Final Project Report

Deliverable ID:	**D1.2**
Dissemination Level:	**PU**
Project Acronym:	**PJ07 OAUO**
Grant:	**733020**
Call:	**H2020-SESAR-2015-2**
Topic:	**SESAR.IR-VLD.Wave1-09-2015**
Consortium Coordinator:	**EUROCONTROL**
Edition date:	**11 Dec 2019**
Edition:	**00.01.02**
Template Edition:	**02.00.01**

Authoring & Approval

Authors of the document

Name/Beneficiary	Position/Title	Date
Kris Delcourte/EUROCONTROL	Project Manager	06/11/2019
Gérard Mavoian/EUROCONTROL	Solution Leader	30/11/2019
Nadine Pilon/EUROCONTROL	Solution Leader	30/11/2019
Klaus-Dieter Hermann/AIRBUS DS	Solution Leader	30/11/2019
Norbert Kupsch/AIRBUS DS	Project Member	02/12/2019

Reviewers internal to the project

Name/Beneficiary	Position/Title	Date
Kris Delcourte/EUROCONTROL	PM	02/12/2019
Etienne De Mûelenaere/ EUROCONTROL	PCIL	10/12/2019
Gérard Mavoian/EUROCONTROL	Solution 1 Lead	10/12/2019
Nadine Pilon/EUROCONTROL	Solution 2 Lead	10/12/2019
Klaus-Dieter Hermann/AIRBUS DS	Solution 3 Lead	10/12/2019
Petr Hlousek/ANS CR (B4)	Project Member	10/12/2019
Morad Hripane/DSNA	Project Member	10/12/2019
Eva Puntero Parla/ENAIRE	Project Member	10/12/2019
Frédéric Rousseau/ATOS	Project Member	10/12/2019
Daniel Chiesa/AIRBUS	Project Member	10/12/2019
Gonzalo Quiles Albert/Indra	Project Member	10/12/2019
Daniel Muller/Thales	Project Member	10/12/2019
Edgar Reuber/EUROCONTROL	PJ.18-01a, Activity Lead	02/12/2019

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

Name/Beneficiary	Position/Title	Date
Kris Delcourte/EUROCONTROL	PM	11/12/2019
Etienne De Mûelenaere/ EUROCONTROL	PCIL	11/12/2019
Gérard Mavoian/EUROCONTROL	Solution 1 Lead	11/12/2019

Nadine Pilon/EUROCONTROL	Solution 2 Lead	11/12/2019
Klaus-Dieter Hermann/AIRBUS DS	Solution 3 Lead	11/12/2019
Petr Hlousek/ANS CR (B4)	Project Member	11/12/2019
Morad Hripane/DSNA	Project Member	11/12/2019
Eva Puntero Parla/ENAIRE	Project Member	11/12/2019
Frédéric Rousseau/ATOS	Project Member	11/12/2019
Daniel Chiesa/AIRBUS	Project Member	11/12/2019
Gonzalo Quiles Albert/Indra	Project Member	11/12/2019
Daniel Muller/Thales	Project Member	11/12/2019

Rejected By - Representatives of beneficiaries involved in the project

Name/Beneficiary	Position/Title	Date

Document History

Edition	Date	Status	Author	Justification
00.00.01	06/11/2019	Draft	Kris Delcourte	First Draft
00.01.00	02/12/2019	Final Draft for review	Gérard Mavoian, Nadine Pilon, Klaus-Dieter Hermann, Norbert Kupsch	Review and completion Solution Specific parts
00.01.01	10/12/2019	Final version	Kris Delcourte	Review by beneficiaries: integrated comments received from Daniel Chiesa/AIRBUS
00.01.02	11/12/2019	Final version	Kris Delcourte	Update of table 3 “Project maturity” with inputs form Solution Leaders

PJ07 OAUO

PJ07 OPTIMISED AIRSPACE USERS OPERATIONS

This Final Project Report is part of a project that has received funding from the SESAR Joint Undertaking under grant agreement No 733020 under European Union's Horizon 2020 research and innovation programme.

Abstract

PJ07 Optimized Airspace Users Operations project is addressing the evolution of Airspace Users processes and tools towards their full integration as ATM stakeholders. In this context, PJ07 represents the AUs' "contribution" to CDM processes addressed by a number of S2020 projects (such as PJ04, PJ06, PJ08, PJ09, PJ18), ensuring effective integration of AU's within ATM in the SESAR 2020 horizon.

PJ07 project intends to bring major benefits to both civil and military Airspace Users by taking into account the airspace users' evolving business needs.

The overall project objectives of PJ07, as formulated at the beginning of the project, are:

- PJ07 Optimized Airspace Users Operations aims at improved Airspace Users' participation - through their Flight/Wing Operations Centre - into ATM Network Collaborative Processes in the future Trajectory Based Operations (TBO) - and Collaborative Decision Making environment. The objective is to improve the planning of flights taking into account existing ATM constraints and to minimize impacts of deteriorated operations for all stakeholders including Airspace Users, in relation with the current ICAO approach on the establishment of a collaborative environment for flights & flow planning (FF-ICE).

- The PJ07 Optimized Airspace Users Operations project will include further evolution of the Airspace Users ATM processes and tools developed in SESAR1. The SESAR1 projects have established the basis for sharing more information (e.g. preferences) at planning phase between Flight/Wing Operations Centres and ATM stakeholders through the use of the Extended Flight Plan (EFPL) and the improved OAT Flight Plan (iOAT FPL). For the User Driven Prioritization Process (UDPP), Airspace

Users have defined methods beyond slot swapping to protect important flights in capacity constraints.

• The co-definition and validation by Airspace Users and ATM stakeholders of the additional information in future trajectories and how it should be used (trajectory management processes), as well as the integration of UDPP within the Trajectory Management processes and the Demand Capacity Balancing (DCB) processes are the objectives of PJ07 together with PJ18 and PJ09. UDPP validation started in SESAR1 will be completed in PJ07 in collaboration with the ATM stakeholders in PJ09 and PJ04.

PJ07 Optimized Airspace Users Operations is structured along 3 SESAR Solutions:

- PJ07-01 - Airspace Users' Processes for Trajectory Definition.
- PJ07-02 - Airspace Users' Fleet Prioritisation and Preferences (UDPP).
- PJ07-03 - Mission Trajectory Driven Processes.

This Final Project Report will describe the main achievements of the project for each of the three solutions.

Table of Contents

List of Tables

List of Figures

Executive Summary

The SESAR 2020 Optimised Airspace User Operations Project (OAUO) or PJ07 is an Industrial Research project that addresses both civil and military airspace users (AUs), by further improving their processes and tools in relation to their interaction with ATM Network Operations, with at its heart an improved Collaborative Decision-Making (CDM) process that takes into account the evolving business needs of airspace users.

PJ07 is structured along three solutions. These solutions were a continuation of SESAR I. In SESAR 2020 some new concepts were introduced and the solutions have evolved those concepts to a higher level of maturity via development of requirements, prototypes and the execution of validation exercises.

The three solutions and their main achievements are described hereafter.

1. **"Airspace Users Processes for Trajectory Definition"** has as main objective to develop requirements and validated procedures and workflows for Flight Operations Centres enabling them to interact better with other ATM stakeholders. This is especially the case with the Network Manager regarding trajectory definition in the planning phase. The solution addressed mainly 2 operational improvements:

- AUO-0219: Use of Enriched DCB Information and Enhanced What-Ifs to Improve AU Flight Planning;

- AUO-0208: Use of Simple AU Preferences in DCB Processes.

The main results from Solution 1 are the following:

Regarding the clarification of concepts, it concerns in particular the following points:

- DCB information and what-if functions need to be integrated with AU flight planning processes and systems in order to improve trajectory optimisation and enable automation of decisions.

- Different types of hotspots need to be defined as shared information between flow managers and AUs in order to improve CDM processes and reduce the risk of network instability.

- Regarding AU simple preferences as input to DCB processes, two types of flight delay criticality indicators (FDCIs) have been defined: Proactive FDCI issued for critical flights before any DCB measure is allocated and Reactive FDCI for corrective action by NMF to reduce the impact.

  Information flows and content as well as procedures and rules have been defined and fully agreed for reactive FDCI while some elements need to be defined yet for proactive FDCI.

Concerning performance assessment, the validation has provided the following results:

- High benefits in terms of departure punctuality and AU cost-efficiency (in particular a 26% reduction of ATFCM delays in Winter period can be expected);

- A slight degradation in terms of fuel efficiency (+37 Kgs per refilled flight, +0.006 kg per flight ECAC wide) and predictability KPAs due to the increase of flight plan changes to avoid DCB constraints. However, the results of the validation can be considered overall very positive since the impact is very limited (at least in nominal situations and out of highly constrained network situation like in Summer);

- No specific impact on equity.

2.“**Airspace Users Fleet Priorities and Preferences Processes (UDPP)**” aims at integrating smoothly the priorities of airspace users via the User Driven Prioritisation Process (UDPP) with collaborative processes at airports and in Network DCB processes, allowing those processes to perform multi-criteria optimisation tasks involving many stakeholders. Beyond this main objective aiming towards V2 maturity, in V1 this solution also addresses how airspace users that are regular users at a given airport but with only few flights, typically less than 6 flights (called Low Volume Users in a Constraint – LVUC –) can prioritise their flights. Finally in V1 as well, the solution addressed preferences in a joint research with solution1 exploring how DCB could select flights for DCB light measures based on information (e.g. preferences) provided by airspace users –named “absolute priority”, in contrast with the “relative priority” of flights within an AU’s own fleet used in UDPP-.

For the main activity in V2, the solution focused on the validation of Operational Improvements (OI) AUO-0109: “UDPP for Airport Constraints” with the UDPP service to AUs; and partially AUO-0110: “UDPP for Network Constraints”, for the integration in the Network environment under the DCB “full delegation” mode, which represents the current operating environment. The process allows airspace users to prioritize their flights given a Capacity Constrained Situation (CCS) on departure, arrival and/or en-route and provides the users with a “What If prio” that returns the impact of the Network on the proposed AU solution. The process does not resolve the total amount of delay caused by the capacity constraint, but permits airspace users to rearrange their flights according to their own business needs and therefore to reduce the impact of delays on their operational costs. The validation exercise was performed together with PJ04.02 in Total Airport Management, which tested the use of UDPP at an Airport Operations Center (APOC) focusing only on stand allocation planning on arrival.

The main results from Solution 2 are the following:

- The validation exercise based on the used prototyping tools has demonstrated that UDPP will bring benefits in punctuality and flexibility while maintaining equity between AUs, as well as providing substantial cost savings for the Airspace Users of up to 58% of the costs caused by ATFCM delays. UDPP is considered as operationally feasible by Airspace users and acceptable by Airport representatives although the limited scope made the exercise not fully conclusive.

