



# Final Project Report

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## Task contributors

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## Abstract

Project 11.01.05 objective is to validate some of the various SESAR operational improvements related to the Flight/Wing Operations Centres domain for several types of Airspace Users (Military, Business, General and Commercial Aviation). Validation exercises of V2 and V3 maturity levels have been undertaken in conjunction with other SESAR projects with the support of prototypes developed within 11.01.04. Those exercises have been performed using mainly shadow mode and real time simulation methods in order to validate several operational requirements related to Aeronautical Information Management, Free Routing, MET information, UDPP, Trajectory definition exchange for civil and military (through iOAT and Extended Flight Plan) as well as Advanced Flexible Use of Airspace.

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## Acronyms

Acronym	Definition
4D	Four Dimension
ADR	Airspace Data Repository
ADS	Airbus Defence and Space
AFUA	Advanced Flexible Use of Airspace
AIM	Aeronautical Information Management
AIS	Aeronautical Information Service
AIXM	Aeronautical Information Exchange Model
ANSP	Air Navigation Service Provider
AOC	Airline Operations Center
AOLO	Aircraft Operators Liaison Officers
ARES	Airspace Reservation/Restriction
ASM	Airspace Management
ATM	Air Traffic Management
ATC	Air Traffic Control
AU	Airspace User
B2B	Business to Business
BMT	Business and Mission Trajectory
CACD	Central Airspace and Capacity Database
CDM	Collaborative Decision Making
CFSP	Computerized Flight Planning Service Providers
CMAC	Civil-Military ATM Coordination
CS	Central Service
CTOT	Calculated Take Off Time
DCB	Demand and Capacity Balancing
DIB	Digital Integrated Briefing

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DMA	Dynamic Mobile Areas
D-NOTAM	Digital NOTAM
DS	Defence and Space / Dataset
DSNA	Direction des Services de la Navigation Aérienne
EFPL	Extended Flight Plan
ENB	Enabler
E-OCVM	European Operational Concept Validation Methodology
EXE	Exercise
FDA	Fleet Delay Apportionment
FIXM	Flight Information Exchange Model
FOC	Flight Operations Centres
FPL	Flight Plan
FR	Free Routing
GAT	General Air Traffic
HMI	Human Machine Interface
ICAO	International Civil Aviation Organisation
ID	Identifier
IFPS	Integrated Initial Flight Plan Processing System
iOAT	Improved Operational Air Traffic
iRBT	Initial Reference Business Trajectory
iRMT	Initial Reference Mission Trajectory
iSMT	Initial Shared Mission Trajectory
LARA	Local and Sub-Regional Airspace Management System
LSY	Lufthansa Systems
MET	Meteorological Information
NM	Network Manager
NMVP	Network Management Validation Platform
NOTAM	Notice to Airmen

OAT	Operational Air Traffic
OFA	Operational Focus Area
OI	Operational Improvement
OSD	Operational Service and Environment Definition
P	Project
PCP	Pilot Common Project
RAD	Route Availability Document
RBT	Reference Business Trajectory
RMT	Reference Mission Trajectory
RTSA	Real Time Status of Airspace
SEG	Security Exchange Gateway
SESAR	Single European Sky ATM Research Programme
SFP	Selective Flight Protection
SJU	SESAR Joint Undertaking
SMT	Shared Mission Trajectory
SWIM	System Wide Information Management System
TTO	Target Time Over
UDPP	User Driven Prioritisation Process
VALP	Validation Plan
VALR	Validation Report
VP	Validation Plan
VPA	Variable Profile Area
V&V	Verification and Validation
WOC	Wing Operations Centres
WP	Work Package

# 1 Project Overview

As part of the Work Package 11.1 titled Flight/Wing Operations Centres, project 11.01.05 scope is the pre-operational validation of the improvements related to all types of Airspace Users operations from the Airspace User Operations Support.

The project 11.01.05 was created with an initial scope to validate at pre-operational level (maturity V3) the operational improvements part of Step2 and 3 if available. Also the project aimed to validate at its initiation the operational requirements developed at P11.01.02 level. However, WP11.1 adopted a revised process during the year 2014 in order to run ahead the validation cycle using an agile methodology, with the purpose to update more mature operational requirements only at the end of the V&V cycle. Therefore, following WP11.1 revised process and the programme shift, the project scope has been refined in order to include as well validation exercises of V2 maturity level and to limit the activities to Step1 and 2. Since WP11.1 (through P11.01.02) was in charge to define operational requirements and to ensure Airspace Users acceptance, P11.01.05 needed to run validation activities related to the FOC/WOC domain from an Airspace User perspective. In consequence, several workshops also through P11.01.01 and P11.01.02 as well as involvement of Airspace Users during the various exercises have been used to support the development of the SESAR solutions.

Those exercises have been performed using mainly real time simulation and shadow mode methods in order to validate several operational improvements related to the following subjects and subsequent solutions:

- Aeronautical Information Management (solution #34: Digital integrated briefing)
- Free Routing (solution #33: Free Routing for flights both in cruise and vertically-evolving above a specified flight level in low-to-medium density airspace)
- Advanced Flexible Use of Airspace (solution #31: Variable profile military reserved areas and enhanced civil-military collaboration)
- Extended Flight Plan (solution #37)

In addition to that, exercises were also performed with other improvements such as use of Global Ensemble Weather forecast (MET information) in the flight planning process, UDPP Step 2 and the mission trajectory process (mission planning through use of iOAT and Extended Flight Plan and mission monitoring).

