CIVIL AVIATION AUTHORITY OF NEPAL

ELECTRONIC FLIGHT BAG (EFB)

APPROVAL PROCEDURE MANUAL

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ELECTRONIC FLIGHT BAG (EFB)APPROVAL PROCEDURE MANUAL

FOREWORD

This Electronic Flight Bag (EFB) Approval Procedure Manual has been developed by the Civil Aviation Authority of Nepal (CAA Nepal). It provides details and guidance to the CAA Nepal Inspectors for approval of Electronic Flight Bag when requested by Operator. This edition of the manual has been issued by the Director General pursuant to the Rule 82 of Civil Aviation regulations 2002.

This manual will be reviewed periodically and amended if required. Any suggestion regarding the improvement of this manual is welcome and such suggestion shall be forwarded to the Flight Safety Standards Department.

This manual comes into effect when Director General, CAA Nepal approves this manual.

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Director General

Civil Aviation Authority of Nepal

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Abbreviations

AFM	Aircraft Flight Manual
AID	Aircraft Interface Device
AMMD	Aircraft Moving Map Display
AODB	Airport, Runway, Obstacle Database
ARINC	Aeronautical Radio, Inc
CAAN	Civil Aviation Authority of Nepal
CDL	Configuration Deviation List
ECL	Electronic Checklist
EFB	Electronic Flight Bag
EMI	Electromagnetic Interference
FCOM	Flight Crew Operating Manual
GNSS	Global Navigation Satellite System
HMI	Human- Machine- Interface
IFW	In- Flight Weather
M&B	Mass and Balance
MEL	Minimum Equipment List
OEM	Original Equipment Manufacturer
PED	Portable Electronic Device
RTCA/DO	Radio Technical Commission for Aeronautical/ Documents
SCAP	Standardized Computerized Aircraft Performance
SOP	Standard Operating Procedure
STC	Supplement Type Certificate
TACS	Taxi Aid Camera System
TALP	Take-off and Landing Performance
TC	Type Certificate
WAFS	World Area Forecast System

1. EQUIPMENT / HARDWARE CONSIDERATIONS

1.1 SYSTEM DESCRIPTION AND CLASSIFICATION OF EFB SYSTEMS

This section is divided into two parts. The first part deals with the host platform (e.g. the hardware and operating system) used to run the EFB software suite. The second part deals with this software suite which includes the EFB applications installed to provide the relevant functionality.

1.1.1 EFB systems hardware

Based on Hardware considerations EFBs can be either **portable** or **installed**.

1.1.1.1 Portable EFB

Definition

A portable EFB is a portable EFB host platform, used on the flight deck, which is not part of the certified aircraft configuration and are considered to be PEDs. They generally have self-contained power and may rely on data connectivity to achieve full functionality.
Modifications to the aircraft to use portable EFBs require the appropriate airworthiness approval depending on the extend of modification.

Complementary characteristics

- A portable EFB can be operated inside and outside the aircraft.
- A portable EFB hosts type A and/or type B EFB software applications.
- In addition, it may host miscellaneous (non-EFB) software applications.
- A portable EFB is a portable electronic device (PED).
  (i.e. PEDs are any kind of electronic device, typically but not limited to consumer electronics, brought on board the aircraft by crew members, passengers, or as part of the cargo and that are not included in the approved aircraft configuration. All equipment that is able to consume electrical energy falls under this definition. The electrical energy can be provided from internal sources as batteries (chargeable or non-rechargeable) or the devices may also be connected to specific aircraft power sources).
- The mass, dimensions, shape, and position of the portable EFB should not compromise flight safety.
- A portable EFB may be provided with aircraft power through a certified power source.
- If mounted, the portable EFB is easily removable from its mounting device or attached to it, without the use of tools by the flight crew. If mounted, the attachment or removal does not constitute a maintenance action.
- A portable EFB may be part of a system containing EFB installed resources which are part of the certified aircraft configuration.
- The installed EFB components are part of the certified aircraft configuration with the intended function to mount the EFB to the aircraft and/or connect to other systems.

- When a portable EFB is a T-PED, the conditions for use of its transmitting capability are established in the approved Aircraft Flight Manual (AFM). In absence of information in the AFM, the EFB transmitting capability may be allowed during non-critical phases of the flight.
- Portable EFBs may be used in all phases of the flight if secured to a certified mount or securely attached to a viewable stowage device in a manner which allows its normal use.
- Portable EFBs not meeting the above characteristic, should be stowed during critical phases of the flight.
- Portable EFBs are controlled PEDs. (i.e. A controlled PED is a PED subject to administrative control by the operator using it. This will include, inter alia, tracking the allocation of the devices to specific aircraft or persons and ensuring that no unauthorised changes are made to the hardware, software, or databases).
- Any EFB component that is either not accessible in the flight crew compartment by the flight crew members or not removable by the flight crew, should be installed as 'certificated equipment' covered by a Type Certificate (TC), changed TC or Supplemental (S)TC.

1.1.1.2 Installed EFB

Definition

An EFB host platform installed in the aircraft and considered as an aircraft part. 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).

Complementary characteristics

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

1.1.2 Software applications for EFB systems

- The functionality associated with the EFB system depends, in part, upon the applications loaded on the host platform. The classification of the applications, based on respective safety effects, is intended to provide clear divisions among such applications and, therefore, the assessment process applied to each.
- **Appendix-6** and **Appendix-7** provide support regarding the classification of traditional EFB software applications. They may be used for justifying a classification provided that the application does not feature design or functional novelties introducing new ways of interaction or unusual procedures.
- If an application is not listed in the appendices or presents a high degree of novelty, the classification should be established using the definitions provided hereafter and the guidance

in **Appendix-8**. For the purpose of the following definitions, 'malfunction or misuse' means any failure, malfunction of the application, or design-related human errors that can be reasonably expected in service.

1.1.2.1 Type A

Definition

Type A applications are EFB applications whose malfunction or misuse have no safety effect.

Complementary characteristics

Type A applications:

(a) may be hosted on either portable or installed EFBs;

(b) do not require any approval; and

(c) should follow guidance provided in **Appendix-9**, **paragraph 9.2.**

Examples of Type A applications can be found in **Appendix-6.**

1.1.2.2 Type B

Definition

Type B applications are applications:

(a) whose malfunction or misuse are limited to a minor failure condition; and

(b) which do neither substitute nor duplicate any system or functionality required by airworthiness regulations, airspace requirements, or operational rules.

Complementary characteristics

Type B applications:

(a) may be hosted on either portable or installed EFBs;

(b) require an operational assessment; and

(c) do not require an airworthiness approval.

Examples of Type B applications can be found in **Appendix-7.**

1.2 HARDWARE CONSIDERATIONS FOR INSTALLED RESOURCES AND MOUNTING DEVICES

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

Installed resources are the input/output components external to the EFB host platform itself, such as an installed remote display, a control device (e.g. a keyboard, pointing device, switches, etc.), or a docking station.

The installed resources should be dedicated to EFB functions only, or in the case of use of resources shared with avionics, this possibility shall be part of the approved type design. It should be demonstrated, using the appropriate level of assessment, that the integration in the aircraft of the EFB and the EFB software applications does not jeopardise the compliance of the aircraft installed systems and equipment (including the shared resources) with the applicable certification specifications such as CS 25.1302 or 25.1309.

Installed resources require an airworthiness approval.

1.2.1 Mounting devices

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

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

1.2.2 Data connectivity

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

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

1.2.3 Power to the EFB

Installed power provisions should comply with the applicable airworthiness requirements. Connection of the EFB to a non-essential, or to the least critical, power bus is recommended, so failure or malfunction of the EFB or power supply will not affect safe operation of aircraft critical or essential systems. **Note:** Refer **Appendix-11** for guidance.

1.3 HARDWARE CONSIDERATIONS FOR PORTABLE EFBs

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

1.3.1 Physical characteristics

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

1.3.2 Readability

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

1.3.3 Environmental

The EFB has to be operable within the foreseeable cockpit operating conditions including probable high/low temperatures, and after rapid depressurization if the EFB is intended for use in such an event. **Note:** Refer **Appendix-12** for further guidance.

1.3.4 Basic non-interference testing

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

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

1.3.4.3 Method 1

- 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.

1.3.4.4 Method 2

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

1.3.5 Additional testing for transmitting portable EFBs

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

1.3.5.2 This test consists of two separate test requirements:

- ***Test Requirement 1.*** Each model of the device should have an assessment of potential electromagnetic interferences (EMI) based on a representative sample of its frequency and power output. This EMI assessment should follow a protocol such as set forth in RTCA/DO-294, Guidance on Allowing Transmitting Portable Electronic Devices (T-PEDs) on Aircraft. This frequency assessment must confirm that no interference of aircraft equipment will occur as a result of intentional transmissions from these devices.

- ***Test Requirement 2*****.** Once an EMI assessment has determined that there will be no interference from the EFB's intentional transmissions (Test Requirement 1), and basic non-interference testing has been conducted with the device not deliberately transmitting (see Chapter 3, 3.4), non-interference testing should be conducted with an operating transmit function. The position of the transmitting device is critical to non-interference testing; hence, locations of the EFB and of the transmitter (if applicable) should be clearly defined and adhered to.

1.3.6 Power supply, connection and source

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

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

1.3.6.3 Means to turn off the power source, other than a circuit breaker, should be reachable by the pilot when strapped in the normal seated position (e g. access to unplug the EFB or a separate hardware or software switch clearly labelled for the power source).
Note: Refer **Appendix-11** for guidance.

1.3.7 Batteries

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

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

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

1.3.8 Cabling

The operator needs to ensure that any cabling attached to the EFB, whether in the dedicated mounting or when handheld, does not present an operational or safety hazard. Ensure electrical wiring interconnection systems (EWIS) are considered for installed cables to comply with CS 25 specification.

1.3.9 Temperature rise

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

1.3.10 Data connectivity between EFBs

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

1.3.11 Data connectivity to aircraft systems

See section 1.2.2.

