Technical report, composite cooperative surveillance prototype

Document information	
Project Title	Integrated Surveillance sensor technologies
Project Number	15.04.02
Project Manager	Thales
Deliverable Name	Technical report, composite cooperative surveillance prototype
Deliverable ID	D08
Edition	00.01.00
Template Version	03.00.00
Task contributors	
DFS,EUROCONTROL;INDRA;NATS	

Abstract

The present document describes the low-level specifications for the Composite Cooperative Surveillance System. The specifications address the functional ADS-B and WAM Ground Surveillance Domain without addressing any physical implementation. It includes the following key information: Scope and context of the Composite Cooperative Surveillance System and Generic & Specific low-level requirements for the different systems under analysis in the project. The document serves as input to the subsequent project deliverable, which will further elaborate detailed objectives and exercises for the Composite Cooperative Surveillance System.

Authoring & Approval

Prepared By - *Authors of the document.*		
Name & Company	**Position & Title**	**Date**
<Name / Company>	<Position / Title>	15/07/2015
██████████████ /EUROCONTROL	███████████████████	15/07/2015
██████████ /INDRA		15/07/2015
███████████ INDRA		15/07/2015
███████████ INDRA		15/07/2015
█████████ DFS		15/07/2015
█████████ NATS		15/07/2015

Reviewed By - *Reviewers internal to the project.*		
Name & Company	**Position & Title**	**Date**
██████████████ /EUROCONTROL	███████████████████	19/10/2015
██████████ /INDRA		19/10/2015
████████████ INDRA		19/10/2015
███████████ / INDRA		19/10/2015
█████████ DFS		19/10/2015
██████████ NATS		19/10/2015
███████ NATS		19/10/2015
███████ DFS		19/10/2015

Reviewed By - *Other SESAR projects, Airspace Users, staff association, military, Industrial Support, other organisations.*		
Name & Company	**Position & Title**	**Date**
<Name / Company>	<Position / Title>	<DD/MM/YYYY>

Approved for submission to the SJU By - *Representatives of the company involved in the project.*		
Name & Company	**Position & Title**	**Date**
████████████ /EUROCONTROL	███████████████████	19/10/2015
████████████ INDRA		19/10/2015
█████████ NATS		19/10/2015
████████ DFS		21/10/2015

Rejected By - *Representatives of the company involved in the project.*		
Name & Company	**Position & Title**	**Date**
<Name / Company>	<Position / Title>	<DD/MM/YYYY>

Project Number 15.04.02
Error! Unknown document property name. **- Technical report, composite cooperative surveillance prototype.**

Edition 00.01.00

Rational for rejection
None.

Document History

Edition	Date	Status	Author	Justification
00.00.01	03/06/2015	Draft	████ INDRA	New Document
00.00.02	21/07/2015	Draft	████ INDRA	Update for review
00.00.03	21/08/2015	Draft	████ INDRA	Update for review
00.00.04	19/10/2015	Draft	████ INDRA	Update for review & approval
00.01.00	21/10/2015	Final version for submission	████ INDRA	Update for review & approval

Intellectual Property Rights (foreground)

This deliverable consists of SJU foreground. However, the systems themselves have IPRs owned by one or several Members or their Affiliates or the relevant vendor companies, which have developed them.

Table of Contents

List of tables

List of figures

Executive summary

This document describes the low-level requirements of the different composite cooperative surveillance platform components, which definitions are based on the high-level specifications of the Deliverable 06 "Technical report, composite cooperative surveillance studies" (ref. [13]).

Those specifications have been derived from the available related standards, ED-142 (ref.[4]) and ED-129A (ref. [5]), guidance material for the use of composite WAM – ADS-B data [6], ESAV published material [3] and specific implementation needs for the different platforms under implementation (NATS & DFS-INDRA). The next deliverable of this Task 06 (D09, ref.[14]) will define the testing and physical implementations, through the Verification Plan.

It includes the following key information:

- Composite Cooperative Surveillance System description.

- Generic requirements for Composite Cooperative Surveillance System.

- Particular low-level requirements for each of the systems under analysis in the project.

The project studies the benefit of the so-called Composite Cooperative Surveillance Systems, which will use data coming from validated ADS-B targets to complement the information of the WAM dataflow. ADS-B targets will be validated using different methods developed in 15.4.5 projects i.e. WAM validation, TDOA validation or Range validation (ref.[10] [11] [12]). In addition, the project evaluates the benefit of this systems working in different configurations and compare the results obtained in standard (active) and passive WAM configurations operating in similar conditions. The configuration and functionalities to be tested at low level are:

- Compliance with GEN-SUR

- Compliance with the future EUROCAE standard for Composite WAM – ADS-B systems

- Passive acquisition

- Ranging assessments with comparison to passive WAM

- DAP extraction assessments

- ADD comparison and population assessment

- Performance assessment for 5NM, 3NM, 2.5NM and 2NM separation

- User acceptance trials,

- MST integration.

- Identifying ADS-B candidate spoof alerts.

- Study the reduction of RF usage due to the use of composite WAM – ADS-B data.

In this document low level requirements are defined for the INDRA-DFS and for the NATS systems. These requirements will be implemented and tested later on 15.04.02 Task 006-D09 [14].

founding members

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

1   Introduction

1.1   Purpose of the document

This document describes the low-level requirements for the Composite Cooperative Surveillance System developed and tested inside the project.

1.2   Intended readership

The audience of this document includes

- Project 15.04.02 Integrated Surveillance sensor technologies project members

- Project 15.01.06 Spectrum Management & Impact Assessment members

- Project 15.04.06 Improved 1090MHz ADS-B Ground station capacity and security project members

- Project 15.01.07 CNS System of System definition and roadmap project members

- Projects 15.04.05 a & b Surveillance ground system enhancements for ADS-B

- Standardization bodies (EUROCAE, RTCA…)

- ANSPs

1.3   Inputs from other projects & EUROCAE activities

The following on-going and past activities have contributed to establishing the low level requirements for the Composite Cooperative Surveillance System:

- EUROCONTROL CASCADE Program.

- EUROCAE WG51-SG4. This WG is developing guidance about the use of WAM and ADS-B systems to provide composite surveillance. The work of this WG, initially expected as a new EUROCAE specification and finally to be included as annex to the existing ones [4] and [5] is taken as a direct input for the project, with attention to the functional requirements. At the moment this document was written, the new EUROCAE specifications ED-129B and ED-142A were not published yet. The working paper ADS-B / WAM "Composite" Provisions for Inclusion within ED-129B & ED-142A is anyway an input for this document as well.

- Task 05 from Project 15.04.02 composed by Deliverable 06 Technical Report (ref. [13]) and Deliverable 07 Verification Objectives (ref. [9])

- Projects 15.4.5.A and 15.4.5.B. Methods for ADS-B data validation have been defined and tested in 15.4.5 projects (ref.[10] [11] [12]). Some of these methods directly related to WAM systems will be implemented in the composite cooperative surveillance system.

- These inputs are cognisant of the validation activities undertaken by NATS in the CRISTAL RAD HD project as funded through the EUROCONTROL CASCADE programme.

1.4 Task organization

founding members

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

Two different tasks are defined: Task 05 is for definition of high-level requirements allocated to systems and the definition of a validation strategy. In task 06 low-level requirements are derived from T05 requirements and are allocated to system components (this deliverable). In addition, a verification plan with detailed validation exercises is defined in this task (D09 ref.[14]).

The next figure summarize the organization described above:
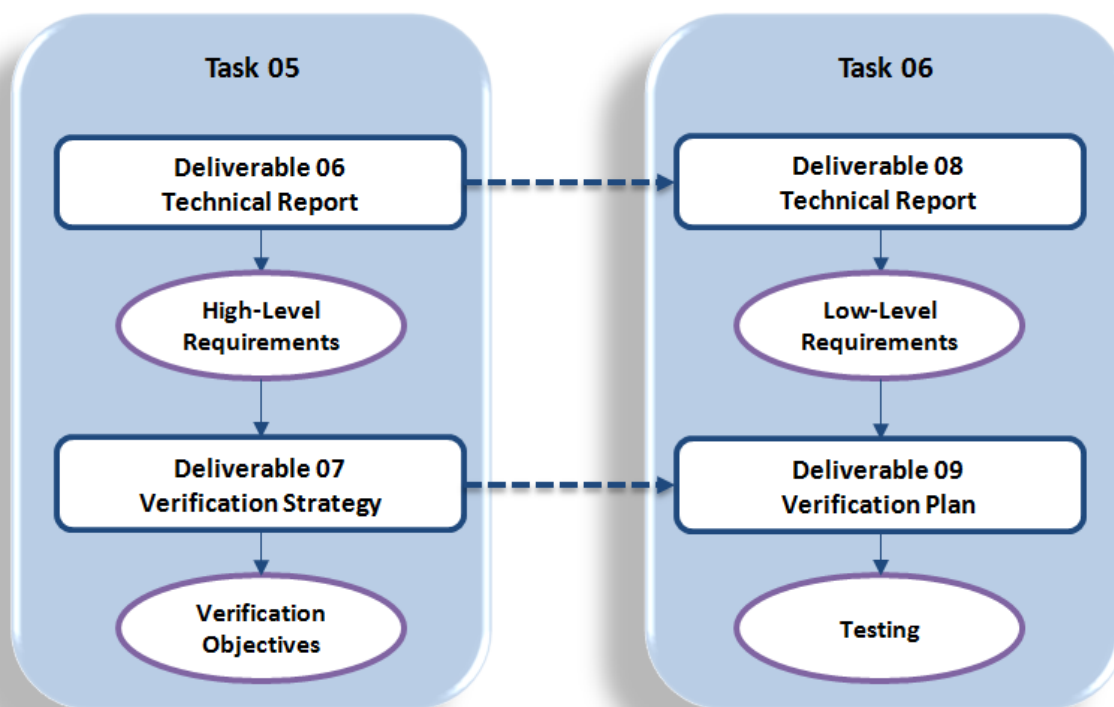
Figure 1: Requirements and verification organization

In this Task 06 Deliverable 08 will be developed the low-level requirements. Some of them will be particularly defined by each one of the project members in the different platforms, while others need to be co-ordinately developed.

Then, the Verification Plan process will assure that the requisites defined by the project members NATS, Indra and DFS are implemented in accordance with the technical specifications. The process ensures that each solution will comply with the stakeholders' needs.

Each implementer will be in charge of running the verification test in appropriate scenarios to demonstrate the correct implementation of the requirements.

The process will verify if a maturity level of feasibility and performance capability is reached to declare the prototypes ready for validation.

1.5   Requirements Definitions – General Guidance

Requirements have been developed according to the SESAR Requirements and V&V Guidelines [1].

They are broken down according to the source of the requirements and or to the platform in which they will be tested.

The requisites layout follow the guidelines described in [2]. As agreed during the technical kick of meeting of this project, this document has been created using the generic project deliverable template. Inside the task the team followed as much as possible the requirement structure defined for the TS template. However, with this kind of template, toolbox does not work with complete functionalities and the Requirement definition is not exactly the same as in a Technical Specification. Traceability of requisites will be included in this specification to ensure that each requirement is covered at least by one of the developed systems.

In accordance with the guidelines in [2], requirement identifiers follow the scheme:

REQ-15.04.02-D08-00xx.yyyy, where:

xx	Meaning
10	NATS CRSTL requirement
20	INDRA requirement
30	DFS requirement
40	INDRA-DFS requirement
50	INDRA-NATS requirement
60	INDRA-DFS-NATS requirement

Table 1: Requirement Identifier Allocation

1.6 Glossary of terms

A common understanding of the definitions of the following terms as applied in the context of this document is considered necessary:

- WAM system: Wide Area Multilateration System.

- Multilateration System: One method of locating an aircraft using the transponder signal is multilateration. In this technique, the transponder signal from the aircraft is received at multiple receivers at known locations. The signal arrives at the receivers at different times due to the different separation distances from the target. The TDOA can be calculated in a number of different ways, including cross-correlation of captured waveforms and differences between absolute Time of Arrival (TOA) measurements, and forms the basis of the multilateration technique. (Note that in Multilateration System which uses active Interrogation, this so-called 'time-hyperbolic method' can also be augmented by other techniques).

A *Multilateration System* is any group of equipment configured to provide position and identification derived from target-transmitted signals using Time Difference of Arrival (*TDOA*) techniques.

- ADS-B: Automatic Dependent Surveillance – Broadcast (ADS-B) is a means by which aircraft, aerodrome vehicles and other objects automatically transmit and/or receive identification, position, velocity and additional data in a broadcast mode via a data link

- Composite Surveillance System: A Composite Surveillance system is also, more correctly, known as a Composite (ADS-B and WAM) Surveillance System.

- Composite (ADS-B and WAM) Surveillance System: A surveillance system which exploits the synergies between two similar but different surveillance techniques – ADS-B and WAM. In their standalone form they are both distributed cooperative surveillance systems. The term composite is used to signify that various system components, physical and logical, are shared. Shared information from WAM and ADS-B processing is used to supplement the basic levels of performance that are to be achieved by each system in their standalone mode in particular with respect to reducing WAM active interrogation rates, providing additional confidence information on ADS-B horizontal position information (including spoofing) and enhancing overall data continuity performance. For the aim of this project, the Composite Surveillance system is composed by a Composite Surveillance Sensor and a Multi sensor Tracker.

- Composite Surveillance Sensor: Surveillance elements that provide ADS-B, WAM and composite data flows.

- Multi Sensor Tracker: Central fusion node for the processing of the surveillance data.

- Ranging: Technique used in multilateration systems to determine the distance of a target to one or more transmitting elements.

- Partial position: In the scope of this document is defined as the points of the space for which their distance difference (and consequently the time difference of arrival (TDOA)) to two receivers is lower than a fixed value. This defines a number of hyperbolas on which the position is contained. Predicted Position: A position obtained from an extrapolation process when operating in periodic mode such that output data generated on each output period is applicable at the time of output. Two types are considered:
  o Smoothed Periodic Predicted Mode based on previous position detections of several output periods.
  o Consolidated Periodic Predicted Mode is based on previous position detections within the most recent output period.

- Pre-tracked Data: Data derived from a 'measurement' or a plot derived directly from 'measured' data i.e. not tracked, smoothed or predicted output at a periodic rate or data driven time-stamped with the time of applicability of the 'measurement'.

- Tracked data: Pre-tracked data that has had a supplementary tracking processing stage applied to it to obtain a predicted position.

