AMC 033 – ELECTRONIC FLIGHT BAG GUIDELINES

ACCEPTABLE MEANS OF COMPLIANCE
(AMC)

GUIDE FOR
ELECTRONIC FLIGHT BAG
(EFB)

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ELECTRONIC FLIGHT BAG (EFB)

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1. INTRODUCTION

1.1 General

This Acceptable Means of Compliance (AMC) provides information and DCA policy regarding the acceptable method of compliance for the certification, airworthiness and operational approval for both portable and installed Electronic Flight Bag (EFB) aircraft computing devices.

The information is primarily designed for the initial application from an Aruban operator without EFB experience. However, each application will be processed according to the type of EFB, previous experience and quality of documentation.

1.2 References

This AMC is based on the following publications which have been accepted as defining references on this subject.
   a. JAR-OPS 1.1040(m) for Aruba for AOC holders;
   b. AUA-OPS 2, paragraph 12.7.3 for General Aviation operators;
   c. FAA AC 120-76A;
   d. FAA AC 91-78;
   e. JAA TGL 36;
   f. AMC 20-25;
   g. EASA AMC 25.1581 Appendix 1 – Computerised Aeroplane Flight Manual;
   h. JAA TGL No. 26 MEL Policy;
   i. EUROCAE ED-130 Guidance for the Use of Portable Electronic Devices (PEDs) on Board Aircraft;
   j. EUROCAE ED-12() Software Considerations in Airborne Systems and Equipment Certification;
   k. EUROCAE ED-14() Environmental Conditions and Test Procedures for Airborne Equipment;
   l. UL 1642 Underwriters Laboratory Inc. (UL) Standard for Safety for Lithium Batteries.

1.3 Background

One of the major motivators for using EFB is to reduce or eliminate the need for paper and other reference material in the cockpit. Operators have long recognized the benefits of using portable electronic computing devices, including commercially available portable computers, to perform a variety of functions traditionally accomplished using paper references. EFB system may be approved for use in conjunction with or replace some of the hard copy materials that pilots typically carry in their flight bags. EFB can electronically store and retrieve documents required for flight operations, such as the general operations manual, minimum equipment list, operations specification, and control documents.

The applicant remains responsible for ensuring the accuracy of the information used and that it is derived from verifiable sources. The use of EFBs is intended to cover an alternative method of storing, retrieving and use of the manual and information required by the applicable operational requirements.

The evaluation of an EFB has both an airworthiness and operational aspect and, where necessary, to make a complete evaluation of an EFB system, there is a need for close coordination between each process.

1.4 Definitions

Aircraft Administrative Communications (AAC)

AAC data link receive/transmit information that includes but is not limited to, the support of applications identified in Appendices A and B of this AMC. Aeronautical Administrative Communications (AAC) are defined by ICAO as communications used by aeronautical operating agencies related to the business aspects of operating their flights and transport services. The airlines use the term Airline Operational Communication (AOC) for this type of communication.

Electronic Flight Bag

An electronic display system intended primarily for cockpit/flight deck or cabin use. EFB devices can display a variety of aviation data or perform basic calculations (e.g. performance data, fuel calculations and etc. as approved by the DCA). In the past, some of these functions were traditionally accomplished using paper references or were based on data provided to the flight crew by an airline's flight dispatch function. The scope of the EFB system functionality may also include various other hosted databases and applications. Physical EFB displays may use various technologies, formats, and form of communication. These devices are sometimes referred to as auxiliary performance computers (APC) or laptop auxiliary performance computers (LAPC).

The EFB may also support other functions that have no paper equivalent (e.g., a video surveillance display).

EFB Administrator

The EFB Administrator is the person appointed by the operator, held responsible for the administration of the EFB system within the company. The EFB administrator is the primary link between the operator and the EFB system and software suppliers.
He/she will be the person in overall charge of the EFB system and will be responsible for ensuring that any hardware conforms to the required specification and that no unauthorised software is installed. He/she will also be responsible for ensuring that only the current version of the application software and data packages are installed on the EFB system.

EFB System

An EFB system includes the hardware and software needed to support an intended function.

Data Connectivity for EFB Systems
Data connectivity for EFB system supports either uni- or bi-directional data communication between the EFB and the aircraft systems (e.g., avionics).

Hosted Application
Software installed on an EFB system that allows specific operational functionality.

Interactive Information
Information presented on the EFB that, via software applications, could be selected and rendered in a number of dynamic ways. This includes variables in the information presented based on data-oriented software algorithms, concepts of de-cluttering, and "on-the-fly" composition as opposed to pre-composed information.

Mounting Device
A mounting device builds up portable equipment. It may include arm-mounted, kneeboard, cradle, or docking-stations, etc. It may have aircraft power and data connectivity. It may require quick-disconnect for egress.

Portable Electronic Device (PED)
PED are typically lightweight consumer electronic devices, which are personally owned (passenger or crew-member) and personally operated and have functional capability for communications, entertainment, data processing, and/or utility. There are two basic categories of PEDs – those with and those without intentional transmitting capability. (Ref.: ED-130/RTCA DO-294())
Class 1 and 2 EFBs are considered PEDs.

Controlled Portable Electronic Device (PED)
A controlled PED is subject to administrative control by the company. This will include, inter alia, tracking the location of the devices to specific aircraft or persons and ensuring that no unauthorised changes are made to the hardware, software or databases. A controlled PED will also be subject to procedures to ensure that it is maintained to the latest amendment state.

Pre-Composed Information
Information previously composed into a static composed state (non-interactive). The composed displays have consistent, defined and verifiable content, and formats that are fixed in composition. Applications based on pre-composed information may contain "contextual access" like hyperlink, bookmark.

1.5 Approval Requirements

a. Non-Turbo-Jet Light Aeroplanes below 5700 kg
    Non-Turbo-Jet Light Aircraft below 5700 kg do not require DCA approval subject to installation and airworthiness requirements.

    Note: Refer to all Sections except Section 5.

b. AOC Holders and Operators of Large and Turbo-Jet Aeroplanes
    An operator of an aeroplane shall not employ electronic navigation data products that have been processed for application in the air and on the ground unless the Aruban DCA, as the State of Registry, has approved the operator's procedures for ensuring that the process applied and the products delivered have met acceptable standards of integrity and that the products are compatible with the intended function of the equipment that will use them.
    An operator shall implement procedures that ensure the timely distribution and insertion of current and unaltered electronic navigation data to all aeroplanes that require it.

    Note: Refer to all Sections except Section 6.

c. Fractional Ownership
    DCA approval required

    Note: Same requirements as Large and Turbo Jet Aeroplanes. Refer to all Sections except Section 6.

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2. HARDWARE CLASSES OF EFB SYSTEMS

This AMC defines three hardware classes of EFB system: Class 1, 2 and 3.

2.1 Class 1 EFB

Class 1 EFB systems do not require airworthiness approval and are:
   a. Are generally Commercial-Off-The-Shelf (COTS)-based computer systems used for aircraft operations (e.g. laptop, tablet PC);
   b. Are not attached to an aircraft mounting device;
   c. Are considered to be a controlled PED (see paragraph *1.4*);
   d. May only connect to aircraft power through a certified power source (see section 4.1.1.3);
   e. Are normally without aircraft data connectivity except under specific condition (see paragraph 4.1.1.4; and
   f. Are stowed during critical phases of flight.

A Class 1 EFB is not considered to be part of the certified aircraft configuration, i.e. not in the aircraft Type design nor installed by a change to the Type design nor added by a Supplemental Type Certificate. Therefore, Class 1 EFB systems do not require airworthiness approval. Normally without aircraft data connectivity except under specific conditions (see Section 4.1.1(d)),

Note: An Apple iPad is considered as a Class 1 EFB.

2.2 Class 2 EFB

Class 2 EFB systems require airworthiness approval as described in Section 5 and are:
   a. Generally include COTS-based computer systems used for aircraft operations (e.g., laptop, tablet PC) considered as a controlled PED;
   b. Are attached to an aircraft mounting device, allowing use during all phases of flight;
   c. May be connected to installed resources (e.g. a remote display unit, cursor control device, keyboard etc.);
   d. May only connect to aircraft power through a certified power source (See section 4.1.2.5);
   e. May receive data from the aircraft systems (see section 6.1.2.6); and
   f. Should not have the capability to send data to the aircraft systems except under specific conditions (see section 4.1.2.6).

A Class 2 EFB or a part of a Class 2 EFB system, are considered portable if tools are not required to remove an EFB from the flight deck and a flight crew member is able to perform the task. Portable EFBs should be located on the flight deck and controlled by the flight crew during all phase of flight. Any EFB components/hardware not accessible on the flight deck by the flight crew and/or not portable should be installed and certificated equipment covered by a Type Certificate (TC), changed TC or Supplemental (S)TC. (The one exception to being accessible on

the flight deck is a remotely mounted antenna that provides signal reception to a Class 1 or 2 EFB) A portable EFB is considered as a controlled PED (refer to section 4.3).

Note: Class 2 EFB system power, data connectivity and mounting devices require the DCA Airworthiness approval based on the State of Design approval.

2.3 Class 3 EFB

Class 3 EFB systems are installed equipment requiring an airworthiness approval. This approval should cover the host platform and installed resources and integrity of the EFB hardware installation (e.g. server, display, keyboard, power, switching), including hardware and operating system software qualification. Such aspects as the human machine interface should also be addressed.

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3. SOFTWARE APPLICATION FOR EFB SYSTEMS

This AMC defines three types of software applications: Types A, B and C. For applications or functions not listed in Appendix A or Appendix B, the applicant should coordinate evaluation and approval with the DCA.

The functionality associated with the EFB System depends upon the applications loaded on the host. The classification of the applications into two Types (A and B) is intended to provide clear divisions between the scope and therefore the approval process applied to each one. Although guidelines and examples are provided in this AMC to provide guidance as to the Type associated with a particular application, there is still the potential for misclassification.

3.1 Type A Software Applications

Type A software applications include pre-composed, fixed presentations of data currently presented in paper format.

Type A software applications:
    a. May be hosted on any of the hardware classes;
    b. Require Operational approval by the DCA;
    c. Do not require an airworthiness approval.

Typical examples of Type A software applications may be found in Appendix A.

3.2 Type B Software Applications

Type B software applications include interactive applications that can manipulate data and presentation.

Type B applications:
    a. May be hosted on any of the hardware classes;
    b. Require Operational approval from the DCA;
    c. Do not require an airworthiness approval.

Typical examples of Type B software applications may be found in Appendix B.

To be used in critical phases of flight, an EFB displaying Type B software must be secured and viewable. A kneeboard is one way to accomplish this.

Note: Applications "Apps" for the Apple iPad are usually Type B.

3.3 Type C Software Applications

Type C applications are dynamic EFB applications considered to be ineligible for classification as either Type A or B.

Type C applications:
   a. May only be hosted on Class 3 Hardware;
   b. May be installed together with Type A and/or B applications provided the Type A and/or Type B EFB applications do not interfere with Type C applications (e.g. a partition, a segregation or by demonstration);
   c. Require both Airworthiness and Operational approvals (refer to section 4.2.2).

Typical examples of Type C applications can be found in Appendix C.

Note: AMMD Type C application may be installed on Class 2 host platform without segregation subject to the specific conditions and approval processes described in Appendix H of this AMC.

3.4 Own-ship Position

Class 1 EFBs with Type B software must not display the aircraft's position, also referred to as "own-ship position" on moving map on Class 1 and 2 EFB. Most applications, such as the Jeppesen Mobile TC App, inhibits own-ship position.

3.5 Software Control

An operator shall implement procedures that ensure the timely distribution and insertion of current and unaltered electronic navigation data to all aeroplanes that require it. The operator needs to establish specific procedures to verify that revisions to the database contained in the EFBs are current, complete and approved. Unauthorized modification or installation of any new database intended for operational use is not permitted unless the new database has been demonstrated to comply with the original approval basis.