1.3.12 External connectivity

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

1.3.13 Stowage

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

Viewable stowage

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

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

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

2. HUMAN FACTORS

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

(a) general considerations including workload, usability, integration of the EFB into the flight deck, display and lighting issues, system shutdown and system failures;

(b) physical placement issues, including stowage area, use of unsecured EFBs, design and placement of mounting devices;

(c) considerations for interference with anthropometric constraints, cockpit ventilation and speaker sound;

(d) training and procedure considerations, including training on using EFB applications, the EFB policy and procedures manual, fidelity of the EFB training devices and mechanisms for gathering user feedback on EFB use;

(e) hardware considerations — refer to Chapter 1; and

(f) software considerations — refer to Chapter 6.

Note: Refer to **Appendix-9** for details Human Factor consideration.

3. CREW OPERATING PROCEDURE

3.1 General

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

3.1.2 If an EFB generates information similar to that generated by existing flight-deck systems, procedures should clearly identify the following:

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.

3.1.3 If normal operational procedures require an EFB for each flight-deck crew member, the set-up should comply with the definition of independent EFB platforms.

3.1.4 Operators should include the requirements for EFB availability in the operations manual, as part of the minimum equipment list, or both.

3.2 REVISIONS AND UPDATES

3.2.1 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).

3.2.2 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. Procedures should specify what actions to take if the software applications or databases loaded on the EFB are out of date.

3.3 WORKLOAD AND CREW COORDINATION

3.3.1 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.

3.3.2 Workload should be distributed among 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.

3.4 REPORTING

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

4. 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 the following:

(a) overview of the system architecture;
(b) preflight checks of the system;
(c) limitations of the system;
(d) 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) 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 CAA Nepal.

For further details refer to **Appendix-10.**

5. EFB RISK ASSESSMENT

5.1 GENERAL

5.1.1 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.

5.1.2 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.

5.1.3 The guidance on safety risk assessment is contained in the CAA Nepal requirement for Safety Management System (CAR-19) and Safety Management Manual (SMM) (Doc 9859).

5.2 EFB FAILURES AND MITIGATION MEANS

5.2.1 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.

5.2.2 Mitigation against EFB failure or impairment may be accomplished by one or a combination of the following:

(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.

6. EFB FUNCTIONS

6.1 GENERAL

6.1.1 FOR-A and FOR- H require that the CAA Nepal specifically approve the operational use of EFB functions to be used for the safe operation of aircraft.

6.1.2 FOR-A and FOR-H require that CAA Nepal establish criteria for the operational use of EFB functions to be used for the safe operation of aircraft.

6.1.3 EFB functions to be used for the safe operation of aircraft are considered to be those whose failure, malfunction or misuse would have an adverse effect on the safety of flight operations (e.g. increased in-flight crew workload during critical phases of flight, reduction in functional capabilities or safety margins).

6.1.4 Those functions should be recorded in the operations manual and linked to the operations specifications as proposed in **Appendix-3.**

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

a) document browsers displaying information required to be carried by requirements (subject to approval, where required);
b) electronic aeronautical chart applications;
c) airport moving map display (AMMD) applications, not used as a primary 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 applications that provide take-off, en-route, approach, landing and missed approach performance calculations; and
f) mass and balance calculation applications.

These applications require special attention during their evaluation, as described in **Appendix-1.**

6.1.6 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 that 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 meteorological conditions, obstacles or other traffic, in-flight or on ground;
b) displaying information that 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;
c) communicating with air traffic control;
d) sending data to aircraft systems not certified for this intended purpose; and
e) any other function determined by the CAA Nepal to require airworthiness certification.

6.1.7 The display of own-ship position, in-flight, for strategic use is not universally accepted by CAA Nepal and not specifically covered in this manual. If an operator elects to implement the display of own-ship position, in-flight, on an EFB application, the following risks should be addressed and properly mitigated:

a) use of hazardously misleading information (in particular in case of erroneous position or frozen display);
b) misuse of the information for short-term piloting, e.g. for track monitoring purposes (see 6.1.6, a);
c) excessive fixation on EFB information and excessive head-in time; and
d) conflicting information with certified aircraft systems.

Possible effects of improperly mitigated risks include an increase in workload and a decrease in situation awareness. In some cases, crews might unknowingly build an over-reliance on this uncertified, yet compelling information.

6.2 CONSIDERATIONS FOR ALL EFB APPLICATIONS

6.2.1 Software HMI

6.2.1.1 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.

6.2.1.2 Software considerations should be addressed, including ease of 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 and content and use of active regions.

6.2.1.3 ***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. CAA Nepal requirements in conflict with the recommendation above should have precedence.

6.2.1.4 ***System error messages:*** It may be desirable to have an indication of whether an application is fully or partially disabled or is not visible or accessible to the user available to the user upon request. It may be desirable to prioritize these EFB status and fault messages.

6.2.1.5 ***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.

6.2.1.6 ***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.

6.2.1.7 ***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.

6.2.1.8 Software developers and operators are encouraged to evaluate the usability of an existing (Human -Machine Interference) HMI before developing a new HMI themselves. It is also recommended that the HMI be reviewed 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.

6.2.2 Electronic signatures

6.2.2.1 CAA Nepal requirements at times requires a signature to signify acceptance or to confirm the authority.

6.2.2.2 In order to be accepted as an equivalent-to-handwritten signature, electronic signatures used in EFB applications need, as a minimum, to fulfil the same objectives and 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).*

6.3 CONSIDERATIONS FOR EFB APPLICATIONS TO BE USED FOR THE SAFE OPERATION OF AIRCRAFT

6.3.1 EFB management

6.3.1.1 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, at least one person (e.g. dedicated EFB manager, OPS director) should possess an overview of the complete EFB system, including the distribution of responsibilities within the operator's management structure.

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

6.3.1.3 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.

6.3.1.4 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, email client, picture management) do not adversely impact the operation of the EFB.

6.3.1.5 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, relevant software applications and knowledge about flight operations.

6.3.1.6 EFB management should establish procedures to ensure that no unauthorized changes take place to EFB applications. An EFB policy and procedures manual may be part of the operator's operations manual **(Appendix-4).**

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

6.3.1.8 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 applications.

6.3.1.9 Any new or modified EFB application requires a reassessment for proper functioning and on whether any additional training or procedures are necessary.

6.3.2 Quality assurance

The operator should ensure that the software developer has a quality assurance process in place. The software development and verification processes should be included and documented in the quality assurance process.

7. AIRWORTHINESS AND OPERATIONAL EVALUATION PROCESS

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

AIRWORTHINESS APPROVAL

The airworthiness approval is necessary for installed EFB systems, as well as EFB installed resources and mounting device. Refer Para 1.2.

A portable EFB device does not require an airworthiness approval but its presence and use in the cockpit needs to be evaluated to ensure modification, if any meets CAA Nepal requirements. Refer Para 1.3.

7.1 DEFINITION OF SCOPE

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

a) has no EFB experience, thus requiring a "new application and approval process"; or
b) has initiated the process of establishing an EFB program; or
c) has an existing approved EFB program.

7.1.2 An operator implementing EFB functions may choose to start a paperless flight-deck operation without paper backup or a 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. However, during initial approval process paperless flight-deck operation is not permitted until the operators submits satisfactory final operational report to CAA Nepal and CAA Nepal grants specific EFB approval.

7.2 INITIAL DISCUSSION WITH THE CAA Nepal (PHASE 1)

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

7.3 APPLICATION (PHASE 2)

Phase 2 begins when the operator submits a formal compliance plan to CAA Nepal for evaluation. The plan is reviewed for completeness and compliance to the requirements and CAA Nepal may coordinate with other agencies as necessary. Once CAA Nepal is satisfied with the submitted plan, the operator follows that plan to produce a complete EFB program. 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 the following:

a) EFB operational suitability report (if applicable);
b) EFB hardware and application specifications;
c) EFB operator procedures or manual revisions;
d) EFB training program;
e) EFB evaluation report; and
f) EFB risk assessment.

7.4 CAA Nepal REVIEW (PHASE 3)

7.4.1 CAA Nepal should use a checklist in **Appendix-2** to conduct a review of the application submitted by an operator.

7.4.2 Where an operator seeks to start operations with a new EFB system, CAA Nepal should participate in either 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. CAA Nepal should examine the technical content and quality of the proposed EFB program and other supporting documents and procedures.

7.5 OPERATIONAL EVALUATION (PHASE 4)

7.5.1 The operator should conduct an operational evaluation that verifies whether the above elements have been satisfied. The operator should notify CAA Nepal of its intention to conduct an operational evaluation by sending a plan and should keep a receipt of this notification in the aircraft during the test period.

7.5.2 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. Operators need to submit final operational report after the operational evaluation.

The operator should produce and retain a final operational report, which summarises all activities conducted and the means of compliance used, supporting the operational use of the EFB system. An example of typical items that the operator should include in this report is provided in **Appendix-5**.

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

7.5.4 Final items for CAA Nepal to consider are as follows:

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

7.6 ISSUANCE OF EFB OPERATIONS SPECIFICATIONS AND APPROVAL (PHASE 5)

CAA Nepal granting a specific EFB approval to the operator should update the operations specifications with an EFB entry. The operations specifications will reference the location in the operations manual where more details of the approved EFB applications can be found **(Appendix-3).**

8. EFB USE IN GENERAL AVIATION OPERATIONS WITH HELICOPTERS OR OTHER THAN LARGE OR TURBOJET AEROPLANES

8.1 EQUIPMENT / HARDWARE CONSIDERATION

Operators involved in general aviation with helicopters or other than large or turbojet aeroplanes, should consider the following provisions before using an EFB.

The operator should follow the provisions of Para 1.3 when using a portable EFB.

8.2 PILOT OPERATING PROCEDURES

To ensure that adequate guidance is available for use of the EFB applications, the user guide established by the software developer should be available to the pilot.

8.3 PILOT TRAINING

The pilot should be familiar with EFB use before using it in-flight. Changes to EFB hardware or software may warrant additional familiarization.