Since WP11.1 consists of a consortium of several companies, Lufthansa Systems, Sabre, Honeywell and Airbus Defence and Space have contributed to the project with Airbus as coordinator.

This contribution has been done in two forms:

- Contributing to exercises (P11.01.05 as contributor)
  - Contribution to Validation Plan and Validation Report documents
- Leading exercises (P11.01.05 as leader)
  - Production of Validation Plans and Reports

In cooperation with other SESAR projects, P11.01.05 has contributed therefore to several SESAR solutions that will be described in the further sections.

## 1.1 Project progress and contribution to the Master Plan

Project 11.01.05 has worked as part of WP11.1 with the overall 11.1 projects and specifically with P11.01.04 (Prototype) providing the tools and platforms necessary to perform all the exercises part of the validation activities.

The validation technique most used has been the real time simulation but the exercises have also been performed with shadow modes, gaming sessions and platform-based gaming.

The tools were provided by Computerized Flight Planning Service Providers (CFSP) and those tools and platforms are described more precisely in the following projects as per its scope: P11.01.03 (Technical specifications) and P11.01.04 (Prototype). Even if trajectories calculation (provision of flight plans) was not the only task for the validation activities, it was one of the major preparation tasks for achieving the validation exercises.

Due to organization of WP11.1, each project is a piece of a puzzle, and the overall picture is revealed at WP level only.

Furthermore, the project 11.01.05 succeeded in establishing efficient coordination with the other SESAR following projects to achieve the exercises listed below, especially:

- P07.06.02 Optimized Airspace Users Operations (EFPL and UDPP)
- P07.05.04 Flexible Airspace Management
- P13.02.02 Aeronautical Information Management
- P04.03 Integrated and pre-operational validation & cross validation
- P11.02.02 MET Information Systems. Development, Validation and Verification

It permitted in the end to execute several validations that were needed to achieve the overall concept of Business/Mission trajectory. This concept and its associated benefits are directly or indirectly dependent on the success needed in the other Operational Focus Areas such as the ones provided below.

The list below summarizes all the validation exercises in which P11.01.05 led or contributed to and provides as well the associated exercise leader, the contributors and the OFAs related to. Airbus as coordinator is not mentioned since it acts beforehand as P11.01.05 leader.



<b>Exercise</b>	<b>Leader</b>	<b>Contributors</b>	<b>OFA</b>	<b>Exercise Title</b>
Exe311 - V2 Step 1 - EFPL	07.06.02 Eurocontrol	WP11.1 (LSY and Sabre)	03.01.04 BMT	Enhanced current flight planning processes Part 1
Exe616 - V2 Step 1-EFPL	07.06.02 Eurocontrol	WP11.1 (LSY and Sabre)	03.01.04 BMT	Enhanced current flight planning processes Part 2
Exe775 - V2 Step 2-BMT	11.01.05 (LSY)	Thalès	03.01.04 BMT	Collaborative Trajectory Management between AOC and ATC
Exe774 – V2 Step 1-WOC	11.01.05 (ADS)	Eurocontrol CMAC	03.01.04 BMT	State Airspace Users' Processes Validation Step 1 Lot #1
Exe710 – V3 Step 1- AFUA	07.05.04 Eurocontrol	WP11.1 (LSY +ADS) CMAC	05.03.01 Airspace Management and AFUA	Real time airspace status data exchange
Exe716 - V2 Step 1-iOAT	07.06.02 Eurocontrol	WP11.1 (ADS) CMAC	03.01.04 BMT	Harmonization and centralized management of OAT flight plan
Exe730 - V2 Step 2- UDPP	07.06.02 Eurocontrol	WP11.1 (Sabre) ADS	05.03.06 UDPP	UDPP on local FOC-APT use cases
Exe791 - V2 Step 1-MET	11.01.05 (Sabre)	WP11.2 (MET)	03.01.04 BMT	Use of global ensemble wind forecasts (GEWF) within the flight planning process
Exe789 – V3 Step 1-WOC	11.01.05 (ADS)	Eurocontrol CMAC	03.01.04 BMT and 05.03.01 Airspace Management and AFUA	Validate State Airspace User Processes in Step 1 Lot #2
Exe461 – V3 Step 1-AIM	13.02.02 Frequentis	Eurocontrol WP11.1 (HON and Sabre)	ENB02.01.02 AIM/MET	Digital Integrated Briefing for all phases of flight
Exe797 – V2 Step 1-FR	04.03 Skyguide/ DSNA	WP11.1 (Sabre and LSY)/ Eurocontrol	03.01.03 FR	Conflict detection and ATC interoperability in a Free routing environment
Exe713 – V3 Step 1-EFPL	07.06.02 Eurocontrol	WP11.1 (LSY and Sabre)	03.01.04 BMT	EFPL usage in flight planning, DCB and ATC operations
Exe790 – V2 Step 1-WOC	11.01.05 (ADS)	Eurocontrol CMAC	03.01.04 BMT	Validate State Airspace User Processes in Step 2 Lot #3

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The table below summarizes for each Operational Improvement how the project 11.01.05 contributed to it and what the project made to increase the level of maturity of each OI. Even though the exercises have been performed by using either Dataset 13, 14 or 15, the most recent SESAR OIs Dataset (DS16) has been used as a reference in this table to be in accordance with the latest programme status. In addition to that, the OIs in this table from DS16 are covering the same scope of OIs that were used in the previous datasets except for three of them that come from Dataset 14.

