAC ↔ REIM	**KMR**	18	11	29	62%	93%	n.s.
KUAC↔ LIPU ↔ REIM	**KLR**	19	6	25	76%	100%	*

Leg	Leg	UC#0113					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC↔ LIPU ↔ MUAC ↔ REIM	**KLMR**	18	2	20	90%	100%	*
	Total:	197	45	242	81%	100%	*
Average use case success / Significance:		81% / *					

Table 75: EXE-IOP-02 Validation Result of CRT-18.02b-TRL6-TVALP-001.013 (UC#0113)

B.7.2.1.8   CRT-18-02b-TRL6-TVALP-001.013 (UC#0118)

UC Title: **Force-assume by the Receiving RE**

UC Result: The technical requirements associated to UC#0118 have been validated technically by means of RTS.

In 75% of the test cases (53) the system reacted as defined in the use case.

Leg	Leg	UC#0118					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	**KR**	3	3	6	50%	66%	n.s.
MUAC ↔ REIM	**MR**	6	2	8	75%	96%	*
KUAC ↔ MUAC	**KM**	2	1	3	67%	88%	n.s.
ENAIRE ↔ MUAC	**EM**	0	0	0	-	-	-
LIPU ↔ REIM	**RL**	2	2	4	50%	69%	n.s.
KUAC ↔ LIPU	**KL**	3	1	4	75%	94%	n.s.
KUAC↔ MUAC ↔ REIM	**KMR**	12	2	14	86%	100%	*
KUAC↔ LIPU ↔ REIM	**KLR**	4	2	6	67%	89%	n.s.
KUAC↔ LIPU ↔ MUAC ↔ REIM	**KLMR**	8	0	8	100%	100%	*
	Total:	40	13	53	75%	100%	*
Average use case success / Significance:		75% / *					

Table 76: EXE-IOP-02 Validation Result of CRT-18.02b-TRL6-TVALP-001.018 (UC#0118)

B.7.2.1.9   CRT-18-02b-TRL6-TVALP-001.013 (UC#0126)

UC Title: **Negotiation of C&T contractual data other than DCT between Transferring RE and Receiving RE**

UC Result: The technical requirements associated to UC#0126 have been validated technically by means of RTS.

In 76% of the test cases (66) the system reacted as defined in the use case.

Leg	Leg	UC#0126					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	**KR**	3	0	3	100%	100%	*
MUAC ↔ REIM	**MR**	14	1	15	93%	100%	*
KUAC ↔ MUAC	**KM**	4	2	6	67%	89%	n.s.
ENAIRE ↔ MUAC	**EM**	0	0	0	-	-	-
LIPU ↔ REIM	**RL**	5	2	7	71%	94%	n.s.
KUAC ↔ LIPU	**KL**	5	1	6	83%	98%	*
KUAC↔ MUAC ↔ REIM	**KMR**	6	4	10	60%	83%	n.s.
KUAC↔ LIPU ↔ REIM	**KLR**	3	5	8	38%	36%	n.s.
KUAC↔ LIPU ↔ MUAC ↔ REIM	**KLMR**	10	1	11	91%	100%	*
	Total:	50	16	66	76%	100%	*
Average use case success / Significance:		76% / *					

Table 77: EXE-IOP-02 Validation Result of CRT-18.02b-TRL6-TVALP-001.026 (UC#0126)

B.7.2.2 OBJ-18.02b-TRL6-TVALP-002 Results

This objective deals with the validation of the Management of the FO Flight Script use cases.

Use Case ID	Succ. Crit. ID	Use Case Title
UC#0201	CRT-18.02b-TRL6-TVALP-002.001	Creation and sharing of a constraint
UC#0210	CRT-18.02b-TRL6-TVALP-002.010	Modification of 2D Route

Use Case ID	Succ. Crit. ID	Use Case Title
UC#0214	CRT-18.02b-TRL6-TVALP-002.014	En route cruising level management
UC#0243	CRT-18.02b-TRL6-TVALP-002.043	Sharing of executive constraints (CFL, Speed, Heading, Rate)
UC#0244	CRT-18.02b-TRL6-TVALP-002.044	Route amendment inside a downstream's airspace
UC#0245	CRT-18.02b-TRL6-TVALP-002.045	Transfer of a constraint impacted by a route change

Table 78: Validated Success Criteria / Use Cases of OBJ-18.02b-TRL6-TVALP-002 in EXE-IOP-02

B.7.2.2.1   CRT-18-02b-TRL6-TVALP-002.001 (UC#0201)

UC Title: **Creation and sharing of a constraint**

UC Result: The technical requirements associated to UC#0201 have been validated technically by means of RTS.

In 87% of the test cases (46) the system reacted as defined in the use case.

Leg	Leg	UC#0201					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	**KR**	9	4	13	69%	95%	*
MUAC ↔ REIM	**MR**	8	0	8	100%	100%	*
KUAC ↔ MUAC	**KM**	4	0	4	100%	100%	*
ENAIRE ↔ MUAC	**EM**	0	0	0	-	-	-
LIPU ↔ REIM	**RL**	6	1	7	86%	99%	*
KUAC ↔ LIPU	**KL**	7	0	7	100%	100%	*
KUAC↔ MUAC ↔ REIM	**KMR**	2	1	3	67%	88%	n.s.
KUAC↔ LIPU ↔ REIM	**KLR**	4	0	4	100%	100%	*
KUAC↔ LIPU ↔ MUAC ↔ REIM	**KLMR**	0	0	0	0%	-	-
	Total:	40	6	46	87%	100%	*

Leg	Leg	UC#0201					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
Average use case success / Significance:		87% / *					

<div align="center">Table 79: EXE-IOP-02 Validation Result of CRT-18.02b-TRL6-TVALP-002.001 (UC#0201)</div>

B.7.2.2.2 CRT-18-02b-TRL6-TVALP-002.001 (UC#0210)

UC Title: **Modification of 2D Route**

UC Result: The technical requirements associated to UC#0210 have been validated technically by means of RTS.

In 74% of the test cases (77) the system reacted as defined in the use case.

Leg	Leg	UC#0210					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	**KR**	5	4	9	56%	75%	n.s.
MUAC ↔ REIM	**MR**	7	9	16	44%	40%	n.s.
KUAC ↔ MUAC	**KM**	12	2	14	86%	100%	*
ENAIRE ↔ MUAC	**EM**	0	0	0	-	-	-
LIPU ↔ REIM	**RL**	9	0	9	100%	100%	*
KUAC ↔ LIPU	**KL**	5	0	5	100%	100%	*
KUAC↔ MUAC ↔ REIM	**KMR**	11	3	14	79%	99%	*
KUAC↔ LIPU ↔ REIM	**KLR**	4	2	6	67%	89%	n.s.
KUAC↔ LIPU ↔ MUAC ↔ REIM	**KLMR**	4	0	4	100%	100%	*
	Total:	57	20	77	74%	100%	*
Average use case success / Significance:		74% / *					

<div align="center">Table 80: EXE-IOP-02 Validation Result of CRT-18.02b-TRL6-TVALP-002.010 (UC#0210)</div>

B.7.2.2.3 CRT-18-02b-TRL6-TVALP-002.014 (UC#0214)

UC Title: **En route cruising level management**

UC Result: The technical requirements associated to UC#0214 have been validated technically by means of RTS.

In 100% of the test cases (11) the system reacted as defined in the use case.

Leg	Leg	UC#0214					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	1	0	1	100%	100%	*
MUAC ↔ REIM	MR	1	0	1	100%	100%	*
KUAC ↔ MUAC	KM	3	0	3	100%	100%	*
ENAIRE ↔ MUAC	EM	0	0	0	-	-	-
LIPU ↔ REIM	RL	1	0	1	100%	100%	*
KUAC ↔ LIPU	KL	2	0	2	100%	100%	*
KUAC↔ MUAC ↔ REIM	KMR	2	0	2	100%	100%	*
KUAC↔ LIPU ↔ REIM	KLR	1	0	1	100%	100%	*
KUAC↔ LIPU ↔ MUAC ↔ REIM	KLMR	0	0	0	0%	-	-
Total:		11	0	11	100%	100%	*
Average use case success / Significance:		100% / *					

Table 81: EXE-IOP-02 Validation Result of CRT-18.02b-TRL6-TVALP-002.014 (UC#0214)

B.7.2.2.4   CRT-18-02b-TRL6-TVALP-002.043 (UC#0243)

UC Title: **Sharing of executive constraints (CFL, Speed, Heading, Rate)**

UC Result: The technical requirements associated to UC#0243 have been validated technically by means of RTS.

In 100% of the test cases (6) the system reacted as defined in the use case.

Leg	Leg	UC#0214					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	0	0	0	0%	-	-
MUAC ↔ REIM	MR	0	0	0	0%	-	-

Leg	Leg	UC#0214					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ MUAC	**KM**	0	0	0	0%	-	-
ENAIRE ↔ MUAC	**EM**	0	0	0	-	-	-
LIPU ↔ REIM	**RL**	5	0	5	100%	100%	*
KUAC ↔ LIPU	**KL**	1	0	1	100%	100%	*
KUAC↔ MUAC ↔ REIM	**KMR**	0	0	0	0%	-	-
KUAC↔ LIPU ↔ REIM	**KLR**	0	0	0	0%	-	-
KUAC↔ LIPU ↔ MUAC ↔ REIM	**KLMR**	0	0	0	0%	-	-
	Total:	6	0	6	100%	100%	*
Average use case success / Significance:		100% / *					

Table 82: EXE-IOP-02 Validation Result of CRT-18.02b-TRL6-TVALP-002.043 (UC#0243)

B.7.2.2.5   CRT-18-02b-TRL6-TVALP-002.044 (UC#0244)

UC Title: **Route amendment inside a downstream's airspace**

UC Result: The technical requirements associated to UC#0244 have been validated technically by means of RTS.

In 57% of the test cases (7) the system reacted as defined in the use case.

Note: The result of the binominal test is not significant.

Leg	Leg	UC#0244					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	**KR**	2	0	2	100%	100%	*
MUAC ↔ REIM	**MR**	1	1	2	50%	75%	n.s.
KUAC ↔ MUAC	**KM**	1	0	1	100%	100%	*
ENAIRE ↔ MUAC	**EM**	0	0	0	-	-	-
LIPU ↔ REIM	**RL**	0	0	0	0%	-	-
KUAC ↔ LIPU	**KL**	0	0	0	0%	-	-
KUAC↔ MUAC ↔ REIM	**KMR**	0	1	1	0%	50%	n.s.
KUAC↔ LIPU ↔ REIM	**KLR**	0	1	1	0%	50%	n.s.

Leg	Leg	UC#0244					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC↔ LIPU ↔ MUAC ↔ REIM	**KLMR**	0	0	0	0%	-	-
	Total:	4	3	7	57%	77%	n.s.
Average use case success / Significance:		57% / n.s.					

Table 83: EXE-IOP-02 Validation Result of CRT-18.02b-TRL6-TVALP-002.044 (UC#0244)

B.7.2.2.6   CRT-18-02b-TRL6-TVALP-002.045 (UC#0245)

UC Title: **Transfer of a constraint impacted by a route change**

UC Result: The technical requirements associated to UC#0245 have been validated technically by means of RTS.

In 57% of the test cases (7) the system reacted as defined in the use case.

Note: The result of the binominal test is not significant.

Leg	Leg	UC#0245					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	**KR**	2	0	2	100%	100%	*
MUAC ↔ REIM	**MR**	1	1	2	50%	75%	n.s.
KUAC ↔ MUAC	**KM**	1	0	1	100%	100%	*
ENAIRE ↔ MUAC	**EM**	0	0	0	-	-	-
LIPU ↔ REIM	**RL**	0	0	0	0%	-	-
KUAC ↔ LIPU	**KL**	0	0	0	0%	-	-
KUAC↔ MUAC ↔ REIM	**KMR**	0	1	1	0%	50%	n.s.
KUAC↔ LIPU ↔ REIM	**KLR**	0	1	1	0%	50%	n.s.
KUAC↔ LIPU ↔ MUAC ↔ REIM	**KLMR**	0	0	0	57%	77%	n.s.
	Total:	4	3	7	57%	77%	n.s.
Average use case success / Significance:		57% / n.s.					

Table 84: EXE-IOP-02 Validation Result of CRT-18.02b-TRL6-TVALP-002.045 (UC#0245)

B.7.2.3 OBJ-18.02b-TRL6-TVALP-003 Results

This objective deals with the validation of the Informative Distribution between System Instances use cases.

Use Case ID	Succ. Crit. ID	Use Case Title
UC#0301	CRT-18.02b-TRL6-TVALP-003.001	FO creation & sharing

Table 85: Validated Success Criterion / Use Case of OBJ-18.02b-TRL6-TVALP-003 in EXE-IOP-02

B.7.2.3.1 CRT-18-02b-TRL6-TVALP-003.001 (UC#0301)

UC Title: **FO creation & sharing**

UC Result: The technical requirements associated to UC#0301 have been validated technically by means of RTS.

In 87% of the test cases (822) the system reacted as defined in the use case.

Leg	Leg	UC#0301					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	69	2	71	97%	100%	*
MUAC ↔ REIM	MR	62	7	69	90%	100%	*
KUAC ↔ MUAC	KM	43	0	43	100%	100%	*
ENAIRE ↔ MUAC	EM	6	0	6	100%	100%	*
LIPU ↔ REIM	RL	50	0	50	100%	100%	*
KUAC ↔ LIPU	KL	20	1	21	95%	100%	*
KUAC↔ MUAC ↔ REIM	KMR	44	5	49	90%	100%	*
KUAC↔ LIPU ↔ REIM	KLR	45	5	50	90%	100%	*
KUAC↔ LIPU ↔ MUAC ↔ REIM	KLMR	374	89	463	81%	100%	*
	Total:	713	109	822	87%	100%	*
Average use case success / Significance:		87% / *					

Table 86: EXE-IOP-02 Validation Result of CRT-18.02b-TRL6-TVALP-003.001 (UC#0301)

B.7.2.4 OBJ-18.02b-TRL6-TVALP-004 Results

This objective deals with the validation of the FO protocol failures use cases.

Use Case ID	Succ. Crit. ID	Use Case Title
UC#0401	CRT-18.02b-TRL6-TVALP-004.001	Management of discrepancies with local view

Table 87: Validated Success Criterion / Use Case of OBJ-18.02b-TRL6-TVALP-004 in EXE-IOP-02

B.7.2.4.1   CRT-18-02b-TRL6-TVALP-004.001 (UC#0401)

UC Title: **Management of discrepancies with local view**

UC Result: The technical requirements associated to UC#0401 have been validated technically by means of RTS.