8.4 EFB RISK ASSESSMENT

For general aviation operations, hazard assessment in the traditional sense is not practical; therefore, the following mitigations are presented to address risks associated with EFB use. Before each flight, the pilot should conduct the following checks to ensure the continued safe operation of the EFB during the flight:

a) general check of the EFB operation by switching it ON and checking that the applications intended to be used in-flight are operative;
b) check battery or other power sources to ensure the availability of the EFB during taxi and flight operations, including diversions and reasonable delays;
c) check for currency of EFB databases (effective dates), (e.g. aeronautical charts, performance calculation, and weight and balance applications); and
d) check that an appropriate backup is available when using an application displaying information or data required to be on board.

8.5 EFB FUNCTIONS

8.5.1 If EFB applications provide functions that display information related to the aircraft position in-flight, navigation, terrain or traffic surroundings or altitude, the pilot should be aware of the potential misleading or erroneous information displayed and should only use these functions as an advisory means.

8.5.2 When using an aeronautical chart, performance calculation, mass and balance or in-flight weather application, or an airport moving map display (AMMD), the following considerations should be taken into account by the pilot:

a) ***Aeronautical chart application*****.** The aeronautical charts that are depicted should contain the information necessary, in appropriate form, to conduct the flight safely.

Consideration should be given to the size and resolution of the display to ensure legibility.

b) ***Performance calculation and mass and balance (M&B) application*.** Prior to the first use of a performance or M&B application and following any update of the database supporting the application, the operator should obtain assurance that the output of the application corresponds with the data derived from the AFM (or other appropriate sources).

c) ***Airport moving map display application*.** An AMMD application should not be used as a primary means of navigation for taxi; outside references remain primary.

d) ***In-flight weather application*.** The displayed meteorological information may be forecast, observed, or both and may be updated on the ground or in-flight. It should be based on data from providers approved by the meteorological authority concerned or other sources approved by the operator. Consideration should be given to the latency of meteorological information and the hazards associated with utilization of latent information. Pilots should only use in-flight weather applications for broad strategic avoidance of adverse meteorological conditions.

8.6 EVALUATION PROCESS

As stated in Chapter 7, an evaluation process is not required, but it is nevertheless recommended that pilots and/or the operator/owner undergo an evaluation period to ensure that mitigations to risk, including EFB failures, EFB misuse and other EFB malfunctions, are addressed. During this period, the pilot or owner/operator should validate that the EFB is as available and reliable as the paper-based system being replaced, if applicable.

APPENDIX-1

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 appendix.

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

The operator should retain the following documentation:

(a) Functional description document (for the initial assessment and any subsequent functional change);

(b) Release notes (for both initial and all subsequent software releases) or equivalent;

(c) Version description document (for both initial and all subsequent releases);

(d) First article inspection report (refers to quality controlled release of the EFB Software Application);

(e) Ground viewer (to enable user validation of the software releases and data base releases and updates);

(1) Viewers should use the same software components as the airborne application; and

(2) Viewers should enable user validity checking of airborne data bases before installation on an aircraft.

1. TAKE-OFF AND LANDING PERFORMANCE (TALP) AND MASS AND BALANCE (M&B) APPLICATIONS

1.1 Introduction

1.1.1 The validity and integrity of take-off and landing performance (TALP) and mass and balance (M&B) data are essential for safe flight operations. These types of EFB applications and the operator's procedures for their use, require thorough evaluation prior to being approved for service.

1.1.2 CAA Nepal should consider the application architecture, the HMI, the documented testing results and the operator's EFB procedures and training before approving the operational use of EFB, TALP and M&B applications.

1.2 Take-off and landing performance (TALP) applications architecture

1.2.1 TALP applications are usually separated into different layers:

a) human-machine interface (HMI);

b) calculation module;

c) aircraft-specific information; and

d) airport, runway, obstacle database (AODB).

Figure A-1 shows a typical architecture of a TALP 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. Alternatively, there might be solutions where modularity

is taken to a point where some or all parts are supplied by different providers.

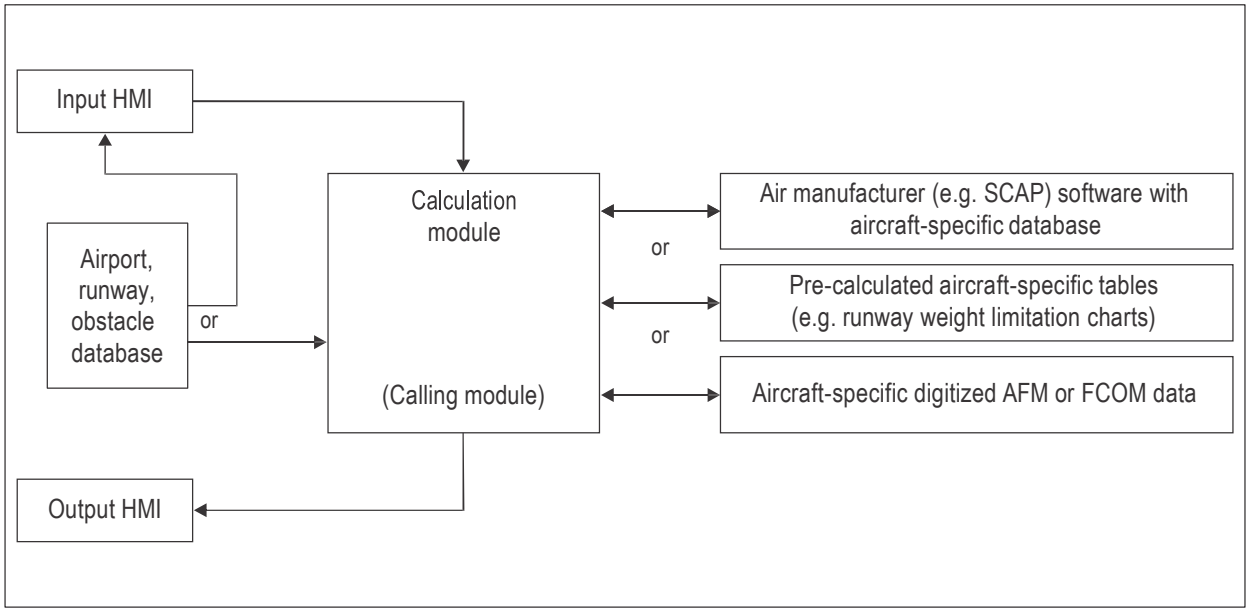

Figure A-1. Typical architecture of a TALP application

1.2.2 ***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.

1.2.3 ***Calculation module*:** The calculation module will process the requested data from the input HMI and determine the results which are then returned to the output HMI.

1.2.3.1 TALP source data is generally derived from either pre-calculated tables (e.g. runway weight limitation charts), digitized AFM or FCOM charts, or equations of motion-based software algorithms and data.

1.2.3.2 For TALP source data that is either digitized AFM data or based on equations of motion, the data is generally provided in a form that complies with the International Air Transport Association (IATA) Standardised Computerised Aircraft Performance (SCAP) specification. The IATA SCAP specification provides a standardized means for manufacturers, operators and third parties to exchange aircraft performance data.

1.2.3.3 A typical software system that uses the SCAP approach will consist of the calling module or "SCAP module" (also known as a "manufacturer's module"). To obtain the results, the calculation module assembles the inputs from the HMI and other sources; it may call the SCAP software several times. Thus, the expression "calling module" has become widespread in the industry.

1.2.3.4 Another way for the calculation module to obtain results is to interpolate between pre-calculated tables (e.g. runway weight limitation charts).

1.2.3.5 In some cases, where manufacturer software and data are not available, paper AFM or FCOM charts may be digitized by third parties that develop the data for their own products.

1.2.4 ***Aircraft performance data sources*:** Different sources of performance data can be used by TALP applications. Performance data can be delivered in various digitized formats:

a) SCAP modules or equivalent, delivered by the manufacturer;

b) digitized aircraft performance data, built by the operator 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 airports, runways 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 Take-off and landing performance (TALP), mass and balance (M&B) applications and human-machine interface (HMI)

1.3.1 Operators and CAA Nepal should be aware that pilot data-entry errors have been a contributing factor to numerous aviation incidents and accidents. A well-designed HMI can significantly reduce the risk of errors. The following are examples of design guidelines that are supplemental to the software HMI considerations from Chapter 6:

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 TALP 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 HMI 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 subfleets, the selected subfleet should be clearly displayed to the flight crew.

g) The HMI should be designed so that input data are difficult to enter into the wrong fields of the HMI, by defining data-entry rules.

h) The HMI 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 TALP 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 HMI 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 6).

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, they should be displayed with the input parameters used for calculation.
m) Any active MEL/CDL/special restriction should be clearly visible and identifiable.
n) In the case of multiple runway selection, the output data should be clearly associated with the selected runway.
o) Changes of runway data by the pilot should be clearly displayed and the changes should be easy to identify.

1.4 Take-off and landing performance (TALP) and mass and balance (M&B) applications testing

1.4.1 Accurate TALP and M&B calculations are essential to safe aircraft operation. EFB applications can be effective tools used to make these calculations. Authorities and operators should be aware of the importance of thoroughly testing EFB applications that use mathematical algorithms or calculation modules before they are approved for operational use.

1.4.2 Applications designed to perform TALP and M&B calculations must use data derived from the AFM or other sources acceptable to the operator's CAAN.

1.4.3 Application testing should be conducted with the application running on a representative operating system and hardware device.

1.4.4 A proper evaluation of a TALP or M&B EFB application includes documented testing that verifies the calculation accuracy, user interface and complete environmental integration. The extent of testing and supporting documentation should reflect the complexity and functionality of the application being tested.

1.4.5 *Calculation Accuracy Tests*. Tests designed to verify an application calculates TALP and M&B results that are consistent with the AFM data or advisory data provided by the aircraft manufacturer.

