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Manual on Electronic Flight Bags (EFBs)

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Chapter 1

INTRODUCTION

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

An EFB is defined Annex 6 as:

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

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

- Part I (International Commercial Air Transport – Aeroplanes), paragraph 6.24;
- Part II (International General Aviation – Aeroplanes), paragraph 2.4.17;
- Part III (International Commercial Operations – Helicopters), Section 2, paragraph 4.17; and
- Part III (International General Aviation – Helicopters), Section 3, paragraph 4.12.

When referencing Sections 2.4.17.1, 4.12.1, 4.17.1, 6.24.1 of the EFB SARPs, it is to be understood that EFBs shall not adversely affect the performance of the aeroplane/helicopter systems.

Sections 6.24.1 and 6.24.2 of the EFB SARPs addresses the responsibilities of States and operators regarding EFB hardware and EFB functions. As stated in Annex 6, this manual is complementing the SARPs by proposing guidance to understand the intent and objectives of the requirements to perform an operational evaluation of an EFB system and its commonly used functions, and where appropriate, to grant an specific approval.

Operators are encouraged to use it also as a source of information.

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

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Chapter 2

ACRONYMS AND DEFINITIONS

2.1 ACRONYMS

AFM	Aeroplane flight manual
AID	Aircraft interface device
AMMD	Airport moving map display
AODB	Airport and obstacles database
CAA	Civil aviation authority
CDL	Configuration deviation list
CPU	Central processing unit
EMI/EMC	Electro-magnetic interference/electro-magnetic compatibility
FCOM	Flight crew operating manual
GNSS	Global navigation satellite system
GUI	Graphical user interface
HMI	Human-machine interface
MAC	Mean aerodynamic chord
M&B	Mass and balance
MEL	Minimum equipment list
PED	Portable electronic device
SCAP	Standard computerized aircraft performance
SOP	Standard operating procedure
STC	Supplemental type certificate
TACS	Taxi aid camera system
TC	Type certificate
T/O	Take-off
TOM	Take-off mass
T-PED	Transmitting PED
ZFM	Zero fuel mass

2.2 DEFINITIONS

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

Critical phases of flight. As defined by the State of the Operator, e.g. take-off, approach and landing.

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

EFB software application. Software function hosted on an EFB platform.

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

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

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

Portable electronic device (PED). Typically lightweight consumer electronic device which is functionally capable for communications, data processing and/or utility.

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

Transmitting PED. A PED containing one or more devices intentionally emitting radio frequencies (WIFI, GSM, Bluetooth, etc.).

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Chapter 3

EQUIPMENT/HARDWARE CONSIDERATIONS

3.1 **Types of EFB**

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

b) Portable EFBs are not part of the aircraft configuration and are considered as PEDs. They generally have self-contained power and may rely on data connectivity to achieve full functionality. Modifications to the aircraft to use portable EFBs require the appropriate airworthiness approval depending on the State's regulatory framework.

c) Installed EFBs are integrated into the aircraft, subject to normal airworthiness requirements and under design control. The approval of these EFBs is included in the aircraft's type certificate (TC) or in a supplemental type certificate (STC).

3.2 **Hardware considerations for installed resources and mounting device**

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.

3.2.1 Mounting devices

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

a) the mounting method for the EFB should allow easy access to the EFB controls and a clear unobstructed view of the EFB display by the pilot when strapped in the normal seated position. It should be located such that the effects of glare and/or reflections are minimized. This may be accomplished by providing some adjustment by the flight crew to compensate for glare and reflections;

b) it should be confirmed that the intended EFB hardware mounted in the device does not obstruct visual or physical access to aircraft displays, controls, or external vision and that its location does not impede crew ingress, egress and emergency egress paths; and

c) there should be no mechanical interference between the EFB in its mounting device and any of the flight controls in terms of full and free movement, under all operating conditions and no interference with buckles, oxygen hoses, etc.

3.2.2 Data Connectivity

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

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

3.2.3 Power to the EFB

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

3.3 **Hardware considerations for portable EFBs**

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, suction cup, etc.).

3.3.1 Physical characteristics

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

3.3.2 Readability

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

3.3.3 Environmental

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

3.3.4 Basic non-interference testing

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

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

3.3.4.3 **Method 1**

Step 1 is an electromagnetic interference (EMI) test using RTCA/DO-160, Section 21, Category M. An EFB vendor or other source can conduct this test for an EFB user/operator. An evaluation of the results of the RTCA/DO-160 EMI test can be used to determine if an adequate margin exists between the EMI emitted by the EFB and the interference susceptibility threshold of aircraft equipment. If this step determines that adequate margins exist for all interference, then the test is complete. However, if this step identifies inadequate margins for interference, then step 2 testing must be conducted.

Step 2 testing is a complete test in each aircraft using standard industry practices. This should be done to the extent normally considered acceptable for non-interference testing of a portable EFB in an aircraft for all phases of flight. Credit may be given to other aircraft of the same make and model equipped with the same avionics as the one tested.

3.3.4.4 **Method 2**

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

3.3.5 Additional testing for transmitting portable EFBs

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

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's intentional transmissions (Test Requirement 1), and basic non-interference testing has been conducted with the device not deliberately transmitting (Chapter 3.3.4), non-interference testing should be conducted with 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.

