CHAPTER 36

ELECTRONIC FLIGHT BAG (EFB)

1.0 PURPOSE

The purpose of this chapter is to provide guidance regarding the Operational Approval Evaluation process required to approve an Operator's application for EFB.

2.0 Reference Regulations

Nig. CARs 8.2.1.10

3.0 Introduction

3.1 EFB is a system comprising hardware and software that provides:

- Flight Crew access to emerging electronic flight operations data, general purpose computing and communications. Similar application may be found available to the cabin in some cases.
- Replacement of many of today's paper documents.
- A range of implementations spanning portable electronic devices up to installed certified integrated systems.

3.2 It should be noted that the following features are not considered as EFB functions and, unless airworthiness approved, should not be hosted on an EFB:

a) Displaying information which may be tactically used by the flight-crew members to check or control the aircraft position or trajectory,
b) Displaying information which may be directly used by the flight crew to assess the real-time status of aircraft critical and essential systems,
c) Communicating with air traffic services,
d) Sending data to certified aircraft systems other than those certified for that intent.

4.0 Hardware system

4.1 Types of EFB

EFBs can be either portable or installed.

4.1.1 Portable EFB

(a) Definition

A portable EFB is a portable EFB host platform, used on the flight deck, which is not part of the certified aircraft configuration.

(b) Complementary Characteristics

- A portable EFB can be operated inside and outside the aircraft.
- A portable EFB hosts type A and/or type B EFB software applications. In addition, it may host miscellaneous (non-EFB) software applications.
- A portable EFB is a portable electronic device (PED).
- The mass, dimensions, shape, and position of the portable EFB should not compromise flight safety.
- A portable EFB may be provided with aircraft power through a certified power source.
- If mounted, the portable EFB is easily removable from its mounting device or attached to it, without the use of tools by the flight crew. If mounted, the attachment

or removal does not constitute a maintenance action.

- A portable EFB may be part of a system containing EFB installed resources which are part of the certified aircraft configuration.
- The installed EFB components are part of the certified aircraft configuration with the intended function to mount the EFB to the aircraft and/or connect to other systems.
- When a portable EFB is a T-PED (Transmitting PED), the conditions for use of its transmitting capability are established in the approved Aircraft Flight Manual (AFM).
- Portable EFBs may be used in all phases of the flight if secured to a certified mount or securely attached to a viewable stowage device in a manner which allows its normal use. Portable EFBs not meeting the above characteristic, should be stowed during critical phases of the flight.
- Portable EFBs are controlled PEDs.
- Any EFB component that is either not accessible in the flight crew compartment by the flight crew members or not removable by the flight crew, should be installed as 'certificated equipment' covered by a Type Certificate (TC), changed TC or Supplemental (S)TC.

4.2 Installed EFB

(a) Definition
An EFB host platform installed in the aircraft and considered as an aircraft part, covered, thus, by the aircraft airworthiness approval.

(b) Complementary Characteristics
An installed EFB is managed under the aircraft type design configuration.

4.2.1 In addition to hosting Type A and B applications, an installed EFB may host certified applications, provided the EFB meets the certification requirements for hosting such applications, including assurance that the non-certified software applications do not adversely affect the certified application(s). For example, a robust partitioning mechanism is one possible means to ensure the independence between certified applications and the other types of applications.

4.2.2 The installation shall be approved through certification process such as STC. Operator has the responsibility to evaluate and declare that the modifications fulfil the requirements of the STC and is applicable to the EFB definition of this Document.

4.3 Hardware Considerations For Portable EFB

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

4.3.2 Physical characteristics
The size and practicality of the EFB should be considered as the device may be cumbersome for normal use on a flight deck.

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

4.3.4 Environmental
The EFB has to be operable within the foreseeable cockpit operating conditions including rapid depressurization, if the EFB is intended for use after rapid depressurization.

4.3.5 Basic Non Interference Testing

4.3.5.1 EFB devices intended to be used in all phases of flight should demonstrate that they meet environmental standards for radiated emissions for equipment operating in an airborne environment. Installed EFBs will be required to demonstrate non-interference with other aircraft systems as part of their certification process. As previously noted, portable EFBs are considered to be portable electronic devices (PEDs). As such, in this section any reference to PEDs is also applicable to portable EFBs.

