



# ADS-B Ground Surveillance Specifications for Third Iteration

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## Task contributors

EUROCONTROL, INDRA, NORACON, SELEX, THALES

## Abstract

The present document describes the third iteration of specifications for the ADS-B Surveillance System. The selection of the requirements upon which these specifications are based are derived from the preceding deliverable D17. The specifications address the functional ADS-B Ground Surveillance Domain without addressing any physical implementation. It includes the following key information:

- Scope and context of the ADS-B Surveillance System.
- The allocation of enhancements for project Iteration 3 (from D17).
- High Level specifications for the ADS-B Ground Surveillance Domain with an indication of the possible system components to which this specification is applicable.

The document serves as input to the subsequent project tasks which will further elaborate the high level specifications into detailed specifications for the ADS-B Ground

Surveillance Domain components.

## Authoring & Approval

Prepared By		
Name & company	Position / Title	Date
Christos Rekkas / EUROCONTROL	Project Manager	12/05/2012
Miguel Muñoz / INDRA	Focal Point	16/05/2012
Luca Menè / SELEX	Focal Point	11/05/2012
Volker Seidelmann / THALES	Focal Point	23/05/2012

Reviewed By		
Name & company	Position / Title	Date
Miguel Muñoz / INDRA	Focal Point	30/05/2012
Jan Stibor / NORACON	Focal Point	01/06/2012
Luca Menè / SELEX	Focal Point	29/05/2012
Andreas Ehser / THALES	Project Expert	29/05/2012
Alex Engel / EUROCONTROL	Project Expert	26/05/2012
Maria Tabernero / AENA	Focal Point	30/05/2012
Stuart Hunter / EUROCONTROL	Expert (external to the project)	20/06/2012
Neil Gardner / NATS	Expert (external to the project)	07/06/2012

Approved By		
Name & company	Position / Title	Date
Christos Rekkas / EUROCONTROL	Project Manager	27/08/2012
Miguel Muñoz / INDRA	Focal Point	30/08/2012
Jan Stibor / NORACON	Focal Point	30/08/2012
Luca Menè / SELEX	Focal Point	30/08/2012
Volker Seidelmann / THALES	Focal Point	30/08/2012
Maria Tabernero / AENA	Focal Point	30/08/2012

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## Intellectual Property Rights (foreground)

This deliverable consists of SJU foreground.

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## Executive summary

The present document describes the third iteration of Specifications for the ADS-B Surveillance System. The selection of the requirements upon which these specifications are based are derived from the preceding deliverable D17 (Ref [1]). The specifications address the functional ADS-B Ground Surveillance Domain without addressing any physical implementation. It includes the following key information:

- Scope and context of the ADS-B Surveillance System.
- The allocation of enhancements for project Iteration 3 (from Ref [1])
- High Level specifications for the ADS-B Ground Surveillance Domain with an indication of the possible system components to which this specification is applicable.

The Project covers enhancements to the baseline by a number of potential drivers (applications and technological enhancements) which can be clustered as follows:

- Initial ADS-B applications
- Applications defined in SESAR projects (including future separation modes such as spacing, separation etc.)
- Integration of ADS-B with WAM
- Security and Civil-Military Interoperability
- 1090 ES MHz datalink technology enhancements
- Other enhancements

In accordance with the set of enhancements defined in Ref [1], high-level requirements are addressed in order to support:

- Applications based on SESAR project deliveries (after analysis not retained for Iteration 3)
- Advanced enhancements from integration with WAM
  - ADS-B target report update by WAM system
- Advanced security enhancements
  - Range measurement from active interrogation
  - ADS-B Report validation using FDPS or other relevant inputs (such as 4D)
- 1090 ES technology
  - Enhancements for impact from SESAR project 9.21, if available (after analysis not retained for Iteration 3)

In addition, the following new functionality, (driven by relevant EUROCONTROL CASCADE Programme work), is proposed

- Other enhancements
  - Use of the Flight Plan to indicate the approval of the aircraft for ADS-B operations and the corresponding approval reference (e.g. AMC 20-24, SPI IR etc.)

# 1 Introduction

## 1.1 Purpose of the document

This document describes the high level requirements for the third iteration of specifications for the ADS-B Ground Surveillance System

It is to be used as the input document for the project tasks producing the component specifications for ADS-B Ground Station, Surveillance Data Processing and Distribution systems as well as for the enhancements to the baseline interfaces.

The requirements shall be at a high level and shall be allocated to one or more of the above-mentioned components.

## 1.2 Intended readership

The audience of this document includes:

- Projects 15.04.05.a and b,
- Any other SJU projects that may require ADS-B Surveillance Systems for their validation activities.

## 1.3 Inputs from other projects

The following on-going and past activities have contributed to establishing the high level requirements for the ADS-B Ground Surveillance System:

- EUROCONTROL CASCADE Program
- EUROCAE/RTCA standardisation activities for ADS-B Surveillance Applications (Ref [7], [8], [19].)
- ADS-B Avionics equipment standardisation by EUROCAE/RTCA (Ref [4],[5], [6]).

## 1.4 Structure of the document

Chapter 1: Purpose and scope; Requirements structure; Component purpose and high level overview

Chapter 2: General component description

Chapter 3: ADS-B Ground Surveillance Functional and Non-Functional Requirements

Chapter 4: Referenced documents

Appendix A: Traceability Matrix

## 1.5 Requirements Definitions – General Guidance

Requirements have been developed according to the SESAR Requirements and V&V Guidelines Ref [2].

They are broken down according to the source of the requirements, derived from the allocation which was done in Ref [1].

The layout follows the description in Ref [3].