3.3.6 Power supply, connection and source

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

3.3.6.2 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.

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

3.3.7 Batteries

3.3.7.1 The operator should ensure that the batteries are compliant to the applicable standards for use in an aircraft.

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

a) risk of leakage;

b) safe storage of spares including the potential for short circuit; and

c) hazards due to on-board continuous charging of the device, including battery overheat.

3.3.8 Cabling

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

3.3.9 Temperature rise

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

3.3.10 Data connectivity between EFBs

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

3.3.11 Data connectivity to aircraft systems

See paragraph 3.2.2.

3.3.12 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 operator ground network). External connectivity leading to a change to the aircraft type design should require an airworthiness approval. The extent of this information is dependent on the complexity of the interface to the aircraft systems.

3.3.13 Stowage

All handheld 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.

Viewable stowage

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

Some types of viewable stowage securing means may have characteristics that degrade sensibly with ageing 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.

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

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Chapter 4

HUMAN FACTORS

The operator should carry out an assessment of the human-machine interface and aspects governing crew coordination when using the EFB. Whenever possible, the EFB user interface philosophy should be consistent (but not necessarily identical) with the flight deck design philosophy. The review of the complete system should include but 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 us ing EFB applications, EFB policy and procedures manual, fidelity of EFB training device, and mechanisms for gathering user feedback on EFB use;

e) hardware considerations – refer to Chapter 3; and

f) software considerations – refer to Chapter 4.

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Chapter 5

CREW OPERATING PROCEDURES

5.1 General

5.1.1 The operator should have procedures for using the EFB in conjunction with the other flight deck equipment.

5.1.2 If an EFB generates information similar to that generated by existing flight deck systems, 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.

5.1.3 If normal operational procedures require an EFB for each flight deck crew member, the setup should comply with the definition of independent EFB platforms.

5.1.4 Operators should include the requirements for EFB availability in the Operations Manual and/or as part of the minimum equipment list.

5.2 Revisions and updates

5.2.1 The operator should have a procedure in place to allow flight crews 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).

5.2.2 Flight crews should not have to confirm the revision dates for other databases that would not adversely affect flight operations in case of outdated data. Procedures should specify what actions to take if the software applications or databases loaded on the EFB are out-of-date.

5.3 Workload and crew coordination

5.3.1 In general, using an EFB should not increase 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.

5.3.2 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.

5.4 **Reporting**

A reporting system for EFB failures should be established. Procedures should be 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.

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Chapter 6

FLIGHT CREW TRAINING

The use of the EFB should be conditional on 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) pre-flight 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 the authority.

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Chapter 7

EFB RISK ASSESSMENT

7.1 General

7.1.1 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.

7.1.2 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.

7.1.3 The guidance on safety risk assessment is contained in the *Safety Management Manual (SMM)* (Doc 9859).

7.2 EFB failures and mitigation means

7.2.1 Based on the outcome of the EFB risk assessment, the operator should determine the need for software architectural features, people, procedures, and/or equipment to eliminate, reduce, or control risks associated with an identified failure in a system.

7.2.2 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 fall-back 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 crewmembers;

f) complete set of sealed paper backups in the flight deck; and/or

g) procedural means.

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Chapter 8

EFB FUNCTIONS

8.1 General

8.1.1 Annex 6 — *Operation of Aircraft*, Part I — *International Commercial Air Transport — Aeroplanes* and Part III — *International Operations — Helicopters*, Section II require that the State of the Operator specifically approves the operational use of EFB functions to be used for the safe operations of aircraft.

8.1.2 Annex 6, Part II — *International General Aviation — Aeroplanes* and Part III, Section III require that the State of Registry establishes criteria for the operational use of EFB functions to be used for the safe operations of aircraft.

8.1.3 EFB functions to be used for the safe operations of aircraft are considered to be those whose failure, malfunction or misuse would have 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.).

8.1.4 Those functions should be recorded in the operations manual and linked to the operations specifications as proposed in Appendix C (for commercial air transport), (see 9.6).

8.1.5 The applications below may be considered to be 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 display (AMMD) applications, not used as a p rimary means of navigation on the ground and used in conjunction with other materials and procedures;

d) cabin-mounted video and aircraft exterior surveillance camera displays;

e) aircraft performance calculation application to provide take-off, en-route, approach, landing and missed approach performance calculations; and

f) mass and balance calculation application.

Those functions require special attention during their evaluation, as described in Appendix A.

8.1.6 On the contrary, the following features are not EFB functions and, unless certified as avionics functions, should not be hosted on an EFB:

a) displaying information which may be tactically used by the flight-crew members to check, control, or deduce the aircraft position or trajectory, either to follow the intended navigation route or to avoid adverse weather, obstacles or other traffic, in flight or on ground (except AMMD as described above);

b) 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 r eplacement for existing installed avionics, and/or to manage aircraft critical and essential systems following failure;

c) communicating with air traffic control;

d) sending data to the certified aircraft systems other than the EFB installed/shared resources; and

e) if the CAA determines that the function requires airworthiness certification.