Operators also need to establish revision control procedures so that flight crew and others can ensure that the contents of the system are current and complete. These revision control procedures may be similar to the revision control procedures used for paper or other storage media. For data that is subject to a revision cycle control process, it should be readily evident to the user which revision cycle has been incorporated in the information obtained from the system.

The operator should identify a means to demonstrate that adequate security measures are in place to prevent malicious introduction of unauthorized modification to all the systems. EFB systems need to be protected from possible contamination from external viruses.

4. HARDWARE AND SOFTWARE APPROVAL PROCESSES

4.1 EFB Hardware Approval Process (Host Platform)

4.1.1 Class 1 EFB Hardware

As a PED, a Class 1 EFB device does not require an airworthiness approval. However, paragraphs 4.1.1.1 through 4.1.1.4 should be assessed where applicable during the operational approval process, where an assessment should be made of the physical use of the device on the flight deck. Safe stowage, crashworthiness, security and use under normal environmental conditions including turbulence should also be addressed.

4.1.1.1 Electromagnetic Interference (EMI) Demonstrations

For the purpose of EMI demonstrations, Class 1 EFB devices should satisfy the criteria contained within ED-130/RTCA DO-294(). If the Class 1 EFB device is to remain powered (including being in stand-by mode) during take-off and landing, further EMI demonstrations (laboratory, ground or flight test) are required to provide greater assurance of non-interference and compatibility. Assessment should be made against the requirements of ED-14()/DO-160() Section 21, Emission of Radio Frequency Energy and results submitted to the competent authority for acceptance during the EFB operational approval.

4.1.1.2 Batteries

During the procurement of Class 1 EFB devices, special consideration should be given to the intended use and maintenance of devices incorporating lithium batteries. In particular, the applicant should address the following issues:
  a. Risk of leakage;
  b. Safe storage of spares including the potential for short circuit;
  c. Hazards due to on-board continuous charging of the device, including battery overheat;
  d. Any other hazards due to battery technology.

The operator is responsible for the maintenance of EFB system batteries and should ensure that they are periodically checked and replaced when required.

When EFBs with lithium battery systems that connect to the aircraft power system is used the lithium battery should comply with the following criteria:
  a. Safe cell temperatures and pressures should be maintained during any foreseeable charging or discharging condition and during any failure of the charging or battery monitoring system. The lithium battery installation should preclude explosion in the event of those failures;

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b. Design of the lithium batteries should preclude the occurrence of self-sustaining, uncontrolled increases in temperature or pressure;

c. No explosive or toxic gases emitted by any lithium battery in normal operation, or as the result of any failure of the battery charging system or monitoring system, may accumulate in hazardous quantities within the aircraft;

d. No corrosive fluids or gases that may escape from any lithium battery may damage the surrounding structure or any adjacent systems, equipment, or electrical wiring of the aircraft;

e. Each lithium battery should have provisions to prevent any hazardous effect on structure or essential systems caused by the maximum amount of heat the battery can generate during a short circuit of the battery or of its individual cells; and

f. There should be a capability to control the charging rate of the battery automatically, so as to prevent battery overheating or overcharging.

As a minimum specification, the lithium battery incorporated within the EFB device should have been tested to Underwriters Laboratory Inc. (UL) Standard for Safety for Lithium Batteries reference UL 1642.

4.1.1.3 Power Source

The EFB power source should be designed such that it may be deactivated at any time. Where there is no possibility for the flight crew to quickly remove or un-plug the power to the EFB system, a clearly labeled and conspicuous means (e.g. on/off switch) should be provided. Circuit breakers are not to be used as switches; their use for this purpose is prohibited.

In order to achieve an acceptable level of safety, certain software applications, especially when used as a source of required information, may require that the EFB system have access to an alternate power supply.

Further considerations can be found in Appendix K of this AMC.

4.1.1.4 Data Connectivity

Data connectivity of the EFB to other aircraft systems is not authorised except if the EFB is connected to:

a. A system completely isolated from the avionics/aircraft systems (e.g., EFB system connected to a transmission medium that receives and transmits data for AAC purposes for usage on the ground only);

b. A certified data link to receive data only from aircraft systems, where the data link, through the certification process, has an approved security device to protect the aircraft systems from receiving any data from the EFB system and from the installation or use of unauthorised applications and data.

Through the certification process, this data link should also have been demonstrated to protect the installed aircraft systems from adverse effects due to EFB system failures. Subject to the above provisions, there is no further evaluation required when connecting the EFB to the aircraft data link port.

4.1.1.5 Rapid Depressurization Testing

Environmental testing, specifically testing for rapid depressurization, may need to be performed when the EFB host applications that are required to be used during flight following a rapid depressurisation. However, since many Class 1 EFB devices were originally COTS electronic systems accepted for aviation use, testing done on a specific EFB model configuration may be applied to other aircraft installations and these generic environmental tests may not need to be duplicated. The operator seeking approval should provide:

a. Evidences of these tests that have already been accomplished; or
b. Suitable alternate procedures to deal with the total loss of the EFB system.

Further considerations can be found in Appendix L of this AMC.

4.1.2 Class 2 EFB Hardware

Elements of a Class 2 EFB system require an airworthiness approval. The approval is limited in scope to the aircraft mounting device, crashworthiness, data connectivity, EFB power connection and the installed resources, if any. The COTS-based computer system hosting the EFB software applications and the Operating System is considered to be a controlled PED and does not require an airworthiness approval.

An evaluation of the EFB mounting device, flight deck location, data connectivity, EFB power connection and the installed resources, if any, should be conducted as described below. In order to evaluate the EFB mounting device, crashworthiness, data connectivity, EFB power connection and installed resources, a complete EFB system may be necessary and should be therefore provided**.**

4.1.2.1 Design of the Mounting Device

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

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

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

b. The mounting device should be able to lock in position easily. Selection of positions should be adjustable enough to accommodate a range of flight crew member preferences. In addition, the range of available movement should accommodate the expected range of users' physical abilities (i.e., anthropometrics constraints). Locking mechanisms should be of the low-wear type that will minimize slippage after extended periods of normal use.

c. Crashworthiness considerations should be considered in the design of this device. This includes the appropriate restraint of any class device when in use.

d. A provision should be provided to secure or lock the mounting device in a position out of the way of flight crew operations when not in use. When stowed, the device and its securing mechanism should not intrude into the flight deck space to the extent that they cause either visual or physical obstruction of important flight controls/displays and/or egress routes.

e. Mechanical interference issues of the mounting device, either on the side panel (side stick controller) or on the control yoke in terms of full and free movement under all operating conditions and non-interference with buckles etc. For yoke mounted devices (Supplemental) Type Certificate holder data should be obtained to show that the mass inertia effect on column force has no adverse affect on the aircraft handling qualities.

f. If the EFB requires cabling to mate with aircraft systems or other EFBs, and if the cable is not run inside the mount, the cable should not hang loosely in a way that compromises task performance and safety. Flight crew should be able to easily secure the cables out of the way during aircraft operations (e.g., cable tether straps).

g. Cables that are external to the mounting device should be of sufficient length to perform the intended tasks. Cables too long or short could present an operational or safety hazard.

4.1.2.2 Placement of the EFB Display

The EFB display unit should be placed in such a way that it does not unduly impair the pilot's external view during all phases of the flight. The location of the display unit should be assessed for impact to egress requirements. Glare and reflection should not interfere with the normal duties of the flight crew. Screen luminance should be assessed in lighting conditions varying from direct sun light to night.

When the EFB is in use (intended to be viewed or controlled), its display should be within 90 degrees on either side of each pilot's line of sight. This does not apply if the information is not being directly monitored from the EFB during flight. For example, an EFB may generate take-off and landing V-speeds, but these speeds are used to set speeds bug or are entered into the FMS, and the airspeed indicator is the sole reference for the V-speeds. In this case, the EFB system need not be located in the pilot's primary field of view. A 90-degree viewing angle may be unacceptable for certain EFB applications if aspects of the display quality are degraded at large

viewing angles (e.g., the display colours wash out or the displayed colour contrast is not discernible at the installation viewing angle).

In addition, consideration should be given to the potential for confusion that could result from presentation of relative directions (e.g., positions of other aircraft on traffic displays) when the EFB is positioned in an orientation inconsistent with that information. For example, it may be misleading if own aircraft heading is pointed to the top of the display and the display is not aligned with the aircraft longitudinal axis. Each EFB system should be evaluated with regard to these requirements (See CS 23.1321, CS 27.1321, CS 29.1321 and CS 25.1321.). If the display is an installed resource, it should be assessed against CS 25.1302 or in accordance with the applicable certification basis.

4.1.2.3 EMI Demonstrations

For the purpose of EMI demonstrations, Class 2 EFB devices should satisfy the criteria contained within ED-130/RCTA DO 294(). If the EFB system is to be used during take-off and landing, further EMI demonstrations (laboratory, ground or flight test) are required to provide assurance of non-interference and ensure compatibility.

The EFB system should then be assessed against the requirements of ED-14()/DO-160() Section 21, Emission of Radio Frequency Energy.

4.1.2.4 Batteries

See paragraph 4.1.1.2

4.1.2.5 Power Source

See paragraph 4.1.1.3.

4.1.2.6 EFB Data Connectivity

EFB data connectivity should be validated and verified to ensure non-interference and isolation from aircraft systems during data transmission and reception.
Installed aircraft systems should not be adversely affected by EFB system failures.

The EFB system can only send data to the aircraft systems if:
   a. The EFB system is connected to a certified data link (either wired or wireless) where the data link, through the certification process, has an approved security device to protect the aircraft systems from installation or use of unauthorised applications and data. If this data link is approved through the certification process, then there is not further evaluation required when connecting the EFB to the aircraft data link port;
   b. A direct connection from the EFB system to an aircraft system has been assessed to ensure that security threats from the EFB system are identified and risk mitigation

strategies are implemented to protect the aircraft systems from adverse impacts reducing the aircraft safety, functionality and continued airworthiness.

The EFB system can receive data from any aircraft systems.
It can be connected as well to a system outside the aircraft (e.g. "Gatelink" or GPRS) for AAC/AOC communications purposes. Connectivity may be wired or wireless.

4.1.2.7 Rapid Depressurization Testing

See paragraph 4.1.1.5.

4.1.2.8 Installed Resources

Installed resources may consist of components such as an installed remote display, a control device (e.g. a keyboard, pointing device, switching etc.) or a docking station or the portable EFB hardware platform. The portable EFB hardware platform may be in use when stowed.

The installed resources can be dedicated to EFB functions only or shared between both EFB and airworthiness-approved avionics functions except for the Primary Flight Display (PFD), (e.g. display of EFB data on Multi-Function Displays) provided the EFB is segregated from the installed resource by a certified interface that prevents the EFB from adversely affecting certified systems, resources or functionality.

When sharing an installed MFD, either in part or completely, the EFB should be demonstrated to not obstruct or restrict the display of required aircraft parameters under both normal and abnormal operating conditions e.g., engine parameters and fault warning system.
It is particularly important that EFB software applications displayed on an MFD comply with guidelines which ensure compatibility with the display and alerting philosophy, are considered within the overall display prioritisation and do not inhibit automatic or pilot selected recall of required aircraft functions e.g., terrain warning, TCAS.
Installed resources require an airworthiness approval.

4.1.3 Class 3 EFB Hardware

A Class 3 EFB is considered as installed equipment and therefore requires an airworthiness approval. Assessment of compliance with the airworthiness requirements would typically concentrate on two areas:

    a. The intended function and safety (e.g., security and integrity), applicable only to the interfaces with the avionics data sources and not to the software applications. The failure modes of the interface between the EFB and its avionics data sources should be assessed under normal and faulty conditions.

Note 1: An assessment should be carried out to ensure that security threats from a Class 3 EFB are identified and risk mitigation strategies are implemented to protect the aircraft systems from adverse impacts reducing the aircraft safety, functionality and continued airworthiness.