In accordance with the guidelines in Ref [3], requirement identifiers follow the scheme:

REQ-15.04.05.a-D20-00xx.yyyy, where

xx	Meaning
14-19	Reserved for SESAR applications Functional req.
24-29	Reserved for SESAR applications Performance req.
30	WAM integration req.
40	Security req.
50	Civil/Military req.
60	1090ES Technology req.
00	Other

Table 1 Requirement Identifier Allocation

## 1.6 Functional block Purpose

The ADS-B Ground Surveillance Domain is a subset of the overall Ground Surveillance System, and adds the reception, processing and integration of ADS-B data into the surveillance data provided to the ATM System.

The ADS-B Ground Surveillance Domain consists of sets of networked ground stations plus data distribution and filtering functions, as well as tracking/fusion capabilities with other surveillance sources.

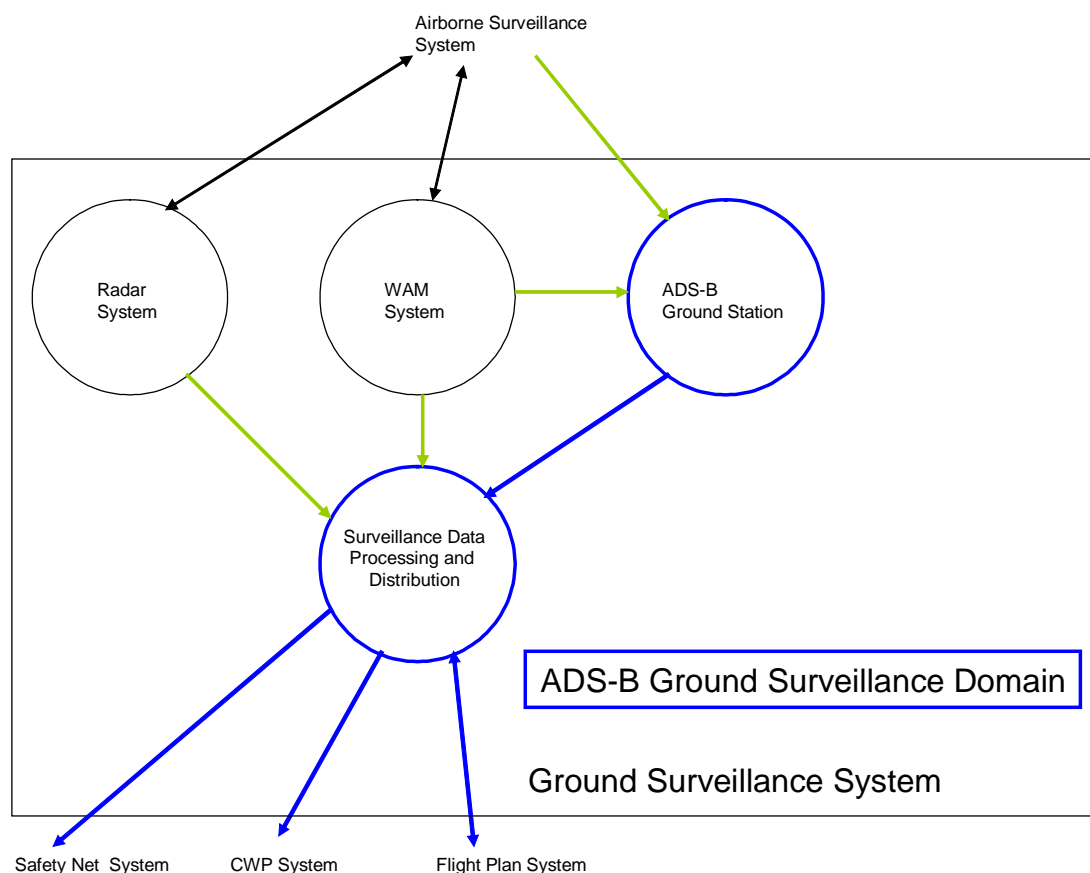
## 1.7 Functional block Overview

The figure below depicts a functional context diagram of the future Ground Surveillance System, where the impacted system elements are marked in blue.

Please note that the inclusion of Radar Systems and/or WAM systems depends on the operational environment and associated ADS-B applications which are to be deployed.

In case of ADS-B NRA or ADS-B APT deployment, ADS-B will be the only surveillance source.





**Figure 1 ADS-B Ground Surveillance Domain Context**

- = Existing standardised interfaces, already processed by Baseline, not modified by P15.4.5a
- = Existing standardised interfaces, already processed by Baseline, modified by P15.4.5a
- = Existing standardised interfaces, out of scope of P15.4.5a

In the context of this project, the following functional components are addressed:

- **ADS-B Ground Station**

The term 'ADS-B Ground Station' in this document refers to a 1090ES Ground Station. The primary function of the ADS-B Ground Station is to receive 1090 MHz RF input on the Air Interface, extract data from the 1090 MHz ES messages, assemble the data into ASTERIX Category 21 ADS-B Reports and send these reports over the Ground Interface.

This specification is not intended to dictate the physical architecture of the equipment. In alignment with the chosen baseline specifications for ADS-B Ground Stations (Ref [9]), the definition of an ADS-B Ground Station is intended to include a distributed architecture where 1090 ES reception functionality is located remotely and the report assembly for one or more sites is hosted centrally in a common server. This distributed architecture allows for the integration of WAM systems and ADS-B Ground Stations. It allows also for physical implementations where SDPD functionality is implemented in the common server of the ADS-B Ground Stations.

- **Surveillance Data Processing and Distribution (SDPD)**

The baseline for the SDPD is the ARTAS multi-sensor tracking system enhancement based on the second iteration specifications. This system associates surveillance reports

originating from different surveillance technologies (radar, WAM, ADS-B, and ADS-C) and fuses the associated reports into a unique system track. The system tracks are assembled into ASTERIX CAT 62 System Track Messages and these messages are sent over the Ground Interface.

