



ICAO

Doc 10020

Manual on Electronic Flight Bags (EFBs)

Second Edition, 2018



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AMENDMENTS

Amendments are announced in the supplements to the *Products and Services Catalogue*; the Catalogue and its supplements are available on the ICAO website at www.icao.int. The space below is provided to keep a record of such amendments.

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TABLE OF CONTENTS

	<i>Page</i>
Introduction.....	(vii)
Glossary.....	(ix)
Chapter 1. Equipment/hardware considerations	1-1
1.1 Types of EFBs.....	1-1
1.2 Hardware considerations for installed resources and mounting devices	1-1
1.3 Hardware considerations for portable EFBs	1-2
Chapter 2. Human Factors.....	2-1
Chapter 3. Crew operating procedures	3-1
3.1 General.....	3-1
3.2 Revisions and updates	3-1
3.3 Workload and crew coordination	3-1
3.4 Reporting.....	3-2
Chapter 4. Flight crew training	4-1
Chapter 5. EFB risk assessment.....	5-1
5.1 General.....	5-1
5.2 EFB failures and mitigation means.....	5-1
Chapter 6. EFB functions.....	6-1
6.1 General.....	6-1
6.2 Considerations for all EFB applications.....	6-2
6.3 Considerations for EFB applications to be used for the safe operation of aircraft	6-3
Chapter 7. Operational evaluation process.....	7-1
7.1 Definition of the scope	7-1
7.2 Initial discussion with the CAA (Phase 1)	7-1
7.3 Application (Phase 2)	7-1
7.4 CAA review (Phase 3)	7-2
7.5 Operational evaluation (Phase 4)	7-2
7.6 Issuance of EFB operations specifications and approval (Phase 5).....	7-3

Chapter 8. EFB use in general aviation operations with helicopters or other than large or turbojet aeroplanes	8-1
8.1 Equipment/hardware considerations	8-1
8.2 Pilot operating procedures.....	8-1
8.3 Pilot training.....	8-1
8.4 EFB risk assessment.....	8-1
8.5 EFB functions	8-2
8.6 Evaluation process	8-2
Appendix A. Guidance for EFB software applications.....	App A-1
Appendix B. Specific approval checklist.....	App B-1
Appendix C. Example of operations specifications and operations manual content	App C-1
Appendix D. EFB policy and procedures manual.....	App D-1

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INTRODUCTION

This guidance material was developed based on the electronic flight bag (EFB) provisions contained in Amendments 38, 33 and 19 to Annex 6 — *Operation of Aircraft*, Part I — *International Commercial Air Transport — Aeroplanes*, Part II — *International General Aviation — Aeroplanes* and Part III — *International Operations — Helicopters*, respectively.

An EFB is defined in Annex 6 as:

“An electronic information system, comprised of equipment and applications for flight crew, which allows for storing, updating, displaying and processing of EFB functions to support flight operations or duties.”

The EFB Standards and Recommended Practices (SARPs) are contained in Annex 6:

- Part I (*International Commercial Air Transport — Aeroplanes*), 6.25;
- Part II (*International General Aviation — Aeroplanes*), 2.4.17;
- Part III (*International Operations — Helicopters*),
 - Section II (*International Commercial Air Transport*), 4.17; and
 - Section III (*International General Aviation*), 4.12.

When referencing paragraphs 2.4.17.1, 4.12.1, 4.17.1, 6.25.1 of the EFB SARPs, it is to be understood that EFBs will not adversely affect the performance of the aeroplane/helicopter systems.

Paragraphs 6.25.1 and 6.25.2 of the EFB SARPs address the responsibilities of States and operators regarding EFB hardware and EFB functions. As stated in Annex 6, this manual complements the SARPs by proposing guidance on the intent and objectives of the requirements to perform an operational evaluation of an EFB system and its commonly used functions. The guidance is also intended to support the granting of a specific approval by the State of the Operator, where appropriate.

Operators are encouraged to use the EFB system as a source of information.

This manual does not address EFB airworthiness issues; these are covered in Annex 8 — *Airworthiness of Aircraft*. Not all software functions are eligible as EFB functions. Further guidance is provided in the manual (see Chapter 4).