Note 2: The assessment of safety and integrity of the EFB software application should be addressed through the approval of the application itself (see Section 6.2).

b. Hardware and operating system software qualification should be conducted in accordance with the agreed Design Assurance Level (DAL) for the system and its interfaces.

Note: DAL attribution at this stage (empty platform) may prohibit hosting of future software applications due to inconsistency between the criticality of the future software application and the platform DAL.

A Class 3 EFB may form part of a host platform (i.e. a network server) supporting other functions such as central maintenance. Such functions are considered to be outside of the scope of this AMC and their approval should be conducted in accordance with the applicable airworthiness provisions.

For a Class 3 EFB a human factors assessment should be conducted. At this stage the evaluation is restricted to the EFB hardware resources comprising display, keyboard, switches, annunciators, etc. However, in order to assess the human factors aspects of these devices, it may be necessary to host emulation software on the platform. This may be a dedicated software package developed purely for the purposes of conducting the assessment or be one or more of the intended EFB software applications. The human factors assessment should be conducted in accordance with the criteria applied during the aircraft type design or modification exercise and identified within the aircraft certification basis. If no prior human factors requirements have been applied, the applicant should follow the process described in Appendix D.

4.1.4 Certification Documentation

4.1.4.1 Aircraft Flight Manual

For Class 2 and 3 EFB, the Aircraft Flight Manual (AFM) section or an Aircraft Flight Manual Supplement (AFMS) should contain any limitations concerning:
a. the use of the EFB host platform for Class 3 EFB system;
b. the use of the installed EFB provisions/ resources for Class 2 EFB system.

For this purpose, the AFM(S) should make reference to any guidelines (relevant to the airworthiness approval), intended primarily for EFB software application developers or EFB system suppliers.

4.1.4.2 Guidelines for EFB Software Application Developers (Class 3)

A guideline document should be written and maintained to provide a set of limitations, considerations and guidelines to design, develop and integrate software applications into the EFB host platform. The guideline should address at least the following:

a. a description of the architecture for the host platform;

b. information necessary in order to define a software application, including library routines etc.;

c. the EFB Design Assurance Level (DAL) and any assumptions, limitations or risk mitigations means necessary to support this;

d. information necessary to ensure development of a software application consistent with the avionics interface and the human machine interface, that is also accurate, reliable, secure, testable, and maintainable;

e. rules of co-habitation of any new software application with those already approved;

f. guidelines on how to integrate any new software application into the platform; and,

g. a quality assurance process for developing software applications in the context of the host platform.

The guidelines document may also be of relevance to the operator, operator's competent authority, the Agency and JOEB.

4.1.4.3 Guidelines for EFB system suppliers (Class 2)

Guidelines should be written and maintained when EFB resources for a Class 2 EFB system are installed. These installed resources are considered as provisions, which are part of the aircraft configuration and therefore, are certificated.
The document should provide a set of requirements and guidelines to integrate the Portable Class 2 EFB system in the installed provisions and to design and develop EFB software applications.

Guidelines intended primarily for use by the EFB system supplier, should address at least the following:

a. A description of the installed EFB resources and associated limitations if any. For example:

- Intended function, limitations of use, regulatory framework, etc.;

- Characteristics of the mounting devices, display units, control and pointing devices, printer, etc.;

- Maximum authorized characteristics (dimensions, weight, etc.) of the portable parts of the EFB system supported by the mounting devices;

- EFB provisions architecture description, including normal / abnormal / manual/ automatic reconfigurations; and

- Normal / abnormal / emergency / maintenance procedures including allowed phases of flight.

   b. Characteristics and limitations, including safety and security considerations to protect the aircraft systems, concerning:

      a. power supply;

      b. laptop battery; and

      c. data connectivity (in the case of incomplete provision).

Those guidelines may also be of relevance to the operator, and operator's competent authority,

4.2 EFB Software Approval Process

When seeking an evaluation of a software application for the purpose of an operational approval, the applicant (e.g. an operator supported by the vendor or developer) should make a submission to the competent authority (for further details refer to Appendix F).

4.2.1 Type A and B Software Applications

Type A and B software applications do not require airworthiness approval, but should be approved through the operational approval process.

4.2.2 Type C Software Applications

Type C software applications require both airworthiness and operational approvals.

4.2.3 Non-EFB Software Applications

Software applications supporting function(s) not directly related to operations conducted by crew on the aircraft should be considered as non-EFB software applications and their use is outside of the scope of this document. The EFB Administrator should ensure that non-EFB software applications do not adversely impact the operation of the EFB (refer to 5.8).

Note: If an EFB software application is not listed in Appendices A, B or C, and does not clearly fall into the existing definitions of Sections 5.2.1, 5.2.2, or 5.2.3, advice should be sought from the responsible competent authority

4.2.4 Specific Considerations for Mass and Balance and Performance Applications

Performance applications are typically derived from computerised AFM information, approved against the applicable airworthiness regulations. Only certain modules of the performance program, a particular program revision and a particular host are approved. With Type B performance software applications, the operations' competent authority requires assurance that the resulting data, through software derivation, customisation or optimisation, provides

performance figures that can be verified as being consistent where applicable with the certificated data (AFM). If there is any doubt, the operator's competent authority may wish to seek advice from performance specialists of the Agency to assist in the validation of these types of software application. In general, this involves checking that the EFB derived performance calculations provides consistent results when compared with calculations from the approved AFM modules.

5. OPERATIONAL APPROVAL PROCESS

5.1 Approval Process

The DCA will consider applications from operators to use an EFB system on a case-by-case basis using the process described hereafter. Operators planning to implement the use of EFB systems will need to demonstrate to the DCA that the EFB system is robust and will not provide inaccurate or misleading information to crews.

The operator may demonstrate the fidelity and reliability of the system in a number of ways. Where it is the intention to start EFB operations with no paper back up a full Operational Risk Assessment and suitable means of mitigation against failure or malfunction will be required. Alternatively, the operator may choose to keep the paper back up, as a cross check against the EFB information and as a means of mitigation against failure or malfunction.
A combination of the above methods where some risk assessment and limited paper back up is carried may also be used at the discretion of the DCA. The final Operational Evaluation Test (see section 5.8) will depend on the method used.

Note: Operators of small non-turbo-jet operating under AUA-OPS 2 (General Aviation Aeroplanes) do not require DCA approval subject to installation and airworthiness requirements. Refer to Section 6.

Any modification of the previously approved process for database management or the loading of any new, modified or additional software intended for operational use should not be permitted unless it can be shown that the software does not contravene any applicable regulations the conditions under which the initial operational approval was granted or any other applicable regulations. Any new, modified or additional software should be acceptable to, or, where applicable, should be approved by the DCA in accordance with the conditions specified under this AMC.

An operator should supply the DCA with details of the intended modification of the previously approved process for database management or the loading of any new, modified or additional software in advance of the effective date. However, immediate modifications or changes that are required in the interest of safety may be applied and used immediately, provided that any approval required in accordance with the conditions established in this AMC has been applied for and the modifications and changes follow also the revision control procedures specified in paragraph *7.91*.

Modifications and amendments of database and/or software may also be required by the DCA. The operator should ensure that these modifications and amendments are incorporated and they follow the revision control procedures specified in paragraph *7.9.1*.

5.2 Role of the EFB System Supplier

The EFB system supplier is the link between the application developer and the EFB administrator. In addition to what is stated in 7.9, he/she is responsible for assuring that the EFB software package (batch) is in conforming with this AMC at the time it is delivered to the operator. When an EFB software package is initially delivered to an operator seeking operational approval, the EFB system supplier may apply for a JOEB evaluation to assess conformity against the appropriate regulations, to simplify the operator's approval process

5.3 Risk Assessment for EFB Systems

Prior to the entry into operation of any EFB system, the operator will be required to demonstrate to the competent authority that the system has been subject to a risk assessment conducted under the overall operator's Management System (MS). Where an EFB system replaces traditional paper-based documentation or information, the objective of the Risk Assessment is to demonstrate that the EFB system (hardware and software) achieves at least the same level of accessibility, usability and reliability as the means of presentation it replaces.

Where the EFB system is intended for introduction alongside a paper-based system for a trial period, no risk assessment is required beyond that conducted under the MS. The results of the trial should establish the configuration and use of the system.

Where an accelerated introduction with a reduced trial period or paperless entry-into-service of a new EFB system is intended, a detailed Operational Risk Analysis will be required.

5.3.1 MS Risk Assessment

In considering the accessibility, usability and reliability of the EFB system, the operator should demonstrate to the DCA that the failure of the complete EFB system as well as individual applications including corruption or loss of data and erroneously displayed information has been considered.
Operators will need to establish a reliable alternative means of providing the information available on the EFB system.

This may be accomplished by one or a combination of the following:
- System design;
- Alternative power sources;
- Redundant EFB applications hosted on different platforms;
- The relevant information as paper back-up;
- Procedural means.

5.4 Operational Risk Analysis

The DCA will need to be satisfied that the operator has considered the failure of the complete EFB system as well as individual applications including corruption or loss of data and erroneously displayed information.

The objective of this process is to demonstrate that the software application achieves at least the same level of integrity and availability as the "traditional" means that it is intended to replace.

Where a detailed Operational Risk Analysis is required, the ORA process should:
- Identify potential losses of function or malfunction (detected erroneous output, undetected erroneous output) and associated failure scenarios;
- Analyse the operational repercussions of these failure scenarios; and
- Propose mitigation means e.g., software design features, availability of back up data, operational procedures, training, administration, method to ensure appropriate accuracy and currency of databases etc. linked to the use of this application.

Note: Some EFB applications parameters may depend on crew entries whereas others may be parameters defaulted from within the system and subject to an administration process (e.g. the runway line-up allowance in an aircraft performance application). In the first case, mitigation means will concern mainly training and crew procedures aspects whereas in the second case, mitigation means will more likely focus on administrator and quality policy aspects.

5.4.1 Scope

The analysis will be specific to the operator concerned but will need to address at least the following points:
- Minimization of undetected erroneous application output;
- Ease or otherwise to detect erroneous outputs from the software application including:
  - Description of corruption scenarios
  - Description of mitigation means (crew monitoring);
- Upstream development quality process
  - Reliability of root data used in applications (qualified/verified input data)
  - Application verification and validation checks
  - Non interference of application software e.g., partitioning of Type A, B from Type C or other applications;
- Description of the mitigation means following detected loss of application, or detected erroneous output due to internal EFB error e.g., availability of back up data, procedures etc. This may be in the form of an alternative EFB possibly supplied from a different power source or some form of paper back-up system e.g., Quick Reference Handbook (QRH).

The operator may then propose to the DCA that the EFB system be used as an alternative system to paper documentation. The proposal to the DCA should specify which paper need not be

carried and/or any operational credit sought. The DCA may require a trial period during which paper documentation is retained to confirm the robustness of the system.

EFB system design features such as those assuring data integrity and the accuracy of performance calculations (e.g. a "reasonableness" or "range" check) may have an impact on the ORA. The ORA methodology should be considered by the Original Equipment Manufacturer when developing the EFB system to allow the operational environment to be taken into account and to support the development of the ORA by the operator.

5.5 Dispatch Considerations

The operator should carry out an assessment of the dispatch considerations with regard to the EFB system. The operator should demonstrate how the availability of the EFB system is confirmed by pre-flight checks. Instructions to flight crew should clearly define the actions to be taken in the event of any EFB system deficiency.

In order to achieve an acceptable level of availability, certain software applications, especially when used as a source of required information, may require that the EFB system has an alternate power supply or that procedures exist to mitigate against EFB power supply failures.

Mitigation may be in the form of maintenance and/or operational procedures; examples being:

- Scheduled maintenance task to replace batteries as required;
- Fully charged back-up battery on-board;
- Procedures for the flight crew to check the battery charging level before departure;
- Procedures for the flight crew to switch off the EFB in a timely manner when the aircraft power source is lost.