Despite the fact that an existing physical implementation of an SDPD has been chosen as the baseline, the allocation (or non-allocation) of specific requirements to the SDPD should be interpreted as a functional allocation. This specification should not prevent different physical ADS-B Ground Domain implementations. For example, ADS-B Ground Station functionality hosted in a server common to remote 1090ES reception functionality could be implemented in a physical SDPD system.

- Interfaces

The Interfaces subject to modification by the project refer to:

- ASTERIX CAT21, Ed. 2.80, November 2011 (ref [18])
- ASTERIX CAT 23, Ed. 2.72, October 2011 (ref [18])
- ASTERIX CAT 62, Ed. 2.74, October 2011 (ref [18])
- ASTERIX CAT 63, Ed. 1.3, July 2007 (ref [13])
- ASTERIX CAT 32, ARTAS V8B1, Edition 1.0, February 2011 (ref. [21])

After the latest update of ASTERIX Categories for project 15.4.5a, a renumbering of the ASTERIX Categories was agreed by the ASTERIX Community. Following this renumbering, the following conversion Tables apply:

Category 021	
old	new
2.0a	2.70
2.0b	2.71
2.0c	2.72
2.0d	2.73
2.0e	2.74
2.0f	2.75
2.0g	2.76
2.0h	2.77
2.0i	2.78
2.0j	2.79
2.0k	2.80

Category 023	
old	new
2.0a	2.70
2.0b	2.71
2.0c	2.72

category 062	
old	new
2.0a	2.70
2.0b	2.71
2.0c	2.72
2.0d	2.73
2.0e	2.74

## 1.8 Acronyms and Terminology

Term	Definition
<b>ADD</b>	Aircraft Derived Data
<b>ADS-B</b>	Automatic Dependent Surveillance - Broadcast
<b>ADS-B ADD</b>	Aircraft Derived Data for ATC tools ("ADS-B out" application)
<b>ADS-B APT</b>	Enhanced ATS at the airport surface ("ADS-B out" application)
<b>ADS-B NRA</b>	Enhanced ATS in Non Radar Areas ("ADS-B out" application)

Term	Definition
<b>ADS-B RAD</b>	Enhanced ATS in Radar Areas (“ADS-B out” application)
<b>ARTAS</b>	ATM suRveillance Tracker And Server
<b>ASAS</b>	Airborne Separation Assurance System
<b>ASEP</b>	Airborne SEParation
<b>ASPA</b>	Airborne Spacing Application
<b>ASPA-FIM</b>	Flight-deck Interval Management (“ADS-B in” Airborne Spacing Application)
<b>ASSUMP</b>	Assumption
<b>ASTERIX</b>	All-purpose Structured EUROCONTROL Surveillance Information Exchange
<b>ATC</b>	Air Traffic Control
<b>ATM</b>	Air Traffic Management
<b>ATS</b>	Air Traffic Services
<b>ATSA-ITP</b>	In-Trail Procedure in procedural airspace (“ADS-B in” ATSAW application)
<b>ATSA-SURF</b>	Enhanced Traffic Situational Awareness on the Airport Surface (“ADS-B in” ATSAW application)
<b>ATSAW</b>	Air Traffic Situation Awareness
<b>ATX</b>	ASTERIX
<b>CAT</b>	Data Category
<b>DO</b>	RTCA Document
<b>ED</b>	EUROCAE Document
<b>ES</b>	Extended Squitter
<b>EUROCAE</b>	European Organisation for Civil Aviation Equipment
<b>FDPS</b>	Flight Data Processing System
<b>FIM</b>	Flight-deck Interval Management
<b>GS</b>	Ground Station
<b>INTEROP</b>	Interoperability
<b>IP1</b>	Implementation Package 1
<b>ITP</b>	In-Trail Procedure
<b>Mode S</b>	MODE Select

