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Minimum Aviation System Performance Standards (MASPS) for an Enhanced Flight Vision System to Enable All-Weather Approach, Landing, and Roll-Out to a Safe Taxi Speed

RTCA DO-341
September 26, 2012
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FOREWORD

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- 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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1 PURPOSE AND SCOPE

1.1 Introduction

DO-315 described Minimum Aviation System Performance Standards (MASPS) for Enhanced Vision Systems (EVS), Synthetic Vision Systems (SVS), and Combined Vision Systems (CVS) technologies. An approved combination of EVS and HUD is termed an Enhanced Flight Vision System (EFVS) by the FAA. The European Aviation Safety Agency (EASA) uses the term "EVS" as equivalent to the FAA description of EFVS. While further definitions are in Appendix A, it is important to understand this distinction before reading this document.

Under DO-315A, MASPS have been established for systems used for approach to touchdown in visibility as low as 1000 ft Runway Visual Range (RVR) (or 300 m if applicable) by use of an approved EFVS. Under DO-315B, MASPS have been established for systems that could be used on an instrument approach with lower decision altitude/height and/or possible lower visibility minima, by use of an approved SVS.

In the U.S., the approving regulation to use Enhanced Flight Vision System technology is established under Title 14 of the Code of Federal Regulations (CFR) §91.175 (l) and (m) which states that an approved EFVS may be used in lieu of a pilot's natural vision, and a pilot may proceed with the visual segment of the approach based on the use of EFVS to 100 ft above threshold elevation. Airworthiness guidance for EFVS, EVS, SVS, and CVS can be found in AC 20-167, "Airworthiness Approval of Enhanced Vision System, Synthetic Vision System, Combined Vision System, and Enhanced Flight Vision System Equipment.

This MASPS provide the high level system requirements for EFVS when installed in aircraft with the express purpose of enabling specified straight-in instrument approaches with published vertical guidance to touchdown, landing, and roll-out to a safe taxi speed in visibility as low as 300 ft RVR (100 m) by use of an approved EFVS without need or reliance on natural vision. This MASPS follows from and expands upon the concepts and requirements established under DO-315A and the precedents established under 14 CFR §91.175 (l) and (m), which identified performance standards for an enhanced flight vision systems (EFVS) to enable approach, landing, roll-out and taxi, down to 1000 ft (300 m) runway visual range (RVR). The operational concept follows a fail-operational design.

The operational scenarios used for design context and concepts discussed in this document are written to describe the intended use of the proposed systems and from this context, associated minimum performance standards are derived. They do not define current or future operational regulations or limitations of these technologies.

Section 1 provides information needed to understand the rationale for system characteristics and requirements. This section also contains typical applications and envisioned operational goals and assumptions necessary to establish a basis for the subsequent sections. It describes typical applications and operational goals, as envisioned by members of RTCA Special Committee 213 and EUROCAE Work Group 79, and establishes the basis for the standards stated in Sections 2 through 4. Definitions and assumptions essential to proper understanding of this document are also provided in this section.

Section 2 describes minimum system performance requirements.

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Section 3 contains the minimum performance standards and subsystem/function that is a required element of minimum system performance in Section 2.0. These standards specify the required performance under the standard environmental conditions described.

Section 4 discusses performance evaluations with applicable FAA and EASA regulations, describing the minimum system test procedures to verify system performance compliance (e.g., end-to-end performance verification).

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. The Minimum Aviation System Performance Standards (MASPS) may be implemented by one or more regulatory documents and/or advisory documents (e.g., certifications, authorizations, approvals, commissioning, orders, advisory circulars, and notice.) and may be implemented in part or in total. Any regulatory application of this document is the sole responsibility of appropriate governmental agencies.

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 "should" is used to denote a recommendation that would improve equipment, but does not constitute a requirement.

Note 1: For the purposes of this document, the terms DA and DH are interchangeable.

