Advisory Circular

U.S. Department of Transportation

Federal Aviation Administration

Subject: OBTAINING DESIGN AND PRODUCTION APPROVAL OF AIRPORT MOVING MAP DISPLAY APPLICATIONS INTENDED FOR ELECTRONIC FLIGHT BAG SYSTEMS

Date: 4/30/07   **AC No:** 20-159
Initiated by: AIR-130

1. What is the purpose of this Advisory Circular (AC)?

a. This is a joint Flight Standards Service (AFS) and Aircraft Certification Service (AIR) AC. This AC will guide you in obtaining a design and production approval under Technical Standard Order (TSO) C-165, *Electronic Map Display Equipment for Graphical Depiction of Aircraft Position,* for the software and database used to provide an airport moving map display (AMMD) intended for use on a Class 2 electronic flight bag (EFB) for ground operations. Use this AC in conjunction with the guidance in AC 120-76, *Guidelines for the Certification, Airworthiness, and Operational Approval of Electronic Flight Bag Computing Devices,* if you are a manufacturer applying for technical standard order authorization (TSOA) as a means to enable use of an AMMD in an EFB under the allowance described in AC 120-76 paragraph 8.f.

b. This AC does not apply to any other Type C applications as defined in AC 120-76, such as an electronic map display (EMD) with own-ship symbol intended for use while airborne.

2. Who does this AC apply to?

We wrote this AC for operators and applicants. This AC is not mandatory and does not constitute a regulation. In it, we describe a means, though it is not the only means, to obtain a TSOA for an "incomplete system." However, if you use the means described, you must follow it in all respects.

3. Related references.

All references in this AC to FAA documents are to the current version. The current version is available on the internet at http://rgl.faa.gov/.

a. FAA ACs.

(1) AC 20-115, *RTCA, Inc., Document RTCA/DO-178B.*

(2) AC 20-153, *Acceptance of Data Processes and Associated Navigation Databases.*

(3) AC 120-74, *Parts 91, 121, 125, and 135 Flight Crew Procedures during Taxi Operations.*

(4) AC 120-76, *Guidelines for the Certification, Airworthiness and Operational Approval of Electronic Flight Bag Computing Devices.*

(5) AC 91.21-1, *Use of Portable Devices Aboard Aircraft.*

b. FAA TSOs. TSO-C165, *Electronic Map Display Equipment for Graphical Depiction of Aircraft Position*, dated September 30, 2003.

c. RTCA, Inc. Documents.

(1) RTCA/DO-178B, *Software Considerations in Airborne Systems and Equipment Certification,* dated December 1, 1992 and its equivalent, EUROCAE document ED-12B, *Software Considerations in Airborne Systems and Equipment Certification.*

(2) RTCA/DO-257A, *Minimum Operation Performance Standards for the Depiction of Navigational Information on Electronic Maps,* dated June 25, 2003.

(3) RTCA/DO-272A, *User Requirements for Aerodrome Mapping Information,* dated August 3, 2005 and its equivalent, EUROCAE document ED-99A, *User Requirements for Aerodrome Mapping Information.*

4. How this AC relates to current EFB policy.

a. AC 120-76 describes certain functions, called "applications" that may be displayed using an EFB. Some applications, called Type A and B applications, may be hosted on Class 2 EFBs. Type A and B applications do not require Aircraft Certification Service (AIR) design approval in Class 1 or 2 EFBs. Class 2 EFBs are considered portable electronic devices. AC 120-76 provides a means for these portable electronic devices to be connected to mounting bracket(s), aircraft power, and data connectivity ports.

b. The AMMD, which provides depiction of an own-ship symbol for ground operations, is not identified as a Type A or B application. It can be approved as a Type C application if the manufacturer obtains a design approval. The industry standard for the application was developed by RTCA Special Committee 181 and is published in RTCA/DO-257A. The FAA references RTCA/DO-257A in FAA TSO-C165, which defines the minimum level of functional capability and performance for both portable and installed electronic map displays.

c. TSO-C165 defines that the AMMDs failure condition for misleading information is classified as "minor" and the failure condition for the loss of function is classified as "no effect." Recognizing the nature of these failure effects and considering the potential safety enhancement of improved situation awareness on the airport surface, we describe a streamlined process to allow own-ship position on an AMMD using a TSOA for an "incomplete system." The resulting AMMD software and database, authorized under TSO-C165 with a design and production approval, is eligible for use in an EFB as described in AC 120-76 paragraph 8.f. This application of an incomplete system TSOA is unique to Class 2 EFBs since compliance to airworthiness regulations is not established in these instances. The incomplete TSOA provides an appropriate

assurance of quality and functionality of the AMMD, and AC 120-76 describes acceptable requirements for equipment compatibility and configuration control of the integrated system.

   d.   The TSOA includes both a design and production approval. Production approval is required to manufacture the AMMD software and database. Manufacturers must have in place an FAA-approved quality control system to receive a production approval for the AMMD software and database under a TSOA.