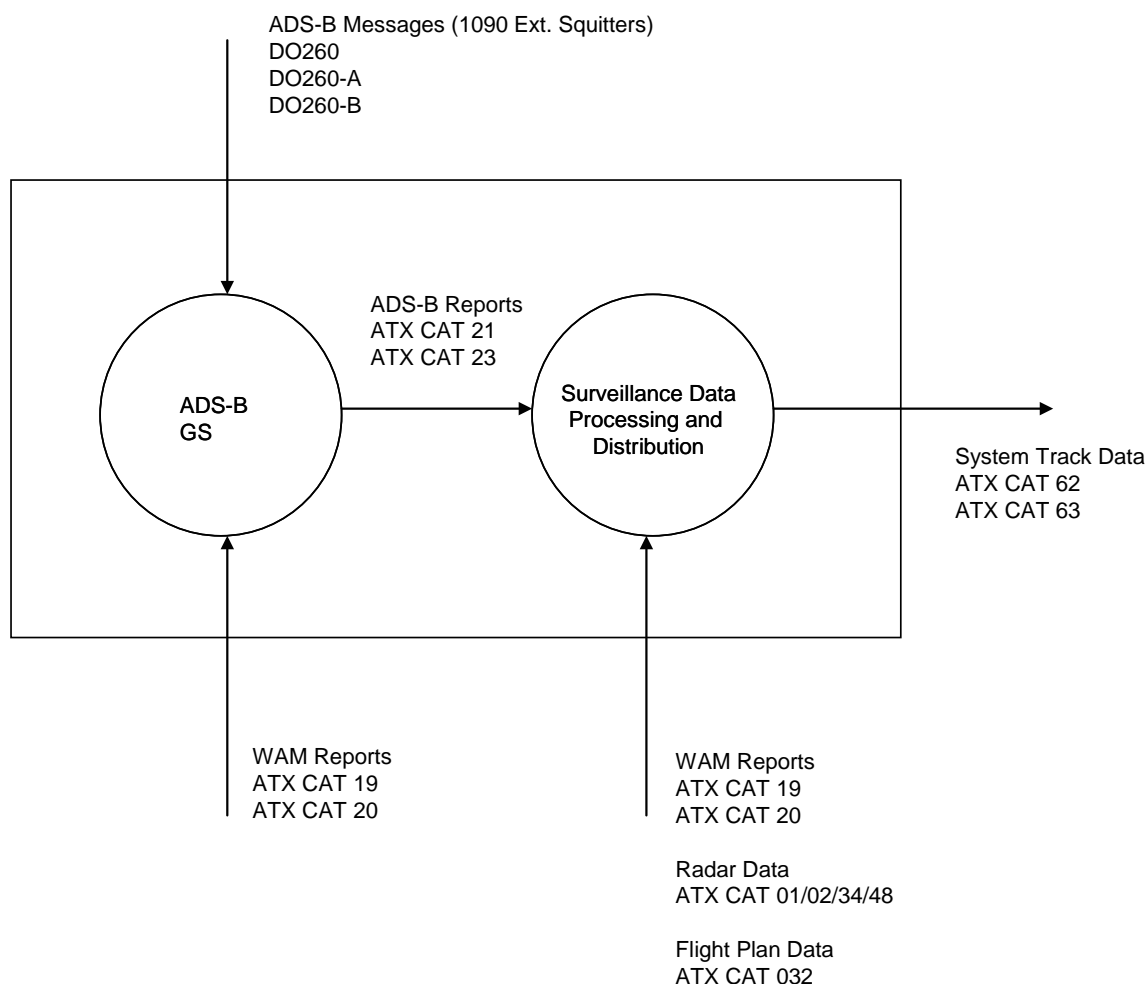
Term	Definition
<b>MOPS</b>	Minimum Operational Performance Standards
<b>NACp</b>	Navigation Accuracy for Position
<b>NRA</b>	Non Radar Airspace
<b>PIR</b>	Project Initiation Report
<b>PR</b>	Performance Requirement
<b>REQ</b>	Requirement
<b>RF</b>	Radio Frequency
<b>RFG</b>	Requirement Focus Group
<b>RMK</b>	Remark
<b>RTCA</b>	Radio Technical Commission for Aeronautics
<b>SDPD</b>	Surveillance Data Processing and Distribution
<b>SESAR</b>	Single European Sky ATM Research (Programme)
<b>SG4</b>	Sub Group 4
<b>SJU</b>	SESAR Joint Undertaking
<b>SMGCS</b>	Surface Movement Guidance and Control System
<b>SMR</b>	Surface Movement Radar
<b>SPR</b>	Safety and Performance Requirements
<b>SPR-INTEROP</b>	Safety, Performance and Interoperability Requirements
<b>SSR</b>	Secondary Surveillance Radar
<b>TDOA</b>	Time Difference Of Arrival
<b>TMA</b>	Terminal Manoeuvring Area
<b>WAM</b>	Wide Area Multilateration

## 2 General Functional block Description

### 2.1 Context

A high level context of the ADS-B Ground Surveillance Domain is shown in Figure 1.

The following Figure gives a more detailed overview of the component boundaries and interfaces.



**Figure 2 Component Context**

### 2.2 Functional block Modes and States

Detailed Modes and States of the sub-components are described in the baseline documents ref [9], and [14].

This document will be used as the reference document for further detailed specifications for ADS-B Ground Stations (D13), SDPD (D14) and ASTERIX Interfaces (D15) related to Iteration 3.

Any change towards the Modes and States as a result of this document will be further detailed into those above mentioned deliverables.

## 2.3 Major Functional block Capabilities

The major components and capabilities are as described in Section 1.7 of this document

## 2.4 User Characteristics

The ADS-B Ground Surveillance System is designed to be used in a high-density traffic environment (en-route and/or TMA and/or Airport), including multiple surveillance techniques. High quality aircraft position data and other aircraft derived data will contribute to accurate Flight Plan updates and conformity monitoring.

Nevertheless due to its scalability (see Section 2.5 hereafter), such a system could also be deployed in non-core European airspace.

## 2.5 Operational Scenarios

The ADS-B Ground Surveillance System shall be capable to be integrated into a multi-sensor surveillance environment as an additional means of surveillance. This usage targets the core European airspace.

The ADS-B Ground Surveillance System shall also be able to be deployed in lower density non-core European airspace. This type of airspace could be Non-Radar Airspace (NRA) in which the ADS-B Ground Surveillance System will be the sole means of surveillance.

The ADS-B Ground Surveillance System shall also be able to be deployed in high density core European airspace. This type of airspace could be Radar Airspace (RAD) in which the ADS-B Ground Surveillance System will be one of more means of surveillance (e.g. including radar and/or WAM).

The ADS-B Ground Surveillance System shall also be able to be deployed at simple to complex airports (as defined in ADS-B APT) with medium traffic complexity where a conventional SMR-only solution would be sufficient for the provision of Aerodrome Control Services supported by Surveillance (SMGCS).

More information on the typical ADS-B APT user characteristics can be found in Ref [19].

The scalability and various potential physical architectures of this system will allow for a surveillance solution adaptable to the local traffic and local ATM system environment.

## 2.6 Functional

Due to the bottom-up approach adopted for this third iteration of specifications, a functional decomposition or analysis linking to modelling performed by X.1.7 and/or B.4.3 projects is not applicable to this document.