8.2 **Considerations for all EFB functions**

8.2.1 Software HMI

8.2.1.1 The EFB system should provide an intuitive, and in general, consistent user interface within and across the various hosted EFB applications. This should include, but not be limited to, data entry methods, colour-coding philosophies, and symbology.

8.2.1.2 Software considerations, including ease o f access to common functions, consistency of symbols, terms and abbreviations, legibility of text, system responsiveness, methods of interaction, use of colour, display of system status, error messages, management of multiple applications, off screen text/content and use of active regions should be addressed.

8.2.1.3 *Use of colours and messages*. The colour “red” should be used only to indicate a warning level condition. “Amber” should be used to indicate a caution level condition. Any other colour may be used for items other than warnings or cautions, providing that the colours used, differ sufficiently from the colours prescribed to avoid possible confusion. EFB messages and reminders should be integrated with (or compatible with) presentation of other flight deck system alerts. EFB aural messages should be inhibited during critical phases of flight. If, however, there is a regulatory requirement that is in conflict with the recommendation above, those should have precedence.

8.2.1.4 *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 prioritize these EFB status and fault messages.

8.2.1.5 *Data entry and error messages*. If user-entered data is 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 is expected.

8.2.1.6 *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.

8.2.1.7 *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.

8.2.2 Electronic signatures

8.2.2.1 State regulations may require a signature to signify acceptance or to confirm the authority.

8.2.2.2 In order 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.

Note.— Guidance on electronic signatures is contained in the Safety Management Manual (SMM) *(Doc 9859).*

8.3 **Considerations for EFB functions to be used for the safe operations of aircraft**

8.3.1 EFB management

8.3.1.1 The operator should have an EFB management system in place. Complex EFB systems may require more than one individual to support the EFB management system. However, one person (e.g. dedicated EFB manager, OPS director, etc.) should possess an overview of the complete EFB system and responsibilities within the operator's management structure.

8.3.1.2 EFB management is the key link between the operator and the EFB system and software suppliers.

8.3.1.3 EFB management is responsible for hardware and software configuration management, and for ensuring, in particular, that no unauthorized software is installed. EFB management is also responsible for ensuring that only a valid version of the application software and current data packages are installed on the EFB system. For some software applications there should be a means for operators to carry out their own check of data content prior to load and/or release for operational use.

8.3.1.4 The EFB management system should ensure that software applications supporting function(s) not directly related to operations conducted by the flight crew on the aircraft (e.g. web browser, e-mail client, picture management, etc.) do not adversely impact the operation of the EFB.

8.3.1.5 Each person involved in EFB management should receive appropriate training in their role and should have a good working knowledge of the proposed system hardware, operating system and relevant software applications as well as knowledge about flight operations.

8.3.1.6 EFB management should establish procedures to ensure that no unauthorized changes take place to EFB functions. EFB policy and procedures manual may be part of the operator's operations manual (see Appendix D).

8.3.1.7 Procedures should be established for the maintenance of the EFB.

8.3.1.8 EFB management should be responsible for the procedures and systems, documented in the EFB policy and procedures manual, that maintain EFB security and integrity. The required level of EFB security depends on the criticality of the used functions.

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Chapter 9

OPERATIONAL EVALUATION PROCESS

The process is designed to lead to specific operational approval, where such is required, and consists of the following courses of actions. Elements of this process are to be understood as guidelines for CAAs and operators and may also be used in instances where specific approval is not required.

Note.— This process is applicable to commercial air transport only.

9.1 Definition of the scope

9.1.1 The scope of the operational evaluation plan will depend upon the applicant's experience with EFBs. Considerations should include whether the operator has:

a) no EFB experience, thus requiring a "new application and approval process"; or

b) initiated the process of establishing an EFB programme; or

c) an existing approved EFB programme established.

9.1.2 An operator implementing EFB functions may choose to start a paperless flight deck operation without paper backup or combination of solutions with limited on-board paper backup. The operator 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.

9.2 Initial discussion with the CAA (Phase 1)

During this phase, the regulator and the operator reach a common understanding of what needs to be evaluated, the applicable requirements, whether trials should take place and when, how they must be conducted and documented, the role of the regulator, and what documents and actions the operator is responsible for during each phase of the approval process.

9.3 Application (Phase 2)

Phase 2 begins when the operator submits a formal compliance plan to the CAA for evaluation. The plan is reviewed for completeness and compliance to the regulations and the CAA may coordinate with other inspectors and regulatory offices as necessary. Once the CAA is satisfied with the submitted plan, the operator follows that plan to produce a complete EFB programme. The operator must clarify the intent of the operation (with or without paper backup or a combination of paperless and paper). The applicant will typically submit information in the application package such as:

a) EFB operational suitability report (if applicable);

b) EFB hardware and application specifications;

c) EFB operator procedures/manual revisions;

d) EFB training programme;

e) EFB evaluation report;

f) EFB risk assessment.

9.4 **Authority review (Phase 3)**

9.4.1 The CAA should use a checklist (see Appendix B) to conduct a review of the application submitted by an operator.

9.4.2 Where an operator seeks to start operations with a new EFB system, the CAA should participate in the simulator evaluation or flight evaluation of an EFB. 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 an existing EFB approval, the suitability of the EFB for that aircraft must be addressed. The CAA should examine the technical content and quality of the proposed EFB programme and other supporting documents and procedures.

