

# **European Aviation Safety Agency**

## **European Technical Standard Order**

SUBJECT: ELECTRONIC MAP SYSTEMS FOR GRAPHICAL DEPICTION OF AIRCRAFT POSITION

### **1 - Applicability**

This ETSO gives the requirements that any Electronic Map System for the Graphical Depiction of Aircraft Position (own-ship), manufactured on or after the date of this ETSO, must meet in order to be identified with the applicable ETSO marking.

This ETSO applies to equipment that is intended to provide graphical depiction of advisory information on a display (e.g. navigation, traffic, weather, obstacles, graphical taxi routing, etc.). The system is intended to improve flight crew positional awareness of the aircraft own-ship position relative to other items depicted on the display.

### **2 - Procedures**

#### 2.1 - General

Applicable procedures are detailed in CS-ETSO Subpart A.

#### 2.2 - Specific

Applications to certify only software without certifying the hardware and/or the operating system will be accepted. Nevertheless, the applicant has to specify requirements for the hardware and/or the operating system to be used, the tests to be performed once the software is integrated into the final system, and the environment which has been used to demonstrate the system functionality.

### **3 - Technical Conditions**

#### 3.1 - Basic

##### 3.1.1 - Minimum Performance Standard (MPS)

New models of Electronic Map Systems that are to be so identified and that are manufactured on or after the effective date of this ETSO must meet the standards set forth for moving map equipment in Section 2 of RTCA document DO-257A, 'Minimum Operational Performance Standards for the Depiction of Navigational Information on Electronic Maps', dated June, 25, 2003 as amended by Appendix 1 to this ETSO.

1) Electronic Map Systems for use in flight must meet the MPS in Sections 2.1 and 2.2 of RTCA/DO-257A as amended by Appendix 1 to this ETSO;

2) Electronic Map Systems for use on the airport surface – AMMD applications - must meet the MPS in Sections 2.1, 2.2, and 2.3 of RTCA/DO-257A as amended by Appendix 1 to this ETSO; and

3) Electronic Map Systems including Vertical Situation Displays (VSD) for use in facilitating pilot’s awareness of the aircraft’s vertical flight path must meet the MPS in Sections 2.1, 2.2, and 2.4 of RTCA/DO-257A as amended by Appendix 1 to this ETSO.

Table 1 summarises the functional description and applicable MPS requirements for Electronic Map Systems.

<b>Electronic Map System functional description</b>	<b>Applicable Requirements Sections in RTCA/DO-257A (as amended by Appendix 1 to this ETSO)</b>			
	<b>2.1</b>	<b>2.2</b>	<b>2.3</b>	<b>2.4</b>
In flight	<b>X</b>	<b>X</b>		
Airport surface (AMMD)	<b>X</b>	<b>X</b>	<b>X</b>	
Vertical Situation Display (VSD)	<b>X</b>	<b>X</b>		<b>X</b>

**Table 1**

Demonstrate the required functional performance under the test conditions specified in RTCA/DO-257A, Section 2.6 as modified by appendix 1 of this ETSO.

### 3.1.2 - Environmental Standard

Demonstrate the required performance under the test conditions specified in RTCA/DO-257A, Section 2.5, using standard environmental conditions and test procedures appropriate for airborne equipment as defined in CS-ETSO Subpart A paragraph 2.1.

### 3.1.3 – Computer Software

See CS-ETSO Subpart A paragraph 2.2.

### 3.1.4 - Electronic Hardware Qualification

See CS-ETSO Subpart A paragraph 2.3

## 3.2 - Specific

### 3.2.1 - Failure Condition Classification

See CS-ETSO Subpart A paragraph 2.4. For the definitions of the intended functions see RTCA/DO-257A section 1.4.

Failure of the functions defined in paragraph 3.1.1 of this ETSO for Electronic Map Systems used in flight and VSD equipment (airborne applications) have been determined to be a major failure condition for malfunctions causing the incorrect depiction of aircraft position (own-ship).

Loss of function for Electronic Map Systems used in flight and VSD equipment (airborne applications) has been determined to be a minor failure condition.

Failure of the function defined in paragraph 3.1.1 of this ETSO for Electronic Map Systems used on the airport surface (ground applications) have been determined to be a minor failure condition for malfunctions causing the incorrect depiction of aircraft position (ownership).

Loss of function for Electronic Map Displays used on the airport surface (ground applications) is determined to be a no safety effect failure condition.

Table 2 summarises the failure condition classifications.

<b>Electronic Map System functional description</b>	<b>Failure condition classification – Incorrect Depiction of Aircraft Position</b>	<b>Failure condition classification – Loss of function</b>
In flight	Major	Minor
Vertical Situation Display (VSD)	Major	Minor
Airport surface (AMMD)	Minor	No Safety Effect

**Table 2**

#### **4 - Marking**

##### 4.1 - General

Marking as detailed in CS-ETSO Subpart A paragraph 1.2.

##### 4.2 - Specific

None

#### **5 - Availability of Referenced Document**

See CS-ETSO Subpart A paragraph 3.

## **Appendix 1**

### **Additional Requirements for Electronic Map Systems**

This appendix defines changes to the Minimum Operational Performance Standards (MOPS) for Electronic Map Systems specified in RTCA/DO-257A, *Minimum Operational Performance Standards for the Depiction of Navigational Information on Electronic Maps*, dated June, 25, 2003.

