# Final Project Report

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**Abstract**

This document is the Final Project Report for 12.03.05 project, performed in the frame of the SESAR Programme.

It provides a summary of the outcome of the project, focusing on the contribution to the achievement of the Masterplan, the deployment of its elements into operations and the provision of inputs to modify existing standards in the ATM domain if identified.

It also includes a recapitulation of things to be improved and things that worked well during the project, together with a thorough analysis of the project deliverables, focused on identifying and justifying deviations from the original project plan, and how they were assessed by the SJU.

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| Rational for rejection |
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| None. |
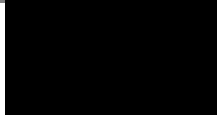
# Document History

| Edition | Date | Status | Author | Justification |
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| 00.00.01 | 02/07/2014 | Draft | ███████ | Final Project Report. |
| 00.00.02 | 19/02/2015 | Draft | | Reviewed Final Project Report after SJU assessment. |
| 00.00.03 | 24/02/2015 | Revised Draft | | Reviewed Final Project Report after 4.1.1 OFA Comments. |
| 00.01.00 | 28/02/2015 | Draft | | Final Project Report to be delivered before Closure GATE. |
| 00.01.01 | 03/03/2015 | Draft | | Updated template to be reviewed by concerned OFAs after GATE commitments. |
| 01.00.00 | 04/03/2015 | Final | | Final deliverable to be submitted. |

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| 01.00.01 | 16/04/2015 | Revised Draft | | Updated FPR with SJU assessment. |
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| 02.00.00 | 21/04/2015 | Final | | Final deliverable to be submitted after 10.09.01/10.09.02/.12.04.04 review |

## Intellectual Property Rights (foreground)

This deliverable consists of SJU foreground.

# 1  Final Project Report

**Progress and contribution the project to the roadmap for deployment activities.**

P12.03.05 "*Enhanced sequencing tools*" contributes to the following topics addressed in the ATM Master Plan:

- Integration of AMAN and DMAN functions with the aim of improving resource planning for the turn-around time of a flight by taking into account the local constraints that can impact the arrival or the departure traffic flows therefore improving accuracy of arrival and departure times

- In cooperation with AMAN/DMAN Projects (P10.09.01 / P10.09.02) and Integration of Departure Management and Surface Management Project (P12.04.04), 12.03.05 project has contributed to build a technical solution for the integration of the whole set of sequencing tools to support ATCOs on the traffic synchronization issues within the TMA or even outside when extending the AMAN Horizon. The goal of the traffic synchronization tools is to develop a set of tools able to manage traffic flows, in complex TMAs with several airports, with accurate information in advance. P12.03.05 contributed specifically:

  - In the Step 1 Concept, providing a set of agreed technical requirements (they will compose a baseline for the SESAR final Outputs) and developing a prototype used in EXE-06.03.02-VP-401 (find Report in [9]) for validating the "*Pre-Departure Sequencing supported by Route Planning*" (TS-0202) Operational Improvement. Declaring, after the exercise, one of its Enablers, AIRPORT-36 (*Provision by the Airport Operator of the relevant constraint to Aerodrome ATC*), as mature enough to be complemented with the rest of the enablers proved in following Validations. All together could lead to the full V3 Maturity of the TS-0202 OI (the whole level of maturity was finally reached in Release 4) becoming the PCP related SESAR Solution #54.

  - In the Step 2 Concept, a first approach to the Technical Coupled AMAN/DMAN Requirements in close collaboration with AMAN/DMAN projects (P10.09.01/02) was produced. And based on them also a prototype providing the departure sequence V2 prototype that was used for Fast Track 11 demonstration.

P12.03.05 contributed specifically to develop the following PCP concepts have been V3 validated in the SESAR framework, having as first Approximation the EXE-06.03.02-VP-401 [9] using a 12.03.05 prototype developed in Phase 1 based on P06.08.04 Step 1 Operational Requirements. In R2 the full V3 maturity was not reached as it can be seen in the Release 2 Report [8], however further R4 Validations completed the V3 maturity.

**Departure Management Synchronized with Pre-departure sequencing:**

Pre-departure management, with the objective of metering the departure flow to a runway by managing Off-Block-Times (via Start-up-Times) which consider the available runway capacity. In combination with Airport – Collaborative Decision Making (A-CDM), Pre-departure management aims thus at reducing taxi times, increasing Network Manager Operations Centre-Slot compliance and increasing predictability of departure times for all linked processes.

Departure management, with the objective of maximizing traffic flow on the runway by setting up a sequence with minimum optimized separations.

**Departure Management integrating Surface Management Constraints:**

The departure sequence at the runway shall be fine-tuned according to real traffic situation reflecting any delay off gate or during taxi to the runway in use which may trigger an update to the departure sequence. The system shall interact with, and provides assistance to, the ground controller and runway controller to coordinate surface movements and to manage an optimized departure sequence consistently with real surface traffic.

