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Minimum Operational Performance Standards for Global Positioning System / Wide Area Augmentation System Airborne Equipment

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Prepared by: SC-159

FOREWORD

This report was prepared by Special Committee 159 (SC-159) and approved by the RTCA Program Management Committee (PMC) on November 28, 2001.

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 Federal Advisory Committee 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.

The organization's recommendations are often used as the basis for government and private sector decisions as well as the foundation for many Federal Aviation Administration Technical Standard Orders.

Since RTCA is not an official agency of the United States Government, its recommendations may not be regarded as statements of official government policy unless so enunciated by the U.S. government organization or agency having statutory jurisdiction over any matters to which the recommendations relate.

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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 the Wide Area Augmentation System (WAAS). Throughout this document, the term “WAAS” is used as a generic reference to Satellite-Based Augmentation Systems (SBAS). These standards are intended to be applicable to other SBAS providers, such as European Geostationary Navigation Overlay Service (EGNOS) and Japan’s Multi-functional Transport Satellite (MTSAT) Satellite -based Augmentation System (MSAS).

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 which 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 WAAS equipment, but does not constitute a requirement.

The standards define minimum performance, functions and features for WAAS-based sensors that provide position information to a multi-sensor system or separate navigation system. They also address WAAS-based Area Navigation (RNAV), and optionally Vertical Navigation (VNAV), equipment to be used for the en route, terminal area, and non-precision approach phases of flight. These standards are based upon a nominal allocation of the aircraft-level requirements in RTCA/DO-236A, *Minimum Aviation System Performance Standards: Required Navigation Performance for Area Navigation*, accounting for the unique issues associated with WAAS and 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 approach procedures with vertical guidance APV and Global Navigation Satellite System (GNSS) Landing System (GLS). The standards cover WAAS-based equipment which is designed to serve combinations of the above phases of flight; updated standards for multi-sensor systems are being developed by RTCA Special Committee 181.

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-236A. Manufacturers and operators who elect to comply directly with the requirements of RTCA/DO-236A 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 TSO authorization.

The regulatory application of these standards is the responsibility of appropriate government agencies. In the United States, the Federal Aviation Administration (FAA) has published a Technical Standard Order (TSO) for GPS/WAAS equipment to reference the requirements and bench test procedures in Section 2.

The word "equipment", as used in this document, includes all components or units necessary (as determined by the equipment manufacturer or installer) to properly perform its intended function. For example, the airborne "equipment" may include: sensor(s), a computer unit, an input-output unit which interfaces with existing aircraft displays/systems, a control unit, a display, shock mount(s), etc. In the case of this example, all of the foregoing components or units constitute the "equipment". It should not be inferred from this example, however, that all GPS/WAAS navigation equipment will necessarily include all of the foregoing components or units. The particular components of GPS/WAAS equipment will