5.5.1 Dispatch with Inoperative EFB Elements

Alternative procedures used for dispatch with inoperative EFB elements, and described either in MEL or in the Operations Manual, should ensure that an acceptable level of safety is maintained. Particular attention should be paid to alternative procedures for applications providing calculated operational data such as a performance application.

The same degree of data input and output integrity in the form of crosschecking and gross error checks should be maintained by the alternative procedure as is obtained by the fully operative system.

Note: Further guidance and means of compliance relating to relief, which may be available under the MEL for inoperative EFB elements, is provided in TGL No. 26.

The purpose of the guidance within TGL 26 is not to require inclusion of Class 1 and 2 EFBs in an operator's MEL, but to provide one means of controlling inoperative EFB equipment. Other means, such as control procedures described within the operator's Operations Manual, may be acceptable by the operator's competent authority.

5.6 Human Machine Interface Assessment for Type A and B Software Applications

The operator will need to carry out an assessment of the human machine interface and aspects governing Cockpit Resource Management (CRM), when using the EFB system. This should include a review of the complete system to include at least the following points:
- Human/machine interface;
- Legibility of text;
- Approach/departure and navigation chart display;
- Responsiveness of application;
- Off-screen text and content;
- Active regions;
- Managing multiple open applications and documents;
- Messages and the use of colors;
- System error messages;
- Data entry screening and error messages.

Note: Further guidance and means of compliance are provided in Appendix D.

5.7 Flight Crew Operating Procedures

5.7.1 Procedures for Using EFB Systems with other Flight Deck Systems

Procedures should be designed to ensure that the flight crews know which aircraft system (e.g., Engine Indicating and Crew Alerting System (EICAS), Flight Management System (FMS), or EFB system) to use for a given purpose, especially when both the aircraft and EFB systems provide similar information.
Procedures should also be designed to define the actions to be taken when information provided by an EFB system does not agree with that from other flight deck sources, or when one EFB system disagrees with another.

If an EFB system generates information similar to that generated by existing cockpit automation, procedures should clearly identify which information source will be primary, which source will be used for back up information, and under what conditions to use the back-up source. Whenever possible and without compromising innovation in design/use, EFB/user interfaces should be consistent (but not necessarily identical) with the flight deck design philosophy.

5.7.2 Flight Crew Awareness of EFB Software/Database Revisions

The operator should have a procedure in place to allow flight crews to confirm prior to flight the revision number and/or date of EFB application software including where applicable, database versions. However, flight crews should not be required to confirm the revision dates for other databases that do not adversely affect flight operations, such as maintenance log forms, a list of airport codes, or the Captain's Atlas. An example of a date sensitive revision is an aeronautical

chart database on a 28-day AIRAC revision cycle. Procedures should specify what actions to take if the software applications or databases loaded on the EFB system are out-of-date.

5.7.3 Procedures to Mitigate and/or Control Workload

Procedures should be designed to mitigate and/or control additional workloads created by using an EFB system. The operator should develop procedures such that both flight crewmembers do not become preoccupied with the EFB system at the same time. Workload should be apportioned between flight crewmembers to ensure ease of use and continued monitoring of other flight crew functions and aircraft equipment. These procedures should be strictly applied in flight and should specify the times at which the flight crew may not use the EFB system.

5.7.4 Defining Flight Crew Responsibilities for Performance Calculations

Procedures should be developed that define any new roles that the flight crew and dispatch office may have in creating, reviewing, and using performance calculations supported by EFB systems.

5.8 Quality Assurance

The operator should establish document procedures for inclusion of the EFB system in their assurance program (JAR-OPS 1.035). This should detail who will be in overall charge of the EFB system, i.e. the EFB Administrator, and who will have DCA to authorize and activate amendments to the hardware and software.

Procedures should be established for the maintenance of the EFB system and how unserviceabilities and failures will be dealt with to ensure that the integrity of the EFB system is assured. Maintenance procedures will also need to include the handling of updated information and how this will be accepted and then promulgated in a timely and complete format to all users and aircraft platforms.
Should a fault or failure of the system come to light it is essential that such failures are brought to the immediate attention of the flight crew and that the system is isolated until rectification action is taken.

As well as back up procedures to deal with system failures a reporting system will need to be in place so that any action necessary, either to a particular EFB system, or to the whole system, is taken in order to prevent the use of erroneous information by flight crews. The EFB system will need to be secure from unauthorized intervention. This should include the use of password protected system updates as well as physical security of the hardware. Measures should also include the control of laptop software installations to prevent use of unauthorized data.

5.9 EFB System Security

The EFB system (including any means used for its updating), like any other aircraft system, should be secure from unauthorised intervention (e.g. malicious software). The operator should demonstrate to their competent authority that adequate security procedures are in place to protect the system. These procedures should guarantee that prior each flight the EFB operational software works as specified and approved and that the EFB operational data is complete, accurate. Moreover, a system should be in place to ensure that the EFB does not accept a data load that contains corrupted content.

The procedures should be transparent, easy to understand, easy to follow and easy to oversee:
- If an EFB consists a COTS component, e.g. a laptop, which can be easily removed, manipulated or replaced by a similar component, then special consideration should be given to the physical security of the hardware;
- In case of a system which offers input ports, especially if widely known protocols are using these ports and/or internet connections are offered, then special consideration should be given to the risks associated with these ports;
- In case a physical media is used to update the EFB system, especially if widely known types of physical media are used, then the operator should use technologies and/or procedures to assure that unauthorized content cannot enter the EFB system through these media.

The required level of EFB security depends on the criticality of the used functions (e.g. an EFB which only holds a list of fuel prices may require less security than an EFB used for performance calculations).

Beyond the level of security required to assure that the EFB can properly perform its intended functions, the level of security ultimately required depends on the abilities and integration level of the EFB. EFBs system which have the ability to send data to aircraft systems should be required to have a higher level of security than EFBs without this capability, whatever the EFB Class and whatever the type of software hosted.

Example of typical safety technologies are:
- Individual system firewalls;
- Clustering of systems with similar safety standards into domains;
- Data encryption & authentication;
- Virus scans;
- Keeping the OS up-to-date;
- Initiating air/ground connections only when required and always from the aircraft;
- "Whitelists" for allowed internet domains;
- VPNs;
- Granting of access rights on a need-to-have basis; and
- A fast response system, which can react quickly to reported threats.

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The EFB Administrator should not only keep the EFB system, but also his/her knowledge about security of EFBs systems up to date.

5.10 Electronic Signatures

JAR–OPS 1, Part-M and other regulations may require a signature to signify either acceptance or to confirm the authority (e.g. load sheet, technical logbook, NOTOC). In order to be accepted as an equivalent to a handwritten signature, electronic signatures used in EFB applications need, as a minimum, to fulfill the same objectives and should, as a minimum, assure the same degree of security as the handwritten or any other form of signature it intends to replace.

To ensure this, an operator should have in place procedures for electronic signatures that guarantee:

- **The uniqueness**: A signature should identify a specific individual and be difficult to duplicate.
- **The significance**: An individual using an electronic signature should take deliberate and recognizable action to affix his or her signature.
- **The scope**: The scope of information being affirmed with an electronic signature should be clear to the signatory and to subsequent readers of the record, record entry, or document.
- **The signature security**: The security of an individual's handwritten signature is maintained by ensuring that it is difficult for another individual to duplicate or alter it.
- **The non-repudiation**: An electronic signature should prevent a signatory from denying that he or she affixed a signature to a specific record, record entry, or document. The more difficult it is to duplicate a signature, the likelier the signature was created by the signatory.
- **The traceability**: An electronic signature should provide positive traceability to the individual who signed a record, record entry, or any other document.

An electronic signature should retain those qualities of a handwritten signature that guarantee its uniqueness. Systems using either a PIN or a password may be appropriate in providing positive traceability to the individual who appended it. Advanced electronic signatures, qualified certificates and secured signature-creation devices needed to create them are typically not required for EFBs operations.

Additional guidance from EASA or the operator's competent authority, if available, should be considered.

Note: The provision of secure access to EFB functions is outside the scope of this document.

5.11 Role of the EFB Administrator

The role of the EFB Administrator is a key factor in the running of the EFB system. Complex EFB systems may require more than one individual to conduct the administration process, but one person should be designated as the EFB administration responsible for the complete system with appropriate authority within the operator's management structure. Each person involved in EFB administration will need to receive appropriate training in the role and should have a good working knowledge of the proposed system hardware, operating system and relevant software application. The content of this training should be determined with the EFB system or application supplier.

The EFB Administrator is responsible for hardware and software configuration management and for ensuring, in particular that no unauthorised software is installed. The EFB Administrator is also responsible for ensuring that only a valid version of the application software and current data packages are installed on the EFB system.

The EFB system supplier should provide guidelines to clearly identify, which parts of the system can be accessed and modified by the EFB Administrator and which parts are only accessible by the supplier. It should also be clearly stated which changes and modifications may be further delegated by the EFB Administrator to maintenance and support staff.
The EFB Administrator should establish and document procedures to ensure that these guidelines are strictly adhered to and that no unauthorized changes take place.

The EFB Administrator will also be responsible for conducting audit measures and for ensuring that company procedures are complied with by all personnel. EFB administration should be subject to independent routine audits conducted by the operator's Quality Assurance Programme (see paragraph 5.8).

5.12 Flight Crew Training

Flight crew will need to be given specific training in the use of the EFB system before any approval is given. Training should include at least the following:
- An overview of the system architecture;
- Pre-flight checks of the system;
- Limitations of the system;
- Specific training on the use of each application and the conditions under which the EFB may and may not be used;
- Restrictions on the use of the system, including where some or all of the system is not available;
- Procedures for cross checking of data entry and computed information;
- Phases of flight when the EFB system may and may not be used;
- CRM and human factor considerations on the use of the EFB; and
- Additional training for new applications or changes to the hardware configuration.

Consideration should also be given to the role that the EFB system plays in Operator Proficiency Checks as part of Recurrent training and checking and to the suitability of training devices used during training and checking.

Note: Further guidance and means of compliance are provided in Appendix E.

5.13 Operational Evaluation Test

5.13.1 General

The object of the Operational Evaluation Test will be to verify that the above elements have been satisfied before final approval of the EFB in place of paper documentation. Operators, who can present evidence of an Operational Evaluation Test from the previous State of Registry, may be waived this test.

5.13.2 Initial Retention of Paper Back-up

Where paper is initially retained as back up, the operational evaluation test will typically be conducted in two stages. The first stage should run in parallel with the equivalent paper format to verify the correctness and reliability of the system. This will normally depend on the flight schedule of the operator be for a six-month period but may be varied at the discretion of the DCA. The evaluation should include audits of the procedures used as well as checks on the accuracy of any computed data. The purpose of the in-service proving period is for the operator to demonstrate to the competent authority that the EFB system provides an acceptable level of accessibility; usability and reliability to those required by the applicable operational requirements (see JAR-OPS 1.135(b) and 1.1040(m)). In particular that:
- The operator's flight crew are able to operate the EFB applications without reference to paper;
- The operator's administration procedures are in place and function correctly;
- The operator is capable of providing timely updates to the applications on the EFB, where a database is involved;
- The introduction of the EFB without paper back up does not adversely affect the operator's operating procedures and alternative procedures for use when the EFB system is not available provide an acceptable equivalent; and
- For a system including uncertified elements (hardware or software), that the system operates correctly and reliably.

On completion of the first stage a report should be sent to the DCA who will then issue an approval for the use of the system in place of the paper format. As a precaution, the paper documentation must be retained during a second stage for use in the event of the EFB system not being available or any fault being detected with the system. When the DCA is satisfied that the

back-up procedures are sufficiently robust, approval may be given to allow removal of the paper documentation.

Each authorization process is considered unique, because of differences in each operator's aircraft types, training programs, operational procedures, intended function of the EFB, etc.