- From this main validation exercise we can conclude that the UDPP for Airport Constraints (AUO-0109) has reached V2 level of maturity from the perspective of the airspace user operational feasibility and has validated to V2 the full autonomy delegation mode of DCB.

- Operational acceptance and feasibility of UDPP was further demonstrated at a shadow trial exercise that took place at the SWISS airline OCC in Zürich for PJ25.

Concerning Cost/Benefit Analysis, the solution will provide the following benefits:

- Considering the deployment of UDPP at ECAC-level of Operational Improvement (OI) Step[1] AUO-0109 (UDPP for Airport constraints), the main benefit is the **reduced impact of a regulation for airspace users** (monetised in the CBA). Some of the other benefits are: a) improved passenger experience (fewer missed connections, fewer cancellations/diversions, fewer overnights due to curfew); b) improvement in punctuality; c) improvement in flexibility.
- The CBA based on an average 40% reduction of the cost of additional ATFM delay extrapolated at ECAC level , has calculated a total Net Present Value of 192 M€ in 2035 with conservative assumption that the deployment would start in 2025.

3. "**Mission Trajectory-driven Processes**", has the same major objective as the first solution, but will refine the Mission trajectory concept as part of the ATM CONOPS and focus on harmonisation of improved OAT flight plans to be developed, processed and distributed to all pertaining actors through WOC systems/functions facilitating integration of initial Mission trajectory into ATM network operations.

The main results from Solution 3 are the following:

- Full V2 level of Maturity was reached for the full solution scope of PJ07.03 including all 6 Operational Improvements (OIs). For that purpose one last V2 validation exercise was executed as a follow up of SESAR I. The usability of initial Mission Trajectories for planning and execution of State Airspace User's Missions in the SESAR environment and the exchange of related data as iOAT FPL between WOC, Regional ATFCM and En-Route/Approach ATS could be successfully demonstrated. The focus of this last validation exercise was on the execution phase as a Real-time Simulation. The exercise demonstrated feasibility of the operational processes and technical systems to support Mission needs with the iOAT FPL.
- An important first step on the road towards V3 level of maturity has been taken with the successful execution of a first V3 exercise. In this first exercise, the technical and operational feasibility of planning Mission Trajectories using the improved (iOAT FPL) was successfully demonstrated. The improved Operational Air Traffic Flight Plan shall generally 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

[1] PJ.07-02 also contains two[1] other OI steps that are not included because (a) AUO-0107 (Prioritisation for Low Volume Users in a Constraint) is still in V1 and will become an Exploratory Research topic and (b) AUO-0110 (UDPP for Network constraints) was only partially validated in Wave 1 and it was not possible to quantify the full benefits (to be included in the V3 CBA). In addition, Dataset 20 Draft includes AUO-0106 (Re-prioritising flights during Execution) as a PJ.07-02 OI Step; however, the Project has a Change Request to unlink the solution in the dataset.

mission requirements, the use of existing Exemption Mechanisms was successfully validated. In addition, this exercise has proven that it is technical feasible to integrate the Mission Trajectory via iOAT FPLs in the regional (NM) and sub-regional/local (FMP) ATFCM systems.

Concerning Cost/Benefit Analysis, the solution will provide following benefits:

- Compliance to the RAD should decrease the complexity for the Network Manager (NM) & Air Traffic Control (ATC) units due to the reduced complexity of OAT and GAT (General Air Traffic) trajectory interactions.
- Military flight planning efficiency will increase through information sharing and the full integration of Military Wing Operation Centres (WOC) in the overall Air Traffic Management.
- Sharing of the full military trajectory should lead to some predictability improvements on the civil side. This additional level of awareness could also reduce associated capacity buffers and provide a small increase in capacity.

1 Project Overview

Project PJ07 focusses on the needs of the Airspace Users and the integration of the Airspace Users in the Network Collaborative processes.

1.1 Operational/Technical Context

1.1.1 **Solution 1-**Airspace Users Processes for Trajectory Definition

Solution PJ07-01 had as main objective the development of requirements and validation of procedures and workflows for Flight Operations Centres (FOC), enabling them to better interact with other ATM stakeholders and especially with the Network Manager Function (NMF) with regard to trajectory definition in the planning phase (preliminary flight plan preparation, use of ATFM Measures and enriched DCB information).

1.1.2 **Solution 2-**Airspace Users Fleet Priorities and Preferences Processes (UDPP)

Today, AUs' views are not sufficiently represented in case of important delays and they need further flexibility, i.e., the ability of the ATM system to accommodate AUs' changing business priorities when demand exceeds the available capacity and to reduce the impact of delay. In SESAR, AUs have recommended to define a User-Driven Prioritisation Process (UDPP) allowing them during planning to reduce the impact of delays on their operations.

With air traffic growth, the European Air Traffic Management Network is about to reach its capacity limits, generating increasing delays to flights and for passengers. To address such increases in delay striving to augment the capacity is complementary to reducing the impact of the delay on airlines and passengers, followed with the User Driven Prioritization Process (UDPP) in solution 2. Aiming to provide additional flexibility for airlines within constrained situations where delays occur during the planning phase, this concept allows prioritisation over several flights, beyond the current slot swapping process by reducing the impact of the delay on airlines and passengers. This process would be an integral part of the collaborative ATM network management framework.

UDPP started in SESAR and addressed both Quick-Wins developments with Enhanced Slot Swapping now deployed in EUROCONTROL NM and Departure Flexibility with DFLEX deployed at CDG airport; and innovative research following an iterative elaboration and validation of a full prioritisation concept that was continued in Solution2 Wave1.

The operational and technical context in which UDPP should operate is during the planning phase when imbalances have to be solved by DCB that involve many flights and can be solved with UDPP – typically for airports imbalances where the only way to solve a congestion is to impose delays on certain flights. UDPP is a service to airspace users connected on the Network through their own tools in the Flight Operations Center. The collaborative planning process involves the airport, the airlines and the Network manager.

1.1.3 **Solution 3-**Mission Trajectory-driven Processes

The solution refers, through a full integration of all operational nodes within the entire ATM system, to the updating of the processes of all operational nodes for the management of the shared and reference initial Mission Trajectory (iSMT/iRMT). These processes respond to the need to accommodate individual military Airspace User needs and priorities without compromising optimum ATM system outcome and the performances of all stakeholders.

Since every nation (currently) has different procedures, the solution highlights the recommended best practices from the point of view of a (future) WOC function and supporting Technical Systems in line with the SESAR driven ATM evolution. It does neither deal with the differences amongst State Airspace Users' processes around Europe, nor try to show nation's peculiarities.

Trajectory Based Operation, or more specifically 4D Trajectory Management, facilitates a fundamental shift away from the management of flights through tactical intervention towards a more strategic focus on planning and intervention by exception. This enables the effective dynamic adjustment of airspace characteristics in order to meet predicted demand, whilst aiming to keep any distortion to the Business/Mission Trajectories to the absolute minimum, as well as providing sufficient flexibility for optimisation purposes.

The concept does not question those tactical actions necessary for safety reasons or those needed to handle non-nominal situations.

The use of a single reference trajectory through a common data set, shared between all actors from the planning phase onwards, represents the backbone for its subsequent management. The management through time and the sharing of flight relevant data amongst all involved actors improves the reactivity, the interoperability and the performance of the network as a whole, facilitating an improved environment within which Airspace Users specific needs can be better accommodated.

The trajectory is shared in the planning phase as the iSMT, based on the preferred trajectory developed internally by the AU. The iSMT is progressively refined through a collaborative iterative process as the planning phase progresses, to take account of, and reflect, the most up-to-date data, ATM constraints and 4D targets.

When specific conditions are met, the iSMT becomes the iRMT. This transition represents end state of the planning phase and beginning of the execution phase.

The iRMT describes the trajectory the Airspace User has agreed to fly and the ANSPs and Airports agree to facilitate. Such data need to be amended through a revision process in order to reflect the current trajectory to be flown by the aircraft. Indeed, this iRMT "reference trajectory" is the fundamental element, i.e. the heart, of the Flight Relevant Data Set, which contains all the data necessary to support all actors' needs for the preparation and execution of the flight.

1.2 Project Scope and Objectives

1.2.1 **Solution 1-**Airspace Users Processes for Trajectory Definition

PJ07.01 has developed 3 topics:

1. Use of Enriched DCB Information and Enhanced What-Ifs to Improve AU Flight Planning (AUO-0219)

"Enriched DCB information will be available to improve AUs decision process when planning or re-planning trajectories. Enriched DCB information encompasses DCB constraints/measures information like ATFCM regulations/CTOT/STAM, and additional DCB information such as hotspots and congestion level indicators. Enriched DCB information is provided either for the trajectory planned by the AU as part of a submitted flight plan or for alternative trajectories considered in the context of advanced what-if. The information can be used in different use-cases: proactive management of fleet delays by AUs or by CDM processes triggered by flow managers (e.g. STAM/Cherry picking measures).
Enriched DCB information and advanced what-if functions will be accessible via SWIM services to enable full integration of flight planning and ATFCM information in AU systems and further automation of AU decisions related to flow management constraints.

Within this topic, the solution aimed at refining:

- Operational requirements for the provision of enriched DCB information (like Hotspots and Congestion Level Indicators) along the Flight Plan and Trial Request Desired Route/Trajectory and along alternative Route/Trajectories that the Airspace User may submit to the Network Management Function, during a Route/Trajectory change negotiation/coordination activity.
- Operational requirements for the provision and the usage of the Trial Request for the Airspace User to analyse possible trajectory alternatives or for Network Management Function to propose alternative options to the Airspace user.

NOTE: In term of DCB information provided to AUs in flight planning, two categories are distinguished:

- *Core DCB Information* provided as part of core FF-ICE services (planning, filing, trial):
  - DCB constraints: the activated ATM constraints (for DCB reasons) that affect a trajectory (e.g. ATFCM regulations, scenarios applied to the flight).
  - DCB measures: it is a trajectory change that is notified to an AU for a flight due to DCB constraints (e.g. CTOT or Target time, re-routing or level-capping imposed in the context of scenarios or STAMs).
- *Enriched DCB information* that could be provided to AUs as part of an extension of the FF-ICE services: in addition to DCB constraints and measures, information provided to AU to give awareness of DCB situation along the trajectory (and possibly nearby the trajectory depending on AU requirements). This includes for example hotspot information, congestion level indicators, provisional CTOT/TT (CTOT/TT information before officially published).

