

Advisory Circular

ELECTRONIC FLIGHT BAG (EFB)

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GENERAL

Advisory Circulars (ACs) are issued by the Director-General of Civil Aviation (DGCA) from time to time to provide practical guidance or certainty in respect of the statutory requirements for aviation safety. ACs contain information about standards, practices and procedures acceptable to CAAS. An AC may be used, in accordance with section 3C of the Air Navigation Act (Cap. 6) (ANA), to demonstrate compliance with a statutory requirement. The revision number of the AC is indicated in parenthesis in the suffix of the AC number.

PURPOSE

This AC provides to demonstrate compliance with the requirements regarding, and information related to an application for, an approval for operations with Electronic Flight Bag (EFB).

APPLICABILITY

This AC is applicable for the operator seeking an approval for operations with EFB.

RELATED REGULATIONS

This AC relates specifically to Division 7 of ANR-98.

RELATED ADVISORY CIRCULARS

- AC 98-1-1 Application for an Approval to Conduct a Special Operation
- AC 121-1-2 Use of Portable Electronic Devices onboard Aircraft

CANCELLATION

This AC supersedes AC AOC-16.

EFFECTIVE DATE

This AC is effective from 1 October 2018.

OTHER REFERENCES

- ICAO Doc 10020 Manual of Electronic Flight Bags (EFBs)
- Hong Kong CAD 562 Electronic Flight Bag (EFB)
- FAA AC 120-76D Authorization for use of electronic flight bags
- EASA AMC 20-25 Airworthiness and operational consideration for electronic flight bags (EFBs)

DEFINITIONS

AID (Aircraft Interface Device). 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.

AMM (Airport Moving Map). A software application displaying airport maps and using a navigation source to depict the aircraft current position on this map while on ground.

Critical phases of flight. Critical phases of flight, as defined by CAAS AC AOC-7(5), includes all ground operations involving taxi, takeoff and landing; all other flight operations conducted below 10,000 feet; and when handling abnormal situations.

Data connectivity for EFB systems. Data connectivity for EFB system supports either uni- or bi-directional data communication between the EFB and other aircraft systems (e.g. avionics). Direct interconnectivity between EFBs or direct connectivity between EFBs and ground systems are not covered by this definition.

EMI/EMC. Electromagnetic Interference / Electromagnetic Compatibility

EFB administrator. An EFB administrator is a person appointed by the operator, held responsible for the administration of the EFB system within the company. The EFB administrator is the primary link between the operator and the EFB system and software suppliers.

EFB host platform. When considering an EFB system, the EFB host platform is the equipment (i.e. hardware) in which the computing capabilities and basic software (e.g. operating system, input/output software) reside.

EFB risk assessment and mitigation. A process that considers an EFB system, its software applications, and its integration inside a specific aircraft, to identify the potential malfunctions and failure scenarios; analyse their operational repercussions; and, if necessary, propose mitigation means.

EFB software application. Software installed on an EFB system that allows specific operational functionality.

EFB system. An EFB system comprises the hardware (including any battery, connectivity provision, I/O devices) and software (including databases) needed to support the intended EFB function(s).

EFB system supplier. The company responsible for developing, or for having developed, the EFB system or part of it. The EFB system supplier is not necessarily a host platform or aircraft manufacturer.

Minor failure conditions. Failure conditions which would not significantly reduce aircraft safety, and which involve crew actions that are well within their capabilities. Minor failure conditions may include, for example, a slight reduction in safety margins or functional capabilities, a slight increase in crew workload, such as routine flight plan changes, or some physical discomfort to passengers or cabin crew.

Mounting device. An aircraft certified part which secures portable or installed EFB, and/or its system components

GUI. Graphical User Interface

HMI. Human Machine Interface

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

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

Portable Electronic Device (PED). PEDs are typically consumer electronic devices, which have functional capability for communications, entertainment, data processing, and/or utility. There are two basic categories of PEDs – those with and those without intentional transmitting capability

SCAP. Standard Computerised Aircraft Performance

STC. Supplemental Type Certificate

Viewable Stowage. A device that is secured either on the flight crew (e.g. kneeboard) or in/to an existing aircraft part (e.g. suction cups) with the intent to hold a portable EFB (e.g. a tablet) viewable to the pilot at her/his duty station. The device is not necessarily part of the certified aircraft configuration.

1 BACKGROUND

- 1.1 An Electronic Flight Bag or EFB is defined by ICAO 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.”
- 1.2 This AC provides the guidance to understand the intent and objectives of the requirements for the performance of operational evaluation of the EFB system and its commonly used functions; and, where appropriate, enables the operator to seek the grant operational approval from CAAS.
- 1.3 This AC does not cover EFB Airworthiness Certification issues.

2 TYPES OF EFB

- 2.1 EFBs can be either portable EFBs or installed EFBs.
- 2.2 Portable EFBs are considered PEDs and are not integral to the aircraft configurations. 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.
- 2.3 Installed EFBs are integrated into the aircraft and are subject to airworthiness requirements. The approval of these EFBs is included in the aircraft type certificate (TC) or the supplemental type certificate (STC).

3 EFB HARDWARE

3.1 Portable EFB

3.1.1 A portable EFB provides a portable host platform, although when used on the flight deck, it is not part of the certified aircraft configuration. Portable EFBs can be used either as hand-held equipment or secured in a mounting device / viewable stowage solution.

3.1.2 The following are complementary characteristics of a Portable EFB:

- (a) A portable EFB is a portable electronic device (PED).
- (b) It can be operated inside and outside the aircraft.
- (c) The mass, dimensions, shape, and position of the portable EFB should not compromise flight safety.
- (d) A portable EFB may connect to aircraft power, data ports (wired or wireless) and installed antennas provided those connections have been installed in a certified and approved manner.
- (e) If secured with viewable stowage, the portable EFB should be easily removable without the use of tools by the flight crew and the attachment or removal does not constitute a maintenance action.
- (f) 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. EFBs not meeting this requirement, should be stowed during critical phases of flight.
- (g) The portable EFB and its operating components should be easily accessible by the flight crew members in the flight compartment.

3.1.3 **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.

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

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

3.1.6 Basic non-interference testing

3.1.6.1 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

3.1.6.2 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.

3.1.6.3 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 methods are means to test portable EFBs that are to remain powered (including being in standby mode) throughout the flight, to ensure that they will not electromagnetically interfere with the operation of aircraft equipment.