Note 2: The FAA has recently instituted changes in the determination of instrument procedure minima to stop using TDZE to determine minima. Future instrument approach minima (MDA or DA/DH) will be referenced to threshold elevation (THRE). The height value specified as MDA(H) or DA(H)/DH will be referenced to THRE for approaches with minima published after August 10, 2010. Existing published IFR approach minima and charting will gradually be changed to reference THRE and be displayed as a height above threshold (HATh). The former terms HAT or TDZE and new terms HATh or THRE are considered interchangeable relative to the requirements of this document.

1.1.1 **EFVS Introduction**

1.1.1.1 This MASPS provide the high level system requirements for EFVS when installed in aircraft with the express purpose of enabling certain straight-in instrument approaches with published vertical guidance to touchdown, landing, roll-out to a safe taxi speed in visibility as low as 300 ft RVR (100 m) by use of an approved EFVS without reliance on natural vision. This MASPS follows from and expands upon the concepts and requirements established under DO-315A, which identified performance standards for an enhanced flight vision systems (EFVS) to enable approach, landing, roll-out and taxi, down to 1000 ft (300 m) runway visual range (RVR).

1.1.1.2 The performance, availability, and integrity of the EFVS shall be sufficient to support the operation. The performance, integrity and availability of the system is created by a combination of vision systems and other components (sensors, systems, displays, etc.) including navigation and guidance systems. Accuracy, availability, and integrity shall be ensured by the system design and/or by operational procedure.

1.1.1.3 The requirements of this MASPS may be global in nature and have international implications; however, they are guided, in whole or in part, by the definitions, intended functions, and

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operational application defined in 14 CFR §§1.1, 91.175 (l) and (m), 121.651, 125.381, and 135.225 as of Amendment 91-281 (69 FR 1620, January 9, 2004). Similar references are found in EU Ops Subpart E, Appendix 1 to OPS 1.430 (h). It should be noted that the European Aviation Safety Agency's (EASA) terminology and operational credit may differ from that of the United States. EASA uses the term Enhanced Vision System (EVS) to describe a system that has the same elements, features and characteristics as an Enhanced Flight Vision System (EFVS) certified by the FAA for use in the United States. EASA's operational concept and corresponding requirements may also be slightly different from those of the FAA.

1.1.1.4 This MASPS specifically focuses on standards to meet existing and emerging FAA and EASA requirements for an Enhanced Flight Vision System. Other guidance material is available (see References). This MASPS is intended to be complementary to these other materials, and is not meant to replace or conflict with these other materials. Conflicts between this MASPS and other material should be resolved on a case-by-case basis.

1.1.1.5 This MASPS defines performance requirements for an EFVS following the precedent set under 14 CFR §91.175 (l) and (m) which established that an approved EFVS may be used in lieu of a pilot's natural vision. However, the EFVS may, in fact, use various elements of or combinations of SVS technology in addition to imaging sensors (EVS) to meet the required operational performance. As such, Synthetic Vision Systems (SVS) and Combined Vision Systems (CVS) are described and discussed as appropriate (see DO-315).

1.1.1.6 It is important to note the flight guidance system (FGS) contribution is not part of this MASPS, but an integral part of the overall display system. This distinction will be portrayed in the succeeding diagrams. FGS criteria may be found in documents such as FAA Advisory Circular (AC) 25.1329A and EASA Acceptable Means of Compliance (AMC) 25.1329. FGS contribution may also be considered as a mitigating factor towards achieving the overall safety requirements.

1.2 Synthetic Vision System/Combined Vision Systems

1.2.1 SVS/CVS Overview

1.2.1.1 A Synthetic Vision System (SVS) is an electronic means to display a computer-generated image of the applicable external topography from the perspective of the flight deck that is derived from aircraft attitude, altitude, position, and a coordinate-referenced database.. A notional diagram for SVS is shown in Figure 1.

1.2.1.2 A Combined Vision System (CVS) is a combination of synthetic and enhanced vision systems. Some examples of a CVS could include, but are not limited to, database-driven synthetic vision images combined with real-time sensor images superimposed and correlated on the same display. This could also include selective blending or fusion of the two technologies based on the intended function of the Combined Vision System seeking certification.

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