In 100% of the test cases (6) the system reacted as defined in the use case.

Leg	Leg	OK	NOK	Total	OK [%]	Binom. Test	Significance
				UC#0401			
KUAC ↔ REIM	**KR**	1	0	1	100%	100%	*
MUAC ↔ REIM	**MR**	0	0	0	0%	-	-
KUAC ↔ MUAC	**KM**	0	0	0	0%	-	-
ENAIRE ↔ MUAC	**EM**	0	0	0	-	-	-
LIPU ↔ REIM	**RL**	0	0	0	0%	-	-
KUAC ↔ LIPU	**KL**	0	0	0	0%	-	-
KUAC↔ MUAC ↔ REIM	**KMR**	3	0	3	100%	100%	*
KUAC↔ LIPU ↔ REIM	**KLR**	2	0	2	100%	100%	*
KUAC↔ LIPU ↔ MUAC ↔ REIM	**KLMR**	0	0	0	0%	-	-
	Total:	6	0	6	100%	100%	*
Average use case success / Significance:		100% / *					

Table 88: EXE-IOP-02 Validation Result of CRT-18.02b-TRL6-TVALP-004.001 (UC#0401)

B.7.2.5 OBJ-18.02b-TRL6-TVALP-005 Results

This objective deals with the validation of the Control Sequences Handling use cases.

Use Case ID	Succ. Crit. ID	Use Case Title
UC#0521	CRT-18.02b-TRL6-TVALP-005.021	Re-entrant flight going through other IOP ATSU
UC#0522	CRT-18.02b-TRL6-TVALP-005.022	Correction of ATSU sequence list

Table 89: Validated Success Criteria / Use Cases of OBJ-18.02b-TRL6-TVALP-005 in EXE-IOP-02

B.7.2.5.1   CRT-18-02b-TRL6-TVALP-005.021 (UC#0521)

UC Title: **Re-entrant flight going through other IOP ATSU**

UC Result: The technical requirements associated to UC#0521 have been validated technically by means of RTS.

In 69% of the test cases (29) the system reacted as defined in the use case.

Leg	Leg	UC#0521					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	8	0	8	100%	100%	*
MUAC ↔ REIM	MR	0	9	9	0%	0%	n.s.
KUAC ↔ MUAC	KM	8	0	8	100%	100%	*
ENAIRE ↔ MUAC	EM	4	0	4	100%	100%	*
LIPU ↔ REIM	RL	0	0	0	0%	-	-
KUAC ↔ LIPU	KL	0	0	0	0%	-	-
KUAC↔ MUAC ↔ REIM	KMR	0	0	0	0%	-	-
KUAC↔ LIPU ↔ REIM	KLR	0	0	0	0%	-	-
KUAC↔ LIPU ↔ MUAC ↔ REIM	KLMR	0	0	0	0%	-	-
Total:		20	9	29	69%	99%	*
Average use case success / Significance:		69% / *					

Table 90: EXE-IOP-02 Validation Result of CRT-18.02b-TRL6-TVALP-005.021 (UC#0521)

B.7.2.5.2   CRT-18-02b-TRL6-TVALP-005.022 (UC#0522)

UC Title: **Correction of ATSU sequence list**

UC Result: The technical requirements associated to UC#0522 have been validated technically by means of RTS.

In 96% of the test cases (243) the system reacted as defined in the use case.

Leg	Leg	UC#0522					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	41	0	41	100%	100%	*
MUAC ↔ REIM	MR	0	0	0	-	-	-
KUAC ↔ MUAC	KM	0	0	0	-	-	-
ENAIRE ↔ MUAC	EM	0	0	0	-	-	-
LIPU ↔ REIM	RL	54	0	54	100%	100%	*
KUAC ↔ LIPU	KL	34	1	35	97%	100%	*
KUAC↔ MUAC ↔ REIM	KMR	0	0	0	-	-	-
KUAC↔ LIPU ↔ REIM	KLR	42	3	45	93%	100%	*
KUAC↔ LIPU ↔ MUAC ↔ REIM	KLMR	141	6	147	96%	100%	*
	Total:	312	10	322	97%	100%	*
Average use case success / Significance:		97% / *					

Table 91: EXE-IOP-02 Validation Result of CRT-18.02b-TRL6-TVALP-005.022 (UC#0522)

B.7.2.6 OBJ-18.02b-TRL6-TVALP-009 Results

This objective deals with the validation of the FO Mechanism use cases.

Use Case ID	Succ. Crit. ID	Use Case Title
UC#0906	CRT-18.02b-TRL6-TVALP-009.006	Management of non-supported features

Table 92: Validated Success Criterion / Use Case of OBJ-18.02b-TRL6-TVALP-009 in EXE-IOP-02

B.7.2.6.1   CRT-18-02b-TRL6-TVALP-009.006 (UC#0906)

UC Title: **Management of non-supported features**

UC Result: The technical requirements associated to UC#0906 have been validated technically by means of RTS.

In 100% of the test cases (3) the system reacted as defined in the use case.

Leg	Leg	UC#0906					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	1	0	1	100%	100%	*
MUAC ↔ REIM	MR	1	0	1	100%	100%	*
KUAC ↔ MUAC	KM	0	0	0	-	-	-
ENAIRE ↔ MUAC	EM	0	0	0	-	-	-
LIPU ↔ REIM	RL	0	0	0	-	-	-
KUAC ↔ LIPU	KL	1	0	1	100%	100%	*
KUAC↔ MUAC ↔ REIM	KMR	0	0	0	-	-	-
KUAC↔ LIPU ↔ REIM	KLR	0	0	0	-	-	-
KUAC↔ LIPU ↔ MUAC ↔ REIM	KLMR	30	6	36	83%	100%	*
	Total:	3	0	3	100%	100%	*
Average use case success / Significance:		100% / *					

Table 93: EXE-IOP-02 Validation Result of CRT-18.02b-TRL6-TVALP-009.006 (UC#0906)

B.7.2.7 OBJ-18.02b-TRL6-TVALP-010 Results

This objective deals with the validation of the Scope and Management of the FO trajectory use cases.

Use Case ID	Succ. Crit. ID	Use Case Title
UC#1001	CRT-18.02b-TRL6-TVALP-010.001	Trajectory Management and Scope

Table 94: Validated Success Criterion / Use Case of OBJ-18.02b-TRL6-TVALP-010 in EXE-IOP-02

B.7.2.7.1   CRT-18-02b-TRL6-TVALP-010.001 (UC#1001)

UC Title: **Trajectory Management and Scope**

UC Result: The technical requirements associated to UC#1001 have been validated technically by means of RTS.

In 96% of the test cases (317) the system reacted as defined in the use case.

Leg	Leg	UC#1001					
		OK	NOK	Total	OK [%]	Binom. Test	Significance
KUAC ↔ REIM	KR	41	1	42	98%	100%	*
MUAC ↔ REIM	MR	0	0	0	-	-	-
KUAC ↔ MUAC	KM	0	0	0	-	-	-
ENAIRE ↔ MUAC	EM	0	0	0	-	-	-
LIPU ↔ REIM	RL	54	1	55	98%	100%	*
KUAC ↔ LIPU	KL	32	2	34	94%	100%	*
KUAC↔ MUAC ↔ REIM	KMR	0	1	1	0%	50%	n.s.
KUAC↔ LIPU ↔ REIM	KLR	47	0	47	100%	100%	*
KUAC↔ LIPU ↔ MUAC ↔ REIM	KLMR	205	12	217	94%	100%	*
	Total:	379	17	396	96%	100%	*
Average use case success / Significance:		96% / *					

Table 95: EXE-IOP-02 Validation Result of CRT-18.02b-TRL6-TVALP-010.001 (UC#1001)

B.7.3 Unexpected Behaviours/Results

The following table contains the anomalies found during the preparation and conduct of the validation exercise.

A more detailed analysis is given in the trouble ticket system MANTIS where the IOP analysis team jointly provided more information and possible solutions to resolve the anomalies.

The anomaly severities described in 0 also apply here.

The solution assessed and analysed the anomalies in post-exercise activities. The outcome of this analysis was that every anomaly stemmed from software implementation problems and not from inmature technical requirements specified in the TS/IRS.

ID	Severity	Status	Owner	LEG	Summary
1514	major	new	Coflight	KUAC>LIPU	Desynchro
1525	major	new	Coflight	MUAC>REIM	Desynchro
1527	major	new	Coflight	MUAC>REIM	Desynchro
1530	major	new	Coflight	REIM>MUAC	Desynchro
1533	major	new	Coflight	MUAC>REIM	Desynchro at FO creation
1534	major	new	Coflight	MUAC>REIM	Desynchro
1535	major	new	Coflight	REIM>MUAC	Desynchro
1536	major	new	Coflight	MUAC>REIM	Desynchro
1537	major	new	Coflight	MUAC>REIM	Desynchro after route MOD
1540	major	new	Coflight	MUAC>REIM	Route change not processed in REIM
1541	major	new	Coflight	MUAC>REIM	Desynchro after route MOD
1542	major	new	Coflight	MUAC>REIM	Desynchro
1544	major	new	Coflight	MUAC>REIM	Desynchro after route MOD
1545	major	new	Coflight	MUAC>REIM	Desynchro
1546	major	new	Coflight	REIM>MUAC	DIRECT NOK
1547	major	new	Coflight	REIM>MUAC	DIRECT not working
1549	major	new	Coflight	KUAC>REIM	Desynchro
1550	major	new	Coflight	REIM>KUAC	Desynchro after route MOD
1551	major	new	Coflight	KUAC>REIM	Desynchro after COF
1554	major	new	Coflight	REIM>KUAC	NFL entry not seen in REIM
1556	major	new	Coflight		Desynchro in re-entry flight
1558	major	new	Coflight	REIM>KUAC	Desynchro in re-entry flight
1567	major	new	Coflight	KUAC-MUAC-REIM	Desynchro in triangle flight
1569	major	new	Coflight	KUAC-MUAC-REIM	Desynchro in triangle flight
1572	major	new	Coflight	KUAC-MUAC-REIM	Desynchro in triangle flight
1585	major	new	Coflight	LIPU>REIM	EFL entry not seen
1522	major	new	Coflight Indra	MUAC>REIM	Desynchro
1574	major	new	Coflight Indra	KUAC-MUAC-REIM	Desync after Force CAP
1590	major	new	Coflight Indra	REIM-KUAC-LIPU	ROF and ASSUME not working

ID	Severity	Status	Owner	LEG	Summary
1592	major	new	Coflight Indra	REIM-KUAC-LIPU	DIRECT not working
1515	major	new	Indra	KUAC>LIPU	Desynchro
1518	major	new	Indra	KUAC>LIPU	Damaged flight
1519	major	new	Indra	KUAC>LIPU	Damaged flight
1531	major	new	Indra	REIM>MUAC	Duplicated FO
1532	major	new	Indra	REIM>MUAC	Duplicated FO
1575	major	new	Indra	KUAC-MUAC-REIM	Desynchro after route MOD
1526	minor	new	Adapt	MUAC>REIM	SFLP not created
1543	minor	new	Adapt	MUAC>REIM	SFPL not created due to dupliacated points
1520	minor	new	Coflight	KUAC>LIPU	ECL not working
1521	minor	new	Coflight	MUAC>REIM	Duplicated FO
1523	minor	new	Coflight	MUAC>REIM	Flight not activated on HMI
1524	minor	new	Coflight	MUAC>REIM	Assume NOK
1528	minor	new	Coflight	REIM>MUAC	Assume not working
1538	minor	new	Coflight	MUAC>REIM	WIFO timed out
1548	minor	new	Coflight	KUAC>REIM	Desynchro
1561	minor	new	Coflight	LIPU>REIM	COF not seen
1562	minor	new	Coflight	LIPU>REIM	Assume not seen
1563	minor	new	Coflight	LIPU>REIM	COF not seen
1564	minor	new	Coflight	REIM>LIPU	Pb on re-entry flight
1570	minor	new	Coflight	KUAC-MUAC-REIM	NFL not seen
1576	minor	new	Coflight	KUAC-MUAC-REIM	Assume not seen in REIM
1583	minor	new	Coflight	LIPU>REIM	NP/Terminated flag not well managed
1584	minor	new	Coflight	LIPU>REIM	ASSUME not possible after WIFO
1586	minor	new	Coflight	REIM>LIPU	WIFO not working
1587	minor	new	Coflight	REIM-KUAC-LIPU	Wrong info after WIFO
1593	minor	new	Coflight	Quadrangle	ROF not seen- Quadrangle
1516	minor	new	Coflight Indra	KUAC>LIPU	WIFO not seen
1517	minor	new	Coflight Indra	KUAC>LIPU	Force ACT failed
1560	minor	new	Coflight Indra	REIM>KUAC	Multiple issues in re entry flight
1588	minor	new	Coflight Indra	REIM-KUAC-LIPU	Assume not seen afetr REROUTE
1589	minor	new	Coflight Indra	REIM-KUAC-LIPU	Accept of WIFO does not work
1591	minor	new	Coflight Indra	REIM-KUAC-LIPU	WIFO problems
1594	minor	new	Coflight Indra	Quadrangle	WIFO not working - Quadrangle
1595	minor	new	Coflight Indra	Quadrangle	ASSUME not seen after DIRECT- Quadrangle
1529	minor	new	Indra	REIM>MUAC	Route mod not seen by other FDP
1539	minor	new	Indra	MUAC>REIM	Route MOD not processed in MUAC
1553	minor	new	Indra	REIM>KUAC	Actions on FO not seen in KUAC
1555	minor	new	Indra	KUAC>REIM	Assume not work after re-entries
1557	minor	new	Indra	REIM>KUAC	ROF not seen in re-entry flight
1559	minor	new	Indra	REIM>KUAC	Assume not seen after re-entries

Founding Members

ID	Severity	Status	Owner	LEG	Summary
1565	minor	new	Indra	KUAC-MUAC-REIM	Assume not seen
1566	minor	new	Indra	KUAC-MUAC-REIM	WIFO not working
1568	minor	new	Indra	KUAC-MUAC-REIM	WIFO NOKin triangle flight
1571	minor	new	Indra	KUAC-MUAC-REIM	COF not working
1573	minor	new	Indra	KUAC-MUAC-REIM	WIFO not working triangle flight
1577	minor	new	Indra	KUAC-MUAC-REIM	Reroute by KUAC not processed in MUAC
1578	minor	new	Indra	MUAC>KUAC	ROF failed in re-entry flight
1579	minor	new	Indra	KUAC>MUAC	Inputs not working in re-entry flight
1580	minor	new	Indra	MUAC>KUAC	WIFO and ROF not working -re-entry flight
1581	minor	new	Indra	KUAC>MUAC	Reroute not working on re-entry- flight
1582	minor	new	Indra	MUAC>KUAC	WIFO not working - reentry flight

Table 96 : Anomalies of Validation Exercise #02

B.7.4 Confidence in Results of Validation Exercise #02

B.7.4.1 Level of significance/limitations of Technological Validation Exercise Results

The validation results obtained between all simulation environments in the technical validation exercise were sufficiently representative, since all use cases but two were validated with significance. The results are ready to be integrated at the SESAR Technology Solution level, because we validated the nominal and non-nominal conditions.