9.5 **Operational evaluation (Phase 4)**

9.5.1 The operator should conduct an operational evaluation which should allow verifying that the above elements have been satisfied. The operator should notify its competent authority of its intention to conduct an operational evaluation by sending a plan and keep a receipt of this notification in the aircraft during the test period.

9.5.2 During this validation phase, operators transitioning from paper to EFB should maintain paper backup 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. Appendix B may be used for data collection during the validation phase.

9.5.3 Operators starting EFB operations without paper backup should have adequate mitigations means in place to access the information in case of EFB failures.

9.5.4 Final considerations by the approving authority:

a) *Unacceptable validation results*. If the CAA finds the proposed EFB reliability and/or function to be unacceptable, the CAA should contact the operator for corrective action. EFB deficiencies should be corrected and the EFB function revalidated prior to approval being issued.

b) *Acceptable validation results*. If the CAA finds the proposed EFB reliability and/or function to be acceptable based on validation data, then the specific approval may be issued.

9.6 Issuance of **EFB Operations Specification and approval (Phase 5)**

The regulatory authority granting a specific EFB approval to the operator should update the Operations Specifications with an EFB entry. The operations specification will reference the location in the operations manual where more details of the approved EFB applications can be found (see Appendix C).

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Chapter 10

EFB USE IN GENERAL AVIATION OPERATIONS

10.1 Criteria for the use of EFB functions used for the safe operations of aircraft

10.1.1 As stated in paragraph 2.4.17 of Annex 6, Part II, the State of Registry shall establish criteria for the operational use of EFB functions to be used for the safe operations of aeroplanes.

10.1.2 These criteria are considered to be additional requirements to EFB general requirements for the use of EFB functions defined in paragraph 8.1 and should be based on the following paragraphs of this manual:

a) hardware considerations for portable EFBs (Chapter 3, 3.3);

b) EFB Risk assessment (Chapter 7);

c) EFB failure and mitigation means (Chapter 7, 7.4);

d) EFB management (Chapter 8, 8.3.1);

e) crew operating procedures (Chapter 5); and

f) flight crew training (Chapter 6).

10.1.3 When defining these criteria, the State of Registry should take into account the following principles:

a) the EFB system should not replace any system or equipment (e.g. navigation, communication, or surveillance system) that is required by aviation regulations;

b) when an EFB system replaces or substitutes regulatory material, it displays information which is functionally equivalent to it;

c) the use of the EFB does not adversely affect equipment or systems required for flight. Information on conducting electromagnetical interference tests can be found in paragraph 3.3.4 of this manual.

10.2 Additional considerations for general aviation

As stated in Chapter 9, the operational evaluation process is not applicable, but it is nevertheless recommended that pilot-in-command and/or the operator/owner undergo an evaluation period to ensure mitigations to risk are addressed. Risks include EFB failures, EFB misuse and other EFB malfunctions. In the specific case of the transition to a paperless cockpit, paper backups of the material on the EFB should be carried on-board during the evaluation period and be readily available to the pilot-in-command. During this period the pilot-in-command or owner/operator should validate that the EFB is as available and reliable as the paper-based system being replaced, if applicable.

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APPENDIX A

GUIDANCE FOR EFB SOFTWARE APPLICATIONS

Preamble

The purpose of this appendix is to provide information on best practices and general guidance for the development of commonly used EFB software applications. The specific examples used are not intended to preclude alternate methods which may accomplish similar objectives. In addition, operators who have been granted a specific approval for particular EFB software applications may wish to consider adopting the methods discussed within this attachment.

Manufacturers, operators or vendors should carefully consider their particular operational needs when developing EFB software applications in an effort to maintain the highest safety and reliability standards for their specific use case.

1. PERFORMANCE (TAKE-OFF, LANDING) AND MASS AND BALANCE

1.1 Introduction

1.1.1 The use of EFB software applications to compute performance and mass and balance (M&B) data has become common in recent years. The computing power and versatility offered by off-the-shelf electronic devices such as laptops and tablets, associated to their flexibility for development and use (in comparison to certified platforms) have allowed the creation of numerous applications for most types of aircraft.

1.1.2 The validity and integrity of performance and M&B data is of the highest relevance for the safety of the flight, and that these applications and the procedures for their use have to be properly evaluated before being approved for service.

1.1.3 A proper calculation workflow is of little use if data is not valid in the first place. The verification of the performance data and calculation algorithms correctness is therefore one essential step of the evaluation.

1.1.4 The other part of the evaluation has to deal with the user interface and crew procedures. Experience has shown that errors involving data entry or interpretation can be frequent. A proper HMI on one side, with adequate administration and crew procedures and training on the other, are necessary to mitigate those errors.

1.2 Performance applications architecture

1.2.1 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 databases (AODB).

The Figure 1 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 below, but rather have the different parts integrated into one software. On the other hand, there might be solutions where modularity is taken to a point where some or all parts are supplied by different providers.