## 2.7 Service View

N/A

## 3 ADS-B Ground Surveillance Functional and non-Functional Requirements

### 3.1 General

The Project covers enhancements to the baseline by a number of potential drivers (applications and technological enhancements) which can be clustered as follows:

- Initial ADS-B applications
- Applications defined in SESAR projects (including future separation modes such as spacing, separation etc.)
- Integration of ADS-B with WAM
- Security and Civil-Military Interoperability
- 1090 ES MHz datalink technology enhancements
- Other enhancements

The Baseline Definition document (Project deliverable D17) has established enhancements to be taken into account for the third iteration which are listed in the first four columns of the Table hereafter. In addition one more enhancement is proposed related to the use of the Flight Plan for indication of approval of aircraft for ADS-B operations. The latter enhancement is driven by relevant work within the EUROCONTROL CASCADE Programme.

ADS-B applications	Integration with WAM	Security and civil-military interop	1090 ES Technology	Other enhancements
Applications based on SESAR project deliveries (e.g. separation applications)	ADS-B target report data update by WAM system	Range measurement from active interrogation  ADS-B Report validation using FDPS or other relevant inputs (such as 4D)	Enhancements for impact from SESAR project 9.21, if available	Use of the Flight Plan to indicate the approval of the aircraft for ADS-B operations and the corresponding approval reference (e.g. AMC 20-24, SPI IR etc.)

**Table 2 Enhancements for Iteration 3**

The baselines for the requirements are the enhancements as specified for Iteration 2. This means that the baselines for Iterations 2 as specified in Ref [15] are implicitly included in the baseline of Iteration 3.

Iteration 3 will thus build on the results of Iteration 2 and relevant IP1 work (such as EUROCONTROL CASCADE Programme regarding ADS-B & WAM, the Surveillance Products & Services regarding

ARTAS and Directorate Single Sky regarding ASTERIX) as well as industry standardisation (such as EUROCAE).

The high level specifications in this document relate to the En-Route and Approach ATC Domain as well as to the Airport Domain.

## 3.2 ADS-B Applications

The available deliverables of SESAR Projects with a potential impact on Ground Surveillance were analysed in terms of their status and content. This was based on expert judgment. The conclusion of this analysis was that no substantial requirements for ADS-B Ground Surveillance could be identified.

The following table contains the projects which were analysed:

Project Number	Project Name
4.7.4a	ATSA-ITP Pioneer Trial
4.7.4b	ASAS-ASEP Oceanic Applications
4.7.5	Self Separation in Mixed Mode Environment
4.7.6	En Route Trajectory and Separation Management – ASAS Separation
5.6.6	ASAS Sequencing and Merging
6.8.1	Flexible and Dynamic Use of Wake Vortex Separation
9.5	ASAS-ASPA
9.6	ASAS ASEP
9.21	ADS-B 1090 Higher Performance Study
9.22	Mid- and Full- ADS-B Capability Research
9.38	ASAS SSEP
10.3.2	ATC Support to ASAS Sequencing and Merging Operations
10.3.3	ATC Support to ASAS In Trail Procedure(ITP)
10.4.4	Time Based Separation

**Table 3 SESAR Projects with potential ground surveillance requirements**



## 3.3 Integration of ADS-B with WAM

### 3.3.1 ADS-B target report data update by WAM system

The proposed enhancement is a possible technical solution to increase the robustness and integrity of ADS-B System output.

[REQ]

Identifier	REQ-15.04.05.a-D20-0030.0001
Requirement	In case of missing ADS-B target report updates, the ADS-B system <b>shall</b> use available WAM system target report updates (position) as target position report.
Title	ADS-B target report update by WAM
Status	<In Progress>
Rationale	ADS-B/WAM shared infrastructure opportunity
Category	<Functional>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	SJU PIR Review P15.4.5a 23/03/2010	<Partial>
<ALLOCATED_TO>	<Functional block>	ADS-B GS	N/A

[REQ]

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
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## 3.4 Security

### 3.4.1 Range measurement from active interrogation

Position information contained in ADS-B ASTERIX reports only relies on the ES transmitted by the target. This exposes the ADS-B system to the risk of receiving false positions that may be reported by spoofing targets or by aircraft with low integrity navigational source.

If the ADS-B System is able to calculate the distance of a target from the GS through the use of a 1030 MHz interrogator, then this information can be correlated with the position reported by the aircraft.

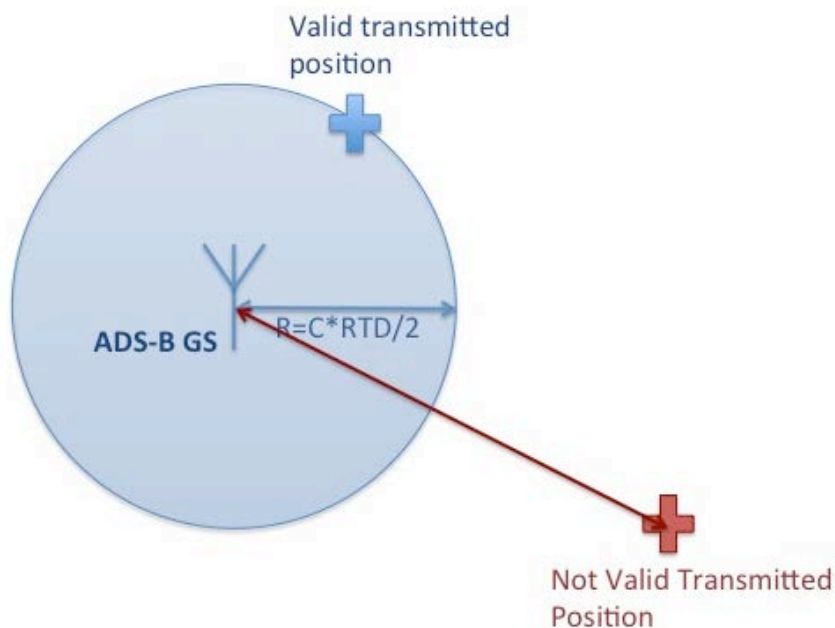


Figure 3 RTD validation principle

Once a Mode S reply is received by the GS, the distance of a target can be expressed in term of Round Trip Delay (RTD); RTD is expressed in seconds and is defined as