1.7 Acronyms and Terminology

Term	Definition

ADD	Aircraft Derived Data
ADS-B	Automatic Dependent Surveillance - Broadcast
AG	Air-Ground
ANSP	Air Navigation Service Provider
ARTAS	ATM suRveillance Tracker And Server
ATC	Air Traffic Control
ATM	Air Traffic Management
CASCADE	Co-operative ATS through Surveillance and Communication Applications Deployed in ECAC
CAT	Category
CMS	Control and Monitoring System (includes Remote Control and Monitoring)
CPS	Centralized Processor System
CRISTAL	Co-operative Validation of Surveillance Techniques and Applications of Package I
DAP	Downlinked Aircraft Parameter
GEN SUR SPR	Generic Surveillance Safety and Performance Requirements
ICAO	International Civil Aviation Organisation
MLAT	Multi-lateration
MRT	Multi-Radar Tracker
MSDF	Multi-Sensor Data Fusion

MSPSR	Mutli-Static Primary Surveillance Radar
MST	Multi-Sensor Tracker
MTBCF	Mean Time Between Critical Failure
MTTR	Mean Time To Repair
NM	Nautical Mile (1852 metres)
NSA	National Supervisory Authority
PD	Probability of Detection
PSR	Primary Surveillance Radar
RF	Radio Frequency
RRRS	Radar Record and Replay System
Rx	Receiver
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.
SPR	Safety and Performance Requirements
SSR	Secondary Surveillance Radar
TDOA	Time Difference of Arrival
TMA	Terminal Manoeuvring Area

TS	Technical Specification
Tx	Transmitter
TXU	Transmitting Unit
WAM	Wide Area Multilateration
WGS84	World Geodetic System 84

2   System description of composite surveillance

Air traffic surveillance systems use both cooperative and non-cooperative techniques to locate aircraft. While non-cooperative techniques rely on the reflection of energy directed at the aircraft, cooperative techniques require the carriage of a transponder or transmitter device on board the aircraft. Systems using the signals broadcast from such transponders / transmitters are classified as a dependant technology, as the ground surveillance systems derive all surveillance information from the decoded message content to determine aircraft identity and 3D position.

The table below summarises the categories that the various existing and new ground-based air traffic Surveillance sensors fall into:

		Air traffic surveillance sensor
Independent Non cooperative		Primary Surveillance Radar (PSR)
		Multi-Static Primary Surveillance Radar (MSPSR) (Under development)
Cooperative	Independent	Secondary Surveillance Radar (SSR) (Mode A/C and Mode S) Wide Area Multilateration (WAM) system MultiLATeration (MLAT) system
	Dependent	Automatic Dependent Surveillance Broadcast (ADS-B)

Figure 2: Categories of air traffic surveillance sensors

It is clear that this classification scheme applies only for the horizontal position. The barometric altitude is always cooperative dependent. Also the range measurement for Mode-A/C/S radars depends on the pre-knowledge of the transponder delay between receiving an interrogation and transmitting the answer. A WAM system working in a passive mode does not rely on the knowledge of this transponder delay, where an active WAM system clearly relies on this knowledge.

Within a Cooperative Independent Surveillance System signals are broadcast from the transponders / transmitter devices of a cooperative aircraft as a result of a trigger interrogation or in support of ACAS or automatically in ADS-B. The ground surveillance system both decodes message content and uses measured parameters to determine aircraft identity and horizontal position, the horizontal position measurement process is 'independent' of aircraft derived information.

SSR, ADS-B (Automatic Dependent Surveillance – Broadcast) and WAM (Wide Area Multilateration) systems are 'Cooperative Surveillance Systems', as they are reliant on signals broadcast from aircraft transmitters/transponders.

A Composite ADS-B and WAM Surveillance System is a surveillance system that exploits the similarities between the two surveillance techniques and combines them into a single system. The term composite is used to signify that various system components and data items are shared whilst ensuring that the required degree of channel autonomy/independence is retained.

2.1   Benefits offered by Composite (ADS-B and WAM) Surveillance

A Composite ADS-B and WAM Surveillance System is a surveillance system which is designed to exploit the synergies between two similar but different surveillance techniques – ADS-B and WAM.

In addition to cost savings, achieved through the co-mounting of system components into a single unit and the associated savings in terms of site costs, communications and efficient utilization of certain common components, the exploitation of synergies between the two surveillance techniques also supports a number of performance enhancements. These include:

- Use of ADS-B message information (excluding position) in the WAM system to support a reduction in the 1030 and 1090 MHz usage by the WAM components:

  o   The use of ADS-B data to support passive acquisition of an aircraft reduces the 1030/1090 MHz footprint of a WAM surveillance system.

  o   The commonality between aircraft derived parameters[1] that are available within an aircraft's ADS-B and Mode S transmission supports a reduction in the number of 1030 MHz interrogations made by the WAM surveillance channel.

  o   Through the techniques described in the two bullet points above the performance of the WAM Surveillance Channel is enhanced from a 1030 MHz RF perspective. Of significant importance is the fact that overall ATM system performance is improved through reduced transponder occupancy and the consequent benefits this brings.

- The availability of 'raw' RF and timing data within the Composite Surveillance System provides information that is not available in other components of a surveillance infrastructure or in standard ADS-B receivers. The information can be used to derive additional indicators:

  o   Ground based 'confidence/credibility' measure of the positional information contained within an aircraft's ADS-B messages based upon the timing data present in the system and derived through an analysis of the time at which ADS-B signals were received at 2 or more time synchronized receivers. Whilst this could be of particular interest during the transition to an ADS-B operational environment it also offers the potential of providing longer term benefits such as the early identification of anomalous avionic behaviour.

  o   The credibility assessment can also provide a means to identify spoofed 'ADS-B transmissions' that have been maliciously introduced into the RF environment. This can be based upon the mechanism described above although the reception of an ADS-B signal at only 1 receiver when line of sight was expected from multiple sites can also provide a credibility indication.

  o   The availability of additional data within the system can also be used to support optional means to provide additional security mitigation techniques in a cost effective manner - although these are currently considered as beyond the scope of this technical specification.

- A comparison of ADS-B and WAM data can be used to:

  o   Support the initial tuning and commissioning of the WAM system.

---

[1] For consistency the term Aircraft Derived Data (ADD) is used within this document. This embraces the ADD broadcast within an ADS-B configuration and also the Downlinked Aircraft Parameters (DAPs) – a term used to denote the information extracted from BDS registers through Mode S Enhanced Surveillance (EHS)

> o   Monitoring: by improving (long term) performance monitoring and alerting of faults in the WAM system. This includes supplementing the WAM channels BITE by using the comparison between the ADS-B position and WAM channel data (particularly concerning expected antenna coverage and time difference of arrival) to alert in the event of timing drift or component failure. For example, if a discrepancy is only apparent in part of the WAM coverage, then it is likely that it is due to a WAM failure condition.

- To improve the performance of the ADS-B channel:

> o   By enabling the allowance of temporary (i.e. short- to medium-duration) reductions in ADS-B quality indicator values, in particular regarding the measurement integrity NIC bound. These temporary reductions would be mitigated by the establishment of an ADS / WAM cross-integrity containment bound that can be associated with the ADS-B data. It is to be noted that a failure in the ADS-B / WAM cross-integrity comparison indication does not take precedence over the ADS-B measurement integrity information (as it might be the WAM channel that is in failure);

> o   by resolving ADS-B data-to-track association issues related to non-unique 24-bit addresses;

> o   by calculating the (mean) ADS-B uncompensated latency that is induced on-board on the ADS-B horizontal position, i.e. in order to reduce the effects on the resulting along-track horizontal position error;

- Safety: by identifying incorrect ADS-B measurement integrity indications (i.e. under failed ADS-B / WAM comparison conditions);

- Security: by identifying spoofed ADS-B targets;

- Monitoring: by supporting the detection of ADS-B avionics anomalies, likely to be indicated by ADS-B / WAM comparison failure conditions sustained over a longer period.

- To keep the electromagnetic interferences as low as possible and to limit the transponder occupancy caused by a WAM system, the WAM part of the composite system may only be used for verification purposes for the position as well as secondary attributes. For the secondary attributes, especially the barometric altitude which is of much more criticality than e.g. the callsign-in-flight, can be confirmed in a similar manner as if a rotating sensor would be present. For a single transceiver unit it is not possible to confirm the complete horizontal position, but proper ranging can be conducted. Even low interrogation rates as one interrogation per minute or two appear to be sufficient for this validation purpose. In this almost passive configuration the performance is achieved by ADS-B, the WAM system has a validation task to fulfil.

It is important to note that the 2D position measurement undertaken within and output by the Wide Area Multilateration element of a Composite Surveillance System remains independent of the 2D positional information contained in the ADS-B message broadcast from the aircraft.

2.2   Basic Assumptions

The design of the Composite ADS-B and WAM Surveillance System was developed in accordance with the following:

- It is assumed that the two channels of data output from the Composite Surveillance System (an ADS-B data stream and a WAM data stream) are passed to the ATM infrastructure for subsequent processing – such as a multi-sensor tracker.

o Thus, a design objective for the Composite Surveillance System is not to repeat functionality that can be assumed to be conducted in subsequent processing stages.

o Performance achieved by a Composite Surveillance System is to be assessed on the basis of system performance i.e. with consideration of both surveillance channels.

• Each surveillance channel, the ADS-B channel and the WAM channel, are to achieve the required level of performance in their standalone mode without recourse to data sharing. From ADS-B point of view, the performance as standalone is defined in ED129A [5], on the other hand, from WAM point of view is defined in ED142 [4].

o Composite processing enhances basic performance rather than being necessary to achieve the required level of performance.

o Positional information of the ADS-B and WAM channels in the sensor is not altered by the composite processing.

• ADS-B surveillance channel data is supplemented with additional indicators included in the ASTERIX category 021 [7] .

• For all the analysis performed in this project 100% of aircraft to be analysed are appropriately equipped with a minimum of SSR transponder through to also ED-102 or ED-102A ADS-B and that non equipped aircraft (or aircraft experiencing avionic failure/transponder anomalies) are not included in the analysis.

- The objective of the "Composite" ADS-B / WAM provisions is not to extend the coverage of the WAM system. i.e. by allowing ADS-B data to be used as an in-fill to a missing WAM sensor or to improve the continuity of a WAM track by filling in with ADS-B horizontal position data.
- In order to ensure co-channel independence, WAM horizontal position measurements must not be affected by possible errors in the ADS-B horizontal position information. Therefore, the latter (as well as ADS-B Geometric Altitude information) is not to be used for establishing WAM horizontal position fixes, nor are co-channel horizontal position data to be fused at "SUR Sensor" level.

2.3 Surveillance Coverage Volumes

Within the coverage of a Composite ADS-B and WAM surveillance system, several volumes can be identified:

• Volume 1: A core volume of airspace where there is both ADS-B and WAM coverage and WAM is accepted to meet the requirements to be used to support separation minima. This volume includes also interrogation coverage.

• Volume 2: Outside the proven WAM coverage there is an area where WAM does not meet the requirements for supporting the separation minima by itself; however the WAM system can still perform TDOA measurements (i.e. this volume is covered by at least two receiver units) and track data can continue to be output to provide situational awareness to controllers. This volume may be located outside the core volume or could be gaps of coverage surrounded by it.

• Volume 3: Rest of the coverage, potentially outer but also lower limits of coverage. It is covered by ADS-B only.

In the core volume (Volume 1) WAM and ADS-B can provide independent surveillance 'layers'. WAM can benefit from ADS-B data to reduce interrogation rate.

In the inter-mediate volumes, (Volume 2) ADS-B may benefit from ADS-B validation methods, such as TDOA measurements or range validation (providing independent integrity measurements and detection of 'spoofing').

Rest of coverage (Volume 3) could be used for early track initiation, in the composite system with respect to WAM. In this volume, ADS-B validated information could be used when no WAM information is available.

2.4   System Configuration and Component Parts

In simplistic terms the Composite Surveillance system is a distributed network of time synchronized ground-based 1090 MHz receivers passing data to a Centralised Processor System (CPS). The CPS processes and consolidates the data received and outputs surveillance data for integration within subsequent surveillance data processing systems of the ANSPs ATM infrastructure or for integration within a local display suite.

As for both ADS-B and WAM deployments the number of 1090 MHz receivers and the locations chosen for the network of the ground based components influences the system performance – particularly the provision of surveillance coverage at lower altitudes.

Composite ADS-B and WAM surveillance systems typically consist of the following main ground components (see Figure 1-2):

- Ground Station Components – deployed in a distributed nature. (A suite of 1090 MHz receivers plus, optionally, 1030 MHz transmitter(s))

- Central Processor System - configurable to include those components required to support optional functionality e.g. active 1030 MHz interrogations, output to a legacy display etc. Some association functions can be performed inside the Central Processor System in the Composite surveillance sensor. This functionality will be executed in the CPS and will be performed with position calculation and association of information objectives. Pre-ASTERIX association is performed in the CPS. The tracking function inside the surveillance sensor different than the one used in the tracker.

- MSDF Tracker: Element to perform post ASTERIX tracking. This component is not included in the Composite WAM – ADS-B sensor.

- Control and Monitoring System: The CMS elements of the system perform the specified control and monitoring system functions of the system.

- Network connections: Communication links between the distributed component parts of the Composite Surveillance System and its CPS.

Project Number 15.04.02
Error! Unknown document property name. **- Technical report, composite cooperative surveillance prototype.**

Edition 00.01.00

Figure 3: Functional description of a generic composite WAM – ADS-B Surveillance system

The above figure represents a diagram which aims to focus on the ADS-B, WAM and MSDF Tracker data that reaches the Air Traffic Controller Surveillance Display.

Legend to the above figure:

- Units contained within dotted cells are optional components

- Units shaded in grey are external systems outside the scope of a composite WAM – ADS-B Surveillance System.

2.4.1 Functionality of the Distributed Component Parts of the System

The signal acquisition side of the Composite Surveillance system is a network of 1090 MHz receivers/remote processors.

Whilst the ground based ADS-B element of a Composite Surveillance System is purely passive it may be necessary to include an active 1030 MHz transmitter(s) to achieve the required level of performance of the WAM elements. An interrogator might be used to confirm ADS-B data like barometric height, to excite transponders when required or to process a simple cross validation of the range of the ADS-B target.

2.4.1.1 1090 MHz Receiver Units:

To support wide area multilateration techniques a number of receivers are to be deployed in a distributed manner. For a 3D position, four are the theoretical minima, and 3 in the case that the system will rely on barometric height.