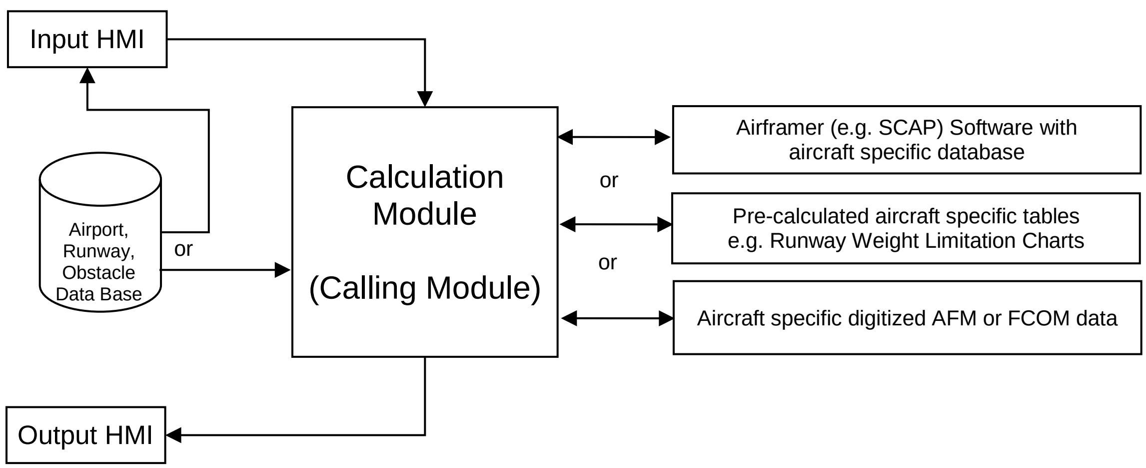

Figure 1. Typical architecture of a performance application

1.2.2 *Input and output HMI*. The Input HMI takes 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.

1.2.3 *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.

1.2.3.1 Calculation modules are commonly set-up 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.

1.2.3.2 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.

1.2.3.3 Where manufacturer software is not available, paper AFM or FCOM charts may have to be digitized.

1.2.4 *Performance data sources*. Different sources of performance data can be used by performance applications. Performance data can be delivered in a digitized format:

a) SCAP modules or equivalent delivered by the manufacturer. The SCAP module is either based on equations of motion or digitized AFM material. Modules may or may not come from an airworthiness approved electronic flight manual;
b) the operator can build its own digitized performance data, based on the data published in the flight manual; and

c) data based on pre-calculated take-off or landing performance tables.

1.2.5 *Airport, runway, obstacle database (AODB).* Take-off and landing performance applications require information about airport, runway and obstacles. 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. The management of this data is critical. The operator is responsible for the data quality, accuracy and integrity of the runway and obstacle data, and should ensure this together with the data provider.

1.3 **Performance and mass and balance (M&B) applications graphical user interface**

1.3.1 Operators and authorities should be aware of the criticality of performance calculations and incidents and accidents where pilot data entry errors have been a contributing factor. A good, well-designed graphical user interface (GUI) can significantly reduce the risk of errors. Below are examples of design guidelines that are supplemental to the software HMI considerations from Chapter 4:

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 the ones from other cockpit sources for the same kind 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 allows to compute both dispatch (regulatory, factored) and other results (e.g. in-flight or unfactored), the flight crew should be made aware of the nature of the results;

e) the application should allow to 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 to 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 should be 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 (commonly more limiting than the certified envelope). 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 (see Chapter 4);

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 showed and the changes should be easy to identify.

1.3.2 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 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.

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

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

1.4 **Performance application testing**

1.4.1 Operators and authorities should be aware of the criticality of performance calculations and the importance of the correctness of the calculation results delivered by performance algorithms or calculation modules.

1.4.2 The development, testing and approval or certification of a performance algorithm or calculation modules is a considerable investment.

1.4.3 Depending on the EFB setup 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.

1.4.4 Correctness test

1.4.4.1 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. 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 (see paragraph 1.2).

1.4.4.2 For selected calculations, a d etailed check against approved data or, where data is 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.

1.4.4.3 An applicant should provide an explanation of the methods used to evaluate a sufficient number of testing points with respect to the design of their software application and databases.

1.4.4.4 Tests can be documented graphically or in tabular form, as is acceptable to the authority.

1.4.5 Robustness and constraint test

1.4.5.1 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.

1.4.5.2 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.

1.4.5.3 The testing should show that the application, in its operating environment (OS and hardware included), is stable and deterministic, i.e. identical answers are generated each time the process is entered with identical parameters.

1.4.6 Integration testing

1.4.6.1 Typically the design and test of performance applications is 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.)

1.4.6.2 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.

1.4.6.3 Where data from other applications are processed (e.g. T/O performance using results from W&B application), the correct interfacing of those data shall be tested.

1.5 **M&B application testing (Reserved)**

- Reserved -

1.6 **Procedures, management and training**

1.6.1 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.

1.6.2 Crew operating procedures

1.6.2.1 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.

1.6.2.2 Performance and M&B calculations should be performed by both pilots independently on independent EFBs, if available.

1.6.2.3 The results should be crosschecked and differences discussed before the results are used operationally.

1.6.2.4 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, an equivalent level of safety can be maintained. Consistency with the EFB risk assessment assumptions should be confirmed.