The validation took place under more realistic conditions than in EXE-IOP-01. The validated functions are ready for industrialisation and deployment (TRL 6).

B.7.4.2 Quality of Technological Validation Exercises Results

Regarding accuracy, the quality of the technical validation results can be rated as excellent. During the validation exercise conduct, validation teams on all sites noted the results of the use cases and the anomalies that occurred. At the end of each day, a de-briefing was organised where the results and observations were consolidated.

Technical observations from industry partners were documented in the MANTIS tool that allows the allocation and tracing of anomalies.

The confidence in the results is statistically given for all use cases but two that were validated technically during EXE-IOP-02.

B.7.4.3 Significance of Technological Validation Exercises Results

The statistical significance is listed in the tables of appendix B.7.2.

For testing the statistical significance, a binomial test was used. Assumption was, that there is a 50% chance for each flight / use case to be passed or not. The level of significance was a priori set to 5% ($\alpha = 0,05$).

Significant tests are marked with an asterisk "*" and not significant ones with "n.s."

B.8 Conclusions

The different vendor's implementations of basic FO IOP could be tested and assessed in a realistic validation environment. The IBPs located at four ANSP premises covered an airspace representing a core part of Europe, which allows the continuous management of flights via up to four ATSUs.

The experts were able to validate the use cases and technical requirements for basic FO IOP.

B.8.1 Conclusions on Technological feasibility

During the post-exercise analysis all requirements attached to the EXE-IOP-02 use cases have been reviewed and it has been agreed that their maturity has reached TRL6.

B.8.2 Conclusions on performance assessments

Improved prototype performance related to EXE-IOP-01.

B.9 Recommendations

A revision of EUROCAE Document ED-133 [13] is needed for the industrialisation and deployment of basic FO IOP.

The solution PJ18-02b can hand over useful material (especially use cases and technical requirements) to EUROCAE WG-59 in order to revise ED-133.

Appendix C   Technological Validation Exercise #03 Report

C.1   Summary of the Technological Validation Exercise #03 Plan

As in the TVALR for solution 18-02b.

C.2   Technological Validation Exercise #03 description and scope

Validation exercise EXE-IOP-03 aimed to validate the remaining use cases and technical requirements for basic FO IOP that were neither validated in EXE-IOP-01 nor in EXE-IOP-02. It was finished after the conduct of EXE-IOP-02.

EXE-IOP-03 was performed by means of expert judgement.

C.3   Summary of Exercise #03 Technological Validation Objectives and success criteria

The table below shows how the validation objectives are covered by technical validation exercise EXE-IOP-03.

Additional information to the referenced success criteria can be seen in Appendix D of the TVALP [8].

SESAR Solution Validation Objective	SESAR Solution Success Criteria	Coverage and Comments on the Coverage of SESAR Solution Validation Objective in Exercise 003	Exercise Validation Objective	Exercise Success Criteria[9]
OBJ-18.02b-TRL6-TVALP-001	CRT-18.02b-TRL6-TVALP-001.003 CRT-18.02b-TRL6-TVALP-001.015 CRT-18.02b-TRL6-TVALP-001.020	Partly covered	EX3-OBJ-18.02b-TRL6-TVALP-001 same description as OBJ-18.02b-TRL6-TVALP-001	EX3-CRT-18.02b-TRL6-TVALP-001.003 EX3-CRT-18.02b-TRL6-TVALP-001.015 EX3-CRT-18.02b-TRL6-TVALP-001.020

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[9] The contents of the exercise success criteria are identical to the equally numbered SESAR solution success criteria (2nd column).

SESAR Solution Validation Objective	SESAR Solution Success Criteria	Coverage and Comments on the Coverage of SESAR Solution Validation Objective in Exercise 003	Exercise Validation Objective	Exercise Success Criteria[9]
	CRT-18.02b-TRL6-TVALP-001.024 CRT-18.02b-TRL6-TVALP-001.027 CRT-18.02b-TRL6-TVALP-001.028 CRT-18.02b-TRL6-TVALP-001.033 CRT-18.02b-TRL6-TVALP-001.036			EX3-CRT-18.02b-TRL6-TVALP-001.024 EX3-CRT-18.02b-TRL6-TVALP-001.027 EX3-CRT-18.02b-TRL6-TVALP-001.028 EX3-CRT-18.02b-TRL6-TVALP-001.033 EX3-CRT-18.02b-TRL6-TVALP-001.036
OBJ-18.02b-TRL6-TVALP-002	CRT-18.02b-TRL6-TVALP-002.024 CRT-18.02b-TRL6-TVALP-002.026 CRT-18.02b-TRL6-TVALP-002.028 CRT-18.02b-TRL6-TVALP-002.031 CRT-18.02b-TRL6-TVALP-002.034	Partly covered	EX3-OBJ-18.02b-TRL6-TVALP-002 same description as OBJ-18.02b-TRL6-TVALP-002	EX3-CRT-18.02b-TRL6-TVALP-002.024 EX3-CRT-18.02b-TRL6-TVALP-002.026 EX3-CRT-18.02b-TRL6-TVALP-002.028 EX3-CRT-18.02b-TRL6-TVALP-002.031 EX3-CRT-18.02b-TRL6-TVALP-002.034

SESAR Solution Validation Objective	SESAR Solution Success Criteria	Coverage and Comments on the Coverage of SESAR Solution Validation Objective in Exercise 003	Exercise Validation Objective	Exercise Success Criteria[9]
	CRT-18.02b-TRL6-TVALP-002.035 CRT-18.02b-TRL6-TVALP-002.040			EX3-CRT-18.02b-TRL6-TVALP-002.035 EX3-CRT-18.02b-TRL6-TVALP-002.040
OBJ-18.02b-TRL6-TVALP-003	CRT-18.02b-TRL6-TVALP-003.004 CRT-18.02b-TRL6-TVALP-003.006	Partly covered	EX3-OBJ-18.02b-TRL6-TVALP-003 same description as OBJ-18.02b-TRL6-TVALP-003	EX3-CRT-18.02b-TRL6-TVALP-003.004 EX3-CRT-18.02b-TRL6-TVALP-003.006
OBJ-18.02b-TRL6-TVALP-004	CRT-18.02b-TRL6-TVALP-004.003 CRT-18.02b-TRL6-TVALP-004.004	Partly covered	EX3-OBJ-18.02b-TRL6-TVALP-004 same description as OBJ-18.02b-TRL6-TVALP-004	EX3-CRT-18.02b-TRL6-TVALP-004.003 EX3-CRT-18.02b-TRL6-TVALP-004.004
OBJ-18.02b-TRL6-TVALP-005	CRT-18.02b-TRL6-TVALP-005.001 CRT-18.02b-TRL6-TVALP-005.003 CRT-18.02b-TRL6-TVALP-005.004 CRT-18.02b-TRL6-TVALP-005.006	Partly covered	EX3-OBJ-18.02b-TRL6-TVALP-005 same description as OBJ-18.02b-TRL6-TVALP-005	EX3-CRT-18.02b-TRL6-TVALP-005.001 EX3-CRT-18.02b-TRL6-TVALP-005.003 EX3-CRT-18.02b-TRL6-TVALP-005.004 EX3-CRT-18.02b-TRL6-TVALP-005.006

SESAR Solution Validation Objective	SESAR Solution Success Criteria	Coverage and Comments on the Coverage of SESAR Solution Validation Objective in Exercise 003	Exercise Validation Objective	Exercise Success Criteria[9]
	CRT-18.02b-TRL6-TVALP-005.010 CRT-18.02b-TRL6-TVALP-005.018			EX3-CRT-18.02b-TRL6-TVALP-005.010 EX3-CRT-18.02b-TRL6-TVALP-005.018
OBJ-18.02b-TRL6-TVALP-006	CRT-18.02b-TRL6-TVALP-006.002	Fully covered	EX3-OBJ-18.02b-TRL6-TVALP-006 same description as OBJ-18.02b-TRL6-TVALP-006	EX3-CRT-18.02b-TRL6-TVALP-006.002
OBJ-18.02b-TRL6-TVALP-008	CRT-18.02b-TRL6-TVALP-008.001 CRT-18.02b-TRL6-TVALP-008.005 CRT-18.02b-TRL6-TVALP-008.007	Fully covered	EX3-OBJ-18.02b-TRL6-TVALP-002 same description as OBJ-18.02b-TRL6-TVALP-002	EX3-CRT-18.02b-TRL6-TVALP-008.001 EX3-CRT-18.02b-TRL6-TVALP-008.005 EX3-CRT-18.02b-TRL6-TVALP-008.007
OBJ-18.02b-TRL6-TVALP-009	CRT-18.02b-TRL6-TVALP-009.005	Partly covered	EX3-OBJ-18.02b-TRL6-TVALP-009 same description as OBJ-18.02b-TRL6-TVALP-009	EX3-CRT-18.02b-TRL6-TVALP-009.005
OBJ-18.02b-TRL6-TVALP-010	CRT-18.02b-TRL6-TVALP-010.002	Partly covered	EX3-OBJ-18.02b-TRL6-TVALP-010 same description as OBJ-18.02b-TRL6-TVALP-010	EX3-CRT-18.02b-TRL6-TVALP-010.002

SESAR Solution Validation Objective	SESAR Solution Success Criteria	Coverage and Comments on the Coverage of SESAR Solution Validation Objective in Exercise 003	Exercise Validation Objective	Exercise Success Criteria[9]
OBJ-18.02b-TRL6-TVALP-011	CRT-18.02b-TRL6-TVALP-011.001 CRT-18.02b-TRL6-TVALP-011.002 CRT-18.02b-TRL6-TVALP-011.003 CRT-18.02b-TRL6-TVALP-011.009	Fully covered	EX3-OBJ-18.02b-TRL6-TVALP-011 same description as OBJ-18.02b-TRL6-TVALP-011	EX3-CRT-18.02b-TRL6-TVALP-011.001 EX3-CRT-18.02b-TRL6-TVALP-011.002 EX3-CRT-18.02b-TRL6-TVALP-011.003 EX3-CRT-18.02b-TRL6-TVALP-011.009

Table 97: Validation Objectives addressed in technical validation exercise 3

C.4 Summary of Technological Validation Exercise #03 Validation scenarios

Not applicable for expert judgement.

C.5 Summary Technological Validation Exercise #03 Assumptions

General validation assumptions are provided in section 3.2.3.

Additionally, it was assumed that the TS/IRS [7] is delivered before the final TVALP submission.

C.6   Deviation from the planned activities

No.	Deviation	Refer TVALP	Justification
C1	TS/IRS was not delivered before the final TVALP submission.	§5.3.5	TS/IRS will be updated after the end of EXE-IOP-03. The assignment of the ATMS requirements to the validation objectives is documented within the present TVALR.
C2	Expert judgement activities were planned to be organised as moderated workshops. These workshops have been partly replaced by a corresponding e-mail workflow process (see below).	§5.3.9.1	Due to Corona crisis circumstances the face to face workshops were not appropriate.
C3	UC#1104 has been removed.	§4.3 ff	Not necessary anymore.
C4	UC#1105 has been removed.	§4.3 ff	Has been shifted to Full IOP.
C5	UC#0403 could not be validated.	§4.3 ff	The partners could not agree on a limited solution in the scope of PJ18. A more complex solution is on the table, but cannot be described in time frame of PJ18-02b.

Table 98: Deviations of validation exercise 3 with respect to the TVALP

The e-mail workflow process (cf. deviation number C2) is aiming to reach consensus on the requirements meaning and wording. The process has been defined as follows:

1. When a use case file is ready for expert judgement validation, the TECH team leader will send it to the analysis team members for review (max. 2 weeks to send comments).

2. Received comments/questions will be answered by the use case author.

3. If necessary, a short web conference on specific issues will be organised with the concerned analysis team members.

4. When comments are closed or no comments are received, approval will be asked from each partner by e-mail (max 1 week to reply).

5. The use case will be considered expert judgement approved after all approvals are received.

6. A web conference could be organised at the end of the complete process for all use cases to share the conclusions.

C.7 Technological Validation Exercise #03 Validation Results

C.7.1 Summary of Technological Validation Exercise #03 Results

Technological Val. Exe. #03 Technological Validation Objective ID	Technological Val. Exe. #03 Technological Validation Objective Title	Technological Val. Exe. #03 Success Criterion ID	Technological Val. Exe. #03 Success Criterion	Technological Val. Exe. #03 Validation Results	Technological Val. Exe. #03 Technological Val. Objective Status
OBJ-18.02b-TRL6-TVALP-001	Coordination and Transfer	18.02b-TRL6-TVALP-001.003	The technical requirements associated to UC#0103 have been validated technically.	OK	Partially OK
		CRT-18.02b-TRL6-TVALP-001.015	The technical requirements associated to UC#0115 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-001.020	The technical requirements associated to UC#0120 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-001.024	The technical requirements associated to UC#0124 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-001.027	The technical requirements associated to UC#0127 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-001.028	The technical requirements associated to UC#0128 have	OK	

Technological Val. Exe. #03 Technological Validation Objective ID	Technological Val. Exe. #03 Technological Validation Objective Title	Technological Val. Exe. #03 Success Criterion ID	Technological Val. Exe. #03 Success Criterion	Technological Val. Exe. #03 Validation Results	Technological Val. Exe. #03 Technological Val. Objective Status
			been validated technically.		
		CRT-18.02b-TRL6-TVALP-001.033	The technical requirements associated to UC#0133 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-001.036	The technical requirements associated to UC#0136 have been validated technically.	OK	
OBJ-18.02b-TRL6-TVALP-002	Management of the FO Flight Script	CRT-18.02b-TRL6-TVALP-002.024	The technical requirements associated to UC#0224 have been validated technically.	OK	Partially OK
		CRT-18.02b-TRL6-TVALP-002.026	The technical requirements associated to UC#0226 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-002.028	The technical requirements associated to UC#0228 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-002.031	The technical requirements associated to UC#0231 have	OK	