Their distribution will influence the 3D volume of airspace within which an ATS Separation Service derived from the WAM system can be provided. ADS-B data to support an ATS Surveillance Service can be provided by one or more receivers. Whilst deploying more ADS-B receivers may increase the PD or the ADS-B coverage volume and hence provide an improved continuity of service in the event of a ground station hardware failure it does introduce additional cost burdens.

Thus whilst it is considered to be most advantageous for common system coverage to have ADS-B and WAM together it may be deemed unnecessary to provide excessive duplication of either ADS-B or WAM remote processing components. Manufacturers may therefore propose a Composite ADS-B and WAM Surveillance System which includes a mixture of types of receiver stations (Composite (ADS-B and WAM) or ADS-B sole or WAM sole).

The distributed nature of the 1090 MHz receivers means that the network may be designed to include spare ground station capacity to ensure that the required system detection performance is achieved even when one or more receivers is off line for maintenance or repair.

The interface between the 1090 MHz receiver units and the Central Processor System is not defined within this technical specification.

The two main tasks of the Receiving Unit are:

- to receive signals from target SSR/Mode-S transponders/ Extended Squitter (ADS-B) transmitters at 1090 MHz, digitize the signals, measure TOA, and transfer the digitized data over a suitable communications data link to the Central Processor System (CPS) and
- To format ADS-B signals for direct transmission to subsequent processing stages.

2.4.1.2 1030 MHz Transmitting Unit(s) (TXU) - OPTIONAL

WAM systems can be deployed in Passive or Active configurations, and in some cases will be used as a combination of both. In the Passive form WAM can rely on the reception of 1090 MHz signals being broadcast from the aircrafts' SSR transponder. This includes ACAS transmissions, Extended Squitter (ADS-B) broadcasts and Mode S /SSR replies originating from other active surveillance sources. In the passive mode of operation certain data items, in particular barometric height, identity

and EHS parameters may not be available at sufficient rates to support the required ATS Surveillance Service.

The above limitation can be addressed by using WAM in an Active configuration. In the Active form the WAM systems are configured with 1030 MHz Transmitting Units (Mode S / SSR interrogators).

The main task of the *Transmitting Unit* is to interrogate target SSR/Mode-S transponders, in accordance with the schedule received from the Central Processor System.

2.4.1.3 Central Processor System (CPS)

The CPS is the node within the system where the information from multiple receiving stations is collated for the purposes of determining WAM target position through *TDOA* calculation, and assembling target reports for output from the WAM channel of the composite system. The CPS performs a similar role in consolidating the separate streams of ADS-B data into a single consolidated output from the ADS-B channel of the composite system.

Both the ADS-B and the WAM surveillance channels of a Composite ADS-B and WAM Surveillance System can operate independently. Indeed they are required to achieve the necessary level of performance in a standalone manner without any exchange of data between the two channels[2]. However there are a range of benefits that sharing of data between the two channels can realise.

A key benefit that the sharing of such data can provide is the creation of an additional ground based 'confidence' measure of the positional information contained within an aircraft's ADS-B messages. By comparing the WAM calculated position of an aircraft with the position that the aircraft broadcast via its ADS-B transmission, taking account of the expected accuracies of the WAM and ADS-B positions, it is possible to derive additional 'confidence' information for the ADS-B horizontal position. Even when there are as few as two receivers equipped with time stamp capability of the ADS-B messages, it is possible to compare the partial position solution (i.e. hyperbole) with the ADS-B position to achieve some measure of confidence[3]. In the case of active systems, it is possible to compare the partial position solution (i.e. Ellipsoid) with the ADS-B position.

2.4.1.4 Network connections

The communication links between the distributed component parts of the Composite Surveillance System and its CPS may be either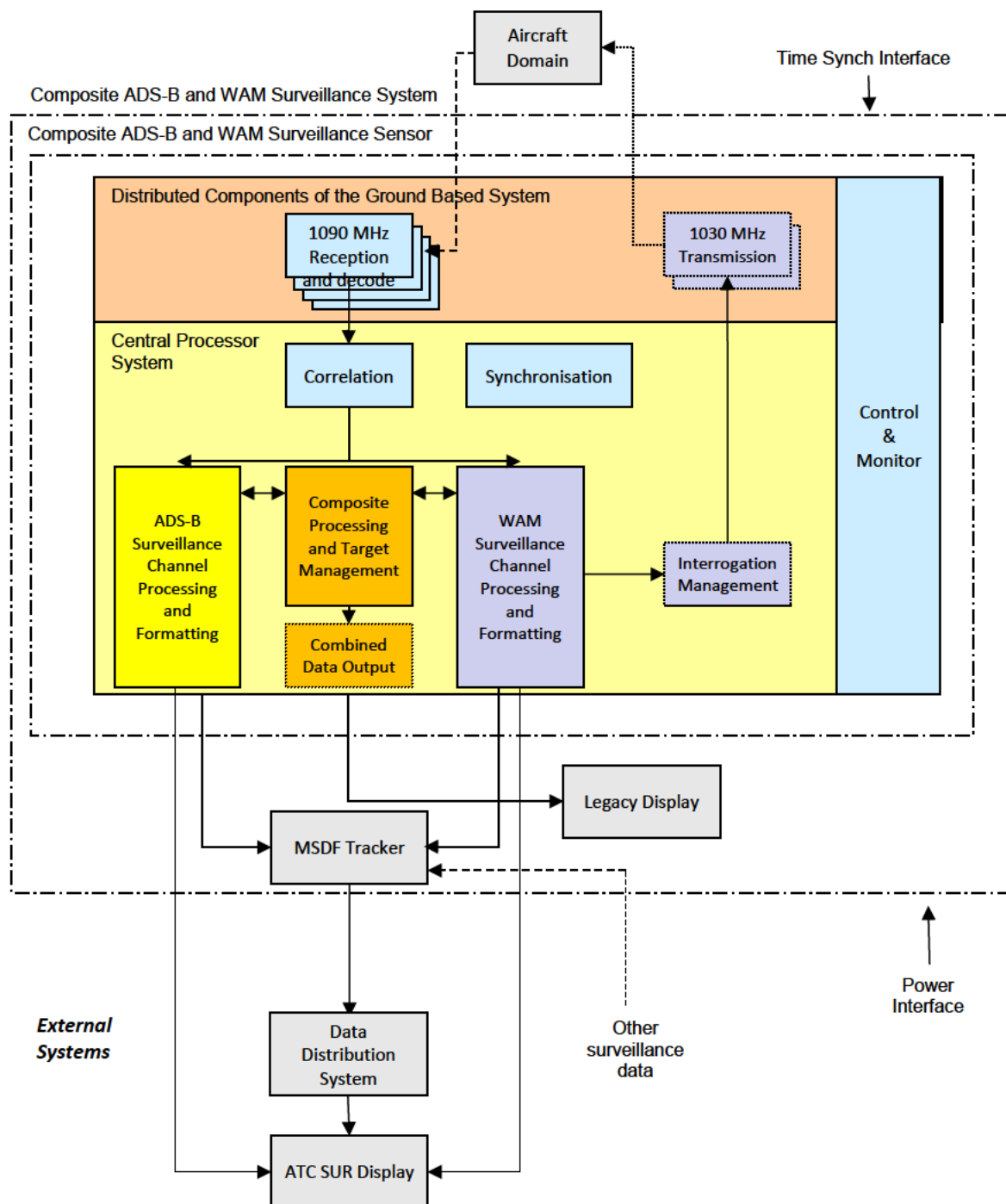 dedicated links with fixed transmission delays, or communication infrastructure provided by a 3rd party supplier. The type of network connection used will generally be dictated by the timing method used by the WAM elements of the system, governed by minimum latency requirements to maintain timing synchronisation and consistency between disparate remote units.

2.4.1.5 Control and Monitoring System (CMS)

The CMS elements of the system perform the specified control and monitoring system functions of the system.

---

[2] However, the use of ADDs to reduce Mode S interrogations and also use of ADS-B data to support passive acquisition are acceptable

[3] It is to be noted that if the ADS-B signal is only received at a single receiver when the declared ADS-B position is in coverage range and visibility of a number of receivers then this could also be taken to indicate a broadcast of a suspicious nature,

The Remote Control and Monitoring Systems may be duplicated to ensure that the required system Mean Time Between Critical Failures is achieved.

2.4.1.6 MSDF Tracker

The PHOENIX MSDF tracker is a multi-target tracker capable of processing various input data reaching from classic rotating radars with a scantime in the range of 5 s to 12 s, MLAT data with typical scantimes from 1 s to 4 s, SMR as well as ADS-B. The tracker is capable to make transitions between these different types of sensors and adapts automatically to the different sensor characteristics.

Furthermore the MSDF tracker is responsible for bias estimation of rotating sensors as well as to partially monitor the integrity of ADS-B data.

3   Composite WAM ADS-B System Requirements

For the evaluation of the benefits of a Composite WAM-ADSB system, different sets of System requirements have been defined.

In accordance with the guidelines in [2], requirement identifiers follow the scheme:

REQ-15.04.02-D08-00xx.yyyy, where:

xx	Meaning
10	NATS CRSTL requirement
20	INDRA requirement
30	DFS requirement
40	INDRA-DFS requirement
50	INDRA-NATS requirement
60	INDRA-DFS-NATS requirement

Table 2: Requirement Identifier Allocation

In the D06 Technical Report (ref. [13]), a first set of system requirements were derived from the EUROCAE documentation already existing and that was related to WAM and ADS-B systems. For the aim of the project, not all requirements included in such document will be tested, as they are considered as a baseline for the project. The analysis is focused on the evaluation of the performances of the prototypes and the capability of improvement using the described techniques (e.g. DAPs, use and creation of ADD, and use of composite WAM – ADS-B data). Whilst ED-142(A) [4] and ED-129 (A/B) [5] include SWAL this development will be of prototype quality and not fully adhering to SWAL or other similar requirements. For the objective of that report (ref. [13]), General design guidelines contained in EUROCAE composite WAM-ADS-B document were used as an input.

Requirements developed in D06 [13] are being revised in this deliverable D8, as the EUROCAE documentation relative to the composite WAM-ADSB surveillance system is in a more advanced state.

System Requisites defined in D06 document are allocated to low level requirements that are defined in this DEL D08.

As different platforms will be created for the validation, a table is included in Appendix A provide implementers for each requisite.

Project Number 15.04.02
Error! Unknown document property name. **- Technical report, composite cooperative surveillance prototype.**

Edition 00.01.00

3.1 Requirements for NATS system

[REQ]

Identifier	REQ-15.04.02-D08-0010.0000
Requirement	The transmitter location shall be predicted to provide coverage both inside and outside the existing passive WAM coverage
Title	CRISTAL transmitter location RF coverage
Status	<In Progress>
Importance	<Essential>
Rationale	The placement of the transmitter will need to have RF coverage that extends outside of the ring of existing receivers.
Category	<Functional>
V&V Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0020.0000	<Partial>

[REQ]

Identifier	REQ-15.04.02-D08-0010.0010
Requirement	The transmitter location coverage shall be predicted to encompass both TMA and En-Route controlled airspace.
Title	CRISTAL transmitter location airspace coverage
Status	<In Progress>
Importance	<Essential>
Rationale	Guaranteed targets of opportunity are needed for the comparison of the range-aided multilateration against passive WAM.
Category	<Functional>
V&V Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0020.0000	<Partial>

[REQ]

Identifier	REQ-15.04.02-D08-0010.0020
Requirement	The transmitter pattern shall be omni-directional
Title	CRISTAL transmitter location RF coverage 2
Status	<In Progress>
Importance	<Essential>
Rationale	Omni-direction RF coverage pattern is needed to provide coverage both inside and outside the WAM passive coverage volume.
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance

| <SATISFIES> | <ATMS Requirement> | REQ-15.04.02-D06-0020.0000 | <Partial> |

[REQ]

Identifier	REQ-15.04.02-D08-0010.0030
Requirement	The transmitter shall have approval from National IFF/SSR Committee '(NISC) to Operate a Secondary Radar Interrogator in the United Kingdom
Title	CRISTAL Transmitter licencing 1
Status	<In Progress>
Importance	<Essential>
Rationale	1030MHz is a protected aeronautical band, approval for transmission in this band with given by the NISC within the UK.
Category	<Functional>
V&V Method	<Inspection>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0020.0010	<Partial>

[REQ]

Identifier	REQ-15.04.02-D08-0010.0040
Requirement	An Aeronautical Radar Radio Licence shall be obtained from the UK CAA
Title	CRISTAL Transmitter licencing 2
Status	<In Progress>
Importance	<Essential>
Rationale	The UK CAA issues licences to users of the 1030MHz aeronautical band
Category	<Functional>
V&V Method	<Inspection>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0020.0010	<Partial>

[REQ]

Identifier	REQ-15.04.02-D08-0010.0050
Requirement	The predicted coverage provided by the transmitter location shall increase the number of receivers that have ADS-B reception at 500ft ARP and above within the London TMA
Title	CRISTAL Low Level coverage
Status	<In Progress>
Importance	<Essential>
Rationale	The 2.5nm ADS-B assessment will require observations of aircraft on approach.
Category	<Functional>
V&V Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0020.0020	<Full>

[REQ]

founding members

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

Identifier	REQ-15.04.02-D08-0010.0060
Requirement	NATS non-operational development ARTAS MST shall accept recorded input of ASTERIX CAT020 NATS RRRS
Title	NATS ARTAS assessment 1
Status	\<In Progress\>
Importance	\<Essential\>
Rationale	Assessment platform
Category	\<Functional\>
V&V Method	\<Inspection\>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
\<SATISFIES\>	\<ATMS Requirement\>	REQ-15.04.02-D06-0020.0060	\<Partial\>
\<SATISFIES\>	\<ATMS Requirement\>	REQ-15.04.02-D06-0020.0070	\<Partial\>

[REQ]

Identifier	REQ-15.04.02-D08-0010.0070
Requirement	NATS non-operational development ARTAS MST shall accept recorded input of ASTERIX CAT021 NATS RRRS
Title	NATS ARTAS assessment 2
Status	\<In Progress\>
Importance	\<Essential\>
Rationale	Assessment platform
Category	\<Functional\>
V&V Method	\<Inspection\>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
\<SATISFIES\>	\<ATMS Requirement\>	REQ-15.04.02-D06-0020.0060	\<Partial\>
\<SATISFIES\>	\<ATMS Requirement\>	REQ-15.04.02-D06-0020.0070	\<Partial\>

[REQ]