5.13.3 Commencement of Operations without Paper Back Up

Where the applicant/operator seeks credit to start of operations without paper back up the operational evaluation test will consist of the following elements:

a. A detailed review of the operational risk analysis
b. A simulator LOFT session to verify the use of the EFB under operational conditions including
    1. normal, abnormal and emergency conditions. Items such as a late runway change and diversion to an alternate should also be included. This should be conducted before any actual line flights, as the outcome may need a change to the flight crew training and/or administrative procedures.
    2. Observation by the DCA of the initial line flights.

The DCA must also be satisfied that operator will be able to continue to maintain the EFB to the required standard through the actions of the administrator and Quality Assurance Programme.

5.14 Final Operational Report (Operational Compliance Summary)

The operator should produce a final operational report, which summarizes all activities conducted as demonstrated means of compliance, supporting the issue of an operational approval of the EFB system. The report should include, but not be limited to, the following;

a. EFB platform/hardware description;
b. Description of each software application to be included in the approval;
c. Risk analysis summary for each application and mitigation means put in place;
d. Human factor assessment for the complete EFB system, human machine interface and all software applications:
    1. Pilot workload in both single-pilot and multi-crew flown aircraft
    2. Size, resolution, and legibility of symbols and text
    3. 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.

    Note: Refer to Appendix D for human machine interface assessment and human factors considerations.

e. Training;
f. EFB Administrator qualification;
g. Statement that confirms that the use of the EFB does not interfere with equipment or systems required for flight.

An example of typical items that the operator should include in this report is provided in Appendix J.

Once the DCA is satisfied that the EFB may be used in place of, or as an alternative to paper based information, may grant an operational approval based on the submission described above.

6. NON AOC HOLDERS AND NON TURBO-JET SMALL AEROPLANES ONLY

6.1 General

For operations by small non-turbo-jet aeroplanes under AUA-OPS 2 (General Aviation Aeroplanes), the use of an EFB in lieu of paper is the decision of the aircraft operator and/or the pilot in command. An approval by the DCA is not required. This AMC however contains guidance on replacing paper products, including aeronautical charts, with an EFB and operators transitioning to a paperless cockpit should undergo a self-evaluation period during which the operator should carry paper backups of the material on the EFB.

During this period, the operator should validate that the EFB is as available and reliable as the paper-based system being replaced.

6.2 Recommendations

a. The operator should carry out an assessment of the human-machine interface and aspects governing Crew Resource Management when using the EFB. General considerations for the assessment includes:
   1. workload, integration of the EFB into the cockpit;
   2. display and lighting issues;
   3. system shutdown and system failures;
   4. Attention must be given to the physical EFB. Some items to consider are placement issues such as stowage during takeoff or landing, and the operation of an unsecured EFB. Use of the controls and input devices may be easy on the ground, but demanding in flight;
   5. Training should include preflight checks of the system, the use of each operational function on the EFB, the conditions (including phases of flight) under which the EFB should not be used, and procedures for cross-checking data entry and computed information;
   6. Operators transitioning to a paperless cockpit should undergo an evaluation period during which the operator should carry paper backups of the material on the EFB. The backup should be readily available to the crew. During this period the operator should validate that the EFB is as available and reliable as the paper-based system being replaced; and
   7. An operator should implement procedures that ensure the timely distribution and insertion of current and unaltered electronic navigation data to all aeroplanes that require it.

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7. SURVEILLANCE (ALL OPERATORS)

Surveillance requirements by all operators should include specific aspects on performance data including:

     a.   Validity, currency and control of data;
     b.   Amendment process;
     c.   Operations Manual;
     d.   SOPs;
     e.   Correct and appropriate use of data;
     f.   Compliance with approval limitations (if applicable); and
     g.   Operator's records.

Note 1: AOC holders and operators of Large and Turbo-jet aeroplanes should include the above requirements in their SMS.

Note 2: Refer to Appendix F for safety considerations regarding EFB.

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APPENDIX A
EXAMPLES OF "TYPE A" ELECTRONIC FLIGHT BAG (EFB) APPLICATIONS REQUIRING APPROVAL

1. Document Browser displaying non-interactive documents in pre-composed format and without contextual access or display driven by sensed aircraft parameters.

- Flight Operations Manuals (FOM) *(Without contextual access based on sensed aircraft parameters)*
- Company Standard Operating Procedures (SOP)
- Airport diversion policy guidance, including a list of Special Designated Airports and/or approved airports with emergency medical services (EMS) support facilities
- Operations Specifications (Ops Specs)
- Cockpit observer briefing cards
- Airplane Flight Manuals (AFM) and Airplane Flight Manual Supplements (AFMS)
- For smaller aircraft, Pilot Operating Handbook (POH), including POH Section IX supplements
- Aircraft performance data (fixed, non-interactive material for planning purposes)
- Airport performance restrictions manual (such as a reference for takeoff and landing performance calculations)
- Other aircraft performance data, including specialized performance data for use in conjunction with advanced wake vortex modeling techniques, land and hold short operations (LAHSO) predictions, etc. (fixed, non-interactive material for planning purposes)
- Maintenance manuals
- Aircraft maintenance reporting manuals
- Aircraft flight log and servicing records
- Autopilot approach and auto-land records
- Flight Management System / Flight Management and Guidance System problem report forms
- Aircraft parts manual
- Services Bulletins / published Airworthiness Directives, etc.
- Required VHF Omni directional Range (VOR) check records
- Minimum equipment list (MEL**)** *(Without contextual access based on sensed aircraft parameters)*
- Configuration Deviation List (CDL)
- Aruban regulations and airport specific rules and regulations
- Airport / Facility Directory (A/FD) data (e.g. fuel availability, LAHSO distances for specific runway combinations, etc.)
- Noise abatement procedures for arriving and departing aircraft
- Published (graphical) pilot Notices to Airman (NOTAM)
- International Operations Manuals, including regional supplementary information and International Civil Organization (ICAO) differences
- Aeronautical Information Publications (AIP)
- Aeronautical Information Manual (AIM)
- Oceanic navigation progress logs
- Pilot flight and duty-time logs
- Flight crew required rest logs

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- ☐ Flight crew qualification logs (such as aircraft qualification, Class II flight crew qualifications, Category (CAT) III qualifications, high minimums logs, night currency logs, pilot in command (PIC) qualifications for special areas, routes and airports and special airports qualifications
- ☐ Captain's report (i.e., captain's incident reporting form)
- ☐ Flight crew survey forms (various)
- ☐ Cabin Crew Manuals
- ☐ EMS reference library (for use during medical emergencies)
- ☐ Trip scheduling and bid lists
- ☐ Aircraft's captain's logs
- ☐ Aircraft's CAT II / CAT III landing records
- ☐ Antiterrorism profile data
- ☐ Hazardous Materials (HAZMAT) oxidizer look up tables
- ☐ Emergency Response Guidance for Aircraft Incidents Involving Dangerous Goods (ICAO Doc 9481-AN/928)
- ☐ Customs declaration and agriculture inspection / clearance form
- ☐ Special reporting forms, such as near mid-air collisions reports, Aviation Safety Reporting System, bird wildlife encounters, etc.
- ☐ Incidents of interference to aircraft electronic equipment from devices carried aboard aircraft
- ☐ Current fuel prices at various airports
- ☐ Realistic training modules, including "PC at home" training applications, "off-duty" training materials review, and pre-flight "mission" rehearsals
- ☐ Check airman and flight instructor records
- ☐ Aircraft operating and information manuals (performance information, weight and balance, systems, limitations, etc.)
- ☐ Flight operations manuals including emergency procedures
- ☐ Airline policies and procedures manuals
- ☐ Aircraft Maintenance Manuals
- ☐ Look-up and completion of various reporting forms
- ☐ Maintenance personnel sign-off of discrepancy form (maintenance discrepancy logs need to be downloaded into a permanent record at least weekly).
- ☐ Flight crew qualifications recordkeeping, including aircraft qualifications, CAT II/III, high minimums, landing currency, flight and duty time, etc.
- ☐ PIC currency requirements
- ☐ The Cabin Attendant Manual
- ☐ Passenger information requests – some are directed to the gate or to the agent meeting the flight (e.g. special meal requests, wheel chair requirements, unaccompanied minors, gate information for connecting flights, flights being held for connecting passengers, etc.)
- ☐ Cabin maintenance write-ups. (Maintenance discrepancy logs need to be downloaded into a permanent record at least weekly.)
- ☐ Approved electronic signature using public/private key technology (PKI)
- ☐ Weather information in a pre-composed format

APPENDIX B
EXAMPLES OF "TYPE B" ELECTRONIC FLIGHT BAG (EFB)

APPLICATIONS

1. Document Browser displaying documents that are interactive, or not in pre-composed format and/or with contextual access or display driven by sensed aircraft parameters.

Such documents might typically be:

☐ Flight Crew Operations Manuals (FCOM) with contextual access based on sensed aircraft parameters
☐ Takeoff, en route, approach and landing, missed approach, go-around, etc. performance calculations. Data derived from algorithmic data or performance calculations based on software algorithms. (1)
☐ Power settings for reduced thrust settings (1)
☐ Runway limiting performance calculations (1)
☐ Cost index modeling
☐ Master flight plan / updating
☐ Interactive Plotting for Class II navigation
☐ Mission rehearsals
☐ 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. (1)
☐ Maintenance discrepancy sign-off logs. (maintenance discrepancy logs need to be downloaded into a permanent record at least weekly).
☐ Cabin maintenance discrepancy reporting forms/ location codes. (Maintenance discrepancy logs need to be downloaded into a permanent record at least weekly.)
☐ Non-interactive electronic approach charts in a pre-composed format from accepted sources
☐ Panning, zooming, scrolling and rotations for approach charts
☐ Pre-composed or dynamic interactive electronic aeronautical charts (e.g. en route, area, approach, and airport surface maps) including, but not limited to, centering and page turning but without display or aircraft / own-ship position. (2) (4)
☐ Electronic checklists, including normal, abnormal, and emergency. EFB checklists cannot be interactive with other aircraft systems. (3)
☐ Application that make use of the Internet and/or other aircraft operational communications 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. (maintenance discrepancy logs need to be downloaded into a permanent record at least weekly.)
☐ Weather data with graphical interpretation
☐ Cabin-mounted and aircraft exterior surveillance camera displays
☐ Apple iPad and other tablets depending upon application

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Notes:

1. *Performance computation application including pre-composed and interactive data may be classified as a Type B, subject to consultation with the responsible airworthiness personnel during the operational approval process. Otherwise, such applications should follow a normal airworthiness approval process.*

2. *Electronic dynamic interactive charts with a symbol indicating aircraft/own-ship position that is displayed during any phase of flight may need to follow a normal airworthiness approval process if functionality, accuracy, refresh rate and resolution enable to use this application as a navigation display.*

3. *Electronic checklist may be classified as a Type B, subject to consultation and agreement with the responsible airworthiness personnel during the operational approval process. Otherwise, such applications should follow a normal airworthiness approval process.*

4. *Although there is not limitation on hosting of type B applications on a Class 1 hardware, in the case of electronic aeronautical chart applications, their normal use on Class 1 hardware is prohibited during critical phases of flight, unless the Class 1 EFB is a knee board system and is securely attached to the pilot in a manner which allows its normal use and meets the HMI criteria specified in appendix D.*

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APPENDIX C
TYPE C SOFTWARE APPLICATIONS

It is important that software applications are correctly classified and that the appropriate level of airworthiness and operational assessment is clearly identified. Appendices A and B of this AMC list software applications which may be classified as either Type A or Type B and which may be approved through an operational approval process.

The distinction between Type B and Type C software may be difficult to establish and may require negotiation between the applicant and EASA. The Notes within Appendix B highlight those applications that will require an airworthiness evaluation prior to operational approval.
This Appendix lists examples of Type C software applications that require a full airworthiness approval process. Type C software applications are those for which the functional hazard assessment has been determined to be greater than 'No Safety Effect'.

