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SESAR Solution PJ.07-03: Validation Report (VALR) for V3

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Abstract

This document provides the initial V3 Validation Report for SESAR Solution PJ.07-03 "Mission Trajectory Driven Processes" and SESAR Activity PJ.18-01a "Mission Trajectories".

It describes the results of the validation of the technical and operational feasibility of planning Mission Trajectories using the improved Operational Air Traffic Flight Plan (iOAT FPL), which shall, in general, be fully compliant with the complete set of ATM Network rules and restrictions, without compromising military mission needs. Where this is not possible without compromising mission requirements, the use of existing Exemption Mechanisms has been validated.

SWIM compliant B2B services for flight filing and message exchange, which had been successfully validated for the exchange between WOC and NM, have been validated during this exercise for the distribution to ATC/FDPS and FMP systems.

This exercise explored in addition the technical feasibility to integrate the Mission Trajectory via iOAT FPLs in the regional (NM) and sub-regional/local (FMP) ATFCM systems; i.e. ETFMS and TCM.

The focus of the validation exercise was on the planning phase and performed in Shadow Mode.

The validation exercise EXE-07.03.02 was successfully conducted in Prague, Friedrichshafen and at the Experimental Centre in Brétigny from 20th to 22nd Mai 2019.

Selected Use Cases were executed using the Airbus Defence and Space WOC prototype "DMAS", the Network Manager Validation Platform (NMVP), a tool corresponding to the real NM operational platform enhanced by prototype functionalities and, for Air Traffic Control, a simulator of the FDPS&FDD and local FMP (TCM) system provided by ANS CR.

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1 Executive summary

This initial V3 validation exercise for SESAR Solution PJ.07-03 “Mission Trajectory Driven Processes” and SESAR Activity PJ.18-01a “Mission Trajectories“ starts the cycle of required exercises necessary to achieve the full V3 maturity level.

It is the last exercise in the context of SESAR Wave1 and has been performed in continuity of earlier V2 validation exercises in SESAR1 and SESAR 2020 Wave 1.

Further V3 validation exercises, necessary to achieve the full V3 maturity level, will be part of SESAR Wave 2 solution 40.

The exercise connected remotely WOC, NM and ATC/FMP systems via SWIM compliant B2B services.

It focussed on the planning phase.

Mission Trajectories in form of the iOAT FPL have been validated and managed centrally by NM a first time together with all other GAT and military flight plans (Shadow mode) using the same prototype system. The NM prototype system was identical to the system used in real operation and enhanced to cope with the specifics of the iOAT FPL.

Compared to the simplified V2 validation of the iOAT FPL by NM, during this initial V3 exercise, iOAT FPLs were subject to full ATM network rules (RAD compliance) checking as suggested by the evolved MT concept.

This exercise could demonstrate successfully, that from an operational and technical perspective it is feasible for the WOC to produce RAD compliant MTs, without impacting on the mission needs. The production of the RAD compliant iOAT FPLs did not require significant additional work load at WOC side.

The higher complexity of the iOAT FPL respecting the RAD restrictions, did neither result in a higher FPL rejection rate, than observed during V2 exercises without RAD checking, nor require a higher workload for manual correction by the NM IFPU operator.

The operational and technical feasibility to use the proposed exemption policy mechanism, i.e. RTECORRATC & STS/ATFMX, to cope for military missions which could not comply with RAD restrictions without compromising their mission needs, was successfully validated.

The ARES conceptual evolution allowing more precise identification of ARES Entry and Exit location and time, to support the increased quality of the trajectory prediction in the corresponding WOC, NM and ATC systems has been successfully V3 validated. This includes the evolutions of the VPA module reference as integral part of the evolved iOAT FPL syntax & concept.

This exercise successfully V3 validated technically and operationally the B2B services for iOAT FPL filing from WOC to NM as well as for the iOAT FPL distribution from NM to ATC.

B2B services were as well successfully validated to connect Regional ATFCM(NM) and local ATC FMP systems.

For the very first time, this exercise validated the technical feasibility to process the MT/iOAT FPLs in the subsequent ATFCM systems of NM and ATC/FMP; i.e. ETFMS and TCM/CHMI.

The SMT can be revised by the WOC, shared again with NM and redistributed to ATC.

Those SMT iterations are result of a CDM process involving the three domains, WOC, NM and ATC.

In order to reach full V3 level of maturity, the operational CDM and DCB processes need to be further elaborated first at operational concept level and later followed by supporting validation exercises. The same is valid for the detailed description and definition of the transition processes and/or conventional triggers from iMT to SMT and from SMT to RMT.

It is also recommended to have a wider military active participation assuring direct military expertise and data from their day-to-day experience in real operations to the concept work and validation activities. Future validations should aim to cover a significant geographical area in order to prepare for deployment and to allow for quantified performance assessment, e.g. in a very large scale demonstration (VLD) exercise.

In short we can conclude that this exercise on the Mission Trajectory and iOAT Flight Plan has been the successful start of the required validations for V3, by focussing on the planning phase and joint validation and management of military and civil FPLs by NM.

2 Introduction

2.1 Purpose of the document

This document provides the Validation Report for SESAR Solution PJ.07-03 for initial V3. It describes the results of the validation exercise defined in PJ.07-03 Validation Plan for V3 [38] and how it has been conducted, and provides a set of relevant conclusions and recommendations.

The results of the Safety and Human Performance assessments described in Part II and IV of the VALP are provided as Assessment Reports Part II and Part IV of the SPR-INTEROP/OSED.

2.2 Intended readership

Other SESAR 2020 Projects:

- SESAR Activity PJ.18-01a for common document preparation with PJ.07-03
- other solutions of the own project PJ.07: PJ.07-01 and PJ.07-02
- other solutions of enabling project PJ.18: PJ.18-02, PJ.18-04 and PJ.18-06
- Project PJ.08 for transversal Safety, Human Performance, Security Assessments and CBA
- Project PJ.09 for transversal Safety, Human Performance, Security Assessments and CBA
- Project PJ.19 for the harmonization and consistency between the S2020 solutions and transversal views
- Project PJ.22 for the harmonization and consistency of requirements over the various S2020 solutions

State Airspace User Representatives:

- CMAC
- MEPS

Airspace Users

- Civil / Military ANSP

Network Manager

- Additional Network Manager Experts, not directly being part of the project (coordinated by the NM representative PoC in PJ0703)

2.3 Background

This initial V3 validation exercise is in continuity of a series of V2 validation exercises already performed under the SESAR1 programme and one V2 exercise performed under SESAR 2020 which resulted in the passing of the V2 gate.

This initial V3 validation exercise for SESAR Solution PJ.07-03 “Mission Trajectory Driven Processes” starts the cycle of required exercises necessary to achieve the full V3 maturity level.

It is the last exercise in the context of SESAR Wave1.

Those V2 exercises focussed on the validation of the MT and iOAT FPL in the planning and execution phase in the domains of WOC, ASM and NM.

The current validation exercise documented in this report, focusses on the validation of the evolved MT concept, which suggests iOAT FPLs, in general, to be compliant with the full set of ATM Network rules and to make use of exemption mechanisms, where this would not be possible without impacting on military mission needs.

The current validation exercises includes firstly, the common processing and validation of iOAT FPLs together with real GAT FPLs from shadow mode traffic fed into the exercise from the real operational platforms.

It covers evolved and more detailed features of the ARES and VPA domain compared to V2.

At a first time, it introduces for exploratory purpose iOAT FPLs in the ATFCM systems; i.e. ETFMS and TCM/FMP, at regional and sub-regional/local level. This technical step is a prerequisite, if iOAT FPL/MT shall be taken into account for Traffic prediction and DCB processes; subject of further conceptual discussions.

More V3 validation exercises are required to achieve V3 maturity of the Mission Trajectory processes and will be continued in SESAR Wave 2 solution 40.

2.4 Structure of the document

The structure of this document is derived from the SJU SESAR 2020 Validation Report template:

- Section 1 provides an executive summary of this document;
- Section 2 is the introduction of the document providing high level information related to the purpose, the audience, the background of the solution, a glossary of terms and a list of acronyms and terminology;
- Section 3 describes the context of the validation and validation plan including a summary of the solution PJ.07-03, a summary of the related validation plan with purpose, objectives, assumptions and exercises and deviations in the exercises with respect to SJU Project Handbook (see [40]) and validation plan;
- Section 4 describes the V3 validation results of solution PJ.07-03 exercises including a detailed analysis per validation objective and the confidence into these results;
- Section 5 describes the conclusions on the maturity of the solution, on concept clarification, technical feasibility and on performance assessment and gives recommendations for the next phase, for updating the ATM Master Plan (see [41]) Level 2 and for regulation and standardisation initiatives;
- Section 6 gives the list of reference documents;

- Appendix A describes the validation results of validation exercise EXE-07.03-V3-VALP-001 including a summary of the validation exercise, a detailed analysis per validation objective, unexpected behaviours, the confidence into the results and conclusions and recommendations;
- Appendix B is empty as solution PJ.07-03 consists of only 1 initial V3 validation exercise;
- Appendix C usually contains the initial V3 Maturity Assessment of solution PJ.07-03.

  (It will be produced as a stand-alone document and integrated in this VALR when available.)

2.5 Glossary of terms

Table 1 provides the glossary of terms as they were defined in the context of SESAR 1.

Term	Definition	Source of the definition
Airspace allocation	A rolling process which takes account of Civil and Military Airspace Users' needs and is carried out through CDM in order to elaborate an optimum solution for ARES allocation and CDR availability	SESAR CONOPS Step 1
Airspace Data	Includes the items defined in Airspace Structure.	P07.05.04
Airspace Reservation (ARES)	A defined volume of airspace temporarily reserved for exclusive or specific use by categories of users.	P07.05.04
Airspace Structure	A specific volume of airspace designed to ensure the safe and optimal operation of aircraft. In the context of the FUA Concept, "Airspace Structures" include Controlled Airspace, ATS Route, CDRs, ATC Sectors, Danger Area (D), Restricted Area (R), Prohibited Area (P), Temporary Segregated Area (TSA), Temporary Reserved Area (TRA), and Cross-Border Area (CBA).	P07.05.04
Civil-military performance-based partnership	Relationship between civil and military ATM stakeholders characterised by mutual cooperation and responsibility, for the achievement of agreed performance objectives through the application of performance-based management.	EURO-CONTROL Civil Military ATM Performance Framework
Improved OAT Flight Plan	A flight plan based upon the ICAO 2012 FPL format, improved with Mission Trajectory data and harmonised military information items, managed centrally at European level and used by	SESAR CONOPS Step 1

Term	Definition	Source of the definition
	military organisations operating IFR in European airspace.	
Key Performance Area (KPA)	"Key Performance Areas are a way of categorising performance subjects related to high level ambitions and expectations." ICAO Global ATM Concept sets out these expectations in general terms for each of the 11 ICAO defined KPAs. For the purposes of this document, the 11 ICAO KPAs plus Human Performance (a proposed addition not yet formally adopted by ICAO) are considered as given.	ICAO Doc 9883
Key Performance Indicator (KPI)	Current/past performance, expected future performance (estimated as part of forecasting and performance modelling), as well as actual progress in achieving performance objectives is quantitatively expressed by means of indicators (sometimes called Key Performance Indicators, or KPIs). To be relevant, indicators need to correctly express the intention of the associated performance objective. Since indicators support objectives, they should not be defined without having a specific performance objective in mind. Indicators are not often directly measured. They are calculated from supporting metrics according to clearly defined formulas, e.g. cost-per-flight-indicator = Sum (cost)/Sum (flights). Performance measurement is therefore done through the collection of data for the supporting metrics.	ICAO Doc 9883
	Key Performance Indicator means specifically the performance indicators used for the purpose of performance target setting.	REGULATION (EU) 390/2013 of 3 May 2013
Mission	One or more aircraft orders to accomplish one particular task, performing a mission as (an) individual flight(s) and/or formation(s).	EURO-CONTROL Civil Military ATM Performance Framework
Network Planning data	Data as derived from the NM B2B web service. The data includes airspace data as derived from the 1) Central Airspace and Capacity Database: - Static data such as air traffic control (ATC) sector boundaries and air routes (for instance, the maximum capacity for each airport and air traffic control sector) - Dynamic data such as the default Air Traffic Control capacities (for instance, the	

Term	Definition	Source of the definition
	number of runways available, availability of air traffic controllers…) and air-route availability based on military airspace usage. 2) Centralised Airspace Data Function: - Airspace Use Plans (AUPs)/Updated Airspace Use Plans (UUPs), - Consolidated European Airspace Use Plan (EAUP) and European Updated Airspace Use Plans (EUUPs) To be published on the NOP Portal and in electronic Airspace Message Information (e-AMI) for those using the NM B2B service.	
Performance Indicator (PI)	Performance indicators' means the indicators used for the purpose of performance monitoring, benchmarking and reviewing.	REGULATION (EU) 390/2013 of 3 May 2013
Performance Objective	These define, in a qualitative but focused way, a desired trend from today's performance (e.g. improvement). A distinction is made between generic objectives and instantiated objectives. Generic objectives specifically focus on what has to be achieved, but do not make statements about the when, where, who or how much. For example 'improve safety' is not specific enough to be an objective, whereas 'reduce the total number of accidents' and even more specifically 'reduce the number of CFIT accidents' would qualify as performance objectives. Instantiated objectives add the when, where, who and how much to the generic objectives. Instantiated objectives can have indicator values and associated targets.	ICAO Doc 9883
Performance Target	Performance targets are closely associated with performance indicators: they represent the values of performance indicators that need to be reached or exceeded to consider a performance objective as being fully achieved.	ICAO Doc 9883
Training event	A military activity taking place within airspace which requires reservation or segregation from general air traffic. A mission may include one or more training events.	EURO-CONTROL Civil Military ATM Performance Framework
Validation Targets	Validation targets are the targets that focus the development of enhanced capabilities by the SJU Projects. They aim to get from the R&D the	Guidance on KPIs and Data Collection Version 1 (2014)

Term	Definition	Source of the definition
	required performance capability to contribute to the achievement of a Strategic Target and, thus, to the SES high level goals.	