Technological Val. Exe. #03 Technological Validation Objective ID	Technological Val. Exe. #03 Technological Validation Objective Title	Technological Val. Exe. #03 Success Criterion ID	Technological Val. Exe. #03 Success Criterion	Technological Val. Exe. #03 Validation Results	Technological Val. Exe. #03 Technological Val. Objective Status
			been validated technically.		
		CRT-18.02b-TRL6-TVALP-002.034	The technical requirements associated to UC#0234 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-002.035	The technical requirements associated to UC#0235 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-002.040	The technical requirements associated to UC#0240 have been validated technically.	OK	
OBJ-18.02b-TRL6-TVALP-003	Informative Distribution between System Instances	CRT-18.02b-TRL6-TVALP-003.004	The technical requirements associated to UC#0304 have been validated technically.	OK	Partially OK
		CRT-18.02b-TRL6-TVALP-003.006	The technical requirements associated to UC#0306 have been validated technically.	OK	
OBJ-18.02b-TRL6-TVALP-004	FO protocol failures	CRT-18.02b-TRL6-TVALP-004.003	The technical requirements associated to UC#0403 have	NOK	Partially OK

Technological Val. Exe. #03 Technological Validation Objective ID	Technological Val. Exe. #03 Technological Validation Objective Title	Technological Val. Exe. #03 Success Criterion ID	Technological Val. Exe. #03 Success Criterion	Technological Val. Exe. #03 Validation Results	Technological Val. Exe. #03 Technological Val. Objective Status
			been validated technically.		
		CRT-18.02b-TRL6-TVALP-004.004	The technical requirements associated to UC#0404 have been validated technically.	OK	
OBJ-18.02b-TRL6-TVALP-005	Control Sequences Handling	CRT-18.02b-TRL6-TVALP-005.001	The technical requirements associated to UC#0501 have been validated technically.	OK	Partially OK
		CRT-18.02b-TRL6-TVALP-005.003	The technical requirements associated to UC#0503 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-005.004	The technical requirements associated to UC#0504 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-005.006	The technical requirements associated to UC#0506 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-005.010	The technical requirements associated to UC#0510 have	OK	

Technological Val. Exe. #03 Technological Validation Objective ID	Technological Val. Exe. #03 Technological Validation Objective Title	Technological Val. Exe. #03 Success Criterion ID	Technological Val. Exe. #03 Success Criterion	Technological Val. Exe. #03 Validation Results	Technological Val. Exe. #03 Technological Val. Objective Status
			been validated technically.		
		CRT-18.02b-TRL6-TVALP-005.018	The technical requirements associated to UC#0518 have been validated technically.	OK	
OBJ-18.02b-TRL6-TVALP-006	IOP Recovery	CRT-18.02b-TRL6-TVALP-006.002	The technical requirements associated to UC#0602 have been validated technically.	OK	OK
OBJ-18.02b-TRL6-TVALP-008	SSR Code Management	CRT-18.02b-TRL6-TVALP-008.001	The technical requirements associated to UC#0801 have been validated technically.	OK	OK
		CRT-18.02b-TRL6-TVALP-008.005	The technical requirements associated to UC#0805 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-008.007	The technical requirements associated to UC#0807 have been validated technically.	OK	
OBJ-18.02b-TRL6-TVALP-009	FO Mechanism	CRT-18.02b-TRL6-TVALP-009.005	The technical requirements associated to UC#0905 have	OK	Partially OK

Technological Val. Exe. #03 Technological Validation Objective ID	Technological Val. Exe. #03 Technological Validation Objective Title	Technological Val. Exe. #03 Success Criterion ID	Technological Val. Exe. #03 Success Criterion	Technological Val. Exe. #03 Validation Results	Technological Val. Exe. #03 Technological Val. Objective Status
			been validated technically.		
OBJ-18.02b-TRL6-TVALP-010	Scope and Management of the FO trajectory	CRT-18.02b-TRL6-TVALP-010.002	The technical requirements associated to UC#1002 have been validated technically.	OK	Partially OK
OBJ-18.02b-TRL6-TVALP-011	Arrival and Departure management	CRT-18.02b-TRL6-TVALP-011.001	The technical requirements associated to UC#1101 have been validated technically.	OK	OK
		CRT-18.02b-TRL6-TVALP-011.002	The technical requirements associated to UC#1102 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-011.003	The technical requirements associated to UC#1103 have been validated technically.	OK	
		CRT-18.02b-TRL6-TVALP-011.009	The technical requirements associated to UC#1109 have been validated technically.	OK	

Table 99: Technological Validation Results Exercise #03

C.7.1.1 Results on technological feasibility

The technological feasibility has been proved by expert judgement.

C.7.1.2 Results per KPA

Not applicable – KPAs have not been defined for solution PJ.18-02b.

C.7.2 Analysis of Exercise #03 Results per Technological Validation objective

The consolidated results for the validation exercise are shown in the following sub-sections.

Only the validation objectives and success criteria, which were planned to be technically validated in EXE-IOP-03 according to the TVALP, are analysed here.

The validation results are marked as follows:

OK: The validation result matches the specification.

NOK: The validation result does not match the specification.

C.7.2.1 OBJ-18.02b-TRL6-TVALP-001 Results

This objective deals with the validation of the coordination and transfer use cases:

Use Case ID	Succ. Crit. ID	Use Case Title
UC#0103	CRT-18.02b-TRL6-TVALP-001.003	Automatic Reversion from CAP/NP to SAP
UC#0115	CRT-18.02b-TRL6-TVALP-001.015	Undo-Send
UC#0120	CRT-18.02b-TRL6-TVALP-001.020	Force-assume by a further downstream unit
UC#0124	CRT-18.02b-TRL6-TVALP-001.024	Point and Point cancellation
UC#0127	CRT-18.02b-TRL6-TVALP-001.027	Negotiation of DCT contractual data between Transferring RE and Receiving RE
UC#0128	CRT-18.02b-TRL6-TVALP-001.028	Negotiation of C&T Contractual data by 2 FDC's
UC#0133	CRT-18.02b-TRL6-TVALP-001.033	Force-assume from a skipped Unit
UC#0136	CRT-18.02b-TRL6-TVALP-001.036	Reversion from NP to CAP

Table 100: Validated Success Criteria / Use Cases of OBJ-18.02b-TRL6-TVALP-001 in EXE-IOP-03

C.7.2.1.1   CRT-18.02b-TRL6-TVALP-001.003 (UC#0103)

UC Title: **Automatic Reversion from CAP/NP to SAP**

UC Result: The technical requirements associated to UC#0103 have been technically validated by means of expert judgement during workshop on 12/12/2019.

C.7.2.1.2   CRT-18.02b-TRL6-TVALP-001.015 (UC#0115)

UC Title: **Undo-Send**

UC Result: The technical requirements associated to UC#0115 have been technically validated by means of expert judgement during workshop on 12/12/2019.

C.7.2.1.3   CRT-18.02b-TRL6-TVALP-001.020 (UC#0120)

UC Title: **Force-assume by a further downstream unit**

UC Result: The technical requirements associated to UC#0120 have been technically validated by means of expert judgement with e-mail workflow process finished on 22/9/2020.

C.7.2.1.4   CRT-18.02b-TRL6-TVALP-001.024 (UC#0124)

UC Title: **Point and Point cancellation**

UC Result: The technical requirements associated to UC#0124 have been technically validated by means of expert judgement with e-mail workflow process finished on 2/10/2020.

C.7.2.1.5   CRT-18.02b-TRL6-TVALP-001.027 (UC#0127)

UC Title: **Negotiation of DCT contractual data between Transferring RE and Receiving RE**

UC Result: The technical requirements associated to UC#0127 have been technically validated by means of expert judgement with e-mail workflow process finished on 24/9/2020.

C.7.2.1.6   CRT-18.02b-TRL6-TVALP-001.028 (UC#0128)

UC Title: **Negotiation of C&T Contractual data by 2 FDC's**

UC Result: The technical requirements associated to UC#0128 have been technically validated by means of expert judgement during workshop on 12/12/2019.

C.7.2.1.7   CRT-18.02b-TRL6-TVALP-001.033 (UC#0133)

UC Title: **Force-assume from a skipped Unit**

UC Result: The technical requirements associated to UC#0133 have been technically validated by means of expert judgement during workshop on 12/12/2019.

C.7.2.1.8   CRT-18.02b-TRL6-TVALP-001.036 (UC#0136)

UC Title: **Reversion from NP to CAP**

UC Result: The technical requirements associated to UC#0136 have been technically validated by means of expert judgement during web conference on 20/02/2020.

C.7.2.2 OBJ-18.02b-TRL6-TVALP-002 Results

This objective deals with the validation of the Management of the FO Flight Script use cases.

Use Case ID	Succ. Crit. ID	Use Case Title
UC#0224	CRT-18.02b-TRL6-TVALP-002.024	Management of holding & stay constraint
UC#0226	CRT-18.02b-TRL6-TVALP-002.026	Modification of IFR/VFR and OAT/GAT
UC#0228	CRT-18.02b-TRL6-TVALP-002.028	Level band clearance
UC#0231	CRT-18.02b-TRL6-TVALP-002.031	Closed heading management
UC#0234	CRT-18.02b-TRL6-TVALP-002.034	Management of active/inactive states of constraints
UC#0235	CRT-18.02b-TRL6-TVALP-002.035	Management of Diversion (new destination airport)
UC#0240	CRT-18.02b-TRL6-TVALP-002.040	Information associated to bypassed points

Table 101: Validated Success Criteria / Use Cases of OBJ-18.02b-TRL6-TVALP-002 in EXE-IOP-03

C.7.2.2.1   CRT-18.02b-TRL6-TVALP-002.024 (UC#0224)

UC Title: **Management of holding & stay constraint**

UC Result: The technical requirements associated to UC#0224 have been technically validated by means of expert judgement during workshop on 12/12/2019.

C.7.2.2.2   CRT-18.02b-TRL6-TVALP-002.026 (UC#0226)

UC Title: **Modification of IFR/VFR and OAT/GAT**

UC Result: The technical requirements associated to UC#0226 have been technically validated by means of expert judgement e-mail workflow on 28/04/2020.

C.7.2.2.3 CRT-18.02b-TRL6-TVALP-002.028 (UC#0228)

UC Title: **Level band clearance**

UC Result: The technical requirements associated to UC#0228 have been technically validated by means of expert judgement e-mail workflow on 24/06/2020.

C.7.2.2.4 CRT-18.02b-TRL6-TVALP-002.031 (UC#0231)

UC Title: **Closed heading management**

UC Result: The technical requirements associated to UC#0231 have been technically validated by means of expert judgement during workshop on 12/12/2019.

C.7.2.2.5 CRT-18.02b-TRL6-TVALP-002.034 (UC#0234)

UC Title: **Management of active/inactive states of constraints**

UC Result: The technical requirements associated to UC#0234 have been technically validated by means of expert judgement e-mail workflow on 31/08/2020.

C.7.2.2.6 CRT-18.02b-TRL6-TVALP-002.035 (UC#0235)

UC Title: **Management of Diversion (new destination airport)**

UC Result: The technical requirements associated to UC#0235 have been technically validated by means of expert judgement during workshop on 12/12/2019.

C.7.2.2.7 CRT-18.02b-TRL6-TVALP-002.040 (UC#0240)

UC Title: **Information associated to bypassed points**

UC Result: The technical requirements associated to UC#0240 have been technically validated by means of expert judgement with e-mail workflow process finished on 15/10/2020.

C.7.2.3 OBJ-18.02b-TRL6-TVALP-003 Results

This objective deals with the validation of the Informative Distribution between System Instances use cases.

Use Case ID	Succ. Crit. ID	Use Case Title
UC#0304	CRT-18.02b-TRL6-TVALP-003.004	Distribution on bilateral rules (General information)
UC#0306	CRT-18.02b-TRL6-TVALP-003.006	Manual subscription/unsubscription to FO

Table 102: Validated Success Criteria / Use Cases of OBJ-18.02b-TRL6-TVALP-003 in EXE-IOP-03

C.7.2.3.1   CRT-18.02b-TRL6-TVALP-003.004 (UC#0304)

UC Title: **Distribution on bilateral rules (General information)**

UC Result: The technical requirements associated to UC#0304 have been technically validated by means of expert judgement e-mail workflow on 31/08/2020.

C.7.2.3.2   CRT-18.02b-TRL6-TVALP-003.006 (UC#0306)

UC Title: **Manual subscription/unsubscription to FO**

UC Result: The technical requirements associated to UC#0304 have been technically validated by means of expert judgement during workshop on 12/12/2019.

C.7.2.4 OBJ-18.02b-TRL6-TVALP-004 Results

This objective deals with the validation of the FO protocol failures use cases.

Use Case ID	Succ. Crit. ID	Use Case Title
UC#0403	CRT-18.02b-TRL6-TVALP-004.003	FO stabilization and protection against multiple successive FO updates
UC#0404	CRT-18.02b-TRL6-TVALP-004.004	De-synchronization and Re-synchronization

Table 103: Validated Success Criteria / Use Cases of OBJ-18.02b-TRL6-TVALP-004 in EXE-IOP-03

C.7.2.4.1   CRT-18.02b-TRL6-TVALP-004.003 (UC#0403)

UC Title: **FO stabilization and Protection against multiple successive FO updates**

UC Result: The technical requirements associated to UC#0403 have not been technically validated by lack of time to provide a complete solution.[10]

C.7.2.4.2   CRT-18.02b-TRL6-TVALP-004.004 (UC#0404)

UC Title: **Management of discrepancies with local view**

UC Result: The technical requirements associated to UC#0404 have been technically validated by means of expert judgement with e-mail workflow process finished on 26/10/2020.

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[10] UC#0403 was not validated: no agreement on a limited solution in the scope of PJ18. A more complex solution is on the table, but cannot be described in time frame of PJ18-02b.

C.7.2.5 OBJ-18.02b-TRL6-TVALP-005 Results

This objective deals with the validation of the Control Sequences Handling use cases.

Use Case ID	Succ. Crit. ID	Use Case Title
UC#0501	CRT-18.02b-TRL6-TVALP-005.001	Automatic Skip of an IOP Unit in favour of the upstream
UC#0503	CRT-18.02b-TRL6-TVALP-005.003	Manual Unskip of an IOP Unit skipped in favour of the upstream
UC#0504	CRT-18.02b-TRL6-TVALP-005.004	Manual Skip of an IOP Unit in favour of the upstream
UC#0506	CRT-18.02b-TRL6-TVALP-005.006	Internal Resp Entity-Skip/Unskip (control remains in same Unit)
UC#0510	CRT-18.02b-TRL6-TVALP-005.010	Manual partial delegation, and cancellation
UC#0518	CRT-18.02b-TRL6-TVALP-005.018	"No Contact" implementation

Table 104: Validated Success Criteria / Use Cases of OBJ-18.02b-TRL6-TVALP-005 in EXE-IOP-03

C.7.2.5.1   CRT-18.02b-TRL6-TVALP-005.001 (UC#0501)

UC Title: **Automatic Skip of an IOP Unit in favour of the upstream**

UC Result: The technical requirements associated to UC#0501 have been technically validated by means of expert judgement during workshop on 12/12/2019.

