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**Minimum Operational Performance Standards
(MOPS) for Global Positioning System/Satellite-
Based Augmentation System Airborne
Equipment**

RTCA DO-229F
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Prepared by: SC-159
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FOREWORD

This document was prepared by Special Committee 159 (SC-159) and approved by the RTCA Program Management Committee on June 11, 2020.

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EXECUTIVE SUMMARY

This new version of the *Minimum Operational Performance Standards (MOPS) for Global Positioning System/Satellite-Based Augmentation System Airborne Equipment* systems has been produced to introduce requirements tags. This version is intended to facilitate the development of future dual frequency, multi-constellation (DFMC) MOPS requirements by introducing requirements tags (i.e., numbers) such that it is easier to reference and compare the single frequency (L1), GPS and SBAS requirements in this MOPS with the future DFMC requirements. Requirements in Appendix R were not tagged because a new MOPS for GNSS-aided inertial navigation systems is expected to soon be approved by RTCA that will supersede them. Changes to sentences in DO-229E with regard to the word “shall” are summarized in the table below. Editorial updates to accommodate the tagging and some clarifications of requirements have been introduced. The sections affected are listed below. Finally, two notes (Section 2.1.1.6 and 2.1.2.2) were updated to reflect additional guidance resulting from recent operational experience.

This version of the document is technically equivalent to RTCA DO-229E.

Table Executive Summary-1: Sections where "Shalls" were Editorially Changed in DO-229F from DO-229E

Change to sentences containing the word “shall”	Document Sections
Replaced the word “shall” with “must” for an external reference. Required for consistency with the Section 1.1 definitions.	2.1.1.10
Removed use of the word “shall” that is inconsistent with the Section 1.1 definitions.	2.1.2.2.1 2.1.5.2.1 Appendix J
Combined two related “shalls” into a single requirement.	2.2.1.1.4.2
Removed multiple uses of the word “shall” within a single requirement.	2.1.1.6 2.2.1.3.4 2.2.1.3.12 2.2.3.2.2 2.2.3.4.2 2.2.4.4.2.2 2.2.4.4.2.3 2.2.4.4.4 G.3.4
Reformulated the requirement structure to avoid duplicate, embedded uses of “shall”.	2.2.3.6.3
Combined two “shalls” predicated on the same condition in one requirement.	2.2.5.2.4

List of Sections with Editorial Changes

2.1.1.4.11	2.2.1.1.4.6	2.2.2.6.3
2.1.1.6	2.2.1.1.5	2.2.3.3.2
2.1.1.10	2.2.1.1.7	2.2.3.3.4
2.1.2.2.2.2	2.2.1.2.1	2.2.4.4.4
2.2.1.1	2.2.1.3.3	2.2.4.6.5
2.2.1.1.1.1	2.2.1.3.12	

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1 PURPOSE AND SCOPE

1.1 Introduction

This document contains Minimum Operational Performance Standards (MOPS) for airborne navigation equipment (2D and 3D) using the Global Positioning System (GPS) augmented by Satellite-Based Augmentation Systems (SBAS); which, in the U.S. is the Wide Area Augmentation System (WAAS). DO-229 only provides standards for single frequency airborne navigation equipment. A separate document will be created in the future to address standards for dual frequency equipment. These standards are intended to be applicable to other SBAS providers, such as European Geostationary Navigation Overlay Service (EGNOS), Japan's Multi-functional Transport Satellite (MTSAT) Satellite-based Augmentation System (MSAS) and India's GPS Aided Geo Augmented Navigation System (GAGAN).

This new version of the *Minimum Operational Performance Standards for Global Positioning System/Satellite-Based Augmentation System Airborne Equipment* systems has been produced to introduce requirements tags. This will facilitate the comparison of these single frequency, GPS only requirements with the future dual frequency, multi-constellation requirements. On very few, specific cases, editorial clarifications of a requirement have been introduced. This version of the document is technically equivalent to RTCA DO-229E.

In this document, the term “shall” is used to indicate requirements. An approved design should comply with every requirement, which can be assured by inspection, test, analysis, or demonstration. The term “must” is used to identify items that are important but are either duplicated somewhere else in the document as a “shall”, or are considered to be outside the scope of this document. The term “should” is used to denote a recommendation that would improve the SBAS equipment, but does not constitute a requirement.

The standards define minimum performance, functions and features for SBAS-based sensors that provide position information to a multi-sensor system or separate navigation system. They also address SBAS-based Area Navigation (RNAV) equipment to be used for the en route, terminal, and Lateral Navigation (LNAV) phases of flight. These standards are based upon a nominal allocation of the aircraft-level requirements in RTCA/DO-236(latest revision), *Minimum Aviation System Performance Standards: Required Navigation Performance for Area Navigation*, accounting for the unique issues associated with SBAS and Global Navigation Satellite System (GNSS) navigation service and minimizing the need for pilot training. These standards also define performance, functions and features for equipment that satisfies the requirements for Lateral Navigation/Vertical Navigation (LNAV/VNAV), Localizer Performance without vertical guidance (LP), and Localizer Performance with Vertical guidance (LPV) instrument procedures. The standards cover SBAS-based equipment that is designed to serve combinations of the above phases of flight.

Compliance with these standards by manufacturers, installers and users is recommended as one means of assuring that the equipment will satisfactorily perform its intended functions under conditions encountered in routine aeronautical operations, and will ensure a basic compatibility with the requirements defined in RTCA/DO-236(latest revision). Manufacturers and operators who elect to comply directly with the requirements of RTCA/DO-236(latest revision) as part of an aircraft certification (type certificate or supplemental type certificate) may bypass these RNAV standards, but are not expected to be eligible for a Class Gamma Technical Standard Order (TSO) authorization.