Method 1:

- (a) **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, or either front door or back door susceptibility, then **step 2** testing must be conducted.
- (b) **Step 2** 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.

Method 2:

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

3.1.7 Additional Testing for Transmitting Portable EFBs and Other Transmitting PEDs

3.1.7.1 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. 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.

Note: *For information and guidance on Use of Portable Electronic Devices On-board Aircraft, refer to CAAS AC 121-1-2.*

3.1.8 Power Supply

3.1.8.1 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.

3.1.8.2 If an operator intends to solely use battery power for the EFB or in the instance of a power source failure; the EFB discharge rates, battery conservation techniques and minimum EFB charge rates for dispatch should be documented.

3.1.8.3 If the EFB hosts functions essential to safe operation of flight, one of the following must be available before a flight departs:

- (a) an established procedure to recharge the battery from aircraft power during flight operations
- (b) a battery or batteries with a combined useful battery life to ensure operational availability during taxi and flight operations to include diversions and reasonable delays considering duration of flight
- (c) an acceptable mitigation strategy providing availability of aeronautical information for the entire duration of flight authorised by the Principal Operations Inspector (POI)

3.1.8.4 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.

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

3.1.8.6 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, etc.).

3.1.9 Batteries

3.1.9.1 The operator should ensure that the batteries in a portable EFB are compliant with the applicable Standards for use in an aircraft.

3.1.9.2 The standards referred to in the following subparagraphs are currently accepted editions:

- (a) United Nations (UN) Transportation Regulations. UN ST/SG/AC.10/11/Rev.5, 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 60950-1,3 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.

3.1.9.3 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.

3.1.9.4 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.

3.1.10 **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. This may be achieved using cable tether straps / clips.

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

3.1.12 **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.

3.1.13 **Data Connectivity to aircraft systems**

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

3.1.13.2 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

3.1.14 **External connectivity.** 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 a 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

3.1.15 Stowage

3.1.15.1 All hand-held EFBs 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.

3.1.15.2 Viewable stowage. Some types of viewable stowage may have characteristics that degrade appreciably with aging or due to 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) have a holding capacity that decreases with pressure. It should be demonstrated that they will still perform their intended function at operating cabin altitudes. Viewable stowage solutions must not interfere with flight control movement, obstruct visual or physical access to controls and/or displays, or obstruct flight crew member ingress or egress. Viewable stowage should minimise blockage of the windshields to allow the pilots to maintain a clear view of critical outside references (e.g., during ground operations, taxiing, takeoff, approach, and landing). Training and procedures must address specific and acceptable placement of viewable stowage devices.

3.1.15.3 Regardless of whether an EFB is secured using either a certified mounting device or viewable stowage, the following guidance should be considered:

- (a) There must be no interference with flight control movement, obstruction to visual or physical access to controls and/or displays or obstruct flight crew member ingress or egress.
- (b) The pilot should have easy access to the EFB controls and a clear unobstructed view of the EFB when strapped in the normal seated position. The effects of glare and/or reflections should be minimised. This may be accomplished by providing some adjustment to the pilot to compensate for glare and reflections.
- (c) Blockage of windshields should be minimised to allow the pilots to maintain a clear view of critical outside references (eg. During ground operations, taxiing, takeoff, approach and landing)

3.2 Installed EFB

3.2.1 Installed EFBs are integrated into the aircraft and are subject to normal airworthiness requirements.

3.2.2 The complementary characteristics below pertain to Installed EFBs:

- (a) In addition to the EFB functions to support flight operations, an installed EFB may host other applications provided they meet CAAS certification requirements.
- (b) The approval of these EFBs is included in the aircraft's type certificate (TC) or in a supplemental type certificate (STC).

4 EFB FUNCTIONS

4.1 General

4.1.1 Use of multiple software applications in an EFB is allowable.

4.1.2 Operational use of EFB functions require CAAS' approval.

4.2 Guidance / Criteria for operational use of EFB functions

4.2.1 The following are the guidance / criteria established by CAAS for the operational use of EFBs that:

- (a) the EFB equipment and its associated installation hardware, including interaction with aircraft systems as applicable, meet the CAAS Airworthiness Certification requirements;
- (b) the operator/owner has assessed the safety risks associated with the operations with support by the EFB function(s);
- (c) the operator/owner has established requirements for redundancy of the information, as appropriate, contained in and displayed by the EFB functions;
- (d) the operator/owner has established and documented procedures for the management of the EFB function(s) including any database it may use;
- (e) the operator/owner has established and documented the procedures for the use of, and training requirements for, the EFB and the EFB function(s).

4.3 EFB functions essential to safe operation of flight

4.3.1 EFB functions whose failure, malfunction or misuse would have an adverse effect on the safety of flight operations (e.g. increase in flight crew workload during critical phases of flight, reduction in functional capabilities or safety margins, etc.) are essential to the safe operation of the flight should be recorded in the **operations manual and linked to the operations specifications**.

4.3.2 The applications below may be considered examples of such functions, depending on their use, associated procedures, and failure mitigation means:

- (a) Document browser displaying information required to be carried by regulations (subject to State authority approval, where required);
- (b) Electronic aeronautical chart applications;
- (c) Airport moving map (AMM) applications, not used as a primary means of navigation on the ground and used in conjunction with other materials and procedures;
- (d) Aircraft performance calculation application to provide take-off, en-route, approach, landing and missed approach performance calculations; and
- (e) Mass and balance calculation application.

4.3.3 THE FOLLOWING FEATURES ARE NOT EFB FUNCTIONS AND, UNLESS CERTIFIED AS AVIONICS FUNCTIONS, SHOULD NOTE BE HOSTED ON AN EFB:

- (a) Displaying information which may be directly used by the flight crew to assess the real-time status of aircraft critical and essential systems, as a replacement for existing installed avionics, and/or to manage aircraft critical and essential systems following failure;
- (b) Communicating with air traffic control;
- (c) Sending data to the certified aircraft systems other than the EFB installed/shared resources; and
- (d) If the EFB function requires airworthiness certification as determined by CAAS.

4.3.4 Display of Own-Ship Position

4.3.4.1 An operator may overlay EFB own-ship position on an EFB only when the installed primary flight display, weather display, or map display also depict own-ship position.