C.7.2.5.2   CRT-18.02b-TRL6-TVALP-005.003 (UC#0503)

UC Title: **Manual Unskip of an IOP Unit skipped in favour of the upstream**

UC Result: The technical requirements associated to UC#0503 have been technically validated by means of expert judgement during workshop on 12/12/2019.

C.7.2.5.3   CRT-18.02b-TRL6-TVALP-005.004 (UC#0504)

UC Title: **Manual Skip of an IOP Unit in favour of the upstream**

UC Result: The technical requirements associated to UC#0504 have been technically validated by means of expert judgement with e-mail workflow process finished on 24/9/2020.

C.7.2.5.4 CRT-18.02b-TRL6-TVALP-005.006 (UC#0506)

UC Title: **Internal Resp Entity-Skip/Unskip (control remains in same Unit)**

UC Result: The technical requirements associated to UC#0506 have been technically validated by means of expert judgement e-mail workflow on 31/08/2020.

C.7.2.5.5 CRT-18.02b-TRL6-TVALP-005.010 (UC#0510)

UC Title: **Manual partial delegation, and cancellation**

UC Result: The technical requirements associated to UC#0510 have been technically validated by means of expert judgement during web conference on 20/02/2020.

C.7.2.5.6 CRT-18.02b-TRL6-TVALP-005.018 (UC#0518)

UC Title: **"No Contact" implementation**

UC Result: The technical requirements associated to UC#0518 have been technically validated by means of expert judgement e-mail workflow on 04/06/2020.

C.7.2.6 OBJ-18.02b-TRL6-TVALP-006 Results

This objective deals with the validation of the IOP Recovery use cases.

Use Case ID	Succ. Crit. ID	Use Case Title
UC#0602	CRT-18.02b-TRL6-TVALP-006.002	Full IOP Recovery mechanism

Table 105: Validated Success Criteria / Use Cases of OBJ-18.02b-TRL6-TVALP-006 in EXE-IOP-03

C.7.2.6.1   CRT-18.02b-TRL6-TVALP-010.002 (UC#0602)

UC Title: **Full IOP Recovery mechanism**

UC Result: The technical requirements associated to UC#0602 have been technically validated by means of expert judgement during web conference on 20/02/2020.

C.7.2.7 OBJ-18.02b-TRL6-TVALP-008 Results

This objective deals with the validation of the SSR Code Management use cases.

Use Case ID	Succ. Crit. ID	Use Case Title
UC#0801	CRT-18.02b-TRL6-TVALP-008.001	Modifying & Sharing the IOP_NSSR, IOP_ASSR, IOP_CSSR
UC#0805	CRT-18.02b-TRL6-TVALP-008.005	To request and provide the IOP_DSSR
UC#0807	CRT-18.02b-TRL6-TVALP-008.007	Sharing the Mode S flight Id

Table 106: Validated Success Criteria / Use Cases of OBJ-18.02b-TRL6-TVALP-008 in EXE-IOP-03

C.7.2.7.1   CRT-18.02b-TRL6-TVALP-008.001 (UC#0801)

UC Title: **Modifying & Sharing the IOP_NSSR, IOP_ASSR, IOP_CSSR**

UC Result: The technical requirements associated to UC#0801 have been technically validated by means of expert judgement during web conference on 20/02/2020.

C.7.2.7.2   CRT-18.02b-TRL6-TVALP-008.005 (UC#0805)

UC Title: **To request and provide the IOP_DSSR**

UC Result: The technical requirements associated to UC#0805 have been technically validated by means of expert judgement during web conference on 20/02/2020.

C.7.2.7.3   CRT-18.02b-TRL6-TVALP-008.007 (UC#0807)

UC Title: **Sharing the Mode S flight Id**

UC Result: The technical requirements associated to UC#0807 have been technically validated by means of expert judgement e-mail workflow on 28/04/2020.

C.7.2.8 OBJ-18.02b-TRL6-TVALP-009 Results

This objective deals with the validation of the FO Mechanism use cases.

Use Case ID	Succ. Crit. ID	Use Case Title
UC#0905	CRT-18.02b-TRL6-TVALP-009.005	Flight Object Removal

Table 107: Validated Success Criteria / Use Cases of OBJ-18.02b-TRL6-TVALP-009 in EXE-IOP-03

C.7.2.8.1   CRT-18.02b-TRL6-TVALP-009.005 (UC#0905)

UC Title: **Flight Object Removal**

UC Result: The technical requirements associated to UC#0905 have been technically validated by means of expert judgement during web conference on 20/02/2020.

C.7.2.9 -18.02b-TRL6-TVALP-010 Results

This objective deals with the validation of the Scope and Management of the FO trajectory use cases.

Use Case ID	Succ. Crit. ID	Use Case Title
UC#1002	CRT-18.02b-TRL6-TVALP-0010.002	Advanced Trajectory Management and Scope

Table 108: Validated Success Criteria / Use Cases of OBJ-18.02b-TRL6-TVALP-010 in EXE-IOP-03

C.7.2.9.1   CRT-18.02b-TRL6-TVALP-010.002 (UC#1002)

UC Title: **Advanced Trajectory Management and Scope**

UC Result: The technical requirements associated to UC#1002 have been technically validated by means of expert judgement during web conference on 20/02/2020.

C.7.2.10   OBJ-18.02b-TRL6-TVALP-011 Results

This objective deals with the validation of the Arrival and Departure management use cases.

Use Case ID	Succ. Crit. ID	Use Case Title
UC#1101	CRT-18.02b-TRL6-TVALP-011.001	Departure Time update
UC#1102	CRT-18.02b-TRL6-TVALP-011.002	SID definition and change
UC#1103	CRT-18.02b-TRL6-TVALP-011.003	STAR definition and change (& Arrival transitions)
UC#1109	CRT-18.02b-TRL6-TVALP-011.009	AMAN (indication of TTL / TTG & XMAN delay sharing)

Table 109: Validated Success Criteria / Use Cases of OBJ-18.02b-TRL6-TVALP-011 in EXE-IOP-03

C.7.2.10.1   CRT-18.02b-TRL4-TVALP-011.001 (UC#1101)

UC Title: **Departure Time update**

UC Result: The technical requirements associated to UC#1101 have been technically validated by means of expert judgement with e-mail workflow process finished on 23/10/2020.

C.7.2.10.2   CRT-18.02b-TRL4-TVALP-011.002 (UC#1102)

UC Title: **SID definition and change**

UC Result: The technical requirements associated to UC#1102 have been technically validated by means of expert judgement with e-mail workflow process finished on 23/10/2020.

C.7.2.10.3   CRT-18.02b-TRL4-TVALP-011.003 (UC#1103)

UC Title: **STAR definition and change (& Arrival transitions)**

UC Result: The technical requirements associated to UC#1103 have been technically validated by means of expert judgement with e-mail workflow process finished on 29/10/2020.

C.7.2.10.4   CRT-18.02b-TRL4-TVALP-011.009 (UC#1109)

UC Title:	**AMAN (indication of TTL / TTG & XMAN delay sharing)**

UC Result:	The technical requirements associated to UC#1109 have been technically validated by means of expert judgement with e-mail workflow process finished on 19/10/2020.

C.7.3 Unexpected Behaviours/Results

Not applicable for expert judgement.

C.7.4 Confidence in Results of Validation Exercise #03

C.7.4.1 Level of significance/limitations of Technological Validation Exercise Results

The validation results obtained by expert judgement in the technical validation exercise were sufficiently representative, since all use cases but one were validated with significance. The results are ready to be integrated at the SESAR Technology Solution level, because we validated the use of the ICD and relevance of associated requirements.

C.7.4.2 The validated functions are ready for industrialisation and deployment (TRL 6).Quality of Technological Validation Exercises Results

The confidence in the results of the expert judgement validation can be rated as good. Validated UC's have been "executed" on paper describing for each step the ICD exchanges and the TS Requirements involved. This "paper" exercise has been toroughly reviewed by all industrial and operational partners.

C.7.4.3 Significance of Technological Validation Exercises Results

Significance of Expert Judgement Validation cannot be measured statically as there is no execution in real ot simulated environment. The validation can be considered as significant in the sense that experts from all Industrial and Operational partners involved in the project have participated to the validation.

C.8 Conclusions

The different industrial partners of basic FO IOP could agree on technical implementation and the way to use it by detailed ICD exchange(technical uses case steps) description.

The industrial and operational experts were able to validate the use cases and technical requirements for basic FO IOP by means of expert judgement.

One use case and a limited set of requirements remain un-validated, see recomandations below.

C.8.1 Conclusions on Technological feasibility

The maturities of the basic FO IOP technical requirements of the expert judgement validated use cases have reached TRL6.

C.8.2 Conclusions on performance assessments

N/A

C.9   Recommendations

For the industrialisation and deployment phase we recommend paying attention to the verification of those use cases / technical requirements that have been validated in EXE-IOP-03 by expert judgement.

To ensure scalability of IOP deployment in the future, it is also recommended to further develop the "FO stabilization and Protection against multiple successive FO updates" which has not reach the required level of maturity (cf. UC#0403).

We recommend paying attention to the following list of (mainly performance and robustness) requirements that have not been validated by means of any use case (cf. [12]):

ID	Title	Reason	Assessment
REQ-18-02b-TS-COTR.0156	Stop the Negotiation Phase in case of no assumption by downstream SI	Robustness mechanism. The defined use case did not allow to technically validate this particular requirement.	This is a mechanism to ensure the robustness of the flight transfer mechanism. It uses mechanisms used in other validated requirements. It does not need extra operational validation.
REQ-18-02b-TS-COTR.0159	Coordination Data frozen after a frequency change	Performance mechanism. The defined use case did not allow to technically validate this particular requirement.	This is a mechanism to ensure the robustness and performance. Its implementation does not add operational risk, it allows to avoid unnecessary FO updates related past events. It does not need extra operational validation.
REQ-18-02b-TS-COTR.0160	C&T Modified Data Urgent Application	No use case covering this particular requirement.	This is about the setting of a flag in the FO 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.
REQ-18-02b-TS-FSMG.0062	FO Expanded Route Refinement of Unknown Items	No use case covering this particular requirement. Note that UC#0301 and UC#1001 could have been extended to cover it.	The concept of an unknown element in the flight script is clear, well understood and modelled in the ICD, so implemented in the service

ID	Title	Reason	Assessment
			interface.Therefore this is considered as low risk in term of validation.
REQ-18-02b-TS-FSMG.0100	flight script Expanded Route including unknown route item	No use case covering this particular requirement. Note that UC#0301 and UC#1001 could have been extended to cover it.	The concept of an unknown element in the flight script 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.
REQ-18-02b-TS-FSMG.0141	Eligibility rules for trajectory modification	Robustness mechanism. The defined use case did not allow to technically validate this particular requirement.	This is a mechanism to ensure the protection of flight script and coordination data against un-authorized modification. This is a technical mechanism that does not need further operational validation.
REQ-18-02b-TS-MECH.0014	Flight transferred to a non-IOP SI	No use case covering this particular requirement.	This is about the setting of a status in the FO. 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 transfering flights from IOP to IOP SI.
REQ-18-02b-TS-MECH.0017	Reporting the loss of local view for a FO	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	Flight coming back from a non-IOP SI	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.

ID	Title	Reason	Assessment
			Therefore the validation of this requirement is not considered at risk.
REQ-18-02b-TS-MECH.0302	Rejection of change requests received by a stakeholder without FDMP role	Implemented in the prototype but not exercised during validation exercises.	This is a protection mechanism which does not need specific operational validation.
REQ-18-02b-TS-MECH.0385	Maximum number of retries allowed upon missing implementation report	Robustness/Performance mechanism. The defined use case did not allow to technically validate this particular requirement.	This is a mechanism to ensure the robustness/performance of the service request in case the FDMP does not reply 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	Limit current conditions updates	Performance mechanism. The defined use cases did not allow to technically validate this particular requirement.	This is a mechanism to ensure good performance of the service request by limiting the number of updates. It does not need operational validation.
REQ-18-02b-TS-MECH.0404	Limit coordination data updates	Performance mechanism. The defined use cases did not allow to technically validate this particular requirement.	This is a mechanism to ensure 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	Limit trajectory updates (ETO)	Performance mechanism. The defined use cases did not allow to technically validate this particular requirement.	This is a mechanism to ensure good performance of the service request by limiting the number of updates. It is

ID	Title	Reason	Assessment
			recommended to run limited validation/trial to determine the correct value of the parameter.
REQ-18-02b-TS-MECH.0406	Limit trajectory updates (levels)	Performance mechanism. The defined use cases did not allow to technically validate this particular requirement.	This is a mechanism to ensure 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.0409	Reporting failed processing of a FO service request	Robustness mechanism. The defined use case did not allow to technically validate this particular requirement.	This is a mechanism to ensure 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.
REQ-18-02b-TS-MECH.1011	Severe Desynchronization removal (FDC)	Defined after validation mechanism to complete the desynchronisation mechanism.	Although no validation risks 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	Severe Desynchronization removal (FDMP)	Defined after validation mechanism to complete the desynchronisation mechanism.	Although no validation risks 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.

ID	Title	Reason	Assessment
REQ-18-02b-TS-MECH.1013	Severe Desynchronization triggering (FDMP)	Defined after validation mechanism to complete the desynchronisation mechanism.	Although no validation risks 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 desynchronisation 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 takeover the FDMP role have been validated.
REQ-18-02b-TS-SCTJ.0101	FDMP trajectory processing when FO Expanded Route includes unknown route items	No use case covering this particular requirement. Note that UC#0301 and UC#1001 could have been extended to cover it.	The concept of an unknown element in the flight script 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.
REQ-18-02b-TS-SEQM.1045	FDC's addition request rejection	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.
REQ-18-02b-TS-SEQM.1046	FDC's removal request rejection	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.

ID	Title	Reason	Assessment
REQ-18-02b-TS-SEQM.1049	Unskip initiator	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.
REQ-18-02b-TS-SEQM.1050	Undelegation: initiator check	No use case covering this particular requirement.	This is a mechanism to protect any un-authorized delegation cacellation. 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.
REQ-18-02b-TS-SEQM.1067	FDC's confirmation request rejection	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.
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	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.

