



# Final Project Report

## Document information

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## Task contributors

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## Abstract

The project provided the technical support for the ASAS sequencing and merging operations. In particular the project delivered the technical documents (technical specification, architecture assessment, technology report) and the ground prototypes for the execution of several validation activities regarding the ASAS sequencing and merging concept, contributing to SESAR Solution #16 (ASAS Spacing applications: Remain behind and Merge Behind). The project has been based on the operational inputs from the operational project and used in validation activities since 2012 to 2015.

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00.01.01	13/09/2016	Final Version	FINMECCANICA	Version updated with partners comments
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## Acronyms

Acronym	Definition
ATCO	Air Traffic Controller
ATM	Air Traffic Management
AMAN	Arrival Manager
ANSP	Air Navigation Service Provider
ASAS	Aircraft Surveillance Applications System
ASPA-IM-S&M	Airborne SPAcing – Interval Managing – Sequencing & Merging
ATC	Air Traffic Control
CWP	Controller Working Position
INTEROP	Interoperability Requirements
OI	Operational Improvement
OSED	Operational Service and Environment Definition
RT	Radio Transmitter
SESAR	Single European Sky ATM Research Programme
SJU	SESAR Joint Undertaking (Agency of the European Commission)
SJU Work Programme	The programme which addresses all activities of the SESAR Joint Undertaking Agency.
SNET	Safety Nets
SPR	Safety and Performance Requirements
TBS	Time Based Separation
TS	Technical Specifications
WP	Work Package

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# 1 Project Overview

The project defined detailed technical documentation (system requirements, architecture assessment, safety assessment) and prototypes for ASAS sequencing and merging procedures, based on the operational inputs from the operational project. In particular the inputs came from the project which was devoted, within the SESAR programme, to detail the operational needs for the ASAS concept.

The prototypes have been used in several validation activities coordinated with other Sesar participants:

- 3 validation activities in 2012
- 1 validation activity in 2013
- 1 validation activity in 2014
- 1 validation activity in 2015.

## 1.1 Project progress and contribution to the Master Plan

The project team was composed by one ANSP (DSNA), three industry partners (Indra, Thales and Selex (Lead)) and Eurocontrol.

The activities addressed by this project contributed to the following enablers.

Code	Name	Project contribution	Maturity at project start	Maturity at project end
<b>APP ATC#61</b>	System Support for ASPA Sequencing & Merging – Step 1	Provisioning of technical description, architecture and prototypes implementing the enabler. Support to validation activities.	TRL 4 Component/subsystem validation in laboratory environment	TRL 5 - System/subsystem /component validation in relevant environment
<b>APP ATC#144</b>	TMA Controllers are able to issue instructions to the pilot via CPDLC messages to maintain time- or distance-based separation against other identified aircraft	Provisioning of technical description, architecture and prototypes implementing the enabler. Support to validation activities.	TRL 4 Component/subsystem validation in laboratory environment	TRL 5 - System/subsystem /component validation in relevant environment

The project defined, developed and tested the tool to support the ASAS sequencing and merging concept on the ATCO Position.

In particular, it defined the technical specifications and the architecture assessment of an appropriate tool which has been implemented by two industry partners and used in the above mentioned validation exercises.

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In particular, the project activities have been sub-divided into the following tasks:

- **Technology Studies**

The project performed some studies of technologies, decision support tools and messages available to support the ASPA-IM-S&M application.

- **Technical Specification**

The project formulated System Requirements for the ASAS ground tool taking into account the operational requirements received from the operational counter-part project. A considerable amount of effort has been spent to ensure the traceability of the TS to the operational OSED, SPR and INTEROP which will help for subsequent deployment of safety assurance.

Key system function is the graphical support for the ASAS manoeuvres, allowing the controller to instruct the pilot via RT or via Datalink and displaying graphically the execution of the manoeuvre instructed.

The system specification constituted the reference document for the ASAS system prototypes development and for their verification.

- **Architecture Assessment**

The project formulated the system design, including logical interfaces with the rest of the system.

The Architecture Assessment Report was aligned with the System Requirements document and with the Preliminary System Architecture.

- **System Safety Assessment**

The project performed the Safety Assessment of the ASAS concept. It was performed an initial safety assessment aiming at the identification of potential safety issues due to the introduction of ASAS manoeuvres.

- **Prototype Development and Test Execution**

The project developed the ASAS tool integrated in the CWP based on the Technical Specifications. The prototype was developed by two different industry partners with different scopes.

In particular the Thales prototype was delivered in one step and used in one validation activity in 2012.

Selex prototype was delivered in two phases: the first version has been used in two validation activities in 2012, while the second version of the prototype, implementing the operational

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requirements updated after the validation execution, has been used in three validation activities: in 2013, 2014 and 2015.

All prototypes and tools have been subject to internal testing and verification before being integrated into the background system.

- **Support to Validation**

During the Validation Exercises, the project gave technical support for the integration and the usage of the ASAS prototype. The project gave also support in the post-exercise analysis of the collected data.

In particular the prototyping and the support in the execution of the validation activities gave an important contribution in the validation of the Sesar Solution #16 ("ASAS Spacing applications 'remain behind' and 'merge behind'").

## 1.2 Project Achievements

A summary of the project achievements is presented below:

- The project defined detailed technical requirements for ASAS tool traced to OSED, SPR and INTEROP. They can be used by a standardisation group as base reference input for the preparation of standard technical system specification
- The project defined the technical documentation (architecture assessment and technology report) supporting the technical requirements
- The project prototypes have been implemented and used in validation exercises to demonstrate the benefits of the ASAS concept

Concluding, project results offered support to other SESAR projects in the evaluation of the ASAS concept. In particular it demonstrated the technical feasibility of achieving the benefits relating to ASAS concept.

## 1.3 Project Deliverables

A summary of the project deliverables is presented in the table below:

Reference	Title	Description
D05	Architecture Assessment Report Phase 1	The deliverable addresses the proposed Architecture Assessment for the ASAS ground tool. It contains the system architecture, including the functional decomposition of the system, the definition of the system interfaces and the sequence diagrams of the flows of information.
D20	Technology Report Phase 2	The deliverable contains the analysis of the available technologies suitable to realize the project. It contains a component overview to

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		support the ASPA operations and the identification of the technical enablers impacted.
D56	Consolidated requirements R5	The deliverable addresses the final version of the System Requirements, closing the loop after the operational requirements updates. It contains a set of technical requirements, functional and non-functional, and their status after the execution of the validation activities. The deliverable contains also a view on the story of the requirements inserted during the project execution.

## 1.4 Contribution to Standardisation

The Project has not contributed to any standardisation activity and its results did not have an impact on standards.

## 1.5 Project Conclusions and Recommendations

From the project point of view, this project demonstrated the technical feasibility of implementing the ground support tool for the ASAS procedures.

The implementation of the concept by two different industries shown that the developments are achievable on different platforms. This suggests that the requirements, passing through different review and update cycles, are platform independent and mature.

Anyway the SESAR Solution #16 didn't reach the expected maturity due to the increase of the controller workload and to a reduction of the fuel efficiency. For this reason, no more activities on this solution are foreseen.

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[36]	B.01	D84	Integrated Roadmap DS16 Release Note, 00.01.00, 25/05/2016

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