267 **Table 1: Glossary of terms**

268 Other terms are defined in the SESAR ATM Lexicon (see [3]).

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270 2.6 Acronyms and Terminology

271 Table 2 provides the acronyms and terminology as it used in this VALR.

Term	Definition
ADCC	Air Defence Command and Control
ADD	Architecture Definition Document
ADR	Airspace Data Repository
AFTN	Aeronautical Fixed Telecommunication Network
AFUA	Advanced Flexible Use of Airspace
AIRAC	Aeronautical Information Regulation And Control
Airbus DS	Airbus Defence and Space
AM	Airspace Manager
AMC	Airspace Management Cell
AN	Availability Note
ANSP	Air Navigation Service Provider
AOC	Airline Operation Centre
AoI	Area of Interest
AoR	Area of Responsibility
APP	Approach
ARES	Airspace Reservation/Restriction
ASCII	American Standard Code for Information Interchange
ASM	Airspace Management

Term	Definition
ASTERIX	All-purpose Structure EUROCONTROL Radar Information eXchange [standard]
ATC	Air Traffic Control
ATFCM	Air Traffic Flow & Capacity Management
ATM	Air Traffic Management
ATM MP	Air Traffic Management Master Plan
ATS	Air Traffic Service
ATSU	Air Traffic Service Unit
AU	Airspace User
AUP	Airspace Use Plan
B2B	Business to Business
BT	Business Trajectory
CACD	Central Airspace and Capacity Database
CBA	Cost Benefit Analysis
CDM	Collaborative Decision Making
CDR	Conditional Route
CFIT	Controlled Flight into Terrain
DCB	Demand and Capacity Balancing
DOD	Detailed Operational Description
EAD	European AIS (Aeronautical Information Service) Database
EATMA	European ATM Architecture
EFPL	Extended Flight Plan
ER	En-Route
E-ATMS	European Air Traffic Management System
E-OCVM	European Operational Concept Validation Methodology
FOC	Flight Operation Centre
FPL	Flight Plan

Term	Definition
FUA	Flexible Use of Airspace
GAT	General Air Traffic
HC	High Complexity
HP	Human Performance
IBP	Industrial Based Platform
ICAO	International Civil Aviation Organisation
IFPS	Integrated Initial Flight Plan Processing System
IFR	Instrumental Flight Rule
iMT	Initial Mission Trajectory
INTEROP	Interoperability Requirements
iOAT FPL	Improved OAT Flight Plan
IP	Internet Protocol
iRMT	Initial Reference Mission Trajectory
IRS	Interface Requirements Specification
iSMT	Initial Shared Mission Trajectory
KPA	Key Performance Area
KPI	Key Performance Indicator
LARA	Local and Sub-Regional Airspace Management System, provided by EUROCONTROL CMAC.
LC	Low Complexity
MC	Medium Complexity
MEPS	Military Engagement Plan for SESAR
MIL	Military
MT	Mission Trajectory
NM	Network Manager
NMVP	Network Manager Validation Platform
NOP	Network Operations Plan

Term	Definition
OAT	Operational Air Traffic
OFA	Operational Focus Areas
OI	Operational Improvement
OSED	Operational Service and Environment Definition
PI	Performance Indicator
PIRM	Programme Information Reference Model
RBT, RMT	Reference Business / Mission Trajectory
R&D	Research & Development
SBT, SMT	Shared Business / Mission Trajectory
se-dmf	System Engineering Data Management Framework
SEG	Secure Exchange Gateway
SES	Single European Sky
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
SW	Software
SWIM	System Wide Information Model
TFM	Traffic Flow Management
TMA	Terminal Area
TRL	Technology Readiness Level
TS	Technical Specification
TTO	Target Time Over
TVALS	Transition Validation Strategy
T/O	Take-off
UC	Use Case

Term	Definition
UUP	Updated Use Plan
VALP	Validation Plan
VALR	Validation Report
VALS	Validation Strategy
VPA	Variable Profile Area
V&V	Verification and Validation
V&VI	Verification and Validation Infrastructure
WOC	Wing Operation Centre
XML	Extended Mark-up Language

272 **Table 2: Acronyms and terminology**

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3 Context of the Validation

3.1 SESAR Solution PJ.07-03: a summary

SESAR Solution PJ.07-03 "Mission Trajectory Driven Processes" refines the Mission Trajectory concept as part of the ATM CONOPS and focuses on the harmonisation of improved OAT flight plans. Initial mission trajectories are

- developed by the WOC system/functions in close coordination with AMC,
- filed to NM for validation for their compliance with the ATM network rules and
- distributed into the ATM network by NM to all pertaining actors as ATC and AD.
- and revised during execution by WOC, ATC and/or the flight crew if required, to achieve the mission objectives.Furthermore, where required mission trajectories are revised during mission execution by WOC, ATC and the flight crew via ATC.

This is achieved by updating the WOC processes for the management of the shared and reference mission trajectory (SMT/ RMT) through a full integration of the WOC within the ATM system. This responds to the need to accommodate individual military airspace user needs and priorities without compromising optimum ATM system outcome and the performances of all stakeholders.

The scope of PJ.07-03 has been developed in close cooperation with PJ.18-01a "Mission Trajectories", (initially a solution on its own, its activities now being integrated into PJ.07.03). The necessary prototypes (WOC, NM, and ATC) and the related documentation were provided by PJ.18-01a.

SESAR Solution ID	SESAR Solution Description	Master or Contributing (M or C)	Contribution to the SESAR Solution short description	OI Steps ref. (from EATMA)	Enablers ref. (from EATMA)
PJ.07-03 Mission Trajectory Driven Processes	Mission Trajectory Driven Processes refer, through a full integration of the WOC within the ATM system, to the updating of wing operations centre (WOC) processes for the management of the shared and reference mission trajectory (SMT/ RMT). These processes respond to the need to accommodate individual military airspace	M	Pan-European OAT Transit Service	AOM-0303	AAMS-10a AIMS-19b AOC-ATM-14 ER APP ATC 143 MIL-0502 MIL-STD-03 MIL-STD-04

SESAR Solution ID	SESAR Solution Description	Master or Contributing (M or C)	Contribution to the SESAR Solution short description	OI Steps ref. (from EATMA)	Enablers ref. (from EATMA)
	user needs and priorities without compromising optimum ATM system outcome and the performances of all stakeholders				NIMS-35
					PRO-014
					PRO-015
			Mission Trajectories in Step 1	AOM-0304-A	AIMS-19b
					AOC-ATM-14
					AOC-ATM-15
					ER APP ATC 143
					ER APP ATC 168
					MIL-0502
					NIMS-35

SESAR Solution ID	SESAR Solution Description	Master or Contributing (M or C)	Contribution to the SESAR Solution short description	OI Steps ref. (from EATMA)	Enablers ref. (from EATMA)
					SWIM-INFR-05a
					SWIM-NET-01a

Table 3: SESAR Solution(s) under Validation

All mentioned OI Steps and Enablers refer to the Dataset 20 draft (see EATMA V12.1 Draft) as described in the EATMA portal (see https://www.eatmportal.eu/working).

All Enablers mentioned in the Table 3 have already reached TRL4 or even TRL6 (see Appendix A of "Final SESAR1 Maturity Assessment Report" [48]).

This initial V3 validation exercise of Solution PJ.07-03 has been conducted in the same context as the previous V2 exercise, but remains limited to the planning phase.

Differences in the data and or scenarios between the two exercises are the result of the evolution of the iOAT FPL format and MT concept.

Therefore, the same enablers as for the previous V2 validation exercise have been included in Table 3 above.

3.2 Summary of the Validation Plan

3.2.1 Validation Plan Purpose

This exercise validated the procedures and processes associated with the management of initial Mission Trajectory using the evolved iOAT FPL format in the planning phase between WOC, NM and ATC.

The evolved iOAT FPL format is the result of the evolution of the MT concept between V2 and this initial V3 exercise. Compared to the V2 version of the iOAT FPL format, the evolution of the concept introduced the drop of the indication of OAT or GAT sections in item 15 of the flight plan. Furthermore it introduced the full compliance of MT to the ATM network rules (RAD) as the general case. Where mission requirements do not allow this, the MT concept proposes the use of two existing exemption mechanisms. The exemption mechanism to coordinate a route with ATC (RMK/RTECORRATC; item 18) before filing, allows to be exempted from RAD rules. The second exemption mechanism is exempting military flights from any ATFCM measure (STS/ATFCM).

The main objective of this validation exercise was to validate the technical feasibility and the operational usability and acceptability of the above described evolutions, as part of the evolved iOAT FPL as means to express and exchange military flight intents, from WOC, NM and ATC perspective.

The validation technique was a Shadow-mode simulation including the main operational processes and human tasks with main focus on the nodes WOC and NM. A Human Performance assessment was conducted for the NM operator.

Since focus was on the planning phase, the ATC node was included to mainly V3 validate the correct distribution via SWIM compliant B2B services of the validated iOAT FPLs by NM.

Furthermore, the ATC node was for the first time, part of the introduction of the iOAT FPLs in regional and local ATFCM system; i.e. at NM/ETFMS and at ATC/FMP, i.e. TCM, and to share related data between these systems by an dedicated SWIM compliant B2B service. The main motivation of this part of the exercise is to start to explore this domain and to support the potential identification of operational requirements for the ATFCM domain for OSEDs and validation exercises in case at concept level it is decided that military flights should be part of the ATFCM/DCB domain.

The geographical environment consisted of the FIRs Prague and Munich in Czech Republic and Germany. They apply to the sub-operating environments TMA – High complexity and En-Route – High complexity. The connection between ATC and WOC to NM applies to the sub-operating environment Network.

3.2.2 Summary of Validation Objectives and success criteria

As described in chapter 4.3 of Solution PJ.07-03 VALP Part I (see [38]).

3.2.3 Validation Assumptions

Error! Reference source not found. contains a list of assumption for the validation exercises. For the validation exercise EXE-07.03-V3-VALP-001 no assumptions had to be taken.

Identifier	Title	Type of Assumption	Description	Justification	Flight Phase	KPA Impacted	Source	Value(s)	Owner	Impact on Assessment

Table 4: Validation Assumptions overview

3.2.4 Validation Exercises List

Solution PJ.07-03 had planned a single exercise EXE-07.03-V3-VALP-001 for the initial V3 maturity validation of the OI Steps and Enablers mentioned in Table 3.

3.3 Deviations

3.3.1 Deviations with respect to the SJU Project Handbook

No deviations from the SJU Project Handbook.

3.3.2 Deviations with respect to the Validation Plan

The validation exercise was conducted according to the Validation Plan. No deviations were recorded.

4 SESAR Solution PJ.07-03 Validation Results

4.1 Summary of SESAR Solution PJ.07-03 Validation Results

Table 4 contains the results per validation objective and success criterion of validation exercise EXE-07.03-V3-VALP-001.

SESAR Solution Validation Objective ID	SESAR Solution Validation Objective Title	SESAR Solution Success Criterion ID	SESAR Solution Success Criterion	SESAR Solution Validation Results	SESAR Solution Validation Objective Status
OBJ-07.03-V3-VALP-OP1	Evolved iOAT FPL concept	CRT-07.03-V3-VALP-OP1-001	The sharing & using of iSMT through evolved iOAT FPL; i.e. filing, validation & distribution is technically feasible and operationally usable and acceptable for WOC, NM and ATC.	The technical feasibility has been successfully validated during the exercise. Military(CMC), NM and WOC experts confirmed the operational usability and acceptablity.	OK
		CRT-07.03-V3-VALP-OP1-002	The acceptance rate (ACK) of evolved iOAT FPLs, compliant to ATM network rules, is equal or better than the acceptance rate of the iOAT FPL being V2 validated in SES1/VP716; i.e. 64% and which did not have to comply with ATM network rules.	The acceptance rate of the RAD compliant evolved iOAT FPLs during the exercise was above 90%	OK

SESAR Solution Validation Objective ID	SESAR Solution Validation Objective Title	SESAR Solution Success Criterion ID	SESAR Solution Success Criterion	SESAR Solution Validation Results	SESAR Solution Validation Objective Status
		CRT-07.03-V3-VALP-OP1-003	The time & workload to prepare an evolved iOAT FPL is equal or less than for the iOAT FPL being V2 validated in SES1/VP716 etc. and SES2020/PJ0703-1.	The time and workload to prepare RAD compliant iOAT FPLs was higher than for the iOAT FPLs during V2 exercises. Nevertheless, according to the WOC operator, the additional time and workload remains acceptable and is expected to reduce over time in function of an increased familiarisation with the RAD. In the current WOC prototype the RAD compliance is not checked automatically. Military would appreciate such a cross check function in the WOC system to support the human operator.	OK
		CRT-07.03-V3-VALP-OP1-004	The time & workload to correct a REJ evolved iOAT FPL for IFPS operator	The required time and work load for the IFPU operator is reduced, due to the fact that the	OK

SESAR Solution Validation Objective ID	SESAR Solution Validation Objective Title	SESAR Solution Success Criterion ID	SESAR Solution Success Criterion	SESAR Solution Validation Results	SESAR Solution Validation Objective Status
			and WOC FPL preparatory is equal or less than for the iOAT FPL being V2 validated in SES1/VP716 etc. and SES2020/PJ0703-1.	iOAT FPLs comply to RAD and are using the civil aeronautical environment. (less military specifics to deal with)	
		CRT-07.03-V3-VALP-OP1-005	The Exemption policy concept using the existing "ATC route coordinated" remark for MT is operationally acceptable and usable for WOC, NM and ATC.	The technical feasibility has been successfully validated during the exercise. Military(CMC), NM, WOC and ATC experts confirmed the operational usability and acceptability . Furthermore, the use of "RMK/RTECORRATC" was observed in quite a number of real military flight plans in the shadow traffic.	OK
		CRT-07.03-V3-VALP-OP1-006	The Exemption policy concept using the existing Special Status indicator "STS" for MT is operationally acceptable and	The technical feasibility has been successfully validated during the exercise. Military(CMC), NM, WOC and ATC experts	OK