Examples of Type C applications are:
- Any application displaying information which may be tactically used by the flight crew to check or control the aircraft trajectory, either to follow the intended navigation route or to avoid adverse weather, obstacles or other traffic, in flight or on ground. The display of own ship position on electronic aeronautical charts, on the presentation of certain weather maps, on the display of terrain or of other aircraft positions relative to own ship's position fall into this category;
- Any application displaying information which may be directly used by the flight crew to assess the real-time status of aircraft critical and essential systems, as a replacement for existing installed avionics, and/or to manage aircraft critical and essential systems following failure;
- Any application enabling primary means of communications related to air traffic services, or whereby the flight path of the aircraft is authorised, directed or controlled.

Note: Applications may not replace any system or equipment (e.g., navigation, communication, or surveillance system) that is required for type-certification or by operating rules.

Note: the term 'tactically used by the flight crew' means that which supports short term decision making by the flight crew.

Note: Applications covered by an airworthiness approval may contain user-modifiable software or data. The boundaries of the user-modifiable parts should be defined as part of the airworthiness approval.

Note: In case of doubt on the applicability of the above criteria, the application developer should contact the responsible authority and seek advice.

Note: Though a Type C application is a certified function and undergoes a full certification process, an operational assessment is still required as part of the JOEB process.

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APPENDIX D
HUMAN MACHINE INTERFACE ASSESSMENT AND HUMAN FACTORS CONSIDERATIONS

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 and operational approvals 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 the AMC.

Note: Where an assessment is conducted as part of an airworthiness approval i.e. for a Class 3 EFB system or Class 2 EFB installed resources, CS 25.1302 titled "Installed systems and equipment for use by the flight crew" or applicable airworthiness basis should be applied.

2. Common Considerations

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, color coding philosophies, and symbology.

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 deck, 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 deck. In addition, when automatic brightness adjustment is incorporated, it should operate independently for each EFB in the flight deck. Buttons and labels should be adequately illuminated for night use. All controls must be properly labeled for their intended function. Consideration should be given to the long-term display degradation as a result of abrasion and aging.

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 deck 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 deck environment.

2.4 General EFB Design Guidelines

2.4.1 Messages and the Use of Colors.

For any EFB system, EFB messages and reminders should meet the requirements in CS 23.1322 or 25.1322, as is appropriate for the intended aircraft. While the regulations refer to lights, the intent should be generalized to extend to the use of colors on displays and controls.

That is, the color "red" shall be used only to indicate a warning level condition. "Amber" shall be used to indicate a caution level condition. Any other color may be used for items other than warnings or cautions, providing that the colors used, differ sufficiently from the colors prescribed to avoid possible confusion. EFB messages and reminders should be integrated with (or compatible with) presentation of other flight deck system alerts. EFB messages, both visual and auditory, should be inhibited during critical phases of flight. Flashing text or symbols should be avoided in any EFB application. Messages should be prioritized and the message prioritization scheme evaluated and documented.

Additionally, during critical phases of 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.

2.4.2 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 prioritized and the message prioritization scheme evaluated and documented.

2.4.3 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.

2.5 Error and Failure Modes

2.5.1 Flight Crew Error

The system should be designed to minimize the occurrence and effects of flight crew error and maximize 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, color-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 deck systems.

2.5.2 Identifying Failure Modes

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

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.

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.

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.

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 deck 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 – other than differences associated with the progress or completion of processing performed in the background.

2.10 Flight Crew Workload

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

3. Specific Application Considerations

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. Alternate approach plate presentations may be acceptable, but will need to be evaluated and approved by the DCA for functionality and human factors.

The Human Machine Interface assessment is key in identifying acceptable mitigation means e.g.:
- To establish procedures to reduce the risk of making errors;
- To control and mitigate additional workload related to EFB use;
- To ensure consistency of colour coding and symbology philosophies, between EFB applications and their compatibility with other flight deck applications;
- To consider aspects of Resource Management (CRM) when using an EFB system.

APPENDIX E
FLIGHT CREW TRAINING

1 General

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.

2 EFB Training and Checking

2.1 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. Where flight crew do not have the necessary experience, additional requirements may have to be applied by the NAA.

2.2 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 Class 1 or Class 2 EFB and using similar software may be credited toward training on a Class 3 EFB with a performance application.

2.3 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 the operator is the Type Rating Training Organisation (TRTO) and training for the issue of the type rating is combined with the operator's conversion course required by EU-OPS 1.945, 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/TRTO may use many methods for ground-based EFB training including written handouts or FCOM material, classroom instruction, pictures, videotape, ground training devices, computer-based instruction, 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 and Familiarisation Training.

2.3.1 Areas of Emphasis During Initial EFB Training

- The use of the EFB hardware and the need for proper adjustment of lighting etc. when the system is used in-flight;
- The intended use of each software application together with limitations and prohibitions on their use;
- If an aircraft performance application is installed, proper cross-checking of data input and output;
- If a terminal chart application is installed, proper verification of the applicability of the information being used;
- If a moving map display is installed, the need to avoid fixation on the map display;
- Failure of component(s) of the EFB.

2.3.2 Typical Initial EFB Training

The following might be a typical training syllabus for a Class 3 EFB system with a document browser, performance application and moving map display.

2.3.2.1 Ground-Based Training

- System architecture overview;
- Display Unit features and use;
- Limitations of the system;
- Restrictions on the use of the system;
    - o Phases of flight
    - o Alternate procedures (MEL)
- Applications as installed;
    - o Use of each application
- Restrictions on the use of each application;
    - o Phases of flight
    - o Alternate procedures (MEL)
- Data input;
- Cross-checking data input and output;
- Use of data output.

2.3.2.2 Flight Training

- Practical use of the Display Unit;
- Display Unit Controls;

- Data input devices;
- Selection of applications;
- Practical use of applications;
- CRM and human factor considerations;
- Situational awareness;
- Avoidance of fixation;
- Cross-checking data input and output;
- Practical integration of EFB procedures into SOPs.

2.4 Initial EFB Checking

2.4.1 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.

2.4.2 Skill Test & Proficiency Check

Proficiency in EFB use is not shown in the required items in App 2 to JAR-FCL 1.240 & 1.295 for the Skill Test for the issue of a type rating following type conversion training or for the Proficiency Check for the renewal of a type rating. However, where the operator is the TRTO and the Skill Test is being conducted following training that is integrated with the operator's conversion course as required by JAR-OPS 1.945, or where the Proficiency Check is being conducted concurrently with the Operator's Proficiency Check required by JAR-OPS 1.965, and where the operator's SOPs are dependant 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 (e.g. item 1.1, item 1.5 etc. in App 2 to JAR-FCL 1.240 & 1.295).

2.4.3 Operator Proficiency Check

JAR-OPS 1.965(b) (1) (i) require that flight crew demonstrates their competence in carrying out normal procedures during the Operator Proficiency Check. Therefore, where an operator's SOPs are dependant on the use of an EFB, proficiency in its use should be assessed.

2.4.4 Line Check

JAR-OPS 1.965(c) requires that flight crew demonstrate their competence in carrying out normal procedures during the Line Check. Therefore, where an operator's SOPs are dependant on the use of an EFB, proficiency in its use should be assessed.

2.4.5 Areas of Emphasis During EFB Checking

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

3 Differences and Familiarisation Training

When the introduction of the use of an EFB requires Differences or Familiarisation Training to be carried out under JAR-OPS 1.950, the requirement can be satisfied by conducting Initial EFB Training.

4 Recurrent EFB Training and Checking

4.1 Recurrent EFB Training

Recurrent training is not normally 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 App1 to JAR-OPS 1.965(a)(1).
Where an operator has established alternative procedures to be used for dispatch with an EFB inoperative or not available, these alternative procedures should be included in the recurrent Aircraft/STD Training as required by App1 to JAR-OPS 1.965(a) (2).
In the case of Mixed Fleet Flying, or where the EFB is not installed across the fleet, NAAs should consider applying additional recurrent training requirements.

4.2 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 2.4.2, 2.4.3 and 2.4.4. Areas of emphasis are as described in paragraph 2.4.5.

5 Suitability of Training Devices

Where the operator's SOPs are dependant 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:

- The Operator's Conversion Course required by JAR-OPS 1.945;
- Differences or Familiarisation Training required by JAR-OPS 1.950;
- Recurrent Training and Checking required by JAR-OPS 1.965.

Where the EFB system is based on a Class 1 device, it is recommended that the device is present and operable and used during all phases of flight during which it would be used under the operator's SOPs.

Where the EFB system is based on a Class 2 or Class 3 device, it is recommended that the device is installed and operable in the training device (simulator) and used during all phases of flight during which it would be used under the operator's SOPs.
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 not installed equipment in the basic aircraft type or variant (i.e. it is an operator option or aftermarket installation), the installation and use of the EFB in the training device is not required for the training and checking for the issue of the type rating nor for the checking for the renewal or revalidation of the type rating.

6 Alternate Means of Compliance

Alternate means of compliance for Flight Crew Training may be approved by the operator's competent authority. If alternate compliance is sought, operators should be required to establish that any proposed alternate means provides an equivalent level of safety to the provisions of this Appendix. Analysis, demonstrations, proof of concept testing, differences documentation or other evidence may be required.

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APPENDIX F
SOFTWARE APPLICATION APPROVAL SUBMISSION

The submission to the competent authority should contain the following:
- Functional Description Document (For the initial submission and any subsequent functional change);
- Release Notes (For both initial and all subsequent releases);
- Version Description Document (For both initial and all subsequent releases);
- First Article Inspection Report (refers to quality controlled release of the EFB Software Application);
- Ground Viewer (to enable user validation of the software releases and data base releases and updates);
  - Viewers should use the same software components as the airborne application
  - Viewers should enable user validity checking of airborne data bases before installation on an aircraft.

Note: Software applications or components created by other than the end user should contain a Certificate of Compliance/Conformity showing under which standard that software was created.

F.1 Additional Requirements for Performance Applications for Takeoff, Landing and Mass & Balance Calculations

When demonstrating compliance for a performance application, the submission should include a data validation report consisting of:
- The methodology and/or plans for validation;
- Representative calculations throughout the operating envelope considering corner points, routine and break points and typically containing at least 250 calculations (including wet and contaminated runway data if used).

Note: The data validation should be performed against the baseline certification document for the aircraft e.g., AFM or AFM DPI.

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APPENDIX G
EFB POLICY AND PROCEDURES MANUAL

Introductory note:
These are the typical contents of an EFB policy and procedures manual that can be part of the operator's operation manual. The proposed skeleton is very extensive. It should 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, Definitions and Acronyms;
   - Hardware Description;
   - Operating System Description;
   - Software Application Description.
5. **Hardware and Operating System Control and Configuration**
   - Purpose and scope;
   - Description:
     o Hardware Configuration and Part No. Control
     o Operating System Configuration and Control
     o Accessibility Control
     o Hardware Maintenance
     o Operating System Updating
   - Responsibilities and Accountabilities;
   - Records and filing;
   - Documentary References.
6. **Software Application Control and Configuration**
   - Purpose and scope;
   - Descriptions:
     o Part No. Control
     o Software Configuration
     o Application Updating
   - Responsibilities and Accountabilities;
   - Records and filing;
   - Documentary References.

7. Maintenance considerations

8. EFB Security Policy

- EFB System architecture;
- Limitations of the EFB system;
- EFB general philosophy, environment and dataflow;
- Detailed presentation of the EFB applications;
- EFB application customization;
- Data management:
  - o Data administration
  - o Organization& workflows
  - o Data Loading
  - o Data revision mechanisms
  - o Approval workflow
  - o Data Publishing & dispatch
  - o Customization
  - o How to manage Airline's specific documents
  - o Airport data management
  - o Aircraft fleet definition
- Data authoring:
  - o Navigation and customization

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APPENDIX H
AIRPORT MOVING MAP DISPLAY (AMMD) APPLICATION WITH OWN-SHIP POSITION

1 Preamble

This Appendix discusses a number of general considerations that apply to all AMMDs that consist of a display of own-ship position on a depiction of the airport surface area. The considerations discussed may, or may not, address any further functionality beyond this basic configuration.

