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USA

Minimum Aviation System Performance Standards (MASPS) for ADS-B Traffic Surveillance Systems and Applications (ATSSA)

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FOREWORD

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1 PURPOSE AND SCOPE

1.1 Introduction

This document contains Minimum Aviation System Performance Standards (MASPS) for ADS-B Traffic Surveillance Systems and Applications (ATSSA). This document is intended to specify requirements for and describe assumptions for all subsystems supporting the operational application of ATSSA, e.g., Automatic Dependent Surveillance - Broadcast (ADS-B), Traffic Information Service – Broadcast (TIS-B), Automatic Dependent Surveillance - Rebroadcast (ADS-R), Airborne Surveillance and Separation Assurance Processing (ASSAP), and Cockpit Display of Traffic Information (CDTI).

This document contains information previously provided in other MASPS: the MASPS for Aircraft Surveillance Applications (ASA) (RTCA DO-289 [48]), the MASPS for Automatic Dependent Surveillance – Broadcast (ADS-B) (RTCA DO-242A [31]) and the MASPS for Traffic Information Service – Broadcast (TIS-B) (RTCA DO-286B [47]). This document combines those MASPS and updates requirements consistent with ADS-B Version 2. Requirements have been added and revised as necessary from ADS-B Version 1 and are reflected in this document to support the operational applications. ADS-B Version 2 is also the basis for ADS-B equipage requirements in the United States and other parts of the world to support air traffic control (ATC) separation services.

These standards specify characteristics that should be useful to designers, installers, manufacturers, service providers and users for systems intended for operational use within the United States National Airspace System (NAS). Where systems are global in nature, the system may have international applications that are taken into consideration.

Compliance with these standards is recommended as one means of assuring that the system and each subsystem will perform its intended function(s) satisfactorily under conditions normally encountered in routine aeronautical operations for the environments intended. These MASPS may be implemented by one or more regulatory documents or advisory documents (e.g., certifications, authorizations, approvals, commissioning, advisory circulars, notices, etc.) and may be implemented in part or in total. Any regulatory application of this document is the sole responsibility of the appropriate governmental agencies.

Chapter 1 of this document describes the ADS-B Traffic Surveillance Systems and Applications and provides information needed to understand the rationale for function characteristics and requirements. This section describes typical applications and operational goals, as envisioned by members of RTCA Special Committee 186, and establishes the basis for the standards stated in Chapters 2 through 4. Definitions and assumptions (**ASSUMP #**) essential to the proper understanding of this document are also provided in this section, and are summarized in §3.7.1. Additional acronyms and definitions are provided in Appendix A.

Chapter 2 describes minimum system performance requirements for the ATSSA system under standard operating and environmental conditions. ATSSA functional requirements and associated performance requirements are provided.

Chapter 3 contains the minimum performance requirements for each subsystem that is a required element of the minimum system performance specified in Chapter 2, as well as

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the interface requirements between these subsystems. Assumptions (**ASSUMP #**) about expected standards for systems external to ATSSA are also documented where they have been made and are summarized in §3.7.1.

Chapter 4 contains the minimum performance requirements for each ASSAP system application requiring the processing of ADS-B Messages that have been received and assembled into reports. The applications are grouped into broad categories of situational awareness, spacing applications, and separation applications.

The appendices are as follows:

- A: Acronyms and Definitions of Terms
- B: Bibliography and References
- C: Derivation of Link Quality Requirements for Future Applications
- D: Receive Antenna Coverage Constraints
- E: Performance Requirements to Support Air-to-Air Use of Target State Reports
- F: Derivation of Track Acquisition and Maintenance Requirements
- G: Future Air-Referenced Velocity (ARV) Broadcast Conditions

The word "sub-function" as used in this document includes all components that make up a major independent, necessary and essential functional part of the system (i.e., a subsystem) so that the system can properly perform its intended function(s). If the system, including any sub-functions, includes computer software or electronic hardware, the guidelines contained in RTCA DO-178C and EUROCAE ED-12C [21] and RTCA DO-254 and EUROCAE ED-80 [36] should be considered even for non-aircraft applications.

1.2 System Overview

Today's airspace system provides separation assurance for aircraft operating under Instrument Flight Rules (IFR), and Visual Flight Rules (VFR) in some circumstances, via air traffic control and air traffic services (ATC/ATS), which are ground-based. These services utilize ground radar surveillance (primary and secondary surveillance radars), ADS-B/WAM surveillance, controller radar displays, air route infrastructure, airspace procedures including flight crew see and avoid, and VHF voice communications to assure separation standards are maintained. In the event of failure of this separation assurance system, aircraft equipped with Airborne Collision Avoidance Systems (ACAS), i.e., TCAS, are warned of potential mid-air collisions as a safety back up.