4.3.4.2 Proper Use of EFB Own-Ship

An operator must ensure flight deck crewmembers understand the proper use of EFB own-ship position, including the need for concurrent use and differentiation. The flight crew's reference for maneuvering the aircraft in the air is the installed primary flight and navigational displays; therefore, they must be able to resolve conflicts between the EFB information depicted on the "secondary" display and the installed avionics system identified for each EFB application as its reference for in-flight use. For EFB own-ship position use in ground operations, use of external visual references shall be sufficient for maneuvering.

4.3.4.3 EFB Own-Ship Display Supporting Requirements

4.3.4.3.1 *Position Source Selection.* Using position data from an installed GNSS source is recommended. Portable equipment is more likely to experience signal blockage, signal degradation, and performance degradation. Position data from a portable GNSS source may be acceptable, but for consistency of availability, the operator is recommended to select an external GNSS source rather than the GNSS internal to the portable EFB.

4.3.4.3.2 *EFB Own-Ship Directionality.* Change own-ship to a non-directional (circular) depiction when track or heading is not available.

4.3.4.3.3 *EFB Own-Ship GNSS Data Stream.* Remove EFB own-ship if the position becomes unavailable or is insufficient for the application. This will guard against a "frozen" own-ship condition caused by position source signal or power loss and removal should take no more than 3 seconds.

4.3.4.3.4 *EFB Own-Ship Surface Use Accuracy.* For airport map applications, a database with an accuracy of 5 meters or less should be used. For airports where such data is not currently available, a database accuracy of up to 30 meters can still be operationally useful. If the database accuracy exceeds 30 meters, do not display EFB own-ship position. An operator should contact its EFB airport map application provider to obtain the accuracy of their database. This information is usually found in documentation supporting the EFB airport map application.

4.4 CONSIDERATIONS FOR ALL EFB FUNCTIONS - SOFTWARE HMI

- 4.4.1 The EFB system should provide an intuitive, and in general, consistent user interfaces within and across the various hosted EFB applications. This should include, but not be limited to, data entry methods, color-coding philosophies, and symbology.
- 4.4.2 Software considerations, including ease of access to common functions, consistency of symbols, terms and abbreviations, legibility of text, system responsiveness, methods of interaction, use of color, display of system status, error messages, management of multiple applications, off-screen text/content and use of active regions should be addressed.
- 4.4.3 Use of colors and messages.
- (a) The color “red” should be used only to indicate a warning level condition.
 - (b) “Amber” should be used to indicate a caution level condition.
 - (c) Any other color may be used for items other than warnings or cautions, providing that the colors used differ sufficiently from the colors prescribed to avoid possible confusion.
 - (d) EFB messages and reminders should be integrated with (or compatible with) presentation of other flight deck system alerts.
 - (e) EFB aural messages should be inhibited during critical phases of flight. If, however, there is a regulatory requirement that conflicts with the recommendation above, those should have precedence.
- 4.4.4 **System error messages.** If an application is fully or partially disabled, or is not visible or accessible to the user, it may be desirable to have an indication of its status available to the user upon request. It may be desirable to prioritise these EFB status and fault messages.
- 4.4.5 **Data entry and error messages.** If user-entered data are not of the correct format or type needed by the application, the EFB should not accept the data. An error message should be provided that communicates which entry is suspect and specifies what type of data are expected.
- 4.4.6 **Responsiveness of application.** The system should provide feedback to the user when user input is accepted. If the system is busy with internal tasks that preclude immediate processing of user input (e.g. calculations, self-test, or data refresh), the EFB should display a “system busy” indicator (e.g. clock icon) to inform the user that the system is occupied and cannot process inputs immediately. The timeliness of system response to user input should be consistent with an application’s intended function.
- 4.4.7 **Off-screen text and content.** If the document segment is not visible in its entirety in the available display area, such as during “zoom” or “pan” operations, the existence of off-screen content should be clearly indicated in a consistent way. For some intended functions, it may be unacceptable if off-screen content is not indicated. This should be evaluated based on the application and intended operational function.
- 4.4.8 **Electronic Signatures.**
- 4.4.8.1 To be accepted as an equivalent to a handwritten signature, electronic signatures used in EFB applications need, as a minimum, to fulfil the same objectives and should, as a minimum, assure the same degree of security as the handwritten or any other form of signature it intends to replace. Authenticated certificates and secure signature creation devices are normally not required for EFB operations.

4.4.8.2 The following documents are requirement and guidance relating to acceptance and use of electronic signatures:

- (a) Electronic Transaction Act (Revised Edition 2011)
- (b) CAAS AC-1-2 Acceptance and use of Electronic Signatures, Electronic Record-keeping system, Electronic documents

Note: For further guidance on electronic signatures refer to ICAO Safety Management Manual Doc 9859.

5 GUIDANCE FOR EFB SOFTWARE APPLICATIONS

- 5.1 The Appendices in this AC provide information on best practices and general guidance for the development of commonly used EFB software applications.
- 5.2 When developing EFB software applications the operator should carefully consider operational needs with the aim to maintain the highest safety and reliability standards for his specific-use case.

6 HUMAN FACTORS

- 6.1 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.
- 6.2 The review of the complete system should include, but is not limited to:
 - (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 procedures 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 paragraph 3;
 - (f) software considerations – refer to paragraph 4.

7 CREW OPERATING PROCEDURES

- 7.1 General
 - 7.1.1 The operator should have procedures for using the EFB in conjunction with the other flight deck equipment.
 - 7.1.2 If an EFB generates information similar to that generated by existing flight deck systems, the procedures should clearly identify:
 - (a) which information source will be primary;
 - (b) which source will be used as secondary information;
 - (c) under what conditions to use the secondary source; and

- (d) what actions to take when information provided by an EFB does not agree with that from other flight deck sources, or, if more than one EFB is used, when one EFB disagrees with another.
- 7.1.3 The operators should include requirements for EFB availability in the operations manual and, as appropriate, in the minimum equipment list.
- 7.2 Revisions and Updates
- 7.2.1 The operator should have a procedure in place to allow the flight crew to confirm the revision number and/or date of EFB application software including, where applicable, database versions (e.g. update to the latest aeronautical charts).
- 7.2.2 Flight crews should not, however, have to confirm the revision dates for databases that would not, in case of outdated data, adversely affect flight operations. There should be procedures to specify what actions to take if the software applications or databases loaded on the EFB are out of date.
- 7.3 Workload and Crew Coordination
- 7.3.1 In general, using an EFB should not increase the crew's workload during critical phases of flight. For other flight phases, crew operating procedures should be designed to mitigate and/or control additional workload created by using an EFB.
- 7.3.2 Workload should be distributed between flight crew members to ensure ease of use and continued monitoring of other flight crew functions and aircraft equipment. The procedures should include specification of the phases of flight at which the flight crew may not use the EFB, if applicable
- 7.4 Reporting
- 7.4.1 A reporting system for EFB failures should be established which includes procedures to inform maintenance and flight crews about a fault or failure of the EFB and the actions taken to isolate it until corrective action is taken.