SESAR Solution Validation Objective ID	SESAR Solution Validation Objective Title	SESAR Solution Success Criterion ID	SESAR Solution Success Criterion	SESAR Solution Validation Results	SESAR Solution Validation Objective Status
			usable for WOC, NM and ATC.	confirmed the operational usability and acceptability. Furthermore, the use of "STS/ATFMX" was observed in quite a number of real military flight plans in the shadow traffic.	
OBJ-07.03-V3-VALP-OP2	Evolved ARES concept	CRT-07.03-V3-VALP-OP2-001	The ARES reference of up to 9 VPA modules is technically feasible and operationally usable and acceptable for integration in iOAT FPL and use by WOC, NM and ATC.	The technical feasibility has been successfully validated during the exercise. Military(CMC), NM and WOC experts confirmed the operational usability and acceptability. As the VPA area used during the exercise was in the North-East of Germany and not inside ATC FIR/UIR Prague airspace, the success criteria could not be validated for ATC.	PARTIALLY OK (WOC& NM)
		CRT-07.03-V3-VALP-OP2-002	The ARES reference to predefined VPA modules	Due to too late identification of this requirement it could not be	OPEN

SESAR Solution Validation Objective ID	SESAR Solution Validation Objective Title	SESAR Solution Success Criterion ID	SESAR Solution Success Criterion	SESAR Solution Validation Results	SESAR Solution Validation Objective Status
			configurations is technically feasible and operationally usable and acceptable for integration in iOAT FPL and use by WOC, NM and ATC.	included in the exercise prototypes.	
		CRT-07.03-V3-VALP-OP2-003	The ARES concept refinement to use predefined Entry/Exit points is technically feasible and operationally usable and acceptable for WOC, NM and ATC.	The technical feasibility has been successfully validated during the exercise. Military(CMC), NM, WOC and ATC experts confirmed the operational usability.	OK
		CRT-07.03-V3-VALP-OP2-004	The ARES concept refinement to use lat./long. geo-coordinate defined Entry/Exit points is technically feasible and operationally usable and acceptable for WOC, NM and ATC.	The technical feasibility has been successfully validated during the exercise. Military(CMC), NM, WOC and ATC experts confirmed the operational feasibility.	OK
		CRT-07.03-V3-VALP-OP2-005	The proposed CDM process through iSMT and Target Time (TTO) negotiation for	The iSMT related CDM process is mainly between WOC & NM.	OK

SESAR Solution Validation Objective ID	SESAR Solution Validation Objective Title	SESAR Solution Success Criterion ID	SESAR Solution Success Criterion	SESAR Solution Validation Results	SESAR Solution Validation Objective Status
			ARES entry time is operationally usable and acceptable for WOC, NM and ATC.	Military(CMC), NM, and WOC confirmed the operational usability and acceptability.. ATS confirms as well the potential usability of the same CDM process for iRMT, presumed the take-off time is adapted to meet TTO result of CDM between all partners. Today available ATS tools in Czech Republic could support this process.	
OBJ-07.03-V3-VALP-OP3	Evolved iOAT FPLs in ETFMS processing	CRT-07.03-V3-VALP-OP3-001	The complete military trajectories for every received iOAT FPL are processed properly by NM's ETFMS.	All filed and valid iOAT FPLs have been properly included & processed by the ETFMS.	OK
OBJ-07.03-V3-VALP-OP4	Evolved iOAT FPLs in sub-regional/local FMP system (TCM) processing	CRT-07.03-V3VALP-OP4-001	The complete military trajectories for every received iOAT FPL in the AOI of ATC is included processed properly by the	All filed and valid iOAT FPLs in the Prague FIR/UIR have been properly included and processed by the local	OK

SESAR Solution Validation Objective ID	SESAR Solution Validation Objective Title	SESAR Solution Success Criterion ID	SESAR Solution Success Criterion	SESAR Solution Validation Results	SESAR Solution Validation Objective Status
			ATC FMP system (TCM).	ATC/FMP tool; i.e. TCM.	
OBJ-07.03-V3-VALP-OP5	Validate the applicability of the NM/Network rules and regulation for iMT	CRT-07.03-V3-VALP-OP5-001	MTs respects ATM route network rules, i.e. RAD, FRA DCT, DCT limits, SID/STAR restrictions, etc.	The respect or non-respect of the different RAD annexes has been successfully validated by a number of specifically prepared iOAT FPLs for each RAD annex.	OK
		CRT-07.03-V3-VALP-OP5-002	Mission objectives are not compromised.	The available exemption policy assures that mission objectives are not compromised. They would be used were ATM Network rules compliance would be in conflict with the mission objectives.	OK
OBJ-07.03-V3-VALP-OP6	iSMT data exchange by means of SWIM(B2B)	CRT-07.03-V3-VALP-OP6-001	Evolved iOAT FPLs are send from WOC to NM/IFPS via B2B.	The SWIM compliant B2B service for iOAT FPL filing has been validated successfully.	OK
		CRT-07.03-V3-VALP-OP6-002	Validation messages for evolved iOAT FPLs flight plan are send from NM to WOC via B2B.	The SWIM compliant B2B service supported successfully the NM iOAT FPL validation	OK

SESAR Solution Validation Objective ID	SESAR Solution Validation Objective Title	SESAR Solution Success Criterion ID	SESAR Solution Success Criterion	SESAR Solution Validation Results	SESAR Solution Validation Objective Status
				messages for the WOC.	
		CRT-07.03-V3-VALP-OP6-003	Evolved iOAT FPLs are distributed from NM to ATC via B2B.	The SWIM compliant B2B service for iOAT FPL distribution from NM to ATC has been validated successfully. All iOAT FPLs for the FIR/UIR Prague were received by ATC. No FPLS not relevant for FIR/UIR Prague were received via this B2B service.	OK
		CRT-07.03-V3-VALP-OP6-004	Information including MT in NM systems can be accessed by ATC systems via B2B service subscription.	The technical feasibility was successfully validated.	OK
OBJ-07.03-V3-VALP-OP7	CDM process for iSMT	CRT-07.03-V3-VALP-OP7-001	The outcome of the CDM process for iSMT has no negative impact on the achievement of mission objectives.	The available exemption policy assures that mission objectives are not compromised. They would be used were ATM Network rules compliance would be in conflict with the mission objectives.	OK

SESAR Solution Validation Objective ID	SESAR Solution Validation Objective Title	SESAR Solution Success Criterion ID	SESAR Solution Success Criterion	SESAR Solution Validation Results	SESAR Solution Validation Objective Status
		CRT-07.03-V3-VALP-OP7-002	The outcome of the CDM process for iSMT has no negative impact on ATM network performance		OK
OBJ-07.03-V3-VALP-OP8	Mission Trajectory Driven Process leads to Performance Benefit	CRT-07.03-V3-VALP-OP8-001	Solution 07.03 increases CAP (Validation Target: 0,505%)		NOK
		CRT-07.03-V3-VALP-OP8-001	Solution 07.03 increases PRD (Validation Target: 0,155%)		NOK

Table 5: Summary of Validation Exercises Results

4.2 Detailed analysis of SESAR Solution Validation Results per Validation objective

4.2.1 OBJ-07.03-V3-VALP-OP1 Results

This validation objective with the title “Evolved iOAT FPL concept” assessed the operational feasibility of the evolved iOAT FPL for mission planning.

For the detailed results refer to Appendix A.3.2 Item 1.

4.2.2 OBJ-07.03-V3-VALP-OP2 Results

This validation objective with the title “Evolved ARES concept” assessed the operational feasibility of the evolved ARES concept to be used for mission planning.

For the detailed results refer to Appendix A.3.2 item 2.

4.2.3 OBJ-07.03-V3-VALP-OP3 Results

This validation objective with the title “Evolved iOAT FPLs in ETFMS processing” assessed the **technical feasibility** to integrate evolved iOAT FPLs in the Traffic Flow management system (ETFMS) processing at regional ATFCM level. (to potentially feed later-on DCB processes for optimising the ATM Network performance)

For the detailed results refer to Appendix A.3.2 item 3.

4.2.4 OBJ-07.03-V3-VALP-OP4 Results

This validation objective with the title "Evolved iOAT FPLs in sub-regional/local TFM system processing " assessed the **technical feasibility** to integrate evolved iOAT FPLs in the Traffic Flow management system processing at sub-regional/local ATFCM level. (to potentially feed later-on sub-regional/local DCB processes for optimising the ATM Network performance)

For the detailed results refer to Appendix A.3.2 item 4.

4.2.5 OBJ-07.03-V3-VALP-OP5 Results

This validation objective with the title "Validate the applicability of the NM/Network rules and regulations for iMT" assessed the technical and operational feasibility to plan Military flight operations in accordance with rules and procedures set by NM for flights integrated in the ATM network operations.

For the detailed results refer to Appendix A.3.2 item 5.

4.2.6 OBJ-07.03-V3-VALP-OP6 Results

This validation objective with the title "iSMT data exchange by means of SWIM(B2B)" assessed the technical and operational feasibility iSMT data to be exchanged between ATM actors (WOC, NM, ATC, FMP) through SWIM (B2B).

For the detailed results refer to Appendix A.3.2 item 6.

4.2.7 OBJ-07.03-V3-VALP-OP7 Results

This validation objective with the title "CDM process for iSMT assessed the technical and operational feasibility and the usability of CDM process for iSMT management.

For the detailed results refer to Appendix A.3.2 item 7.

4.2.8 OBJ-07.03-V3-VALP-OP8 Results

This validation objective with the title "Mission Trajectory Driven Process leads to Performance Benefit "assessed the performance effects of the introduction of the MT Driven Process.

For the detailed results refer to Appendix A.3.2 item 8.

4.3 Confidence in Validation Results

4.3.1 Limitations of Validation Results

The validation exercise covered the entire ECAC area for the shadow traffic and a number of the iOAT FPLs prepared for it. Aspects related to ATC were limited to the geography of the FIR/UIR Prague. The ATC centre was simulated with a reduced functional and technical scope (FPL reception and inclusion in ATC and local ATFCM/FMP system) due to the fact that the exercise did not cover the execution phase.

Original military FPLs from SES1 VP716 provided by two military organisations were tried to be used. Unfortunately a number of them referred to aeronautical environmental points too different to the aeronautical environment of the AIRAC cycle during the exercise. To adapt them to this AIRAC cycle would have required too significant modifications, not assuring any more that the so modified FPLs would have been able to satisfy the initially underlying mission needs.

Further, more recent, original military FPLs were provided by two additional military organisations.

Those could be adapted by minor modifications to comply to the AIRAC cycle of the exercise, without impacting too much in the initially planned trajectory.

Overall, the number of iOAT FPLs plans & profiles per UC were limited in the exercise.

Military AUs were not available for direct involvement in the preparation and execution of the exercise, but were included in external deliverable reviews.

4.3.1.1 Quality of Validation Results

The validation scenarios covered a broad and representative spectrum of operationally relevant use cases and processes. All scenario steps and thus all addressed operational processes could be executed successfully. The confidence in the data quality and the system accuracy is high, since the systems used in the exercise are based on the operational systems in use and just extended for some specifics related to MT concept.

4.3.1.2 Significance of Validation Results

The validation scenarios covered a broad and representative spectrum of operationally relevant use cases and processes. All scenario steps and thus all addressed operational processes could be executed successfully.

The number of iOAT FPLs available in the exercise is not sufficient to make quantified statements on Performance Benefit of sufficient statistical significance. The impact or benefit of the concept changes (solution scenarios) is so small, that it is hardly measureable. This would probably require data of several weeks of civil and military traffic to be analysed in detail requiring very high effort going beyond the resource possibilities of this initial V3 exercise by PJ.07.03.

IFPU operators, WOC and ANS experts, participating to the exercise commented positively on the operational significance of the simulation exercise.

The ATC platform, Network Manager validation platform(NMVP) and WOC Domain System prototypes used in this validation were based on systems which are in operational use today and enhanced with specific features in support of this validation exercise.

The operational significance of the validation exercise results regarding the usage of the evolved iOAT FPL for MT in planning by WOC, NM and ATC, through the use of B2B web services is considered as being high.

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5 Conclusions and recommendations

5.1 Conclusions

5.1.1 Conclusions on SESAR Solution maturity

This validation exercise was the first initial V3 exercise of a series of required exercises to achieve full V3 maturity for the SESAR solution PJ0703 Mission Trajectory.

During the exercise some first requirements linked to the solutions OI steps were V3 validated.

Following the MT concept evolution since V2 maturity gate, further requirements, either new or evolved, were addressed. Those were V2 validated (technical feasibility and operation usability and acceptability).

Further V3 validation exercises on the MT concept are required to achieve full V3 maturity for all its OI Steps, by providing quantified performance indications.

V3 validation efforts for the Mission Trajectory concept will be continued within SESAR2020 Wave 2 solution 40.

5.1.2 Conclusions on concept clarification

The applicability scope of the MT concept & iOAT FPL shall be clarified; i.e. shall all military flights within ECAC area use it, including local OAT flights not leaving its State's/ANSP's area of responsibility. Which would mean they would have to send their FPL to NM for distribution just back to its ANSP. Or should the MT concept & iOAT FPL only be applied to those military flights flying cross boarder through several countries and ANSP's AORs. This will lead to significant differences in the expected number of military flights to be dealt with at the Network Manager level.

The concept shall clarify if and to which extend the MT/iOAT FPLs should be included into the ATFCM domain and operational processes; i.e. Traffic Prediction and DCB, at regional (NM) and local (FMP) level.

The concept should clarify the precise description for the transition iMT->(i)SMT & (i)SMT➔(i)RMT. It should be clarified if the transition is defined by either conventional agreements (time trigger; i.e. x time before planned take off; event triggered: when FPL is filed to NM/when FPL is distributed to ATC) etc. or by the decision of an actor (WOC declares/decides).

The actual status should be clearly indicated within the flight data and made available to all concerned to allow them to process and act on it properly. . The concept should clarify where in the flight data or FPL this status indicator should be put; i.e. item 18 of the iOAT FPL.

The concept could clarify the idea of the ARES reference to predefined VPA modules configurations and clarify their integration in the aeronautical environmental database; i.e. EAD, CACD.

Revision of the MT in execution has been underlined to be an important aspect for the WOC, were NM for the reason of network stability and performance and predictability of the traffic situation strongly depends on AUs and ATS not deviating from the filed flight plan ("fly as you file").