In order to accommodate expected increases in air traffic, separation assurance systems are evolving using new technologies and automation processing support that are expected to enable the delegation of certain spacing or separation tasks to the flight deck. ATSSA represents the aircraft-based portion of this future separation assurance system. A wide range of separation assurance applications are expected to be developed over time that will enable enhanced airspace operations. These enhanced operations are intended to provide improved operational efficiencies, such as increased system capacity and throughput, while maintaining or improving air safety. Both aircraft-based and ground-based applications are discussed in this document.

1.2.1 Definition of ADS-B Traffic Surveillance Systems and Applications

The ADS-B Traffic Surveillance Systems and Applications (ATSSA) system comprises a number of flight-deck-based aircraft surveillance and separation assurance capabilities

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that may directly provide flight crews with surveillance information, as well as surveillance-based guidance and alerts. Surveillance information consists of position and other state data about other aircraft and surface vehicles and obstacles when on or near the airport surface.

ADS-B Traffic Surveillance Systems and Applications are intended to both enhance safety and increase the capacity and efficiency of the air transportation system. Safety will be enhanced by providing improved traffic situational awareness to pilots, as well as capabilities to assist in conflict prevention, conflict detection, and 4-D conflict resolution. Capacity and efficiency will be enhanced by enabling aircraft to fly closer to one another and potentially delegating certain spacing or separation tasks to the flight crew, for example:

- Improving runway throughput in instrument meteorological conditions (IMC) through use of new cockpit tools;
- More efficient departure sequencing without increases in ATC workload;
- Enabling aircraft in oceanic airspace to fly more optimal cruise profiles and pass other aircraft on parallel routes; and
- Accommodating more types of flight trajectories than ATC currently authorizes.

The individual ADS-B Traffic Surveillance Systems and Applications are described in §1.3. It is a goal of these applications to minimize any increase in flight crew and air traffic controller workload while ensuring safety. Particular attention is paid to preventing workload increases during critical phases of flight, such as final approach and landing.

Some ADS-B Traffic Surveillance Systems and Applications are independent of ground systems and air traffic control, while others depend on or interact with services provided by ground systems and air traffic control. These MASPS do specify requirements for ground systems such as Traffic Information Service – Broadcast (TIS-B) and the Automatic Dependent Surveillance – Rebroadcast (ADS-R) services, and states assumptions about the functional and performance capabilities of the services they provide to the extent that these are required by ADS-B Traffic Surveillance Systems and Applications. ADS-B is used to augment or improve current ATC ground surveillance.

1.2.2 Application Assumptions

To achieve the expected gains, this document makes certain assumptions (**ASSUMP #**) about the use of new technology, and summarizes these assumptions in §3.7.1. These assumptions are predicated on the evolution of separation responsibility for the applications covered here. These assumptions include, but are not limited to:

ASSUMP 1: Flight crews, in appropriately equipped aircraft, will be able to perform some functions currently done by ATC, some of which may be at reduced separation standards compared to current separation standards.

ASSUMP 2: The variability in the spacing between aircraft in the airport arrival and/or departure streams will be reduced with the use of certain ATSSA applications.

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ASSUMP 3: For the near and mid-term applications, ATC will be willing to act as a "monitor" and retain separation responsibility between designated aircraft.

ASSUMP 4: Pilot and ATC workload will not be increased substantially by ADS-B Traffic Surveillance Systems and Applications.

ASSUMP 5: Most aircraft will eventually be equipped with avionics to perform ADS-B Traffic Surveillance Systems and Applications (this is necessary to maximize system benefits).

ASSUMP 6: For the far-term applications, pilots may be willing to accept additional separation responsibility beyond what they have today that is currently provided by ATC.

ASSUMP 7: ADS-B avionics and applications will be compatible with future ATC systems and operating procedures.

These assumptions have not yet been fully validated.

1.2.3 ATSSA Architecture

Figure 1-1 provides an overview of the ATSSA system architecture and depicts the interfaces between functional elements for an ATSSA aircraft participant and external systems. The ATSSA system architecture consists of three major components: subsystems for the transmit participant, subsystems for the receive participant, and the ground systems. ATSSA also interfaces with other aircraft systems.

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