8 RISK ASSESSMENT

- 8.1 General
- 8.1.1 The EFB risk assessment is a process that should be performed to assess the risks associated with the use of each EFB function and should allow the operator to keep the risks to an acceptable level by defining the appropriate mitigation means.
- 8.1.2 This risk assessment should be performed before the beginning of the approval process (if applicable) and its results should be reviewed on a periodic basis.
- 8.1.3 The guidance on safety risk assessment is contained in the Safety Management Manual (SMM) (Doc 9859).

8.2 EFB Failures and Mitigation Means

- 8.2.1 Based on the outcome of the EFB risk assessment, the operator should determine the need for software architectural features, personnel, procedures, and/or equipment that will eliminate, reduce, or control risks associated with an identified failure in a system.
- 8.2.2 If normal operational procedures require an EFB for each flight deck crew member, the installation should comply with the definition of independent EFB platforms.
- 8.2.3 Apart from procedures to inform maintenance and flight crews about a fault or failure of the EFB and the actions taken to isolate it until corrective action is taken, back-up procedures should also be in place to prevent the use of erroneous information by flight crews.
- 8.2.4 Mitigation against EFB failure or impairment may be accomplished by one or a combination of:
 - (a) system design;
 - (b) separate and backup power sources for the EFB;
 - (c) electronic fallback solutions to the last known, stable configuration (e.g. before an update);
 - (d) redundant EFB applications hosted on independent EFB platforms;
 - (e) paper products carried by selected crew members;
 - (f) complete set of sealed paper backups in the flight deck; and/or
 - (g) procedural means.

9 FLIGHT CREW TRAINING

- 9.1 The use of the EFB should be conditional upon appropriate training. Training should be in accordance with the operator's SOP (including abnormal procedures) and should include:
 - (a) an overview of the system architecture;
 - (b) preflight checks of the system;
 - (c) limitations of the system;
 - (d) the use of each operational software application
 - (e) restrictions on the use of the system, including when some or all of the EFB functions are not available;
 - (f) the conditions (including phases of flight) under which the EFB may not be used;
 - (g) procedures for cross-checking data entry and computed information;
 - (h) human performance considerations on the use of the EFB;
 - (i) additional training for new applications, new features of current applications, or changes to the hardware configuration;
 - (j) recurrent training and proficiency checks; and
 - (k) any area of special emphasis raised during the EFB evaluation with CAAS.

10 EFB MANAGEMENT

- 10.1 The operator should have an EFB management system in place. The role of an EFB administrator is a key factor in the management of the EFB system. Complex EFB systems may require more than one individual to support the EFB management system. However, at least one person (e.g. the EFB administrator or dedicated EFB manager, OPS director, etc.) should possess an overview of the complete EFB system, including the distribution of responsibilities within the operator's management

structure. This role and accountability can be by delegations and by establishing procedures to ensure compliance

- 10.2 The EFB administrator is the key link between the operator, the EFB system and the software suppliers
- 10.3 The following are responsibilities of the EFB administrator:
- (a) Hardware and software configuration management and for ensuring, in particular, that no unauthorised software is installed.
 - (b) Ensuring that only a valid version of the application software and current data packages are installed on the EFB system.
 - (c) That the operator establishes the means to carry out their own check of data contents prior to load and/or release for operational use.
 - (d) Conducting internal quality control measures to ensure that all EFB management personnel comply with the defined procedures.
 - (e) Ensure that software applications supporting function(s) not directly related to operations conducted by the flight crew on the aircraft (e.g. web browser, email client, picture management, etc.) do not adversely impact the operation of the EFB.
 - (f) Ensure each person involved in EFB management receive appropriate training in their role and have a good working knowledge of the proposed system hardware, operating system and relevant software applications as well as knowledge about flight operations.
 - (g) Should establish procedures, documented in an EFB Policy and Procedures Manual, to ensure that no unauthorised changes take place. The EFB Policy and Procedures Manual may be part of the Operator's Operations Manual
 - (h) Ensure procedures are established for the maintenance of the EFB.
- 10.4 The EFB administrator should be responsible for the overall procedures and systems, documented in the EFB Policy and Procedures Manual that maintain EFB security and integrity to the level of EFB security as required by the criticality of the used functions.

11 OPERATIONAL EVALUATION PROCESS

11.1 Operational evaluation process

11.1.1 Subject to CAAS' operational evaluation and approval, an operator implementing EFB functions:

- (a) may choose to start a paperless flight deck operation without paper backup or a combination of solutions with limited on-board paper backup.
- (b) may also choose to keep the paper backup as a cross-check against the EFB information and as a means of mitigation against failure, when transitioning from paper to electronic format.

11.1.2 The operational evaluation process below is designed to lead to specific operational approval and consists of the following phases of actions. **Appendix F** provides a sample checklist of evaluation items.

11.2 Phase I – Pre-Application discussion

11.2.1 This phase begins when CAAS meets the operator to establish a common contact and the understanding of requirements, of what need to be evaluated and how they must be conducted and documented.

11.3 Phase II – Formal Application

11.3.1 Phase II begins when the operator submits the formal application letter with supporting documents and compliance plan to CAAS for evaluation of completeness and compliance to the regulations. The operator must clarify his intent to operate with or without paper backup or a combination of paperless and paper. The typical documents to be submitted are:

- (a) EFB operational suitability report, as applicable;
- (b) EFB hardware and application specifications;
- (c) EFB operator procedures/manual revisions;
- (d) EFB training programme;
- (e) EFB evaluation
- (f) EFB risk assessment

11.4 Phase III – CAAS Review

11.4.1 At this phase CAAS conducts a review of the operator's submission; examine the technical contents and quality of the proposed EFB program, supporting documents and procedures.

11.5 Phase IV – Operational Trial

11.5.1 The operator would receive permission to conduct an operational trial run to ensure satisfactory operation of the EFB program. This process would normally be conducted over a mutually agreed timeframe. The operator will notify CAAS of the trial progress and the results accordingly.