Identifier	REQ-15.04.02-D08-0010.0080
Requirement	NATS non-operational development ARTAS MST shall accept recorded input of ASTERIX CAT034 NATS RRRS
Title	NATS ARTAS assessment 3
Status	\<In Progress\>
Importance	\<Essential\>
Rationale	Assessment platform
Category	\<Functional\>
V&V Method	\<Inspection\>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
\<SATISFIES\>	\<ATMS Requirement\>	REQ-15.04.02-D06-0020.0060	\<Partial\>
\<SATISFIES\>	\<ATMS Requirement\>	REQ-15.04.02-D06-0020.0070	\<Partial\>

[REQ]

Identifier	REQ-15.04.02-D08-0010.0090
Requirement	NATS non-operational development ARTAS MST shall accept recorded input of ASTERIX CAT048 NATS RRRS

Title	NATS ARTAS assessment 4
Status	<In Progress>
Importance	<Essential>
Rationale	Assessment platform
Category	<Functional>
V&V Method	<Inspection>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0020.0060	<Partial>
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0020.0070	<Partial>

[REQ]

Identifier	REQ-15.04.02-D08-0010.0100
Requirement	The NATS Space Simulation capability shall be configured to accept and display recorded CAT020
Title	NATS UAT CAT020
Status	<In Progress>
Importance	<Essential>
Rationale	Assessment platform
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0020.0080	<Partial>

[REQ]

Identifier	REQ-15.04.02-D08-0010.0110
Requirement	The NATS Space Simulation capability shall be configured to accept and display recorded CAT021
Title	NATS UAT CAT021
Status	<In Progress>
Importance	<Essential>
Rationale	Assessment platform
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0020.0080	<Partial>

[REQ]

Identifier	REQ-15.04.02-D08-0010.0120
Requirement	The NATS Space Simulation capability shall be configured to accept and display recorded CAT062
Title	NATS UAT CAT062
Status	<In Progress>

Importance	<Essential>
Rationale	Assessment platform
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0020.0080	<Partial>

[REQ]

Identifier	REQ-15.04.02-D08-0010.0130
Requirement	The version of SASS-C used in the validation assessment shall be capable of outputting the following metrics: • WAM Probability of Detection, • Probability of false detection, • Probability of false Mode S address determination, • Probability of false Mode A address determination, • Probability of false Pressure Altitude or Mode C determination, • Probability of false Aircraft Identification (ACID) determination, • Probability of consecutive Update Intervals without valid horizontal position
Title	NATS Analysis Tools
Status	<In Progress>
Importance	<Essential>
Rationale	Previous studies for the CRISTAL RAD HD project were unable to provide an assessment of all metrics.
Category	<Functional>
V&V Method	<Inspection>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0020.0090	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0010.0140
Requirement	The validation platform shall provide sufficient low level coverage for the ADS-B separation performance assessment.
Title	Low Level Separation Performance
Status	<In Progress>
Importance	<Essential>
Rationale	Assessment platform
Category	<Functional>
V&V Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0020.0030	<Partial>

[REQ]

Identifier	REQ-15.04.02-D08-0010.0150
Requirement	NATS existing MRT data for the same defined coverage area of the CRISTAL RAD HD validation platform shall be recorded in ASTERIX CAT034 and CAT048 on the NATS RRRS.
Title	Defined coverage
Status	<In Progress>
Importance	<Essential>
Rationale	Assessment platform
Category	<Functional>
V&V Method	<Inspection>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0020.0040	<Partial>

[REQ]

Identifier	REQ-15.04.02-D08-0010.0160
Requirement	The WAM target data shall be recorded in ASTERIX CAT020 on the RRRS and WAM service messages in ASTERIX CAT 19.
Title	NATS UAT CAT021
Status	<In Progress>
Importance	<Essential>
Rationale	Assessment platform
Category	<Functional>
V&V Method	<Inspection>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0020.0050	<Partial>

3.2   Requirements for Indra - DFS system

The following requirements have been allocated to the Indra-DFS Composite Surveillance system.

3.2.1 INDRA Requirements

[REQ]

Identifier	REQ-15.04.02-D08-0020.0000
Requirement	The composite output channel shall be de/activated.
Title	System Outputs 1
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0000	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0010
Requirement	The emitted User Application Profile (UAP) from ASTERIX report shall be configurable.
Title	System Outputs 2
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0000	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0020
Requirement	The ASTERIX data items such as SAC/SIC shall be configurable.
Title	System Outputs 3
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0000	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0030
Requirement	The composite system shall be equipped with a 1030 MHz interrogator, capable of interrogating ADS-B targets according to all relevant ICAO Annex 10 requirements.
Title	ADS-B position comparison 1
Status	<In Progress>
Importance	<Essential>

Project Number 15.04.02 Edition 00.01.00

Error! Unknown document property name. **- Technical report, composite cooperative surveillance prototype.**

Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0020	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0040
Requirement	The composite system shall have the capability to determine the Round Trip Delay (RTD) of every received 1090 MHz reply elicited by its own interrogations (registered as Real RTD).
Title	ADS-B position comparison 2
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0020	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0050
Requirement	The composite system shall register the last RTD of each of the received ES and its time stamp.
Title	ADS-B position comparison 3
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0020	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0060
Requirement	Each calculated RTD shall be considered applicable to RTD Validation for a configurable time period.
Title	ADS-B position comparison 4
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0020	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0070
Requirement	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 and correct, the ADS-B position report shall be marked as VALIDATED & VALID.
Title	ADS-B position comparison 5
Status	\<In Progress\>
Importance	\<Essential\>
Category	\<Functional\>
V&V Method	\<Test\>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
\<SATISFIES\>	\<ATMS Requirement\>	REQ-15.04.02-D06-0010.0020	\<Full\>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0080
Requirement	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 but not correct, the ADS-B position report shall be marked as VALIDATED & NOT VALID.
Title	ADS-B position comparison 6
Status	\<In Progress\>
Importance	\<Essential\>
Category	\<Functional\>
V&V Method	\<Test\>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
\<SATISFIES\>	\<ATMS Requirement\>	REQ-15.04.02-D06-0010.0020	\<Full\>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0090
Requirement	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 not activated, the ADS-B position report shall be marked as NOT VALIDATED.
Title	ADS-B position comparison 7
Status	\<In Progress\>
Importance	\<Essential\>
Category	\<Functional\>
V&V Method	\<Test\>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
\<SATISFIES\>	\<ATMS Requirement\>	REQ-15.04.02-D06-0010.0020	\<Full\>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0100
Requirement	Each time a valid position message is received for a target in "target data maintenance" mode (see ED-129 chapter 3), the composite system shall validate the ADS-B report comparing the ADS-B position data with the computed applicable RTD.
Title	ADS-B position comparison 8
Status	\<In Progress\>
Importance	\<Essential\>

Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0020	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0110
Requirement	The composite system shall be able to report the validation result in the ASTERIX CAT021 ADS-B report.
Title	ADS-B position comparison 9
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0020	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0120
Requirement	It shall be possible to activate/deactivate the function of range measurement from active interrogation.
Title	ADS-B position comparison 10
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0020	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0130
Requirement	Targets shall be associated with tracks through position and identification criteria.
Title	Same aircraft condition 1
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0040	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0140
Requirement	In case of duplicated targets, two different tracks shall be generated.
Title	Same aircraft condition 2

Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0040	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0150
Requirement	The maximum allowable uncompensated latency for ADS-B shall take account of the ADS-B version.
Title	Uncertainties in position 1
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0070	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0160
Requirement	In order to simplify the operation and reduce the amount of calculation, the process shall be correlated between measured TDOAs and ideal TDOAs.
Title	Correlation between TDOAs 1
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0080	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0170
Requirement	The synchronization time between receiver stations shall be less than 0.2 ns.
Title	Correlation between TDOAs 2
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0080	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0180

Requirement	The high accuracy time stamp shall have a common time base for all stations.
Title	Correlation between TDOAs 3
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0080	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0190
Requirement	The SNR of the signals shall be higher than 15 dB in order to ensure a time stamp error less than 5 ns.
Title	Correlation between TDOAs 4
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0080	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0200
Requirement	The information about the result of the validation shall be emitted through the data item I021/040 from ASTERIX CAT021.
Title	Output Comparison information 1
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0090	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0210
Requirement	The functionality defined in REQ-15.04.02-D08-0020.0200 shall be un/selectable.
Title	Output Comparison information 2
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0090	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0220
Requirement	Bits-3/2 of third extension (WAI) of I021/040 from ASTERIX CAT021 shall be included with "not validated" value (10) in order to meet "no WAM/ADS-B comparison was performed".
Title	Output Comparison information 3
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0100	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0230
Requirement	Bits-7/6 of fourth extension (TDoA) of I021/040 from ASTERIX CAT021 shall be included with "not validated" value (10) in order to meet "no WAM/ADS-B comparison was performed".
Title	Output Comparison information 4
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0100	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0240
Requirement	Bits-3/2 of fifth extension (RAI) of I021/040 from ASTERIX CAT021 shall be included with "not validated" value (10) in order to meet "no WAM/ADS-B comparison was performed".
Title	Output Comparison information 5
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0100	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0250
Requirement	TDOAs comparison shall be performed in order to meet the partial position solution.
Title	Output Comparison information 6
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0100	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0260
Requirement	Bits-3/2 of third extension (WAI) of I021/040 from ASTERIX CAT021 shall be included with "validated and valid" (00) in order to meet "Comparison was made against a full, unambiguous, WAM lateral position".
Title	Output Comparison information 7
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0100	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0270
Requirement	Bits-7/6 of fourth extension (TDoA) of I021/040 from ASTERIX CAT021 shall be included with "validated and valid" (00) in order to meet "Comparison was made against a full, unambiguous, WAM lateral position".
Title	Output Comparison information 8
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0100	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0280
Requirement	Bits-3/2 of fifth extension (RAI) 3rd iteration of I021/040 from ASTERIX CAT021 shall be with "validated and valid" (00) included in order to meet "Comparison was made against a Range from interrogation validation".
Title	Output Comparison information 9
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0100	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0290
Requirement	Bits-3/2 of third extension (WAI) of I021/040 from ASTERIX CAT021 shall be included with "validated and not valid" (01) if the result is not valid.

Project Number 15.04.02
        Edition 00.01.00

Error! Unknown document property name. **- Technical report, composite cooperative surveillance prototype.**

Title	Output Comparison information 10
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0100	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0300
Requirement	Bits-7/6 of fourth extension (TDoA) of I021/040 from ASTERIX CAT021 shall be included with "validated and not valid" (01) if the result is not valid.
Title	Output Comparison information 11
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0100	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0310
Requirement	Bits-3/2 of fifth extension (RAI) 3rd iteration of I021/040 from ASTERIX CAT021 shall be with "validated and not valid" (01) if the result is not valid.
Title	Output Comparison information 12
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0100	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0320
Requirement	The ADS-B information included in the combined channel shall include the code-A.
Title	Use of ADS-B non-position data 1
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0110	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0330
Requirement	The ADS-B information included in the combined channel shall include the code-C.
Title	Use of ADS-B non-position data 2
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0110	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0340
Requirement	The ADS-B information included in the combined channel shall include the call sign (if available).
Title	Use of ADS-B non-position data 3
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0110	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0350
Requirement	The composite system shall work only with confirmed tracks.
Title	WAM – ADS-B association 1
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0120	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0360
Requirement	The composite system shall reject individual plots.
Title	WAM – ADS-B association 2
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0120	<Full>

[REQ]

founding members

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

Identifier	REQ-15.04.02-D08-0020.0370
Requirement	The verification time of the validation shall be configurable.
Title	WAM – ADS-B association 3
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0130	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0380
Requirement	The time-out interrogation of the WAM system shall be configurable.
Title	Initial Validation Conditions for Pressure Altitude 1
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0140	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0390
Requirement	The WAM system shall interrogate aircraft with ICAO 24 bit address with correct CRC in DF11.
Title	Initial Validation Conditions for Pressure Altitude 2
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0140	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0400
Requirement	The WAM system shall interrogate aircraft with ICAO 24 bit address with correct CRC in DF17.
Title	Initial Validation Conditions for Pressure Altitude 3
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0140	<Full>

[REQ]

founding members

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

Identifier	REQ-15.04.02-D08-0020.0410
Requirement	The interrogations shall be UF04 asking for DF04.
Title	Initial Validation Conditions for Pressure Altitude 4
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0140	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0420
Requirement	The interrogations shall be UF04 asking for DF20, including the call sign BDS.
Title	Initial Validation Conditions for Pressure Altitude 5
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0140	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0430
Requirement	The time-out parameter of code-C shall be configurable.
Title	Initial Validation Conditions for Pressure Altitude 6
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0180	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0440
Requirement	The interrogations shall stop when the target leaves the covered volume.
Title	Initial Validation Conditions for Pressure Altitude 7
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0180	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0450
Requirement	The time-out parameter shall be configurable in case of Pressure Altitude

	unsuccessful comparison.
Title	Initial Validation Conditions for Pressure Altitude 8
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0190	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0460
Requirement	The WAM system shall initialize the Pressure Altitude tracking with at least 2 active interrogations.
Title	Initial Validation Conditions for Pressure Altitude 9
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0200	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0470
Requirement	The time-out interrogation of the WAM system shall be configurable.
Title	Initial Validation Conditions for Aircraft Identification 1
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0210	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0480
Requirement	The WAM system shall interrogate aircraft with ICAO 24 bit address with correct CRC in DF11.
Title	Initial Validation Conditions for Aircraft Identification 2
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0210	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0490

Requirement	The WAM system shall interrogate aircraft with ICAO 24 bit address with correct CRC in DF17.
Title	Initial Validation Conditions for Aircraft Identification 3
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0210	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0500
Requirement	The interrogations shall be UF05 asking for DF05.
Title	Initial Validation Conditions for Aircraft Identification 4
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0210	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0510
Requirement	The interrogations shall be UF05 asking for DF21, including the call sign BDS.
Title	Initial Validation Conditions for Aircraft Identification 5
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0210	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0520
Requirement	The WAM system shall obtain the call sign identification through the BDS 2,0.
Title	Validation Check for Aircraft Identification
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0220	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0530
Requirement	The call sign time-out parameters shall be configurable.

Title	Periodic re-validation check 1
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0230	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0540
Requirement	The code-A time-out parameters shall be configurable.
Title	Periodic re-validation check 2
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0230	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0550
Requirement	The interrogations shall stop when the target leaves the covered volume.
Title	Periodic re-validation check 3
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0230	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0560
Requirement	The time-out parameter shall be configurable in case of Aircraft Identity unsuccessful comparison.
Title	Periodic re-validation check 4
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0240	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0570
Requirement	The WAM system shall initialize the Aircraft Identification tracking with at least 2 active interrogations of the same aircraft identification.