2. Use of Simple AU Preferences in DCB Processes (AUO-0208)

"As part of CDM processes, the AU can provide preferences information either before or after the publication of DCB constraints. This information can be taken into account in the DCB processes to define measures reducing the impact on the AU costs. Simple preferences refer more specifically to light information like flight delay criticality indication (FDCI) that can be considered by NMF human operators and systems - either at regional, sub-regional or local levels - to avoid ATFCM delay (e.g. slot exemption or level capping/re-routing proposal to avoid an ATFCM regulation) for critical flights."

Within this topic, the solution aimed at refining:

- Operational requirements for the provision of the simple AU preferences (Flight Delay Criticality Indicators (FDCIs)) to indicate that the flight is critical and the use of this information by the NMF.

3. Preliminary flight planning (AU0-0207)

In the flight-planning phase, the SBT management processes are aligned with ICAO FF-ICE increment 1 scenarios. SBT management will start with the provision of the Preliminary Flight Plan (PFP) by the AU triggering trajectory negotiation processes and ATM constraints information exchanges along the planned trajectory. Anticipated provision of PFPs will allow improved traffic predictions and better knowledge of AU's optimum trajectories leading to more efficient ASM and DCB processes in pre-tactical (from D-6 to D-1) and early tactical planning phases."

1.2.2 **Solution 2-**Airspace Users Fleet Priorities and Preferences Processes (UDPP)

AUO-0109: UDPP for Airport constraints;

AUs driven prioritisation process (UDPP) running during planning phase, allowing prioritisation coming from AUs to decrease the impact on their fleet in case of an Airport constraint (e.g. runway saturation). Airports in collaboration with the AUs involved have to come up with a solution to manage the Airport constraint taking into account the network situation if impacted. The ambition in Wave1 is to reach V2 for this OI.

Comment on this OI definition:

Some flights could be airborne; some others could be still on-ground. This is especially true for UDPP on Arrival. In this case UDPP has to manage airborne flights in the constraint but also flight not subject to ATFCM measures).

AUO-0110: UDPP for Network constraints (Wave 2);

AUs driven prioritisation process (UDPP) running during planning phase, allowing prioritisation coming from AUs to decrease the impact on their fleet when several flights are involved into one or several network constraints managed by possibly several FMPs -including FMP at Airports- that need to be reconciled. Although this OI is partially addressed Wave1, its full completion and in particular its V2 validation activities are planned to be completed for V2 maturity in Wave2.

AUO-0107: UDPP for Low Volume Airspace Users in a constraint;

Research in SESAR1 allowed elaborating a method considered acceptable by all AUs, which needs further investigation. Research continues in SESAR2020 on an adaptation of UDPP for LVUC. The aim is to establish, using expert judgment, the conditions to allow LVUC to use the same UDPP prioritisation methods as the other AUs (thus allowing bringing this OI to the same maturity as **AUO-0109**). Beyond expert judgment, no specific validation activity is foreseen.

PJ07-02 covers the below OIs with the aim to reach the target maturity levels at the end of SESAR2020 Wave 1.

OIs	Initial Maturity level	Target Maturity level at the end of Wave 1	OIs description
AUO-0109	Mid-V2 (V1)	V2	UDPP for Airport constraints
AUO-0110	Mid-V2 (V1)	Mid-V2 (V1)	UDPP for Network constraints : will be addressed in Wave 2
AUO-0107	Mid-V1 (V0)	Mid-V1 (V0)	UDPP for Low Volume Users in a Constraint

Table 1: PJ07 Solution 02 Maturity levels table

1.2.3 **Solution 3-**Mission Trajectory-driven Processes

This solution was in continuity of a several projects (P7.5.4, P7.6.2 and SWP11.1 WOC) already performed under the SESAR1 programme.

The solution focused on the evolution of iMT concept and validation of the respective operational improvement steps and enablers. The key achievement was a demonstration of the validation results with V3 maturity but only for selected operational improvements while the entire operational concept will be subject to further R&D with higher maturity level in Wave2.

The results provide integral view of the operational concept comprising all pertinent ATM actors, which were partially or not at all considered in SESAR 1. ATM actors such as En-route/Approach ATS and ATFCM (Regional/Sub-regional/National) are integral part of the operational environment and totally integrated into Mission Trajectory Driven Processes.

1.3 Work Performed

1.3.1 **Solution 1-**Airspace Users Processes for Trajectory Definition

SESAR Solution 07.01 overall Validation Approach

The following diagram provides an overview of the overall approach.

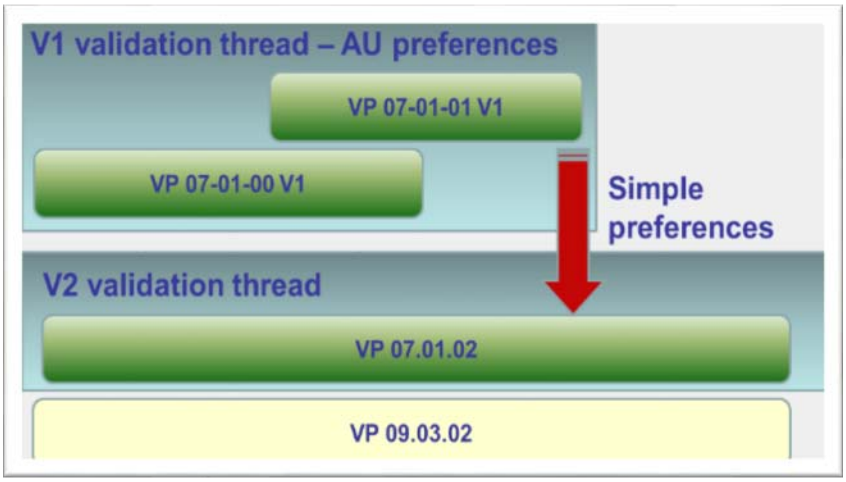


Figure 1: Overall 07.01 Validation Roadmap

Two threads of validation were defined covering respectively:
- V1 validation focusing on the AU preference topic;
- V2 validation addressing topics related to the FF-ICE services. Since these topics are linked to DCB processes, V2 validation activities are jointly conducted with solution 09.03.

These two threads of validation have been conducted in parallel in the first two years of Wave 1. The V1 validation report was delivered in October 2018. Following recommendations of the report, some use-cases related to AU preferences (simple preferences) having achieved V1 maturity, have been integrated into the V2 validation thread and have been addressed in EXE-07.01.02/02 exercise.

SESAR Solution 07.01 Validation Approach for V2

The V2 maturity level has been addressed through an incremental approach of assessments, which covered the first two topics.
1. **The use of enhanced What-ifs function, enriched DCB information** and congestion indicators to allow AUs to assess the network DCB impact on a Flight Plan or preliminary Flight Plan;
2. **The use of AU preferences** (e.g. by considering the FDCI information), **in DCB processes** to indicate AU preferred measures for a flight in case of DCB constraints.

Note: PJ07.01 planned also to address a third topic (Preliminary Flight Plan) but finally no exercise was conducted by the solution.

Three validation exercises have been performed covering these two topics:

1. On Topic 1 (Use of enhanced What-ifs function, enriched DCB information), two validation exercises were run:
    - **EXE 07.01.02/01,** Human-in-the-loop exercise to capture AU detailed requirements, assess the benefits of the concept and perform operational and technical feasibility;
    - **EXE 07.01.02/03**, to perform automated runs simulating AU behaviours to obtain quantitative measure on network stability.
2. On Topic 2 (use of AU preferences in DCB processes), one validation exercise was run:
    - **EXE 07.01.02/02,** Human-in-the-loop exercise to capture AU detailed requirements, assess the benefits of the concept and perform operational and technical feasibility.

These validation activities were performed in close coordination with PJ09.03. This PJ09.03 solution provided to PJ07.01 all the pertinent evolving DCB information (network DCB constraints, congestion Indicators along /around trajectories and route opportunities) and related functionalities to support the AUs in the calculation of optimal trajectories. PJ07.01 provided to PJ09.03 all the necessary inputs from AUs/FOCs to perform the needed actions in terms of complexity assessment & resolution, Hotspot management, etc.
Main documents delivered by the solution are:

- The V2 data pack documents including the V2 OSED, a V2 validation and a CBA
- V1 final documents include the V1 OSED and the V1 validation report.

1.3.2 **Solution 2-**Airspace Users Fleet Priorities and Preferences Processes (UDPP)

The solution performed V1 and V2 activities.

In V1, work continued from SESAR1 on AUO-0107 “UDPP for Low Volume Users in a Constraint (LVUC)” and developed the Flexible Credits for LVUC concept (FCL) that was assessed mid-V1 with the airspace users. The report is included in the PJ07.02 OSED Annex, and the maturity assessment was included in the PJ07.02 VALR Annex. A paper was published in the Journal of Air Transportation:

Sergio Ruiz, Laurent Guichard, Nadine Pilon and Kris Delcourte, EUROCONTROL Experimental Centre, "A New Air Traffic Flow Management User-Driven Prioritisation Process for Low Volume Operator in Constraint: Simulations and Results," Journal of Advanced Transportation, vol. 2019, Article ID 1208279, 21 pages, 2019. http://downloads.hindawi.com/journals/jat/2019/1208279.pdf

In V1 as well, the solution addressed preferences in a joint research with solution1 exploring how DCB could select flights for DCB light measures based on information (e.g. preferences) provided by airspace users –named “absolute priority”, in contrast with the “relative priority” of flights within an AU’s own fleet used in UDPP-. The report is included in the PJ07.01 V1 OSED. The “Absolute priority” concept was included into the V1 validation Gaming exercise in PJ07.01 and the outcome in the PJ07.01 V1 VALR.

In V2, research started with the refinement of the UDPP features to take into account AUs feedback in SESAR1; in particular, AUs requested some automation of the prioritisation: the concept of Margins was elaborated, allowing a semi-automatic allocation of slots to flights based on their time margins of manoeuvre. Also the integration of UDPP in an airport context managed by an APOC was defined in collaboration with PJ04.02, the integration in the Network context with a DCB full delegation mode and the exchange of information for providing a What-If capability to users, were defined with PJ09.03.

The V2 main exercise was EXE-07.02-V2-VALP-006 (integrated with PJ04-02, led by PJ07-02). This was a human-in-the-loop real time simulation with the goal to assess operational feasibility of UDPP and to measure the performance impacts for AUs and for APOC in the operational environment.

The exercise connected four systems/tools to emulate the behaviour and interaction with each stakeholder concerned:

- INNOVE platform emulates the ATFCM system with NM functionalities including B2B services.
- FOC system replicates a simplified Flight Operations Centre (FOC) interface for the flight dispatcher. This is where the participants allocate their UDPP priorities and/or margins. This system also contains a set of rules for the passenger flow model and to produce cost-delay profiles for each flight.
- UDPP Server system receives the prioritisations from the AUs and calculates the new sequence of flights within the UDPP Measure. It then sends this back to the AU during a “what-if” and to the network when the AU publishes their prioritisation.
- APOC system simulates the runway and ground movements at the airport. APOC actors were able to create the UDPP Measure, monitor the airport performance indicators and change the stand allocation planning.