$$RTD = TOA - TOI$$

Where

TOA = Time of Arrival of a Mode S reply

TOI = Time Of Interrogation associated to the same received reply

So that

$$R = c * RTD / 2$$

Once a position ES is received, the target position can be considered VALID if the distance between the target position and the sphere (ellipsoid in case of not co-mounted RX and TX) of radius  $R$  (calculated exploiting RTD), centered on the GS, is lower than a configurable threshold.

*Note: A time validity of the RTD (calculated at a previous reply reception) has to be defined to avoid to perform the validation exploiting a range information too old in time.*

The following tables list all identified high level ADS-B Ground Surveillance Domain requirements for the Active ADS-B validation functionality. The requirements are allocated to one or more ADS-B Ground Surveillance Domain Components. If a requirement is allocated to a specific component, the detailed specifications will be developed in the subsequent project tasks dealing with component specifications.

[REQ]

Identifier	REQ-15.04.05.a-D20-0040.0001
Requirement	The ADS-B Ground Surveillance Domain <b>should</b> be equipped with a 1030

founding members



Avenue de Cortenbergh 100 | B -1000 Bruxelles  
www.sesarju.eu

	MHz interrogator, capable of interrogating ADS-B targets according to all relevant ICAO Annex 10 requirements.
Title	1030 MHz interrogation capability
Status	<In Progress>
Rationale	Proposed security enhancement
Category	<Security>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	NATO C3 Agency Technical Note 1407	<Partial>
<ALLOCATED_TO>	<Functional block>	ADS-B GS	N/A

[REQ]

Identifier	REQ-15.04.05.a-D20-0040.0002
Requirement	If REQ-15.04.05.a-D20-0040.0001 is implemented, the ADS-B Ground Surveillance Domain <b>shall</b> have the capability to determine the Round Trip Delay (RTD) of every received 1090 MHz reply elicited by its own interrogations (registered as <i>Real RTD</i> ).
Title	RTD measurement
Status	<In Progress>
Rationale	Proposed security enhancement
Category	<Security>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	NATO C3 Agency Technical Note 1407	<Partial>
<ALLOCATED_TO>	<Functional block>	ADS-B GS	N/A

[REQ]

Identifier	REQ-15.04.05.a-D20-0040.0003
Requirement	If REQ-15.04.05.a-D20-0040.0002 is implemented, the ADS-B Ground Surveillance Domain <b>shall</b> register the last RTD of each of the received ES and its time stamp.
Title	RTD storage
Status	<In Progress>
Rationale	Proposed security enhancement
Category	<Security>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	NATO C3 Agency Technical Note 1407	<Partial>
<ALLOCATED_TO>	<Functional block>	ADS-B GS	N/A
<ALLOCATED_TO>	<Functional block>	Interfaces	N/A

[REQ]

Identifier	REQ-15.04.05.a-D20-0040.0004
Requirement	If REQ-15.04.05.a-D20-0040.0003 is implemented, each calculated RTD <b>shall</b> be considered applicable to RTD Validation for a configurable time period.
Title	RTD applicability

founding members



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Status	<In Progress>
Rationale	Proposed security enhancement
Category	<Security>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	NATO C3 Agency Technical Note 1407	<Partial>
<ALLOCATED_TO>	<Functional block>	GS	N/A

[REQ]

Identifier	REQ-15.04.05.a-D20-0040.0005
Requirement	If REQ-15.04.05.a-D20-0040.0003 and REQ-15.04.05.a-D20-0040.0004 are implemented, each time a valid position message is received for a target in "target data maintenance" mode (see ED-129 chapter 3) and the associated RTD applicability is elapsed, the ADS-B position report <b>shall</b> be marked as NOT VALIDATED.
Title	Active ADS-B validation use
Status	<In Progress>
Rationale	Proposed security enhancement
Category	<Security>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	NATO C3 Agency Technical Note 1407	<Partial>
<ALLOCATED_TO>	<Functional block>	GS	N/A
<ALLOCATED_TO>	<Functional block>	Interfaces	N/A

Identifier	REQ-15.04.05.a-D20-0040.0006
Requirement	If REQ-15.04.05.a-D20-0040.0003 and REQ-15.04.05.a-D20-0040.0004 are implemented, each time a valid position message is received for a target in "target data maintenance" mode (see ED-129 chapter 3), the ADS-B Ground Surveillance Domain <b>shall</b> validate the ADS-B report comparing the ADS-B position data with the computed applicable RTD.
Title	Active ADS-B validation
Status	<In Progress>
Rationale	Proposed security enhancement
Category	<Security>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	NATO C3 Agency Technical Note 1407	<Partial>
<ALLOCATED_TO>	<Functional block>	ADS-B GS	N/A

[REQ]

Identifier	REQ-15.04.05.a-D20-0040.0007
Requirement	If REQ-15.04.05.a-D20-0040.0006 is implemented, the ADS-B Ground Surveillance Domain <b>shall</b> be able to report the validation result in the ASTERIX CAT021 ADS-B report.
Title	Active ADS-B validation reporting
Status	<In Progress>