For the revision in execution the concept proposes a direct link between WOC and ATC. The concept needs to clarify in detail the operational procedures and technical means for communication and data exchange.

The concept shall clarify the procedure and technical means of FPL & Trajectory data/information update in case of trajectory revision during execution.

For ATC it is important that in future validation exercises, which will include the execution phase, the potential update of the shared trajectory by the actual time of departure and sharing between ATCs by the means of OLDI shall be included. This shall include the update of actual taxi and take-off time and the required coordination between military and civil ATC (mCTR/CTMA/CTA); i.e. the military Tower ATCO will give clearance after coordination with the neighbouring En-Route ATC. The description of this coordination process shall be clarified and be added in the future SESAR2020 Wave 2 Solution40 OSED and EATMA.

This update of the time information of the MT and the ATC coordination process is important, because differences of the estimated/calculated taxi time between WOC and ATC systems were identified already during earlier V2 validations. This needs to be further investigated/developed by the concept.

ATCOs controlling the flights in execution are not expected to be too much impacted. According to the projects ATC operational experts, the ATCO is not too much concerned by a potential timely shift (or not) associated to a waypoint of the FPLs, as (s)he will just control the flight from the moment it appears in the sector.

Nevertheless, the FMP might be concerned, by a flight exempted from ATFCM measures. This should be investigated in future validation exercises. The inclusion of the MT into the FMP domain (as indicated above) and the potential impact of trajectory revisions shall be clarified by the concept and investigated/validated by future validation exercise(s).

Potential performance effects on the SESAR KPAs could not be measured due to the nature of the exercise, which focussed on the planning phase, whereas performance benefits can only be measured during execution phase. Furthermore, performance measurements would require a much higher number of iOAT FPLs to have sufficient data for solid statistical result. This is even more valid as the target KPA performance benefits are extremely low and risk to be covered by potential measurement error impact.

Beside very minor SESAR KPA benefits, which are targeted, it is expected that the solution will provide a number of beneficial effects to the military AU (not part of the SESAR Performance Measurement framework; please see section 5.1.4 below).

5.1.3 Conclusions on technical feasibility

The technical feasibility to connect the WOC, NM and ATC systems by SWIM compliant B2B services has been V3 validated

The technical feasibility to process the iOAT FPL by WOC, NM and ATC systems has been validated, assuming the common use of one environmental aeronautical data base (CACD from NM) for military and civil AUs.

RAD compliant Mission trajectories using the iOAT FPL format can be produced by the WOC and be validated by the relevant NM system; i.e. IFPS, distributed to and integrated in the ATC systems.

The use of the proposed exemption mechanism by MT/iOAT FPL; i.e. RMK/RTECORRATC & STS/ATFMX is technically feasible.

The integration of the evolved ARES concept with dedicated Entry-/Exit points and the reference to VPA modules list is technically feasible.

It is technically feasible to integrate the iOAT FPL related information into ATFCM systems at regional as well as at sub-regional/local level. The exchange data of between those systems over B2B services is technically feasible.

5.1.4 Conclusions on performance assessments

The inclusion of the MT/iOAT FPLs in the Traffic Demand Prediction and in the ATFCM domain is expected to have effects on KPA capacity. Since this aspect was covered only up to the introduction of the iOAT FPLs into the relevant technical systems, i.e. NM/ETFMS, ATC-FMP/CHMI&TCM, operational benefits of those could not be observed.

As for civil GAT flights, beneficial effects can only be expected if military flights would adhere as well largely to the filed flight plan to assure a high level of traffic demand prediction quality.

The use of the proposed exemption mechanism for MT/iOAT FPL; i.e. RMK/RTECORRATC & STS/ATFMX has been validated to be technically feasible.

As exemptions need to be coordinated before flight plan submission between WOC and ATS, workload to elaborate such exemption request by ANS and operational applicability on a daily base depend on the number of military flights, which would request these exemption mechanisms. If the number remains low, the impact might be neglectable; if these mechanisms are requested more often the impact at ANS might be significant.

Potential performance effects on the SESAR KPAs could not be measured due to the nature of the exercise, which focussed on the planning phase, where performance benefits can only be measured during execution phase. Furthermore, reliable performance measurements would require a much higher number of iOAT FPLs to have sufficient data for solid statistical result. This is even more valid as the target KPA performance benefits are extremely low and risk to become unreliable because of potential measurement error impact.

Beside very minor civil SESAR KPA benefits which are already targeted, it is expected that the solution will provide a number of beneficial effects to the military AU(not part of the SESAR Performance measurement framework).

The key benefits the project brings to military AU are

- Harmonised format of iOAT FPL for military IFR flights in controlled airspace across ECAC states

- Harmonised reference for cross-border flights in controlled airspace
- Insurance in harmonised ATS provision to military IFR flights in controlled airspace
- Ability to address military specific requirements for IFR flights operating in controlled airspace (AAR, Formation flights, usage of ARES of different types, RPA etc.)
- Ability to participate in collaborative planning and sharing of the Airspace resource
- Increased flexibility to get access to the airspace at short notice
- Flexibility to refine the Military AU demand and change in real time
- Mutual awareness on each other's demand Military/Military Civil/Military
- Automated processing of iOAT FPL across military infrastructure
- Increased predictability in cross-border operations
- Officially applied and agreed exemption policy
- Facilitate implementation and execution of single or combined RPAS operations
- Cost reduction opportunities through the use of network level solutions for the submission and exchange of flight plan data:
    - Simplification of national military infrastructures supporting ATM
    - Avoiding adaptation of legacy systems.

5.2 Recommendations

5.2.1 Recommendations for next phase

Recommendations have been expressed in the conclusion section 5.1 above to link them and to make the rationale more clear.

For more details please refer to above sections 5.1.1, 5.1.2, 5.1.3 and 5.1.4

5.2.2 Recommendations for updating ATM Master Plan Level 2

EATMA OI and EN information relevant to PJ.07-03 (and PJ.18-01a) should be updated according to the earlier change request transmitted already in 2018, to assure EATMA links OIs and EN only if considered relevant by PJ07.03 domain experts.

Change Requests for dataset 20 draft should be made to actualise the situation in terms of OIs, the linked ENs and their maturity, update of target maturity dates at the beginning of Wave 2.

5.2.3 Recommendations on regulation and standardisation initiatives

The recommendations from previous SESAR 1 validation exercises VP-789 and VP-790 still apply. They are described in chapter 4.1.3 of the related VP-789 VALR (see [43]) and in chapter 4.1.3 of the related VP-790 VALR (see [44]).

These recommendations refer to composed airspaces, ARES entry and exit times, the Aeronautical Data Repository and the direct support of the CDM process of the WOC Mission Support System as described in the current and in the above mentioned VALR.

592 The EUROAT standard has been proven being a valuable standard supporting harmonisation of military
593 operations and research activities in the civil military aviation environment.

6 References

6.1 Applicable Documents

Content Integration

[1] PJ.19-05, EATMA Guidance Material Version 10.0, D5.3, Edition 01.00.00, 09 November 2017

[2] EATMA Community pages

[3] SESAR ATM Lexicon

Content Development

[4] PJ.19-02, SESAR 2020 Concept of Operations Edition 2017, D19.2.1, Edition 01.00.00, 28 November 2017

System and Service Development

[5] 08.01.01 D52: SWIM Foundation v2

[6] 08.01.01 D49: SWIM Compliance Criteria

[7] 08.01.03 D47: AIRM v4.1.0

[8] 08.03.10 D45: ISRM Foundation v00.08.00

[9] B.04.03 D102 SESAR Working Method on Services

[10]B.04.03 D128 ADD SESAR1

[11]B.04.05 Common Service Foundation Method

Performance Management

[12]PJ19: Performance Framework (2017), D4.1, Edition 00.01.00, 04 July 2017

[13]PJ19: Validation Targets (2018), D4.5, Edition 01.00.00, 26 February 2018

[14]B.05 D86 Guidance on KPIs and Data Collection support to SESAR 2020 transition.

[15]16.06.06-D68 Part 1 –SESAR Cost Benefit Analysis – Integrated Model

[16]16.06.06-D51-SESAR_1 Business Case Consolidated_Deliverable-00.01.00 and CBA

[17]Method to assess cost of European ATM improvements and technologies, EUROCONTROL (2014)

[18]ATM Cost Breakdown Structure_ed02_2014

[19]Standard Inputs for EUROCONTROL Cost Benefit Analyses

[20]16.06.06_D26-08 ATM CBA Quality Checklist

[21]16.06.06_D26_04_Guidelines_for_Producing_Benefit_and_Impact_Mechanisms

Validation

[22]03.00 D16 WP3 Engineering methodology

[23]Transition VALS SESAR 2020 - Consolidated deliverable with contribution from Operational Federating Projects

[24]European Operational Concept Validation Methodology (E-OCVM) - 3.0 [February 2010]

System Engineering

[25]SESAR Requirements and V&V guidelines

Safety

[26]SESAR, Safety Reference Material, Edition 4.0, April 2016

[27]SESAR, Guidance to Apply the Safety Reference Material, Edition 3.0, April 2016

[28]SESAR, Final Guidance Material to Execute Proof of Concept, Ed00.04.00, August 2015

[29]SESAR, Resilience Engineering Guidance, May 2016

Human Performance

[30]16.06.05 D 27 HP Reference Material D27

[31]16.04.02 D04 e-HP Repository - Release note

Environment Assessment

[32]SESAR, Environment Reference Material, alias, “Environmental impact assessment as part of the global SESAR validation”, Project 16.06.03, Deliverable D26, 2014.

[33]ICAO CAEP – “Guidance on Environmental Assessment of Proposed Air Traffic Management Operational Changes” document, Doc 10031.

Security

[34]16.06.02 D103 SESAR Security Ref Material Level

[35]16.06.02 D137 Minimum Set of Security Controls (MSSCs).

[36]16.06.02 D131 Security Database Application (CTRL_S)

6.2 Reference Documents

[37]ED-78A GUIDELINES FOR APPROVAL OF THE PROVISION AND USE OF AIR TRAFFIC SERVICES SUPPORTED BY DATA COMMUNICATIONS.

[38]PJ.07-03 Validation Plan for V3, D4.2.050, Edition 00.01.00, 31 July 2019

[39]PJ.07-03 SPR-INTEROP/OSED for initial V3, D4.2.010, Edition 00.01.00, 31 August 2019

[40]Project Handbook, Edition 01.00.01 FINAL, 27 April 2017

[41]European ATM Master Plan, Edition 2015, https://www.atmmasterplan.eu/

[42]VALS (2018), PJ.19 D2.4, Edition 00.01.00, 30 October 2018

[43] SESAR 1 P11.01.05, D26, Update Validation report for stand-alone WOC validation for Step 1 (BMT, AFUA, iOAT FPL), Edition 00.01.00, 08/04/2016

[44] SESAR 1 P11.01.05, D27, Update Validation report for stand-alone WOC validation for Step1 (BMT, AFUA, iOAT FPL), Edition 02.00.00, 24/10/2016

[45] SecRAM 2.0, Security Risk Assessment methodology for SESAR 2020, Edition 02.00.00, 25/09/2017

[46] Technical Specification (TS/IRS) for V3/TRL6, (PJ18.01)D2.1.110, Edition 00.01.00, 30/08/2019

[47] EUROCONTROL guidelines for a harmonised and improved OAT Flight Plan Volume 1 and 2

[48] Final SESAR1 Maturity Assessment Report Executive Summary, Edition 01.00.00, 19 December 2016

Appendix A Validation Exercise #01 Report

A.1 Summary of the Validation Exercise #01 Plan

As described in chapter 5.1 of Solution PJ.07-03 VALP Part I (see [38]).

A.1.1 Validation Exercise description, scope

Following figure provides the general scope of the initial V3 validation exercise EXE-07.03.02-V3-VALP-001.

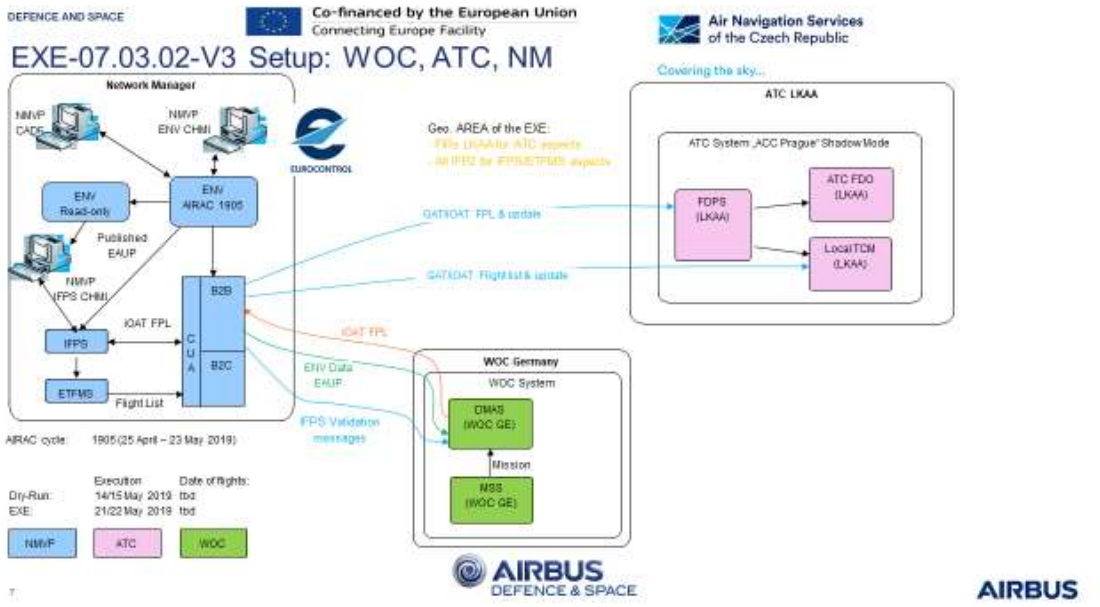

Figure 1 : EXE-07.03.02-V3 Setup

The first initial V3 validation exercise EXE-07.03-V3-VALP-001 focussed on the planning phase and the V3 validation of the usability of iOAT FPL and the initial Mission Trajectories for planning of military Airspace User's Missions and the possibility to validate and manage it centrally together with ICAO2012 flight plans for civil GAT flights by the Network Manager.

