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Safety, Performance, and Interoperability Requirements Document for Enhanced Traffic Situational Awareness During Flight Operations (ATSA-AIRB)

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CHAPTER 1 INTRODUCTION

This document provides the minimum operational, Safety and Performance Requirements (SPR) and Interoperability Requirements (INTEROP) for the implementation of Airborne Traffic Situational Awareness (ATSAW) for "Enhanced Traffic Situational Awareness during flight operations" (ATSA-AIRB). The ATSA-AIRB application is fully defined in the Operational Services and Environment Definition (OSED) found in Annex A.

All material in this document was developed jointly by EUROCAE Working Group 51 and RTCA Special Committee 186 within the group commonly referred to as the "ADS-B Requirements Focus Group" (RFG).

This document was developed based on the criteria for SPR and INTEROP documents set forth in RTCA DO-264/EUROCAE ED-78A, "Guidelines for Approval of the Provision and Use of Air Traffic Services Supported by Data Communications." [9]. It provides the minimum ATSA-AIRB requirements - and allocations thereof - based on the results of a coordinated requirements determination process.

The requirements contained in this document are necessary to provide adequate assurance that the appropriate aspects of the relevant Communication Navigation Surveillance and Air Traffic Management (CNS/ATM) system, when operating together, will perform their intended function in an acceptably safe manner for the operations defined in the OSED.

Whilst all detailed SPR related assessments are found in Annexes to this document, Chapter 3 presents the outcome of the reconciliation process of all of these results into a single set of underlying Safety and Performance Requirements. This process retains the most stringent requirement for those attributes or parameters commonly treated by both the safety and performance assessments. Traceability of those requirements back to the corresponding assessment(s) is provided.

1.1 PURPOSE OF THE DOCUMENT

This document defines and allocates the set of minimum requirements for the end-to-end operational, safety, performance and interoperability aspects for implementations of the ATSA-AIRB application. Allocation of these requirements is done by this SPR/INTEROP to the necessary domains of the CNS/ATM system, i.e. at aircraft and ground domain level.

These requirements can be used as a component for approval processes including aircraft type design approval, aircraft operator operational approval and Air Traffic Services (ATS) provider operational approval. This SPR/INTEROP document is also written to support system specific standards (e.g. MOPS, TSOs) which will be required for many airspace regulators.

Note: Requirements for EVAcq (Enhanced Visual Acquisition) in DO-317 [17], which is an application similar to ATSA-AIRB, are different than those for ATSA-AIRB. A Change Proposal will be developed to harmonize the ASAS MOPS with this SPR by advocating changes to make a DO-317 revision consistent with ATSA-AIRB SPR/INTEROP.

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In addition, this document provides guidance to determine the levels of design assurance and performance that are needed for each element (aircraft, operator and ANSP – Air Navigation Service Provider) to support the ATSA-AIRB application.

The ATSA-AIRB SPR/INTEROP document is also envisaged to be used along with those from other surveillance applications based on Automatic Dependent Surveillance-Broadcast (ADS-B) to develop minimum standards for avionic systems to assure that all subsystems perform their intended functions adequately for these applications.

This document treats ATSA-AIRB as a stand-alone application with a dedicated display. However, it is recognized that other Airborne Surveillance Applications will be layered on top of the nominal ATSAW display, and that some ATSA-AIRB implementations will be done on shared displays with other surveillance sources such as TCAS (Traffic alert and Collision Avoidance System). The requirements of such shared displays, the correlation between multiple surveillance sources and source selection for display of data are left to lower level requirements documents such as DO-317. Nevertheless, an Operational Requirement and training consideration addressing separate TCAS Traffic Display are identified in this document.

Note: It is anticipated that some regulatory authorities will require TCAS and ADS-B displays to be integrated.

1.1.1 ATSA-AIRB application

During flight operations, flight crews should, to the greatest extent possible, maintain a general awareness of the environment in which they are operating. In particular, flight crews must attempt to maintain traffic situational awareness.

Traffic situational awareness is an asset in terms of safety and flight efficiency. During flight operations, flight crews use all available sources of information to build their mental traffic picture by scanning for traffic out the window and listening to radio communications. However, these sources may present some limitations. Visual acquisition of Surrounding Traffic is not usually possible in reduced visibility and can be difficult even in good conditions. Radio communications may only provide a partial picture (e.g. different VHF frequencies used in the same airspace for departures and arrivals in TMA, information about traffic only provided when the controller has time available to make non-mandatory transmissions for instance between IFR (Instrument Flight Rules) flights in class A airspace).

The ATSA-AIRB application aims at enhancing flight crews' traffic situational awareness through the provision of an appropriate on-board graphical display of airborne Surrounding Traffic transmitting ADS-B data and qualified for ATSA-AIRB (i.e. referred to as AIRB Traffic) relative to their aircraft together with supporting information on that traffic. It is expected that this enhanced traffic situational awareness will contribute to improve flight safety and flight operations.

In the context of this document, the term flight crew refers to one or more pilots. The analysis does not take credit for any advantages that may be provided by additional pilots. As a result, the requirements for conducting ATSA-AIRB are applicable to both single and multiple pilot operations.