Each time there is an Operational Improvement linked to a SESAR solution, it has been mentioned in the table. The list of Enablers has not been included in there since this is in the scope of the P11.01.03 and P11.01.04 reports and to not duplicate.

Finally, there has been one exercise not part of the 11.01.05 validation roadmap, in which Lufthansa Systems partner contributed to the EXE-07.05.04-VP-718 (Dynamic Airspace Configurations with DMA type 1) by providing Free Route trajectories.

Code	Name	Project contribution	Maturity at project start	Maturity at project end
AOM-0202-A (DS16)	Automated Support for strategic, pre-tactical and tactical Civil-Military Coordination in Airspace Management (ASM).	Linked to Solution #31  Through EXE710 for the civil part, and EXE789/790 for the military part, the project contribution enables to improve the real time status airspace data exchange. This improvement has been achieved through the use of systems provided by the flight planning system providers representing the Airspace Users (civil and military) and by the Network Manager centralising the ASM cell. Still, works at industrialisation level is absolutely needed for the development of the B2B service for RTSA exchange with the FOC and the coordination process for the eligible flight list.	V1	V3
AOM-0206-A (DS16)	Flexible and modular ARES in accordance with the VPA design principle	Linked to Solution #31  Through EXE710 for the civil part, and EXE789 for the military part, the validation activities permitted this operational improvement to be achieved by simulating the Airspace Reservations (ARES) process with the NM with a very close military airspace user collaboration. The benefits associated to it were demonstrated notably in terms of mission effectiveness.	V1	V3
AOM-0303 (DS16)	Pan-European OAT Transit Service	The contribution to this Operational Improvement has been done at least in WP11.1 through EXE790. Therefore, the WOC validation	V1	V3

		activities contribute to the development of the OAT Transit service for integration of the military operations into the ATM Network operational environment. Mainly, it has been done through the exchange of the improved OAT flight plan and the EFPL but also through the Advanced Flexible Use of Airspace process (Airspace Reservation).		
AOM-0304-A (DS16)	Mission Trajectories in Step 1 (DS16)	Through EXE716/774/789, the WOC contributes to achieve this improvement by exchanging with the Network Manager at a centralised level the improved and harmonised OAT Flight Plan. Through this format, the inclusion of airspace reservation/restriction with associated target times over the entry/exit points becomes an integral part of the mission trajectory. In addition to the iOAT flight plan, Military transport type aircraft operating exclusively under GAT can provide EFPL message.	V1	V2)
AOM-0501 (DS16)	Free Routing for Flights both in cruise and vertically evolving within low to medium complexity environments	Linked to Solution #33 - Through EXE797 led by project 04.03, 11.01.05 contributed to mature this solution at an initial V2 level by providing Free Route trajectories to ANSP in order to assess the feasibility of Free Route in this low to medium complexity environment. This allowed through a higher optimisation in the trajectory calculation to bring more benefits in terms of cost effectiveness for an Airspace User. Still a new validation cycle is required for this operational improvement in order to get a more accurate view of the future Free Routing airspace setup at this level of complexity.	V1	V2
AUO-0104 (DS16)	Selective Flight Protection	Through EXE730 UDPP, project contributed to validate the feasibility of the SFP concept allowing an Airspace User to protect important flights through the use of Operating Credits by putting other flights out of the congested periods.	V1	V2
AUO-0105 (DS16)	Fleet Assignment Delay	Through EXE730 UDPP linked to the previous OI, project contributed to validate the feasibility of the Fleet	V1	V2

		Delay Assignment process (recalled recently Apportionment) by using the support of a FOC UDPP prototype displaying the cost per flight that dynamically changes depending on the amount of delay and helping the Airspace Users to prioritise their flights. The FOC contribution was done in collaboration with project 07.06.02 (Network Manager), with the support of an airport platform and a strong Airspace User group involvement.		
AUO-0203 (DS16)	EFPL in NM processes	Linked to Solution #37  Through EXE311/616/713, 11.01.05 participated in the validation activities with the flight planning systems providers to exchange the Extended Flight Plan (EFPL) with Network Manager (NM) using B2B SWIM services and with the support of several Airspace Users (AUs). Thanks to this new flight plan format (compared to the ICAO2012) being enriched using 4D profile information and flight performance data, it supported to improve the validation process between the AUs and the NM through a more accurate and consistent data exchange. It also contributes to improve the NM traffic predictions.	V2	V3
AUO-0205-B (DS16)	ATC-ATC, ATC/Aircraft and ATC/NM Update and Revision of the Reference Business/Mission Trajectory (RBT/RMT)	This improvement has been approached in the EXE775 of V2 maturity permitting to simulate the collaborative trajectory management between FOC and ATC. Though operational stakeholders were not part of the validation (hence V2 partial), the results show that the technical feasibility to exchange data between the Flight planning system and the ATC flight data processing system was established. An iterative process has been used as per the improvement objective, in order to allow the Airspace User to choose its most preferred solution to the extent where it is possible from a CDM perspective. In the conditions of the exercise, which has a limited traffic flow and complexity, the number of iterations in the CDM process was in average 1.25 to get a trajectory accepted. Since at this level, the results were encouraging, human	V1	V2 (partial)