Title	Periodic re-validation check 5
Status	\<In Progress\>
Importance	\<Essential\>
Category	\<Review of Design\>
V&V Method	\<Test\>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
\<SATISFIES\>	\<ATMS Requirement\>	REQ-15.04.02-D06-0010.0250	\<Full\>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0580
Requirement	The system shall include BITE features.
Title	WAM performance Monitoring 1
Status	\<In Progress\>
Importance	\<Essential\>
Category	\<Functional\>
V&V Method	\<Test\>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
\<SATISFIES\>	\<ATMS Requirement\>	REQ-15.04.02-D06-0010.0260	\<Full\>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0590
Requirement	The system shall calculate statistics about validated/non-validated targets.
Title	WAM performance Monitoring 2
Status	\<In Progress\>
Importance	\<Essential\>
Category	\<Functional\>
V&V Method	\<Test\>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
\<SATISFIES\>	\<ATMS Requirement\>	REQ-15.04.02-D06-0010.0260	\<Full\>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0600
Requirement	The system shall give a warning if a determined threshold is exceeded.
Title	WAM performance Monitoring 3
Status	\<In Progress\>
Importance	\<Essential\>
Category	\<Functional\>
V&V Method	\<Test\>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
\<SATISFIES\>	\<ATMS Requirement\>	REQ-15.04.02-D06-0010.0260	\<Full\>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0610
Requirement	The system shall be able to work in active mode.
Title	Performance evaluation 1
Status	\<In Progress\>

Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0000	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0620
Requirement	The system shall be able to work in passive mode.
Title	Performance evaluation 2
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0000	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0630
Requirement	The deployed combined system shall be able to work in different modes: - Passive, using the opportunity interrogations from other systems. - Active, using the opportunity interrogations from other systems and its own ones. - Active-exclusive, using only its own interrogations.
Title	Performance evaluation 3
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0010	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0640
Requirement	The comparison shall be made in passive and active-exclusive modes.
Title	Performance evaluation 4
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0010	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0650
Requirement	The ASTERIX CAT020 output channel shall be configurable in the update

	rate.
Title	Services 1
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0020	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0660
Requirement	The services shall be independently de/activate.
Title	Services 2
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0020	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0670
Requirement	The flows and categories from the different services shall be independently configurable.
Title	Services 3
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0020	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0680
Requirement	The SIC/SAC shall be independently configurable.
Title	Services 4
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0020	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0690
Requirement	The WAM and Composite services shall be sent with ASTERIX CAT020.

Title	Services 5
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0020	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0700
Requirement	The ADS-B service shall be emitted with ASTERIX CAT021.
Title	Services 6
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0020	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0710
Requirement	The interrogators shall interrogate in Mode S using UF04 asking for DF04.
Title	System Configuration 1
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0030	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0720
Requirement	The interrogators shall interrogate in Mode S using UF05 asking for DF05.
Title	System Configuration 2
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0030	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0730
Requirement	The interrogators shall interrogate in Mode S using UF04 asking for DF20.
Title	System Configuration 3
Status	<In Progress>

Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0030	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0740
Requirement	The interrogators shall interrogate in Mode S using UF05 asking for DF21.
Title	System Configuration 4
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0030	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0750
Requirement	The interrogators shall interrogate in selective mode (not all-call).
Title	System Configuration 5
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0030	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0760
Requirement	The ASTERIX CAT021 channel shall include the NUC and/or NIC/NAC/SIL information in the ASTERIX report.
Title	Evaluation of functions 1
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0110	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0770
Requirement	The times for aligned positions extracted from the tracking of WAM and ADS-B systems shall be compared.
Title	Evaluation of functions 2
Status	<In Progress>

Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0120	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0780
Requirement	Once REQ-15.04.02-D08-0020.0770 is met, an ADS-B average latency shall be calculated.
Title	Evaluation of functions 3
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0120	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0790
Requirement	Once REQ-15.04.02-D08-0020.0770 is met, statistics about the ADS-B version number of the targets shall be calculated.
Title	Evaluation of functions 4
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0120	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0800
Requirement	The latency shall be compared with indicated speed, in order to check if this error is correlated with the ADS-B FOM.
Title	Evaluation of functions 5
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0120	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0810
Requirement	The emitted flows shall be independently de/activated.
Title	Surveillance Sensor ASTERIX Output 1

Status	\<In Progress\>
Importance	\<Essential\>
Category	\<Functional\>
V&V Method	\<Review of Design\>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
\<SATISFIES\>	\<ATMS Requirement\>	REQ-15.04.02-D06-0030.0130	\<Full\>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0820
Requirement	The UAPs for data targets shall be configurable.
Title	Surveillance Sensor ASTERIX Output 2
Status	\<In Progress\>
Importance	\<Essential\>
Category	\<Functional\>
V&V Method	\<Review of Design\>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
\<SATISFIES\>	\<ATMS Requirement\>	REQ-15.04.02-D06-0030.0130	\<Full\>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0830
Requirement	The target data shall be recordable.
Title	Surveillance Sensor ASTERIX Output 3
Status	\<In Progress\>
Importance	\<Essential\>
Category	\<Functional\>
V&V Method	\<Review of Design\>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
\<SATISFIES\>	\<ATMS Requirement\>	REQ-15.04.02-D06-0030.0130	\<Full\>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0840
Requirement	The composite Surveillance Sensor shall provide different SIC-SAC codes for the standard WAM service and for the Composite WAM service.
Title	Surveillance Sensor ASTERIX Output 4
Status	\<In Progress\>
Importance	\<Essential\>
Category	\<Functional\>
V&V Method	\<Review of Design\>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
\<SATISFIES\>	\<ATMS Requirement\>	REQ-15.04.02-D06-0030.0150	\<Full\>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0850
Requirement	The Data Item I021/400 "Receiver ID" and Data Item I021/015 "Service Identification" shall be sent in ASTERIX CAT021 in order to identify the receiver.

Project Number 15.04.02   **Edition 00.01.00**

Error! Unknown document property name. **- Technical report, composite cooperative surveillance prototype.**

Title	Surveillance Sensor ASTERIX Output 5
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0170	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0860
Requirement	The update rate shall be configurable and independent for each flow.
Title	Update rate 1
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0190	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0870
Requirement	The system shall de/activate the WAM stream if needed.
Title	Update rate 2
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0200	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0880
Requirement	The system shall de/activate the ADS-B stream if needed.
Title	Update rate 3
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0200	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0890
Requirement	The system shall de/activate the composite stream if needed.
Title	Update rate 4
Status	<In Progress>

Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0200	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0020.0900
Requirement	The UAPs for the different streams shall be configurable.
Title	Update rate 5
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0200	<Full>

3.2.2 DFS Requirements

[REQ]

Identifier	REQ-15.04.02-D08-0030.0000
Requirement	The MSDF tracker shall process Cat020 data.
Title	Surveillance Sensor ASTERIX Output 6
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0140	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0030.0010
Requirement	The MSDF tracker shall process Cat021 data.
Title	Surveillance Sensor ASTERIX Output 7
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0140	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0030.0020

Requirement	The SAC-SIC information shall be used to distinguish between different input sources.
Title	Surveillance Sensor ASTERIX Output 8
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0160	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0030.0030
Requirement	In addition to the SAC-SIC differentiation of the input data, also the service identification I021/015 and the receiver indication I021/400 shall be used as input differentiation.
Title	Surveillance Sensor ASTERIX Output 9
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0180	<Full>

3.2.3 INDRA-DFS Requirements

[REQ]

Identifier	REQ-15.04.02-D08-0040.0000
Requirement	The minimum number of receiver stations shall be selected in order to multilaterate the signals.
Title	ADS-B position comparison 11
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0010	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0010
Requirement	The minimum number of receiver stations shall be selected in order to obtain a partial position.
Title	ADS-B position comparison 12
Status	<In Progress>
Importance	<Essential>

Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0010	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0020
Requirement	The comparison shall be made through an extrapolation of the ADS-B position and the WAM total position.
Title	ADS-B position comparison 13
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0010	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0030
Requirement	The comparison shall be made through an extrapolation of the ADS-B position and the WAM partial position.
Title	ADS-B position comparison 14
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0010	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0040
Requirement	The comparison shall be made at the same time considering the ADS-B latency.
Title	ADS-B position comparison 15
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0010	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0050
Requirement	The functionality of comparison shall be de/activated.
Title	ADS-B position comparison 16
Status	<In Progress>

Project Number 15.04.02

Edition 00.01.00

Error! Unknown document property name. **- Technical report, composite cooperative surveillance prototype.**

Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0010	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0060
Requirement	The partial position comparison (TDOA with less than four ground stations) shall be performed by TOA correlation.
Title	ADS-B position comparison 17
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0010	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0070
Requirement	The WAM system shall calculate the DOP/PTE of the measurements.
Title	Uncertainties in position 2
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0060	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0080
Requirement	The WAM system shall emit the DOP/PTE to the end user.
Title	Uncertainties in position 3
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0060	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0090
Requirement	The WAM system shall emit the measurements through the I020/RE Reserved Expansion within data item Position Accuracy (PA).
Title	Uncertainties in position 4
Status	<In Progress>

Importance	\<Essential\>
Category	\<Functional\>
V&V Method	\<Test\>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
\<SATISFIES\>	\<ATMS Requirement\>	REQ-15.04.02-D06-0010.0060	\<Full\>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0100
Requirement	Analysis shall be performed to verify the correspondence between theoretical DOP-PTE values and ADS-B validation results.
Title	Uncertainties in position 5
Status	\<In Progress\>
Importance	\<Essential\>
Category	\<Functional\>
V&V Method	\<Test\>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
\<SATISFIES\>	\<ATMS Requirement\>	REQ-15.04.02-D06-0010.0060	\<Full\>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0110
Requirement	The ADS-B system shall emit the uncertainty measurements (FOM/PA) through the data item I021/090 "Quality Indicators".
Title	Uncertainties in position 6
Status	\<In Progress\>
Importance	\<Essential\>
Category	\<Functional\>
V&V Method	\<Test\>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
\<SATISFIES\>	\<ATMS Requirement\>	REQ-15.04.02-D06-0010.0060	\<Full\>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0120
Requirement	The tolerance margin shall be configurable.
Title	Initial Validation Conditions for Pressure Altitude 10
Status	\<In Progress\>
Importance	\<Essential\>
Category	\<Functional\>
V&V Method	\<Review of Design\>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
\<SATISFIES\>	\<ATMS Requirement\>	REQ-15.04.02-D06-0010.0150	\<Full\>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0130
Requirement	In ASTERIX CAT021, the high accuracy time stamp shall be included in data item I021/074 and I021/076.

Title	Evaluation of functions 6
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0040	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0140
Requirement	Bits-7/6 of fourth extension (TDoA) of I021/040 from ASTERIX CAT021 shall be included in order to meet the TODA validation (00 is validated and valid, and 01 validated but not valid).
Title	Evaluation of functions 7
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0040	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0150
Requirement	The TDOA data, transmitted via Cat021/SP, shall be used to calculate an ADS-B error; this error shall be transmitted via Cat062/SP.
Title	Evaluation of functions 8
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0040	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0160
Requirement	Ranging information shall be included in the Special Purpose field.
Title	Evaluation of functions 9
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0050	<Full>

[REQ]

founding members

Identifier	REQ-15.04.02-D08-0040.0170
Requirement	The SP field shall include the total length in octets in the LEN subfield, included itself.
Title	Evaluation of functions 10
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0050	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0180
Requirement	The SP field shall include the SP Item Indicator which indicates what are the items encoded in the SP.
Title	Evaluation of functions 11
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0050	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0190
Requirement	The SP field shall include the Transmission data item with the following subfields: • Transmission Delay • Time of Transmission (UTC), from 1/1/1970 (epoch time)
Title	Evaluation of functions 12
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0050	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0200
Requirement	The SP field shall include the Reception data item with the following subfields: • Repetition Factor • Receiver component ID • Power of Reception • SNR of Reception • Time of Reception (UTC), from 1/1/1970 (epoch time)
Title	Evaluation of functions 13
Status	<In Progress>

Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0050	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0210
Requirement	The SP field shall include the "Secondary Data" data item with the following subfields: • Downlink Format • Target Address • Flight Level • Mode-3/A Code • Downlinked Aircraft ID • Mode S MB Data • Communications/ACAS Capability
Title	Evaluation of functions 14
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0050	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0220
Requirement	The SP field shall include the Remote Unit Location data item with the following subfields: • Repetition Factor • Component ID • Latitude in WGS-84 • Longitude in WGS-84 • Altitude
Title	Evaluation of functions 15
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0050	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0230
Requirement	The difference between the reported ADS-B position and the reported non ADS-B positions (e.g. WAM position solution originated from Cat020) shall be calculated and transmitted via Cat062/SP.
Title	Evaluation of functions 16
Status	<In Progress>

Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0060	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0240
Requirement	The WAM system shall calculate a 2D or 3D position.
Title	Evaluation of functions 17
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0060	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0250
Requirement	The WAM system shall be configurable in order to calculate the minimum number of necessary receiver stations.
Title	Evaluation of functions 18
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0060	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0260
Requirement	In ASTERIX CAT020, the data item I020/090 "Flight Level in Binary Representation" shall be sent with barometric altitude information.
Title	Evaluation of functions 19
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0070	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0270
Requirement	In ASTERIX CAT021, the data item I021/145 "Flight Level" shall be sent with barometric altitude information.
Title	Evaluation of functions 20

Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0070	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0280
Requirement	In ASTERIX CAT021, the barometric altitude shall be represented in FL.
Title	Evaluation of functions 21
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0070	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0290
Requirement	It shall be configurable per SAC-SIC whether the barometric height shall be used to validate the ADS-B barometric height with respect to the Cat062 report.
Title	Evaluation of functions 22
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0070	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0300
Requirement	In case the threshold between barometric altitude from WAM and ADS-B is succeeded, the altitude discrepancy flag I062/200 (ADF) shall be set.
Title	Evaluation of functions 23
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0070	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0310
Requirement	It shall be configurable whether the barometric height in I021/SP shall be used

	to validate the ADS-B barometric height with respect to the Cat062 report.
Title	Evaluation of functions 24
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0070	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0320
Requirement	It shall be possible to calculate the following KPIs: along/across error, total error, POD.
Title	Evaluation of functions 25
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0080	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0330
Requirement	For each of the entities the following KPIs shall be generated: standard deviation, mean, min, max.
Title	Evaluation of functions 26
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0080	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0340
Requirement	It shall be possible to distinguish between different FL bands.
Title	Evaluation of functions 27
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0080	<Full>