4.3.5.2 In order to operate a portable EFB during flight, the user/operator is responsible for ensuring that the EFB will not interfere in any way with the operation of aircraft equipment. The following is an accepted method to test portable EFBs that are to remain powered (including being in standby mode) during flight in order to ensure that the EFB will not interfere in any way with the operation of aircraft equipment.

4.3.5.3 The first step is to conduct 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 (both front door and back door emissions susceptibility), then the test is complete. Front door emissions typically couple to aircraft system antennas by means of propagation through aircraft apertures such as doors and windows while back door emissions couple to aircraft equipment, wires, and cables. However, if this step identifies inadequate margins for interference, or either front door or back door susceptibility, then step 2 testing must be conducted.

4.3.5.4 Step 2 testing non-interference 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 or PED 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.

4.3.5.5 It should be acceptable for operators/users to bypass Step 1 and go directly to Step 2 in order to determine non-interference of the EFB/PED.

4.3.6 Additional Testing for Transmitting Portable EFBs and Other Transmitting PEDs

4.3.6.1 In order to activate the transmitting function of a portable EFB or other PED 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 is responsible to ensure that the device will not interfere with the operation of the aircraft equipment in any way. The following is an accepted method to test portable EFBs and PEDs that are to remain powered (including being in standby mode) during flight.

4.3.6.2 This test consists of two separate test requirements

(a) **Test Requirement 1.** Each model of the device should have an assessment of potential electro-magnetic interferences (EMI) based on a representative sample of the frequency and power output of it. This EMI assessment should follow a protocol such as the applicable processes 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/PED's intentional transmissions, test each model of the device while powered but not deliberately transmitting, using the basic non-interference testing methodology. Basic non-interference testing should be conducted with and without the transmit function being operative. 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.

4.3.7 Power Supply

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

4.3.8 Battery

Due to their proximity to the flight crew and potential hazard to safe operation of the aircraft, the use of rechargeable lithium-type batteries in portable EFBs located in the aircraft cockpit call for the following standards. Operators should collect and retain evidence of the following testing standards to determine whether rechargeable lithium-type batteries used to power EFBs are acceptable for use and for recharging. Operators should collect and retain evidence of the standards in subparagraphs (a) and either (b) or (c) or (d). Refer to the following current editions:

(a) United Nations (UN) Transportation Regulations. UN ST/SG/AC.10/11/Rev.5-2009, Recommendations on the Transport of Dangerous Goods-Manual of Tests and Criteria.

(b) Underwriters Laboratory (UL). UL 1642, Lithium Batteries; UL 2054, Household and Commercial Batteries; and UL 60950-1, Information Technology Equipment - Safety.

NOTE: Compliance with UL 2054 indicates compliance with UL 1642.

(c) International Electrotechnical Commission (IEC). International Standard IEC 62133, Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications.

(d) RTCA/DO-311, Minimum Operational Performance Standards for Rechargeable Lithium Battery Systems. An appropriate airworthiness testing standard such as RTCA/DO-311 can be used to address concerns regarding overcharging, over-discharging, and the flammability of cell components. RTCA/DO-311 is intended to test permanently installed equipment; however, these tests are applicable and sufficient to test EFB rechargeable lithium-type batteries.

The operator should consider introducing procedures to handle thermal runaways or similar battery malfunctions potentially caused by EFB batteries.

4.3.9 Power Connection and Source

4.3.9.1 Connection of EFB power provisions 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.

4.3.9.2 Connection to more critical aircraft power buses is, however, permitted if appropriate, taking into account the intended function of the EFB.

4.3.9.3 In all cases, an electrical load analysis should be conducted to replicate a typical EFB system to ensure that powering or charging the EFB will not adversely affect other aircraft systems and that power requirements remain within power-load budgets.

4.3.9.4 The aircraft power source delivering power supply to the EFB system should be demonstrated to protect the aircraft electrical network from EFB system failures or malfunctions (e.g. short-circuit, over-voltages, over-load, electrical transients or harmonics, etc.).