5.   AMMD functionality and limitations.

   a.   This AC provides a means of compliance to obtain a TSOA for an incomplete AMMD system. The TSOA is an acceptable means of providing AMMD functionality for ground operations. This AC is not applicable for design approval of any other Type C applications, such as an electronic map display (EMD) with own-ship symbol while airborne.

   b.   The intended function of AMMD is to help flight crews orient themselves on the airport surface and improve pilot positional awareness during taxi operations. AMMD function is not sufficient to be used as the basis for maneuvering and assumes compliance with the operational guidelines in AC 120-74, *Parts 91, 121, 125, and 135 Flight Crew Procedures during Taxi Operations*.

   c.   In this AC, the position source for the AMMD must be received from an approved source (e.g., sensor with TSO-C129a, TSO-C145a or other installed GNSS sensor).

6.   How to obtain a TSOA for an incomplete system AMMD.

   a.   If you apply for a TSOA for an incomplete system under the provisions of this AC, you must cite compliance with all the AMMD requirements in TSO-C165 except as noted in paragraphs 6b and 6c below. FAA aircraft certification office (ACO) staff will guide you using FAA Order 8150.1, *Technical Standard Order Program*. You must ensure that the software and database is compatible with the EFB system computing platform on which it is intended to function. AMMD software and database approved under TSOA may be installed on various EFB systems. In your application package you must include software and database installation instructions and a compatibility description to address the AMMD installation for each applicable platform.

   b.   The following TSO-C165 requirements are not applicable to an incomplete system with AMMD software and database only:

      (1)   Flight plan function (RTCA/DO-257A section 2.2.1.2).

      (2)   Schematic drawings and wiring drawings (TSO-C165 paragraphs 5.a(3), 5.a(4), 5.b(4), and 5.b(5)).

      (3)   Materials and process specifications (TSO-C165 paragraphs 5.a(8) and 5.b(6)).

      (4)   Equipment calibration procedures (TSO-C165 paragraph 5.b(2)).

(5) Display parameters (RTCA/DO-257A section 2.2.3).

c. Certain deviations to TSO-C165 apply to this incomplete system. You must request the deviations described below using the procedure specified in TSO-C165 paragraph 3.f:

(1) Environmental qualification (TSO-C165 paragraphs 3.d, 5.a(7) and 5.b(7)). Since the incomplete system does not include hardware, compliance with these requirements cannot be assessed. An acceptable, alternate means of compliance is to limit the installation to EFBs that obtain authorization for use under AC 120-76, which requires assurance of non-interference to installed systems (see AC 91.21-1).

(2) System-level Installation/Interface procedure and limitations (TSO-C165 paragraph 5.a(2)). Since the incomplete system is not intended for installation in an aircraft it is not appropriate to refer to a "separate approval for installation". Replace *Note* required by TSO-C165 paragraph 5.a(2) and substitute the following in the installation procedures:

> This EFB airport moving map display (AMMD) with own-ship position symbol has been authorized under TSO-C165. Use of this application with an EFB in 14 CFR Parts 121, 125, or 135 and Part 91, subpart F operations requires authorization for use in compliance with AC 120-76.

7. Additional guidance on compliance to TSO-C165. The following paragraphs provide clarification of certain TSO-C165 requirements as they apply to the authorization for an incomplete system.

a. Software qualification. The software must comply with all the requirements of RTCA/DO-178B appropriate to Level D software (or its equivalent). The following paragraphs provide guidance on certain RTCA/DO-178B objectives as they relate to the incomplete system.

(1) RTCA/DO-178B, Table A-2 objective 7 and Table A-6 objective 5: You must establish compatibility with the hardware platform and operating system during target computer compatibility testing. Since AMMD loss of function is considered to have no effect, there is no need to specifically evaluate compatibility with other Type A and B software applications that are outside the scope of the TSOA. Include the results of all tests in the TSO qualification test report required by TSO-C165 paragraph 5.a(10). If compatibility is established with several different hardware platforms and operating systems, including different versions of an operating system, these tests should be repeated for each unique configuration of hardware and operating system. The high-level functionality and requirements, as referenced in RTCA/DO-178B paragraph 6.4.3a, should include the following characteristics:

(a) Proper operation of all EFB controls that interface with the application software (per RTCA/DO-257A section 2.1.5).