11.5.2 An operator who is approved to operate EFB without paper backup shall have adequate mitigations means in place to access the information in case of EFB failures.

11.5.3 Final considerations by CAAS:

- (a) Unacceptable validation results: If CAAS finds the proposed EFB reliability and/or function to be unacceptable, CAAS will contact the operator for corrective action. EFB deficiencies should be corrected and the EFB function revalidated prior to being approved.
- (b) Acceptable validation results. If CAAS finds the proposed EFB reliability and/or function to be acceptable based on validation data, then the specific operational approval may be issued.

11.6 Phase V – Issuance of EFB Operational Approval

11.6.1 The successful operator will need to submit to CAAS form CAAS AW68(A) for the Application for Variation of Air Operator Certificate (AOC) to update the AOC Operations Specifications with EFB entry.

11.6.2 The Operations Specifications entry will include references to the operator's Operations Manual where more details of the approved EFB applications are document.

APPENDIX A PERFORMANCE (TAKE-OFF, LANDING) AND MASS & BALANCE

Introduction

- (a) The use of EFB to compute aircraft performance as well as mass and balance (M&B) data has become commonplace in recent years. The computing power and versatility offered particularly by the portable devices such as laptops and tablets in relation to their flexibility for development and use have also allowed the creation of numerous applications for most types of aircraft.
- (b) In any event, for the safe operations of flight, the validity and integrity of the aircraft performance and M&B data are crucial and the applications and the procedures for their use have to be properly evaluated before being used in service.
- (c) In that regard, the verification of the aircraft performance data and calculation algorithm correctness becomes an essential step of the evaluation. The other part of the evaluation is to deal with the user interface and crew procedures. A proper human-machine interface (HMI) on one side, with adequate administration and crew procedures and training on the other, are necessary to mitigate those errors.

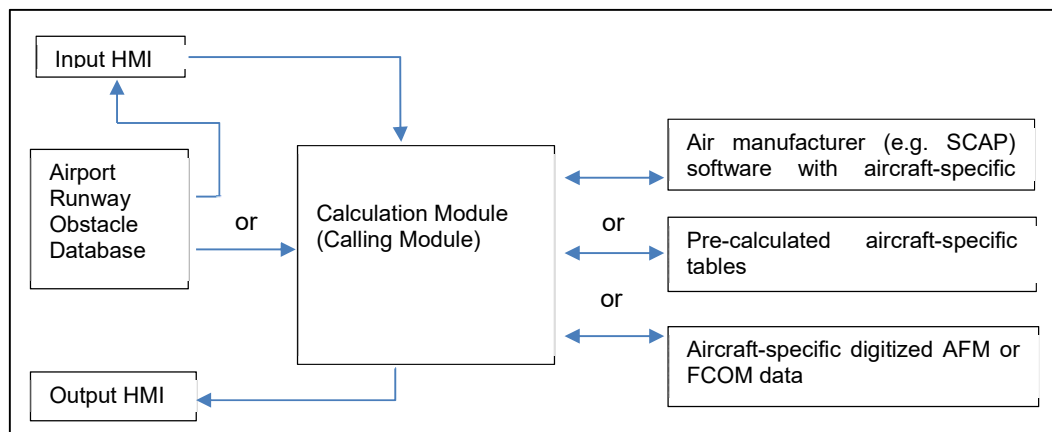
1 Performance applications architecture

1.1 Performance applications are usually separated into different layers:

- (a) HMI (human-machine interface);
- (b) calculation module;
- (c) aircraft-specific information; and
- (d) airport, runway, obstacle database (AODB).

1.1.2 The figure below shows a typical architecture of a performance application. Individual solutions that are in use by operators might not need to be as modular as shown, but rather, have the different parts integrated into one software.

1.1.3 Alternatively, there might be solutions where modularity is taken to a point where some or all parts are supplied by different providers.



- 1.2 **HMI - Input and output HMI:** The input HMI takes the pilot's inputs (or data read from the avionics if applicable) and requests the calculation from the calculation module. The results are transferred to the output HMI.
- 1.3 **Calculation module:** The calculation module will process the request data from the input HMI and determine the results, which are then sent back to the output HMI.
 - 1.3.1 Calculation modules are commonly setup using manufacturer SCAP software together with the respective aircraft-specific database. To obtain the results, the calculation module might call the SCAP software several times. Thus, the expression "calling module" has become widespread in the industry.
 - 1.3.2 Another way for the calculation module to obtain results is to interpolate between pre-calculated tables (e.g. runway weight limitation charts). Those tables are typically calculated using SCAP software. The SCAP software itself, however, is not specifically part of the performance application.
 - 1.3.3 Where manufacturer software is not available, paper AFM or FCOM charts may have to be digitised.
- 1.4 **Performance data sources:** Different sources of performance data can be used by performance applications. Performance data can be delivered in a digitised format:
 - (a) SCAP modules or the equivalent delivered by the manufacturer. The SCAP module is either based on equations of motion or digitised AFM material. Modules may or may not come from an airworthiness approved electronic flight manual;
 - (b) the operator can build its own digitised performance data, based on the data published in the flight manual; and
 - (c) data based on pre-calculated take-off or landing performance tables.
- 1.5 **Airport, runway, obstacle database (AODB):** Take-off and landing performance applications require information about airport, runway and obstacles.
 - (a) The AODB should provide this information in a suitable way. Usually, it is the part of the EFB performance applications that will be updated most often.
 - (b) The management of this data is critical.
 - (c) The operator is ultimately responsible for the data quality, accuracy and integrity of the runway and obstacle data, and should ensure this together with the data provider.