During V2, exclusively iOAT FPL samples had been used. In this initial V3 validation exercise, iOAT FPL were validated commonly together with ICAO2012 GATl FPLs by the same NM IFPS prototype and in addition at a first time have been subject to validating their full compliance to ATM route network rules(RAD).

Furthermore, this initial validation exercise validated for the planning phase, the exemption policy proposed by the concept, for those military flights, which cannot satisfy their operational and mission requirements, if subject to the general ATM network rules (RAD).

A further evolution compared to V2 validation exercises, concerned the more precise information for ARES entry and exit expected to contribute to a more precise prediction of the trajectory. The ARES

concept was further refined for VPAs allowing now to indicate lists of individual VPA modules in the iOAT FPL.

The exercise validated the technical and operational feasibility for the WOC to produce and file evolved iOAT FPLs in respect of the RAD checking or using exemption mechanisms, without impacting on workload or mission needs.

Its scope further covered the validation of the technical feasibility to process those evolved iOAT FPLs in ANS systems; limited to the inclusion in the FDPS and FMP system. ATC monitoring of the flight during execution was out of the scope of this initial V3 exercise.

The exercise has V3 validated the SWIM compliant B2B Flight plan distribution and message exchange.

Limited to the technical and system processing level, the exercise successfully demonstrated the feasibility to integrate the iMT & iOAT FPLs in the relevant ATFCM systems at regional (NM) and local level (ATC/FMP). This was limited to technical feasibility assessment and aimed to potentially identify issues and requirements for future WAVE2 validation exercises.

The operational processes and the roles of the human actors during the planning phase have been assessed. Shadow-mode simulation techniques, including the real air traffic injected from the operational NM systems at the time of the exercise, was used.

A.1.2 Summary of Validation Exercise #01 Validation Objectives and success criteria

The main objective was to assess the feasibility of evolved iOAT FPL (RAD, exemptions policy, ARES refinement, VPA modules etc.) as a means to exchange flight intents between State Airspace Users, Network Manager, Airspace Manager and ATC. The validation objectives refer to the identical interpretation of the 4D flight profiles in the different nodes, the correct distribution of the flight data to all concerned ATC units and the feasibility of OAT FPL to express all ATM and military demands.

Above main objective was complemented by a rather exploratory component, the first time introduction of the iOAT FPLs in the ATFCM domain related systems at regional(NM) and sub-regional/local level ANS/FMP to validate the technical feasibility and to support the future discussions, if and to which extend this would be operationally useful.

More details are described in chapter 4.2 and 5.1.3 of Solution PJ.07-03 VALP Part I (see [38]) and in above chapter 3.2.2 of this document.

Further information on the validation objectives, the success criteria and the results is available in chapter 4 above of this document.

A.1.3 Summary of Validation Exercise #01 Validation scenarios

The Airspace Management related use cases in the scenarios were already validated V3 in SESAR1 WP 07.04 validation exercise VP-710. Therefore, in this validation exercise the required ARES were booked in advance and their activation / deactivation was simulated by Regional ATFCM accordingly.

As the validation exercise focussed on the planning phase the use cases for the execution phase were not part of this validation exercise.

The following planning phase related use cases from PJ.07-03 SPR-INTEROP/OSED (see [39]) are addressed:

- UC-WOC-01: MT Management in Short Term Planning
- UC-ATC-01: MT Management in Short Term Planning
- UC-ATFCM-01a: MT Management in Short Term Planning (Sub-Regional/local ATFCM)
- UC-ATFCM-01b: MT Management in Short Term Planning (Regional ATFCM)

They have been arranged into validation scenarios for several typical military missions. iOAT FPLs are used to communicate the original and revised flight intents between the 3 operational nodes, WOC, NM and ANS (ATC&FMP).

Each scenario focussed on one validation objective; i.e. VPA modules or if the objective covered a list of included several items (list of RAD rules), on one specific validation objective item (RAD rule on city pairs, etc.).

Each of the scenarios included iOAT FPLs prepared for the above mentioned specific aspects, either intentionally produced with an error on it to verify, that the error is technically and/or operationally been identified and captured or intentionally produced with the intent to contain no error.

All use cases and scenarios all apply to the sub-operating environments Network, TMA – High complexity and En-Route – High complexity.

For details refer to chapter 5.1.4 of Solution PJ.07-03 VALP Part I (see [38]).

A.1.4 Summary of Validation Exercise #01 Validation Assumptions

As indicated in chapter 5.1.5 of Solution PJ.07-03 VALP Part I (see [38]), no assumptions have been taken.

Identifier	Title	Type of Assumption	Description	Justification	Flight Phase	KPA Impacted	Source	Value(s)	Owner	Impact on Assessment

Table 6: Validation Assumptions overview

A.2 Deviation from the planned activities

The activities in the validation exercise were conducted as planned and described in Part I of the Validation Plan. No deviations have been recorded.

A.3 Validation Exercise #01 Results

A.3.1 Summary of Validation Exercise #01 Results

Below Table 7: Validation Results for Exercise 1 contains a summary of the results per validation objective.

Validation Exercise #01 Validation Objective ID	Validation Exercise #01 Validation Objective Title	Validation Exercise #01 Success Criterion ID	Validation Exercise #01 Success Criterion	Sub-operating environment	Exercise #01 Validation Results	Validation Exercise #01 Validation Objective Status
OBJ-07.03-V3-VALP-OP1	Evolved iOAT FPL concept	CRT-07.03-V3-VALP-OP1-001	The sharing & using of iSMT through *evolved* iOAT FPL; i.e. filing, validation & distribution is operationally and technically feasible for WOC, NM and ATC.	Network	The technical feasibility has been successfully validated during the exercise. Military(CMC), NM and WOC experts confirmed the operational feasibility.	OK
		CRT-07.03-V3-VALP-OP1-002	The acceptance rate (ACK) of evolved iOAT FPLs, compliant to ATM network rules, is equal or better than the acceptance rate of the iOAT FPL being V2	Network	The acceptance rate of the RAD compliant evolved iOAT FPLs during the exercise was above 90%.	OK

Validation Exercise #01 Validation Objective ID	Validation Exercise #01 Validation Objective Title	Validation Exercise #01 Success Criterion ID	Validation Exercise #01 Success Criterion	Sub-operating environment	Exercise #01 Validation Results	Validation Exercise #01 Validation Objective Status
			validated in SES1/VP716; i.e. 64% and which did not have to comply with ATM network rules.			
		CRT-07.03-V3-VALP-OP1-003	The time & workload for WOC to prepare an evolved iOAT FPL is acceptable for the WOC operator.	En-Route – High, TMA – High, Network	The time and workload to prepare RAD compliant iOAT FPLs was higher than for the iOAT FPLs during V2 exercises. Nevertheless, according to the WOC operator, the additional time and workload remains acceptable and is expected to reduce over time in function of an increased familiarisation with the RAD. In the current WOC prototype the RAD compliance is not checked automatically. Military would appreciate such a cross check function in the WOC system to support the human operator.	OK
		CRT-07.03-V3-VALP-OP1-004	The time & workload to correct a REJ evolved iOAT FPL	En-Route – High, TMA – High, Network	The required time and work load for the IFPU operator is reduced, due to the fact that the iOAT FPLs comply to RAD and	OK

Validation Exercise #01 Validation Objective ID	Validation Exercise #01 Validation Objective Title	Validation Exercise #01 Success Criterion ID	Validation Exercise #01 Success Criterion	Sub-operating environment	Exercise #01 Validation Results	Validation Exercise #01 Validation Objective Status
			for IFPS operator is equal or less than for the iOAT FPL being V2 validated in SES1/VP716 etc. and SES2020/PJ0703-1.		are using the civil aeronautical environment. (less military specifics to deal with)	
		CRT-07.03-V3-VALP-OP1-005	The Exemption policy concept using the existing "ATC route coordinated" remark for MT is operationally feasible for WOC, NM and ATC.	En-Route – High, TMA – High	The technical feasibility has been successfully validated during the exercise. Military(CMC), NM, WOC and ATC experts confirmed the operational feasibility. Furthermore, the use of "RMK/RTECORRATC" was observed in quite a number of real military flight plans in the shadow traffic.	OK
		CRT-07.03-V3-VALP-OP1-006	The Exemption policy concept using the existing Special Status indicator "STS/ATMFX" for MT is operationa	En-Route – High, TMA – High	The technical feasibility has been successfully validated during the exercise. Military(CMC), NM, WOC and ATC experts confirmed the operational feasibility. Furthermore, the use of "STS/ATFMX" was observed in quite a	OK

Validation Exercise #01 Validation Objective ID	Validation Exercise #01 Validation Objective Title	Validation Exercise #01 Success Criterion ID	Validation Exercise #01 Success Criterion	Sub-operating environment	Exercise #01 Validation Results	Validation Exercise #01 Validation Objective Status
			lly feasible for WOC, NM and ATC.		number of real military flight plans in the shadow traffic.	
OBJ-07.03-V3-VALP-OP2	Evolved ARES concept	CRT-07.03-V3-VALP-OP2-001	The ARES reference of up to 9 VPA modules is feasible for integration in iOAT FPL and use by WOC, NM and ATC.	En-Route – High, TMA – High	The technical feasibility has been successfully validated during the exercise. Military(CMC), NM and WOC experts confirmed the operational feasibility. As the VPA area used during the exercise was in the North-East of Germany and not inside ATC FIR/UIR Prague airspace, the success criteria could not be validated for ATC.	PARTIALLY OK (WOC& NM)
		CRT-07.03-V3-VALP-OP2-002	The ARES reference to predefined VPA modules configurations is feasible for integration in iOAT FPL and use by WOC, NM and ATC.	En-Route – High, TMA – High	Due to too late identification of this requirement it could not be included in the exercise prototypes.	OPEN
		CRT-07.03-V3-VALP-OP2-003	The ARES concept refinement to use	En-Route – High, TMA – High	The technical feasibility has been successfully	OK

Validation Exercise #01 Validation Objective ID	Validation Exercise #01 Validation Objective Title	Validation Exercise #01 Success Criterion ID	Validation Exercise #01 Success Criterion	Sub-operating environment	Exercise #01 Validation Results	Validation Exercise #01 Validation Objective Status
			predefined Entry/Exit points is operationally feasible for WOC, NM and ATC.		validated during the exercise. Military(CMC), NM, WOC and ATC experts confirmed the operational feasibility.	
		CRT-07.03-V3-VALP-OP2-004	The ARES concept refinement to use lat./long. geo-coordinate defined Entry/Exit points is operationally feasible for WOC, NM and ATC.	En-Route – High, TMA – High	The technical feasibility has been successfully validated during the exercise. Military(CMC), NM, WOC and ATC experts confirmed the operational feasibility.	OK
		CRT-07.03-V3-VALP-OP2-005	The proposed CDM process through iSMT and Target Time (TTO) negotiation for ARES entry time is operationally feasible for WOC,	En-Route – High, TMA – High	The iSMT related CDM process is mainly between WOC & NM. Military(CMC), NM, and WOC confirmed the operational feasibility. ATS confirms as well the potential feasibility of the same CDM process for iRMT, presumed the take-off time is adapted to meet TTO result of CDM between all partners.	OK

Validation Exercise #01 Validation Objective ID	Validation Exercise #01 Validation Objective Title	Validation Exercise #01 Success Criterion ID	Validation Exercise #01 Success Criterion	Sub-operating environment	Exercise #01 Validation Results	Validation Exercise #01 Validation Objective Status
			NM and ATC.		Today available ATS tools in Czech Republic could support this process.	
OBJ-07.03-V3-VALP-OP3	Evolved iOAT FPLs in ETFMS processing	CRT-07.03-V3-VALP-OP3-001	The complete military trajectories for every received iOAT FPL are processed properly by NM's ETFMS.	Network	All filed and valid iOAT FPLs have been properly included & processed by the ETFMS.	OK
OBJ-07.03-V3-VALP-OP4	Evolved iOAT FPLs in sub-regional/local TFM system processing	CRT-07.03-V3-VALP-OP4-001	The complete military trajectories for every received iOAT FPL are processed properly by sub-regional/local ATFCM(FMP) systems; i.e. TCM.	Network	All filed and valid iOAT FPLs in the Prague FIR/UIR have been properly included and processed by the local ATC/FMP tool; i.e. TCM.	OK
OBJ-07.03-V3-VALP-OP5	Validate the applicability of the NM/Netwo	CRT-07.03-V3-VALP-OP5-001	MTs respects ATM route network rules, i.e.	En-Route – High, TMA – High, Network	The respect or non-respect of the different RAD annexes has been successfully validated by a number of specifically	OK

Validation Exercise #01 Validation Objective ID	Validation Exercise #01 Validation Objective Title	Validation Exercise #01 Success Criterion ID	Validation Exercise #01 Success Criterion	Sub-operating environment	Exercise #01 Validation Results	Validation Exercise #01 Validation Objective Status
	rk rules and regulation for iMT		RAD, FRA DCT, DCT limits, SID/STAR restrictions, etc.		prepared iOAT FPLs for each RAD annex.	
		CRT-07.03-V3-VALP-OP5-002	Mission objectives are not compromised.	En-Route – High, TMA – High	The available exemption policy assures that mission objectives are not compromised. They would be used were ATM Network rules compliance would be in conflict with the mission objectives.	OK
OBJ-07.03-V3-VALP-OP6	iSMT data exchange by means of SWIM(B2B)	CRT-07.03-V3-VALP-OP6-001	Evolved iOAT FPLs are send from WOC to NM/IFPS via B2B.	Network	The SWIM compliant B2B service for iOAT FPL filing has been validated successfully.	OK
		CRT-07.03-V3-VALP-OP6-002	Validation messages for evolved iOAT FPLs flight plan are send from NM to WOC via B2B.	Network	The SWIM compliant B2B service supported successfully the NM iOAT FPL validation messages for the WOC.	OK
		CRT-07.03-V3-VALP-OP6-003	Evolved iOAT FPLs are distributed from NM to ATC via B2B.	Network	The SWIM compliant B2B service for iOAT FPL distribution from NM to ATC has been validated successfully. All iOAT FPLs for the FIR/UIR Prague were received by ATC. No FPLS not	OK