[REQ]

founding members

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

Project Number 15.04.02   **Edition 00.01.00**

Error! Unknown document property name. **- Technical report, composite cooperative surveillance prototype.**

Identifier	REQ-15.04.02-D08-0040.0350
Requirement	It shall be possible to map the KPIs on a geographical grid.
Title	Evaluation of functions 28
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0080	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0360
Requirement	It shall be possible to show the timeline of the KPIs.
Title	Evaluation of functions 29
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0080	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0370
Requirement	The provided accuracy of the WAM system (I020/500 or I020/RE) shall be evaluated against the Cat062 position; especially it shall be checked that it is not too optimistic.
Title	Evaluation of functions 30
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0090	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0380
Requirement	The composite system shall emit the data age information.
Title	Evaluation of functions 31
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0100	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0390
Requirement	The data age information shall be sent in Data Item I021/295 in ASTERIX CAT021.
Title	Evaluation of functions 32
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0100	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0400
Requirement	The data age information shall be sent in DA subfield of RE field in ASTERIX CAT020.
Title	Evaluation of functions 33
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0100	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0410
Requirement	The data ages of I021/295 shall be taken into account to update the corresponding data ages of I062/295.
Title	Evaluation of functions 34
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0100	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0420
Requirement	The data ages of I020/RE SF DA shall be taken into account to update the corresponding data ages of I062/295.
Title	Evaluation of functions 35
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Project Number 15.04.02   **Edition 00.01.00**

Error! Unknown document property name. **- Technical report, composite cooperative surveillance prototype.**

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0100	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0040.0430
Requirement	Statistics with respect to selected data ages of I062/290 and I062/295 shall be generated.
Title	Evaluation of functions 36
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Analysis>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0030.0100	<Full>

3.3 General requirements for the two platforms

3.3.1 Indra-NATS Requirements

[REQ]

Identifier	REQ-15.04.02-D08-0050.0000
Requirement	The ADS-B system shall track the pressure altitude in order to check the values.
Title	Initial Validation Conditions for Pressure Altitude 11
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Test>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0160	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0050.0010
Requirement	The time difference for pressure altitude parameter shall be configurable.
Title	Initial Validation Conditions for Pressure Altitude 12
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0170	<Full>

3.3.2 Indra-DFS-NATS Requirements

[REQ]

Identifier	REQ-15.04.02-D08-0060.0000
Requirement	In case of DF17 reply (ADS-B) with correct CRC, the ICAO 24 bit address shall be validated.
Title	Same aircraft condition 3
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0030	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0060.0010
Requirement	In case of DF11 reply (WAM and ADS-B) with correct CRC, the ICAO 24 bit address shall be validated.
Title	Same aircraft condition 4
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0030	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0060.0020
Requirement	In case of DF4 reply, the validation shall be performed only if the ICAO 24 bit address extracted from CRC belongs to an existing track in the system.
Title	Same aircraft condition 5
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0030	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0060.0030
Requirement	In case of DF5 reply, the validation shall be performed only if the ICAO 24 bit address extracted from CRC belongs to an existing track in the system.
Title	Same aircraft condition 6
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0030	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0060.0040
Requirement	In case of DF20 reply, the validation shall be performed only if the ICAO 24 bit address extracted from CRC belongs to an existing track in the system.
Title	Same aircraft condition 7
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0030	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0060.0050
Requirement	In case of DF21 reply, the validation shall be performed only if the ICAO 24 bit address extracted from CRC belongs to an existing track in the system.
Title	Same aircraft condition 8
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0030	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0060.0060
Requirement	The composite WAM system shall do the extrapolation through an internal tracking.
Title	Common time of applicability 1
Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0050	<Full>

[REQ]

Identifier	REQ-15.04.02-D08-0060.0070
Requirement	The composite ADS-B system shall do the extrapolation using one of the next information: - The speed calculated by tracking - The speed received from the aircraft data
Title	Common time of applicability 2

Status	<In Progress>
Importance	<Essential>
Category	<Functional>
V&V Method	<Review of Design>

[REQ Trace]

Relationship	Linked Element Type	Identifier	Compliance
<SATISFIES>	<ATMS Requirement>	REQ-15.04.02-D06-0010.0050	<Full>

4   References

[1] SESAR Requirements and V&V Guidelines Latest version

[2] SESAR Toolbox User Manual Latest version

[3] K. Pourvoyeur, R. Heidger: "Secure ADS-B Usage in ATC Tracking", Proc. Tyrrhenian International Workshop on Digital Communications / Enhanced Surveillance of Aircraft and Vehicles (TIWDC/ESAV), Sept. 15–16, 2014, Rom, Italy.

[4] ED-142 Technical Specification for Wide Area Multilateration (WAM) Systems.

[5] ED-129A Technical Specification for a 1090 MHz Extended Squitter ADS-B Ground Station

[6] ADS-B / WAM "Composite" Provisions For Inclusion Within ED-129B & ED-142A (WG51-SG4 Working Paper 2 February 2015)

[7] EUROCONTROL STANDARD DOCUMENT FOR SURVEILLANCE DATA EXCHANGE Part 12: Category 021 ADS-B Reports v2.81. September 2012

[8] EUROCONTROL STANDARD DOCUMENT FOR SURVEILLANCE DATA EXCHANGE Part 14v1.8 December 2010

[9] 15.04.02 D07 Verification Strategy, composite cooperative surveillance

[10] 15.04.05a D18 First iteration of ADS-B Surveillance System Specifications

[11] 15.04.05a D19 Second iteration of ADS-B Surveillance System Specifications

[12] 15.04.05a D20 Third iteration of ADS-B Surveillance System Specifications

[13] 15.04.02 D06 Technical report, composite cooperative surveillance studies

[14] 15.04.02 D09 Verification Plan, composite cooperative surveillance

Appendix A   Requisite allocation

REQ 15.04.02 D06 ID	D06 Requirement Description	REQ 15.04.02 D08 ID	D08 Requirement Description	REQUISITE OWNER
REQ-15.04.02-D06-0010.0000	At least two mandatory output sources shall be provided from the Composite Surveillance Sensor, with an optional third output if required • ADS-B Output Channel ASTERIX CAT 021 [7] • WAM Output Channel ASTERIX CAT 020 [8] • Combined Output Channel (optional) could be provided to support legacy displays.	REQ-15.04.02-D08-0020.0000	The composite output channel shall be de/activated.	INDRA
		REQ-15.04.02-D08-0020.0010	The emitted User Application Profile (UAP) from ASTERIX report shall be configurable.	
		REQ-15.04.02-D08-0020.0020	The ASTERIX data items such as SAC/SIC shall be configurable.	
REQ-15.04.02-D06-0010.0010	The aircraft horizontal position transmitted by the ADS-B position messages and as decoded by the composite system shall be compared against the position, or partial position, determined by multilateration techniques in the system for the same aircraft where there is sufficient reception from multiple receivers.	REQ-15.04.02-D08-0040.0000	The minimum number of receiver stations shall be selected in order to multilaterate the signals.	INDRA-DFS
		REQ-15.04.02-D08-0040.0010	The minimum number of receiver stations shall be selected in order to obtain a partial position.	
		REQ-15.04.02-D08-0040.0020	The comparison shall be made through an extrapolation of the ADS-B position and the WAM total position.	
		REQ-15.04.02-D08-0040.0030	The comparison shall be made through an extrapolation of the ADS-B position and the WAM partial position.	
		REQ-15.04.02-D08-0040.0040	The comparison shall be made at the same time considering the ADS-B latency.	

		REQ-15.04.02-D08-0040.0050	The functionality of comparison shall be de/activated.	
		REQ-15.04.02-D08-0040.0060	The partial position comparison (TDOA with less than four ground stations) shall be performed by TOA correlation.	
REQ-15.04.02-D06-0010.0020	The aircraft horizontal position transmitted by the ADS-B position messages and decoded by the composite system shall be compared against the position, or partial position, determined by ranging techniques in the system for the same aircraft.	REQ-15.04.02-D08-0020.0030	The composite system shall be equipped with a 1030 MHz interrogator, capable of interrogating ADS-B targets according to all relevant ICAO Annex 10 requirements.	INDRA
		REQ-15.04.02-D08-0020.0040	The composite system shall have the capability to determine the Round Trip Delay (RTD) of every received 1090 MHz reply elicited by its own interrogations (registered as *Real RTD*).	
		REQ-15.04.02-D08-0020.0050	The composite system shall register the last RTD of each of the received ES and its time stamp.	
		REQ-15.04.02-D08-0020.0060	Each calculated RTD shall be considered applicable to RTD Validation for a configurable time period.	
		REQ-15.04.02-D08-0020.0070	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 and correct, the ADS-B position report shall be marked as VALIDATED & VALID.	

		REQ-15.04.02-D08-0020.0080	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 but not correct, the ADS-B position report shall be marked as VALIDATED & NOT VALID.	
		REQ-15.04.02-D08-0020.0090	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 not activated, the ADS-B position report shall be marked as NOT VALIDATED.	
		REQ-15.04.02-D08-0020.0100	Each time a valid position message is received for a target in "target data maintenance" mode (see ED-129 chapter 3), the composite system shall validate the ADS-B report comparing the ADS-B position data with the computed applicable RTD.	
		REQ-15.04.02-D08-0020.0110	The composite system shall be able to report the validation result in the ASTERIX CAT021 ADS-B report.	
		REQ-15.04.02-D08-0020.0120	It shall be possible to activate/deactivate the function of range measurement from active interrogation	
REQ-15.04.02-D06-0010.0030	The ICAO 24 bit address shall be used to determine that the ADS-B and WAM position information is for the same aircraft.	REQ-15.04.02-D08-0060.0000	In case of DF17 reply (ADS-B) with correct CRC, the ICAO 24 bit address shall be validated.	INDRA-DFS-NATS

		REQ-15.04.02-D08-0060.0010	In case of DF11 reply (WAM and ADS-B) with correct CRC, the ICAO 24 bit address shall be validated.	
		REQ-15.04.02-D08-0060.0020	In case of DF4 reply, the validation shall be performed only if the ICAO 24 bit address extracted from CRC belongs to an existing track in the system.	
		REQ-15.04.02-D08-0060.0030	In case of DF5 reply, the validation shall be performed only if the ICAO 24 bit address extracted from CRC belongs to an existing track in the system.	
		REQ-15.04.02-D08-0060.0040	In case of DF20 reply, the validation shall be performed only if the ICAO 24 bit address extracted from CRC belongs to an existing track in the system.	
		REQ-15.04.02-D08-0060.0050	In case of DF21 reply, the validation shall be performed only if the ICAO 24 bit address extracted from CRC belongs to an existing track in the system.	
REQ-15.04.02-D06-0010.0040	If the composite system has detected that the ICAO 24 bit address is ambiguous (i.e. more than one aircraft with the same address), then comparison of ADS-B and WAM positions shall be used to identify targets and maintain different tracks.	REQ-15.04.02-D08-0020.0130	Targets shall be associated with tracks through position and identification criteria.	INDRA
		REQ-15.04.02-D08-0020.0140	In case of duplicated targets, two different tracks shall be generated.	
REQ-15.04.02-	The ADS-B and WAM lateral position	REQ-15.04.02-	The composite WAM system shall do the	INDRA-

D06-0010.0050	information shall be compared at the same time of applicability.	D08-0060.0060	extrapolation through an internal tracking.	DFS-NATS
		REQ-15.04.02-D08-0060.0070	The composite ADS-B system shall do the extrapolation using one of the next information: - The speed calculated by tracking - The speed received from the aircraft data	
REQ-15.04.02-D06-0010.0060	The comparison between ADS-B and WAM positions shall take into account the normally expected uncertainties in the position information from both ADS-B and WAM.	REQ-15.04.02-D08-0040.0070	The WAM system shall calculate the DOP/PTE of the measurements.	INDRA-DFS
		REQ-15.04.02-D08-0040.0080	The WAM system shall emit the DOP/PTE to the end user.	
		REQ-15.04.02-D08-0040.0090	The WAM system shall emit the measurements through the I020/RE Reserved Expansion within data item Position Accuracy (PA).	
		REQ-15.04.02-D08-0040.0100	Analysis shall be performed to verify the correspondence between theoretical DOP-PTE values and ADS-B validation results	
		REQ-15.04.02-D08-0040.0110	The ADS-B system shall emit the uncertainty measurements (FOM/PA) through the data item I021/090 "Quality Indicators"	
REQ-15.04.02-D06-0010.0070	The maximum allowable uncompensated latency for ADS-B shall take account of the ADS-B version.	REQ-15.04.02-D08-0020.0150	The maximum allowable uncompensated latency for ADS-B shall take account of the ADS-B version.	INDRA

REQ-15.04.02-D06-0010.0080	To minimize the error component produced by the ADS-B in the case of a partial position hyperbola, the difference between the ADS-B position and the intersection of the normal line to the partial position hyperbola shall be compared against a threshold taking account of all the normally expected uncertainties in both measurements (as described above). This approach will provide the best case error for the comparison.	REQ-15.04.02-D08-0020.0160	In order to simplify the operation and reduce the amount of calculation, the process shall be correlated between measured TDOAs and ideal TDOAs.	INDRA
		REQ-15.04.02-D08-0020.0170	The synchronization time between receiver stations shall be less than 0.2 ns.	
		REQ-15.04.02-D08-0020.0180	The high accuracy time stamp shall have a common time base for all stations.	
		REQ-15.04.02-D08-0020.0190	The SNR of the signals shall be higher than 15 dB in order to ensure a time stamp error less than 5 ns.	
REQ-15.04.02-D06-0010.0090	The composite surveillance system shall provide information about the result of the validation to accompany the output of each ADS-B position report.	REQ-15.04.02-D08-0020.0200	The information about the result of the validation shall be emitted through the data item I021/040 from ASTERIX CAT021.	INDRA
		REQ-15.04.02-D08-0020.0210	The functionality defined in REQ-15.04.02-D08-0020.0200 shall be un/selectable.	
REQ-15.04.02-D06-0010.0100	Information shall be set to indicate one of the following comparison conditions: • No WAM/ADS-B comparison was performed [This may be due to lack of WAM coverage or other ill-conditioned solutions]. • Comparison was made against a partial position solution. [Reception by two WAM sensors will provide a position solution hyperbola]. • Comparison was made against a full, unambiguous, WAM lateral position.	REQ-15.04.02-D08-0020.0220	Bits-3/2 of third extension (WAI) of I021/040 from ASTERIX CAT021 shall be included with "not validated" value (10) in order to meet "no WAM/ADS-B comparison was performed".	INDRA
		REQ-15.04.02-D08-0020.0230	Bits-7/6 of fourth extension (TDoA) of I021/040 from ASTERIX CAT021 shall be included with "not validated" value (10) in order to meet "no WAM/ADS-B comparison was performed".	

founding members

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

• Comparison was made against a Range from interrogation validation.	REQ-15.04.02-D08-0020.0240	Bits-3/2 of fifth extension (RAI) of I021/040 from ASTERIX CAT021 shall be included with "not validated" value (10) in order to meet "no WAM/ADS-B comparison was performed".	
	REQ-15.04.02-D08-0020.0250	TDOAs comparison shall be performed in order to meet the partial position solution.	
	REQ-15.04.02-D08-0020.0260	Bits-3/2 of third extension (WAI) of I021/040 from ASTERIX CAT021 shall be included with "validated and valid" (00) in order to meet "Comparison was made against a full, unambiguous, WAM lateral position".	
	REQ-15.04.02-D08-0020.0270	Bits-7/6 of fourth extension (TDoA) of I021/040 from ASTERIX CAT021 shall be included with "validated and valid" (00) in order to meet "Comparison was made against a full, unambiguous, WAM lateral position".	
	REQ-15.04.02-D08-0020.0280	Bits-3/2 of fifth extension (RAI) 3rd iteration of I021/040 from ASTERIX CAT021 shall be with "validated and valid" (00) included in order to meet "Comparison was made against a Range from interrogation validation".	
	REQ-15.04.02-D08-0020.0290	Bits-3/2 of third extension (WAI) of I021/040 from ASTERIX CAT021 shall be included with "validated and not valid" (01) if the result is not valid.	