1.6.3 Procedures for EFB security and quality assurance

1.6.3.1 Application and data should be checked for integrity and protected against unauthorized manipulation, e.g. by checking file checksum values at EFB start-up or prior to each calculation.

1.6.3.2 A quality assurance process should apply for all performance related software application modifications.

1.6.4 Procedures for addressing EFB failures

1.6.4.1 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 effected.

1.6.4.2 A reporting system shall be in place, allowing the operator to detect the nature of problems and to decide on mitigations.

1.6.5 Flight crew training

1.6.5.1 Training should emphasize 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.

1.6.5.2 Training should include cross checks (e.g. with avionics or flight plan data) and gross error checks 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.

1.6.5.3 It should be understood, that the use of EFBs makes performance calculations simple and does not eliminate the necessity of good pilot performance knowledge.

1.6.5.4 Through the use of EFBs, new procedures may be introduced (e.g. the use of multiple flaps settings for takeoff) and pilots should be trained accordingly.

1.6.6 Management of performance EFB applications

Within the operator's organization, 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 utilize a designated person/group which 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 (eg SCAP modules) used on the EFB.

2. **ELECTRONIC CHARTING**

2.1 **Description**

2.1.1 An EFB software application that supports route planning, route monitoring and navigation by displaying required information. Includes visual, instrument and aerodrome charts.

2.1.2 Considerations:

a) electronic aeronautical charts should provide, at least to a minimum, a l evel 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.

Note.— See also Annex 4 — Aeronautical Charts*, Section 20 – Electronic aeronautical chart display.*

3. TAXI AID CAMERA SYSTEM (TACS)

3.1 Description

3.1.1 TACS is an EFB software application to increase situational awareness during taxi by displaying electronic real-time images of the actual external scene.

3.1.2 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 this case, the information provided to the pilot should have been verified to be accurate;

d) connection to one or more installed vision system. Vision systems include but are not limited to visible light cameras, forward-looking infrared sensors and low-light level image intensifying;

e) operators should establish SOPs for use of TACS. Training should emphasize use of TACS as an additional resource and not as a primary means for ground navigation or avoiding obstacles; and

f) pilot use of TACS should not induce disorientation.

4. AIRPORT MOVING MAP DISPLAY (AMMD)

4.1 This section provides some consideration on how to demonstrate the safe operational use for AMMD applications to be hosted on EFBs.

4.2 An EFB AMMD with own-ship position symbol is designed to assist flight crews in orienting themselves on the airport surface to improve pilot positional awareness during taxi operations. The AMMD function is not to be used as the primary means of taxiing navigation. This application is limited to ground operations only.

4.3 The AMMD application is designed to indicate airplane position and heading (in case the own-ship 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 like inadvertently entering a RWY.

4.4 Considerations for AMMD:

a) AMMD 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 total system error of the end-to-end system should be specified and characterized by either the AMMD software developer, EFB vendor or OEM, etc. The accuracy should be sufficient to ensure that the own-ship symbol is depicted on the correct runway or taxiway;

c) the AMMD should provide compensation means for the installation dependent antenna position bias error, i.e. along track error associated to the GNSS antenna position to the flight deck;

d) the system should automatically remove the own-ship position when the aircraft is in flight (e.g. weight on wheels, speed monitoring) and when the positional uncertainty exceeds the maximum defined value;

e) it is recommended that the AMMD detects, annunciates to the flight crew and fully removes depiction of own-ship data, in case of any loss or degradation of AMMD functions due to failures such as memory corruption, frozen system, latency, etc.;

f) the AMMD database should comply with applicable standards for use in aviation (refer to ICAO Annex 6, Part I, 7.4 – Electronic navigation and data management); and

g) the operator should review the documents and the data provided by the AMMD developer and ensure that installation requirements of the AMMD software in the specific EFB platform and aircraft are addressed.

4.5 Flight crew training

4.5.1 The operator should define specific training in support of an AMMD's implementation. It should be included in the operator's overall EFB training.

4.5.2 The operating manual or user guide shall provide sufficient information to flight crews including limitations and accuracy of the system and all related procedures.

5. ELECTRONIC CHECKLIST (RESERVED)

- Reserved -

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APPENDIX B

SPECIFIC OPERATIONAL APPROVAL CHECKLIST

1. Introduction

1.1 The checklists below constitute an example of what may be used during Phase 3 of the EFB operational evaluation process.

1.2 Checklist items can be customized to the specific EFB and applications being evaluated.

1.3 Checklist items are designed so that some questions may be not applicable (check "N/A"). Questions answered as "No" are meant to allow identifying deficiencies that should be corrected and revalidated prior to approval being issued.