1.4.5.1 The results of TALP applications are influenced by a large number of input parameters, and therefore it is not feasible to verify all possible outputs for accuracy. Test cases should be defined to sufficiently cover the entire operating envelope of the aircraft under a representative cross section of conditions for TALP applications (e.g. runway surface condition, runway slope, wind conditions, temperature, pressure altitude, obstacle clearance and aircraft configuration, including failures with a performance impact).

1.4.5.2 The results of M&B applications are also influenced by a large number of input parameters, and therefore it is not feasible to verify all possible outputs for accuracy. Test cases should be defined to sufficiently cover the entire operating envelope of the aircraft under a representative cross section of conditions for M&B applications (e.g. fuel load schedules including varying fuel densities or actual fuel density if known, passenger load schedules, cargo load schedules and unique or special cargo loads).

1.4.5.3 Test cases should also be defined to sufficiently cover a representative cross section of an operator's aircraft (e.g. different aircraft types, models, configurations and modifications).

1.4.5.4 Test cases should contain a detailed check showing that the application produces results that match or are consistently conservative to results derived from previously approved methods accepted by the CAAN.

1.4.5.5 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.

1.4.5.6 Test cases should demonstrate the application is stable and produces consistent results each time the process is entered with identical parameters.

1.4.5.7 Tests should be acceptable to the operator's CAAN.

1.4.6 *User-interface tests*. Tests designed to verify that an application's user interface is acceptable.

1.4.6.1 Test cases should be defined to demonstrate that:

a) the HMI requirements are complied with **(see section 1.3.1 in Appendix-1)**;
b) the application has a reasonable system response when incorrect values are inadvertently entered;
c) the application provides easily comprehended results or error messages and instructions if incorrect input values (e.g. outside envelope, wrong combination of inputs) are entered; and
d) the application does not fail or get into a state that would require special skills or procedures to bring it back to an operational state if incorrect input values are entered.

1.4.7 *Operational integration tests*. Tests that demonstrate that the application runs properly in the complete operational environment for which the EFB application is to be used.

1.4.7.1 Test cases should be defined that demonstrate that:

a) the application functions correctly on the EFB platform;
b) the application does not adversely impact other EFB applications or aircraft systems or vice versa; and
c) the application correctly interfaces with other applications when applicable (e.g. take-off performance using results from M&B application).

1.5 Procedures, management and training

The evaluation of EFB applications that calculate TALP and M&B data should take into consideration all other processes, procedures and training that support the use of the application.

1.5.1 Normal operating procedures

1.5.1.1 Procedures should ensure the proper use of EFB applications that calculate TALP or M&B data. The procedures should apply to the flight crew and ground personnel (e.g. flight dispatchers, flight operating officers, operating personnel) who may have roles defined in the use of the applications.

1.5.1.2 TALP and M&B data should be independently calculated and cross-checked by both pilots. When a dispatch system described in Annex 6, Part 1, Chapter 3 is used for the control and supervision of flights, the flight dispatcher (or other ground staff assigned) should verify that the results are within operating limits. Any differences should be discussed before the results are used operationally. All M&B documents should be available to the dispatcher or the person on the ground responsible for the control and supervision of flight before take-off.

1.5.2 Abnormal operating procedures

Procedures should ensure that a high level of safety can be maintained consistent with the EFB risk assessment assumptions during a loss of EFB functionality (e.g. the loss of a single

application or the failure of the device hosting the application).

1.5.3 Security procedures

The application and the data it references 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).

1.5.4 Training

1.5.4.1 Training should emphasize the importance of executing all TALP and M&B performance calculations in accordance with SOP to assure fully independent and cross-checked calculations. As an example, one pilot should not announce the values to be entered into the HMI of the performance applications because an incorrect announcement could lead to both calculations showing the same misleading results.

1.5.4.2 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 (e.g. entering the zero fuel mass (ZFM) as take-off mass (TOM) or transposing digits).

1.5.4.3 Training should emphasize that the use of EFBs makes TALP and M&B calculations simple but it does not eliminate the necessity of good pilot performance knowledge.

1.5.4.4 Through the use of EFBs, new procedures may be introduced (e.g. the use of multiple flap settings for take-off) and pilots should be trained accordingly.

1.5.5 Management of performance TALP and M&B EFB applications

Within the operator's organization, the responsibilities between the TALP and M&B management and the EFB management should be clear and well documented. An operator should designate a person or group who are sufficiently trained to provide support for the performance tools. This person or group must have comprehensive knowledge of current regulations, TALP and M&B, and TALP and M&B software (e.g. SCAP modules) used on the EFB.

2. ELECTRONIC CHARTING APPLICATION

2.1 Description

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

2.1.2 The following should be considered:

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 and arrival procedures) if the chart is the expanded detail (fold-over) type.

d) Panning, scrolling, zooming, rotating or other active manipulation is permissible.

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

decluttering.

3. TAXI AID CAMERA SYSTEM (TACS)

3.1 Description

3.1.1 Taxi aid camera system (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 The following should be considered:

a) Ensure real-time, live display of received imagery without noticeable time-lapse.

b) Image quality should be adequate during foreseeable environmental lighting condition.

c) Display of turning or aircraft dimension aids may be provided, (e.g. turning radius, undercarriage track width). In such cases, the information provided to the pilot should be verified for accuracy.

d) Connection should be made to one or more installed vision systems that 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 TACS. Training should emphasize use of TACS as an additional resource and not as a primary means for ground navigation or avoiding obstacles.

f) Pilot use of TACS should not induce disorientation.

4. AIRPORT MOVING MAP DISPLAY (AMMD)

4.1 Description

4.1.1 This section provides some consideration on how to demonstrate the safe operational use for airport moving map display (AMMD) applications to be hosted on EFBs.

4.1.2 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.

4.1.3 The AMMD application is designed to indicate aeroplane 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 that notify crews about potentially dangerous conditions, for example, inadvertently entering a runway.

4.1.4 The following should be considered:

a) An 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. The accuracy should be sufficient to ensure that the own-ship position symbol is depicted on the correct runway or taxiway.

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

d) The system should automatically remove the own-ship position symbol 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 Annex 6, Part I, 7.5 — *Electronic navigation data management*).

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.

4.2 Flight Crew Training

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

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

For detailed information on crew training refer **Appendix-10.**

5. ELECTRONIC CHECKLIST APPLICATION

5.1 Scope

5.1.1 An electronic checklist (ECL) is an EFB application that displays checklists to the flight crew by means of an EFB.

5.1.2 This guidance applies to the following:

a) an ECL displaying pre-composed information or featuring a specific HMI to display the information in an optimized way to the flight crew;

b) an ECL with or without capability to interact with the pilot to record the completion of the actions and checklists;

c) an ECL without capability to process information from the aircraft (e.g. a stand-alone ECL); and

Note.— *The capability to process information from the aircraft is more critical and not addressed by this manual.*

d) an ECL displaying only normal checklists (Non-normal/abnormal/emergency checklists and procedures are more critical and are not addressed in this manual).

5.1.3 Other ECL functionalities, such as those identified in the list below, may be present, in which case the operator's CAAN is responsible for the establishment of the applicable basis for compliance:

a) The ECL receives information from the aircraft (e.g. senses items such as aircraft system state, switch positions). The status of the sensed items may be reflected on the checklist. For example, if an action line of a checklist indicates that a button should be pressed and the aircraft sensors sense that the button has been pressed, then the checklist display will indicate that the item has been accomplished.

b) The ECL content includes non-normal (abnormal or emergency)

checklists/procedures.

5.2 HMI design and Human Factors considerations

5.2.1 The ECL system (hardware, software) should provide at least the same level of accessibility, usability and reliability as a paper checklist.

5.2.2 HMI and Human Factor considerations:

a) Accessibility time for any checklist should not be longer than an equivalent paper checklist.
b) All checklists should be easily accessible for reference or review.
c) The resulting pilot actions called from an ECL should be identical to a paper checklist.
d) The pilot should be able to clearly recognizable which items or checklists are safety relevant for the operation of the aircraft and which are of an additional nature.
e) Checklists should be presented in accordance with the normal sequence of flight.
f) The title of the checklist should be displayed and distinguished at all times when in use.
g) An indication of the existence of off-screen checklist content should be provided.
h) The end of each checklist should be clearly indicated.
i) The effect of switching between ECL and other EFB applications on the same hardware should be evaluated.

5.2.3 Additional HMI and Human Factor considerations for ECL with capability to interact with the pilot to record the completion of the actions and checklists:

a) ECL should provide a checklist overview displaying which checklists are completed and which are not.
b) ECL should display the completion status of action items within a checklist.
c) It should be possible to restart a checklist, if needed. The crew should be able to reset the checklist with a verification step to confirm the restart.
d) It should be possible to uncheck an action item in a checklist, if needed.

5.3 Flight crew procedures

5.3.1 The operator should consider the impact on the pilot's workload in determining the method of use of ECL.

5.3.2 Flight crew procedures should be established to:

a) ensure that the flight crew verifies the validity of the ECL database before use; and
b) define backup procedure in case of loss of ECL during the flight to enable access to checklists at any time (e.g. to include scenarios regarding power loss, software malfunctions).

5.4 Administration

5.4.1 The operator should also establish a consistent and methodical process for modifying the ECL data and updated data transmission and implementation on the EFBs. Such processes should include a method for database applicability verification to individual aircraft in the operator's fleet.

5.4.2 ECL populated data content should:

a) be concise, simple, clear and unambiguous; and
b) ensure consistency between aircraft manufacturer provided data and operator

customized data (e.g. language, terminology, acronyms).

5.5 Flight crew training and documentation

The operator should define specific flight crew training in support of an ECL implementation. It should be included in the operator's overall EFB training. The operating manual or user guide should provide sufficient information to flight crews including limitations of the system and all related procedures.

6. IN-FLIGHT WEATHER (IFW) APPLICATION

6.1 Definition

In the context of this manual, in-flight weather (IFW) is an electronic flight bag (EFB) function enabling the crew to access meteorological information.