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The ATSA-AIRB application will supplement the other available sources of information (i.e. out the window and/or radio communication) on AIRB Traffic and should support the rapid and accurate mental integration of out the window and radio communication information (e.g. the display of Aircraft Identification in conjunction with the voice communications party-line effect helps the flight crew in building their mental traffic picture) and help the flight crew to address the limitations of these sources (e.g. identification of the presence of a Traffic of Interest that cannot be visually acquired for instance due to limited visibility conditions or aircraft being out of the field of vision).

The ATSA-AIRB application can be used anytime the aircraft operating the ATSA-AIRB application (referred to as AIRB Aircraft) is airborne, i.e. from the runway departure on take-off, through in-flight operations, and during approach to touchdown, in all classes of airspace, in both Instrument Meteorological Conditions (IMC) and Visual Meteorological Conditions (VMC), by aircraft operating under Instrument Flight Rules (IFR) and Visual Flight Rules (VFR) and by all types of aircraft, from large commercial jets to small General Aviation aircraft. The actual expected benefits will vary depending on the airspace and operational flight rules.

The ATSA-AIRB application does not supersede any existing ICAO SARPS (Standards and Recommended Practices). For example, Annex 2 “Rules of the Air” [2] regarding adherence to the flight plan remain unchanged (see Annex 2 - Rules of the Air, Chapter 3 - General Rules, Section 3.6 - Air Traffic Control Service, paragraph 3.6.2 - Adherence to Flight Plan.). The first sub-paragraph (3.6.2.1) mentions that "*Except as provided for in 3.6.2.2 and 3.6.2.4, an aircraft shall adhere to the current flight plan or the applicable portion of a current flight plan submitted for a controlled flight unless a request for a change has been made and clearance obtained from the appropriate air traffic control unit, or unless an emergency situation arises which necessitates immediate action by the aircraft, in which event as soon as circumstances permit, after such emergency authority is exercised, the appropriate air traffic services unit shall be notified of the action taken and that this action has been taken under emergency authority.*"

1.1.2 Use of document for approvals

This document is intended to support the approval of all elements of the CNS/ATM system relating to the ATSA-AIRB application.

The corresponding safety, performance and interoperability assessments are based on the detailed specification of the OSED. States or regions implementing an application different to that specified in the OSED must take into account those differences in the operations or environment in supporting analysis and must analyze the impact of these differences on the requirements.

The assessments and specifications in this document are not intended to be the sole basis for operational and airworthiness approval. However, this material can be used as an important component for establishing minimum design and system performance standards for ANSP, aircraft operator and aircraft certification approvals for the ATSA-AIRB application.

Aircraft and avionics system designers should consider any additional specifications that may enhance the system supporting the ATSA-AIRB application in view of other future

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Airborne Surveillance Applications (ASA) so that systems designed for ATSA-AIRB will easily accommodate more demanding ADS-B enabled operations in the future.

1.2 SCOPE OF THE DOCUMENT

This document includes the definition of the services and the Environmental Conditions relevant to the implementation of the ATSA-AIRB application and the operational, safety, performance and interoperability requirements for using the application.

Note: Requirements that provide protection against intentional behavior causing harm or sabotage are beyond the scope of this document.

Note: Requirements related to the recording of ADS-B data for accident or incident investigation purposes are beyond the scope of this document.

1.2.1 ATSA-AIRB context

ATSA-AIRB is one of many envisioned applications based on an ADS-B "IN" function that relies on the participation of ADS-B OUT equipped aircraft. There is a strong expectation that ADS-B OUT will be implemented widely using, for example, the published SPR/INTEROP documents such as ADS-B-NRA [13] and ADS-B-RAD [14]. Furthermore, some SPR/INTEROP documents for Airborne Surveillance Applications are already published (i.e. ATSA-ITP [16] and ATSA-VSA [15]). This document has therefore been developed considering the assessments of these Ground and Airborne Surveillance Applications.

ATSA-AIRB is one of the applications originally defined as a first package of Ground and Airborne Surveillance Applications enabled by ADS-B and collectively called "Package 1" [6]. All applications defined within Package I are enabled by ADS-B given a sufficient level of equipage of aircraft broadcasting ADS-B information and/or ground stations and/or other aircraft receiving and processing that same data.

This document considers ATSA-AIRB as an isolated application. However, all Package 1 Applications are envisioned to be implemented and it should be noted that system requirements that satisfy the ATSA-AIRB application do not necessarily satisfy others. Implementation of all Package 1 applications will require harmonization of minimum system requirements to facilitate interoperability between applications. Additionally, differences between similar applications specified in DO-317 [17] and Package 1 should be harmonized in the future.

The envisioned applications within Package 1 fall into two categories as follows:

ADS-B Package 1 Ground Surveillance Applications (GSA) which are:

- ADS-B-NRA Enhanced ATS in non-radar areas using ADS-B surveillance
- ADS-B-RAD Enhanced ATS in radar areas using ADS-B surveillance
- ADS-B-APT Airport surface surveillance
- ADS-B-ADD Aircraft derived data for Air Traffic Control tools

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