V2 Additional activities included:

- The verification of the UDPP algorithm in terms of equity through Fast Time Simulations.
- A Human Performance and safety workshop to capture the understanding of changes, issues, benefits and mitigations as well as the safety hazards of UDPP on all stakeholders
- An extrapolation of the exercise results to the ECAC area with conservative assumptions that in turn were an input to the PJ07.02 CBA.

Finally a Shadow mode trial of UDPP at SWISS OCC at Zurich was organised in support to PJ25:

- Pre-Testing at the EEC with the UDPP Server and INNOVE platform for PJ25, with Skyguide and Swiss in July 2018
- Shadow mode trial in Zurich on the NMVP in September 2019

In terms of dissemination, UDPP was presented at the SESAR Innovation Days:

- N. Pilon, S. Ruiz, A. Bujor, A. Cook & L. Castelli, “Improved flexibility and equity for airspace users during demand-capacity imbalance - an introduction to the user-driven prioritisation process”, Sixth SESAR Innovation Days, Delft, Netherlands, 2016
- Sergio Ruiz, Laurent Guichard and Nadine Pilon, EUROCONTROL Experimental Centre,”Optimal Delay Allocation under High Flexibility Conditions during Demand-Capacity Imbalance: A theoretical approach to show the potential of the User Driven Prioritization Process “, SESAR Innovation Days, Belgrade, 2017

- Nadine Pilon, Laurent Guichard, EUROCONTROL Experimental Centre, and Katherine Cliff, THINK, "Reducing Impact of Delays using Airspace User-Driven Flight Prioritisation, User Driven Prioritisation Process Validation Simulation and Result", SESAR Innovation Days, Athens, 2019

UDPP was also presented at:

- Steve Kirby, "Minimizing the Cost of Delay for Airspace Users", 12th USA/Europe ATM R&D Seminar, Seattle, USA on 29th June 2017

- Nadine Pilon, "The need for Airspace Users-driven flight prioritisation in case of delay: the User Driven Prioritisation Process", AGIFORS Airlines Operations Group on 6th June 2019 in Paris.

1.3.3 **Solution 3-**Mission Trajectory-driven Processes

The following was performed to check the feasibility (V2) of the solution:

- Preparation of a detailed description with operational, interoperability requirements (as textual documents and in the SESAR tool for requirement engineering (se-dmf)) of the Mission Trajectory concept for mission planning and execution between WOC, ASM, ATFCM and ATC.

- Preparation of validation and safety and HP assessment plans to analyse the feasibility of the described MT concept.

- Preparation of technical and interface requirements for the MT concept by using iOAT FPL for communication between WOC, ASM, ATFCM and ATC.

- Execution of a V2 validation exercise to check the feasibility of the described MT concept with WOC, NM and ATC in Brétigny and Prague.

- Preparation of a detailed description of the results of the validation exercise including safety and HP and

- detailed analyse of the costs and benefits of the described MT concept

The V2 maturity gate passed in November 2018.

In the V3-cycle the evolved iOAT FPL format and concept due to findings and recommendation of previous SESAR validation exercises led to an adaptation of the MT concept. The following was performed.

- Update of the detailed description with operational, interoperability requirements (as textual documents and in the SESAR tool for requirement engineering (se-dmf)) of the MT concept for mission planning and execution between WOC, ASM, ATFCM and ATC.

- Preparation of validation and safety and HP assessment plans to analyse the feasibility and benefits of the updated MT concept.

- Preparation of technical and interface requirements for the updated MT concept by using iOAT FPL for communication between WOC, ASM, ATFCM and ATC.

- Execution of a V3 validation exercise to check the feasibility and benefits of the described MT concept with WOC, NM and ATC in Friedrichshafen, Brétigny and Prague.
- Preparation of a detailed description of the results of the validation exercise including safety and HP.
- detailed analyse of the costs and benefits of the described MT concept and
- update of the EATMA model according to the latest details in MT concept.

1.4 Key Project Results

1.4.1 **Solution 1-**Airspace Users Processes for Trajectory Definition

Since the solution includes 3 distinct OIs/topics that can be validated and implemented independently, the conclusions in each section are split per OI/topic.

Conclusions on SESAR Solution maturity

1) Use of Enriched DCB Information and Enhanced What-If to Improve AU Flight Planning -AUO-0219 (core OI of the solution)

V2 maturity level is achieved. Operational feasibility is demonstrated, operational benefits assessed and technical specifications developed. Results have been obtained so far only for the Winter period and need yet to be confirmed in highly en-route constrained situations.

2) Use of Simple AU Preferences in DCB Processes - AUO-0208

For this OI, we must distinguish proactive FDCI and reactive FDCI.

Regarding reactive FDCI, the maturity is high since some existing procedures and system functions implemented by NM in operations can apply with limited adaptations. For the reactive FDCI, there is no need for further R&D activities, most of the validation questions have been addressed in the 07.01/09.03 iteration 2b exercise. Therefore, this specific improvement can be considered of having achieved V3 maturity level.

For proactive FDCI, V2 maturity level is partially achieved. Operational feasibility is demonstrated and operational benefits assessed. There is still the need to clarify procedures, define more precise interoperability requirements and develop system requirements.

3) Preliminary flight planning - AU0-0207

The OI is in early V2 maturity status. Since no 07.01 exercise addressed this topic in Wave 1, neither operational feasibility nor technical feasibility have been demonstrated. PJ09.03 have generated results in terms of DCB traffic prediction improvement but no assessment of operational benefits for AUs can be derived yet from these results.

The following table summarises the maturity level of the OIs at the end of Wave 1.

OI	Maturity level at the end of W1	Comments
AUO-0219 Enriched DCB information and advanced what-if	V2 completed	Network instability risks in highly constrained network situation will be addressed at V3 maturity level.
AUO-0208 AU simple preferences	V3 completed for reactive FDCI V2 partial for proactive FDCI	Reactive FDCI could be implemented at very short term since it does not need FOC enablers.
AUO-0207 Preliminary flight planning	Early V2	09.03 exercise has shown some potential benefits for network prediction, pre-tactical phase was not covered. Neither operational feasibility nor technical feasibility have been demonstrated yet.

Following the V2 gate it has been decided to crete jointly with solution 09.03 a new solution- for reactive FDCI since this topic has achieve the V3 maturity status.

1.4.2 **Solution 2-**Airspace Users Fleet Priorities and Preferences Processes (UDPP)

With regards to the V2 maturity, the main validation results are:

- For AUs, each UDPP feature is useable, desirable, feasible and acceptable in operations (needs automation in the FOC to support the allocation of priorities/margins when there are a lot of flights).
- For airports APOC, although looking at stand allocation covering a limited range of the Total Airport management, the initial results looked acceptable to APOC participants, although not fully conclusive.
- Performance results show that, whilst respecting equity, more flexibility brings more cost efficiency for AUs. An average of 58 % reduction of the additional cost of delays could be measured in the exercise, and UDPP increased the number of successful connections for passengers by more than 4% for Hub users.

- The extrapolation at ECAC level resulted in an average 40% reduction of cost of delays due to ATFM. The CBA for PJ07.02 was positive with a NPV of 192 M€ at 2035 under the assumption of a deployment starting only in 2025 and with only one AU using UDPP at only 15 airports.

1.4.3 Solution 3-Mission Trajectory-driven Processes

Evolved iOAT FPL concept:

- The technical feasibility of sharing & using of iSMT through evolved iOAT FPL has been successfully validated during the exercise. Military (CMC), NM and WOC experts confirmed the operational usability and acceptability.

- The acceptance rate of the RAD compliant evolved iOAT FPLs during the exercise was above 90%.

- 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.

- The required time and workload for the IFPU operator is reduced, due to the fact that the iOAT FPLs comply to RAD and are using the civil aeronautical environment. (less military specifics to deal with).

- The technical feasibility of the Exemption policy concept as remark 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/RTECOORATC” was observed in quite a number of real military flight plans in the shadow traffic.

- The technical feasibility of the Exemption policy concept as special status has been successfully validated during the exercise. Military (CMC), NM, WOC and ATC experts 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.

Evolved ARES concept

- The technical feasibility of booking up to 9 VPA modules being reflected in the iOAT FPL template has been successfully validated during the exercise. Military (CMC), NM and WOC experts confirmed the operational usability and acceptability. As the ARES 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.

- The technical feasibility to use predefined Entry/Exit points has been successfully validated during the exercise. Military (CMC), NM, WOC and ATC experts confirmed the operational usability.

- The technical feasibility to use Lat/Long geo-coordinates to define Entry/Exit points has been successfully validated during the exercise. Military (CMC), NM, WOC and ATC experts confirmed the operational feasibility.
- The iSMT related CDM process is mainly between WOC & NM. 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.

Evolved iOAT FPLs in ETFMS processing

- All filed and valid iOAT FPLs have been properly included & processed by the ETFMS.

Evolved iOAT FPLs in sub-regional/local FMP system (TCM) processing

- 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.

Applicability of the NM/Network rules and regulation for iMT

- 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.
- 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.

iSMT data exchange by means of SWIM(B2B)

- The SWIM compliant B2B service for iOAT FPL filing has been validated successfully. The service supported successfully the NM iOAT FPL validation messages for the WOC.
- 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.

CDM process for iSMT

- 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.
- The outcome of the CDM process for iSMT has no negative impact on ATM network performance.

1.5 Technical Deliverables

Reference	Title	Delivery Date[2]	Dissemination Level[3]
	Description		
D2.2	Solution PJ07-01: V2	08/11/2019	PU
This deliverable is Data Pack V2 of Solution PJ07-01. It contains the following individual components of Solution 07-01 V2: SPR/INTEROP/OSED V2 including the annexes SAR, HPAR, and PAR, TS/ISR V2, VALR V2 and CBA V2.			
D3.1	Solution PJ07-02: V2	31/10/2019	PU
This deliverable is Data Pack V2 of Solution PJ07-02. It contains the following individual components of Solution 07-02 V2: SPR/INTEROP/OSED V2 including the annexes SAR, HPAR, and PAR, TS/ISR V2, VALR V2 and CBA V2.			
D4.1	Solution PJ07-03: V2	31/10/2019	PU
This deliverable is Data Pack V2 of Solution PJ07-03. It contains the following individual components of Solution 07-03 V2: SPR/INTEROP/OSED V2 including the annexes SAR, HPAR, and PAR, TS/IRS V2 (from PJ18.01a), VALR V2 and CBA V2. This data pack was used as the basis for the V2 Maturity assessment gate that took place on 15-Nov. This maturity gate was successful passed and resulted into the V2 maturity level being assigned to the full solution (6 OI's).			
D4.2	Solution PJ07-03: V3 Ongoing	31/10/2019	PU
This deliverable is Data Pack V2 of Solution PJ07-03. It contains the following individual components of Solution 07-03 V3: SPR/INTEROP/OSED V3 including the annexes SAR and HPAR, TS/IRS TRL 6 (from PJ18.01a), VALR V3 and CBA V3.			