Rationale	Proposed security enhancement
Category	<Security>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	NATO C3 Agency Technical Note 1407	<Partial>
<ALLOCATED_TO>	<Functional block>	ADS-B GS	N/A
<ALLOCATED_TO>	<Functional block>	Interfaces	N/A

[REQ]

Identifier	REQ-15.04.05.a-D20-0040.0008
Requirement	If REQ-15.04.05.a-D20-0040.0007 is implemented, the SDPD <b>shall</b> be able to use the validation result
Title	Active ADS-B validation consistency use
Status	<In Progress>
Rationale	Proposed security enhancement
Category	<Security>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	NATO C3 Agency Technical Note 1407	<Partial>
<ALLOCATED_TO>	<Functional block>	SDPD	N/A
<ALLOCATED_TO>	<Functional block>	Interfaces	N/A

[REQ]

Identifier	REQ-15.04.05.a-D20-0040.0009
Requirement	If REQ-15.04.05.a-D20-0040.0008 is implemented, the validation result (positive/negative) <b>should</b> be reported to the end user of the surveillance data
Title	Active ADS-B validation forwarding
Status	<In Progress>
Rationale	Proposed security enhancement
Category	<Security>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	NATO C3 Agency Technical Note 1407	<Partial>
<ALLOCATED_TO>	<Functional block>	SDPD	N/A
<ALLOCATED_TO>	<Functional block>	Interfaces	N/A

[REQ]

Identifier	REQ-15.04.05.a-D20-0040.0010
Requirement	It <b>shall</b> be possible to activate/desactivate the function of range measurement from active interrogation
Title	Desactivation of range measurement from active interrogation
Status	<In Progress>
Rationale	Proposed security enhancement
Category	<Security>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	NATO C3 Agency Technical Note 1407	<Partial>
<ALLOCATED_TO>	<Functional block>	GS	N/A

### 3.4.2 ADS-B Report validation using FDPS or other relevant inputs (such as 4D)

The use of FDPS data as a means to indicate the approval of aircraft for ADS-B operations is covered in Section 3.7.1 hereafter, addressing the wider issue of mixed traffic operations.

Regarding other inputs such as 4D and following investigation, it was concluded that no requirements could be identified at this stage.

Following analysis, it was concluded that there are no tangible requirements on Project 15.4.5a for this Iteration.

## 3.5 Civil Military Interoperability

The ADS-B Surveillance System shall be interoperable with the military aircraft ADS-B In/Out solution defined in 9.24. The project will follow the outcome of Project 9.24, but for Iteration 3, no tangible requirements for the ADS-B Ground Surveillance Domain have been identified.

## 3.6 1090 ES Technology

The status of projects 9.21 and 9.22 was analysed and it was concluded that there is no impact on Project 15.4.5a for this Iteration.

## 3.7 Other Enhancements

### 3.7.1 Use of Flight Plan to indicate the approval of aircraft for ADS-B operations

In the context of the EUROCONTROL CASCADE Programme work, the use of the Flight Plan to indicate the approval of aircraft for ADS-B operations is being elaborated.

The currently ongoing ADS-B deployments use (or encourage to use) the RMK/ indication followed by the text ADSB in the flight plan Item 18 (i.e. RMK/ ADSB) to indicate that the aircraft are eligible to receive ADS-B based ATC services in respective airspace.

The ICAO PANS ATM (Doc 4444) amendments, that will become applicable in November 2012 (Flight plan 2012), will introduce methods to indicate ADS-B capabilities in Item 10b. The specific provisions are described hereafter:

*ITEM 10b: EQUIPMENT AND CAPABILITIES includes:*  
*B1 = ADS-B with dedicated 1090 MHz ADS-B 'out' capability*  
*B2 = ADS-B with dedicated 1090 MHz ADS-B 'out' and 'in' capability*  
*(Also includes provision for ADS-B using other data link technologies)*

*Where capability is defined as comprising the following elements:*

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- a) presence of relevant serviceable equipment on board the aircraft;
- b) equipment and capabilities commensurate with flight crew qualifications; and
- c) where applicable, authorisation from the appropriate authority.

It is noted that the Flight plan provisions for Item 10b do not allow to explicitly indicate the relevant ADS-B airworthiness approval or approval baseline and any amendment would require a very long period before agreement. However, Item 18 (e.g. its SUR indicator) allows flexibility and could be used to provide additional information (such as the ADS-B Out and ADS-B In approval references). The corresponding Item 18 entry could for example be SUR/AMC2024 or SUR/XYZZ for CS-ACNS etc.

The ground systems and procedures should be adapted to allow the processing of ADS-B data from the approved aircraft, whilst rejecting that from non-approved aircraft.

This information is useful for ATCO awareness as well as for discarding ADS-B inputs from the no-approved aircraft.

