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Minimum Operational Performance Standards (MOPS) for Detect and Avoid (DAA) Systems

RTCA DO-365C
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Prepared by: SC-228

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FOREWORD

This document was prepared by Special Committee 228 (SC-228) and approved by the RTCA Program Management Committee (PMC) on September 15, 2022.

RTCA, Incorporated is a not-for-profit corporation formed to advance the art and science of aviation and aviation electronic systems for the benefit of the public. The organization functions as a Standards Development Organization and develops consensus based recommendations on contemporary aviation issues. RTCA's objectives include, but are not limited to:

- coalescing aviation system user and provider technical requirements in a manner that helps government and industry meet their mutual objectives and responsibilities;
- analyzing and recommending solutions to the system technical issues that aviation faces as it continues to pursue increased safety, system capacity, and efficiency;
- 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
- assisting in developing the appropriate technical material upon which positions for the International Civil Aviation Organization and the International Telecommunication Union and other appropriate international organizations can be based.

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REVISION (REV) HISTORY

Rev Level	Description	Date	Effective Sections
-	Initial Publication	05/31/2017	All
A	Added Terminal Area DWC, Transit through Class B, Support for GBSS	03/26/2020	All
B	Added Class 3 – ACAS Xu, Non-cooperative DWC applicable to all classes, updated ATAR classes for different performance levels	03/18/2021	All
C	Added an EO/IR sensor class option as an alternative to ATAR	09/15/2022	All

EXECUTIVE SUMMARY

RTCA has been developing the Minimum Operational Performance Standards (MOPS) for equipment needed to support the safe operations of Unmanned Aircraft (UA) flights within the National Airspace System (NAS) and beyond the operational limits placed on small Unmanned Aircraft Systems (UAS) (see Section 107 of Title 14 (Aeronautics and Space) of the United States Code of Federal Regulations (14 U.S. CFR)). In 2013, RTCA initiated Special Committee 228 (SC-228) with a narrower scope; namely, to develop MOPS needed for (a) a Detect and Avoid (DAA) system (the focus of Working Group 1 (WG-1) and (b) a Control and Non-Payload Communications (CNPC) link system (the focus of WG-2).

The DAA system was specified to assist the remote pilot with operating an aircraft safely in the NAS. An aircraft flying in the NAS must comply with the operating rules of 14 CFR, specifically, §§ 91.2[illegible] 91.111, 91.113, 91.123 and 91.181(b), which address see and avoid, collision avoidance, right-of-way rules, and remaining well clear. The DAA equipment may also be used to comply with the duties in International Civil Aviation Organization (ICAO) Annex 2 to the Convention on International Civil Aviation, specifically Chapter 2, Paragraph 2.3.1. These operating regulations assumed that a pilot would be onboard the aircraft and would be able to fully comply with these rules.

This document contains MOPS for DAA systems used in aircraft transiting and performing extended operations in Class D, E, and G airspace along with transiting Class B and C airspace. It includes equipment to enable UAS operations near Terminal Areas during approach and departure in Class C, D, E, and G airspace, and off-airport locations, but not operating in the visual traffic pattern or on the surface. It does not apply to small UAS (under 55 pounds (lbs)) operating in low-level environments (below 400') or other segmented areas.

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1 PURPOSE AND SCOPE

1.1 Introduction

This document contains Minimum Operational Performance Standards (MOPS) for Detect and Avoid (DAA) systems used in Unmanned Aircraft Systems (UAS) transiting through Class B, C, D, E, and G airspace and performing extended operations higher than 400' Above Ground Level (AGL) in Class D, E (up to Flight Level (FL) 180), and G airspace. It includes equipment to enable UAS operations in Terminal Areas during approach and departure in Class C, D, E and G airspace and off-airport locations. It does not apply to small UAS (sUAS) operating in low-level environments (below 400') or other segmented areas. Likewise, it does not apply to operations in the Visual Flight Rules (VFR) traffic pattern of an airport or to surface operations. For a complete description of operations and environments, refer to RTCA DO-398 Operational Services and Environment Description for Detect and Avoid Systems. These standards specify DAA system characteristics that should be useful for designers, manufacturers, installers and users of the equipment.

These MOPS focus on Unmanned Aircraft (UA) to enable safe flight in airspace normally frequented by commercial transport and general aviation aircraft. Aircraft operations in all classes of airspace vary, from operation under Instrument Flight Rules (IFR) in Reduced Vertical Separation Minimum (RVSM) airspace to VFR operations with minimal onboard equipage. The UA may need to carry relatively large and high-power sensor systems, depending on the class of sensors required for the speed of the UA. Alternatively, these MOPS also allow a class of equipment where all sensors are on the ground, which enables operations of UAS with reduced payload capabilities (see Subparagraph 2.1.10.1 for descriptions of all equipment classes). This version of the document adds a class of non-cooperative sensor that does allow some weight and power savings. Future revisions of this document may address other operational scenarios and sensors better suited to smaller UAS needs, pending further negotiation with airspace regulators.

During the original development of this document, members of the committee expressed concern about equipment without an explicit collision avoidance function providing an appropriate level of safety for the in-scope operations. Concerns were expressed regarding the safety of the system when compared to manned see-and-avoid capability, the usability of the well clear definition developed herein, and the impacts of replacing “collision avoidance” with a "regain well clear" concept. Concerns were also expressed that a formal safety analysis was not available to guide MOPS development, and that a top-level performance requirement was not established to provide a means for requirement traceability to lower-level requirements. To this end, the Federal Aviation Administration (FAA) commissioned an internal Safety Risk Management Panel during development of RTCA Document 365 (DO-365) to analyze and identify the conditions under which Equipment Class 1 or Equipment Class 2 is sufficient for the intended operations in the National Airspace System (NAS) (see Subparagraph 2.1.10.1 for a description of equipment classes). The FAA is using this safety analysis to determine required equipage and any necessary operational mitigations. Going forward, the committee expects the FAA to update the safety analysis based on changes to DAA systems or the NAS.

Compliance with these standards is recommended as one means of assuring that the equipment will perform its intended function(s) satisfactorily under the conditions specified herein. Any regulatory application of this document is the sole responsibility of appropriate governmental agencies.