Table 2: Project Deliverables

[2] Delivery data of latest edition

[3] Public or Confidential

2 Links to SESAR Programme

2.1 Contribution to the ATM Master Plan

Code	Name	Project contribution	Maturity at project start	Maturity at project end
PJ07.01	**Airspace Users Processes for Trajectory Definition**		**V1**	**V2**
AUO-0207	Preliminary Flight Planning	Solution 07.01 developed use cases, BIMs and requirements related to this OI but did not perform any validation.	V1	Early V2
AUO-0208	Use of Simple AU Preferences in DCB Processes	Solution 07.01 jointly with PJ09.03 developed use cases, BIMs and requirements related to this OI. The solution also performed V2 validation (operational feasibility) and CBA.	V1	V2 partially for proactive FDCI V3 for reactive FDCI
AUO-0219	Use of Enriched DCB Information and Enhanced What-Ifs to improve AU Flight Planning	Solution 07.01 jointly with PJ09.03 developed use cases, BIMs and requirements related to this OI. The solution also performed V2 validation (operational feasibility, performance assessment) and CBA.	V1	V2

PJ07.02	**Airspace Users Fleet Priorities and Preferences Processes (UDPP)**		**V1**	**V2**
AUO-0107	Prioritisation for Low Volume Users in a Constraint	Elaboration of the Flexible Credits for LVUC (FCL) concept, AU expert judgment validation V1	V0	V1 ongoing
AUO-0109	UDPP for Airport Constraints	Refinement of the UDPP concept incl. creation of the new MARGIN based on AUs needs. Validation of collaboration with APOC stand allocation management for arrivals.	V1	V2
AUO-0110	UDPP for Network Constraints	Full delegation mode from DCB. Integration of Network constraints for prioritised flights on arrivals.	V1	V2 partial
PJ07.03	**Mission Trajectory Driven Processes**		**V1**	**V3 ongoing**
AOM-0303	Pan-European Transit Service	Solution 07.03 developed a Prototype, Use Cases, and Interfaces between WOC, ATC, ASM and NM to validate the processes.	V2	V3
AOM-0304-A	Improved and harmonised OAT flight Plan	Solution 07.03 developed a Prototype, Use Cases, and Interfaces between WOC, ATC, ASM and NM to validate the processes.	V2	V3

AUO-0210	Participation in CDM through iSMT and Target Time (TTO) negotiation	Solution 07.03 developed a Prototype, Use Cases, and Interfaces between WOC, ATC, ASM and NM to validate the processes.	V2	V2
AUO-0211	WOC Management of iRMT via improved OAT Flight Plan	Solution 07.03 developed a Prototype, Use Cases, and Interfaces between WOC, ATC, ASM and NM to validate the processes.	V2	V2
AUO-0215	Sharing iSMT through improved OAT Flight Plan	Solution 07.03 developed a Prototype, Use Cases, and Interfaces between WOC, ATC, ASM and NM to validate the processes.	V2	V3
AUO-0228	Agreed iRMT	Solution 07.03 developed a Prototype, Use Cases, and Interfaces between WOC, ATC, ASM and NM to validate the processes.	V1	V2

Table 3: Project Maturity

2.2 Contribution to Standardisation and regulatory activities

The 07.01 solution is mainly linked to ICAO FF-ICE increment 1 standardisation activity. The following table provides a summary of the recommendations per topic.

07.01 OI/Topics	Related ICAO FF-ICE services/information	Recommendations
AUO-0219 Enriched DCB information & advanced what-if	FF-ICE planning, filing and trial services	Once V3 maturity is achieved (wave 2), all the relevant enriched DCB information - including hotpots – considered in 07.01 exercise should be provided in the FF-ICE planning, trial and filing services.
AUO-0208 AU simple preferences/FDCI	FF-ICE fleet prioritization information	Once V3 maturity is achieved for proactive FDCI (Wave 2), all information defined in the context of the FDCI should be considered as part of the FF-ICE fleet prioritization information in particular to support the future implementation of the FDCI for both reactive and proactive mode.

3 Conclusion and Next Steps

3.1 Conclusions

3.1.1 **Solution 1-**Airspace Users Processes for Trajectory Definition

The following table summarises the maturity level of the OIs at the end of Wave 1.

OI	Maturity level at the end of W1	Comments
AUO-0219 Enriched DCB information and advanced what-if	V2 completed	Network instability risks in highly constrained network situation will be addressed at V3 maturity level.
AUO-0208 AU simple preferences	V3 completed for reactive FDCI V2 partial for proactive FDCI	Reactive FDCI could be implemented at very short term since it does not need FOC enablers.
AUO-0207 Preliminary flight planning	Early V2	09.03 exercise has shown some potential benefits for network prediction, pre-tactical phase was not covered. Neither operational feasibility nor technical feasibility have been demonstrated yet.

Conclusions on concept clarification

Use of Enriched DCB Information and Enhanced What-If to Improve AU Flight Planning - AUO-0219

Related to this topic, the main conclusions are:

1. This OI supports efficiently both AU-driven and FMP-driven decision processes. Two main use-cases can be considered:
   - AUs monitoring their fleet and re-optimising their flight trajectories taking into account DCB constraints and information.
   - Improved CDM process in the context of DCB cherry-picking measures. AUs use enriched DCB information and what-if functions to either decide to accept FMP/NM proposals or propose effective counter proposals.

2. Hotspot information is a key element of enriched DCB information for AUs. It is much more stable and reliable than congestion indicators information since based on human – LTM – assessment of the DCB situation. Hotspots' publication can be viewed as part of the CDM process between LTM, NM and AUs to allow NMF to improve network stability and control Airspace users' reactions to the publication of DCB constraints. Two types of hotspots can be distinguished with distinct use-cases/procedures.
   - FMP resolution hotspot: declared by an FMP to alert AUs that some measures are in phase of elaboration to solve a DCB imbalance. AUs should wait for FMP solution before taking any initiative to avoid the hotspot.

- Protection hotspot: it is declared by FMP to ask AUs not to submit FPL changes that will load an airspace/traffic volume. The information is of particular interest for AUs searching for alternative routes/trajectories avoiding ATFCM regulations (use of what-if functions).

Further rules and procedures must be defined related to the hotspots' publication to increase the impact of hotspot information on AU decision processes. Identification and publication of hotspots can be managed by human operators but workload associated to these new capabilities still need to be more deeply assessed and further automation is required to support the monitoring of publishing hotspots' information in particular during periods when the LTM is busy with other tasks like the elaboration of cherry-picking measures.

3. Conversely, congestion indicators are too instable and complex information to be considered as primary information for AU decisions. They could be provided for situation awareness purposes but their impact on decisions should be very limited and therefore operational requirements should only mention the provision of this information as optional.

AU Preferences in DCB Processes/FDCI - AUO-0208

- Two types of FDCI/user preferences were identified:
  - Proactive FDCI issued for critical flights before any DCB measure is allocated to the flight.
  - Reactive FDCI: issued when a DCB measure is already affecting the flight with the aim that NMF can take any corrective action to reduce the impact.

- The FDCI information used during the validation activities was identified by AUs as an efficient mechanism to notify critical flights to NM/FMP.

- This information provided is accepted by the FMPs as trustworthy and as improving situational awareness/transparency. It enables the FMPs to prioritise critically delayed flights in a relevant timeframe and more accurately than with the current process.

- The FDCI shows its highest value within the last two hours before airborne, before the ATFCM delay is still varying significantly so performing an FDCI action like force-slot could be counteractive.

Sharing this information via the NOP increased significantly the situational awareness for all stakeholders, especially providing full transparency amongst the different AU and the possibility for all DCB actors to support or act - in coordination with NMOC- on the FDCI flight.

Preliminary flight planning - AU0-0207

No concept clarification conclusion for this topic.

Conclusions on technical feasibility

In general, technical enablers were successfully implemented on NM side. Moving into deeper details:

- HMI: in some cases, the workload associated to the FDCI management by FMPs and AUs to prioritise critically delayed flight is too high, particularly in the proactive mode.
- There is room for more automation and simplification in the collaborative and coordination process to take full advantage of the NOP capabilities (e.g. ETFMS CDM function for negotiation of ATFCM measures).

At FOC side, systems requirements have been clarified in particular related to the FOC system enablers required for the OI AUO-2019. The full assessment of the technical feasibility will be addressed in V3 maturity phase using prototypes of FOC systems.

Conclusions on performance assessments

Table 4 includes the main conclusions on the KPAs addressed by the 07.01 exercises.

KPA	Results
Punctuality	Solution 07.01 demonstrated that the use of enriched DCB information and enhanced what-if in the context of the flight planning should improve departure punctuality ✓ + 0,72% Departures < +/- 3 min ✓ ATFCM delay reduction : -0,15 minutes per flight ✓ 26% reduction of ATFCM delays. These results are only applicable for the Winter period (not applicable to highly constrained network situations such as Summer period).
Predictability	Solution 07.01 demonstrated that without the definition of strict rules or incentives for AUs to anticipate their decisions related to FPL changes, the number of late flight changes can slightly increase. In the Winter period simulations, this slight increase of FPL changes did not induce network instability. Such results/conclusions are not applicable to highly constrained network situations (e.g. Summer period).
Environment/Fuel Efficiency	Automatic simulation shows only limited average increase of planned fuel (the impact is marginal: +37 kg per refilled flight, +0,006kg per flight ECAC wide) due to the additional re-routings planned by the AUs to avoid regulations. This is an encouraging result considering the 26% reduction of delays induced by the re-routings. The increase of fuel is higher in case of important disruptions.
Equity	Solution 07.01 has demonstrated that the use of enriched DCB information and enhanced what-if in the context of the flight planning has not a negative impact on Equity.

Table 4: Performance Results at Solution Level

3.1.2 **Solution 2-**Airspace Users Fleet Priorities and Preferences Processes (UDPP)

Recommendation from maturity Gate included :

- Concept : cut-off time, launch of UDPP : to be refined with DCB
- System : response time, automation of margins
- Future validation :
    - performance assessment through FTS to assess impact of several UDPP on Network stability
    - integration with APOC to cover full Total Airport Management processes
- Updating ATM Master Plan Level 2 :
    - It is recommended that AUO-0109 should transition to V3.
    - AUO-0110 should address several network constraints (whilst unlikely used for En-Route).
    - Further research on AUO-0107 as part of the Exploratory Research program.
    - The link with the OI step AUO-0106 should be removed as this is out of scope.
- Regulation and standardisation :

- no impact on standards

- need to check compatibility with existing local agreements between Airport, ANSP and airlines.