6.2 Intended Use and Limitations

6.2.1 The introduction of IFW is supplemental to the information required by Annex 3 — *Meteorological Service for International Air Navigation*. It would contribute to increased situational awareness and support the flight crew when making strategic decisions.

6.2.2 The IFW application could be used to access both information required to be on board (e.g. world area forecast system (WAFS) data) and supplemental weather information.

6.2.3 Use of IFW should be non-safety-critical and not necessary for the performance of the flight.

6.2.4 In order to be non-safety-critical, IFW should not be used to support tactical decisions and/or substitute certified aircraft systems (e.g. weather radar).

6.2.5 Information from the official flight documentation or aircraft primary systems should always prevail in case there is a contradiction with IFW information.

6.2.6 Meteorological information in IFW applications may be displayed, for example, as an overlay on aeronautical charts and geographical maps or may be a stand-alone weather depiction (e.g. radar images, satellite images).

6.3 Meteorological Information Considerations

6.3.1 Meteorological information can be forecast and/or observed, and can be updated on the ground and/or in- flight. It should be based on data from providers approved by the meteorological authority concerned or other sources approved by the operator.

6.3.2 The meteorological information provided to the flight crew should, as far as possible, be consistent with the information available to ground-based users (e.g. airline operations centre (AOC), dispatcher) in order to establish common situation awareness and to facilitate collaborative decision-making.

6.4 Display Considerations

6.4.1 Meteorological information should be presented to the flight crew in a format that is appropriate to the content of the information; graphical depiction is encouraged whenever practicable.

6.4.2 Presentation should include:

a) type of information contained in the meteorological information (e.g. forecast or observed);
b) currency or age and validity time of the meteorological information;
c) information necessary for interpreting the meteorological information (e.g. legend); and

d) a clear indication of any missing information or data in order for the flight crew to determine areas of uncertainty when making hazardous weather avoidance decisions.

6.4.3 If meteorological information is overlaid on aeronautical charts, special considerations should be given to human-machine interface (HMI) issues in order to avoid adverse effects on the basic chart functions.

6.4.4 Meteorological information may require reformatting for cockpit use, for example, to accommodate display size or depiction technology. However, any reformatting of meteorological information should preserve both the geo-location and intensity of meteorological conditions regardless of projection, scaling or any other types of processing.

6.4.5 IFW display should, as far as possible, be consistent with the flight-deck design philosophy in terms of location of titles, location and visual representation of legends, element size, labelling and text styles, etc.

6.4.6 It is recommended that the IFW is able to display the meteorological information in relation to the route or operational flight plan, in order to ease interpretation of forecast information.

6.5 Training and Procedures

6.5.1 The operator is required to specify standard operating procedures (SOPs) specifying the use of IFW information.

6.5.2 Adequate training should be provided for the use of IFW. Training should address the following:

a) limitations of the IFW, in particular those presented in section 6.2;
b) latency of observed meteorological information and the hazards associated with utilization of old information;
c) that IFW information beyond Annex 3 specifications is supplementary to the required information;
d) use of the application;
e) different types of displayed information (e.g. forecast or observed);
f) symbology (e.g. symbols, colours);
g) interpretation of meteorological information;
h) identifying failures (e.g. incomplete uplinks, datalink failures, missing information);
i) avoiding fixation; and
j) managing workload.

6.6 Note

6.6.1 Consideration should be given to the speed of technological development. The authority providing or arranging for the provision of meteorological service for international air navigation on behalf of a Contracting State (meteorological authority) should collaboratively work with the stakeholders to assess and, if requirements are met (e.g. actuality, latency, accuracy), enable new service implementation.

6.6.2 Whenever possible, future comparable information display functions, e.g. volcanic ash, solar radiation, should consider this guidance unless specific guidance is available.

APPENDIX- 2

SPECIFIC APPROVAL CHECKLIST

Phase 3 CAA Nepal review of the EFB Operational Evaluation Process

NOTE:

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.

Part 1 HARDWARE

SN	DESCRIPTION	YES	NO	NA	REMARKS
1.	Have the installed EFB resources been certified by a CAAN to accepted aviation standards either during the certification of the aircraft, service bulletin by the original equipment manufacturer, or by a third-party STC?				
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?				
3.	Will the display be readable in all the ambient lighting conditions, both day and night, encountered on the flight deck?				
4.	Has the operator demonstrated that the EFB will not electromagnetically interfere with the operation of aircraft equipment?				
5.	Has the EFB been tested to confirm operation in the anticipated environmental conditions (e.g. temperature range, low humidity, altitude)?				
6.	Have procedures been developed to establish the level of battery capacity degradation during the life of the EFB?				
7.	Is the capability of connecting the EFB to certified aircraft systems covered by an airworthiness approval?				
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?				
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?				
10.	Can the brightness or contrast of the EFB display be easily adjusted by the flight crew for various lighting conditions?				

Reviewed by FOI (sign & date): **Reviewed by AWI (sign & date):**

Part 2 INSTALLATION – MOUNTING

SN	DESCRIPTION	YES	NO	NA	REMARKS
1.	Has the installation of the mounting device been approved in accordance with the appropriate airworthiness regulations?				
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.?				
3.	Has it been confirmed that the mounted EFB location does not impede crew ingress, egress and emergency egress path?				
4.	Is it evident that the mounted EFB does not obstruct visual or physical access to aircraft displays or controls?				
5.	Does the mounted EFB location minimize the effects of glare and/or reflections?				
6.	Does the mounting method for the EFB allow easy access to the EFB controls and a clear unobstructed view of the EFB display?				
7.	Is the EFB mounting easily adjustable by flight crew to compensate for glare and reflections?				
8.	Does the placement of the EFB allow sufficient airflow around the unit, if required?				

Reviewed by FOI (sign & date): **Reviewed by AWI (sign & date):**

Part 3 SOFTWARE

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

Software application: _____(fill in the name of the software application)

SN	DESCRIPTION	YES	NO	NA	REMARKS
1.	Is the application considered an EFB function (see Chapter 6)?				
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?				
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))?				
4.	Does the software application have adequate security measures to ensure data integrity (e.g. preventing unauthorized manipulation)?				
5.	Does the EFB system provide, in general, a consistent and intuitive user interface, within and across the various hosted applications?				
6.	Has the EFB software been evaluated to consider HMI and workload aspects?				
7.	Does the software application follow Human Factors guidance?				
8.	Can the flight crew easily determine the validity and currency of the software application and databases installed on the EFB, if required?				
Power connection/batteries					
SN	**DESCRIPTION**	**YES**	**NO**	**NA**	**REMARKS**
9.	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)?				
10.	Is the power source suitable for the device?				
11.	Have guidance/procedures been provided for battery failure or malfunction?				
12.	Is power to the EFB, either by battery and/or supplied power, available to the extent required for the intended operation?				
13.	Has the operator ensured that batteries are compliant to acceptable standards?				
Cabling					
SN	**DESCRIPTION**	**YES**	**NO**	**NA**	**REMARKS**

14.	Has the operator ensured that any cabling attached to the EFB, whether in the dedicated mounting or when handheld, does not present an operational or safety hazard (e.g. it does not interfere with flight controls movement, egress, oxygen mask deployment,)?				
15.	For CS 25 aircraft only, ensure electrical wiring interconnection systems (EWIS) are being considered for installed cables.				
Stowage					
SN	**DESCRIPTION**	**YES**	**NO**	**NA**	**REMARKS**
16.	If there is no mounting device available, can the EFB be easily and securely stowed and readily accessible in-flight?				
17.	Is it evident that stowage does not cause any hazard during aircraft operations?				
Viewable Stowage					
SN	**DESCRIPTION**	**YES**	**NO**	**NA**	**REMARKS**
18.	Has the operator documented the location of its viewable stowage?				
19.	Has the operator ensured that the stowage characteristics remain within acceptable limits for the proposed operations?				
20.	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, maneuvering, or other action), it will not interfere with flight controls, damage flight-deck equipment or injure flight crew?				

Reviewed by FOI (sign & date): **Reviewed by AWI (sign & date):**

Part 4 MANAGEMENT

EFB Management					
SN	**DESCRIPTION**	**YES**	**NO**	**NA**	**REMARKS**
1.	Is there an EFB management system in place?				
2.	Does one person possess an overview of the complete EFB system and responsibilities within the operator's management structure?				
3.	Are the authorities and responsibilities clearly defined within the EFB management system?				
4.	Are there adequate resources assigned for managing the EFB?				
5.	Are third party (e.g. software vendor) responsibilities clearly defined?				
Crew Procedures					
SN	**DESCRIPTION**	**YES**	**NO**	**NA**	**REMARKS**
6.	Is there a clear description of the system, its operational philosophy and operational limitations?				
7.	Are the requirements for EFB availability in the operations manual and/or as part of the minimum equipment list (MEL)?				
8.	Have crew procedures for EFB operation been integrated within the existing operations manual?				
9.	Are there suitable crew cross-checks for verifying safety-critical data (e.g. performance, mass and balance (M&B) calculations)?				
10.	If an EFB generates information similar to that generated by existing flight-deck systems, do procedures identify which information will be primary?				
11.	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?				
12.	Are there procedures that specify what actions to take if the software applications or databases loaded on the EFB are out of date?				
13.	Are there procedures in place to prevent the use of erroneous information by flight crews?				
14.	Is there a reporting system for system failures?				
15.	Have crew operating procedures been designed to mitigate and/or control additional workload created by using an EFB?				
16.	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?				
EFB Risk Assessment					
SN	**DESCRIPTION**	**YES**	**NO**	**NA**	**REMARKS**

17.	Has an EFB risk assessment been performed?				
18.	Are there procedures/guidance for loss of data and identification of corrupt/erroneous outputs?				
19.	Are there contingency procedures for total or partial EFB failure?				
20.	Is there a procedure in the event of a dual EFB failure (e.g. use of a paper checklist or a third EFB)?				
21.	Have the EFB dispatch requirements (e.g. minimum number of EFBs on board) been incorporated into the operations manual?				
22.	Have MEL or procedures in case of EFB failure been considered and published?				
Training					
SN	**DESCRIPTION**	**YES**	**NO**	**NA**	**REMARKS**
23.	Is the training material appropriate with respect to the EFB equipment and published procedures?				
24.	Does the training cover the list of items in Chapter 4 — *Flight crew training*?				
Hardware Management Procedures					
SN	**DESCRIPTION**	**YES**	**NO**	**NA**	**REMARKS**
25.	Are there documented procedures for the control of EFB hardware configuration?				
26.	Do the procedures include maintenance of EFB equipment?				
Software Management Procedures					
SN	**DESCRIPTION**	**YES**	**NO**	**NA**	**REMARKS**
27.	Are there documented procedures for the configuration control of loaded software and software access rights to the EFB?				
28.	Are there adequate controls to prevent corruption of operating systems, software and databases?				
29.	Are there adequate security measures to prevent system degradation, malware and unauthorized access?				
30.	Are procedures defined to track database expiration/updates?				
31.	Are there documented procedures for the management of data integrity?				
32.	If the hardware is assigned to the flight crew, does a policy on private use exist?				