2 **PERFORMANCE AND MASS AND BALANCE (M&B) APPLICATIONS GRAPHICAL USER INTERFACE**

- 2.1 Data error in performance calculations have been identified to have contributed to Incidents and accidents. A good, well-designed graphical user interface (GUI) can significantly reduce such error risks. Below are examples of design guidelines which are part of software HMI considerations in Chapter 12:
 - (a) input data and output data (results) should be clearly distinctive. All the information necessary for a given task should be presented together or easily accessible;
 - (b) all data required for the performance and M&B applications should be prompted-for or displayed, including correct and unambiguous terms (names), units of measurement (e.g. kg or lbs). The units should match those from other cockpit sources for the same type of data;

- (c) field names and abbreviations used in the GUI should correspond to those used in the manuals and should match the labels in the cockpit;
- (d) if the application computes both dispatch (regulatory, factored) and other results (e.g. in-flight or not factored), the flight crew should be made aware of the nature of the results;
- (e) the application should clearly distinguish user entries from default values or entries imported from other aircraft systems;
- (f) the aircraft tail sign used for calculation must be clearly displayed to the flight crews, if relevant differences between tail signs exist. If tail signs are associated with different sub-fleets, the selected sub-fleet should be clearly displayed to the flight crew;
- (g) the GUI should be designed so that input data are difficult to enter into the wrong fields of the GUI, by defining data entry rules;
- (h) the GUI should only accept input parameters within the aircraft's operational envelope approved for the operator. Consideration should be given to the plausibility of outputs within the AFM envelope but outside normal operating conditions;
- (i) all critical performance calculation assumptions (e.g. use of thrust reversers, full or reduced thrust/power rating) should clearly be displayed. The assumptions made about any calculation should be at least as clear to pilots as similar information would be on a tabular chart;
- (j) the GUI should indicate to the pilot if a set of entries results in an unachievable operation (for instance, a negative stopping margin), in accordance with general HMI considerations;
- (k) the user should be able to modify its input data easily, especially to account for last-minute changes;
- (l) when calculation results are displayed, the most critical input parameters should be visible at the same time;
- (m) any active MEL/CDL/special restriction should be clearly visible and identifiable;
- (n) in case of multiple runway selection, the output data should be clearly associated with the selected runway; and
- (o) changes of runway data by the pilot should be clearly displayed and the changes should be easy to identify.

2.2 The development, testing and approval of a GUI are considerable investments and system integrators and operators are encouraged to evaluate the usability of an existing GUI before developing a new GUI themselves. It is also recommended to review the GUI after some time of operation in the everyday environment for unforeseeable common human errors with special regard to the specific-use case of the operator, which require changes or enhancement of the given design.

2.3 Any new or modified GUI requires exhaustive testing of this component.

2.4 Any major GUI modification requires a new risk assessment by the operator.

3 **PERFORMANCE APPLICATION TESTING**

3.1 The criticality of performance calculations and the importance of the correctness of the calculation results delivered by performance algorithms or calculation modules cannot be over-emphasised and hence the justification for the considerable investment in the development, testing and approval or certification of a performance algorithm or calculation module.

- 3.2 Depending on the EFB set-up three different test phases may apply:
- (a) the **correctness test** checks whether the performance results are consistent with the approved data;
 - (b) a **robustness and constraint test** checks for sensible system behaviour in case incorrect values have been entered; and
 - (c) finally, the **integration test** shall make sure that the application runs in the EFB environment without any issue.

3.3 **Correctness test**

- 3.3.1 When developing a performance calculation module which processes entry variables (e.g. take-off or landing performance calculations), the calculation outputs must be verified. Due to the large number of parameters influencing the results of performance applications, testing all possible combinations of parameter values is not feasible.
- 3.3.2 Test cases should, therefore, be defined to sufficiently cover the operations of the aircraft under a representative cross section of conditions (e.g. for performance applications: runway state and slope, different wind conditions and pressure altitudes, various aircraft configuration including failures with a performance impact, etc.), and take into account the data sources and their individual characteristics (e.g. corner points, break points, etc.). The evaluation effort should be adapted to the type of data source used.
- 3.3.3 For selected calculations, a detailed check against approved data, or where data are not approved in the AFM, the best available data has to be documented. Those calculations must prove that the module's results will match the data source or are consistently conservative throughout the entire operating envelope of the aircraft.
- 3.3.4 The operator should provide an explanation of the methods used to evaluate enough testing points with respect to the design of their software application and databases.
- 3.3.5 Tests, documented graphically or in tabular form, are subject to Authority acceptance.

3.4 **Robustness and constraint test**

- 3.4.1 Sufficient test cases shall make sure that the performance application provides understandable answers or instructions if incorrect input values (outside envelope, wrong combination of inputs) are entered.
- 3.4.2 Even if using incorrect input values, the application shall not fail or get into a state that would require special skills or procedures to bring it back to an operational state.
- 3.4.3 The testing should show that the application, in its operating environment (operating software (OS) and hardware included), is stable and deterministic, i.e. identical answers are generated each time the process is entered with identical parameters.

3.5 **Integration testing**

- 3.5.1 Typically, the design and test of performance applications are done on a different hardware and software environment than the EFB. Thus, integration testing shall make sure that the application runs properly on the EFB environment. These tests should be performed using the final system (e.g. a connected EFB, hosting the performance HMI, while accessing a ground-based performance engine and database via a mobile phone link.)

- 3.5.2 Integration testing shall ensure the performance application(s) produces the same results on the EFB as on the computer it was designed and tested on. In addition, the performance application shall not interfere adversely with other EFB applications or vice versa.
- 3.5.3 Where data from other applications are processed (e.g. T/O performance using results from the M&B application), the correct interfacing of those data shall be tested.
- 3.5.4 Finally the overall acceptability of the performance calculation should be assessed. E.g. the data modification and calculation times should be within acceptable limits to allow quick recalculations in case of dynamic operational conditions like meteorological or last minute runway changes.

4 **M&B APPLICATION TESTING (RESERVED)**

– *Reserved* –

5 **PROCEDURES, MANAGEMENT AND TRAINING**

- 5.1 When approving the operational use of a performance or M&B application(s), due consideration shall also be given to all other processes that contribute to the use of the application.
- 5.2 **Crew operating procedures**
 - 5.2.1 Procedures should be developed that define any new roles that the flight crew and the flight dispatcher may have in creating, reviewing, and using performance or M&B calculations supported by EFBs.
 - 5.2.2 Performance and M&B calculations should be performed by both the pilots independently on independent EFBs, if available.
 - 5.2.3 The results should be cross-checked and differences discussed before the results are used operationally.
 - 5.2.4 Crew procedures should ensure that, in the event of loss of functionality by an EFB through either the loss of a single application or the failure of the device hosting the application, a high level of safety can be maintained. Consistency with the EFB risk assessment assumptions should be confirmed.
- 5.3 **Procedures for EFB security and quality assurance**
 - 5.3.1 Application and data should be checked for integrity and protected against unauthorised manipulation, e.g. by checking file checksum values at EFB start-up or prior to each calculation.
 - 5.3.2 A quality assurance process should apply for all performance-related software application modifications.