The outcome of the maturity Gate was that the UDPP has completed V2 maturity based on the self-assessment made by the solution that identified remaining gaps.

3.1.3 **Solution 3-**Mission Trajectory-driven Processes

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/RTECOORATC & 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.

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.

The validation exercise was the first initial V3 exercise of a series of required exercises to achieve full V3 maturity for this SESAR solution. 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. The V3 validation efforts for the Mission Trajectory concept will be continued within SESAR2020 Wave 2 solution 40.

3.2 Plan for next R&D phase (Next steps)

3.2.1 **Solution 1-**Airspace Users Processes for Trajectory Definition

The next phase should validate the OIs AUO-0217 and AUO-0208 at V3 level focusing on the following aspects:

- Conduct additional simulations for the Summer period in order to:
  - Assess the benefits for AUs in highly constrained network situation;
  - Assess the impact on demand stability and the risk of increase of DCB measures.
- Define requirements, rules and procedures (at V3 maturity level) to mitigate the risk of demand instability.
- Address at V3 maturity level systems' interoperability aspects.
- Precise the applicability of the different use-cases defined for the OI AUO-0219. In particular, define more precisely the operational environment and network situations in which AU-driven or FMP/NMF-driven use-cases are the most suitable.
- Clarify the different types of hotspot and associated rules and procedures, define and validate required automation and tools needed to support FMPs in the identification, publication and monitoring of protection hotspots.
- Define CDM negotiation processes between AU, NM and LTM for exchanges of flow/flight as smart, concise and automated to the maximum degree possible.
- Wave 2 human-in-the-loop validation should put the focus on measuring in a very realistic environment close to target operations the workload of operators (AUs, NM, ANSPs) in order to define optimum automation needs and procedures to increase human performances. The

validation scenarios should consider also other SESAR solutions improvements that may affect the tasks of concerned operators (FMPs, AU dispatchers, NM operators).

- Complete some use-cases/scenarios to consider NM actors roles/responsibilities and involve NM actors in future V3 exercises.
- Further elaborate and validate with all local actors the Flight Delay Criticality Indicator in proactive mode issued for critical flights before any DCB measure is allocated to the flight.
- Further develop and validate operational requirements and procedures related to post-operations. A particular focus should be put on information sharing and processes in post-operations to monitor the impact of new evolutions on equity, network stability and influence of DCB information on airlines behaviours.

The next R&D phase should also address the validation of the OI AUO-0207 - which is at a lower level of maturity – related to the Preliminary Flight plan:

- Conduct first further V2 validation exercises to assess technical and operational feasibility of the Preliminary FPL concept;
- Once V2 achieved, conduct V3 validation to address the feasibility, benefits and CBA related to the provision of PFPs in ATFCM pre-tactical phase.

3.2.2 **Solution 2-**Airspace Users Fleet Priorities and Preferences Processes (UDPP)

The main gaps identified at the maturity Gate are:

- Lack of sufficient local-DCB expertise to complete the integration of UDPP in DCB processes
- Incomplete TS/IRS resulting from the above
- Missing the assessment of the impact of several UDPP on the Network stability

Future research will assess the impacts of multiple UDPP measures on the stability of the network through Fast Time Simulations. Future steps will address the integration of UDPP into network collaborative processes with local and regional ATM actors at airports and with NM in a context closer-to-operations.

Before the start of Wave 2, already some preparatory activities take place:

- the validation plan and the technical specification for a Fast Time Simulation are being prepared for getting the tool ready for an exercise in Wave 2.
- Some technical verifications are being performed following the SWISS trial in order to define the future work.

In Wave2, UDPP will be integrated into arrival management processes, with partners from ANSP and airports and the Network Manager that will contribute to complete the gaps identified above.

3.2.3 **Solution 3-**Mission Trajectory-driven Processes

Finalize the validation of OI steps related to the mission planning phase, add performance measurements, and validate OI steps related to the mission execution phase

Consider new aspects from the harmonised military views on “Civil-Military Collaborative Decision-Making in the future European Air Traffic Management”

Clarify a precise description for the transition from iSMT to iRMT. It should be clarified if the transition is defined by either conventional agreement (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 (e.g. WOC declares/decides).

4 References

4.1 Project Deliverables

	Project	Title	Id Code	Edition	Date
[1]	PJ07 OAUO	Project Management Plan	D1.1	00.01.05	27-02-17
[2]	PJ07 OAUO	Quarterly Progress Report Q4 2016	D1.3	00.01.00	30-01-17
[3]	PJ07 OAUO	Quarterly Progress Report Q1 2017	D1.4	00.01.00	18-04-17
[4]	PJ07 OAUO	Quarterly Progress Report Q2 2017	D1.5	00.01.00	27-07-17
[5]	PJ07 OAUO	Quarterly Progress Report Q3 2017	D1.6	00.01.00	20-10-17
[6]	PJ07 OAUO	Quarterly Progress Report Q4 2017	D1.7	00.01.00	29-01-18
[7]	PJ07 OAUO	Quarterly Progress Report Q1 2018	D1.8	00.01.00	06-04-18
[8]	PJ07 OAUO	Quarterly Progress Report Q2 2018	D1.9	00.01.00	31-07-18
[9]	PJ07 OAUO	Quarterly Progress Report Q3 2018	D1.10	00.01.00	24-10-18
[10]	PJ07 OAUO	Quarterly Progress Report Q4 2018	D1.11	00.01.00	16-01-19
[11]	PJ07 OAUO	Quarterly Progress Report Q1 2019	D1.12	00.01.00	29-04-19
[12]	PJ07 OAUO	Quarterly Progress Report Q2 2019	D1.13	00.01.00	30-07-19
[13]	PJ07 OAUO	Final Project Report	D1.2	00.01.01	10-12-19
[14]	PJ07 OAUO	H – Requirement No. 1	D5.1	00.01.01	15-03-17
[15]	PJ07 OAUO	POPD – Requirement No. 2	D5.2	00.01.01	15-03-17
[16]	PJ07 OAUO	NEC – Requirement No. 3	D5.3	00.01.01	15-03-17
[17]	PJ07 OAUO	EPQ – Requirement No. 4	D5.4	00.01.01	15-03-17
[18]	PJ07 OAUO	SESAR Solution PJ07-01 VALP for V1	D2.2.111	01.00.00	06-06-18
[19]	PJ07 OAUO	SESAR Solution PJ07-01 VALR for V1	D2.2.041	00.01.01	13-09-18
[20]	PJ07 OAUO	PJ07.01 OSED V1 Part I	D2.2.011	00.01.00	26-10-18
[21]	PJ07 OAUO	SESAR Solution PJ07-01 VALP for V2, intermediate	D2.2.110	00.01.03	04-06-18
[22]	PJ07 OAUO	SESAR2020 Availability Note PJ07-01	D2.2.120	00.01.00	09-04-19
[23]	PJ07 OAUO	SESAR Solution PJ07-01 VALP for V2 (Final, including HP Plan and Safety Plan)	D2.2.121	00.02.00	26-04-19
[24]	PJ07 OAUO	SESAR Solution PJ07-01 TS/IRS for V2	D2.2.020	00.01.00	08-10-19
[25]	PJ07 OAUO	V2 Final OSED/SPR/INTEROP (including SAR, HPAR, PAR)	D2.2.010	00.00.16	10-10-19
[26]	PJ07 OAUO	SESAR Solution PJ07-01 Final VALR for V2	D2.2.040	00.01.00	10-10-19
[27]	PJ07 OAUO	SESAR Solution PJ07-01 CBA for V2	D2.2.030	00.01.01	28-10-19
[28]	PJ07 OAUO	Solution PJ07-01 V2 Data Pack	D2.2	01.00.00	08-11-19
[29]	PJ07 OAUO	Solution PJ07-02 Intermediate TS/IRS for V2	D3.1.113	00.00.24	27-03-18
[30]	PJ07 OAUO	Solution PJ07-02 Intermediate OSED/SPR/INTEROP for V2	D3.1.110	00.02.01	28-03-18
[31]	PJ07 OAUO	Solution PJ07-02 Intermediate VALP for V2	D3.1.112	00.00.02	02-05-18
[32]	PJ07 OAUO	Solution PJ07-02 Intermediate CBA for V2	D3.1.111	00.00.14	31-10-18
[33]	PJ07 OAUO	Solution PJ07-02 Intermediate (2) VALP for V2 (including HP Plan and Safety Plan)	D3.1.150	00.01.01	01-11-18
[34]	PJ07 OAUO	Solution PJ07-02 Final VALP for V2 (including HP Plan and Safety Plan)	D3.1.050	00.02.00	29-05-19

[35]	PJ07 OAUO	Solution PJ07-02 Availability Note APOC-UDPP for V2	D3.1.120	00.03.01	03-06-19
[36]	PJ07 OAUO	Solution PJ07-02 Final OSED/SPR/INTEROP (including SAR, HPAR, PAR) for V2	D3.1.010	00.03.03	24-09-19
[37]	PJ07 OAUO	Solution PJ07-02 2 Final TS/SPR for V2	D3.1.020	00.01.01	24-09-19
[38]	PJ07 OAUO	Solution PJ07-02 Final CBA for V2	D3.1.030	00.01.01	25-09-19
[39]	PJ07 OAUO	Solution PJ07-02 final VALR for V2	D3.1.040	00.01.00	25-09-19
[40]	PJ07 OAUO	Solution PJ07-02 V2 Data Pack	D3.1	01.00.00	31-10-19
[41]	PJ07 OAUO	Solution PJ07.03 Initial OSED/SPR/INTEROP V2	D4.1.100	00.01.00	31-08-17
[42]	PJ07 OAUO	Solution PJ07-03 Intermediate VALP for V2 (including Safety and HP Plan)	D4.1.110	00.01.01	17-08-17
[43]	PJ07 OAUO	Solution PJ07-03 Final VALP for V2 (including Safety and HP Plan)	D4.1.111	00.02.00	25-06-18
[44]	PJ07 OAUO	Solution PJ07.03 Initial OSED/SPR/INTEROP V2 including Safety, HP, and Performance assessment reports and BIM)	D4.1.010	00.02.01	29-06-18
[45]	PJ07 OAUO	Solution PJ07-03 final VALR for V2	D4.1.030	00.02.00	09-07-18
[46]	PJ07 OAUO	Solution PJ07-03 Final CBA for V2	D4.1.040	00.01.00	09-07-18
[47]	PJ07 OAUO	Solution PJ07-03 V2 Data Pack	D4.1	01.00.00	25-10-18
[48]	PJ07 OAUO	Solution PJ07-03 Intermediate VALP for V2 (including Safety and HP Plan)	D4.2.049	00.00.03	08-04-19
[49]	PJ07 OAUO	Solution PJ07-03 Final VALP for V2 (including Safety and HP Plan)	D4.2.050	00.01.00	06-08-19
[50]	PJ07 OAUO	Solution PJ07-03 final VALR for V3	D4.2.030	00.01.00	30-09-19
[51]	PJ07 OAUO	Solution PJ07-03 final CBA for V3	D4.2.040	00.01.00	30-09-19
[52]	PJ07 OAUO	Solution PJ07.03 Final OSED/SPR/INTEROP V3 including Safety and HP assessment reports)	D4.2.010	00.01.24	23-10-19
[53]	PJ07 OAUO	Solution 3 V3 Data Pack	D4.2	01.00.00	05-11-19