Validation Exercise #01 Validation Objective ID	Validation Exercise #01 Validation Objective Title	Validation Exercise #01 Success Criterion ID	Validation Exercise #01 Success Criterion	Sub-operating environment	Exercise #01 Validation Results	Validation Exercise #01 Validation Objective Status
					relevant for FIR/UIR Prague were received via this B2B service.	
		CRT-07.03-V3-VALP-OP6-004	Information including MT in NM systems(ETFMS) can be accessed by ATS(TCM) systems via B2B service subscription.	Network	The technical feasibility was successfully validated.	OK
OBJ-07.03-V3-VALP-OP7	CDM process for iSMT	CRT-07.03-V3-VALP-OP7-001	The outcome of the CDM process for iSMT has no negative impact on the achievement of mission objectives.	En-Route – High, TMA – High	The available exemption policy assures that mission objectives are not compromised. They would be used were ATM Network rules compliance would be in conflict with the mission objectives.	OK
		CRT-07.03-V3-VALP-OP7-002	The outcome of the CDM process for iSMT has no negative impact on ATM network performance	En-Route – High, TMA – High, Network	The CDM process leads to an acceptable solution for all nodes. The process itself does not impact... The result of the CDM process is avoiding or minimizing negative impacts.	OK

Validation Exercise #01 Validation Objective ID	Validation Exercise #01 Validation Objective Title	Validation Exercise #01 Success Criterion ID	Validation Exercise #01 Success Criterion	Sub-operating environment	Exercise #01 Validation Results	Validation Exercise #01 Validation Objective Status
OBJ-07.03-V3-VALP-OP8	Mission Trajectory Driven Process leads to Performance Benefit	CRT-07.03-V3-VALP-OP8-001	Solution 07.03 increases CAP (Validation Target: 0,505%)		Not possible to measure by this exercise	NOK
		CRT-07.03-V3-VALP-OP8-002	Solution 07.03 increases PRD (Validation Target: 0,155%)		Not possible to measure by this exercise	NOK

761 **Table 7: Validation Results for Exercise 1**

762

A.3.2 Analysis of Exercise 1 Results per Validation objective

For the reference scenario a number of iOAT FPLs were filed by the WOC and submitted to NM for validation and distribution to concerned ATS. For the reference scenario, the IFPS run with deactivated checking of the ATM network rules (RAD restrictions) on iOAT FPLs.

The set of following iOAT FPLs were used as reference cases:

MITD101
MITD102
MITD103
MITD104
MITD105
MITD106
MITD107
MITD108
MITD109
MITD110
MITD111

All above iOAT FPLs were submitted by the WOC and correctly received by NM for validation and distributed to ATC.

All iOAT FPLs were validated by NM's IFPS and distributed to ATC.

The iOAT FPLs MITD101-104 were not received by the Czech ATC system, since there trajectory was not penetrating Czech ATC AoI. This expected system behaviour confirmed as well the correct working of the NM distribution for iOAT FPLs.

The iOAT FPLs MITD109 & 110 were rejected by the IFPS. Those two flight plans indicated the use of a section of the route in an altitude band, not available.

(R)PROF194: RAK P861 GOLOP IS NOT AVAILABLE IN FL RANGE F245..F660:EM4024A

(R)PROF194: GOLOP M725 HDO IS NOT AVAILABLE IN FL RANGE F245..F660:EM4024A

The above error is linked to a human error due to flight plan preparation in non-respect of additional rules beyond the pure RAD rules. The system performed as expected.

The acceptance rate for this reference scenarios of iOAT FPLs not exposed to the RAD checking was observed at 82%.

mmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmm

1. OBJ-07.03-V3-VALP-OP1 Results

769 This validation objective with the title “Evolved iOAT FPL concept” assessed the operational feasibility
770 of the evolved iOAT FPL for mission planning.

771

CRT-07.03-V3-VALP-OP1-001	The sharing & using of iSMT through evolved iOAT FPL; i.e. filing, validation & distribution is operationally and technically feasible for WOC, NM and ATC.
CRT-07.03-V3-VALP-OP1-002	The acceptance rate (ACK) of evolved iOAT FPLs, compliant to ATM network rules, is equal or better than the acceptance rate of the iOAT FPL being V2 validated in SES1/VP716; i.e. 64% and which did not have to comply with ATM network rules.
CRT-07.03-V3-VALP-OP1-003	The time & workload to prepare an evolved iOAT FPL is equal or less than for the iOAT FPL being V2 validated in SES1/VP716 etc. and SES2020/PJ0703-1.
CRT-07.03-V3-VALP-OP1-004	The time & workload to correct a REJ evolved iOAT FPL for IFPS operator and WOC FPL preparatory is equal or less than for the iOAT FPL being V2 validated in SES1/VP716 etc. and SES2020/PJ0703-1.
CRT-07.03-V3-VALP-OP1-005	The Exemption policy concept using the existing “ATC route coordinated” remark for MT is operationally feasible for WOC, NM and ATC.
CRT-07.03-V3-VALP-OP1-006	The Exemption policy concept using the existing Special Status indicator “STS/ATMFX” for MT is operationally feasible for WOC, NM and ATC.

772

773 CRT-07.03-V3-VALP-OP1-001: All iSMTs were successfully shared, in form of the evolved iOAT FPL,
774 between WOC, NM and ATC during the exercise, which by this demonstrated the technical feasibility
775 to file, validate and distribute it. Military(CMC), NM, WOC ATC experts confirmed the operational
776 feasibility.

777 For ATC it is important that in future validation exercises including the execution phase, the potential
778 update of the shared trajectory by the actual time of departure and sharing between ATCs by the
779 means of OLDI shall be included. This shall include the update for actual taxi and Take-off time and the
780 required coordination between military and civil ATC (mCTR/CTMA/CTA); i.e. the military Tower ATCO
781 will give clearance after coordination with the neighbouring EnRoute ATC. The description of this
782 coordination process shall be added in the OSED and EATMA.

783 This update of the time information of the MT and the ATC coordination process is important,
784 differences of the estimated/calculated taxi time between WOC and ATC systems were identified
785 already during earlier V2 validations. This needs to be further investigated/developed.

786 The above comment relates to the transition from SMT to RMT and does not impact on the above
787 success criteria for the iSMT.

788

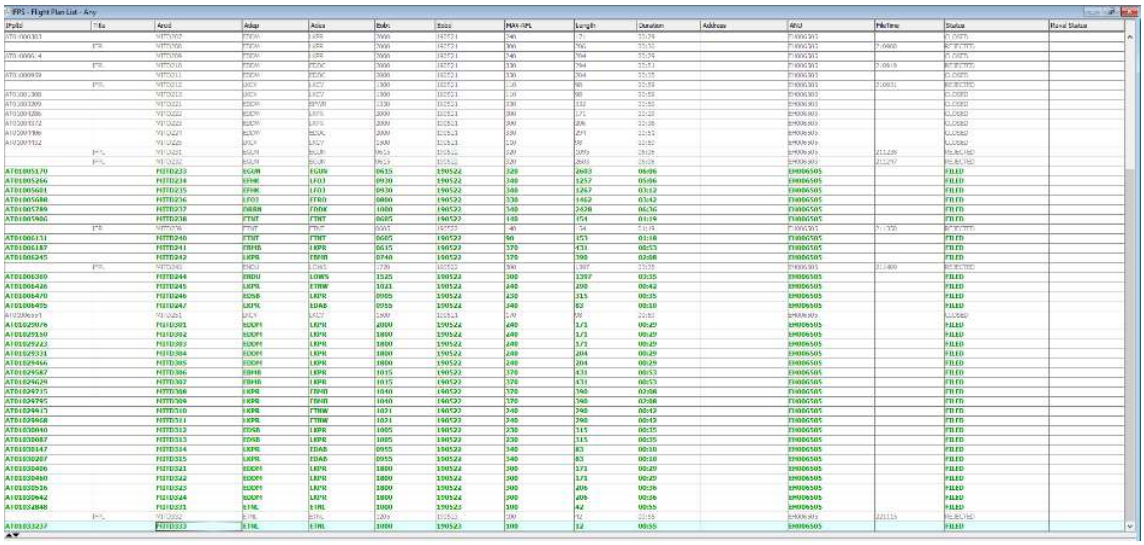

Figure 2: NM's IFPS Flight List containing validated iOAT FPLs (green)

CRT-07.03-V3-VALP-OP1-002 (ACK rate): This criteria was successfully achieved. The acceptance rate of the RAD compliant iOAT FPLs was above 90% and so significantly above the rate of 64% observed in SES1/VP716. This is obviously the result of the RAD compliant iOAT FPLs containing less military specifics. The figures should be used with care, as the exercise did rely only on a relatively low number of flight plans.

Were the criteria was achieved with success during the exercise, in future deployment the acceptance rate of military flight plans in iOAT FPL depends on several factors, i.e. it depends on the quality of

- the WOC SW,
- the network rule data in the WOC,
- the training of the WOC operator

For the above reason and because the exercise did rely only on a relatively low number of flight plans, the above figure for the ACK rate achieved during the exercise should be used with care.

CRT-07.03-V3-VALP-OP1-003(WOC workload): The time and workload to prepare RAD compliant iOAT FPLs was higher than for the iOAT FPLs during V2 exercises.

According to the WOC operator, the additional time and workload remains acceptable and is expected to reduce over time in function of an increased familiarisation with the RAD.

CRT-07.03-V3-VALP-OP1-004(IFPS operator workload): The required time and work load for the IFPU operator is reduced, due to the fact that the iOAT FPLs comply to RAD and are using the common and integrated aeronautical environment dataset (less military specifics to deal with).

CRT-07.03-V3-VALP-OP1-005 (Exemption mechanism RMK/RTECRRATC): The technical feasibility has been successfully validated during the exercise.

This success criterion is successfully addressed in iOAT FPL:

MIT5500

Military (CMC), NM, WOC and ATC experts confirmed the operational feasibility as used during the exercise.

Furthermore, the use of "RMK/RTECORRATC" was observed in quite a number of real military flight plans in the shadow traffic.

The exercise did not include the coordination process between WOC and ATC, which needs to happen before the day of execution of the flight. The deadline until this coordination can be requested, varies in today's operation from ANSP to ANSP.

The accepted exemption request for an ATC coordinated route (RMK/RTECOORATC) needs to be asked by the WOC re-confirmation from ATC shortly before execution.

Usually such request is checked and be granted by office staff of ANSPs. Since the FPL of an exempted flight is a non-standard flight, it can present quite a lot of work for the verification of each request, as function of the complexity of the military flight interacting with other planned flights and the airspace situation.

ATCOs would become aware only at the time of, or just before execution or at the best during the team briefing by the Supervisor.

RMK/RTECORRATC should only be used for the entire flight and cannot be used as today to replace OAT/GAT section indications.

Where the validation demonstrated operational feasibility at exercise level, the amount of workload at ANSP/ATC level would rise with the number of flights making use of this, reason why it should be used as proposed by the current MT concept, only exceptionally by military flights.

CRT-07.03-V3-VALP-OP1-006(Exemption mechanism STS/ATFMX): The technical feasibility has been successfully validated during the exercise.

This success criterion is successfully addressed in iOAT FPL:

MIT5100
MIT5200
MIT5300
MIT5400
MIT5500

Military(CMC), NM, WOC and ATC experts confirmed the operational feasibility during the exercise.

Furthermore, the use of "STS/ATFMX" was observed in quite a number of real military flight plans in the shadow traffic.

ATCO is controlling flight in execution. According to the projects ATC operational experts, the ATCO is not too much concerned by a potential timely shift(or not) associated to a waypoint of the FPLs, as (s)he will just control the flight from the moment it appears in the sector.

Nevertheless, the FMP might be concerned, by a flight exempted from ATFCM measures. This should be investigated in future validation exercises.

During the exercise a regulation, LKIOAT22, was put in place for all flights departing and arriving Prague airport. iOAT FPLs with no exemption STS/ATFMX, were correctly caught by the regulation and got a delay attributed. For the flight MITD302 in below example this resulted in an departure delay attribution of 16 minutes.

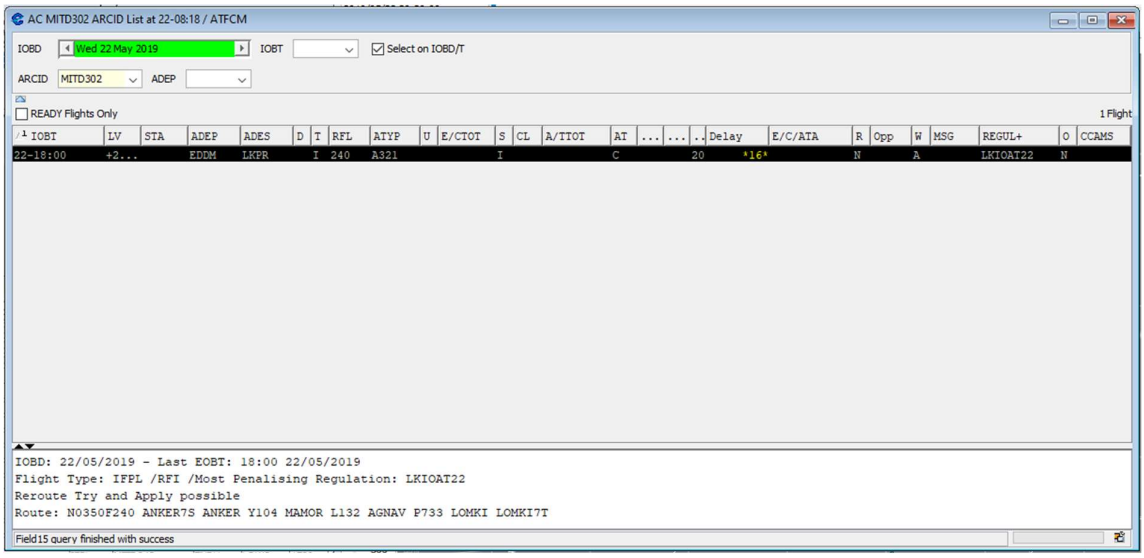

Figure 3: Delay attribution to iOAT FPL MITD302 without "STS/ATFMX"

The clone flight MITD303 contained the ATFCM exemption "STS/ATFMX" in its iOAT FPL. This was correctly interpreted by the NM ETFMS system resulting in this flight getting no delay attributed.

