RTCA, Inc.
1828 L Street, NW, Suite 805
Washington, D.C. 20036-5133 USA

Safety, Performance and Interoperability Requirements Document for the ADS-B Non-Radar-Airspace (NRA) Application

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Prepared by: SC-186
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Telephone: 202-833-9339
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FOREWORD

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SECTION 1. INTRODUCTION

This standard provides the minimum operational, safety, and performance requirements (SPR) and interoperability requirements (INTEROP) for the implementation of the Automatic Dependent Surveillance – Broadcast (ADS-B) application "Enhanced Air Traffic Services in Non-Radar Areas using ADS-B surveillance" (ADS-B-NRA). This application is fully defined in the Operational Services and Environment Definition (OSED) found in Annex A.

This document was developed based on guidance for SPR and INTEROP standards contained in RTCA DO-264/EUROCAE ED-78A, "Guidelines for Approval of the Provision and Use of Air Traffic Services Supported by Data Communications." [18]. This document provides the minimum ADS-B-NRA requirements - and allocations of these requirements to both air and ground domains.

The requirements contained in this document are necessary to provide adequate assurance that the elements of the relevant Communication, Navigation, and Surveillance / 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.

This requirements definition is based on the results of a requirements determination process performed by the "ADS-B Requirements Focus Group" (RFG). The RFG was established through the EUROCONTROL/FAA Memorandum of Cooperation. It operates as a joint EUROCAE and RTCA activity assuming the responsibility for the SPR and INTEROP standard material contained in this document[1,2].

1.1 Purpose

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 ADS-B-NRA application. Requirements are allocated to the necessary domains of the CNS/ATM system, i.e., at aircraft and ground domain level.

These requirements can be used for approval processes including aircraft type design approval, and operational approvals for aircraft operators and Air Traffic Services Providers (ATSP).

In addition, this document also provides guidance to determine the levels of design assurance and performance that are needed for the aircraft domain systems and ground domain systems, to support the ADS-B-NRA application.

The ADS-B-NRA SPR and INTEROP standards are envisaged to be used along with SPR and INTEROP standards from other surveillance applications based on ADS-B to develop minimum standards for avionics systems. These standards will assure that all subsystems perform their intended functions adequately for ADS-B applications.

1.1.1 ADS-B-NRA

The ADS-B-NRA application is designed to support and enhance Air Traffic Services in both En-route and TMA airspaces in non-radar areas (NRA).

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[1] More specifically, the work was conducted under the Terms of References of RTCA SC-186 and EUROCAE WG53.

[2] The EUROCONTROL CASCADE Programme acted as the European Reporting Authority for the OSED part of this document.

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The introduction of ADS-B in non-radar areas will provide enhancements to these services (compared to current capabilities) in a way similar to the introduction of secondary surveillance radar (SSR), assuming a sufficient number of aircraft are ADS-B equipped. In particular, the Air Traffic Control Service will be enhanced by providing controllers with improved surveillance of aircraft positions, which will result in the use of separation standards similar to that of radar. The issue of partial equipage, and its impact on the safety assessment contained in this document, is covered in more detail in the OSED at Annex A and in particular Annex A.3.4.4.

A summary of the ADS-B-NRA application is found in §1.2.1.3.

1.1.2 Use of EUROCAE ED-78A/RTCA DO-264

This document was developed in accordance with the criteria for SPR and INTEROP standards set forth in ED-78A/DO-264, "Guidelines for Approval of the Provision and Use of Air Traffic Services Supported by Data Communications" [18].

1.1.3 Use of Document for Approvals

This document is intended to support the approval of the ADS-B element of the CNS/ATM system. It uses an end-to-end systems analyis approach.

The safety, performance, and interoperability assessments are based on the detailed specification of the OSED. States or regions implementing applications similar to that described in the OSED should take into account differences in their specific operations or environment that might change the supporting analysis.

The analyses and specifications in this document are not intended to be a 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 ATSP, aircraft operator, and aircraft certification approvals for the ADS-B-NRA application.

While the requirements in this document represent the minimum requirements for implementing ADS-B-NRA, aircraft and avionics system designers should consider potential future needs for these systems based on future applications. A sound engineering approach will help to assure that systems designed for ADS-B-NRA will easily accommodate more demanding ADS-B enabled operations in the future.

The Ground requirements are applicable to "ATS Provider" domain. For the ground application, the assumptions and the analysis processes as set out in this document are intended to be at a level such that they can form the basis for specific local implementations.

It is the responsibility of any ATS provider using this document, and wishing to implement ADS-B-NRA, to ensure that the various conditions or assumptions mentioned in this document are applicable for the local target environment. This is in particular true for the:

a) Local environment characteristics;

b) Characteristic of a local reference radar supporting 5 NM;

c) Identification of hazards and their severity class in the local environment.

ATS providers wishing to implement the ADS-B-NRA application in their own airspace should consider the information and processes presented in this material. If they need to perform additional analysis for a particular case, then any of the information in this document may be re-used to help in the development of that particular airspace.

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Information on adapting this SPR standard to a local implementation can be found in §1.3.3 of ED-78A/DO-264 [18]. Guidelines for qualifying a CNS/ATM system element to an SPR standard can be found in sections 5 and 6 of ED-78A/DO-264[18]. Additional guidance is provided in Annex C of this document, e.g., with respect to the applied risk classification scheme for operational hazards.

Note 1: This standard is intended to provide the basis for demonstrating that an implemented system can meet the relevant operational, safety, performance and interoperability requirements for services performed within the operational limitations defined herein. This standard is not intended to constrain the use of an implementation only to the services and operational limits defined herein. In cases where ATS service providers intend to support expanded operations or wish to define new services, corresponding changes or additions to the operational, safety, performance and interoperability requirements addressed in this document will need to be considered.

Note 2: Following on the EUROCAE ED-78A/RTCA DO-264 guidelines, SPR and INTEROP standard material provide recommendations intended for government organizations, conferences of governments, or agencies having statutory jurisdiction over the use and provision of data link services. These recommendations are for use by such government organizations to enunciate official policy related to such matters in aeronautical information publications (AIPs), notices to airmen (NOTAMs), airplane flight manuals (AFMs), and operator specifications.

1.2 Scope of the Document

This document includes the definition of the services and the environmental conditions relevant to the implementation of the ADS-B-NRA application, and the operational, safety, performance and interoperability requirements for using the application.

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

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 ADS-B-NRA Context

This document considers ADS-B-NRA as an isolated application. However, it should be recognized that all Package I applications (see §1.2.1.2) are envisioned to be implemented and that minimum requirements of all of these applications for both the air and ground domains should be considered when designing avionics and ground systems.

1.2.1.1 ADS-B

"ADS-B is a means by which aircraft, aerodrome vehicles and other objects can automatically transmit and/or receive data such as identification, position and additional data as appropriate in a broadcast mode via a data-link."

ADS-B is *automatic* because no external stimulus is required; it is *dependent* because it relies on on-board position sources, and on-board broadcast transmission systems, to provide surveillance information to other users. The aircraft originating the broadcast will have no knowledge of which users are receiving its broadcast. Any user, either aircraft or ground based, within range of this broadcast, may choose to receive and process the ADS-B surveillance information.

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