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Safety, Performance and Interoperability Requirements Document for Enhanced Air Traffic Services in Radar-Controlled Areas Using ADS-B Surveillance (ADS-B-RAD)

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Prepared by: SC-186
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FOREWORD

This document was prepared by the "ADS-B Requirements Focus Group" (RFG). The RFG was established through the Eurocontrol/FAA Memorandum of Cooperation. The RFG operates as a joint EUROCAE and RTCA Special Committee 186 (SC-186) activity. This document was approved by the RTCA Program Management Committee (PMC) on September 9, 2009.

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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 Radar-Controlled Areas using ADS-B surveillance" (ADS-B-RAD). 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" [22]. This document provides the minimum ADS-B-RAD 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 elements of the relevant Communication, Navigation, and 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. This system includes ground and airborne elements.

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].

While all detailed SPR-related assessments are found in Annexes to this document, Section 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

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-RAD 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 as a component of approval processes including aircraft type design approval, aircraft operator operational approval, and Air Traffic Services (ATS) provider operational approval, but this SPR/INTEROP specification is also written to feed system-specific standards (e.g., MOPS, TSOs, etc.) which will be required for many airspace regulators to support approvals, along with system-specific data.

[1] More specifically, the work was conducted under the Terms of Reference of RTCA SC-186 and EUROCAE WG-51.
[2] The Eurocontrol CASCADE Program acted as the European Reporting Authority for the OSED part of this document.

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

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

This document defines ADS-B requirements applicable to dense airspaces such as those that will be found in Europe and the USA. The requirements in this document have been developed from a necessarily conservative comparative analysis of ADS-B performance to radar performance. Local implementers may pursue further studies and analyses, such as target level-of-safety (TLS) studies in relation to the ADS-B-RAD operational performance assessment, to confirm minimum performance standards (see the discussion of Annex B, §2.2.2.1). If these studies indicate that a different set of requirements can be supported, the relevant standards may be updated accordingly. Local administrations may also consider relaxing some requirements in the light of their own airspace conditions and other comparative radar considerations.

1.1.1 ADS-B-RAD

The ADS-B-RAD application will support, and in some cases enhance, Air Traffic Services through the addition of ADS-B coverage in areas where radar surveillance exists. It will apply to the En Route and terminal airspace as outlined in §2.2.1 in classes A to D. The application is designed to support the following ICAO Air Traffic Services:

- Air Traffic Control Service (i.e., Area Control Service and Approach Control Service);
- Flight Information Service;
- Alerting Service; and
- Air Traffic Advisory Service.

The introduction of ADS-B may enhance these services by improving the overall quality of surveillance (i.e., ADS-B added to a single radar layer) such that an operational benefit may include a reduction in the applied separation standards from those applied in today's airspace.

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

This document was developed in accordance with the criteria for SPR and INTEROP standards set forth in EUROCAE ED-78A and RTCA DO-264, "*Guidelines for Approval of the Provision and Use of Air Traffic Services Supported by Data Communications*" [22].

Wherever appropriate, the ED-78A/DO-264 guidelines have been refined to serve the determination of surveillance application requirements. In particular, as applicable to all RFG applications, more detailed safety assessment guidance has been established, which can be found in Annex C.

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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. States or regions implementing an application different from that specified in the OSED must take into account those differences in the operations or environment in supporting analysis.

The assessments 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 ATS Provider, aircraft operator, and aircraft certification approvals for the ADS-B-RAD application.

The requirements in this document represent the minimum global interoperability requirements for implementing ADS-B-RAD, within the scope of the selected operational environments and also with respect to the selected reference radar performance. Aircraft and avionics system designers should consider any additional specifications that may enhance the system supporting the ADS-B-RAD application in view of other future Ground and Airborne Surveillance Applications. A sound engineering approach will help to assure that systems designed for ADS-B-RAD may accommodate more demanding ADS-B-enabled operations in the future.

The Ground requirements expressed in this document are applicable to the "ATS Provider" domain. It is the responsibility of any ATS provider using this document, and wishing to implement ADS-B-RAD, to ensure that the various conditions and assumptions mentioned in this document are applicable for the local target environment.

Information on adapting this SPR standard to a local implementation can be found in §1.3.3 of ED-78A/DO-264 [22]. Guidelines for qualifying a CNS/ATM system element to an SPR standard can be found in §5 and §6 of ED-78A/DO-264 [22]. Additional guidance is provided in Annex C of this document, e.g., the applied risk classification scheme for operational hazards.

Notes:

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.*
2. *Following the EUROCAE ED-78A/RTCA DO-264 [22] 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 datalink 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), aircraft flight manuals (AFMs), and operator specifications.*

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1.2 Scope of the Document

This document includes the definition of the services and environmental conditions relevant to the implementation of the ADS-B-RAD application as outlined in §2.2.1, and the operational, safety, performance and interoperability requirements for using the application.

Notes:

1. *Requirements that provide for protection against intentional behavior causing harm or sabotage are beyond the scope of this document.*
2. *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-RAD Context

ADS-B-RAD is one of the applications originally defined as an initial package of ground and airborne surveillance applications enabled by ADS-B and collectively called "Package 1"[3] [15]. All applications defined within Package 1 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.

The applications within Package 1 fall into two categories and are dealt with by the RFG using the following terms:

ADS-B Package 1 Ground-Based Surveillance Applications:

- 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 (ATC) tools

ADS-B Package 1 Airborne-Based Surveillance Applications:

- ATSA-VSA Enhanced visual separation on approach
- ATSA-ITP In-trail procedure in oceanic airspace
- ATSA-AIRB Enhanced traffic situational awareness during flight operations
- ATSA-SURF Enhanced traffic situational awareness on the airport surface
- ASPA-S&M Enhanced sequencing and merging operations

Notes:

1. *ADS-B-RAD, by itself, is a combination of ADS-B-ACC (Area Control Centre) and ADS-B-TMA (Terminal Maneuvering Area) which defined ATC services based on ADS-B in En Route and terminal areas, respectively in Package 1.*

[3] Some of the original application acronyms have been modified in the course of the work of the Requirements Focus Group.

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