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GLOSSARY

ACRONYMS

AFM	Aircraft flight manual
AID	Aircraft interface device
AMMD	Airport moving map display
AOC	Airline operations centre
AODB	Airport, runway, obstacle database
CAA	Civil aviation authority
CDL	Configuration deviation list
ECL	Electronic checklist
EFB	Electronic flight bag
EMI	Electromagnetic interference
FCOM	Flight crew operating manual
GNSS	Global navigation satellite system
HMI	Human-machine interface
IFW	In-flight weather
M&B	Mass and balance
MEL	Minimum equipment list
OEM	Original equipment manufacturer
PED	Portable electronic device
SCAP	Standardised Computerised Aircraft Performance
SOP	Standard operating procedure
STC	Supplemental type certificate
TACS	Taxi aid camera system
TALP	Take-off and landing performance
TC	Type certificate
TOM	Take-off mass
T-PED	Transmitting PED
WAFS	World area forecast system
ZFM	Zero fuel mass

DEFINITIONS

Aircraft interface device (AID). A device or function that provides an interface between the EFBs and other aircraft systems which protects the aircraft systems and related functions from the undesired effects from non-certified equipment and related functions.

Critical phases of flight. The period of high workload on the flight deck, normally being the periods between the beginning of taxiing until the aircraft is on the route climb phase and between the final part of descent to aircraft parking.

Electronic flight bag (EFB). An electronic information system, composed of equipment and applications for flight crew, which allows for the storing, updating, displaying and processing of EFB functions to support flight operations or duties.

EFB software application. Software hosted on an EFB platform, providing one or more EFB functions.

EFB management. Contains all procedures related to the operator's EFB management system as listed in the section "EFB management".

Installed resources. Hardware/software installed in accordance with airworthiness requirements.

Independent EFB platforms. Multiple EFB platforms that are designed such that no single failure makes all of them unavailable.

Operator. The person, organization or enterprise engaged in or offering to engage in an aircraft operation.

Portable electronic device (PED). Any lightweight, electrically-powered equipment. These devices are typically consumer electronic devices capable of communication, data processing and/or utility. Examples range from handheld, lightweight electronic devices such as tablets, e-readers, and smart phones to small devices such as MP3 players and electronic toys.

Note.— The definition of PED encompasses both transmitting and non-transmitting PEDs.

Standard operating procedure (SOP). Flight crew operating procedures as described in the flight operations manuals.

Transmitting PED. A PED that contains an intentional transmitter, which has some or all of the device's radio frequency transmitting functions turned on. Intentional transmitters may include devices enabled with cellular technology, wireless radio frequency network devices, and other wireless-enabled devices such as remote control equipment (which may include toys), two-way radios, cellular/mobile/smart phones and satellite phones.

Chapter 1

EQUIPMENT/HARDWARE CONSIDERATIONS

1.1 TYPES OF EFBs

EFBs can be either portable or installed (i.e., part of the aircraft definition).

- a) Portable EFBs are not part of the aircraft configuration and are considered to be PEDs. They generally have self-contained power and may rely on data connectivity to achieve full functionality. Modifications to the aircraft to use portable EFBs require the appropriate airworthiness approval depending on the State's regulatory framework.
- b) Installed EFBs are integrated into the aircraft, subject to normal airworthiness requirements and under design control. The approval of these EFBs is included in the aircraft's type certificate (TC) or in a supplemental type certificate (STC).

1.2 HARDWARE CONSIDERATIONS FOR INSTALLED RESOURCES AND MOUNTING DEVICES

Installed resources should be certified during the certification of the aircraft, through service bulletins by the original equipment manufacturer (OEM) or through a third-party STC.

1.2.1 Mounting devices

If the mounting is permanently attached to the aircraft structure, the installation will be approved in accordance with the appropriate airworthiness regulations. The following guidance may be considered for that purpose:

- a) The mounting method for the EFB should allow the pilot (when strapped in a seated position) to have easy access to the EFB controls and a clear unobstructed view of the EFB display. The EFB should be located such that the effects of glare and/or reflections are minimized. Flight crew should be able to make adjustments to compensate for glare and reflections.
- b) It should be confirmed that the intended EFB hardware in its mounting device does not obstruct visual or physical access to aircraft displays, controls or external vision, and that its location does not impede crew ingress, egress and emergency egress paths.
- c) There should be no mechanical interference between the EFB in its mounting device and any of the flight controls in terms of full and free movement, under all operating conditions, and no interference with buckles, oxygen hoses, etc.