(b) Proper display performance, operating characteristics, and status indications (per RTCA/DO-257A section 2.2.4).

(c) Demonstration of the AMMD function's ability to detect and fully remove depiction of own-ship position when the position sensor horizontal positional accuracy exceeds

the maximum value specified in RTCA/DO-257A sections 2.3.1.1.1 and 2.3.1.1.2 or when the position source becomes unavailable. We recommend the manufacturer consider using a tighter accuracy threshold to ensure the own-ship symbol is depicted on the correct runway or taxiway.

(d) Demonstration of the AMMD function's ability to detect and fully remove depiction of directionality of own-ship position as specified in RTCA/DO-257A section 2.3.1.2 (such as when aircraft is stopped, or during a slow taxi).

(e) Demonstration of the AMMD function's ability to detect and fully remove depiction of own-ship position when the EFB's operating system attempts to corrupt memory allocation or cause other erroneous information (e.g., task or interrupt conflicts).

(f) Demonstration of the AMMD function's ability to detect and fully remove depiction of own-ship position when airborne, or when taxi speed exceeds 40 knots ground speed.

(g) Any additional testing unique to the system architecture that is necessary to ensure that the application software, when loaded into the target computer platform, complies with the applicable requirements of RTCA/DO-257A sections 2.1, 2.2 and 2.3.

> **Note:** Operators may use the compatibility information documented in the installation instructions when obtaining authorization to use the EFB under AC 120-76.

(2) RTCA/DO-178B Table A-4 objective 13: You must establish detection and fault handling means to protect AMMD software from malfunction that could be caused by any Type A and B applications and the commercial-off-the-shelf (COTS) computing platform including the operating system.

(3) RTCA/DO-178B software configuration index: You must include the target computing platform and operating system in the configuration index. However, these components are not included under the incomplete system TSOA described by this AC. For Class 2 EFBs, the FAA recognizes that these commercial off-the-shelf (COTS) products and changes to the product may be made by the supplier without any indication in the part number or version.

b. Database. The AMMD function includes an airport map displayed from a database. The manufacturer must comply with section 2.2.5 of RTCA/DO-257A. One method for establishing compliance for the database updating process is to obtain a FAA letter of acceptance (LOA) as described in AC 20-153, *Acceptance of Data Processes and Associated Navigation Databases*. The data requirements must be defined, and we encourage compliance with RTCA/DO-272A, with at least 'medium' accuracy and 'routine' integrity. RTCA/DO-272A is the industry standard for data supporting AMMD.

c. Marking. The software must provide a means to easily display the required marking (TSO-C165 paragraph 4) on the target computer platform as well as identification as an incomplete system. While it is not necessary to physically mark any component of the system with TSO-C165, use of electronic part marking data (per 14 CFR § 21.607(d)) must be verifiable

on the ground at any geographical location. If the software is hosted on a transferring medium (for example, a Secure Digital (SD) memory card), identify this transferring medium in accordance with the marking requirements in TSO-C165 paragraph 4.

    d. Operating instructions and equipment limitations. In addition to the requirements of TSO-C165 paragraph 5.a(1), add the following *Note* to the installation manual and/or operations manual:

> This EFB airport moving map display (AMMD) with own-ship position symbol is designed to assist flight crews in orienting themselves on the airport surface to improve pilot positional awareness during taxi operations. The AMMD function is not to be used as the basis for ground maneuvering. This application is limited to ground operations only.

8. Installation instructions. In addition to the installation manual requirements specified in TSO-C165, include the following:

    a. Identification of each target EFB system computing platform (including hardware platform, operating system version, and Type A and B applications) with which this AMMD application was demonstrated to be compatible.

    b. Program installation instructions, as applicable, for each target EFB computer.

    c. Requirements for data provided by other installed systems, such as a GNSS sensor. This should include the latency of the position as provided to the EFB to support compliance with RTCA/DO-257A section 2.2.4 (item 20). The typical latency of installed GPS sensors is 200 ms. The instructions should also identify the required position update rate to support compliance with RTCA/DO-257A section 2.2.4 (item 21), and any limitations or configuration required to properly site the nose of the aircraft (depending on location of GPS antenna installed on the aircraft relative to the pilot's position).

9. EFB platform installation eligibility. Evidence of a TSOA design approval for the AMMD Type C application (see AC 120-76 paragraph 8.f) is an adequate indication to the FAA for use in an EFB system that the manufacturer has demonstrated to be compatible.

10. Related Federal Aviation Regulations. Title 14 of the Code of Federal Regulations (14 CFR) parts 21, 23, 25, 27, 29, 43, 91, 121, 125, and 135.

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