4.2 Project Communication and Dissemination papers

[1] Sergio Ruiz, Laurent Guichard and Nadine Pilon, EUROCONTROL Experimental Centre,”Optimal Delay Allocation under High Flexibility Conditions during Demand-Capacity Imbalance: A theoretical approach to show the potential of the User Driven Prioritization Process “, SESAR Innovation Days, Belgrade, 2017

[2] Nadine Pilon, Laurent Guichard, EUROCONTROL Experimental Centre, and Katherine Cliff, THINK, “Reducing Impact of Delays using Airspace User-Driven Flight Prioritisation, User Driven Prioritisation Process Validation Simulation and Result”, SESAR Innovation Days, Athens, 2019

Paper published in the Journal of Air Transportation:

[3] Sergio Ruiz, Laurent Guichard, Nadine Pilon and Kris Delcourte, EUROCONTROL Experimental Centre, "A New Air Traffic Flow Management User-Driven Prioritisation Process for Low Volume Operator in Constraint: Simulations and Results," Journal of Advanced

Transportation, vol. 2019, Article ID 1208279, 21 pages, 2019. Link: http://downloads.hindawi.com/journals/jat/2019/1208279.pdf

[4] Nadine Pilon, "The need for Airspace Users-driven flight prioritisation in case of delay: the User Driven Prioritisation Process", AGIFORS Airlines Operations Group on 6th June 2019 in Paris.

ICAO publications:

[5] Isabelle Luxembourg, Gerard Mavoian, Kim Breivik, "European SESAR validation activity on the trajectory development in a collaborative environment with AUs and Flow Managers in the context of FF-ICE/1", ICAO ATMRPP Working paper, November 2019

[6] Gerard Mavoian, Kim Breivik, Philippe Leplae, Isabelle Luxembourg, 'European SESAR evaluation activity on FF-ICE/1 services", ICAO ATMRPP Information paper, March 2019

Appendix A Glossary of Terms, Acronyms and Terminology

A.1 Glossary of terms

Term	Definition	Source of the definition
AIR-REPORT	A report from an aircraft in flight prepared in conformity with requirements for position, and operational and/or meteorological reporting.	ICAO Annex 3
Aircraft Rotation	All of the flights that one aircraft will fly in a day and the following days.	N/A
Airport Capacity (CAP)	The capacity at "maximum observed throughput" airport.	SESAR I D108 SESAR 2020 Transition Performance Framework
Airspace User Cost Efficiency (AUC)	Cost Efficiency obtained by Airspace Users other than gate-to-gate ATM costs.	SESAR I D108 SESAR 2020 Transition Performance Framework
Baseline Delay	Represents the allocated delay to each flight in a constrained situation without UDPP. Represents the delay of each flight face to a problem if no UDPP measures were taken, and/or the environment as it is in the present situation. It is used as a baseline of the UDPP equity and can be used to benchmark the UDPP concept to identify the concepts' benefits.	UDPP SPR-INTEROP/OSED, edition 00.03.03,15/10/2019
Capacity Constrained Situation (CCS)	A period of time in which the Capacity of an ATFM element (Airspace, Arrival Runway, Departure Runway ...) is reduced. It defines the new capacity constraint due to this condition. In most of the case, this CCS will generate a Regulation to be managed by Airport/DCB/NM.	UDPP SPR-INTEROP/OSED, edition 00.03.03,15/10/2019
CDM	Collaborative decision-making (CDM) is defined as a process focused on how to decide on a course of action articulated between two or more community members. Through this process, ATM community members share information related to that decision, agree on, and apply the decision-making approach and principles. The overall objective of the process is to improve the performance of the ATM system as a whole while balancing the needs of individual ATM community members. From a military perspective CDM is a process from which all participating parties can gain benefits through the negotiation of proposed options. The negotiation stops either at the moment when all participating parties agree with the result or when they reach a limit in their capability to accept further compromise due to defined priorities".	CONOPS 2017
Exemption policy	The exemption policy is a state prerogative and applies in the circumstances when special operational requirements or aircraft equipage require exemption from restrictions and	PJ.07-03

Term	Definition	Source of the definition
	regulations, which in nominal case applies to all IFR flights conducted in controlled airspace.	
FDCI	FDCI is a parameter provided by the Airspace User to indicate the importance for the flight to progress on time.	VALR V2 PJ07.01

Table 5: Glossary

A.2 Acronyms and Terminology

Term	Definition
ANSP	Air Navigation Service Provider
AO	Aircraft Operator
AOP	Airport Operations Portal
API	Airport Planning Information
APOC	Airport Operations Centre
APT	Airport (stakeholder in CBA)
ATC	Air Traffic Control
ATCO	Air Traffic Control Officer
ATM	Air Traffic Management
ATFCM	Air Traffic Flow and Capacity Management
ATFM	Air Traffic Flow Management
ATM	Air Traffic Management
ATS	Air Traffic Services
AU	Airspace User
AUC	Airspace User Cost Efficiency
BA	Business Aviation
B2B	Business-to-Business

BT	Business Trajectory
CAA	Civil Aviation Authority
CASA	Computer-Assisted Slot Allocation
CBA	Cost Benefit Analysis
CCS	Capacity Constraint Situation
CDG	Charles de Gaulle
CDM	Collaborative Decision Making
CTOT	Calculated Take Off Time
DCB	Demand Capacity Balancing
DPI	Departure Planning Information
EATMA	European Air Traffic Management Architecture
ECAC	European Civil Aviation Conference
E-OCVM	European Operational Concept Validation Methodology
EQUI	Access and Equity
ER	Exploratory Research
FDA	Fleet Delay Assignment (SESAR1)
FDR	Fleet Delay Re-ordering (SESAR2020)
FF-ICE	Flight and Flow Information for a Collaborative Environment
FLX	Flexibility
FMP	Flow Management Position
FOC	Flight Operations Centre
FOC	Full Operational Capability
FTS	Fast Time Simulation
HMI	Human Machine Interface
HP	Human Performance
IBP	Industry-Based Platform

ICAO	International Civil Aviation Organisation
IFPU	Initial Flight Plan Processing Unit
INAP	Integrating Network ATC Planning
INTEROP	Interoperability requirements
IOC	Initial Operational Capability
KPA	Key Performance Area
KPI	Key Performance Indicator
LTF	Long-Term Forecast
LVU	Low Volume User
LVUC	Low Volume Users in a Constraint
MFP	Maximum number of Flights that can be Protected
MNIT	Maximum Negative Impact of Time
MT	Mission Trajectory
NM	Network Management
NMOC	Network Management Operations Centre
NOP	Network Operations Plan/Portal
NPV	Net Present Value
OAO	Operating Aircraft Operator
OAT	Operational Air Traffic
OAUO	Optimised Airspace Users Operations
OI	Operational Improvement
OSED	Operational Service and Environment Definition
Pflight	Protected flight
PI	Performance Indicator
PUN	Punctuality
PRD	Predictability

R&D	Research and Development
RNEST	Research Network Strategic Tool
RTS	Real Time Simulation
SA	Scheduled Airlines
SAF	Safety
SESAR	Single European Sky ATM Research Programme
SFP	Selective Flight Protection
SJU	SESAR Joint Undertaking (Agency of the European Commission)
SOBT	Scheduled Off Block Time
SIBT	Scheduled In Block Time
SPR	Safety and performance requirements
SUT	System Under Test
SWIM	System Wide Information Management
TBC	To be confirmed
TSAT	Target Start Up Approval Time
TTOT	Target Take Off Time
UDPP	User Driven Prioritization Process
VALP	Validation Plan
VALS	Validation Strategy
V0	E-OCVM lifecycle phase: ATM Needs
V1	E-OCVM lifecycle phase: Scope
V2	E-OCVM lifecycle phase: Feasibility
V3	E-OCVM lifecycle phase: Pre-industrial development & integration