ID	Title	Reason	Assessment
REQ-18-02b-TS-SWIM.0032	FDMP handling of FO version collision	Robustness mechanism. The defined use cases did not allow to technically validate 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	FDMP report FO distribution failure	Robustness mechanism. The defined use cases did not allow to technically validate 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	FDC to report ICD version mismatch	Robustness mechanism. The defined use cases did not allow to technically validate 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.
REQ-18-02b-TS-WIFO.0045	WIFO Cancellation	No use case covering this particular requirement.	This is about the setting of a status in a WhatIf FO 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.
REQ-18-02b-TS-WIFO.0051	WIFO realignment management	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 ricky. It is recommended to perform some limeted validation on the re-alignment mechanism.

Table 110: Technical requirements not linked to any success criteria / use cases

Appendix D   Validation Objective – Technical Requirement Matrix

The following table shows the technical requirements with maturities assigned to the success criteria/validation objectives (cf. [10], [11]):

Validation Objective	Success Criterion	ATMS Requirement(s)	Maturity
OBJ-18.02b-TRL6-TVALP-001		REQ-18-02b-TS-COTR.0001	TRL6
		REQ-18-02b-TS-COTR.0004	TRL6
		REQ-18-02b-TS-COTR.0008	TRL6
		REQ-18-02b-TS-COTR.0009	TRL6
		REQ-18-02b-TS-COTR.0028	TRL6
		REQ-18-02b-TS-COTR.0029	TRL6
		REQ-18-02b-TS-COTR.0037	TRL6
		REQ-18-02b-TS-COTR.0143	TRL6
		REQ-18-02b-TS-COTR.0157	TRL6
		REQ-18-02b-TS-COTR.0158	TRL6
		REQ-18-02b-TS-MECH.0008	TRL6
	CRT-18.02b-TRL6-TVALP-001.001	REQ-18-02b-TS-MECH.0319	TRL6
		REQ-18-02b-TS-MECH.0336	TRL6
		REQ-18-02b-TS-FSMG.0155	TRL6
		REQ-18-02b-TS-MECH.0205	TRL6
		REQ-18-02b-TS-MECH.0207	TRL6
		REQ-18-02b-TS-MECH.0309	TRL6
		REQ-18-02b-TS-MECH.0316	TRL6
		REQ-18-02b-TS-MECH.0320	TRL6
		REQ-18-02b-TS-MECH.0375	TRL6
		REQ-18-02b-TS-MECH.0407	TRL6
		REQ-18-02b-TS-MECH.0408	TRL6

Validation Objective	Success Criterion	ATMS Requirement(s)	Maturity
		REQ-18-02b-TS-SWIM.0028	TRL6
		REQ-18-02b-TS-SWIM.0030	TRL6
	CRT-18.02b-TRL6-TVALP-001.002	REQ-18-02b-TS-COTR.0010	TRL6
	CRT-18.02b-TRL6-TVALP-001.003	REQ-18-02b-TS-COTR.0001	TRL6
		REQ-18-02b-TS-COTR.0016	TRL6
		REQ-18-02b-TS-COTR.0029	TRL6
		REQ-18-02b-TS-COTR.0157	TRL6
	CRT-18.02b-TRL6-TVALP-001.005	REQ-18-02b-TS-COTR.0143	TRL6
		REQ-18-02b-TS-COTR.0200	TRL6
		REQ-18-02b-TS-COTR.0201	TRL6
		REQ-18-02b-TS-COTR.0205	TRL6
		REQ-18-02b-TS-COTR.0207	TRL6
		REQ-18-02b-TS-MECH.0205	TRL6
		REQ-18-02b-TS-MECH.0207	TRL6
		REQ-18-02b-TS-MECH.0303	TRL6
		REQ-18-02b-TS-MECH.0305	TRL6
		REQ-18-02b-TS-MECH.0315	TRL6
	CRT-18.02b-TRL6-TVALP-001.006	REQ-18-02b-TS-COTR.0139	TRL6
		REQ-18-02b-TS-COTR.0140	TRL6
		REQ-18-02b-TS-COTR.0143	TRL6
		REQ-18-02b-TS-COTR.0202	TRL6
		REQ-18-02b-TS-FSMG.0001	TRL6
		REQ-18-02b-TS-FSMG.0009	TRL6
		REQ-18-02b-TS-FSMG.0076	TRL6
		REQ-18-02b-TS-FSMG.0084	TRL6
		REQ-18-02b-TS-FSMG.0086	TRL6

Validation Objective	Success Criterion	ATMS Requirement(s)	Maturity
		REQ-18-02b-TS-FSMG.0120	TRL6
		REQ-18-02b-TS-FSMG.0129	TRL6
	CRT-18.02b-TRL6-TVALP-001.009	REQ-18-02b-TS-COTR.0135	TRL6
		REQ-18-02b-TS-FSMG.0076	TRL6
	CRT-18.02b-TRL6-TVALP-001.012	REQ-18-02b-TS-COTR.0008	TRL6
		REQ-18-02b-TS-COTR.0011	TRL6
		REQ-18-02b-TS-COTR.0028	TRL6
		REQ-18-02b-TS-COTR.0038	TRL6
		REQ-18-02b-TS-COTR.0122	TRL6
		REQ-18-02b-TS-COTR.0130	TRL6
		REQ-18-02b-TS-COTR.0149	TRL6
		REQ-18-02b-TS-COTR.0150	TRL6
		REQ-18-02b-TS-FSMG.0155	TRL6
	CRT-18.02b-TRL6-TVALP-001.013	REQ-18-02b-TS-COTR.0028	TRL6
		REQ-18-02b-TS-COTR.0037	TRL6
		REQ-18-02b-TS-COTR.0131	TRL6
		REQ-18-02b-TS-COTR.0149	TRL6
		REQ-18-02b-TS-COTR.0150	TRL6
		REQ-18-02b-TS-COTR.0154	TRL6
		REQ-18-02b-TS-COTR.0158	TRL6
		REQ-18-02b-TS-COTR.0152	TRL6
		REQ-18-02b-TS-COTR.0153	TRL6
		REQ-18-02b-TS-COTR.0161	TRL6
		REQ-18-02b-TS-COTR.0162	TRL6
		REQ-18-02b-TS-COTR.0206	TRL6
		REQ-18-02b-TS-FSMG.0155	TRL6

Validation Objective	Success Criterion	ATMS Requirement(s)	Maturity
	CRT-18.02b-TRL6-TVALP-001.015	REQ-18-02b-TS-COTR.0016	TRL6
		REQ-18-02b-TS-COTR.0040	TRL6
		REQ-18-02b-TS-COTR.0150	TRL6
		REQ-18-02b-TS-COTR.0157	TRL6
	CRT-18.02b-TRL6-TVALP-001.018	REQ-18-02b-TS-COTR.0047	TRL6
		REQ-18-02b-TS-COTR.0111	TRL6
		REQ-18-02b-TS-COTR.0120	TRL6
		REQ-18-02b-TS-COTR.0200	TRL6
		REQ-18-02b-TS-COTR.0201	TRL6
		REQ-18-02b-TS-SEQM.1014	TRL6
		REQ-18-02b-TS-FSMG.0155	TRL6
	CRT-18.02b-TRL6-TVALP-001.020	REQ-18-02b-TS-COTR.0047	TRL6
		REQ-18-02b-TS-COTR.0111	TRL6
		REQ-18-02b-TS-COTR.0120	TRL6
		REQ-18-02b-TS-SEQM.1014	TRL6
		REQ-18-02b-TS-SEQM.1041	TRL6
		REQ-18-02b-TS-SEQM.1042	TRL6
		REQ-18-02b-TS-SEQM.1044	TRL6
		REQ-18-02b-TS-SEQM.1070	TRL6
	CRT-18.02b-TRL6-TVALP-001.024	REQ-18-02b-TS-INFO.1100	TRL6
		REQ-18-02b-TS-INFO.1120	TRL6
		REQ-18-02b-TS-INFO.1130	TRL6
		REQ-18-02b-TS-INFO.1140	TRL6
		REQ-18-02b-TS-INFO.1150	TRL6
		REQ-18-02b-TS-INFO.1160	TRL6
		REQ-18-02b-TS-INFO.1170	TRL6

Validation Objective	Success Criterion	ATMS Requirement(s)	Maturity
		REQ-18-02b-TS-FSMG.0009	TRL6
		REQ-18-02b-TS-FSMG.0076	TRL6
		REQ-18-02b-TS-FSMG.0084	TRL6
		REQ-18-02b-TS-WIFO.0001	TRL6
		REQ-18-02b-TS-WIFO.0005	TRL6
		REQ-18-02b-TS-WIFO.0007	TRL6
		REQ-18-02b-TS-WIFO.0016	TRL6
		REQ-18-02b-TS-WIFO.0017	TRL6
		REQ-18-02b-TS-WIFO.0027	TRL6
		REQ-18-02b-TS-WIFO.0029	TRL6
		REQ-18-02b-TS-WIFO.0031	TRL6
		REQ-18-02b-TS-WIFO.0032	TRL6
	CRT-18.02b-TRL6-TVALP-001.026	REQ-18-02b-TS-WIFO.0033	TRL6
		REQ-18-02b-TS-WIFO.0037	TRL6
		REQ-18-02b-TS-WIFO.0038	TRL6
		REQ-18-02b-TS-WIFO.0040	TRL6
		REQ-18-02b-TS-WIFO.0041	TRL6
		REQ-18-02b-TS-WIFO.0042	TRL6
		REQ-18-02b-TS-WIFO.0043	TRL6
		REQ-18-02b-TS-WIFO.0049	TRL6
		REQ-18-02b-TS-WIFO.0052	TRL6
		REQ-18-02b-TS-WIFO.0028	TRL6
		REQ-18-02b-TS-WIFO.0046	TRL6
		REQ-18-02b-TS-WIFO.0048	TRL6
	CRT-18.02b-TRL6-TVALP-001.027	REQ-18-02b-TS-COTR.0135	TRL6
		REQ-18-02b-TS-FSMG.0004	TRL6

Validation Objective	Success Criterion	ATMS Requirement(s)	Maturity
		REQ-18-02b-TS-WIFO.0001	TRL6
		REQ-18-02b-TS-WIFO.0005	TRL6
		REQ-18-02b-TS-WIFO.0007	TRL6
		REQ-18-02b-TS-WIFO.0016	TRL6
		REQ-18-02b-TS-WIFO.0017	TRL6
		REQ-18-02b-TS-WIFO.0027	TRL6
		REQ-18-02b-TS-WIFO.0029	TRL6
		REQ-18-02b-TS-WIFO.0031	TRL6
		REQ-18-02b-TS-WIFO.0032	TRL6
		REQ-18-02b-TS-WIFO.0033	TRL6
		REQ-18-02b-TS-WIFO.0037	TRL6
		REQ-18-02b-TS-WIFO.0038	TRL6
		REQ-18-02b-TS-WIFO.0040	TRL6
		REQ-18-02b-TS-WIFO.0041	TRL6
		REQ-18-02b-TS-WIFO.0043	TRL6
		REQ-18-02b-TS-WIFO.0049	TRL6
		REQ-18-02b-TS-WIFO.0052	TRL6
		REQ-18-02b-TS-WIFO.0057	TRL6
		REQ-18-02b-TS-WIFO.0058	TRL6
	CRT-18.02b-TRL6-TVALP-001.028	REQ-18-02b-TS-COTR.0029	TRL6
		REQ-18-02b-TS-WIFO.0001	TRL6
		REQ-18-02b-TS-WIFO.0005	TRL6
		REQ-18-02b-TS-WIFO.0007	TRL6
		REQ-18-02b-TS-WIFO.0016	TRL6
		REQ-18-02b-TS-WIFO.0017	TRL6
		REQ-18-02b-TS-WIFO.0027	TRL6

Validation Objective	Success Criterion	ATMS Requirement(s)	Maturity
		REQ-18-02b-TS-WIFO.0029	TRL6
		REQ-18-02b-TS-WIFO.0031	TRL6
		REQ-18-02b-TS-WIFO.0032	TRL6
		REQ-18-02b-TS-WIFO.0033	TRL6
		REQ-18-02b-TS-WIFO.0037	TRL6
		REQ-18-02b-TS-WIFO.0038	TRL6
		REQ-18-02b-TS-WIFO.0041	TRL6
		REQ-18-02b-TS-WIFO.0043	TRL6
		REQ-18-02b-TS-WIFO.0049	TRL6
	CRT-18.02b-TRL6-TVALP-001.033	REQ-18-02b-TS-COTR.0047	TRL6
		REQ-18-02b-TS-COTR.0111	TRL6
		REQ-18-02b-TS-COTR.0120	TRL6
		REQ-18-02b-TS-SEQM.1014	TRL6
		REQ-18-02b-TS-SEQM.1020	TRL6
		REQ-18-02b-TS-SEQM.1041	TRL6
		REQ-18-02b-TS-SEQM.1042	TRL6
	CRT-18.02b-TRL6-TVALP-001.036	REQ-18-02b-TS-COTR.0016	TRL6
		REQ-18-02b-TS-COTR.0157	TRL6
		REQ-18-02b-TS-FSMG.0003	TRL6
		REQ-18-02b-TS-FSMG.0004	TRL6
		REQ-18-02b-TS-FSMG.0009	TRL6
		REQ-18-02b-TS-FSMG.0028	TRL6
		REQ-18-02b-TS-FSMG.0061	TRL6
		REQ-18-02b-TS-MECH.0365	TRL6
OBJ-18.02b-TRL6-TVALP-002	CRT-18.02b-TRL6-TVALP-002.001	REQ-18-02b-TS-COTR.0202	TRL6
		REQ-18-02b-TS-COTR.0204	TRL6

Validation Objective	Success Criterion	ATMS Requirement(s)	Maturity
		REQ-18-02b-TS-FSMG.0001	TRL6
		REQ-18-02b-TS-FSMG.0003	TRL6
		REQ-18-02b-TS-FSMG.0009	TRL6
		REQ-18-02b-TS-FSMG.0010	TRL6
		REQ-18-02b-TS-FSMG.0011	TRL6
		REQ-18-02b-TS-FSMG.0018	TRL6
		REQ-18-02b-TS-FSMG.0028	TRL6
		REQ-18-02b-TS-FSMG.0038	TRL6
		REQ-18-02b-TS-FSMG.0047	TRL6
		REQ-18-02b-TS-FSMG.0051	TRL6
		REQ-18-02b-TS-FSMG.0061	TRL6
		REQ-18-02b-TS-FSMG.0072	TRL6
		REQ-18-02b-TS-FSMG.0076	TRL6
		REQ-18-02b-TS-FSMG.0080	TRL6
		REQ-18-02b-TS-FSMG.0084	TRL6
		REQ-18-02b-TS-FSMG.0086	TRL6
		REQ-18-02b-TS-FSMG.0106	TRL6
		REQ-18-02b-TS-FSMG.0107	TRL6
		REQ-18-02b-TS-FSMG.0129	TRL6
		REQ-18-02b-TS-FSMG.0135	TRL6
		REQ-18-02b-TS-FSMG.0151	TRL6
		REQ-18-02b-TS-FSMG.0152	TRL6
		REQ-18-02b-TS-FSMG.0046	TRL6
		REQ-18-02b-TS-FSMG.0054	TRL6
		REQ-18-02b-TS-FSMG.0081	TRL6
		REQ-18-02b-TS-FSMG.0083	TRL6