		factor assessment will still need to be done to further validate and mature this operational improvement.		
AUO-0210 (DS16)	Participation in CDM through iSMT and Target Time (TTO) negotiation	Through EXE790, 11.01.05 military part has contributed to this OI by validating the CDM process through the exchange of iOAT flight plans and ARES with the Network Manager. Data exchange was including ATM related information specific to mission objectives.	V1	V2
AUO-0211 (DS16)	WOC Management of iRMT via improved OAT FPL	Through EXE789, 11.01.05 military part has contributed to this OI by validating the progress in the status of missions through the exchange of iOAT flight plans.	V1	V2
AUO-0215 (DS16)	Sharing iSMT through improved OAT flight plan	Within the WOC validation activities (EXE716/790), the improved OAT flight plan containing flight intentions enriched with mature information regarding military operational and technical requirements has been developed and shared with the Network Manager. Its maturity has been limited mainly due to further improvements needed at the level of the Network Management system.	V1	V2
AUO-0223 (DS16)	Harmonised and improved integration of airspace and ATC constraints/procedures in trajectories calculated by FOCs and NM.	Within the validation activities through EXE311/616/713 with project 07.06.02 representing NM, work has been undertaken with 11.01.05 to improve the way to take into account the data (ATM constraints: RAD restrictions...) through the flight plan validation process and also to identify the gaps or errors occurred by the misinterpretation between the flight planning system and the IFPS (Integrated Initial Flight Planning System from Network Manager). There are still discussions needed in regards to the other non-mandatory published constraints to get a higher trajectory alignment such as Profile Tuning Restrictions to be further studied in SESAR2020, hence the V2 maturity level achievement.	V1	V2
AUO-0303-A (DS14)	Ground-ground aspects related to iRBT/iRMT revision (executed at ground or	This operational improvement has been initially approached through the EXE710 (Real Time Airspace status data exchange), in order to validate	V1	V1

	flight crew initiative)	the objectives and consequent benefits of optimising trajectories by revision based on the updated status of airspace. Unfortunately, due to time and scope reconsideration, the execution phase went out of the exercise.		
AUO-0303-B (DS14)	Ground-ground aspects related to RBT/RMT revision (executed at ground or flight crew initiative, when aircraft is airborne)	This improvement has been validated at a partial V2 maturity level in the EXE775 Collaborative trajectory management between FOC and ATC.  The project contribution is the same for the OI AUO-0205-B from DS16.	V1	V2 (partial)
MET-0101 (DS16)	Enhanced MET observations, nowcasts and forecasts provided by ATM-MET systems for Step 1	11.01.05 performed an exercise on the use of Global Ensemble weather forecast in cooperation with WP11.2 (MET services). This cooperation permitted to use a new Meteorological model to predict the weather based on probability in order to improve the flight planning process with more information on the weather uncertainty. In this perspective, 11.01.05 contributed to validate one part of this operational improvement.	V1	V2 (partial)
IS-0205 (DS16)	Digital Integrated Briefing for pre-flight phase	Linked to solution #34  This OI has been validated through EXE461 in conjunction with project 13.02.02. Digital briefing support provided by WP11.1 partners was used to validate the benefits of enhanced filtering, sorting and graphical possibilities for the dispatcher and pilot. This digitally enhanced briefing integrating AIS and MET information was presented in an interactive manner to several Airspace Users that participated in the real time simulation.	V1	V3
IS-0206 (DS16)	Digital Integrated Briefing during flight execution phase	The contribution to validate this OI was done in EXE461 using ground and on-board electronic devices for the dispatchers and pilots from civil Airspace Users and Business and General Aviation users. Since the Air Ground SWIM connectivity was not available, the maturity could only reach V2 in this step. The provision of Digital NOTAM and digital MET data showed that it improved the situational awareness of the	V1	V2



		dispatcher and pilots during the execution phase.		
IS-0301 (DS14)	Provision and use of FOC/WOC data to enhance ATM ground system performance.	The provision of FOC/WOC data to enhance ATM ground performance notably in terms of demand and capacity balancing but also in predictability has been validated through several topics such as the use of EFPL, AFUA (ARES) and military flight plans (iOAT and EFPL).	V1	V3
IS-0901-A (DS16)	SWIM for Step1	The contribution to the use of SWIM specifically for the B2B services to share traffic flow management information (including the capability to file and validate flight plans) has been validated through the EXE713 use of Extended Flight plan and EXE710 Real Time Status of Airspace. In those two subjects (EFPL and AFUA), the development and application of SWIM was done in accordance to the SWIM compliance rules.	V1	V3
IS-0901-B (DS16)	SWIM for Step2	There was no contribution in P11.01.05 within EXE461 AIM since but it was defined and validated at the level of concept and requirements in P11.01.01 and P11.01.02.	V0	V1