Project Number 15.04.02
Error! Unknown document property name. **- Technical report, composite cooperative surveillance prototype.**

Edition 00.01.00

		REQ-15.04.02-D08-0020.0300	Bits-7/6 of fourth extension (TDoA) of I021/040 from ASTERIX CAT021 shall be included with "validated and not valid" (01) if the result is not valid.	
		REQ-15.04.02-D08-0020.0310	Bits-3/2 of fifth extension (RAI) 3rd iteration of I021/040 from ASTERIX CAT021 shall be with "validated and not valid" (01) if the result is not valid.	
REQ-15.04.02-D06-0010.0110	Use of ADS-B non-position data by the WAM channel shall be permissible only when all the following conditions are met: • The ADS-B and WAM channel tracks are associated and the WAM track has "full" 3D position. • The ADS-B track position data agrees with the WAM track position (i.e. the comparison flag is successful). • Validation of the ADS-B data item, depending upon certain ADS-B protocol versions, is successful.	REQ-15.04.02-D08-0020.0320	The ADS-B information included in the combined channel shall include the code-A.	INDRA
		REQ-15.04.02-D08-0020.0330	The ADS-B information included in the combined channel shall include the code-C.	
		REQ-15.04.02-D08-0020.0340	The ADS-B information included in the combined channel shall include the call sign (if available).	
REQ-15.04.02-D06-0010.0120	Before an ADS-B data item can be used in the WAM track, the WAM horizontal position determined on the data plot containing the data item shall be successfully associated with the WAM track.	REQ-15.04.02-D08-0020.0350	The composite system shall work only with confirmed tracks.	INDRA
		REQ-15.04.02-D08-0020.0360	The composite system shall reject individual plots.	
REQ-15.04.02-D06-0010.0130	Validation of the applicable ADS-B data item (Pressure Altitude, Aircraft Identification) shall be done after initial validation conditions are met and periodically thereafter at pre-defined	REQ-15.04.02-D08-0020.0370	The verification time of the validation shall be configurable.	INDRA

REQ-15.04.02-D06-0010.0140	The WAM track shall have initialised the track Pressure Altitude information using at least 2 active interrogations.	REQ-15.04.02-D08-0020.0380	The time-out interrogation of the WAM system shall be configurable.	INDRA
	(parameter) time intervals.			
		REQ-15.04.02-D08-0020.0390	The WAM system shall interrogate aircraft with ICAO 24 bit address with correct CRC in DF11.	
		REQ-15.04.02-D08-0020.0400	The WAM system shall interrogate aircraft with ICAO 24 bit address with correct CRC in DF17.	
		REQ-15.04.02-D08-0020.0410	The interrogations shall be UF04 asking for DF04.	
		REQ-15.04.02-D08-0020.0420	The interrogations shall be UF04 asking for DF20, including the call sign BDS.	
REQ-15.04.02-D06-0010.0150	The validation check of Pressure Altitude data shall require the values from WAM and ADS-B to be within a certain tolerance margin.	REQ-15.04.02-D08-0040.0120	The tolerance margin shall be configurable.	INDRA-DFS
REQ-15.04.02-D06-0010.0160	The tolerance margin between Pressure Altitude values from WAM and ADS-B shall take account of possible differences in altitude values due to uncertainties in quantisation and timing. See [3]	REQ-15.04.02-D08-0050.0000	The ADS-B system shall track the pressure altitude in order to check the values.	INDRA-NATS
REQ-15.04.02-D06-0010.0170	The validation check of Pressure Altitude shall require the time difference between the ADS-B and WAM values to be less than a parameter	REQ-15.04.02-D08-0050.0010	The time difference for pressure altitude parameter shall be configurable.	INDRA-NATS

founding members

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

	amount.			
REQ-15.04.02-D06-0010.0180	After initialisation and successful validation, the WAM track shall actively interrogate for Pressure Altitude information at a periodic time interval determined by a system parameter and the ADS-B validation check repeated.	REQ-15.04.02-D08-0020.0430	The time-out parameter of code-C shall be configurable.	INDRA
		REQ-15.04.02-D08-0020.0440	The interrogations shall stop when the target leaves the covered volume.	
REQ-15.04.02-D06-0010.0190	In case of unsuccessful comparison outcome, the WAM track shall re-initialise the Pressure Altitude information using active interrogations.	REQ-15.04.02-D08-0020.0450	The time-out parameter shall be configurable in case of Pressure Altitude unsuccessful comparison.	INDRA
REQ-15.04.02-D06-0010.0200	In case of a WAM track loss of Pressure Altitude for longer than a parameter time, the track shall complete its initial validation conditions before attempting ADS-B data validation.	REQ-15.04.02-D08-0020.0460	The WAM system shall initialize the Pressure Altitude tracking with at least 2 active interrogations.	INDRA
REQ-15.04.02-D06-0010.0210	The WAM track shall have initialised the track Aircraft Identification information using at least 2 active interrogations giving the same Aircraft Identification.	REQ-15.04.02-D08-0020.0470	The time-out interrogation of the WAM system shall be configurable.	INDRA
		REQ-15.04.02-D08-0020.0480	The WAM system shall interrogate aircraft with ICAO 24 bit address with correct CRC in DF11.	
		REQ-15.04.02-D08-0020.0490	The WAM system shall interrogate aircraft with ICAO 24 bit address with correct CRC in DF17.	
		REQ-15.04.02-D08-0020.0500	The interrogations shall be UF05 asking for DF05.	

		REQ-15.04.02-D08-0020.0510	The interrogations shall be UF05 asking for DF21, including the call sign BDS.	
REQ-15.04.02-D06-0010.0220	The validation check of Aircraft Identification data shall require the values from WAM and ADS-B to be the same.	REQ-15.04.02-D08-0020.0520	The WAM system shall obtain the call sign identification through the BDS 2,0.	INDRA
REQ-15.04.02-D06-0010.0230	After initialisation and successful validation, the WAM track shall actively interrogate for Aircraft Identity information at a periodic time interval determined by a system parameter and the ADS-B validation check repeated.	REQ-15.04.02-D08-0020.0530	The call sign time-out parameters shall be configurable.	INDRA
		REQ-15.04.02-D08-0020.0540	The code-A time-out parameters shall be configurable.	
		REQ-15.04.02-D08-0020.0550	The interrogations shall stop when the target leaves the covered volume.	
REQ-15.04.02-D06-0010.0240	In case of unsuccessful comparison outcome, the WAM track shall re-initialise the Aircraft Identity information using active interrogations.	REQ-15.04.02-D08-0020.0560	The time-out parameter shall be configurable in case of Aircraft Identity unsuccessful comparison.	INDRA
REQ-15.04.02-D06-0010.0250	In case of a WAM track loss of Aircraft Identity information for longer than a parameter time, the track shall complete its initial validation conditions before attempting ADS-B data validation.	REQ-15.04.02-D08-0020.0570	The WAM system shall initialize the Aircraft Identification tracking with at least 2 active interrogations of the same aircraft identification.	INDRA
REQ-15.04.02-D06-0010.0260	Candidate WAM/ADS-B composite installations should consider the potential use of ADS-B to assist with WAM system performance monitoring including possible cost benefits to the overall system deployment and maintenance.	REQ-15.04.02-D08-0020.0580	The system shall include BITE features.	INDRA
		REQ-15.04.02-D08-0020.0590	The system shall calculate statistics about validated/non-validated targets.	

founding members

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

		REQ-15.04.02-D08-0020.0600	The system shall give a warning if a determined threshold is exceeded.	
REQ-15.04.02-D06-0020.0000	The location of the Mode S interrogator shall support a comparative assessment of the multi-ranging (active) and passive WAM operation.	REQ-15.04.02-D06-0020.0000	The transmitter location shall be predicted to provide coverage both inside and outside the existing passive WAM coverage.	NATS
		REQ-15.04.02-D08-0010.0010	The transmitter location coverage shall be predicted to encompass both TMA and En-Route controlled airspace.	
		REQ-15.04.02-D08-0010.0020	The transmitter pattern shall be omni-directional.	
REQ-15.04.02-D06-0020.0010	The interrogator of the validation platform shall confirm to all licensing obligations and constraints placed on it by the UK NSA.	REQ-15.04.02-D08-0010.0030	The transmitter shall have approval from National IFF/SSR Committee '(NISC) to Operate a Secondary Radar Interrogator in the United Kingdom.	NATS
		REQ-15.04.02-D08-0010.0040	An Aeronautical Radar Radio Licence shall be obtained from the UK CAA.	
REQ-15.04.02-D06-0020.0020	The validation platform shall provide sufficient low level coverage for the ADS-B separation performance assessment.	REQ-15.04.02-D08-0010.0050	The predicted coverage provided by the transmitter location shall increase the number of receivers that have ADS-B reception at 500ft ARP and above within the London TMA.	NATS
REQ-15.04.02-D06-0020.0030	NATS existing MRT data for the same defined coverage area of the CRISTAL RAD HD validation platform shall be recorded in ASTERIX CAT034 and CAT048 on the NATS RRRS	REQ-15.04.02-D08-0010.0140	The validation platform shall provide sufficient low level coverage for the ADS-B separation performance assessment.	NATS

founding members

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

REQ-15.04.02-D06-0020.0040	The WAM target data shall be recorded in ASTERIX CAT020 on the RRRS and WAM service messages in ASTERIX CAT 19.	REQ-15.04.02-D08-0010.0150	NATS existing MRT data for the same defined coverage area of the CRISTAL RAD HD validation platform shall be recorded in ASTERIX CAT034 and CAT048 on the NATS RRRS.	NATS
REQ-15.04.02-D06-0020.0050	The ADS-B target data shall be recorded in ASTERIX CAT021 on the RRRS and ADS-B service messages in ASTERIX CAT 23.	REQ-15.04.02-D08-0010.0160	The WAM target data shall be recorded in ASTERIX CAT020 on the RRRS and WAM service messages in ASTERIX CAT 19.	NATS
REQ-15.04.02-D06-0020.0060	NATS non-operational development ARTAS MST shall take input of ASTERIX CAT020, CAT021, CAT034 and CAT048 from the NATS RRRS in various combinations (*to validate the integration of ADS-B and WAM in an MST*).	REQ-15.04.02-D08-0010.0060	NATS non-operational development ARTAS MST shall accept recorded input of ASTERIX CAT020 NATS RRRS.	NATS
		REQ-15.04.02-D08-0010.0070	NATS non-operational development ARTAS MST shall accept recorded input of ASTERIX CAT021 NATS RRRS.	
		REQ-15.04.02-D08-0010.0080	NATS non-operational development ARTAS MST shall accept recorded input of ASTERIX CAT034 NATS RRRS.	
		REQ-15.04.02-D08-0010.0090	NATS non-operational development ARTAS MST shall accept recorded input of ASTERIX CAT048 NATS RRRS.	
REQ-15.04.02-D06-0020.0070	NATS RRRS shall be used to replay recorded CAT020, CAT 19, CAT021, CAT 23, CAT034 and CAT048 to NATS non-operational development ARTAS MST.	REQ-15.04.02-D08-0010.0060	NATS non-operational development ARTAS MST shall accept recorded input of ASTERIX CAT020 NATS RRRS.	NATS
		REQ-15.04.02-D08-0010.0070	NATS non-operational development ARTAS MST shall accept recorded input of ASTERIX CAT021 NATS RRRS.	