Traditionally, due to the safety effect of an AMMD for erroneously misleading information being Minor (in accordance with CS 25.1309), an AMMD has been classified as a Type C EFB software application that could only be hosted on a Class 3 EFB platform with an operating system and application software qualified to at least RTCA DO-178B/EUROCAE ED-12B 'Level D'.

However, it is recognised that an AMMD can aid pilot positional awareness on the airport maneuvering area and there have been proposals to allow AMMDs to be hosted on a non-certified platform. Under such conditions the host platform might be a Class 2 EFB device in a Commercial Off-The Shelf (COTS) based environment such as Microsoft Windows. This introduces potential failure conditions which cannot be mitigated easily and which could adversely affect the overall operation of an EFB.

Since it is essential that potential AMMD providers understand the requirements for safety related application services related to integration of an AMMD function on an alternative EFB platform, this Appendix additionally discuses the factors applicable to the hosting of an AMMD on a Class 2 EFB.
Note: The use of an AMMD with an own ship position on a Class 1 EFB is not permitted.

2 General considerations

2.1 Classification of an AMMD

An AMMD application should not be used as a primary means of taxing navigation and should only be used in conjunction with other materials and procedures identified within the Operating Concept – see paragraph 2.7.
Thus, an AMMD application with display of own-ship position is considered as having a Minor safety effect when displaying misleading information and is therefore classified as an EFB Type C software application.
Note: the failure condition for the loss of function is classified as "no effect."

2.2 Total System Error

The Total System Error of the end-to-end system should be specified and characterised. The maximum acceptable error should be 40 meters (based on half the separation of taxiways at aerodrome code letter E as specified in ICAO Annex 14). This Total System Error should be allocated to the various components of the system and the validation of performance to those error terms should be provided as part of the substantiation of system safety. The Total System Error should include (as a minimum):

- Map database error (to a CE of 95%). The process for developing and assuring database accuracy will be a required deliverable;
- Display presentation precision. The method for calculating display error and the results of the error at all zoom levels will be a required deliverable;
- Position Source Error (GNSS). The method for calculation of this error will be a required deliverable. As this error source is dependent on the geometry of the satellites, worst case should be assumed in the analysis. This should include the probability of satellite failures. The detection of signal in space unavailability should also be considered;
- System latency errors. This is the time delay between data input and position displayed to the flight crew including antenna delay and internal EFB system processing;
- Latency errors due to speed. The applicant can consider removal of the own-ship position at a certain speed as part of the mitigation. However, the influence of taxi speed on own-ship presentation should be considered and documented;
- Antenna position bias error i.e. along track error associated to the GNSS antenna position to the flight deck.

Note: the position source for AMMD should be received from an approved source e.g. installed GNSS sensor.

An applicant should consider a full Total Error Analysis and a Report containing the above items (as a minimum) should be provided in the applicant's submission for approval.

2.3 Failure Mode Requirements

The most significant hazard associated with an AMMD is the display of erroneously misleading information to the flight crew. The factors applicable to the AMMD function in this area are:

- The concept and algorithm which control the display of own-ship position and reaction to failure modes;
- Annunciation of the loss of critical inputs;
- Annunciation and loss of less critical inputs (such as heading);
- Triggering of the error term algorithm;
- Corruption of the map database.

The applicant should demonstrate mitigation in the form of the design of the AMMD and the procedural training proposed for flight crew.

2.4 Map Database Updates

Airport map databases are vulnerable to facility changes due to infrastructure upgrades. The applicant should submit details of the processes by which they:
- Receive data from the flight crews, operators and authorities regarding airport facility changes and data discrepancies;
- Perform the data update and confirm its accuracy;
- Distribute those changes;
- Substantiate the adequacy of the update cycle;
- Handle infrastructure changes which are outside the revision cycle;

The applicant should also provide details of the Quality Assurance (QA) tools provided to assure that map details are correct and a substantiation that the QA tools match the aircraft installation.

2.5 Flight Crew Confirmation of Map Effectivity

The Flight Crew should be able to easily ascertain the effectivity of the on-board map database. Out of effectivity databases should be annunciated prior to use of the AMMD function. The design should consider scenarios in which the EFB is left powered-on after a flight sector.

2.6 Training Requirements

The applicant may use flight crew procedures to mitigate some hazards. This will include limitations on the use of the AMMD function. As the AMMD could be a compelling display and the procedural restrictions are a key component of the mitigation, training should be addressed in support of an AMMD's implementation.

Any mitigation to hazards that are mitigated by flight crew procedures should be included in flight crew training. Details of AMMD training should be included in the applicant's overall EFB training submission (refer to appendix F).

2.7 Operating Concept

The operating concept of how the AMMD will be used, controlled, and maintained should be addressed. The Operating Concept should include as minimum:
- Pilot Operation, including confirmation of effectivity;
- Handling of updates;

- Quality Assurance function;
- Handling of NOTAMS.

3 Considerations for AMMD on a Class 2 EFB

3.1 Scope

Traditional software development and validation processes in accordance with DO-178B/EUROCAE ED-12B 'Level D' may not be applied to a COTS based operating system hosting an AMMD application. Alternative means of compliance are provided in this Appendix providing an equivalent level of safety to this more traditional method.

Operational Approval (including airworthiness demonstration) will only be granted on a "known" platform for a given software environment (host plus EFB applications) – see paragraph 3.2. Credit may be taken for certain elements e.g., the supporting analysis and validation, where similarity can be demonstrated from a previous approval exercise leading to an operational approval.

This section of the Appendix is not intended to describe requirements that are a barrier to implementation of an AMMD on a Class 2 EFB, but to be a reference for those requirements which should be followed to assure a safe implementation.

3.2 Software Integration Issues

The traditional avionics software development process is contained in RTCA DO-178B / EUROCAE ED-12B. Key to this process is a deterministic Operating System which is generally custom-developed and its behaviour substantiated to an appropriate level.

COTS software such as Microsoft Windows is a non-deterministic operating system whose behaviour is generally unknown. Specific details of how it works are considered proprietary to the Operating System software developer (e.g. Microsoft) and are not officially provided. While these developers may provide a Software Development Kit, this is targeted to a non-avionics environment and is not intended for development of safety related systems.

Substantiation from the Operating System software developer regarding the integration of applications on a given platform may not, therefore, be available. In this situation, responsibility for the substantiation becomes the responsibility of the application developer and system, and the main issue will be non-interference from other applications on the same platform.

Applications in a COTS environment spawn sub-processes known as threads. These threads access hardware and software services which are shared by other processes (both application and system). Common service utilization is a frequent source of problems with software integration. As these common services are somewhat invisible to the application developer, the preclusion by design of these potential failure conditions is not an option.

It should also be noted that due to access time requirements, most of the applications are launched immediately so they can be quickly activated. The applications are not necessarily quiescent whilst not in focus. While a Software Development Kit (SDK) might address requirements for processor utilization during out-of-focus operations, the lack of transparency of the Operating System would preclude deterministic validation.

In the area of software integration, as a minimum requirement for the approval of an AMMD on a Class 2 EFB, the applicant should be able to demonstrate:
- Full validation of the operation of the AMMD with the entire suite of EFB applications;
- Full validation while the EFB system is attached to the aircraft systems providing data (or a validated simulation).

Note: Background applications such as communication and other functions should be running and all operating scenarios should be included in the validation.

3.3 Display Requirements

EFB displays are generally used for administrative information and they may not be designed for use during all phases of flight. If the AMMD is to be added to an existing EFB, the following should be accomplished and included in the applicant's submission:
- An analysis of low light operations. This should include:
  - Readability of the display in direct sunlight
  - Non-interference with night vision
  - Colour washout due to dimming
- Pilot workload analysis for dimming operations;
- Obstruction of vision due to the installation of the display unit.

For further consideration refer to Appendix D.

3.4 Continuing Airworthiness

As the AMMD is installed in a platform with a non-deterministic operating system, the applicant should provide a plan for assuring non-interference from future system updates. As a minimum, this plan should address:
- The validation suite which will be run before any system update is performed;
- The plan for assuring that third-party or operator-provided application additions or changes are subjected to that validation suite;
- Notification to the Competent Authority of planned updates and submittal of the non-interference test report.

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3.5 Aircraft Interfaces

The AMMD with own-ship position requires information such as position and may require further information such as heading. If this information is obtained from aircraft systems, the system should substantiate that the equipment connection will not make any essential buses unavailable to other on-board equipment. This should be via an airworthiness approval and should contain as a minimum:
- Bus loading analysis;
- Failure mode analysis.

If the strategy is to obtain this information directly, then non-interference should be demonstrated in the areas of:
- EMI;
- Non-interference with critical aircraft radio frequencies.

For external antennas, a non-interference analysis will be part of the airworthiness approval process.

3.6 Functional Hazard Analysis

A complete functional hazard analysis is required, taking into account the above sections. It should contain (as a minimum):
- A description of the methodology used;
- A list of all hazards - this should include all end-to-end sources;
- A description of the mitigation strategy for each hazard.

3.7 Documentation Requirements

The applicant's submission should include:
- Operational Concept;
- Functional Hazard Analysis;
- Error Term Analysis;
- Functional Description;
- Validation Plan and results;
- Training Plan;
- Continued Airworthiness Plan;
- Aircraft Interface Protection.

3.8 Summary

The ability to host AMMD applications on devices which are not covered by Airworthiness approval e.g. Class 2 EFB devices, is seen to improve operational safety.

However, moving this application from Type Design to realm to the Operational Approval realm does not mean that validation of safe implementation is not required but the responsibility falls on a different applicant.

None of the requirements contained in this Appendix are new, but they provide an equivalent level of safety to a more traditional software development process, which would otherwise not be applicable to a non-deteministic Operating System.

It is recommended that the applicant of an AMMD with own-ship position on an EFB Class2 device to contact the DCA at early stage in the development programme to establish more detailed requirements.

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APPENDIX I

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APPENDIX J
EXAMPLE OF OPERATIONAL APPROVAL SUBMISSION REPORT

The competent authority may use the operational approval submission report as a compliance matrix against this AMC. References to the relevant supporting documents should be included.

System Description and Classification of EFB System
- A general description of the proposed EFB system;
- Class of EFB System proposed (§ 3.1).

Software Applications
- List of Type A applications installed (§ Appendix A);
- List of Type B applications installed (§ Appendix B);
- List of Type C applications installed (§ Appendix C);
- List of non-EFB applications installed.

Hardware Approval (relevant information or references)
For a Class 1 EFB:
- EMI Compliance Demonstration (§ 4.1.1.1);
- Lithium Battery Compliance Demonstration (§ 4.1.1.2);
- Depressurisation Compliance Demonstration (§ 4.1.1.5);
- Details of the Power Source (§ 4.1.1.3);
- Details of any Data Connectivity (§ 4.1.1.4).

For a Class 2 EFB:
- Details of the airworthiness approval for the Mounting Device (§ 4.1.2.1);
- Description of the placement of the EFB Display (§ 4.1.2.2);
- Details of the use of Installed Resources (§ 4.1.2.8);
- EMI Compliance Demonstration (§ 4.1.2.3);
- Lithium Battery Compliance Demonstration (§ 4.1.2.4);
- Depressurisation Compliance Demonstration (§ 4.1.2.7);
- Details of the Power Source (§ 4.1.2.5);
- Details of any Data Connectivity (§ 4.1.2.6).

For a Class 3 EFB:
- Details of the airworthiness approval as installed equipment (§ 4.1.3).

Certification Documentation
- Limitations to be contained within the Aircraft Flight Manual (§ 4.1.4.1);
- Guidelines for EFB Application Developers (§ 4.1.4.2);
- Guidelines for EFB system suppliers (§ 4.1.4.3).

Specific Considerations for Performance Applications
- Details of performance data validation conducted (§ 4.2.4).