Some changes replace sections of RTCA/DO-257A. Other just add additional text; in this latter case the additional text is underlined.

#### **DO-257A MOPS is modified as follows:**

##### **1. Display Operating Characteristics and Status Indications**

2.2.4 A new sub-section 25 to section 2.2.4 has been added:

25. A process activity monitor (watchdog) shall be implemented to detect frozen processes and to remove outdated/frozen information from the screen, or to clearly indicate the invalid data. The process activity monitor shall be able to detect the occurrence of the failure within 5 seconds.

##### **2. Database (Navigation)**

2.2.5 The first paragraph from 2.2.5 and the current sub-section 5 has been replaced, two new sub-sections to 2.2.5 have been added:

As an alternative to (or in addition to) an external data source, the EMD may use ~~an internal~~ database to store information such as flight plans, nearby fixes, airspace boundaries, raster aeronautical charts, or airport mapping information. If an internal or external database is being used, the following requirements apply: ...

- Subsection 5 changes are underlined:

5. The processes of producing and updating aeronautical databases shall meet the standards specified in EUROCAE ED-76/RTCA DO-200A *Standards for Processing Aeronautical Data*, dated October 1998 or subsequent revisions.

- Add the following new subsections:

7. Specification of the Data Quality Requirements (DQRs) for the EMD system shall be developed and incorporated as part of the compliance documentation (Reference EUROCAE ED-76/RTCA DO-200A, section 2.3.2).
8. Corruption of the map database shall be detected and annunciated to the flight crew clearly and in a timely manner.

##### **3. Runways**

2.3.1.1.1 The current sub-section 6 of section 2.3.1.1.1 has been deleted and replaced by:

6. The aerodrome database accuracy for runway data elements shall meet medium category data quality as defined in EUROCAE ED-99C/RTCA DO-272C *User Requirements for Aerodrome Mapping Information*, dated September 2011, or subsequent revisions.

- The following new subsection is added:

7. The total system accuracy shall be sufficient for the AMMD intended function, and shall not exceed 50 meters (95 %). The position source accuracy (36 m) and total database accuracy (5 m) may be reallocated, if the total system accuracy remains less than or equal to 50 meters. The formula for calculating total system accuracy is:

$$\sqrt{[(\text{Position Source Accuracy})^2 + (\text{Total Database Accuracy})^2 + (\text{Latency Effects})^2 + (\text{Display Errors})^2]} + |\text{Uncompensated GPS Antenna Offset}| = \text{Total System Accuracy}$$

#### **4. Taxiways**

2.3.1.1.2 In page 32, the current sub-section 4 of section 2.3.1.1.2 has been deleted and replaced by:

4. When depicted, the aerodrome database accuracy for taxiway data elements shall meet medium category data quality as defined in RTCA DO-272C/ED-99C, or subsequent revisions.

*Note: For airports where no known taxiway data is published and errors are noted, operators using the moving map will report database errors to the database supplier as described in section 2.3.5.*

The following new subsection is added:

5. The total system accuracy shall be sufficient for the AMMD intended function, and shall not exceed 50 meters (95 %). The position source accuracy (36 m) and total database accuracy (5 m) may be reallocated, if the total system accuracy remains less than or equal to 50 meters. The formula for calculating total system accuracy is:

$$\sqrt{[(\text{Position Source Accuracy})^2 + (\text{Total Database Accuracy})^2 + (\text{Latency Effects})^2 + (\text{Display Errors})^2]} + |\text{Uncompensated GPS Antenna Offset}| = \text{Total System Accuracy}$$

#### **5. Depiction of Ownship Position**

2.3.1.2 New sub-sections 7 and 8 to section 2.3.1.2 have been added:

7. The AMMD shall provide a means to compensate for installation dependent GPS antenna offset (i.e., along track aircraft reference point bias associated with GNSS antenna position relative to the nose of the aircraft).

*Note: Acceptable means of compliance include the use of system calibration or a limitation on the GNSS antenna installation position in relation to the nose of the aircraft.*

8. AMMD applications limited to the airport surface (ground applications) and having only a minor failure classification, shall remove the own-ship position symbol at a ground speed above 80 knots. A means to allow lower values is recommended to adjust for actual aircraft performance or to mitigate installation dependant horizontal position latency.

#### **6. Database (AMMD)**

2.3.5 The following paragraph is inserted before subsection 1:

Both internal and external EMD databases shall meet the following requirements: ...

- By keeping the notes sub-section 2 of section 2.3.5 has been deleted and replaced by:
  2. The processes of producing and updating aerodrome databases shall meet the standards specified in EUROCAE ED-76/RTCA DO-200A or subsequent revisions. Description of the data quality requirements (DQRs) for the EMD database shall be specified (Reference EUROCAE ED-76/RTCA DO-200A, section 2.3.2).
- Add the following new subsection:
  3. Corruption of the EMD database shall be detected and annunciated to the flight crew clearly and in a timely manner.

## **7. Bench Test Procedures**

Section 2.6 is modified so as to include all additional and modified requirements stated above in the applicable test sections.