Project Number 15.04.02
Error! Unknown document property name. **- Technical report, composite cooperative surveillance prototype.**

Edition 00.01.00

		REQ-15.04.02-D08-0010.0080	NATS non-operational development ARTAS MST shall accept recorded input of ASTERIX CAT034 NATS RRRS.	
		REQ-15.04.02-D08-0010.0090	NATS non-operational development ARTAS MST shall accept recorded input of ASTERIX CAT048 NATS RRRS.	
REQ-15.04.02-D06-0020.0080	The NATS Space Simulation facility shall be configured to accept CAT020, CAT021 and CAT062 inputs (for shadow mode validation by controllers).	REQ-15.04.02-D08-0010.0100	The NATS Space Simulation capability shall be configured to accept and display recorded CAT020.	NATS
		REQ-15.04.02-D08-0010.0110	The NATS Space Simulation capability shall be configured to accept and display recorded CAT021.	
REQ-15.04.02-D06-0020.0090	The version of SASS-C used in the validation assessment shall be capable of providing the validation performance assessment metrics.	REQ-15.04.02-D08-0010.0130	The version of SASS-C used in the validation assessment shall be capable of outputting the following metrics: • WAM Probability of Detection, • Probability of false detection, • Probability of false Mode S address determination, • Probability of false Mode A address determination, • Probability of false Pressure Altitude or Mode C determination, • Probability of false Aircraft Identification (ACID) determination,	NATS

			• Probability of consecutive Update Intervals without valid horizontal position.	
REQ-15.04.02-D06-0030.0000	The deployed system shall be used to evaluate the impact on the Identification performance values of the standard WAM service for Active and passive system operation	REQ-15.04.02-D08-0020.0610	The system shall be able to work in active mode.	INDRA
		REQ-15.04.02-D08-0020.0620	The system shall be able to work in passive mode.	
REQ-15.04.02-D06-0030.0010	The deployed system shall be used to evaluate the increment on the Identification performance values of the Composite WAM – ADS-B service for Active and passive system operation	REQ-15.04.02-D08-0020.0630	The deployed combined system shall be able to work in different modes: - Passive, using the opportunity interrogations from other systems. - Active, using the opportunity interrogations from other systems and its own ones. - Active-exclusive, using only its own interrogations.	INDRA
		REQ-15.04.02-D08-0020.0640	The comparison shall be made in passive and active-exclusive modes.	
REQ-15.04.02-D06-0030.0020	The composite surveillance sensor shall provide the following services simultaneously: • WAM service • ADS-B service • Composite WAM/ADS-B service	REQ-15.04.02-D08-0020.0650	The ASTERIX CAT020 output channel shall be configurable in the update rate.	INDRA
		REQ-15.04.02-D08-0020.0660	The services shall be independently de/activated.	
		REQ-15.04.02-D08-0020.0670	The flows and categories from the different services shall be independently configurable.	
		REQ-15.04.02-D08-0020.0680	The SIC/SAC shall be independently configurable.	

		REQ-15.04.02-D08-0020.0690	The WAM and Composite services shall be sent with ASTERIX CAT020.	
		REQ-15.04.02-D08-0020.0700	The ADS-B service shall be emitted with ASTERIX CAT021.	
REQ-15.04.02-D06-0030.0030	The WAM and Composite service shall work as passive or active system using one or several Mode S interrogators.	REQ-15.04.02-D08-0020.0710	The interrogators shall interrogate in Mode S using UF04 asking for DF04.	INDRA
		REQ-15.04.02-D08-0020.0720	The interrogators shall interrogate in Mode S using UF05 asking for DF05.	
		REQ-15.04.02-D08-0020.0730	The interrogators shall interrogate in Mode S using UF04 asking for DF20.	
		REQ-15.04.02-D08-0020.0740	The interrogators shall interrogate in Mode S using UF05 asking for DF21.	
		REQ-15.04.02-D08-0020.0750	The interrogators shall interrogate in selective mode (not all-call).	
REQ-15.04.02-D06-0030.0040	The next functionalities shall be evaluated • ADS-B Positional validation. In this area, different methods will be used to validate the ADS-B data transmitted by targets. The following methods will be used: • TDOA validation with at least 2 Receiver Stations Some guidance for TDOA validation is provided in [6] The result of the ADS-B data validation will be	REQ-15.04.02-D08-0040.0130	In ASTERIX CAT021, the high accuracy time stamp shall be included in data item I021/074 and I021/076.	INDRA-DFS
		REQ-15.04.02-D08-0040.0140	Bits-7/6 of fourth extension (TDoA) of I021/040 from ASTERIX CAT021 shall be included in order to meet the TODA validation (00 is validated and valid, and 01 validated but not valid).	

		REQ-15.04.02-D08-0040.0150	The TDOA data, transmitted via Cat021/SP, shall be used to calculate an ADS-B error; this error shall be transmitted via Cat062/SP.	
REQ-15.04.02-D06-0030.0050	The next functionalities shall be evaluated • ADS-B Positional validation In this case will be used the following method to validate the ADS-B data transmitted by targets: • Range validation in Active WAM context, checking that the ADS-B reported position is located in inside the boundary limits of the ellipsoid produced by the replies of the target to an interrogation generated by the system. The result of the ADS-B data validation will be provided in specific ASTERIX CAT21 bits created for that purpose. See [7] Ranging information will be included in the SP bits of the ASTERIX CAT021.	REQ-15.04.02-D08-0040.0160	Ranging information shall be included in the Special Purpose field.	INDRA-DFS
		REQ-15.04.02-D08-0040.0170	The SP field shall include the total length in octets in the LEN subfield, included itself.	
		REQ-15.04.02-D08-0040.0180	The SP field shall include the SP Item Indicator which indicates what are the items encoded in the SP.	
		REQ-15.04.02-D08-0040.0190	The SP field shall include the Transmission data item with the following subfields: • Transmission Delay • Time of Transmission (UTC), from 1/1/1970 (epoch time)	
		REQ-15.04.02-D08-0040.0200	The SP field shall include the Reception data item with the following subfields: • Repetition Factor • Receiver component ID • Power of Reception • SNR of Reception • Time of Reception (UTC), from 1/1/1970 (epoch time)	

Note: the top-left cell of the first row contains: "provided in specific ASTERIX CAT21 bits created for that purpose. See [7] Ranging information will be included in the SP bits of the ASTERIX CAT021."

		REQ-15.04.02-D08-0040.0210	The SP field shall include the "Secondary Data" data item with the following subfields: • Downlink Format • Target Address • Flight Level • Mode-3/A Code • Downlinked Aircraft ID • Mode S MB Data • Communications/ACAS Capability	
		REQ-15.04.02-D08-0040.0220	The SP field shall include the Remote Unit Location data item with the following subfields: • Repetition Factor • Component ID • Latitude in WGS-84 • Longitude in WGS-84 • Altitude	
REQ-15.04.02-D06-0030.0060	The next functionalities shall be evaluated ADS-B Positional validation In this case will be used the following method to validate the ADS-B data transmitted by targets: • Full WAM validation, comparing the ADS-B reported position with the position calculated by the WAM system. The result of the ADS-B data validation will be	REQ-15.04.02-D08-0040.0230	The difference between the reported ADS-B position and the reported non ADS-B positions (e.g. WAM position solution originated from Cat020) shall be calculated and transmitted via Cat062/SP.	INDRA-DFS
		REQ-15.04.02-D08-0040.0240	The WAM system shall calculate a 2D or 3D position.	

Project Number 15.04.02
Error! Unknown document property name. **- Technical report, composite cooperative surveillance prototype.**

Edition 00.01.00

		REQ-15.04.02-D08-0040.0250	The WAM system shall be configurable in order to calculate the minimum number of necessary receiver stations.	
provided in specific ASTERIX CAT21 bits created for that purpose. See [7] Ranging information will be included in the SP bits of the ASTERIX CAT021.				
REQ-15.04.02-D06-0030 .0070	The next functionalities shall be evaluated • Barometric altitude provided by ADS-B with Barometric altitude provided by WAM system obtained from active interrogations. Checking the difference of the barometric altitude reported in ADS-B squitter with the barometric altitude obtained by the WAM system using the (DF4) replies.	REQ-15.04.02-D08-0040.0260	In ASTERIX CAT020, the data item I020/090 "Flight Level in Binary Representation" shall be sent with barometric altitude information.	INDRA-DFS
		REQ-15.04.02-D08-0040.0270	In ASTERIX CAT021, the data item I021/145 "Flight Level" shall be sent with barometric altitude information.	
		REQ-15.04.02-D08-0040.0280	In ASTERIX CAT021, the barometric altitude shall be represented in FL.	
		REQ-15.04.02-D08-0040.0290	It shall be configurable per SAC-SIC whether the barometric height shall be used to validate the ADS-B barometric height with respect to the Cat062 report.	
		REQ-15.04.02-D08-0040.0300	In case the threshold between barometric altitude from WAM and ADS-B is succeeded, the altitude discrepancy flag I062/200 (ADF) shall be set.	
		REQ-15.04.02-D08-0040.0310	It shall be configurable whether the barometric height in I021/SP shall be used to validate the ADS-B barometric height with	

founding members

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

			respect to the Cat062 report.	
REQ-15.04.02-D06-0030.0080	Quality of the different tracks provided by the different services will be analysed: • Individual accuracy (along, across, POD, RMS, sigma, max err) of ADS-B and WAM. • Combined accuracy of ADS-B and WAM. The quality of the track provided by the WAM sensor shall be analysed by individual accuracy evaluations (along, across, POD, RMS, sigma, max error).	REQ-15.04.02-D08-0040.0320	It shall be possible to calculate the following KPIs: along/across error, total error, POD	INDRA-DFS
		REQ-15.04.02-D08-0040.0330	For each of the entities the following KPIs shall be generated: standard deviation, mean, min, max.	
		REQ-15.04.02-D08-0040.0340	It shall be possible to distinguish between different FL bands.	
		REQ-15.04.02-D08-0040.0350	It shall be possible to map the KPIs on a geographical grid.	
		REQ-15.04.02-D08-0040.0360	It shall be possible to show the timeline of the KPIs.	
REQ-15.04.02-D06-0030.0090	The provided accuracy of the WAM data shall be analysed. Adding WAM plots to good ADS-B (e.g. NUC=8) would not necessarily enhance the track quality of the position result. Therefore it appears of more interest to evaluate the accuracy of the provided accuracy of the WAM sensor.	REQ-15.04.02-D08-0040.0370	The provided accuracy of the WAM system (I020/500 or I020/RE) shall be evaluated against the Cat062 position; especially it shall be checked that it is not too optimistic.	INDRA-DFS
REQ-15.04.02-D06-0030.0100	The provided track data ages shall be analysed. Track data ages are a pretty good methods to show the advantage of composite surveillance (besides the ability of cross validation).	REQ-15.04.02-D08-0040.0380	The composite system shall emit the data age information.	INDRA-DFS
		REQ-15.04.02-D08-0040.0390	The data age information shall be sent in Data Item I021/295 in ASTERIX CAT021.	

		REQ-15.04.02-D08-0040.0400	The data age information shall be sent in DA subfield of RE field in ASTERIX CAT020.	
		REQ-15.04.02-D08-0040.0410	The data ages of I021/295 shall be taken into account to update the corresponding data ages of I062/295.	
		REQ-15.04.02-D08-0040.0420	The data ages of I020/RE SF DA shall be taken into account to update the corresponding data ages of I062/295.	
		REQ-15.04.02-D08-0040.0430	Statistics with respect to selected data ages of I062/290 and I062/295 shall be generated.	
REQ-15.04.02-D06-0030.0110	The next functionalities shall be evaluated: • Analysis of ADS-B figure of merit Statistics for the different quality parameters NUC (DO-260) and/or NIC/NAC/SIL (Do-260A/B) will be analysed for the different targets of opportunity and for the different transponder versions.	REQ-15.04.02-D08-0020.0760	The ASTERIX CAT021 channel shall include the NUC and/or NIC/NAC/SIL information in the ASTERIX report.	INDRA
REQ-15.04.02-D06-0030.0120	The next functionalities shall be evaluated: • ADS-B uncompensated latency	REQ-15.04.02-D08-0020.0770	The times for aligned positions extracted from the tracking of WAM and ADS-B systems shall be compared.	INDRA
		REQ-15.04.02-D08-0020.0780	Once REQ-15.04.02-D08-0020.0770 is met, an ADS-B average latency shall be calculated.	
		REQ-15.04.02-D08-0020.0790	Once REQ-15.04.02-D08-0020.0770 is met, statistics about the ADS-B version number	

founding members

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

Project Number 15.04.02
Error! Unknown document property name. **- Technical report, composite cooperative surveillance prototype.**

Edition 00.01.00

			of the targets shall be calculated.	
		REQ-15.04.02-D08-0020.0800	The latency shall be compared with indicated speed, in order to check if this error is correlated with the ADS-B FOM.	
REQ-15.04.02-D06-0030.0130	The composite Surveillance Sensor shall provide target data in ASTERIX cat 20 v1.8 for WAM (standard and composite) and ASTERIX cat 21 v2.81 for ADS-B.	REQ-15.04.02-D08-0020.0810	The emitted flows shall be independently de/activated.	INDRA
		REQ-15.04.02-D08-0020.0820	The UAPs for data targets shall be configurable.	
		REQ-15.04.02-D08-0020.0830	The target data shall be recordable.	
REQ-15.04.02-D06-0030.0140	MSDF Tracker shall process as inputs ASTERIX CAT020 and CAT021	REQ-15.04.02-D08-0030.0000	The MSDF tracker shall process Cat020 data.	DFS
		REQ-15.04.02-D08-0030.0010	The MSDF tracker shall process Cat021 data.	
REQ-15.04.02-D06-0030.0150	The composite Surveillance Sensor shall provide different SIC-SAC codes for the standard WAM service and for the Composite WAM service	REQ-15.04.02-D08-0020.0840	The composite Surveillance Sensor shall provide different SIC-SAC codes for the standard WAM service and for the Composite WAM service	INDRA
REQ-15.04.02-D06-0030.0160	MSDF tracker shall differentiate the WAM flow and Composite WAM flow with the SIC-SAC codes.	REQ-15.04.02-D08-0030.0020	The SAC-SIC information shall be used to distinguish between different input sources.	DFS
REQ-15.04.02-D06-0030.0170	The composite Surveillance Sensor shall differentiate ADS-B dataflows with service or	REQ-15.04.02-D08-0020.0850	The Data Item I021/400 "Receiver ID" and Data Item I021/015 "Service Identification" shall be sent in ASTERIX CAT021 in order	INDRA

	receiver indicator in ASTERIX CAT021.		to identify the receiver.	
REQ-15.04.02-D06-0030.0180	MSDF Tracker shall differentiate ADS-B dataflows with service or receiver indicator in ASTERIX CAT021.	REQ-15.04.02-D08-0030.0030	In addition to the SAC-SIC differentiation of the input data, also the service identification I021/015 and the receiver indication I021/400 shall be used as input differentiation.	DFS
REQ-15.04.02-D06-0030.0190	WAM, ADS-B and Composite WAM/ADS-B services shall be capable to be configured with a different update rate or to work in data driven mode.	REQ-15.04.02-D08-0020.0860	The update rate shall be configurable and independent for each flow.	INDRA
REQ-15.04.02-D06-0030.0200	The different WAM, ADS-B and composite WAM/ADS-B streams shall be available in parallel.	REQ-15.04.02-D08-0020.0870	The system shall de/activate the WAM stream if needed.	INDRA
		REQ-15.04.02-D08-0020.0880	The system shall de/activate the ADS-B stream if needed.	
		REQ-15.04.02-D08-0020.0890	The system shall de/activate the composite stream if needed.	
		REQ-15.04.02-D08-0020.0900	The UAPs for the different streams shall be configurable.	

-END OF DOCUMENT-

founding members

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