Operational Approval
- Details of Operational Risk Analysis (ORA) conducted (§ 5.4);
- Details of the Human Machine Interface Assessment conducted for Type A and B Software Applications (§ 5.6);
- Details of Flight Crew Operating Procedures (§5.7):
    - Procedures for Using EFB Systems with Other Flight Deck Systems (§ 5.7.1);
    - Flight Crew Awareness of EFB Software/Database Revisions (§ 5.7.2);
    - Procedures to Mitigate and/or Control Workload (§ 5.7.3);
    - Flight Crew Responsibilities for Performance Calculations (§ 5.7.4).
- Details of proposed Quality Assurance oversight of EFB system (§ 5.8);
- Details of EFB System Security measures (§ 5.9);
- Details of EFB Administration procedures including provision of the EFB Policy and Procedures Manual (§ 5.10& § 5.10.1);
- Details of the system for routine EFB System maintenance (§ 5.11);
- Details of Flight Crew Training (§ 5.12):
    - Initial training;
    - Differences training;
    - Recurrent training.
- Report of the Operational Evaluation Test (§ 5.13):
    - Proposals for the initial retention of paper back up (§ 5.13.1);
    - Proposals for the commencement of operations without paper back up (§ 7.9.2).
- EFB platform/hardware description;
- Description of each software application to be included in the approval (see Appendix G);
- Risk analysis summary for each application and mitigation means put in place;
- Human factor 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;

- o 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.
- Training;
- EFB Administrator qualification.

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APPENDIX K
POWER SUPPLY CONSIDERATIONS FOR CLASS 1 AND 2 EFBs

If the aircraft is equipped with electrical power outlet(s) in the cockpit, the operator should ensure that their certified characteristics are compatible with the intended use for the EFB system. The powering or charging of the EFB system should be compatible with the electrical characteristics of the power supplied by the outlets in terms of power consumption, voltage, frequency, etc. in order not to impair the EFB system or other aircraft systems.

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

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

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APPENDIX L
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 pressurized aircraft. Rapid decompression testing should follow the RTCA DO-160 guidelines for rapid decompression testing up to the maximum operating altitude of the aircraft in which the EFB is to be used.

- **Pressurised Aircraft:** When a Class 1 or 2 EFB has successfully completed rapid depressurisation testing while turned ON then no mitigating procedures need be developed beyond dual redundancy. When a Class 1 or 2 EFB has successfully completed rapid depressurisation testing while turned OFF then procedures will need to be developed to ensure 1 of the 2 EFBs on board the aircraft remains OFF or configured so no damage will be incurred should rapid decompression occur in flight above 10,000 feet AMSL.
  If the EFB system has not been tested or has failed the rapid depressurisation test then alternate procedures or paper back-up should be available.

- **Non-Pressurised Aircraft**: Rapid decompression testing is not required for a Class 1 or 2 EFB used in a non-pressurized 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 required aeronautical information.

APPENDIX M
EFB CLASSIFICATION MATRIX

EFB APPLICATIONS	HARDWARE CLASS	AIRWORTHINESS INVOLVEMENT	FLIGHT OPERATIONS INVOLVEMENT	OPERATOR REQUIREMENTS
Type A Refer to Appendix A	Class 1,2,3	Class 1: No Class 2: Yes, for ☐ Mounting device ☐ Power ☐ Data Connectivity Class 3: Yes for the EFB installation and human factor aspects Type A: No	☐ Risk Analysis ☐ Human Factor assessment ☐ Quality Assurance ☐ System Administration ☐ Crew Training ☐ Operational Evaluation Test ☐ Statement approval	- Develop program for usage - Non-interference
Type B Refer to Appendix B	Class 1,2,3	Class 1: No Class 2: Yes, for ☐ Mounting device ☐ Power ☐ Data Connectivity Class 3: Yes for the EFB installation and human factor aspects Type B: No	☐ Risk Analysis ☐ Human Factor assessment ☐ Quality Assurance ☐ System Administration ☐ Crew Training ☐ Operational Evaluation Test ☐ Final report	- Develop program for usage - Non-interference
Type C Supports Additional Applications	Class 2, 3	Yes, for: ☐☐Mounting device ☐☐Power ☐☐Data connectivity ☐☐EFB TSO/STC	☐ Risk Analysis ☐ Human Factor assessment ☐ Quality Assurance ☐ System Administration ☐ Crew Training ☐ Operational Evaluation Test ☐ Final report ☐☐Data updates according to the maintenance manual or inspection program ☐Issue OpSpecs	Per current airworthiness and operational approval process

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APPENDIX N
SAFETY CONSIDERATIONS

1. Introduction

This information is presented in order to alert flight crew to the findings of a recent accident report, which concerns the use of an Electronic Flight Bag (EFB). In this instance, the EFB had been used to provide both weight and balance information and also take-off and landing performance data.

Aircraft manufacturers provide operators with performance data and, also, weight and balance data, both of which can be built into the EFB software. An operator's software administrator will be responsible for the setting up of a weight and balance page for each specific aircraft and also, the installation of an aerodrome database in the EFB. However, the aircraft manufacturer neither reviews nor approves this work. The operator's software administrator also has the option to disable the weight and balance page in the EFB to prevent crews from using it, but some operators choose to leave the weight and balance page available in order to provide a cross-check against the loadmaster's manual calculations.

The weight and balance feature allows the flight crew to perform basic operations, including, for example, the calculation of stabilizer trim settings for take-off. In the weight and balance summary page, the user can enter passenger weights, cargo zone weights and fuel load. When this information is entered, the take-off and projected landing weights are automatically updated and may be passed across to the planned weight field on the main input dialogue screen, where they may be programmed to overwrite some or all of the entries in this field without further notification to the user.

Many of the performance applications installed on EFB systems include a feature which retains the environmental parameters when the application is shut down, and even when the EFB is switched off. Additionally, the take-off mass to be used may also be retained; the purpose of this being to allow the pilot to perform a re-calculation without having to re-enter data in all the fields.

As a consequence, it is possible for a user to fail to notice an inappropriate item of data on switching on, as all required fields will be populated with data from the previous calculation.

The primary finding in the accident report to which this information refers concludes that the wrong take-off weight was used to determine the V speeds and take-off thrust required. As a consequence, the aircraft was destroyed when it failed to achieve flying speed, and all aboard were killed.

2. Scope

All operators, both commercial and non-commercial, should consider the advice as it applies to their operations when using Electronic Flight Bags. For aeroplane and helicopter non–commercial operators this information should be considered in addition to the Flight Manual content.

3. Guidance Material

Attention is drawn to the following:

An operational approval allows an operator to use an EFB to replace traditional paper sources of information if, "an acceptable level of accessibility, usability and reliability can be assured". Implicit in this rule is the need to provide adequate levels of cross-checking and a methodology that ensures the identification of gross errors when using an electronic system, which is comparable to the industry best practice established for manual systems.

Crew procedures for the use of traditional paper performance charts often include practices that recognize basic human factors principles associated with the influence of decisions and acceptance of the validity of information and these should be carried over to the use of electronic calculation and the presentation of this kind of data.

The use of a single EFB on the flight deck poses the same risks with regard to the acceptance of data output as do those posed by having only one pilot on a multi-crew aeroplane determining performance data from a paper chart. Standard Operating Procedures for the use of an EFB should include procedures that utilize independent calculation by each crew member, provide for effective cross-checking and facilitate the trapping of gross errors.

4. Recommendation

4.1 Operators are Recommended to Modify EFB Software so as to Prevent:

     a. Other applications from inputting data into any field on the performance application feature when this is used to derive operational performance for a critical phase of flight; and
     b. Any field in the performance application which is used to derive operational performance for a critical phase of flight from remaining populated after the EFB is shut down.

Where these actions cannot be achieved by means of software modification, operators should ensure that crew procedures include the requirement, before any calculation is conducted, to enter or re-enter data manually in any fields in the performance application that are used to derive operational performance for a critical phase of flight,

4.2 Operators are recommended to establish and provide training on EFB operating procedures as detailed below:

4.2.1 Crew procedures should ensure that calculations are conducted independently by each crew member before data outputs are accepted for use.

4.2.2 Crew procedures should ensure that a formal cross-check is made before data outputs are accepted for use. Such cross-checks should utilize the independent calculations described in 4.2.1 above, together with the output of the same data from other sources on the aircraft.

4.2.3 Crew procedures should ensure that a gross-error check is conducted before data outputs are accepted for use. Such a gross-error check may use either a "rule of thumb" or the output of the same data from other sources on the aircraft.

4.2.4 Crew procedures should ensure that, in the event of loss of functionality by an EFB through either the loss of a single application, or the failure of the device hosting the application, an equivalent level of security of data output can be maintained by the use of alternative procedures.

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APPENDIX O
APPLICATION FOR ELECTRONIC FLIGHT BAG (EFB) APPROVAL INS-16.020

Application for Special Operational Approvals   *INS-16.020*

MINISTRY OF TOURISM TRANSPORTATION AND LABOUR

Department of Civil Aviation ARUBA

1. Applicant Details

Operator: ....

AOC No. (if applicable): ....

Coordinator/Administrator:

	#1	#2
Name:		
Tel:		
Email:		

2. Aircraft Details

Aircraft Registration: **P4 -**... ... ...

Aircraft Mfr.: ....

Model: ....

Aircraft S/N: ....

3. Applying for:

Applying for:	Page Reference	AMC Reference	Additional remarks from the Applicant:
a. □ RVSM,	2	AMC-036	
b. □ MNPS/RVSM	2	AMC-036	
c. □ RNP≤0.3 Authorization	2	AMC-036	
d. □ RNP≤0.3 Approach	2	AMC-036	
e. □ RNAV-1/PR-NAV	2	AMC-036	
f. □ RNAV-2	2	AMC-036	
g. □ RNAV-5/BR-NAV	2	AMC-036	
h. □ RNP-4	2	AMC-036	
i. □ RNP-10	2	AMC-036	
j. □ CAT I *(Below standard)*	3	AMC-035	
k. □ CAT II	3	AMC-035	
l. □ CAT III □ a,	3	AMC-035	
□ b	3	AMC-035	
m. □ EFB	4	AMC-033	
n. □ HUD/EVS	5	AMC-034	
o. □ CPDLC	6	AMC-037	
p. □ GPS *(Approach)*	2	AMC-036	
Additional Information	7	-----------	

4. Applicant's Declaration:

The undersigned certifies that the above information and the corresponding pages are correct and true and the aeroplane equipment, continuing airworthiness, minimum equipment for dispatch, operating procedures and flight crew training comply with the requirements of DCA-Aruba.

Name:	Position:	Signature:	Date: (in dd-mmm-yyyy)

Application for Special Operational Approvals   *INS-16.020*

3(m.)	ELECTRONIC FLIGHT BAG (EFB), refer to AMC-033		

1. EFB Hardware

Hardware Class	□ Class 1	□ Class 2	□ Class 3
Make & Type:			
On-board Power Supply (add details):			
Installation Method:			
EMI Demonstration*			
Rapid Depressurization Testing*			

2. EFB Software Applications

Software Application Type:	□ Type A		□ Type B
Data Storage Device:	□ Installed	□ CD/DVD	□ Other*
□ Notebook □ Notepad □ PDA	Make & type:		
Data control & update procedure*			

3. Operations & Training   *(tick if attached)*

Tasks to be performed using EFB – add on page 7. *(Also refer to AMC-033 Appendix A or B)*	
Operational Risk Analysis completed *(attach)*	
Data base currency, control and quality *(add details)*	
Contingency procedures *(in Operations Manual)*	
Crew basic training *(in Operations Manual; attach)*	
Crew recurrent training *(in Operations Manual; attach)*	

4. Supporting Documentation   *(tick if attached)*

AFM, AFM Supplement, STD *(if applicable)*	
Operations Manual (SOPs)	
Operations Manual training	
Operational Evaluation Test Report	
Final Operational Report	
MEL *(if applicable)*	
Operational Risk Analysis *(if applicable)*	

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Application for Special Operational Approvals   *INS-16.020*

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