## 1.2 Project achievements

Through the work performed by WP11.01, the maturity of the following operational areas increased:

- BMT (including Extended Flight plan)
  - The Extended Flight Plan exercise (EXE713) that enabled to mature at V3 the flight planning process between AU and NM showed that a potential reduction of flight plan could reach up to 15%. It evinced as well that the alignment of trajectories will bring benefits in terms of cost effectiveness for an Airspace User but also in terms of predictability for the whole ATM network implying an improved demand and capacity balancing.
- Free Route
  - Although the Free Routing area -having reached V2- will need further research and development activities within SESAR2020, the Free Routing flight planning showed in the configuration of the Exercise 797 that the potential maximum benefits that Free Routing provides would reach:
    - 1.37% in AU cost effectiveness by applying a Minimum Cost Track configuration, and
    - 2.53% in fuel efficiency if applying only a Minimum Fuel Track efficiency.

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- AFUA
  - The exchange of real time airspace status has enabled the FOC in the validation activities to demonstrate that not only flexibility in flight planning is enhanced but also Airspace User cost effectiveness increased thanks to the recalculation of more optimised trajectories based on released Airspace information.
  - The implementation of the AFUA concept during the creation of the Mission Trajectory (WOC) and the sharing of the information to LARA and NM enables the effective use of airspace for all stakeholders.
- UDPP
  - The use of UDPP processes such as FDA and SFP permitted to show as per the exercise results, that there could be a quite interesting over cost reduction due to delays for the Airspace Users in the range of 10-20% independent of the type of operations that was executed in the frame of a Capacity Constrained Situation. The Fleet Delay Apportionment process being as the most used one compared to the SFP that is more used in specific cases, will enable to limit or improve the delay of important flights that have been prioritised.
- Digital Briefing
  - The digital briefing related exercise confirmed the expected benefits in terms of situational awareness enhanced for dispatchers and pilots, reduction of briefing time thanks to a higher readability of NOTAMS and MET information with the support of enhanced digital display and graphical presentation.
- Mission trajectory management
  - The validation exercises demonstrated that Military Airspace Users are able to participate in the ASM processes and the Network Manager's central FPL validation through the use of iOAT Flight Plans and EFPL by using the Secure Exchange Gateway (SEG). The need for the SEG is the connection between WOC and IP networks. The WOC is also able to download aeronautical data from the AIM Domain System/CS5 and to plan cross-border missions.

In relation to the PCP, 11.01.05 contributed to the following solutions as indicated in the project overview and the table of OIs.

- Solution #31 - Variable profile military reserved areas and enhanced civil-military collaboration
- Solution #33 - Free routing for flights both in cruise and vertically-evolving above a specified flight level in low-to-medium density airspace
- Solution #34 - Digital integrated briefing
- Solution #37 - Extended Flight Plan

Those solutions are not implemented yet up to the report date but for the solution #37 EFPL, it is foreseen to be implemented by the Network Manager in 2017. The solution #33 is still to be developed for SESAR2020 in order to get a full V3 maturity and to achieve the implementation target date from 2021. Recommendations in regards to the remaining solutions are mentioned in the conclusion of this report.

## 1.3 Project Deliverables

The following table presents the relevant deliverables that have been produced by the project.

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Reference	Title	Description
D24	Validation report for stand-alone WOC validation for Step 1 – (BMT, AFUA, iOATFPL)	<p>This document describes the validation report for the Wing Operation Centres as described in the "WOC OSED" toward E-OCVM V2.</p> <p>The validation activities demonstrated State Airspace User's Step 1 concepts. The validation was carried out with the WOC prototype, ASM support system, and AIXM5.1 Data from CACD</p>
D28	Validation Report Integrated Validation Across WPs for Step 2 V2 - EXE775 (BMT)	The document reports the results of EXE-11.01.05-VP-775 which analysed a trajectory negotiation between FOC and ATC systems. Exercise confirmed that the concept of trajectory negotiation can help to more efficiently operate flights and use ATM capacity.
D29	Contribution to EXE-07.05.04-VP-710 - AFUA Step 1 V3 Validation Report	<p>This document provides the contribution of WP11.1 to the Validation Report for the RTSA (Real Time Status of Airspace) information sharing concept element of AFUA. It describes the results of the validation exercise defined and reported in 07.05.04 Flexible Airspace Management final validation report under ID D52.</p> <p>Overall, the exercise results allowed for a good appraisal of the validation objectives the users' community expected to be measured. The expectations of the civil airspace users focused primarily on the possible benefits they could get out of the involvement of their FOC organizations in AFUA through the RTSA information sharing.</p>
D26	Update Validation report for stand-alone WOC validation for Step 1 (BMT, AFUA, iOATFPL)	<p>This document encompasses the results of V2/V3 validation exercise VP-789 in Release 5.</p> <p>The exercise VP-789 was successfully conducted at EUROCONTROL Experimental Centre in Brétigny. The selected Use Cases in terms of mission planning and monitoring were demonstrated using the Airbus Defence and Space Mission Planning product OPTARION® and the Air Situation Display product "DMAS". The ASM Cell was represented by "LARA", an application program provided and operated by EUROCONTROL/CMAC. The Network Manager was represented by NMVP, a tool provided and operated by EUROCONTROL. This validation exercise clarified that Military Airspace Users are able to participate in the ASM processes and the Network Manager's central FPL validation and management processes, to download aeronautical data from the ADR and to plan cross-border missions.</p>
D32	Contribution to EXE-13.02.02-VP-461 - AIM Step 1 V3 Validation Report Honeywell	This document provides the validation results of the Honeywell module developed within EXE-13.02.02-VP-461 in ENB02.01.02 AIM/MET OFA (which main Validation report is under ID27). The focus is on the provision of digital NOTAM on ground before the flight and on-board during flight, on electronic