In terms of the Masterplan, the project contributes to the implementation of the following enablers, as defined in Dataset 13 (maturity assessment is based on Release 5 Plan [11]):

- AIRPORT-36 *"Provision by the Airport Operator of the relevant constraint to Aerodrome ATC"* (Step 1), was considered fully mature after being supported in EXE-06.03.02-VP-401.

- AERODROME-ATC-09a "*Improvement of operational orchestration among arrival / departure management and surface management services"*. (Step 1) .

- AERODROME-ATC-09b "*Sequence Based Improvement of operational orchestration among arrival / departure management and surface management services"*. (Step 2).

- AERODROME-ATC-44a "*Departure sequence updated taking into account surface management information*". (Step 2).

These enablers are linked with the following OI (operational improvements):

- TS-0202 "Pre-Departure Sequencing supported by Route Planning" (Step 1). Expected full V3 in Sesar 1. Sesar Solution #54, PCP related

- TS-0308 "Flow based Integration of Arrival and Departure Management" (Step 1). Full V3 Maturity expected in Sesar 1.

- TS-0309 "Sequence based Integration of Arrival and Departure Management" (Step 2). Full V3 Maturity expected in Sesar 1. Sesar Solution #15.

- TS-0203 "Departure Management supported by Route Planning and Monitoring" (Step 2). Full V3 Maturity expected in Sesar 1. Sesar Solution #14, PCP related.


**Project's key Deliverables**

Main deliverables within the projects are:

1) <u>D12.3.5.D02 - Phase 1 - System Requirements Specification</u> – This Document is the Step 1 Technical Specification describing a DMAN able to provide:

- Optimum runway

- Pre-departure sequence

- Departure sequence

- Collaborate with local AMAN

- HMI

DMAN described here is a support tool for tower delivery controllers, apron/ground controllers and tower supervisors to perform the departure management process. It is based on the operational concept developed by the "*Enhanced Sequencing Tools*" P06.08.04 project within its Basic DMAN OSED [7]  and the Initial S1V1 OSED [5] with the aim of supporting Release 2 validation activities.

In this TS, Enabler AIRPORT-36 is fully and AERODROME-ATC-09a partially covered.


2) <u>D12.3.5.D08 - Phase 2 - Initial system Requirement Specification</u> -  This Document is the Step 2 Technical Specification covering coupled AMAN/DMAN requirements. It has been developed in common with P10.09.01/P10.09.02, as the arrival sequence leading projects, with the aim of ensuring coherence on coupling requirements inside both 3 projects. The coupled function takes into account:

- Arrival constraints.

- Departure constraints.

- Runway constraints.

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- Surface constraints.

The outcome of the coupled AMAN/DMAN function is an integrated sequence for arrivals (TLDT) and departure (TTOT).

In this TS, Enabler AERODROME-ATC-09b and AERODROME-ATC-44a are partially covered.


3) The latter deliverable was expected to be the first version of the Step 2 TS, based on available operational documentation [6] developed by the Coupling AMAN/DMAN project (P06.08.04) with the aim of being updated with other operational inputs regarding DMAN for multiple airports. As this concept is not expected to be addressed in the operational thread, next phase of the document has been suppressed. That corresponded to P12.03.05 Phase 3 that has been cancelled and it is the reason to early close the project.


**Project achievements**

With the goal of validating some of the concepts described before, P12.03.05 developed:

1) A prototype in the Step 1 framework that was the mean to validate the Pre-Departure Sequencing supported by Route Planning concept (TS-0202) within EXE06.03.02-VP-401 in December 2012. Find below some details of the Exercise:

   - **High Level Objectives** – This exercise provided an opportunity to validate, in an integrated environment, operational concepts related to departure management, surface management, i.e. routing planning, and improvements related to surveillance. This concept was validated in an airport with a complex lay-out using and integrated Controller Working Position.

   - **12.03.05's contribution** – The communication between the DMAN and the A-SMGCS routing function in both directions is possible by using this prototype. In this communication, the A-SMGCS routing function provided the taxi-time to the DMAN, which then calculates the TSAT which is displayed to the clearance controller.

   - **Main Outcome** – The system updated the pre-departure sequence taking into account information from the A-SMGCS routing and planning function. The difference between the planned and the actual take-off time was reduced thanks to the connexion. The predictability of the take-off also increased. On the other hand, the difference between the planned and the Actual Off-Block Time (AOBT) was not improved. The fuel consumption was reduced improving the Environmental sustainability.

   - **Maturity Level** - EXE-06.03.02-VP-401 was tagged as V3 maturity, but waiting for EXE-06.08.04-VP-453 (R4) to full validate V3 TS-0202 Operational Improvement (corresponding to Sesar Solution #54). The unique Enabler that was identified in EXE-401 was AIRPORT-36.  It can be considered fully mature.