APPENDIX- 3

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 6), an entry must be included in the operator's operations specifications approved by the CAAN. The operations specifications will reference the location in the operations manual where the approved EFB applications are detailed. Figure C-1 shows an example of a specific approval EFB entry.

OPERATIONS SPECIFICATIONS (Subject to the approved conditions in the operations manual)				
SPECIFIC APPROVAL	YES	NO	DESCRIPTION	REMARKS
Continuing Airworthiness				
EFB for A/C type *Type 1*			18 - Specifically approved EFB hardware and software applications for A/C type *Type 1* are contained in [operations manual reference]	
Other				
18. *List the EFB functions*				

Figure C-1. Example of a specific approval EFB entry

Note. *— 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 EFB-specific approvals referenced in the operations specifications 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 C-2 contains an example of a

companion EFB-specific approval table.

The "Approved hardware for A/C type" column of the companion *EFB (hardware and software) with specific approval table* should match the "DESCRIPTION" column of the operations specifications form. The "EFB applications" column of the table should list all the applications requiring a specific approval and include the application version, with any applicable limitations. The "Specific references and/or remarks" column of the table should include the application version in addition to any specific operations manual reference and other remarks, if applicable.

EFB (hardware and software) with specific approval		
Approved hardware for A/C type	EFB applications *(List of EFB functions, versions and any applicable limitations.)*	Specific references and/or remarks
EFB for A/C type *Type 1*	– Aircraft performance calculation (take-off and landing) – *AppName1 ver x.x*	*See procedures in operations manual page X* *Backup: Quick Reference Handbook*
	– Airport moving map – *AppName2 ver x.x*	*Refer to operations manual page X*
	– Charts application: En route – *AppName3 ver x.x*	*See operations manual page Y Paper backup operation*
	– Airport charts (SID, STAR, approach) – *AppName4 ver x.x*	*Paperless operation* *Refer to operations manual page Z*
EFB for A/C type *Type 2*	– Charts application: En route – *AppName3 ver x.x*	*See operations manual page X Paper backup operation*

Figure C-2. Example of a companion EFB-specific approval table

APPENDIX- 4

EFB POLICY AND PROCEDURES MANUAL

These are the typical contents of an EFB policy and procedures manual that can be part of the Operation Manual. The proposed outline is very extensive. It may be adapted to the specific EFBs system and to the size and complexity of the operations in which the operator is involved.

EFB Policy & Procedures Manual

Typical Contents

1. Revision history

2. List of effective pages or paragraphs

3. Table of contents

4. Introduction

- Glossary of terms and acronyms
- EFB general philosophy, environment and dataflow
- EFB system architecture
- Limitations of the EFB system
- Hardware description
- Operating system description
- Detailed presentation of the EFB applications
- EFB application customisation
- Data management:
  - Data administration
  - Organisation & workflows
  - Data loading
  - Data revision mechanisms
  - Approval workflow
  - Data publishing & dispatch
  - Customisation
  - How to manage the airline specific documents
  - Airport data management
  - Aircraft fleet definition
- Data authoring
  - Navigation and customisation

5. Hardware and operating system control and configuration

- Purpose and scope
- Description of the following processes:
  - Hardware configuration and part No control
  - Operating system configuration and control
  - Accessibility control
  - Hardware maintenance
  - Operating system updating

- Responsibilities and accountabilities
- Records and filing
- Documentary references

6. Software application control and configuration

- Purpose and scope
- Description of the following processes:
  - Part No control
  - Software configuration management
  - Application updating process
- Responsibilities and accountabilities
- Records and filing
- Documentary references

7. Flight crew

- Training
- Operating procedures (normal, abnormal, and emergency)

8. Maintenance considerations

9. EFB Security Policy

- Security solutions and procedures

APPENDIX- 5

EXAMPLE OF FINAL OPERATIONAL REPORT

System description and classification of EFB system

- A general description of the proposed EFB system
- EFB system (harware and software applications) proposed

Software applications

- List of Type A applications installed
- List of Type B applications installed
- List of miscellaneous (non-EFB) software applications installed

Hardware (relevant information or references)

For portable EFB used without installed resources:

- EMI compliance demonstration
- Lithium battery compliance demonstration
- Depressurisation compliance demonstration
- Details of the power source

For portable EFB served by installed resources:

- Details of the airworthiness approval for the mounting device
- Description of the placement of the EFB display
- Details of the use of installed resources
- EMI compliance demonstration
- Lithium battery compliance demonstration
- Depressurisation compliance demonstration
- Details of the power source
- Details of any data connectivity

For installed EFB:

- Details of the airworthiness approval as installed equipment

Certification documentation

- Limitations contained within the AFM
- Guidelines for EFB application developers
- Guidelines for EFB system suppliers

Specific considerations for performance applications

- Details of performance data validation conducted

Operational assessment

- Details of the EFB risk assessment conducted
- Details of the human machine interface assessment conducted for Type A and B Software applications
- Details of flight crew operating procedures:
  - Procedures for using EFB systems with other flight crew compartment systems
  - Flight crew awareness of EFB software/database revisions
  - Procedures to mitigate and/or control workload

  - Flight crew responsibilities for performance calculations
- Details of proposed compliance monitoring oversight of the EFB system
- Details of EFB system security measures
- Details of EFB administration procedures including provision of the EFB policy and procedures manual
- Details of the electronic signatures procedure
- Details of the system for routine EFB System maintenance
- Details of flight crew training:
  - Initial training
  - Differences training
  - Recurrent training
- Report of the operational evaluation test:
  - Proposals for the initial retention of paper backup
  - Proposals for the commencement of operations without paper backup
- EFB platform/hardware description;
- Description of each software application to be included in the assessment;
- Risk assessment summary for each application and mitigation means put in place;
- Human factors assessment for the complete EFB system, human machine interface and all software applications;
  - Pilot workload in both single-pilot and multi-crew flown aircraft
  - Size, resolution, and legibility of symbols and text
  - For navigation chart display: access to desired charts, access to information within a chart, grouping of information, general layout, orientation (e.g., track-up, north-up), depiction of scale information
- Operator training;
- EFB administrator qualification.

APPENDIX- 6

EXAMPLES OF TYPE A SOFTWARE APPLICATIONS

Type A applications are EFB applications whose malfunction or misuse would have no adverse effect on the safety of any flight operation, i.e. a hazard level defined as no greater than a 'no safety effect' failure condition classification. Such applications might typically be, but not limited to:

(a) browser displaying:

(1) the certificates and other documents required to be carried by the applicable operational regulations and where copies are acceptable such as:
  (i) the noise certificate, and its English translation if applicable;
  (ii) the air operator certificate (AOC);
  (iii) the operations specifications relevant to the aircraft type, issued with the AOC; and
  (iv) the Third-Party Liability Insurance Certificate(s);

(2) some manuals and additional information and forms required to be carried by the applicable operational regulations such as:
  (i) notification of special categories of passenger (SCPs) and special loads; and
  (ii) passenger and cargo manifests, if applicable; and

(3) other information within the operator's aircraft library such as:
  (i) airport diversion policy guidance, including a list of special designated airports and/or approved airports with emergency medical service (EMS) support facilities;
  (ii) maintenance manuals;
  (iii) Emergency response guidance for aircraft incidents involving dangerous goods (ICAO Doc 9481-AN/928);
  (iv) aircraft parts manuals;
  (v) service bulletins/published Airworthiness Directives, etc.;
  (vi) current fuel prices at various airports;
  (vii) trip scheduling and bid lists;
  (viii) passenger information requests;
  (ix) check airman and flight instructor records; and
  (x) Flight crew currency requirements.

(b) interactive applications for crew rest calculation in the framework of flight time limitation;

(c) interactive forms to comply with the reporting requirements of the CAA Nepal and the operator.

APPENDIX- 7

TYPE B SOFTWARE APPLICATIONS

A non-exhaustive list of possible Type B software applications, that are to be evaluated, is provided in this Appendix.

— Document Browser displaying the following documents, interactive or not, or not in pre-composed format, and not driven by sensed aircraft parameters:
  - The manuals and additional information and forms required to be carried by Regulations such as:
    - The Operations Manual (including the MEL and CDL);
    - The Aircraft Flight Manual;
    - The Operational Flight Plan;
    - The aircraft continuing airworthiness records, including the technical Log;
    - Meteorological information including with graphical interpretation;
    - ATS Flight Plan;
    - notices to airmen (NOTAMs) and aeronautical information service (AIS) briefing documentation;

— Electronic aeronautical chart applications including en route, area, approach, and airport surface maps; these applications may offer features such as panning, zooming, scrolling, and rotation, centring and page turning, but without display of aircraft/own-ship position.

— Use of Airport Moving Map Displays (AMMD) applications that are compliant with the means set forth in **Appendix-1**, in particular with the ETSO-C165a approval.