		<p>information devices for non-FOC equipped Business and General Aviation Airspace Users. The validation exercise was performed in Honeywell premises in simulated cockpit environment, evaluating improved human performance by flight crews. The results indicate that actualisation of D-NOTAM during flight brings clear benefits to the flight crews.</p> <p>The prototype was not fully integrated into operational systems and the validation exercise was performed on the maturity level V2.</p>
D33	Contribution to EXE-13.02.02-VP-461 - AIM Step 1 V3 Validation Report Sabre	<p>This deliverable describes the Sabre contribution, as a part of the overall digital enhanced briefing concept by validating the provision of an enhanced flight Information briefing package based on digital data, to EXE-13.02.02-VP-461 (refer to main Validation Report under ID27). Focus of the Sabre contribution to this exercise was the validation of improved situational awareness for pilots and flight dispatchers during all phases of the flight through digitally enhanced flight briefing services from a conceptual and operational point of view. An AIM prototype developed by Sabre producing digital integrated briefing (DIB) was used in this validation exercise and demonstrated that there is a reduction of the briefing time, situational awareness was maintained or increased. Information update capabilities provided were assessed very positively and all different possibilities of updating, requesting and adding new information as well as detecting updated information were assessed as being usable and easy to do.</p>
D30	Contribution to EXE-07.06.02-VP-730 – UDPP Step 2 V2 Validation Report	<p>This contribution to validation report describes the performed activities and results from WP11.01 (FOC) as part of EXE-07.06.02-VP-730 (main VALR is under ID90). The exercise evaluated the Fleet Delay Apportionment (FDA) and Selective Flight Protection (SFP) concepts, which are the two features of the User Driven Prioritisation Process (UDPP) for SESAR Step 2. In conclusion, FDA and SFP are both needed, rather than just one or the other. Generally, it was FDA that provided most to achieving the goal of the airspace user. SFP is a very strong tool with much higher impact to the flight program as it requires suspension of at least one flight. Therefore most AU's defined the SFP process as last card to be played if nothing else is possible any more.</p>
D31	Contribution to EXE-07.06.02-VP-713 – EFPL Step 1 V3 Validation Report	<p>This document contains the contribution from Lufthansa Systems and Sabre (WP11.1 members) perspective for the Validation Report of the EXE-07.06.02-VP-713 (under ID55), which is performed in the context of OFA03.01.04: Business and Mission Trajectory. This validation exercise aims at exploring the feasibility of the EFPL (Extended</p>

		<p>Flight Plan) data exchange between airspace users and the Network Manager. In particular this validation exercise takes a look onto flight plan processing, predictability, DCB and human performance. This exercise was therefore performed in close collaboration with a number of airspace users that provided EFPL data for their operational flights. Apart from that the feasibility to provide EFPLs in a FIXM format was explored. To that end, Lufthansa Systems and EUROCONTROL developed prototype systems that were able to provide and handle EFPLs in a FIXM format.</p> <p>The validation exercise has shown that the use of the EFPL for filing is already on a high maturity level.</p>
D23	Contribution to EXE-04.03-VP-797-Free Route Step 1 V2 Validation Report	<p>This document contains the contribution from Lufthansa Systems and Sabre (WP11.1 members) perspective for the Validation Report of the EXE04.03-VP-797 (under IDM602), which is performed in the context of OFA03.01.03 Free Routing. This validation exercise aims at exploring the feasibility of the Free Route Airspace concept in low and medium complexity environments. To that end, Free Route trajectories for multiple Free Routing Airspaces setups have been calculated that demonstrate the potential benefits that Free Route operations provide from a flight planning perspective to the airspace user in terms of fuel efficiency and airspace user cost effectiveness. The main Validation Report is a P04.03 document provided by skyguide and DSNA, which integrates the findings of this report.</p>
D27	Update Validation report for stand-alone WOC validation for Step1 (BMT, AFUA, iOATFPL)	<p>This document contains the validation results for the exercise VP-790 that demonstrated State Airspace User's Step 1 concepts, carried out with the WOC prototype, the Secure Exchange Gateway (SEG), LARA as an ASM support system, and the NMVP system (NM B2B web services, IFPS, CACD). The concept was validated in these 2 areas: support of the ARES CDM process; bi-directional data exchange with non-military IP networks. The focus of this exercise was therefore the participation of the WOC in the ARES CDM process as well as the impact of the Secure Exchange Gateway (SEG) on the connection of the WOC network with other non-military networks having different classification levels. In conclusion, the SEG is a pre-requisite for the WOC to take part in online CDM.</p>

In this deliverable list, the document contents relate to Validation results specifically though the exercise plan is included as well in those reports in a summarized way. Many of those deliverables are contribution to Validation Reports since 11.01.05 was mainly for the civil activities, contributing to exercises led by other SESAR projects. Final Validation Reports identification numbers are indicated in the description of the associated deliverables.