1.2.2 Data connectivity

1.2.2.1 The capability of connecting the EFB to certified aircraft systems has to be covered by an airworthiness approval.

1.2.2.2 Certified aircraft systems should be protected from adverse effects of EFB system failures by using a certified AID. An AID may be implemented as a dedicated device, e.g. as defined in ARINC 759, or it may be implemented in non-dedicated devices, such as an EFB docking station, a network file server or other avionics equipment.

1.2.3 Power to the EFB

Installed power provisions should comply with the applicable airworthiness regulations. Connection of the EFB to a non-essential, or to the least critical, power bus is recommended, so failure or malfunction of the EFB or power supply will not affect safe operation of aircraft critical or essential systems.

1.3 HARDWARE CONSIDERATIONS FOR PORTABLE EFBs

Portable EFBs can be used as either handheld equipment or mounted in a fixed or movable mount attached to the aircraft structure or temporarily secured (e.g. kneeboard, suction cup).

1.3.1 Physical characteristics

The size and practicality of the EFB should be evaluated as some devices may prove to be cumbersome for normal use on a flight deck.

1.3.2 Readability

The EFB data should be legible under the full range of lighting conditions expected on the flight deck, including direct sunlight.

1.3.3 Environmental

The EFB has to be operable within the foreseeable cockpit operating conditions including probable high/low temperatures, and after rapid depressurization if the EFB is intended for use in such an event.

1.3.4 Basic non-interference testing

1.3.4.1 As previously noted, portable EFBs are considered to be PEDs. As such, any reference to PEDs in this section is also applicable to portable EFBs.

1.3.4.2 The user/operator is responsible for ensuring that a portable EFB will not interfere in any way with the operation of aircraft equipment. The following methods can be used to test portable EFBs that are to remain powered (including being in standby mode) throughout the flight, in order to ensure that they will not electromagnetically interfere with the operation of aircraft equipment.

1.3.4.3 Method 1

- 1) Step 1 is an electromagnetic interference (EMI) test using RTCA/DO-160, Section 21, Category M. An EFB vendor or other source can conduct this test for an EFB user/operator. An evaluation of the results of the RTCA/DO-160 EMI test can be used to determine if an adequate margin exists between the EMI emitted by the EFB and the interference susceptibility threshold of aircraft equipment. If this step determines that adequate margins exist for all interference, then the test is complete. However, if this step identifies inadequate margins for interference, then step 2 testing must be conducted.
- 2) Step 2 testing is a complete test in each aircraft using standard industry practices. This should be done to the extent normally considered acceptable for non-interference testing of a portable EFB in an aircraft for all phases of flight. Credit may be given to other aircraft of the same make and model equipped with the same avionics as the one tested.

1.3.4.4 Method 2

As an alternative, Step 2 of Method 1 can be used directly to determine non-interference of the EFB.

1.3.5 Additional testing for transmitting portable EFBs

1.3.5.1 To activate the transmitting functions of a portable EFB during flight in conditions other than those that may be already certified at aircraft level (e.g., tolerance to specific transmitting PED models) and hence documented in the aircraft flight manual or equivalent, the user/operator must ensure that the device will not interfere with the operation of the aircraft equipment in any way. The following is a method to test transmitting portable EFBs that are to remain powered (including being in standby mode) during flight.

1.3.5.2 This test consists of two separate test requirements:

- a) *Test Requirement 1.* Each model of the device should have an assessment of potential electromagnetic interferences (EMI) based on a representative sample of its frequency and power output. This EMI assessment should follow a protocol such as set forth in RTCA/DO-294, *Guidance on Allowing Transmitting Portable Electronic Devices (T-PEDs) on Aircraft*. This frequency assessment must confirm that no interference of aircraft equipment will occur as a result of intentional transmissions from these devices.
- b) *Test Requirement 2.* Once an EMI assessment has determined that there will be no interference from the EFB's intentional transmissions (Test Requirement 1), and basic non-interference testing has been conducted with the device not deliberately transmitting (see Chapter 3, 3.4), non-interference testing should be conducted with an operating transmit function. The position of the transmitting device is critical to non-interference testing; hence, locations of the EFB and of the transmitter (if applicable) should be clearly defined and adhered to.