2) A prototype in the Step 2 (Project Phase 2) to support AMAN/DMAN demo (Fast Track), based on two main aspects, the operational concept developed in the Coupling AMAN/DMAN project (P06.08.04) in its OSED [6] and the SWIM service defined in the context of Fast Track 11 (RunwayMixSequenceService currently included in the ISRM 1.0.). This Demonstration used a development of a unique component addressing sequencing management process providing arrival and departure sequences up to tower and approach ATCOs with the aim of sharing same information to both domains, mainly in mixed mode runways.

The reason to perform an activity like this demonstration and not a formal Validation was the difficulty to find a partner to lead, at this moment, a V2 Validation exercise regarding this coupling concept, and to take advantage of the opportunity to verify the developments together with the SWIM infrastructure in an initial phase.

After having run the Demonstration, and once made evident Indra technical coupling solution, it was disliked by Thales. Indra understanding of the Technical Solutions within the SESAR

Programme is that there should be one Operational concept described by the Operational Projects which may be implemented with different valid technical solutions. Indra decided to develop for this FT a unique component with AMAN and DMAN functionalities able to manage both arrival and departure sequences in all kinds of Runways in a complex TMA. FT11 was the first Step of the prototypes focused in a mix mode Runway, assessing the different deployment options of the sequencing component concluding that it could be deployed either in the ACC Center or in the TWR.

P12.03.05 closure does not lead to create any gap within the programme, since although there are no specific requirements foreseen for DMAN in the operational thread (neither for a single airport nor multiple airport environment), any integration system requirement between AMAN/DMAN will be covered by P10.09.01/P10.09.02 and any integration system requirement between DMAN/SMAN will be covered by P12.04.04.


### Potential contribution to the development of new Standards and Norms

Standardization exchanges between AMAN-DMAN-SMAN have been not addressed by 12.03.05 due to the lack of a fully mature Operational Concept behind the different systems and the evolving character of nowadays discussions regarding the concept in the Operational layer of the Programme.


### Recommendations & Lessons Learnt

What worked well?

- Coordination with related technical projects to ensure coherence in the technical solution developed.

- Collaboration with SESAR partners within the different projects.

- Relation with SJU and Gates review process to get feedback on the project evolution.

- The common objective of enhance sequencing tools to improve ATC systems.

- Validation activities have helped to validate the concept and identify issues to be more investigated in future exercises.

What should be improved?

- Within the programme, one technical project was expected to receive inputs from several operational projects (06.08.04, 05.06.07 and 05.06.04), with different schedules for operational documentation delivery and validation activities, with the consequent difficulty of the alignment on prototype delivery and scope of the prototypes, because at the end systems are unique and have to fulfil all the operational needs. OFAs tried to mitigate this point, but coordination among OFAs could be improved, mainly among OFAs in different domains, as in the case of sequencing projects, linked with OFAs within WP5 and WP6.

- Too many changes on templates, traceability matrix, procedures, new organization in OFAs,…Impacting on the way of working of the projects

- Top-down approach is difficult to follow when all the projects have the same timeframe: transversal, operational and technical.

- Sequencing tools were distributed among several technical projects, with no same partners. This is an issue since it is not possible to build a whole set of sequencing tools to validate the global concept. One of the aims of SESAR is to ensure interoperability between components of the European ATM system. Therefore, distribution of systems amongst several partners should not be an obstacle to reach this goal. A discussion lead by B.04.03 is trying to sort out this interfacing issue.

# 2 References

**[1]** SESAR Programme Management Plan, Edition 03.00.01

**[2]** European ATM Master Plan, Edition 2

**[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]** SCH_12.03.05_Latest_Approved_Baseline,13/02/2015

**[5]** P06.08.04, - S01V1 Initial OSED, D07, 00.01.01, 6/06/2011

**[6]** P06.08.04, - S02V1 Initial OSED, D21, 00.01.00, 29/06/2012

**[7]** P06.08.04, - OSED basic DMAN, D32, 00.02.00, 08/04/2011

https://extranet.sesarju.eu/WP_06/Project_06.08.04/Project%20Plan/Deliverables%20-%20AMAN-DMAN%20step%202/DEL-06.08.04%20D21%20OSED%20AMAN-DMAN%20Step2-V1%2000.01.00.pdf

**[8]** Release 2 Close-Out Report, Ed 01.00.00, 18/06/2013

https://extranet.sesarju.eu/releasehome/Release%20Management%20Library/Release%202%20close%20out%20Report%20%20v1.0.0.pdf

**[9]** 06.03.02 Airport ATM performance (execution phase), 6.3.2 Release 2 Validation Report, D03, 00.01.01, 15/05/2013

https://extranet.sesarju.eu/WP_06/Project_06.03.02/Project%20Plan/Release%202/D03%201st%20del/6.3.2%20Release%202%20Validation%20Report%20(Sections%201%20to%205).0.1.1.doc

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**[10]** Final Project Report Template, 01.01.00, 23/06/2014

**[11]** Release 5 Plan v1.0, 01.00.00, 19/12/2014

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