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## 1.4 Contribution to Standardisation

The project 11.01.05 contributed indirectly to the standardisation since it is focussed on the validation of the operational improvements. Still, the tools and platforms that were provided by project 11.01.04 were in some cases following the standardisation aspects as the FIXM standard. Please refer to project 11.01.03 and 11.01.04 for further information on this subject.

## 1.5 Project Conclusion and Recommendations

In conclusion, P11.01.05 contributed to the solutions part of the PCP as indicated in the project achievements section. Those solutions have reached a V3 maturity level including Extended Flight Plan, the Variable profile military reserved areas and enhanced civil-military collaboration and Digital integrated briefing. Therefore those are ready to go to next phase V4 which is industrialisation. The solution #33 Free Routing for flights both in cruise and vertically-evolving above a specified flight level in low-to-medium density airspace is considered to be further studied in SESAR2020.

Even if those solutions have been finalised at V3 level, some recommendations below need to be taken into account for the next phase V4 and in SESAR2020 for the respective subjects:

- Solution #31 - Variable profile military reserved areas and enhanced civil-military collaboration

Even if the validation objectives of the airspace users have been demonstrated in the exercise environment, some limitations need to be considered for the next phase such as:

Inclusion of the flights in execution since it is a key component of the industrial environment and does influence the impact assessment the stakeholders would actually perform.

A structured and agreed setup for the list of eligible flights and a B2B connection to facilitate the information exchange between the FOC and the NM in order to perform a CDM process as effectively required in an actual environment.

Finally, the FOC involvement in the decisions of additional ARES publications while the airspace use plan is in execution should be considered in order to take into account the civil AUs evaluation of the their traffic status from the overall impact assessment. This should be done by enhancing also the interaction between the FOC and the NM through the AOLO (Aircraft Operators Liaison Officers) function.

- Solution #34 - Digital integrated briefing

The usage of digital NOTAM and MET information in the pre-flight phase brings clear benefits to dispatchers and pilots in terms of improved situational awareness, flight time and potential reduced fuel consumption. However, some recommendations and further improvements should be considered in the scope of future developments such as specificities associated to the HMI design. Also, real in-flight usage tests would bring valuable data to identify the types of situation that occur most frequently in order to better suit the user needs in terms of digital information provision and display.

- Solution #37 - Extended Flight Plan

Even if the concept is already on a very high maturity level, further items should be addressed in future activities that will be required for the introduction of the concept into flight operations.

Differences still exist between the trajectory provided by the airspace user and the one processed and replied by the NM. On one hand the use of Profile Tuning Restrictions in the NM system and on the other hand deviating implementations of aeronautical data in the different systems are sources for

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such deviations. It should be investigated how these differences could be reduced or whether special procedures could be designed that lead to a better alignment of both trajectories.

The information provided in the reject message reply by NM could be improved and enriched by allowing graphical information in order to improve the Airspace user (flight dispatcher) view onto the trajectory and the understanding of the reject reason.

This validation exercise, especially the part related to the FIXM usage, showed that the use of certain units of measure impacts the validity of a flight plan significantly. Therefore the item units of measure and the related granularity of data should be addressed again to agree on the appropriate units and related procedures of use.

Most of the airspace user pointed out that the definition and standardization of processes, procedures and formats related to the exchange of EFPLs is required and seen as important. Currently the processes related to the EFPL filing were equal to those used for the ICAO flight plan. However, further investigation should be performed on how to deal with differences between the AU planned trajectory and the trajectory replied and processed by NM.

Therefore, as a first step, a more operational approach could be done for EFPL implementation that offers the airspace user the possibility to plan some flights using EFPL and to become familiar with the concept. Hence an approach involving the airspace users as soon as possible would be recommended for the implementation phase. A working group could be created in parallel of the implementation during the learning curve to identify gaps in processes in order to reach the full benefits of the EFPL.

And some recommendations for the solution at maturity V2:

- Solution #33 - Free routing for flights both in cruise and vertically-evolving above a specified flight level in low-to-medium density airspace

At general level, it should be ensured that the on-going and future implementation projects regarding Free Route are implemented such that synchronization and standardisation between them is easily possible.

One important factor that should be considered in this area is the handling of hotspots evolving due to Free Route trajectories. The validation results showed that CTOTs are not satisfactory as the sole constraint regulation measurement. Furthermore, restrictions can no longer be attached to segments in a Free Routing Airspace, therefore, it is expected that volume based restrictions will be used. While there is a need for some restrictions in order for ATC and NM to manage the traffic, they should be limited to the necessary minimum.