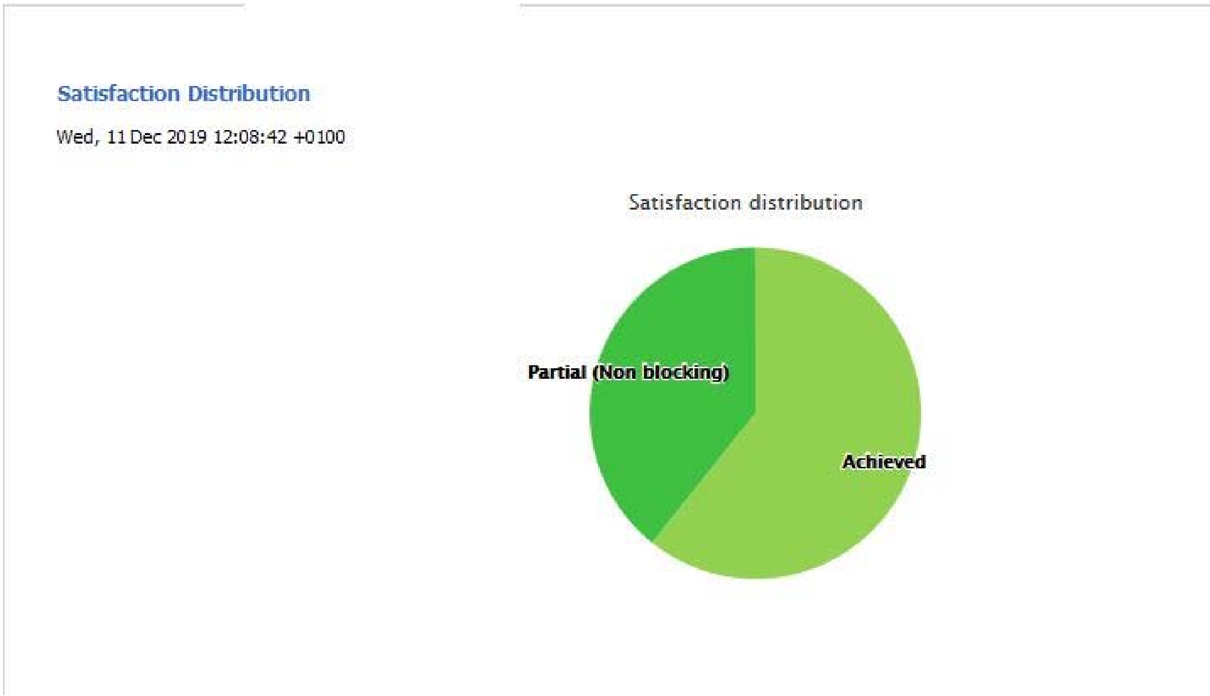
Table 6: Acronyms and technology

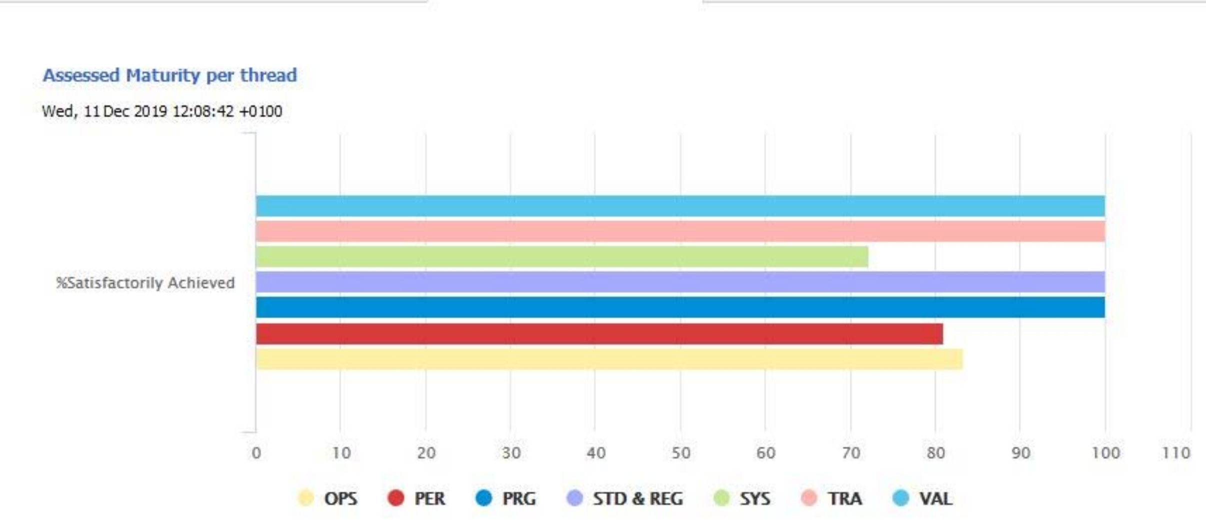
Additional Material

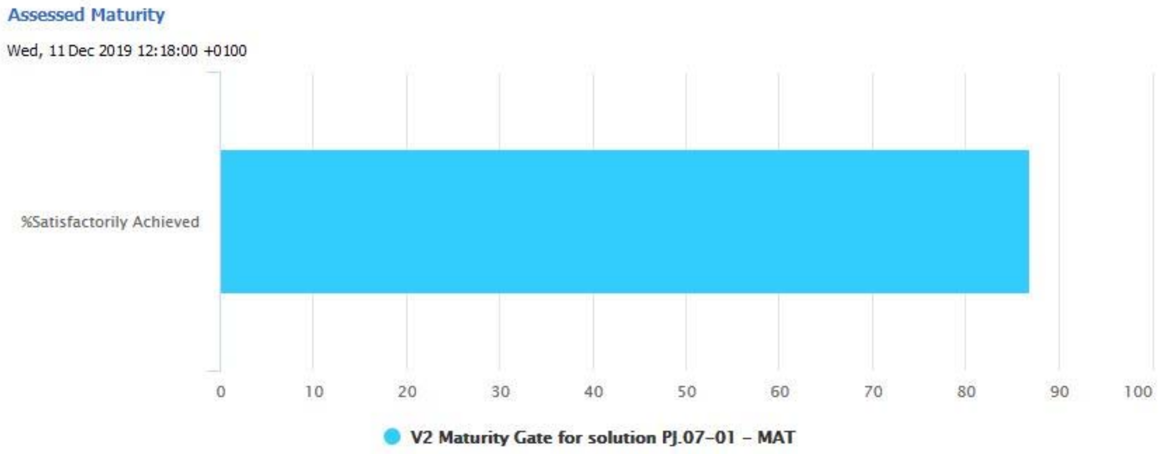
A.3 Final Project maturity self-assessment

A.3.1 Maturity Assessment Solution 1

07.01 V2 SESAR Maturity Criteria 1.0.x







A.3.2 Maturity Assessment Solution 2

B.1.2.1 V2 Maturity Assessment of AUO-0109 and AUO-0110

The maturity assessment of the SESAR Solution PJ.07-02 was based on the validation activities that fully validated the OI step AUO-0109 and partially validated AUO-0110.

AUO-0109 UDPP for Airport Constraints started at early V2 (V1) and at the end of Wave 1, it has reached the V2 maturity level. It is recommended that AUO-0109 should progress towards a V3 maturity level.

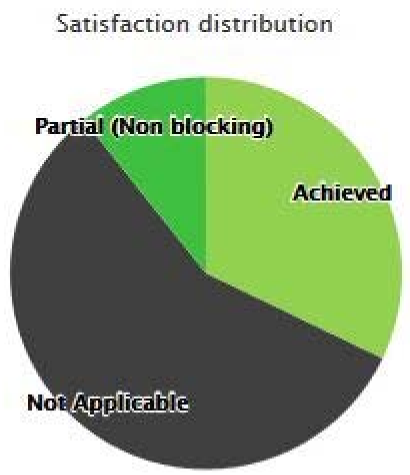
AUO-0110 'UDPP for Network constraints' has been partially addressed as this OI will apply the already validated methods of UDPP at one UDPP network constraint at airports within the full autonomy delegation mode of the DCB collaborative framework. As local DCB stakeholders did not participate during Wave 1, AUO-0110 could not be addressed further. Several constraints and en-route constraints have not been addressed in SESAR2020 Wave 1. The gaps for AUO-0110 have been identified and the activities required to address these gaps are reported in section **Error! Reference source not found.** of this document.

Overall, the SESAR Solution PJ.07-02 has reached a V2 maturity and it is recommended to progress towards a V3 maturity level with Local DCB expertise in order to integrate UDPP in the Collaborative Framework.

PJ0702 Maturity Assessment.xlsx

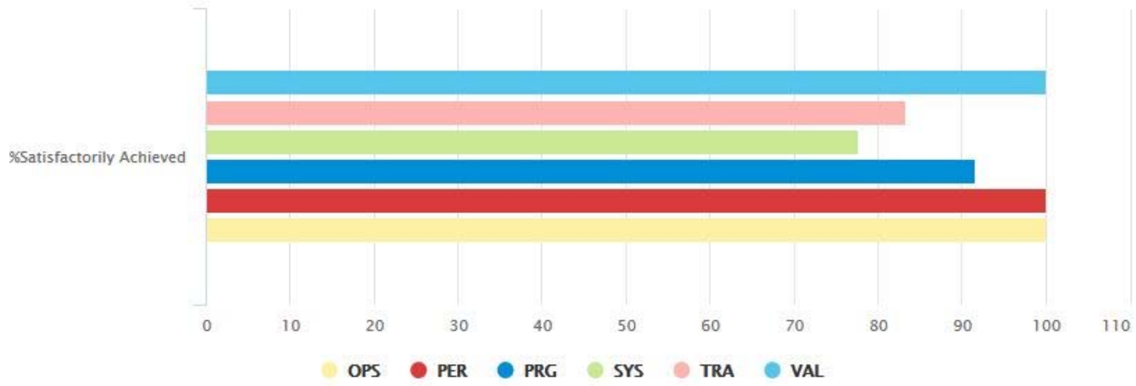
Satisfaction Distribution

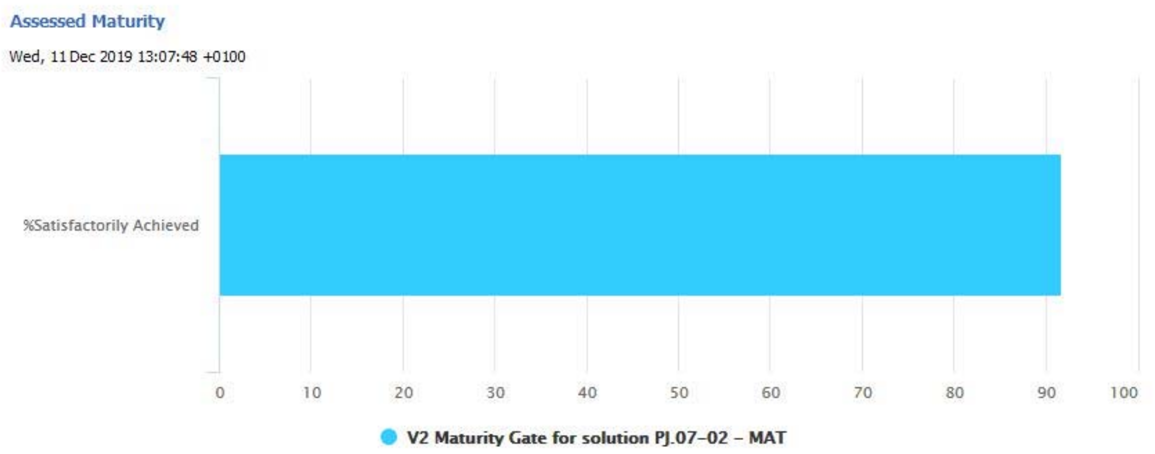
Wed, 11 Dec 2019 12:58:11 +0100



Assessed Maturity per thread

Wed, 11 Dec 2019 13:07:48 +0100





B.1.2.2 V1 Maturity Assessment of AUO-0107

AUO-0107 UDPP for Low Volume Users' has been investigated in Solution PJ.07-02 and the outcome included in the OSED [37]. A maturity self-assessment below has been performed concluding that it is currently at a maturity of V0 (early V1).

LVUC V1 Maturity
Assessment Report.(

Further research will take place as part of the Exploratory Research programme of SESAR.

A.3.3 Maturity Assessment Solution 3

20191209_PJ0703
V3 On-going Maturi