2. Example of specific operational approval checklist

Part I

Hardware	
Have the installed EFB resources been certified by a C AA 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 □ No □ N/A □
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 □ No □ N/A □
Will the display be readable in all the ambient lighting conditions, both day and night, encountered on the flight deck?	Yes □ No □ N/A □
Has the operator demonstrated that the EFB will not electromagnetically interfere with the operation of aircraft equipment?	Yes □ No □ N/A □
Has the EFB been tested to confirm operation in the anticipated environmental conditions (e.g., temperature range, low humidity, altitude, etc.)?	Yes □ No □ N/A □
Have procedures been developed to establish the level of battery capacity degradation during the life of the EFB?	Yes □ No □ N/A □
Is the capability of connecting the EFB to certified aircraft systems covered by an airworthiness approval?	Yes □ No □ N/A □
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 □ No □ N/A □
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 □ No □ N/A □

Can the brightness or contrast of the EFB display be easily adjusted by the flight crew for various lighting conditions?	Yes □ No □ N/A □

Part 2

Installation	
Mounting	
Has the installation of the mounting device been approved in accordance with the appropriate airworthiness regulations?	Yes □ No □ N/A □
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 □ No □ N/A □
Has it been confirmed that the mounted EFB location does not impede crew ingress, egress and emergency egress path?	Yes □ No □ N/A □
Is it evident that the mounted EFB does not obstruct visual or physical access to aircraft displays or controls?	Yes □ No □ N/A □
Does the mounted EFB location minimize the effects of glare and/or reflections?	Yes □ No □ N/A □
Does the mounting method for the EFB allow easy access to the EFB controls and a clear unobstructed view of the EFB display?	Yes □ No □ N/A □
Is the EFB mounting easily adjustable by flight crew to compensate for glare and reflections?	Yes □ No □ N/A □
Does the placement of the EFB allow sufficient airflow around the unit, if required?	Yes □ No □ N/A □

Part 3

Note.— This part should be completed multiple times to account for the different software applications being considered.

Software Application: ______________________ (fill in name of software application)	
Is the application considered an EFB function (see chapter 4)?	Yes ☐ No ☐ N/A ☐
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 ☐ No ☐ N/A ☐
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., weight and balance, performance, etc.)?	Yes ☐ No ☐ N/A ☐
Does the software application have adequate security measures to ensure data integrity e.g. preventing unauthorized manipulation?	Yes ☐ No ☐ N/A ☐
Does the EFB system provide, in general, a consistent and intuitive user interface, within and across the various hosted applications?	Yes ☐ No ☐ N/A ☐
Has the EFB software been evaluated to consider HMI and workload aspects?	Yes ☐ No ☐ N/A ☐
Does the software application follow Human Factors guidance?	Yes ☐ No ☐ N/A ☐
Can the flight crew easily determine the validity and currency of the software application and databases installed on the EFB, if required?	Yes ☐ No ☐ N/A ☐
Power Connection / Batteries	
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 ☐ No ☐ N/A ☐
Is the power source suitable for the device?	Yes ☐ No ☐ N/A ☐
Have guidance/procedures been provided for battery failure or malfunction?	Yes ☐ No ☐ N/A ☐
Is power to the EFB, either by battery and/or supplied power, available to the extent required for the intended operation?	Yes ☐ No ☐ N/A ☐
Has the operator ensured that the batteries are compliant to acceptable standards?	Yes ☐ No ☐ N/A ☐

Cabling	
Has the operator ensured that any cabling attached to the EFB, whether in the dedicated mounting or when hand held does not present an operational or safety hazard (e.g., it does not interfere with flight controls movement, egress, oxygen mask deployment, etc.)?	Yes ☐ No ☐ N/A ☐
Stowage	
If there is no mounting device available, can the EFB be easily stowed securely and readily accessible in flight?	Yes ☐ No ☐ N/A ☐
Is it evident that stowage does not cause any hazard during aircraft operations?	Yes ☐ No ☐ N/A ☐
Viewable stowage	
Has the operator documented the location of its viewable stowage?	Yes ☐ No ☐ N/A ☐
Had the operator ensured that the stowage characteristics remain within acceptable limits for the proposed operations?	Yes ☐ No ☐ N/A ☐
Has the operator demonstrated that if the EFB moves or is separated from its stowage, or if the viewable stowage is unsecured from the aircraft (as a result of turbulence, manoeuvring, or other action), it will not interfere with flight controls, damage flight deck equipment, or injure flight crew members?	Yes ☐ No ☐ N/A ☐

Part 4

MANAGEMENT	
EFB Management	
Is there an EFB management system in place?	Yes ☐ No ☐ N/A ☐
Does one person possess an overview of the complete EFB system and responsibilities within the operator's management structure?	Yes ☐ No ☐ N/A ☐
Are the authorities and responsibilities clearly defined within the EFB management system?	Yes ☐ No ☐ N/A ☐
Are there adequate resources assigned for managing the EFB ?	Yes ☐ No ☐ N/A ☐
Are third parties (e.g. software vendor) responsibilities clearly defined?	Yes ☐ No ☐ N/A ☐