Validation Objective	Success Criterion	ATMS Requirement(s)	Maturity
		REQ-18-02b-TS-FSMG.0088	TRL6
		REQ-18-02b-TS-FSMG.0121	TRL6
		REQ-18-02b-TS-FSMG.0122	TRL6
		REQ-18-02b-TS-FSMG.0124	TRL6
		REQ-18-02b-TS-MECH.0403	TRL6
		REQ-18-02b-TS-MECH.0412	TRL6
	CRT-18.02b-TRL6-TVALP-002.010	REQ-18-02b-TS-COTR.0001	TRL6
		REQ-18-02b-TS-COTR.0002	TRL6
		REQ-18-02b-TS-COTR.0200	TRL6
		REQ-18-02b-TS-COTR.0201	TRL6
		REQ-18-02b-TS-COTR.0202	TRL6
		REQ-18-02b-TS-FSMG.0003	TRL6
		REQ-18-02b-TS-FSMG.0004	TRL6
		REQ-18-02b-TS-FSMG.0061	TRL6
		REQ-18-02b-TS-FSMG.0068	TRL6
		REQ-18-02b-TS-FSMG.0069	TRL6
		REQ-18-02b-TS-FSMG.0074	TRL6
		REQ-18-02b-TS-FSMG.0076	TRL6
		REQ-18-02b-TS-FSMG.0077	TRL6
		REQ-18-02b-TS-MECH.0002	TRL6
		REQ-18-02b-TS-MECH.0321	TRL6
		REQ-18-02b-TS-MECH.0344	TRL6
		REQ-18-02b-TS-MECH.0347	TRL6
		REQ-18-02b-TS-MECH.0360	TRL6
		REQ-18-02b-TS-MECH.0360	TRL6
		REQ-18-02b-TS-MECH.0365	TRL6

Validation Objective	Success Criterion	ATMS Requirement(s)	Maturity
		REQ-18-02b-TS-MECH.0398	TRL6
		REQ-18-02b-TS-SEQM.0100	TRL6
		REQ-18-02b-TS-SEQM.0101	TRL6
		REQ-18-02b-TS-SEQM.1001	TRL6
		REQ-18-02b-TS-FSMG.0002	TRL6
		REQ-18-02b-TS-FSMG.0133	TRL6
	CRT-18.02b-TRL6-TVALP-002.014	REQ-18-02b-TS-COTR.0202	TRL6
		REQ-18-02b-TS-COTR.0204	TRL6
		REQ-18-02b-TS-FSMG.0001	TRL6
		REQ-18-02b-TS-FSMG.0009	TRL6
		REQ-18-02b-TS-FSMG.0010	TRL6
		REQ-18-02b-TS-FSMG.0011	TRL6
		REQ-18-02b-TS-FSMG.0017	TRL6
		REQ-18-02b-TS-FSMG.0038	TRL6
		REQ-18-02b-TS-FSMG.0050	TRL6
		REQ-18-02b-TS-FSMG.0061	TRL6
		REQ-18-02b-TS-FSMG.0072	TRL6
		REQ-18-02b-TS-FSMG.0076	TRL6
		REQ-18-02b-TS-FSMG.0080	TRL6
		REQ-18-02b-TS-FSMG.0082	TRL6
		REQ-18-02b-TS-FSMG.0087	TRL6
		REQ-18-02b-TS-FSMG.0106	TRL6
		REQ-18-02b-TS-FSMG.0107	TRL6
		REQ-18-02b-TS-FSMG.0135	TRL6
		REQ-18-02b-TS-MECH.0306	TRL6
		REQ-18-02b-TS-MECH.0347	TRL6

Validation Objective	Success Criterion	ATMS Requirement(s)	Maturity
		REQ-18-02b-TS-MECH.0360	TRL6
	CRT-18.02b-TRL6-TVALP-002.024	REQ-18-02b-TS-FSMG.0001	TRL6
		REQ-18-02b-TS-FSMG.0003	TRL6
		REQ-18-02b-TS-FSMG.0009	TRL6
		REQ-18-02b-TS-FSMG.0028	TRL6
		REQ-18-02b-TS-FSMG.0143	TRL6
		REQ-18-02b-TS-FSMG.0161	TRL6
		REQ-18-02b-TS-SCTJ.0107	TRL6
	CRT-18.02b-TRL6-TVALP-002.026	REQ-18-02b-TS-FSMG.0160	TRL6
		REQ-18-02b-TS-FSMG.0162	TRL6
	CRT-18.02b-TRL6-TVALP-002.028	REQ-18-02b-TS-FSMG.0003	TRL6
		REQ-18-02b-TS-FSMG.0009	TRL6
	CRT-18.02b-TRL6-TVALP-002.031	REQ-18-02b-TS-FSMG.0003	TRL6
		REQ-18-02b-TS-FSMG.0004	TRL6
		REQ-18-02b-TS-FSMG.0009	TRL6
		REQ-18-02b-TS-FSMG.0010	TRL6
		REQ-18-02b-TS-FSMG.0076	TRL6
		REQ-18-02b-TS-FSMG.0080	TRL6
	CRT-18.02b-TRL6-TVALP-002.034	REQ-18-02b-TS-COTR.0202	TRL6
		REQ-18-02b-TS-FSMG.0001	TRL6
		REQ-18-02b-TS-FSMG.0009	TRL6
		REQ-18-02b-TS-FSMG.0010	TRL6
		REQ-18-02b-TS-FSMG.0011	TRL6
		REQ-18-02b-TS-FSMG.0017	TRL6
		REQ-18-02b-TS-FSMG.0018	TRL6
		REQ-18-02b-TS-FSMG.0038	TRL6

Validation Objective	Success Criterion	ATMS Requirement(s)	Maturity
		REQ-18-02b-TS-FSMG.0051	TRL6
		REQ-18-02b-TS-FSMG.0061	TRL6
		REQ-18-02b-TS-FSMG.0064	TRL6
		REQ-18-02b-TS-FSMG.0072	TRL6
		REQ-18-02b-TS-FSMG.0076	TRL6
		REQ-18-02b-TS-FSMG.0080	TRL6
		REQ-18-02b-TS-FSMG.0106	TRL6
		REQ-18-02b-TS-FSMG.0107	TRL6
		REQ-18-02b-TS-FSMG.0135	TRL6
		REQ-18-02b-TS-FSMG.0151	TRL6
		REQ-18-02b-TS-FSMG.0152	TRL6
		REQ-18-02b-TS-FSMG.0153	TRL6
		REQ-18-02b-TS-FSMG.0161	TRL6
		REQ-18-02b-TS-MECH.0360	TRL6
	CRT-18.02b-TRL6-TVALP-002.035	REQ-18-02b-TS-COTR.0002	TRL6
		REQ-18-02b-TS-FSMG.0009	TRL6
		REQ-18-02b-TS-FSMG.0061	TRL6
		REQ-18-02b-TS-FSMG.0139	TRL6
		REQ-18-02b-TS-MECH.0321	TRL6
		REQ-18-02b-TS-MECH.0344	TRL6
		REQ-18-02b-TS-MECH.0360	TRL6
		REQ-18-02b-TS-MECH.0365	TRL6
		REQ-18-02b-TS-SEQM.1001	TRL6
	CRT-18.02b-TRL6-TVALP-002.040	REQ-18-02b-TS-COTR.0200	TRL6
		REQ-18-02b-TS-COTR.0201	TRL6
		REQ-18-02b-TS-FSMG.0061	TRL6

Validation Objective	Success Criterion	ATMS Requirement(s)	Maturity
		REQ-18-02b-TS-FSMG.0074	TRL6
		REQ-18-02b-TS-FSMG.0160	TRL6
		REQ-18-02b-TS-FSMG.0162	TRL6
		REQ-18-02b-TS-MECH.0002	TRL6
		REQ-18-02b-TS-MECH.0344	TRL6
		REQ-18-02b-TS-MECH.0347	TRL6
		REQ-18-02b-TS-MECH.0360	TRL6
		REQ-18-02b-TS-MECH.0398	TRL6
		REQ-18-02b-TS-SEQM.0100	TRL6
		REQ-18-02b-TS-SEQM.0101	TRL6
		REQ-18-02b-TS-SEQM.1001	TRL6
	CRT-18.02b-TRL6-TVALP-002.043	REQ-18-02b-TS-COTR.0202	TRL6
		REQ-18-02b-TS-FSMG.0001	TRL6
		REQ-18-02b-TS-FSMG.0003	TRL6
		REQ-18-02b-TS-FSMG.0009	TRL6
		REQ-18-02b-TS-FSMG.0010	TRL6
		REQ-18-02b-TS-FSMG.0011	TRL6
		REQ-18-02b-TS-FSMG.0017	TRL6
		REQ-18-02b-TS-FSMG.0018	TRL6
		REQ-18-02b-TS-FSMG.0038	TRL6
		REQ-18-02b-TS-FSMG.0061	TRL6
		REQ-18-02b-TS-FSMG.0072	TRL6
		REQ-18-02b-TS-FSMG.0076	TRL6
		REQ-18-02b-TS-FSMG.0080	TRL6
		REQ-18-02b-TS-FSMG.0106	TRL6
		REQ-18-02b-TS-FSMG.0107	TRL6

Validation Objective	Success Criterion	ATMS Requirement(s)	Maturity
		REQ-18-02b-TS-FSMG.0135	TRL6
		REQ-18-02b-TS-FSMG.0136	TRL6
		REQ-18-02b-TS-MECH.0360	TRL6
		REQ-18-02b-TS-FSMG.0006	TRL6
		REQ-18-02b-TS-FSMG.0030	TRL6
	CRT-18.02b-TRL6-TVALP-002.044	REQ-18-02b-TS-FSMG.0004	TRL6
		REQ-18-02b-TS-FSMG.0009	TRL6
		REQ-18-02b-TS-FSMG.0061	TRL6
		REQ-18-02b-TS-FSMG.0139	TRL6
		REQ-18-02b-TS-FSMG.0140	TRL6
		REQ-18-02b-TS-FSMG.0149	TRL6
		REQ-18-02b-TS-FSMG.0150	TRL6
		REQ-18-02b-TS-MECH.0401	TRL6
	CRT-18.02b-TRL6-TVALP-002.045	REQ-18-02b-TS-FSMG.0004	TRL6
		REQ-18-02b-TS-FSMG.0009	TRL6
		REQ-18-02b-TS-FSMG.0056	TRL6
		REQ-18-02b-TS-FSMG.0061	TRL6
		REQ-18-02b-TS-FSMG.0071	TRL6
		REQ-18-02b-TS-FSMG.0072	TRL6
		REQ-18-02b-TS-FSMG.0073	TRL6
		REQ-18-02b-TS-FSMG.0076	TRL6
		REQ-18-02b-TS-FSMG.0077	TRL6
		REQ-18-02b-TS-FSMG.0125	TRL6
		REQ-18-02b-TS-FSMG.0137	TRL6
		REQ-18-02b-TS-FSMG.0029	TRL6
		REQ-18-02b-TS-FSMG.0032	TRL6

Validation Objective	Success Criterion	ATMS Requirement(s)	Maturity
		REQ-18-02b-TS-FSMG.0088	TRL6
		REQ-18-02b-TS-FSMG.0149	TRL6
		REQ-18-02b-TS-FSMG.0150	TRL6
		REQ-18-02b-TS-MECH.0401	TRL6
OBJ-18.02b-TRL6-TVALP-003		REQ-18-02b-TS-COTR.0200	TRL6
		REQ-18-02b-TS-COTR.0201	TRL6
		REQ-18-02b-TS-COTR.0202	TRL6
		REQ-18-02b-TS-FSMG.0017	TRL6
		REQ-18-02b-TS-FSMG.0051	TRL6
		REQ-18-02b-TS-FSMG.0061	TRL6
		REQ-18-02b-TS-FSMG.0072	TRL6
		REQ-18-02b-TS-FSMG.0135	TRL6
		REQ-18-02b-TS-MECH.0001	TRL6
		REQ-18-02b-TS-MECH.0002	TRL6
		REQ-18-02b-TS-MECH.0201	TRL6
	CRT-18.02b-TRL6-TVALP-003.001	REQ-18-02b-TS-MECH.0202	TRL6
		REQ-18-02b-TS-MECH.0312	TRL6
		REQ-18-02b-TS-MECH.0330	TRL6
		REQ-18-02b-TS-MECH.0331	TRL6
		REQ-18-02b-TS-MECH.0336	TRL6
		REQ-18-02b-TS-MECH.0344	TRL6
		REQ-18-02b-TS-MECH.0347	TRL6
		REQ-18-02b-TS-MECH.0360	TRL6
		REQ-18-02b-TS-MECH.0398	TRL6
		REQ-18-02b-TS-MECH.0399	TRL6
		REQ-18-02b-TS-MECH.0410	TRL6

Validation Objective	Success Criterion	ATMS Requirement(s)	Maturity
		REQ-18-02b-TS-MECH.0411	TRL6
		REQ-18-02b-TS-SEQM.0100	TRL6
		REQ-18-02b-TS-SEQM.0101	TRL6
		REQ-18-02b-TS-SEQM.1001	TRL6
		REQ-18-02b-TS-FSMG.0133	TRL6
		REQ-18-02b-TS-FSMG.0138	TRL6
		REQ-18-02b-TS-MECH.0018	TRL6
		REQ-18-02b-TS-MECH.0332	TRL6
		REQ-18-02b-TS-MECH.0413	TRL6
		REQ-18-02b-TS-SEQM.1003	TRL6
		REQ-18-02b-TS-SEQM.1004	TRL6
		REQ-18-02b-TS-SEQM.1005	TRL6
	CRT-18.02b-TRL6-TVALP-003.004	REQ-18-02b-TS-MECH.0348	TRL6
		REQ-18-02b-TS-MECH.0397	TRL6
		REQ-18-02b-TS-MECH.0398	TRL6
	CRT-18.02b-TRL6-TVALP-003.006	REQ-18-02b-TS-INFO.0016	TRL6
		REQ-18-02b-TS-MECH.0339	TRL6
		REQ-18-02b-TS-MECH.0340	TRL6
		REQ-18-02b-TS-MECH.0341	TRL6
		REQ-18-02b-TS-MECH.0347	TRL6
		REQ-18-02b-TS-MECH.0350	TRL6
		REQ-18-02b-TS-MECH.0398	TRL6
OBJ-18.02b-TRL6-TVALP-004	CRT-18.02b-TRL6-TVALP-004.001	REQ-18-02b-TS-COTR.0047	TRL6
		REQ-18-02b-TS-COTR.0155	TRL6
		REQ-18-02b-TS-MECH.0307	TRL6
		REQ-18-02b-TS-MECH.0308	TRL6