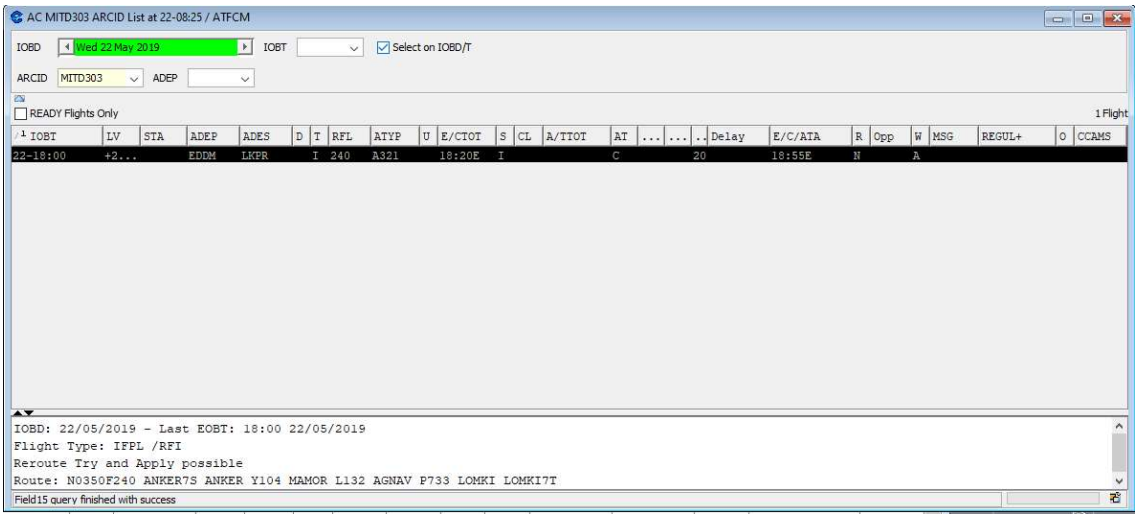

Figure 4: iOAT FPL MITD303 with "STS/ATFMX", being exempted by the system from delay attribution

2. OBJ-07.03-V3-VALP-OP2 Results

This validation objective with the title "Evolved ARES concept" assessed the operational feasibility of the evolved ARES concept to be used for mission planning.

CRT-07.03-V3-VALP-OP2-001	The ARES reference of up to 9 VPA modules is feasible for integration in iOAT FPL and use by WOC, NM and ATC.
CRT-07.03-V3-VALP-OP2-002	The ARES reference to predefined VPA modules configurations is feasible for integration in iOAT FPL and use by WOC, NM and ATC.
CRT-07.03-V3-VALP-OP2-003	The ARES concept refinement to use predefined Entry/Exit points is operationally feasible for WOC, NM and ATC.
CRT-07.03-V3-VALP-OP2-004	The ARES concept refinement to use lat./long. geo-coordinate defined Entry/Exit points is operationally feasible for WOC, NM and ATC.
CRT-07.03-V3-VALP-OP2-005	The proposed CDM process through iSMT and Target Time (TTO) negotiation for ARES entry time is operationally feasible for WOC, NM and ATC.

CRT-07.03-V3-VALP-OP2-001 (VPA modules list): The technical feasibility has been successfully validated during the exercise. The WOC could produce and file iOAT FPLs containing reference to VPA modules, which were successfully checked by NM's IFPS against the activation periods in the AUP.

Military (CMC), NM and WOC experts confirmed the operational feasibility. As the VPA area used during the exercise was in the North-East of Germany and not inside ATC FIR/UIR Prague airspace, the success criteria could not be validated for ATC.

Below example shows the iOAT FPL *MITD331* using a list of 5 VPA modules of EDVPANE.

(FPL-MITD331-IM

-A400/H-SDY/HD1

-ETNL1000

-N0200F100 DCT LEGSA STAY1/A/EDBASIC1A/EDBASIC1B/EDBASIC1C/EDBASIC1D/EDBASIC1E/F100F140/0045 LAG DCT

-ETNL0055 ETSH

-EUR/PROTECTED

EUR/OAT DOF/190523 EET/LEGSA0010)

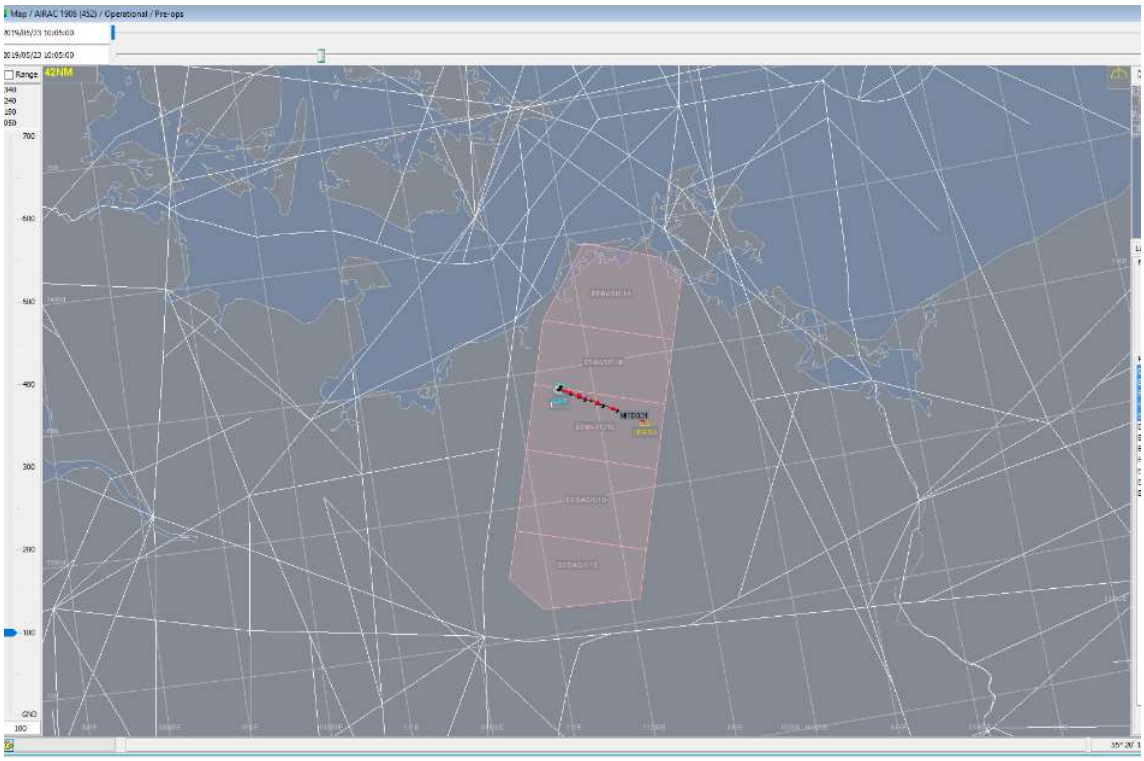

Figure 5: iOAT FPL MITD331 using VPA modules list

CRT-07.03-V3-VALP-OP2-002 (predefined VPA modules scenarios): Due to too late identification of this requirement, it could not be included in the exercise prototypes and not be validated by this exercise.

CRT-07.03-V3-VALP-OP2-003: The technical feasibility has been successfully validated during the exercise.

Military (CMC), NM, WOC and ATC experts confirmed the operational feasibility.

What is proposed by the MT concept with regards to ARES Entry/Exit points, corresponds largely to today's praxis in Czech Republic. This is not the case for a number of other countries in the IFPZ.

Based on the experience made in the Czech Republic, for operational and technical reasons, it is suggested to evolve the MT concept by defining different, specific points, either for Entry or for Exit.

Prior to a deployment, the existing Entry/Exit points in the Czech Republic would need to be renamed to make them ICAO & IFPS compliant.

CRT-07.03-V3-VALP-OP2-004: The technical feasibility, to use geographical coordinates expressed in Lat./Long. to define ARES entry and exit points within the iOAT FPL, has been successfully validated during the exercise.

Military (CMC), NM, WOC and ATC experts confirmed the operational feasibility.

The CWP in the Czech Republic, supports the ATCO by interpreting lat.long.geo-points from FPLs and clearly indicates their position on the CWP display.

The MT concept in the OSED should suggest this functionality for implementation in all CWP systems of ANSPs were this is not yet available.

Following example shows the iOAT FPL *MITD333* using geographical coordinates for the ARES entry in & exit from the ARES EDVPANE build by a number of VPA modules EDBASIC.

(FPL-MITD333-IM

-A400/H-SADFGHIKM1RTUWXY/L

-ETNL1000

-N0200F100 DCT 5358N01226E STAY1/A/EDBASIC1A/EDBASIC1B/EDBASIC1C/EDBASIC1D/EDBASIC1E/F100F140/0045 LAG DCT

-ETNL0055 ETSH

-PBN/A1B1C1D1L1O1S1 EUR/PROTECTED

EUR/OAT NAV/GPS COM/+8705 DOF/190523 EET/5358N01226E0010 01226E0010)

CRT-07.03-V3-VALP-OP2-005(iSMT CDM TTO ARES entry): Military (CMC), NM, WOC and ATC experts confirmed the operational feasibility, presumed the take-off time is adapted to meet TTO result of CDM between all partners. Today available ATC tools in Czech Republic could support this process.

This success criterion is successfully addressed in iOAT FPL (EATC):

MIT4100
MIT4200
MIT4300
MIT4400
MIT4500
MIT4600

And iOAT FPLs(CR):
MIT3100
MIT3200

3. OBJ-07.03-V3-VALP-OP3 Results

This validation objective with the title "Evolved iOAT FPLs in ETFMS processing" assessed the **technical feasibility** to integrate evolved iOAT FPLs in the Traffic Flow management system (ETFMS) processing at regional ATFCM level. (to potentially feed later-on DCB processes for optimising of the ATM Network performance)

CRT-07.03-V3-VALP-OP3-001	The complete military trajectories for every received iOAT FPL are processed properly by regional ATFCM systems; i.e. NM's ETFMS.

CRT-07.03-V3-VALP-OP3-001: The exercise validated successfully the technical feasibility to process properly the complete military trajectories for every received iOAT FPL by NM's ETFMS. All iOAT FPLs from the exercise, call signs "MITxxxx", were correctly processed by the ETFMS and correctly associated to the airspaces flight list.

The figure below shows the flight list for the LKPR airspace including the exercise iOAT FPLs; i.e. MITxxxx call signs.

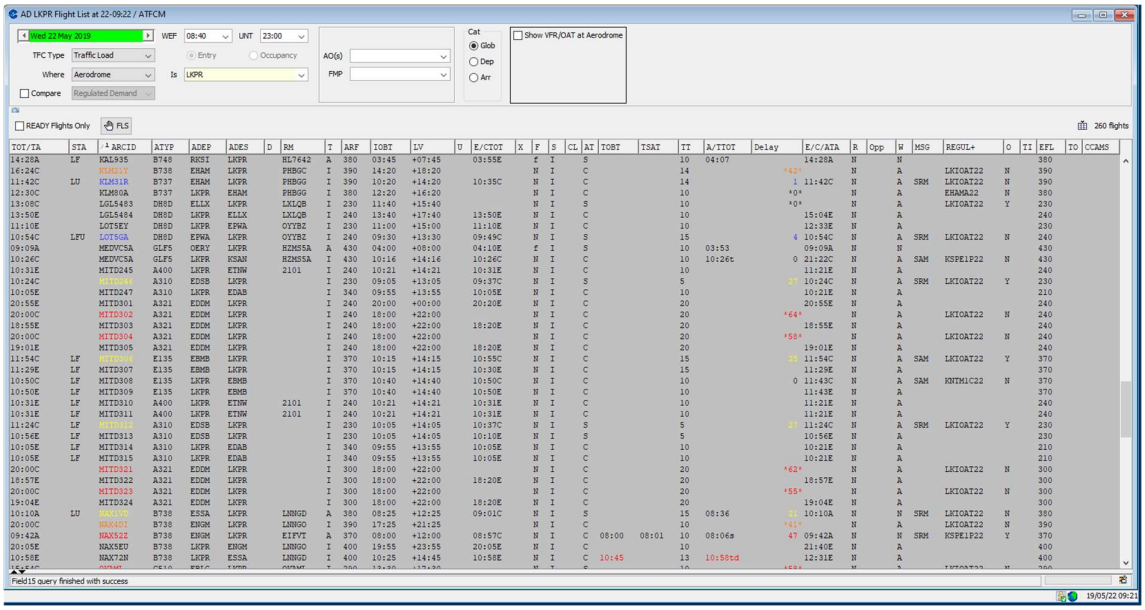

Figure 6: NM ETFMS Flight list for LKPR airspace including iOAT FPLs ("MITxxxx" call signs)

As shown in the OBJ-07.03-V3-VALP-OP1 paragraph, under Success criteria CRT-07.03-V3-VALP-OP1-006, departure delays had been correctly attributed or not by the NM system, dependent if the iOAT FPL did contain in Fied18 the **S**pecial **St**atus ATFCM exemption indicator "STS/ATFMX" or not.

4. OBJ-07.03-V3-VALP-OP4 Results

This validation objective with the title "Evolved iOAT FPLs in sub-regional/local TFM system processing" assessed the **technical feasibility** to integrate evolved iOAT FPLs in the Traffic Flow management system processing at sub-regional/local ATFCM level. (to potentially feed later-on sub-regional/local DCB processes for optimising of the ATM Network performance)

CRT-07.03-V3-VALP-OP4-001	The complete military trajectories for every received iOAT FPL are processed properly by sub-regional/local ATFCM(FMP) systems; i.e. TCM.

CRT-07.03-V3-VALP-OP4-001: All iOAT FPLs have been processed correctly and integrated in the FMP/TCM tool at local ATC level.