(a) A placard should be mounted beside the power outlet, containing the information needed by the flight or maintenance crews (e.g. 28 VDC, 115 VAC, 60 or 400 Hz, etc.).

(b) The EFB power source should be designed so that it may be deactivated at any time. If the flight crew cannot quickly remove the plug, which is used to connect the EFB to the aircraft electrical network, an alternate means should be provided to quickly stop powering and charging the EFB. Circuit breakers are not to be used as switches; their use for this purpose is prohibited.

(c) If a manual means (e.g. on/off switch) is used, this means should be clearly labelled and be readily accessible.

(d) If an automatic means is used, the applicant should describe the intended function and the design of the automatic feature and should substantiate that the objective of deactivating the EFB power source, when required to maintain safety, is fulfilled.

4.3.10 Cabling

4.3.10.1 If cabling is installed to mate aircraft systems with an EFB;

(a) if the cable is not run inside the mount, the cable should not hang loosely in a way that compromises task performance and safety. Flight crew should be able to easily secure the cables out of the way during operations (e.g. cable tether straps);

(b) cables that are external to the mounting device should be of sufficient length in order not to obstruct the use of any movable device on the flight crew compartment.

4.3.11 Temperature rise

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

4.3.12 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 influence otherwise independent EFB platforms.

4.3.13 Data Connectivity to aircraft systems

4.3.13.1 EFB data connectivity should be validated and verified to ensure non-interference and isolation from certified aircraft systems during data transmission and reception.

4.3.13.2 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.

4.3.14 External connectivity

4.3.14.1 Some EFB may have the provision for external ports other than power or data connectivity with aircraft systems (e.g. an antenna or a data connection to operator ground network). Details should be supplied and approvals if necessary should be sought. 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.

4.4 Hardware Considerations for Installed Resources

4.4.1 Installed resources should be certified either during the certification of the aircraft, through service bulletin by the original equipment manufacturer or through a third party STC.

4.4.2 Mounting Devices

4.4.2.1 If the mounting is permanently attached to aircraft structure, the installation will be approved in accordance with the appropriate airworthiness regulations.

4.4.2.2 The mounting device attaches or allows mounting of the EFB system. The EFB system may include more than one mounting device if it consists of separate items (e.g. one docking station for the EFB host platform and one cradle for the remote display).

4.4.2.3 The mounting device should not be positioned in such a way that it obstructs visual or physical access to aircraft controls and/or displays, flight crew ingress or egress, or external vision. The design of the mounting device should allow the user easy access to any item of the EFB system, even if stowed, and notably to the EFB controls and a clear view of the EFB display while in use. The following design practices should be considered:

(a) The mounting device and associated mechanisms should not impede the flight crew in the performance of any task (normal, abnormal, or emergency) associated with operating any aircraft system.

(b) When the mounting device is used to secure an EFB display (e.g. portable EFB, installed EFB side display), the mount should be able to be locked in position easily. If necessary, selection of positions should be adjustable enough to accommodate a range of flight crew member preferences. In addition, the range of available movement should accommodate the expected range of users' physical abilities (i.e. anthropometrics constraints). Locking mechanisms should be of the low-wear types that will minimise slippage after extended periods of normal use.

(c) Crashworthiness considerations should be taken into account in the design of this device. This includes the appropriate restraint of any device when in use.

(d) When the mounting device is used to secure an EFB display (e.g. portable EFB, installed EFB side display), a provision should be provided to secure or lock the mounting device in a position out of the way of flight crew operations when not in use. When stowed, the device and its securing mechanism should not intrude into the flight crew compartment space to the extent that they cause either visual or physical obstruction of flight controls/displays and/or egress routes.

(e) Mechanical interference issues of the mounting device, either on the side panel (side stick controller) or on the control yoke in terms of full and free movement under all operating conditions and non-interference with buckles, etc. For yoke mounted devices, (Supplemental)

Type Certificate holder data should be obtained to show that the mass inertia effect on column force has no adverse effect on the aircraft handling qualities.

(f) Adequate means should be provided (e.g. hardware or software) to shut down the portable EFB when its controls are not accessible by the pilot strapped in the normal seated position.