Validation Objective	Success Criterion	ATMS Requirement(s)	Maturity
		REQ-18-02b-TS-MECH.0310	TRL6
		REQ-18-02b-TS-MECH.0344	TRL6
	CRT-18.02b-TRL6-TVALP-004.004	REQ-18-02b-TS-MECH.0322	TRL6
		REQ-18-02b-TS-MECH.0414	TRL6
		REQ-18-02b-TS-MECH.1001	TRL6
		REQ-18-02b-TS-MECH.1002	TRL6
		REQ-18-02b-TS-MECH.1003	TRL6
		REQ-18-02b-TS-MECH.1004	TRL6
		REQ-18-02b-TS-MECH.1005	TRL6
		REQ-18-02b-TS-MECH.1006	TRL6
		REQ-18-02b-TS-MECH.1007	TRL6
		REQ-18-02b-TS-MECH.1008	TRL6
		REQ-18-02b-TS-MECH.1015	TRL6
OBJ-18.02b-TRL6-TVALP-005	CRT-18.02b-TRL6-TVALP-005.001	REQ-18-02b-TS-COTR.0029	TRL6
		REQ-18-02b-TS-COTR.0047	TRL6
		REQ-18-02b-TS-FSMG.0154	TRL6
		REQ-18-02b-TS-SEQM.1016	TRL6
		REQ-18-02b-TS-SEQM.1018	TRL6
		REQ-18-02b-TS-SEQM.1022	TRL6
		REQ-18-02b-TS-SEQM.1062	TRL6
	CRT-18.02b-TRL6-TVALP-005.003	REQ-18-02b-TS-SEQM.1011	TRL6
		REQ-18-02b-TS-SEQM.1019	TRL6
		REQ-18-02b-TS-SEQM.1043	TRL6
	CRT-18.02b-TRL6-TVALP-005.004	REQ-18-02b-TS-COTR.0147	TRL6
		REQ-18-02b-TS-COTR.0203	TRL6
		REQ-18-02b-TS-COTR.0209	TRL6

Validation Objective	Success Criterion	ATMS Requirement(s)	Maturity
		REQ-18-02b-TS-FSMG.0154	TRL6
		REQ-18-02b-TS-SEQM.1015	TRL6
		REQ-18-02b-TS-SEQM.1016	TRL6
	CRT-18.02b-TRL6-TVALP-005.006	REQ-18-02b-TS-COTR.0047	TRL6
		REQ-18-02b-TS-COTR.0200	TRL6
		REQ-18-02b-TS-COTR.0201	TRL6
		REQ-18-02b-TS-FSMG.0154	TRL6
	CRT-18.02b-TRL6-TVALP-005.010	REQ-18-02b-TS-MECH.0304	TRL6
		REQ-18-02b-TS-SEQM.1024	TRL6
		REQ-18-02b-TS-SEQM.1025	TRL6
		REQ-18-02b-TS-SEQM.1027	TRL6
		REQ-18-02b-TS-SEQM.1029	TRL6
		REQ-18-02b-TS-SEQM.1030	TRL6
		REQ-18-02b-TS-SEQM.1033	TRL6
		REQ-18-02b-TS-SEQM.1036	TRL6
		REQ-18-02b-TS-SEQM.1037	TRL6
		REQ-18-02b-TS-SEQM.1041	TRL6
		REQ-18-02b-TS-SEQM.1042	TRL6
		REQ-18-02b-TS-SEQM.1044	TRL6
		REQ-18-02b-TS-SEQM.1051	TRL6
	CRT-18.02b-TRL6-TVALP-005.018	REQ-18-02b-TS-SEQM.1115	TRL6
		REQ-18-02b-TS-SEQM.1116	TRL6
		REQ-18-02b-TS-SEQM.1117	TRL6
		REQ-18-02b-TS-SEQM.1118	TRL6
		REQ-18-02b-TS-SEQM.1119	TRL6
		REQ-18-02b-TS-SEQM.1120	TRL6

Validation Objective	Success Criterion	ATMS Requirement(s)	Maturity
		REQ-18-02b-TS-SEQM.1121	TRL6
		REQ-18-02b-TS-SEQM.1122	TRL6
		REQ-18-02b-TS-SEQM.1123	TRL6
		REQ-18-02b-TS-SEQM.1124	TRL6
	CRT-18.02b-TRL6-TVALP-005.021	REQ-18-02b-TS-COTR.0001	TRL6
		REQ-18-02b-TS-COTR.0008	TRL6
		REQ-18-02b-TS-COTR.0028	TRL6
		REQ-18-02b-TS-COTR.0029	TRL6
		REQ-18-02b-TS-COTR.0037	TRL6
		REQ-18-02b-TS-FSMG.0155	TRL6
	CRT-18.02b-TRL6-TVALP-005.022	REQ-18-02b-TS-SEQM.1006	TRL6
		REQ-18-02b-TS-SEQM.1007	TRL6
		REQ-18-02b-TS-SEQM.1008	TRL6
		REQ-18-02b-TS-SEQM.1009	TRL6
		REQ-18-02b-TS-SEQM.1010	TRL6
		REQ-18-02b-TS-SEQM.1011	TRL6
		REQ-18-02b-TS-SEQM.1042	TRL6
		REQ-18-02b-TS-SEQM.1043	TRL6
		REQ-18-02b-TS-SEQM.1044	TRL6
		REQ-18-02b-TS-SEQM.1060	TRL6
		REQ-18-02b-TS-SEQM.1061	TRL6
		REQ-18-02b-TS-SEQM.1063	TRL6
		REQ-18-02b-TS-SEQM.1064	TRL6
		REQ-18-02b-TS-SEQM.1065	TRL6
		REQ-18-02b-TS-SEQM.1066	TRL6
		REQ-18-02b-TS-SEQM.1068	TRL6

Validation Objective	Success Criterion	ATMS Requirement(s)	Maturity
		REQ-18-02b-TS-SEQM.1034	TRL6
		REQ-18-02b-TS-SEQM.1047	TRL6
OBJ-18.02b-TRL6-TVALP-006	CRT-18.02b-TRL6-TVALP-006.002	REQ-18-02b-TS-MECH.0010	TRL6
		REQ-18-02b-TS-MECH.0012	TRL6
		REQ-18-02b-TS-MECH.0013	TRL6
		REQ-18-02b-TS-SWIM.0040	TRL6
		REQ-18-02b-TS-SWIM.0042	TRL6
		REQ-18-02b-TS-SWIM.0048	TRL6
		REQ-18-02b-TS-SWIM.0050	TRL6
		REQ-18-02b-TS-SWIM.0052	TRL6
		REQ-18-02b-TS-SWIM.0054	TRL6
OBJ-18.02b-TRL6-TVALP-008	CRT-18.02b-TRL6-TVALP-008.001	REQ-18-02b-TS-SSRC.0005	TRL6
		REQ-18-02b-TS-SSRC.0010	TRL6
		REQ-18-02b-TS-SSRC.0012	TRL6
		REQ-18-02b-TS-SSRC.0014	TRL6
		REQ-18-02b-TS-SSRC.0017	TRL6
		REQ-18-02b-TS-SWIM.0046	TRL6
	CRT-18.02b-TRL6-TVALP-008.005	REQ-18-02b-TS-SSRC.0006	TRL6
		REQ-18-02b-TS-SSRC.0009	TRL6
		REQ-18-02b-TS-SSRC.0010	TRL6
		REQ-18-02b-TS-SSRC.0013	TRL6
		REQ-18-02b-TS-SSRC.0014	TRL6
		REQ-18-02b-TS-SSRC.0015	TRL6
		REQ-18-02b-TS-SSRC.0016	TRL6
	CRT-18.02b-TRL6-TVALP-008.007	REQ-18-02b-TS-SSRC.0005	TRL6
		REQ-18-02b-TS-SSRC.0010	TRL6

Validation Objective	Success Criterion	ATMS Requirement(s)	Maturity
		REQ-18-02b-TS-SSRC.0011	TRL6
OBJ-18.02b-TRL6-TVALP-009	CRT-18.02b-TRL6-TVALP-009.005	REQ-18-02b-TS-MECH.0208	TRL6
		REQ-18-02b-TS-MECH.0209	TRL6
		REQ-18-02b-TS-MECH.0210	TRL6
	CRT-18.02b-TRL6-TVALP-009.006	REQ-18-02b-TS-MECH.0323	TRL6
		REQ-18-02b-TS-MECH.0324	TRL6
		REQ-18-02b-TS-MECH.0398	TRL6
		REQ-18-02b-TS-WIFO.0054	TRL6
		REQ-18-02b-TS-WIFO.0055	TRL6
		REQ-18-02b-TS-WIFO.0055	TRL6
		REQ-18-02b-TS-WIFO.0056	TRL6
OBJ-18.02b-TRL6-TVALP-010	CRT-18.02b-TRL6-TVALP-010.001	REQ-18-02b-TS-COTR.0200	TRL6
		REQ-18-02b-TS-COTR.0201	TRL6
		REQ-18-02b-TS-FSMG.0001	TRL6
		REQ-18-02b-TS-FSMG.0017	TRL6
		REQ-18-02b-TS-FSMG.0051	TRL6
		REQ-18-02b-TS-FSMG.0061	TRL6
		REQ-18-02b-TS-FSMG.0072	TRL6
		REQ-18-02b-TS-FSMG.0135	TRL6
		REQ-18-02b-TS-FSMG.0143	TRL6
		REQ-18-02b-TS-FSMG.0144	TRL6
		REQ-18-02b-TS-FSMG.0145	TRL6
		REQ-18-02b-TS-FSMG.0164	TRL6
		REQ-18-02b-TS-FSMG.0165	TRL6
		REQ-18-02b-TS-MECH.0001	TRL6
		REQ-18-02b-TS-MECH.0002	TRL6

Validation Objective	Success Criterion	ATMS Requirement(s)	Maturity
		REQ-18-02b-TS-MECH.0201	TRL6
		REQ-18-02b-TS-MECH.0202	TRL6
		REQ-18-02b-TS-MECH.0312	TRL6
		REQ-18-02b-TS-MECH.0330	TRL6
		REQ-18-02b-TS-MECH.0331	TRL6
		REQ-18-02b-TS-MECH.0344	TRL6
		REQ-18-02b-TS-MECH.0347	TRL6
		REQ-18-02b-TS-MECH.0360	TRL6
		REQ-18-02b-TS-MECH.0398	TRL6
		REQ-18-02b-TS-MECH.0399	TRL6
		REQ-18-02b-TS-MECH.0410	TRL6
		REQ-18-02b-TS-MECH.0411	TRL6
		REQ-18-02b-TS-SEQM.0100	TRL6
		REQ-18-02b-TS-SEQM.0101	TRL6
		REQ-18-02b-TS-SEQM.1001	TRL6
		REQ-18-02b-TS-COTR.0200	TRL6
		REQ-18-02b-TS-COTR.0201	TRL6
		REQ-18-02b-TS-FSMG.0017	TRL6
		REQ-18-02b-TS-FSMG.0051	TRL6
		REQ-18-02b-TS-FSMG.0061	TRL6
	CRT-18.02b-TRL6-TVALP-010.002	REQ-18-02b-TS-FSMG.0072	TRL6
		REQ-18-02b-TS-FSMG.0135	TRL6
		REQ-18-02b-TS-FSMG.0145	TRL6
		REQ-18-02b-TS-FSMG.0160	TRL6
		REQ-18-02b-TS-FSMG.0161	TRL6
		REQ-18-02b-TS-FSMG.0162	TRL6

Validation Objective	Success Criterion	ATMS Requirement(s)	Maturity
		REQ-18-02b-TS-FSMG.0163	TRL6
		REQ-18-02b-TS-MECH.0001	TRL6
		REQ-18-02b-TS-MECH.0002	TRL6
		REQ-18-02b-TS-MECH.0312	TRL6
		REQ-18-02b-TS-MECH.0331	TRL6
		REQ-18-02b-TS-MECH.0344	TRL6
		REQ-18-02b-TS-MECH.0347	TRL6
		REQ-18-02b-TS-MECH.0360	TRL6
		REQ-18-02b-TS-MECH.0398	TRL6
		REQ-18-02b-TS-MECH.0399	TRL6
		REQ-18-02b-TS-MECH.0410	TRL6
		REQ-18-02b-TS-SEQM.0100	TRL6
		REQ-18-02b-TS-SEQM.0101	TRL6
		REQ-18-02b-TS-SEQM.1001	TRL6
OBJ-18.02b-TRL6-TVALP-011	CRT-18.02b-TRL6-TVALP-011.001	REQ-18-02b-TS-ADMG.0004	TRL6
	CRT-18.02b-TRL6-TVALP-011.002	REQ-18-02b-TS-ADMG.0005	TRL6
		REQ-18-02b-TS-FSMG.0061	TRL6
		REQ-18-02b-TS-FSMG.0115	TRL6
		REQ-18-02b-TS-FSMG.0161	TRL6
		REQ-18-02b-TS-MECH.0413	TRL6
		REQ-18-02b-TS-SCTJ.0107	TRL6
	CRT-18.02b-TRL6-TVALP-011.003	REQ-18-02b-TS-ADMG.0003	TRL6
		REQ-18-02b-TS-FSMG.0061	TRL6
		REQ-18-02b-TS-FSMG.0139	TRL6
		REQ-18-02b-TS-FSMG.0161	TRL6
		REQ-18-02b-TS-SCTJ.0107	TRL6

Validation Objective	Success Criterion	ATMS Requirement(s)	Maturity
	CRT-18.02b-TRL6-TVALP-011.009	REQ-18-02b-TS-ADMG.0001	TRL6
		REQ-18-02b-TS-ADMG.0002	TRL6
		REQ-18-02b-TS-ADMG.0003	TRL6

Table 111: Technical requirements with TRL assigned to the success criteria/validation objectives

Appendix E   Adaptation Data and Traffic Scenarios

All details for a better understanding of the process applied to reach the target scenario and a common adaptation data set are shown in the following embedded document:

Adaptation and
Traffic