## 2 References

- [1] SESAR Programme Management Plan, Edition 03.00.01
- [2] [European ATM Master Plan](#)
- [3] Multilateral Framework Agreement (“MFA”) signed between the SJU, EUROCONTROL and its 15 selected members on August 11, 2009, amended on 14 June 2010, 19 October 2010 and 2 July 2012
- [4] SESAR Solutions Catalogue, First Edition, 2016
- [5] 11.01.05 Pre-Operational Validation, PIR, D08, 00.00.04, 17/12/2014
- [6] 11.01.05 Pre-Operational Validation, Contribution to EXE-07.05.04-VP-710 - AFUA Step 1 V3 Validation Report, D29, 00.01.00, 10/09/2015
- [7] 11.01.05 Pre-Operational Validation, Contribution to EXE-13.02.02-VP-461 AIM Validation Report Honeywell, D32, 00.01.00, 21/04/2016
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- [9] 11.01.05 Pre-Operational Validation, Contribution to EXE-07.06.02-VP-713- EFPL Step 1 V3 Validation Report, D31, 00.01.00, 21/07/2016
- [10] 11.01.05 Pre-Operational Validation, Contribution to EXE-07.06. 02-VP-730 - UDPP Step2 V2 Validation Report, D30, 00.01.00, 01/07/2016
- [11] 11.01.05 Pre-Operational Validation, Update Validation report for stand-alone WOC validation for Step 1 (BMT, AFUA, iOATFPL), D19, 00.01.00, 08/04/2016
- [12] 11.01.05 Pre-Operational Validation, Validation Report Integrated Validation Across WPs for Step 2 V2 - EXE775 (BMT), D28, 00.02.00, 22/05/2015
- [13] 11.01.05 Pre-Operational Validation, FOC Validation Report – EXE-791 Step1 V2 (BMT-MET), D25, 00.02.00, 25/05/2016
- [14] 11.01.05 Pre-Operational Validation, Contribution to EXE-04.03-VP-797- Free Route Step 1 V2 Validation Report, D23, 00.01.00, 19/08/2016
- [15] 11.01.05 Pre-Operational Validation, Update Validation report for stand-alone WOC validation for Step1 (BMT, AFUA, iOATFPL), D27, 01.00.00, 30/08/2016
- [16] List of all project deliverables:
  - D08, Project Initiation Report
  - D10, D11.1.5-1ma-WOC - WOC Validation Plan Step 1 (BMT, AFUA, iOATFPL)
  - D11, D11.1.5.1ca-BMT - FOC Validation plan - EXE775 Step 2 V2 (BMT)
  - D12, D11.1.5.1ca-UDPP - Contribution to EXE-07.06.02-VP-730 – UDPP Step 2 V2 Validation Plan
  - D13, D11.1.5.1ca-AIM - Contribution to EXE-13.02.02-VP-461 – AIM Step 1 V3 Validation Plan
  - D09, D11.1.5-1ca-AFUA - Contribution to EXE-07.05.04-VP-710 – AFUA Step 1 V3 Validation Plan
  - D15, D11.1.5-1ca-MET - FOC Validation Plan - EXE-791 Step 1 V2 (BMT-MET)
  - D16, D11.1.5-1ca-EFPL - Contribution to EXE-07.06.02-VP-713 – EFPL Step 1 V3 Validation Plan
  - D17, D11.1.5-1ca-FR - Contribution to EXE-04.03-VP-797– Free Route Step 1 V2 Validation Plan
  - D18, D11.1.5-1cb-UDPP - Update Contribution to EXE-07.06.02-VP-730 – UDPP Step 2 V2 Validation Plan
  - D19, D11.1.5-1mb-WOC - Update WOC Validation plan Step 1 (BMT, AFUA, iOATFPL)

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- D20, D11.1.5-1cb-AIM - Update Contribution to EXE-13.02.02-VP-461 – AIM Step 1 V3 Validation Plan
- D22, D11.1.5-1mc-WOC - Update WOC Validation plan Step1 (BMT, AFUA, iOATFPL)
- D23, D11.1.5-3ca-FR - Contribution to EXE-04.03-VP-797– Free Route Step 1 V2 Validation Report
- D24, D11.1.5-2ma-WOC - Validation report for stand-alone WOC validation for Step 1 - (BMT, AFUA, iOATFPL)
- D25, D11.1.5-2ca-MET - Validation Report for stand-alone FOC Step1 V2 -EXE791 (BMT-MET)
- D26, D11.1.5-2mb-WOC - Update Validation report for stand-alone WOC validation for Step 1 (BMT, AFUA, iOATFPL)
- D27, D11.1.5-2mc-WOC - Update Validation report for stand-alone WOC validation for Step 1 (BMT, AFUA, iOATFPL)
- D28, D11.1.5.3c-BMT - Validation Report integrated validation across WPs for Step 2 V2– EXE775 (BMT)
- D29, D11.1.5.3c-AFUA - Contribution to EXE-07.05.04-VP-710 – AFUA Step 1 V3 Validation Report
- D30, D11.1.5-3ca-UDPP - Contribution to EXE-07.06.02-VP-730 – UDPP Step 2 V2 Validation Report
- D31, D11.1.5-3ca-EFPL - Contribution to EXE-07.06.02-VP-713 – EFPL Step 1 V3 Validation Report
- D32, D11.1.5-3ca-AIM-HON - Contribution to EXE-13.02.02-VP-461 - AIM Step 1 V3 Validation Report Honeywell
- D33, D11.1.5-3ca-AIM-SAB - Contribution to EXE-13.02.02-VP-461 - AIM Step 1 V3 Validation Report Sabre
- D35, D11.1.5-6 Final Project Report

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