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Minimum Aviation System Performance Standards for Aircraft Surveillance Applications (ASA)

Volume I

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Foreword

This report was prepared by Special Committee 186 (SC-186) and approved by the RTCA Program Management Committee (PMC) on December 9, 2003.

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- developing consensus on the application of pertinent technology to fulfill user and provider requirements, including development of minimum operational performance standards for electronic systems and equipment that support aviation; and
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1 Purpose and Scope

1.1 Introduction

This document contains Minimum Aviation System Performance Standards (MASPS) for Aircraft Surveillance Applications (ASA). This document is intended to:

- Specify requirements for and describe assumptions for all sub-systems supporting the operational application of ASA, e.g., Surveillance Transmit Processing (STP), Automatic Dependent Surveillance - Broadcast (ADS-B), Airborne Surveillance and Separation Assurance Processing (ASSAP), and Cockpit Display of Traffic Information (CDTI).
- Describe in detail specific operational applications of ASA.

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. This 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 Aircraft Surveillance Applications system and provides information needed to understand the rationale for function characteristics and requirements. The ASA sub-functions consist of a Surveillance Transmit Processing (STP) function, a surveillance function, a surveillance data processing function, and a display function. 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 and 3, including the use of Transmit Quality Level (TQL) and ASA Capability Level (ACL). Definitions and assumptions essential to the proper understanding of this document are also provided in this section. Additional definitions are provided in Appendix AA.

Chapter 2 describes minimum system performance requirements for the ASA applications under standard operating and environmental conditions. ASA functional requirements and associated performance requirements are provided. ASA Capability Levels are identified and specified.

Chapter 3 contains the minimum performance standards for each sub-subsystem that is a required element of the minimum system performance specified in Chapter 2, as well as the interface requirements between these sub-functions. Assumptions about expected standards for systems external to ASA are also documented.

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There are two groupings of appendices. The first group of appendices, labeled with double letters, contains supplemental information related to the body of the document. These appendices are as follows:

AA: Acronyms and Definitions of Terms
AB: Bibliography
AC: Accuracy and Integrity Parameters
AD: Air-to-Ground Surveillance Considerations
AE: Compatibility of ASA MASPS with ADS-B Standards and Fielded Systems

The second group of appendices describes the individual applications included in these MASPS. Appendix B introduces and describes the methodologies used to complete the application safety and requirements analyses, and provides guidance for interpreting the fault-trees used as part of the analysis effort. Appendices C through J contain the complete application descriptions, as well as the safety and requirements analyses, for each of the applications included in this version of this MASPS. These analyses provide the basis for the requirements included in this MASPS. These appendices are as follows:

B: Description of Application Appendices
C: Enhanced Visual Acquisition (EVAcq)
D: Conflict Detection (CD)
E: Airport Surface Situational Awareness (ASSA)
F: Final Approach and Runway Occupancy Awareness (FAROA)
G: Enhanced Visual Approach (EVApp)
H: Airborne Conflict Management (ACM)
I: Approach Spacing for Instrument Approaches (ASIA)
J: Independent Closely Spaced Parallel Approaches (ICSPA)

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 so that the system can properly perform its intended function(s). If the system, including any sub-functions, includes computer software, the guidelines contained in [RTCA DO-178B] should be considered even for non-aircraft applications.

1.2 System Overview

1.2.1 Definition of Aircraft Surveillance Applications

The Aircraft Surveillance Applications (ASA) system comprises a number of flight-deck-based aircraft surveillance and separation assurance capabilities 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 also, when on or near the airport surface, position and other state data about appropriately equipped surface vehicles or obstacles.

ASA 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 as well as capabilities to assist in conflict prevention, conflict detection, and 4-D conflict resolution, both on the airport surface and while airborne. Capacity and efficiency will be enhanced by delegating certain spacing or separation tasks to the flight crew, for example:

- Allowing aircraft to safely approach closer to each other than is possible using current surveillance systems and operational procedures;

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- Improving runway throughput in instrument meteorological conditions (IMC) through use of new cockpit tools; and
- Accommodating more kinds of flight trajectories than ATC currently authorizes.

The individual ASA applications are described in §1.4. It is a goal of these applications to minimize any increase in workload while maximizing increased safety. Particular attention to preventing workload increases is necessary during critical phases of flight, such as final approach and landing.

Some ASA 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. This MASPS does not specify requirements for ground systems other than Traffic Information Service – Broadcast (TIS-B), but does state assumptions about the functional and performance capabilities of the services they provide to the extent that these are required by ASA applications. While ADS-B may be used to augment or improve current ATC ground surveillance, these uses are outside the scope of this ASA MASPS.

To achieve the expected gains, this document makes certain assumptions about the how the use of this new technology. These assumptions include, but are not limited to:

A. Flight crews, in appropriately equipped aircraft, will be able to perform functions currently done by ATC, some of which may be at reduced separation standards compared to current separation standards.
B. There is a "variance in the spacing" between aircraft in the arrival stream for approach and landing operations in today's environment that will be reduced with the use of certain ASA applications.
C. Pilots will be willing to accept separation responsibility currently provided by ATC.
D. Pilot and controller workload will not be increased by ASA applications.
E. Most aircraft will eventually be equipped with avionics to perform ASA applications (this is necessary to maximize benefits).
F. ATC will be willing to act as a "monitor" and retain separation responsibility between designated aircraft.
G. ASA avionics will be compatible with ATC conflict probing equipment (e.g., User Request Evaluation Tool (URET).

These assumptions have not yet been fully validated, nor have any new operational procedures been approved.

1.2.2 Surveillance and Separation Assurance System Architecture

Today's airspace system provides separation assurance from traffic in IFR operations 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), 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.

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