4.4.3 Stowage

4.4.3.1 When an EFB is stowed, the device and its securing mechanism should not intrude into the flight deck space to the extent that they cause either visual or physical obstruction of flight controls/displays and/or exit routes.

5.0 Operational Approval Evaluation Process

5.1 The process is designed to lead to formal operational approval where such is required and consists of the following courses of actions.

5.2 Elements of this process may also be used in instances where formal approval is not required.

5.3 The scope of the operational evaluation plan will depend upon the applicant's familiarity with EFB:
(a) the operator already has an existing approved EFB program established,
(b) is in the process of establishing an EFB program or
(c) has no EFB experience, thus requiring a "new application and approval process".

5.4 The operator is implementing EFB for a new fleet and may choose to start a paperless flight deck operation without paper back up.

5.5 A combination of solutions, with limited on-board paper backup, may also be used.

5.6 The operator may choose to keep the paper backup as a cross-check against the EFB information and as a means of mitigation against failure, when transition from paper to electronic format.

5.7 Phase One: Request Approval:

5.7.1 Phase one of the process begins when the operator requests approval from the NCAA to use the EFB. It should be noted that use of the EFB prior to operational approval does not imply any deviation from the operator's present procedures. It simply defines a training phase which will eventually lead to paperless trials.

5.7.2 During this phase, the NCAA and the operator reach a common understanding of when paperless trials should begin, how they must be conducted and documented, the role of the NCAA, and what documents and actions the operator is responsible for during each phase of the approval process.

5.8 Phase Two: Application

5.8.1 Phase Two begins when the operator submits a formal compliance plan to the NCAA for evaluation. The plan is reviewed for completeness and the NCAA may coordinate with other regulatory offices as necessary. Once the plan is accepted, the operator follows that plan to produce a complete EFB program. The operator must clarify the intent of the operation (with or without paper back-up or a combination of paperless and paper). The applicant user should submit the following information in the application package:

- EFB Operational Suitability Report
- EFB hardware and application specification EFB operator procedures/manual revisions,
- EFB evaluation checklists,
- EFB training program,
- EFB evaluation report
- Operational risk analysis

5.9 Phase Three: NCAA Review

5.9.1 The NCAA should use the checklist in the TGM to conduct a review of the application submitted by an operator. The NCAA should participate in the simulator evaluation or flight evaluation of an EFB when an operator is requesting initial EFB approval. Additional simulator or flight evaluations are not required for adding a new EFB to an existing approval unless there is a substantial change in EFB intended functions. When a new aircraft is added to a certificate with existing EFB approval, the suitability of the EFB for that aircraft must be addressed as part of the aircraft conformity and configuration control process. The NCAA should examine the technical content and quality of the proposed EFB program and other supporting documents and procedures. The operator's program for EFB management is critical to EFB reliability. The EFB program must address all EFB issues and be well documented.

5.10 Phase Four: Interim Approval to use EFB

5.10.1 An interim EFB Approval may be granted to allow the operator to proceed with EFB validation testing.

5.10.2 For operator transitioning from paper to EFB, during this validation of 6-month period, the operator must maintain paper back-up for all electronic information. The validation phase begins when the operator formally begins use of the EFB combined with paper backup for an established period of time. Use the EFB line Evaluation Job Aids for data collection during the validation phase.

5.10.3 For operators starting EFB operations without paper back-up, they must have in place adequate mitigations means to access the information in case of EFB failures, that are accepted by the NCAA.

5.10.4 Final considerations by the approving authority:

(a) Unacceptable Validation Results. If the NCAA finds the proposed EFB reliability and/or function to be unacceptable, the NCAA should contact the operator for corrective action. EFB deficiencies should be corrected and the EFB function revalidated prior to paperless approval being issued.

(b) Acceptable Validation Results. If the NCAA finds the proposed EFB reliability and/or function to be acceptable based on validation data then paperless approval may be issued.

5.11 Phase Five: Approval to use EFB

5.11.1 A formal letter is issued by the NCAA granting use of the EFB to the operator. Additionally, the approval of a "paperless flight deck" may be added if it was included as a part of the OPS Evaluation.

5.11.2 The initial approval should define criteria for changes to the EFB system which may require consideration of an amended approval.