5.4 Procedures for addressing EFB failures

- 5.4.1 Procedures should be developed and introduced to assure that EFB failure events, especially those where the EFB failure leads to the calculation of misleading information (such as an error in the AODB), is immediately brought to the attention of other pilots who may be affected.
- 5.4.2 A reporting system shall be in place allowing the operator to detect the nature of problems and to decide on mitigations.

5.5 Flight crew training

- 5.5.1 Training should emphasise the importance of executing all performance calculations in accordance with SOP to assure fully independent calculations. As an example, one pilot should not announce the values to be entered into the HMI of the performance applications, because a wrong announcement could lead to both calculations showing the same misleading results.
- 5.5.2 Training should include cross-checks (e.g. with avionics or flight plan data) and gross error check methods (e.g. “rule-of-thumb”) that may be used by pilots to identify order-of-magnitude errors like entering the ZFM as TOM or transposed digits.
- 5.5.3 It should be understood, that the use of EFBs makes performance calculations simple and does not eliminate the necessity of good pilot performance knowledge.
- 5.5.4 Using EFBs, new procedures may be introduced (e.g. the use of multiple flaps settings for take-off) and pilots should be trained accordingly.

5.6 Management of performance EFB applications

- 5.6.1 Within the operator’s organisation, the responsibilities between the performance management, other departments involved and the EFB management should be if separate, clear and well-documented. Furthermore, an operator needs to utilise a designated person/group who is sufficiently trained to provide support for the performance tools. This person/group must have comprehensive knowledge of current regulations, aircraft performance and performance software (e.g. SCAP modules) used on the EFB.

APPENDIX B ELECTRONIC CHARTING

1 Description

- 1.1 An EFB software application that supports route planning, route monitoring and navigation by displaying required information and includes visual, instrument and aerodrome charts.
- 1.2 Considerations:
- (a) electronic aeronautical charts should provide, at least to a minimum, a level of information and usability comparable to paper charts;
 - (b) for approach charts, the EFB software application should be able to show the entire instrument approach procedure all at once on the intended EFB hardware, with a degree of legibility and clarity equivalent to that of a paper chart;
 - (c) an EFB display may not be capable of presenting an entire chart (e.g. airport diagram, departure/arrival procedures, etc.) if the chart is the expanded detail (fold-over) type;
 - (d) panning, scrolling, zooming, rotating, or other active manipulation is permissible; and
 - (e) for data driven charts, it should be assured that shown symbols and labels remain clearly readable, (e.g. not overlapping each other). Layers of data may be used for de-cluttering.

APPENDIX C AIRCRAFT EXTERIOR VIDEO SURVEILLANCE

- 1 Description
 - 1.1 Aircraft exterior surveillance may be an EFB hosted software application to increase situational awareness during taxi by displaying real-time video of the actual external scene.
- 2 Considerations:
 - (a) ensure real-time, live display of received imagery without noticeable time-lapse;
 - (b) adequate image quality during foreseeable environmental lighting conditions;
 - (c) display of turning or aircraft dimension aids may be provided, (e.g. turning radius, undercarriage track width, etc.). In such cases, the information provided to the pilot should be verified to be accurate;
 - (d) connection to one or more installed vision systems. Vision systems include, but are not limited to, visible light cameras, forward-looking infrared sensors and intensifying low-light level images;
 - (e) operators should establish SOPs for use of the application. Training should emphasise use of as an additional resource and not as a primary means for ground navigation or avoiding obstacles; and
 - (f) pilot use should not induce disorientation.

APPENDIX D AIRPORT MOVING MAP (AMM)

- 1 Introduction
 - 1.1 This section provides some consideration on how to demonstrate the safe operational use for AMM applications to be hosted on EFBs.
 - 1.2 An EFB AMM 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 AMM function is not to be used as the primary means of taxiing navigation. This application is limited to ground operations only.
 - 1.3 The AMM application is designed to indicate the aircraft position and heading (in case the own-ship position symbol is directional) on dynamic maps. The maps graphically portray runways, taxiways and other airport features to support taxi and taxi-related operations. Additionally, warning functions can be provided which notify crews about potentially dangerous conditions, i.e. inadvertently entering a RWY.
- 2 Considerations for AMM:
 - (a) an AMM application should not be used as the primary means of taxiing navigation; primary means of taxiing navigation remains the use of normal procedures and direct visual observation out of the cockpit window;
 - (b) the display of own-ship information in the AMM application should comply with the requirements detailed in para 4.3.4 of this AC.

APPENDIX E EFB POLICY AND PROCEDURES MANUAL

- 1 The following are typical contents of an EFB policy and procedures manual that can be fully or partly integrated in the Operations Manual, as applicable.
- 2 The structure and content of the EFB policy and procedures manual should correspond to the size of the operator, the complexity of its activities and the complexity of the EFB used.
 - Introduction
 - EFB general philosophy
 - EFB limitations
 - EFB approved hardware and software applications
 - EFB management
 - Responsibilities
 - Data management
 - Updates and changes management
 - Hardware description
 - EFB system architecture
 - Hardware configuration control
 - Software description
 - Operating system description
 - List and description of applications hosted
 - Flight crew training
 - Operating procedures
 - Maintenance considerations
 - Security considerations

APPENDIX F EVALUATION CHECKLIST

Part 1 – HARDWARE		
1	Have the installed EFB resources been certified by a CAA to accepted aviation standards either during the certification of the aircraft, service bulletin by the original equipment manufacturer, or by a third-party STC?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
2	Has the operator assessed the physical use of the device on the flight deck to include safe stowage, crashworthiness (mounting devices and EFBs, if installed), safety and use under normal environmental conditions including turbulence?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
3	Will the display be readable in all the ambient lighting conditions, both day and night, encountered on the flight deck?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
4	Has the operator demonstrated that the EFB will not electromagnetically interfere with the operation of aircraft equipment?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
5	Has the EFB been tested to confirm operation in the anticipated environmental conditions (e.g. temperature range, low humidity, altitude, etc.)?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
6	Have procedures been developed to establish the level of battery capacity degradation during the life of the EFB?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
7	Is the capability of connecting the EFB to certified aircraft systems covered by an airworthiness approval?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
8	When using the transmitting functions of a portable EFB during flight, has the operator ensured that the device does not electromagnetically interfere with the operation of the aircraft equipment in any way?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
9	If two or more EFBs on the flight deck are connected to each other, has the operator demonstrated that this connection does not negatively affect otherwise independent EFB platforms?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
10	Can the brightness or contrast of the EFB display be easily adjusted by the flight crew for various lighting conditions?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
Part 2 - INSTALLATION		
Mounting		
1	Has the installation of the mounting device been approved in accordance with the appropriate airworthiness regulations?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
2	Is it evident that there are no mechanical interference issues 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 other equipment such as buckles, oxygen hoses, etc.?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
3	Has it been confirmed that the mounted EFB location does not impede crew ingress, egress and emergency egress path?	Yes <input type="checkbox"/> No <input type="checkbox"/>