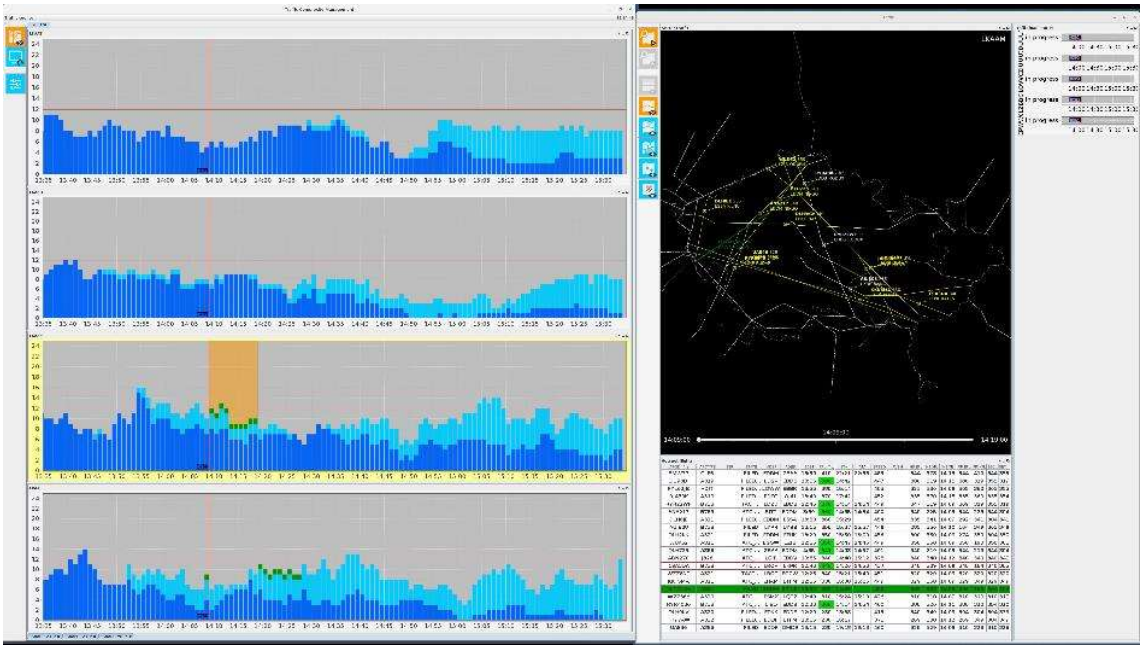

Figure 7: CR ANS FMP tool TCM including iOAT FPLs (in green)

As an additional visual support to the FMP, the predicted traffic is indicated in two different colours (blue or green) for civil FPLs and military iOAT FPLs in the graphic of the airspace volume counts.

From ATC perspective the concept could try to clarify, if for military flights as for civil flights, as well DPI and FSA messages to update the information for ATFCM tools would be send.

5. OBJ-07.03-V3-VALP-OP5 Results

This validation objective with the title "Validate the applicability of the NM/Network rules and regulation for iMT" assessed the technical and operational feasibility to plan initial mission trajectories (iMT) in accordance with rules and procedures set by NM for flights integrated in the ATM network operations.

CRT-07.03-V3-VALP-OP5-001	MTs respects ATM route network rules, i.e. RAD, FRA DCT, DCT limits, SID/STAR restrictions, etc.
CRT-07.03-V3-VALP-OP5-002	Mission objectives are not compromised.

CRT-07.03-V3-VALP-OP5-001: The validation exercise successfully demonstrated the applicability of Network rules(RAD) to the iOAT FPLs for MTs. For each of the different rules in the RAD annex, specific iOAT FPLs have been produced and the rule were tested positively and negatively (iOAT FPL respecting RAD rule or not).

CRT-07.03-V3-VALP-OP5-002: A number of real military flight plans from different sources; i.e. EATC, MUAC, CZAF, SES1 VAL716 (BAC& RNLAF) have been modified to comply with the RAD.

These modification of real military FPLs to make them compliant to the RAD lead to differences in the trajectories. Mostly horizontally (2D/lat.long.) and partially as well in the vertical dimension (3d/FL).

To which extent this might compromise the mission objectives cannot be answered by the exercise, since the military AUs having produced the initial original military FPL are not part of the exercise team and the mission objectives are not know.

Below example shows the difference between the initial routing and the RAD compliant routing of a flight arriving from the Netherlands, overflying the north east of Germany and the Baltic sea and states and finally returning towards the Netherlands.

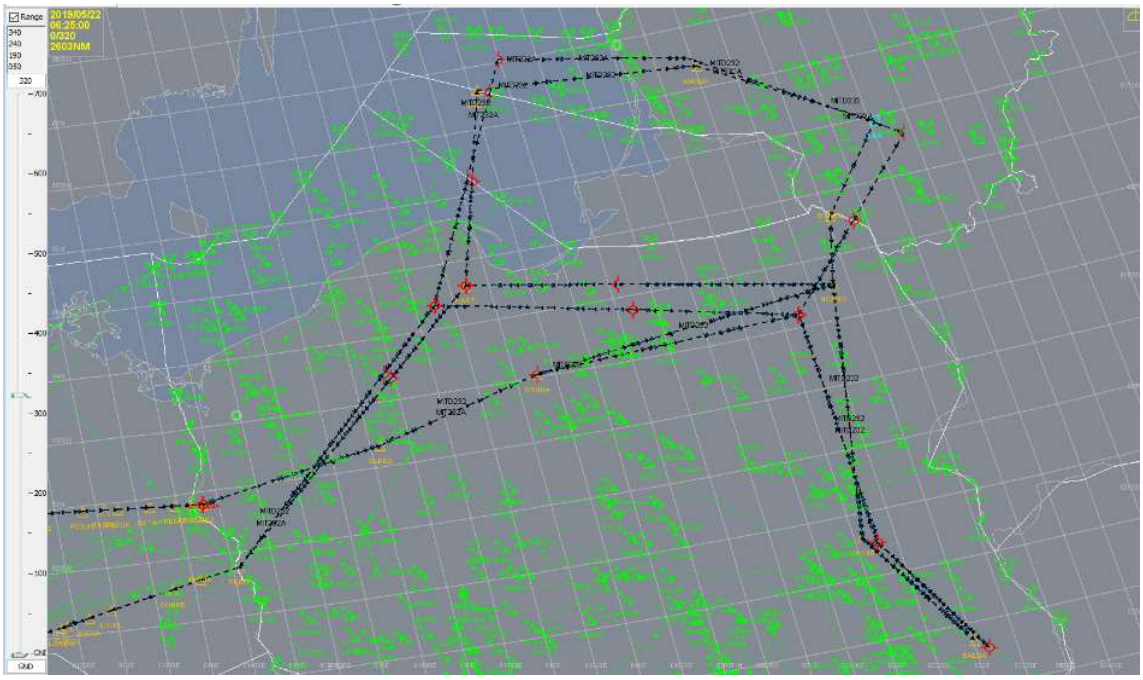

Figure 8: Initial routing versus RAD compliant routing (orange way points)

Initial Route:

-ROUTE N0440F320 BANEM DCT SONDO M183 REDFA UL620 ARNEM UP147 RKN UL980 DLE UZ717 GARLU Z870 BKD/N0440F300 L619 ALUKA/N0440F320 DCT OLNED DCT GRUDA DCT 5336N02214E/M068F280 DCT 5145N02216E 5047N02310E 5145N02216E 5336N02214E 5411N01745E 5601N01929E 5545N02157E 5449N02423E 5336N02214E 5411N01745E DCT SUBIX/M076F280 Z20 MAG L986 DLE UL980 RKN UL602 SPY DCT NAVPI IFPSTOP DCT MLD IFPSTART

RAD compliant route (Coord replaced to closest published FRA WPT (orange) in order to stay as close to original filed routing):

-ROUTE N0440F320 BANEM DCT SONDO M183 REDFA UL620 ARNEM UP147 RKN UL980 DLE UZ717 GARLU Z870 BKD/N0440F300 L619 ALUKA/N0440F320 DCT OLNED DCT GRUDA DCT NORNO/M068F280 DCT VAXUR DCT BALBA DCT VAXUR DCT NORNO DCT KARTI DCT BALIT DCT MANUX DCT KNA DCT BOKSU DCT NORNO DCT KARTI DCT SUBIX/M076F280 Z20 MAG L986 DLE UL980 RKN UL602 SPY DCT NAVPI IFPSTOP DCT MLD IFPSTART

RAD Appendix 3: City Pair Level Capping

- illegal City pair
- wrong level for a valid combination

This success criterion is successfully addressed in iOAT FPLs :

MITR300
MITR301

RAD Appendix 4: En-Route DCTs / General Limits

- illegal WPT combination for IN and OUT in CR
- wrong time for a valid combination
- wrong altitude for a valid combination

This success criterion is successfully addressed in iOAT FPLs:

MITR400
MITR401
MITR402

RAD Appendix 5: Airport Connectivity

- illegal SID/STAR

This success criterion is successfully addressed in iOAT FPLs:

MITR500

RAD Appendix 6: Flight Profile Restrictions

- illegal altitude at AoR crossing

This success criterion is successfully addressed in iOAT FPLs:

MITR501

RAD Appendix 7: FUA Restrictions

- illegal crossing of military area

This success criterion is successfully addressed in iOAT FPLs:

MITRRAD7

6. OBJ-07.03-V3-VALP-OP6 Results

This validation objective with the title “iSMT data exchange by means of SWIM (B2B)” assessed the technical and operational feasibility iSMT data to be exchanged between ATM actors (WOC, NM, ATC, FMP) through SWIM (B2B).

CRT-07.03-V3-VALP-OP6-001	Evolved iOAT FPLs are send from WOC to NM/IFPS via B2B.
CRT-07.03-V3-VALP-OP6-0012	Validation messages for evolved iOAT FPLs flight plan are send from NM to WOC via B2B.
CRT-07.03-V3-VALP-OP6-003	Evolved iOAT FPLs are distributed from NM to ATC via B2B.
CRT-07.03-V3-VALP-OP6-004	Information including MT in NM systems (ETFMS) can be accessed by ATC (TCM) systems via B2B service subscription.

The validation objective “iSMT data exchange by means of SWIM (B2B)” has been successfully achieved by the exercise. WOC, NM and ATC technical and operational expert staff confirmed the successful achievement of the criteria CRT-07.03-V3-VALP-OP6-001 to CRT-07.03-V3-VALP-OP6-004. NM received all iOAT FPLs filed by the WOC, which correctly received all validation messages from NM. ATC received all iOAT FPLs with trajectories inside the Prague FIR/UIR. ATC did not receive iOAT FPLs for trajectories not inside their airspace.

The ATFCM system B2B service between NM ETFMS and ATC FMP tool TCM, was established with success. All relevant iOAT FPL & trajectory were correctly and completely integrated in the relevant flight lists, counts and count graphics over time both in the ETFMS and in the FMP tool TCM.

7. OBJ-07.03-V3-VALP-OP7 Results

This validation objective with the title “CDM process for iSMT” assessed the technical and operational feasibility and the usability of CDM process for iSMT management.

CRT-07.03-V3-VALP-OP7-001	The outcome of the CDM process for iSMT has no negative impact on the achievement of mission objectives.
CRT-07.03-V3-VALP-OP7-002	The outcome of the CDM process for iSMT has no negative impact on ATM network performance

CRT-07.03-V3-VALP-OP7-001: OK: The available exemption policy are essential part of the iSMT CDM process and assure that options are available to protect mission objectives. The proposed exemption mechanisms have been validated for their use within the iOAT FPL within the exercise.They would be

used in deployment were ATM Network rules compliance would be in conflict with the mission objectives.

CRT-07.03-V3-VALP-OP7-002: OK: The CDM process for iSMT leads to an acceptable solution for all nodes. The process itself does not impact on the ATM performance. The result of the CDM process is avoiding or minimizing negative impacts on the ATM network and the needs of all other nodes.

8. OBJ-07.03-V3-VALP-OP8 Results

This validation objective with the title "Mission Trajectory Driven Process leads to Performance Benefit "assessed the performance effects of the introduction of the MT Driven Process.

CRT-07.03-V3-VALP-OP8-001	Solution 07.03 increases CAP (Validation Target: 0,505%)
CRT-07.03-V3-VALP-OP8-002	Solution 07.03 increases PRD (Validation Target: 0,155%)

OPEN/NOK: Potential performance effects on the SESAR KPAs could not be measures due to the nature of the exercise, which focussed on the planning phase, where performance benefits can only be measured during execution phase. Furthermore, performance measurement would require a much higher number of iOAT FPLs to have sufficient data for solid statistical result. This is even more valid as the target KPA performance benefits are extremely low and risk to be covered by potential measurement error impact.

A.3.3 Unexpected Behaviours/Results

The validation exercise was executed according to the prepared scenario Excel Sheet. All scenarios were executed as planned. No unexpected behaviour was observed.

A.3.4 Confidence in Results of Validation Exercise 1

1. Level of significance/limitations of Validation Exercise Results

This is the first initial V3 validation exercise at the end of SESAR 2020 Wave1. The conclusions are described in section 5.1. A number of additional V3 exercises are required in future to reach full V3 maturity.

For the limitations of the validation exercise please see section 4.3.1 and the level of significance please refer to section 4.3.1.2.

2. Quality of Validation Exercises Results

See section 4.3.1.1.

3. Significance of Validation Exercises Results

See section 4.3.1.2.

A.3.5 Conclusions

As there was just one single first initial V3 validation exercise in SESAR 2020 Wave1, the conclusions are described in section 5.1.

1. Conclusions on concept clarification

See section 5.1.2.

2. Conclusions on technical feasibility

See section 5.1.3.

3. Conclusions on performance assessments

See section 5.1.4.

A.3.6 Recommendations

As there was just one single first initial V3 validation exercise in SESAR 2020 Wave1, the recommendations are described in section 5.2.

Appendix B Validation Exercise #02 Report

N/A

Appendix C SESAR Solution(s) Maturity Assessment

The Appendix C SESAR Maturity Assessment after this initial V3 exercise will be prepared as an independent document/deliverable.

-END OF DOCUMENT-

Insert beneficiary's logos below, if required