— Applications that make use of the internet and/or other aircraft operational communications (AAC) or company maintenance-specific data links to collect, process, and then disseminate data for uses such as spare parts and budget management, spares/inventory control, unscheduled maintenance scheduling, etc.

— Cabin-mounted video and aircraft exterior surveillance camera displays;

— Aircraft performance calculation application that uses algorithmic data or calculates using software algorithms to provide:
  - take-off, en route, approach and landing, missed approach, etc. performance calculations providing limiting masses, distances, times and/or speeds;
  - power settings, including reduced take-off thrust settings;
  - mass and balance calculation application used to establish the mass and centre of gravity of the aircraft and to determine that the load and its distribution is such that the mass and balance limits of the aircraft are not exceeded.

— Airport Moving Map Displays (AMMD) applications not covered by an ETSO-C165a approval;

— Other Type B applications not listed in this appendix.

APPENDIX- 8

PROCESS FOR THE CLASSIFICATION OF SOFTWARE APPLICATIONS

1. Purpose

- As described in Para 1.1.2, the classification of the Type A and Type B EFB applications is based on the severity of failure conditions resulting from malfunctions and misuse (hereinafter referred to as 'failures') of the EFB applications.
- It is not required to perform a full system safety assessment in order to classify EFB applications.
- In practice, the assessment of these failure conditions can be achieved through the application at software level of the process described in Para 2 of this Appendix.
- The severity of the failure conditions will determine the classification of the EFB applications.

2. Process

As a first step, it should be verified that the application does not belong to the following list of applications that are not eligible for classification as either type A or B:

Applications:

(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;

(b) displaying information which may be directly used by the flight crew to assess the realtime 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;

(c) communications with air traffic services;

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

Then, this process should:

(a) identify failure conditions resulting from potential losses of function or malfunction (detected and undetected erroneous output) with consideration of any relevant factors (aircraft/system failures, flight crew procedures, operational or environmental conditions, etc.) which would alleviate or intensify the effects; and

(b) classify the failure conditions according to the severity of their effects.

Failure conditions classified as minor should then be verified through a qualitative appraisal of the integrity and safety of the system design and installation. Software involved in Minor Failure Condition should be classified as level D according to the relevant industry standard.

Software applications with failure conditions classified above minor are ineligible as EFB Type A or B applications.

Notes:

— The severity of the failure conditions linked to displaying a function already existing in the certified type design, or already authorised through an ETSO, and used with same concept of operation, cannot be less than already assessed for this function;

— The data resulting from this process may be reused by the operators in the context of the EFB risk assessment process.

APPENDIX- 9

HUMAN MACHINE INTERFACE ASSESSMENT AND HUMAN FACTORS CONSIDERATIONS

1.1 General principles

This Appendix provides Guidance Material for the assessment of the human machine interface associated with the EFB system. It provides general criteria that may be applied during assessments conducted during both the airworthiness approval and operational assessment and is restricted to human factors assessment techniques and means of compliance. The process for division of responsibilities and who does what is contained within the main body of this manual.

Note: Where an assessment is conducted as part of an airworthiness approval e.g. for an installed EFB system or installed resources for portable EFB, CS 25.1302 titled 'Installed systems and equipment for use by the flight crew' or applicable airworthiness basis should be applied.

1.2 Common considerations

1.2.1 Human machine interface

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

1.2.2 Legibility of text

Text displayed on the EFB should be legible to the typical user at the intended viewing distance(s) and under the full range of lighting conditions expected on a flight crew compartment, including use in direct sunlight. Users should be able to adjust the screen brightness of an EFB independently of the brightness of other displays on the flight crew compartment. In addition, when automatic brightness adjustment is incorporated, it should operate independently for each EFB in the flight crew compartment. Buttons and labels should be adequately illuminated for night use. All controls should be properly labelled for their intended function. Consideration should be given to the long-term display degradation as a result of abrasion and ageing.

1.2.3 Input devices

In choosing and designing input devices such as keyboards or cursor control devices, applicants should consider the type of entry to be made and flight crew compartment environmental factors, such as turbulence, that could affect the usability of that input device. Typically, the performance parameters of cursor control devices should be tailored for the intended application function as well as for the flight crew compartment environment.

1.2.4 General EFB design guidelines

1.2.4.1 Consistency

1.2.4.1.1 Consistency between EFBs and applications

Particular attention should be paid to the consistency of all interfaces, in particular when a provider develops the software application and a different organisation integrates it into the EFB.

1.2.4.1.2 Consistency with flight deck applications

Whenever possible and without compromising innovation in design/use, EFB user interfaces should be consistent with the other flight deck avionics applications with regard to design philosophy, look and feel, interaction logics and workflows.

1.2.4.2 Messages and the use of colours

For any EFB system, EFB messages and reminders should meet the requirements in CS 23.1322, 25.1322 or applicable certification basis, as is appropriate for the intended aircraft. While the

regulations refer to lights, the intent should be generalised to extend to the use of colours on displays and controls. That is, colour 'red' is to be used only to indicate a warning level condition. 'Amber' is to be used to indicate a caution level condition. Red and amber colours should be limited and considerate. 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 crew compartment system alerts. EFB messages, both visual and auditory, should be inhibited during critical phases of the flight.

Flashing text or symbols should be avoided in any EFB application. Messages should be prioritised and the message prioritisation scheme evaluated and documented.

Additionally, during critical phases of the flight, required flight information should be continuously presented without un-commanded overlays, pop-ups, or pre-emptive messages, excepting those indicating the failure or degradation of the current EFB application. However, if there is a regulatory or Technical Standard Order (TSO) requirement that is in conflict with the recommendation above, those should have precedence.

1.2.4.3 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 a positive indication of its status available to the user upon request. Certain non-essential applications such as e-mail connectivity and administrative reports may require an error message when the user actually attempts to access the function rather than an immediate status annunciation when a failure occurs. EFB status and fault messages should be prioritised and the message prioritisation scheme evaluated and documented.

1.2.4.4 Data entry screening 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. The EFB system should incorporate input error checking that detects input errors at the earliest possible point during entry, rather than on completion of a possibly lengthy invalid entry.

1.2.5 Error and failure modes

1.2.5.1 Flight crew error

The system should be designed to minimise the occurrence and effects of flight crew error and maximise the identification and resolution of errors. For example, terms for specific types of data or the format in which latitude/longitude is entered should be the same across systems. Data entry methods, colour-coding philosophies, and symbology should be as consistent as possible across the various hosted EFB applications. These applications should also be compatible with other flight crew compartment systems.

1.2.5.2 Identifying failure modes

The EFB system should be capable of alerting the flight crew of probable EFB system failures.

1.2.6 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. The feedback

and system response times should be predictable to avoid flight crew distractions and/or uncertainty.

1.2.7 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 certain portions of documents are not visible. This should be evaluated based on the application and intended operational function. If there is a cursor, it should be visible on the screen at all times while in use.

1.2.8 Active regions

Active regions are regions to which special user commands apply. The active region can be text, a graphic image, a window, frame, or other document object. These regions should be clearly indicated.

1.2.9 Managing multiple open applications and documents

If the electronic document application supports multiple open documents, or the system allows multiple open applications, indication of which application and/or document is active should be continuously provided. The active document is the one that is currently displayed and responds to user actions. Under non-emergency, normal operations, the user should be able to select which of the open applications or documents is currently active. In addition, the user should be able to find which flight crew compartment applications are running and switch to any one of these applications easily. When the user returns to an application that was running in the background, it should appear in the same state as when the user left that application, with the exception of differences stemming from the progress or completion of processing performed in the background.

1.2.10 Flight crew workload

The positioning and procedures associated with the use of the EFB should not result in unacceptable flight crew workload. Complex, multi-step data entry tasks should be avoided during take-off, landing, and other critical phases of the flight. An evaluation of the EFB intended functions should include a qualitative assessment of incremental pilot workload, as well as pilot system interfaces and their safety implications.

1.3 Specific application considerations

1.3.1 Approach/departure and navigation chart display

The approach, departure, and navigation charts that are depicted should contain the information necessary, in appropriate form, to conduct the operation to at least a level of safety equivalent to that provided by paper charts. It is desirable that the EFB display size is at least as large as current paper approach charts and that the format be consistent with current paper charts. The HMI assessment is key to identifying acceptable mitigation means, e.g.:

(a) to establish procedures to reduce the risk of making errors;

(b) to control and mitigate additional workload related to EFB use;

(c) to ensure consistency of colour coding and symbology philosophies, between EFB applications and their compatibility with other flight crew compartment applications; and

(d) to consider aspects of Crew Resource Management (CRM) when using an EFB system.

1.3.2 Performance applications and mass & balance calculations

Input data and output data (results) shall be clearly separated from each other. All the information necessary for a given calculation task should be presented together or easily accessible. All data required for the performance and mass & balance applications should be asked for or displayed, including correct and unambiguous terms (names), units of measurement (e.g. kg or lbs), and when applicable index system and CG-position declaration (e.g. Arm/%MAC). The units should match the ones from the other cockpit sources for the same kind of data. Airspeeds should be provided in a way directly useable in the cockpit unless the unit clearly indicates otherwise (e.g. KCAS). Any difference in the type of airspeed provided by the EFB application and the type provided by the AFM or FCOM performance charts should be mentioned in the pilot guides and training material. 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 active mode.

Inputs

The application should allow to clearly distinguish user entries from default values or entries imported from other aircraft systems. Performance applications should offer to the flight crew the ability to check whether a certain obstacle is included in the performance calculation and/or to include revised or new obstacle information in the performance calculation.

Outputs

All critical performance calculation assumptions (e.g. use of thrust reversers, full or reduced thrust/power rating) should be clearly displayed. The assumptions made about any calculation should be at least as clear to pilots as similar information would be on a tabular chart. All output data should be available in numbers. The application should indicate if a set of entries results in an unachievable operation (for instance a negative stopping margin) with a specific message or colour scheme. This should be done in accordance with D.2.4.2 (Messages and the use of colours). In order to allow a smooth workflow and to prevent data entry errors, the layout of the calculation outputs should be such that it is not inconsistent with the data entry interface of the aircraft applications in which the calculation outputs are used (e.g. Flight Management Systems).