		N/A <input type="checkbox"/>
4	Is it evident that the mounted EFB does not obstruct visual or physical access to aircraft displays or controls?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
5	Does the mounted EFB location minimise the effects of glare and/or reflections?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
6	Does the mounting method for the EFB allow easy access to the EFB controls and a clear unobstructed view of the EFB display?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
7	Is the EFB mounting easily adjustable by flight crew to compensate for glare and reflections?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
8	Does the placement of the EFB allow sufficient airflow around the unit, if required?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
PART 3 - SOFTWARE		
<i>Note — This part should be completed multiple times to account for the different software applications being considered.</i>		
Software application: _____ (fill in name of software application)		
1	Is the application considered an EFB function (see paragraph 4 of this AC)?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
2	Has the software application been evaluated to confirm that the information being provided to the pilot is a true and accurate representation of the documents or charts being replaced?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
3	Has the software application been evaluated to confirm that the computational solution(s) being provided to the pilot is a true and accurate solution (e.g. performance, and mass and balance (M&B), etc.)?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
4	Does the software application have adequate security measures to ensure data integrity (e.g. preventing unauthorised manipulation)?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
5	Does the EFB system provide, in general, a consistent and intuitive user interface, within and across the various hosted applications?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
6	Has the EFB software been evaluated to consider HMI and workload aspects?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
7	Does the software application follow Human Factors guidance?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
8	Can the flight crew easily determine the validity and currency of the software application and databases installed on the EFB, if required?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>

Power connection / Battery		
1	Is there a means other than a circuit-breaker to turn off the power source (e.g. can the pilot easily remove the plug from the installed outlet)?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
2	Is the power source suitable for the device?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
3	Have guidance/procedures been provided for battery failure or malfunction?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
4	Is power to the EFB, either by battery and/or supplied power, available to the extent required for the intended operation?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
5	Has the operator ensured that the batteries are compliant to acceptable standards?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
Cabling		
1	Has the operator ensured that any cabling attached to the EFB, whilst mounted or <i>hand-held</i> does not present an operational or safety hazard (e.g. it does not interfere with flight controls movement, egress, oxygen mask deployment, etc.)?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
Stowage		
1	If there is no mounting device available, can the EFB be easily stowed securely and readily accessible in flight?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
2	Is it evident that stowage does not cause any hazard during aircraft operations?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
Viewable Stowage		
1	Has the operator documented the location of its viewable stowage?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
2	Has the operator assessed that the stowage characteristics remain within acceptable limits for the proposed operations?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
3	Has the operator assessed that if the EFB moves or is separated from its stowage, or if the viewable stowage is unsecured from the aircraft (because of turbulence, maneuvering, or other action), it will not interfere with flight controls, damage flight deck equipment, or injure flight crew members? (A full motion flight simulator may be used for this assessment)	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>

PART 4 - MANAGEMENT		
EFB Management		
1	Is there an EFB management system in place?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
2	Does one person possess an overview of the complete EFB system and responsibilities within the operator's management structure?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
3	Are the authorities and responsibilities clearly defined within the EFB management system?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
4	Are there adequate resources assigned for managing the EFB?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
5	Are third parties (e.g. software vendor) responsibilities clearly defined?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
Crew Procedures		
1	Is there a clear description of the system, its operational philosophy and operational limitations?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
2	Are the requirements for EFB availability in the operations manual and / or as part of the minimum equipment list (MEL)?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
3	Have crew procedures for EFB operation been integrated within the existing operations manual?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
4	Are there suitable crew cross-checks for verifying safety-critical data (e.g. performance, mass & balance (M&B) calculations)?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
5	If an EFB generates information similar to that generated by existing flight deck systems, do procedures identify which information will be primary?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
6	Are there procedures when information provided by an EFB does not agree with that from other flight deck sources, or, if more than one EFB is used, when one EFB disagrees with another?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
7	Are there procedures that specify what actions to take if the software applications or databases loaded on the EFB are out of date?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
8	Are there procedures in place to prevent the use of erroneous information by flight crews?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
9	Is there a reporting system for system failures?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>

10	Have crew operating procedures been designed to mitigate and/or control additional workload created by using an EFB?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
11	Are there procedures in place to inform maintenance and flight crews about a fault or failure of the EFB, including actions to isolate it until corrective action is taken?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
EFB risk assessment		
1	Has an EFB risk assessment been performed?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
2	Are there procedures/guidance for loss of data and identification of corrupt/erroneous outputs?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
3	Are there contingency procedures for total or partial EFB failure?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
4	Is there a procedure in the event of EFB failure? The operator may employ mitigation strategies to reduce the probability of EFB failures prior to becoming airborne. Adequate mitigations must be employed to ensure pertinent critical information resident on the EFB is available to the flight crew during the flight. In such cases the operator will have to demonstrate to CAAS a full Operational Risk Assessment with suitable means of mitigation against failure or malfunction of all EFBs	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
5	Have the EFB dispatch requirements (e.g. minimum number of EFBs on board) been incorporated into the operations manual?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
6	Have MEL or procedures in case of EFB failure been considered and published?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
Training		
1	Is the training material appropriate with respect to the EFB equipment and published procedures?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
2	Does the training cover the list of items in paragraph 9 — <i>Flight crew training</i> – of this AC?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
Hardware management procedures		
1	Are there documented procedures for the control of EFB hardware configuration?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
2	Do the procedures include maintenance of EFB equipment?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
Software Management Procedures		

1	Are there documented procedures for the configuration control of loaded software and software access rights to the EFB?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
2	Are there adequate controls to prevent corruption of operating systems, software, and databases?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
3	Are there adequate security measures to prevent system degradation, malware and unauthorised access?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
4	Are procedures defined to track database expiration/updates?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
5	Are there documented procedures for the management of data integrity?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>
6	If the hardware is assigned to the flight crew, does a policy on private use exist?	Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>