1.3.6 Power supply, connection and source

1.3.6.1 The operator should ensure that power to the EFB, either by battery or externally supplied power, is available to the extent required for the intended operation.

1.3.6.2 The power source needs to be suitable for the device. It may be a dedicated power source or a general purpose source already fitted.

1.3.6.3 Means to turn off the power source, other than a circuit breaker, should be reachable by the pilot when strapped in the normal seated position (e.g. access to unplug the EFB or a separate hardware or software switch clearly labelled for the power source).

1.3.7 Batteries

1.3.7.1 The operator should ensure that the batteries are compliant with the applicable Standards for use in an aircraft.

1.3.7.2 The operator should consider introducing procedures to handle thermal runaways or similar battery malfunctions potentially caused by EFB batteries (e.g. lithium-based batteries). At least the following issues should be addressed:

- a) risk of leakage;
- b) safe storage of spares including the potential for short circuit; and
- c) hazards due to on-board continuous charging of the device, including battery overheat.

1.3.8 Cabling

The operator needs to ensure that any cabling attached to the EFB, whether in the dedicated mounting or when handheld, does not present an operational or safety hazard.

1.3.9 Temperature rise

Operating the proposed EFB device may generate heat. The placement of the EFB should allow sufficient airflow around the unit.

1.3.10 Data connectivity between EFBs

If two or more EFBs on the flight deck are connected to each other, then the operator should demonstrate that this connection does not negatively affect otherwise independent EFB platforms.

1.3.11 Data connectivity to aircraft systems

See section 1.2.2.

1.3.12 External connectivity

Some EFBs may have a provision for external ports other than power or data connectivity with aircraft systems (e.g. an antenna or a data connection to the operator ground network). External connectivity leading to a change to the aircraft type design should require an airworthiness approval. The extent of this information is dependent on the complexity of the interface to the aircraft systems.

1.3.13 Stowage

1.3.13.1 All handheld EFBs not secured on the flight crew (e.g. kneeboard) or into an existing aircraft part (e.g. suction cups) need to be stowed during critical phases of flight to ensure the safety of the occupants of the flight deck. Stowage needs to be configured such that the EFB can be easily stowed securely but remain readily accessible in-flight. The method of stowage should not cause any hazard during aircraft operations.

Viewable stowage

1.3.13.2 A portable EFB (not mounted in a mounting device) may be used during all phases of flight provided that it is secured on the flight crew or into an existing aircraft part with the intended function to hold acceptable light mass portable devices viewable to the pilot's required duty station. This viewable stowage device is not necessarily part of the certified aircraft configuration. Its location should be documented in the EFB policy and procedures manual.

1.3.13.3 Some types of viewable stowage securing means may have characteristics that degrade appreciably with age or because of various environmental factors. In that case, it should be ensured that the stowage characteristics remain within acceptable limits for the proposed operations. Securing means based on vacuum (e.g. suction cups) which have a holding capacity that decreases with pressure. It should be demonstrated that they will still perform their intended function at operating cabin altitudes.

1.3.13.4 In addition, it should be demonstrated that if the EFB moves or is separated from its stowage, or if the viewable stowage is unsecured from the aircraft (as a result of turbulence, manoeuvring, or other action), it will not interfere with flight controls, damage flight-deck equipment or injure flight crew members.

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Chapter 2

HUMAN FACTORS

The operator should carry out an assessment of the human-machine interface and aspects governing crew coordination when using the EFB. Whenever possible, the EFB user-interface philosophy should be consistent (but not necessarily identical) with the flight-deck design philosophy. The review of the complete system should include, but is not limited to, the following:

- a) general considerations including workload, usability, integration of the EFB into the flight deck, display and lighting issues, system shutdown and system failures;
 - b) physical placement issues, including stowage area, use of unsecured EFBs, design and placement of mounting devices;
 - c) considerations for interference with anthropometric constraints, cockpit ventilation and speaker sound;
 - d) training and procedure considerations, including training on using EFB applications, the EFB policy and procedures manual, fidelity of the EFB training devices and mechanisms for gathering user feedback on EFB use;
 - e) hardware considerations — refer to Chapter 1; and
 - f) software considerations — refer to Chapter 6.
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