Identifier	REQ-15.04.05.a-D20-0000.0001
Requirement	The ADS-B Ground Surveillance Domain <b>shall</b> be capable of receiving Flight plan information on ADS-B equipage and capabilities (Item 10b).
Title	Flight Plan derived information on ADS-B equipage
Status	<In Progress>
Rationale	Indication of ADS-B approval status
Category	<Functionality>
Validation Method	
Verification Method	<Test>

## [REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	CASCADE Programme issue	<Partial>
<ALLOCATED_TO>	<Functional block>	SDPD	N/A
<ALLOCATED_TO>	<Functional block>	Interfaces	N/A

## [REQ]

Identifier	REQ-15.04.05.a-D20-0000.0002
Requirement	The ADS-B Ground Surveillance Domain <b>shall</b> be capable of receiving Flight plan information on ADS-B approval reference (Item 18).
Title	Flight Plan derived information on ADS-B equipage
Status	<In Progress>
Rationale	Indication of ADS-B approval status
Category	<Functionality>
Validation Method	
Verification Method	<Test>

## [REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	CASCADE Programme issue	<Partial>
<ALLOCATED_TO>	<Functional block>	SDPD	N/A
<ALLOCATED_TO>	<Functional block>	Interfaces	N/A

## [REQ]

Identifier	REQ-15.04.05.a-D20-0000.0003
Requirement	The ADS-B Ground Surveillance Domain <b>shall</b> process the information on the ADS-B approval of aircraft in order to confirm approval status of aircraft.
Title	ADS-B approval status confirmation
Status	<In Progress>
Rationale	Indication of ADS-B approval status

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Category	<Functionality>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	CASCADE Programme issue	<Partial>
<ALLOCATED_TO>	<Functional block>	SDPD	N/A

Identifier	REQ-15.04.05.a-D20-0000.0004
Requirement	The ADS-B Ground Surveillance Domain <b>shall</b> discard ADS-B information from the aircraft which are non-approved for ADS-B operations.
Title	Discarding of information for the non-approved aircraft
Status	<In Progress>
Rationale	Indication of ADS-B approval status
Category	<Functionality>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	CASCADE Programme issue	<Partial>
<ALLOCATED_TO>	<Functional block>	SDPD	N/A

[REQ]

Identifier	REQ-15.04.05.a-D20-0000.0005
Requirement	The ADS-B Ground Surveillance Domain <b>shall</b> process information from the approved aircraft only.
Title	Processing of information for the approved aircraft
Status	<In Progress>
Rationale	Indication of ADS-B approval status
Category	<Functionality>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	CASCADE Programme issue	<Partial>
<ALLOCATED_TO>	<Functional block>	SDPD	N/A

Identifier	REQ-15.04.05.a-D20-0000.0006
Requirement	The ADS-B Ground Surveillance Domain <b>shall</b> provide information for the approved aircraft to its Users.
Title	Provision of information for approved aircraft.
Status	<In Progress>
Rationale	
Category	<>
Validation Method	
Verification Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	CASCADE Programme issue	<Partial>
<ALLOCATED_TO>	<Functional block>	SDPD	N/A



## 3.8 Functional block Internal Data Requirements

This specification does not prescribe any particular internal component architecture.

## 3.9 Design and Construction Constraints

No design or construction constraints have been identified.

### 3.9.1 Functional block Interface Requirements

The ADS-B Ground Surveillance System uses the EUROCONTROL ASTERIX Surveillance Standard for all message exchange with other ground ATM system components as well as for internal communication between ADS-B Ground Station and Surveillance Data Processing components.

For the reception of airborne data the ADS-B Ground Surveillance System uses the ED-102A/DO-260B standard, but shall also be compatible with ED-102/DO-260 and DO-260A standards.

## 4 References

- [1] SJU 15.04.05a Specification Baseline Document, D17, Ed. 00.01.00, Oct 2010
- [2] SESAR Requirements and V&V Guidelines Latest version
- [3] SESAR Toolbox User Manual Latest version
- [4] EUROCAE/RTCA MOPS for 1090 MHz ADS-B, ED-102/DO-260, Sept. 2000
- [5] RTCA MOPS for 1090ES ADS-B and TIS-B, DO-260A, Dec. 2006 (includes Changes 1 and 2)
- [6] EUROCAE/RTCA MOPS for 1090ES ADS-B and TIS-B, ED-102A/DO-260B, Dec. 2009
- [7] EUROCAE/RTCA SPR Document for ADS-B NRA Application, ED-126/DO-303, Dec. 2006
- [8] EUROCAE/RTCA SPR Document for ADS-B RAD Application, ED-161/DO-318, Sept. 2009
- [9] EUROCAE ED129: Technical Specification for a 1090 MHz Extended Squitter ADS-B Ground Station, June 2010
- [10] EUROCONTROL ASTERIX Standards CAT 021, Ed 2.80, November 2011,
- [11] EUROCONTROL ASTERIX Standards CAT 023, Ed 2.72, October 2011
- [12] EUROCONTROL ASTERIX Standards CAT 062, Ed.2.74, October 2011
- [13] EUROCONTROL ASTERIX Standards CAT 063, Ed 1.3, July 2007,
- [14] EUROCONTROL ARTAS V8, System/Segment Specifications, Doc. 46 127 300 – 305
- [15] SJU 15.04.05a ADS-B Surveillance System Spec. for It 2, D19, Ed. 00.03.00, Sept 2011
- [16] SJU 15.04.05a ADS-B Ground Station Spec. for It 2, D09, Sept 2011
- [17] SJU 15.04.05a 1090 SDPD URs for It 2, D10, Sept 2011
- [18] SJU 15.04.05a Interface Spec. for It .2 , D11, Sept 2011
- [19] EUROCAE/RTCA SPR Document for ADS-B APT Application, ED-163/DO-321, Nov. 2010
- [20] CRISTAL RAD HD Air Derived Data (ADD) Study, CRSTL3/RPT/02 Issue 1, Jan. 2010
- [21] EUROCONTROL ASTERIX Specification CAT 032, ARTAS V8B1, Edition 1.0, February 2011

### 4.1 Use of copyright / patent material /classified material

No copyright/patent material is included in this specification.

## Appendix A Traceability

The project intends to import all requirements defined in this document as well as the lower level derived requirements as specified in Deliverables D13, D14 and D15, into a requirements management tool (like DOORS).

Such a tool will then generate an overall traceability matrix which could be included in this document at a later stage.

## Appendix B


- END OF DOCUMENT -