Modifications

The user should be able to modify performance calculations easily, especially when making last minute changes. Calculation results and any outdated input fields should be deleted:
(a) when modifications are entered;
(b) when the EFB is shut down or the performance application is closed; and
(c) when the EFB or the performance application have been in a standby or ‘background’ mode long enough, i.e. such that it is likely that when it is used again the inputs or outputs are outdated.

APPENDIX- 10

FLIGHT CREW TRAINING

The purpose of this Appendix is to describe considerations for training and checking when Standard Operating Procedures (SOP) are dependent on the use of an EFB system.

1.1 EFB training and checking

1.1.1 Assumptions regarding flight crew previous experience

Training for the use of the EFB should be for the purpose of operating the EFB itself and the applications hosted on it, and should not be intended to provide basic competence in areas such as aircraft performance, etc. Initial EFB training, therefore, should assume basic competence in the functions addressed by the software applications installed.

Training should be adapted to the crew experience and knowledge.

1.1.2 Programmes crediting previous EFB experience

Training programmes for the EFB may take credit for previous EFB experience. For example, previous experience of an aircraft performance application hosted on a portable EFB and using similar software may be credited toward training on an installed EFB with a performance application.

1.1.3 Initial EFB training

Training required for the grant of an aircraft type rating may not recognise variants within the type nor the installation of particular equipment. Any training for the grant of a type qualification need not, therefore, recognise the installation or use of an EFB unless it is installed equipment across all variants of the type. However, where training for the issue of the type rating is combined with the operator's conversion course required by ORO.FC.220, the training syllabus should recognise the installation of the EFB where the operator's SOPs are dependent on its use.

Initial EFB Training may consist of both ground-based and in-flight training depending on the nature and complexity of the EFB system. An operator or approved training organisation (ATO) may use many methods for ground-based EFB training including written hand-outs or FCOM material, classroom instruction, pictures, videotape, ground training devices, computer-based instruction, FSTD, and static aircraft training. Ground-based training for a sophisticated EFB lends itself particularly to CBT-based instruction. In-flight EFB training should be conducted by a suitably qualified person during Line Flying Under Supervision or during Differences, Conversion or Familiarisation Training.

1.1.3.1 Areas of emphasis during initial EFB training

(a) The use of the EFB hardware and the need for proper adjustment of lighting, etc. when the system is used in-flight;

(b) The intended use of each software application together with limitations and prohibitions on their use;

(c) If an aircraft performance application is installed, proper cross-checking of data input and output;

(d) If a terminal chart application is installed, proper verification of the applicability of the information being used;

(e) If a moving map display is installed, the need to avoid fixation on the map display; and

(f) Failure of component(s) of the EFB.

1.1.3.2 Typical initial EFB training

The following might be a typical training syllabus, if not contrasting with the operational suitability data provided by the aircraft manufacturer.

1.1.3.2.1 Ground-based training

(a) System architecture overview;
(b) Display Unit features and use;
(c) Limitations of the system;
(d) Restrictions on the use of the system;
    (1) Phases of the flight;
    (2) Alternate procedures (e.g. MEL).
(e) Applications as installed;
(f) Use of each application;
(g) Restrictions on the use of each application;
    (1) Phases of the flight;
    (2) Alternate procedures (e.g. MEL).
(h) Data input;
(i) Cross-checking data input and output; and
(j) Use of data output.

1.1.3.2.2 Flight training

(a) Practical use of the Display Unit;
(b) Display Unit Controls;
(c) Data input devices;
(d) Selection of applications;
(e) Practical use of applications;
(f) CRM and human factor considerations;
(g) Situational awareness;
(h) Avoidance of fixation;
(i) Cross-checking data input and output; and
(j) Practical integration of EFB procedures into SOPs.

1.1.4 Initial EFB checking

1.1.4.1 Initial ground EFB checking

The check conducted following the ground-based element of Initial EFB Training may be accomplished by questionnaire (oral or written) or as an automated component of EFB computer-based training depending on the nature of the training conducted.

1.1.4.2 Skill test & proficiency check Proficiency in EFB use is not shown in the required items in for the Skill Test for the issue of a type rating following type conversion training or for the Proficiency Check for the renewal or revalidation of a type rating. Where the operator's SOPs are dependent on the use of the EFB on the particular type or variant, proficiency in the use of the EFB should be assessed in the appropriate areas.

1.1.4.3 Operator proficiency check

ORO.FC.230 (b)(1) requires that flight crew demonstrate their competence in carrying out normal procedures during the Operator Proficiency Check (OPC). Therefore, where an operator's SOPs are dependent on the use of an EFB, proficiency in its use should be assessed during the OPC.

Where the OPC is performed on an FSTD not equipped with the operator's EFB, proficiency should be assessed by another acceptable means.

1.1.4.4 **Line check**

ORO.FC.230 (c) requires that flight crew demonstrate their competence in carrying out normal procedures during the line check. Therefore, where an operator's SOPs are dependent on the use of an EFB, proficiency in its use should be assessed during line check.

1.1.4.5 **Areas of emphasis during EFB checking**

(a) Proficiency in the use of each EFB application installed;
(b) Proper selection and use of EFB displays;
(c) Where an aircraft performance application is installed, proper cross-checking of data input and output;
(d) Where a terminal chart application is installed, proper check of the validity of the information and the use of the chart clip function;
(e) Where a moving map display is installed, maintenance of a proper outside visual scan without prolonged fixation on EFB operation, especially during the taxiing operations; and
(f) Actions following the failure of component(s) of the EFB, including hot EFB battery.

1.2 Differences or familiarisation training

When the introduction of the use of an EFB requires Differences or Familiarisation Training to be carried out under ORO.FC.125, the elements of Initial EFB Training should be used, as described above.

1.3 Recurrent EFB training and checking

1.3.1 Recurrent EFB training

Recurrent training is normally not required for the use of an EFB, provided the functions are used regularly in line operations. Operators should be encouraged, however, to include normal EFB operations as a component of the annual ground and refresher training required by AMC1 ORO.FC.230.

In the case of mixed fleet flying, or where the EFB is not installed across the fleet, additional recurrent training should be applied. Initial training programme developed under 1.1.3 is considered to be sufficient.

1.3.2 Recurrent EFB Checking

Recurrent EFB checking should consist of those elements of the licence proficiency check, the operator proficiency check and the line check applicable to the use of an EFB as described in paragraphs 1.1.4.2, 1.1.4.3, and 1.1.4.4. Areas of emphasis are as described in paragraph 1.1.4.5.

1.4 Suitability of training devices

Where the operator's SOPs are dependent on the use of an EFB, it is recommended that the EFB is present during the operator's training and checking. Where present, the EFB should be configured and operable in all respects as per the relevant aircraft. This should apply to:
(a) the operator's conversion course required by ORO.FC.220;
(b) Differences or familiarisation training required by ORO.FC.125; and
(c) Recurrent training and checking required by ORO.FC.230.

Where the EFB system is based on a portable device used without any installed resources, it is recommended that the device is present and operable and used during all phases of the flight during which it would be used under the operator's SOPs.

For all other types of EFB system, it is recommended that the device is installed and operable in the training device (FFS) and used during all phases of the flight during which it would be used under the operator's SOPs. However, an operator may define an alternative means of compliance when the operator's EFB system is neither installed nor operable in the training device.

Note: It is not necessary for the EFB to be available for that training and checking which is not related to the operator and the operator's SOPs.

Where the EFB is installed equipment in the basic aircraft type or variant, the installation and use of the EFB in the training device is required for the training and checking for the issue of the type rating and for the checking for the renewal or revalidation of the type rating.

APPENDIX- 11

Power Supply Considerations for PORTABLE EFBs

If an EFB is permanently attached to the essential power network, it could affect the essential generation system (emergency generator and/or battery, bus bars, distribution system) to which it is connected.

Certification specifications require that an alternate high integrity electrical power supply system, independent of the normal electrical power system, be provided to power those services necessary for continued safe flight and landing, in case of loss of the normal system. Adding other unnecessary services/loads will affect the integrity of this alternate power system. Portable and installed EFBs are considered non-essential equipment and, therefore, not considered necessary for continued safe flight and landing. It is, hence, not recommended to connect the EFB to an essential power bus.

APPENDIX- 12

CONSIDERATIONS FOR RAPID DEPRESSURISATION TEST

When the EFB system hosts applications that are required to be used during flight following a rapid depressurisation, testing is required to determine an EFB device's functional capability. The information from the rapid depressurisation test is used to establish the procedural requirements for the use of that EFB device in a pressurised aircraft. Rapid decompression testing should follow the EUROCAE ED-14G/RTCA DO-160F guidelines for rapid decompression testing up to the maximum operating altitude of the aircraft on which the EFB is to be used.

The EFB should be operative for at least 10 minutes after the start of the decompression.

(a) Pressurised aircraft: When a portable EFB has succesfully completed rapid depressurisation testing, then no mitigating procedures for the depressurisation event need to be developed. When a portable EFB has failed the rapid depressurisation testing while turned ON, but successfully completed it when OFF, then procedures will need to ensure that at least one EFB on board the aircraft remains OFF during the applicable flight phases or configured so that no damage will be incurred should rapid decompression occur in flight above 10 000 ft AMSL.

If the EFB system has not been tested or has failed the rapid depressurisation test, then alternate procedures or paper backup should be available.

(b) Non-Pressurised aircraft: Rapid decompression testing is not required for an EFB used in an non-pressurised aircraft. The EFB should be demonstrated to reliably operate up to the maximum operating altitude of the aircraft. If EFB operation at maximum operating altitude is not attainable, procedures should be established to preclude operation of the EFB above the maximum demonstrated EFB operation altitude while still maintaining availability of the required aeronautical information.