Crew Procedures	
Is there a clear description of the system, its operational philosophy and operational limitations?	Yes ☐ No ☐ N/A ☐
Are the requirements for EFB availability in the Operations Manual and/or as part of the minimum equipment list (MEL)?	Yes ☐ No ☐ N/A ☐
Have crew procedures for EFB operation been integrated within the existing Operations Manual?	Yes ☐ No ☐ N/A ☐
Are there suitable crew cross-checks for verifying safety-critical data (e.g., performance, mass & balance calculations)?	Yes ☐ No ☐ N/A ☐
If an EFB generates information similar to that generated by existing flight deck systems, do procedures identify which information will be primary?	Yes ☐ No ☐ N/A ☐
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 ☐ No ☐ N/A ☐
Are there procedures that specify what actions to take if the software applications or databases loaded on the EFB are out-of-date?	Yes ☐ No ☐ N/A ☐
Are there procedures in place to prevent the use of erroneous information by flight crews?	Yes ☐ No ☐ N/A ☐
Is there a reporting system for system failures?	Yes ☐ No ☐ N/A ☐
Have crew operating procedures been designed to mitigate and/or control additional workload created by using an EFB?	Yes ☐ No ☐ N/A ☐
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 ☐ No ☐ N/A ☐
EFB Risk Assessment	
Has an EFB Risk Assessment been performed?	Yes ☐ No ☐ N/A ☐
Are there procedures/guidance for loss of data and identification of corrupt/erroneous outputs?	Yes ☐ No ☐ N/A ☐
Are there contingency procedures for total or partial EFB failure?	Yes ☐ No ☐ N/A ☐
Is there a procedure in the event of a dual EFB failure (e.g., use of paper checklist or a third EFB)?	Yes ☐ No ☐ N/A ☐

Have the EFB dispatch requirements (e.g. minimum number of EFB on board) been incorporated into the Ops Manual?	Yes □ No □ N/A □
Have MEL or procedures in case of EFB failure been considered and published?	Yes □ No □ N/A □
Training	
Is the training material appropriate with respect to the EFB equipment and published procedures?	Yes □ No □ N/A □
Does the training cover the list of bulleted items in Section 8 "Flight Crew Training"?	Yes □ No □ N/A □
Hardware Management Procedures	
Are there documented procedures for the control of EFB hardware configuration?	Yes □ No □ N/A □
Do the procedures include maintenance of EFB equipment?	Yes □ No □ N/A □
Software Management Procedures	
Are there documented procedures for the configuration control of loaded software and software access rights to the EFB?	Yes □ No □ N/A □
Are there adequate controls to prevent corruption of operating systems, software, and databases?	Yes □ No □ N/A □
Are there adequate security measures to prevent system degradation, malware and unauthorised access?	Yes □ No □ N/A □
Are procedures defined to track database expiration/updates?	Yes □ No □ N/A □
Are there documented procedures for the management of data integrity?	Yes □ No □ N/A □
If the hardware is assigned to the flight crew, does a policy on private use exist?	Yes □ No □ N/A □

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APPENDIX C

EXAMPLE OF OPERATIONS SPECIFICATIONS and OPERATIONS MANUAL CONTENT

When an EFB function is to be used for the safe operation of an aeroplane (see Chapter 4), an entry must be included in the operators operations specifications approved by the CAA. The operations specification will reference the location in the operations manual where the approved EFB applications are detailed. Figure C1 shows an example of a specific approval EFB entry.

OPERATIONS SPECIFICATIONS (Subject to the approved conditions in the operations manual)				
SPECIAL AUTHORIZATIONS	YES	NO	SPECIFIC APPROVALS	REMARKS
Continuing airworthiness				
EFB for A/C type *Type1*			19 - Specifically approved EFB hardware and software applications for A/C type *Type1* are contained in [Operations manual reference]	
EFB for A/C type *Type2*			- Specifically approved EFB hardware and software applications for A/C type *Type2* are contained in [Operations manual reference]	
Other				
19. List of EFB functions with any applicable limitations.				

Figure C1

Notes: Boxes YES/NO are not used since some EFB functions might not require an operational approval. Other EFB functions not requiring an EFB approval should not be listed in the Operations Specifications form.

The specific EFB approvals referenced in the operations specification form should have a companion detailed list of EFB approved hardware and software applications. This list should be located in the operations manual in a table and be updated through the normal operations manual approval process established by the State. Figure C2 contains an example of a companion EFB specific approval table.

The “Approved Hardware for A/C Type” should match the “SPECIAL AUTHORIZATIONS” column of the Operations Specifications form. The “Approved EFB Applications” column should indicate the EFB functions, including version which are specifically approved with any applicable limitations. The “Specific references and/or remarks” should include the application version in addition to any specific operations manual reference and other remarks if applicable.

EFB Specifically Approved Hardware and Software Applications		
Approved Hardware for A/C Type	Specifically Approved EFB Applications *(List of EFB function, version and any applicable limitations.)*	Specific References and/or Remarks
EFB for A/C type *Type1*	- Aircraft performance calculation (Take off & landing) – *AppName1 ver x.x* -Airport Moving Map – *AppName2 ver x.x* -Charts application : En route – *AppName3 ver x.x* -Airport Charts (SID, STAR, approach) – *AppName4 ver x.x*	*See procedures in operations manual p. X* *Back up: QRH* *Refer to operations manual page(xx)* *See operations manual p. Y* *Paper back up operation* *Paperless Operation refer to operations manual p. Z*
EFB for A/C type *Type2*	-Charts application : En route – *AppName3 ver x.x*	*See operations manual p. X* *Paper back up operation*

Figure C2

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APPENDIX D

EFB POLICY AND PROCEDURES MANUAL

These are the typical contents of an EFB policy and procedures manual that can be fully or partly integrated in the Operations Manual, if applicable.

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**

— END —