Transport Canada Transports Canada

Advisory Circular

Subject: **Electronic Flight Bags**

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1.0 INTRODUCTION

(1) This Advisory Circular (AC) is provided for information and guidance purposes. It may describe an example of an acceptable means, but not the only means, of demonstrating compliance with regulations and standards. This AC on its own does not change, create, amend or permit deviations from regulatory requirements, nor does it establish minimum standards.

1.1 Purpose

(1) The purpose of this document is to:

(a) provide guidelines for the certification, airworthiness and operational approval of both portable and installed Electronic Flight Bags (EFBs);

(b) specify the principle that all EFBs to be used on an aircraft are to be subjected to a defined evaluation process;

(c) minimize the burden on operators, installers, manufacturers, and Transport Canada Civil Aviation (TCCA) by specifying that some EFB evaluations can be delegated;

(d) provide specific guidance material for certain EFB applications and approvals and establish certification, airworthiness/installation, and operational approval guidance for EFB systems; and

(e) provide checklists to assist operators, installers and TCCA in evaluating EFB implementations.

1.2 Applicability

(1) This document applies to TCCA personnel, delegates, and the aviation industry.

1.3 Description of Changes

(1) Not applicable.

2.0 REFERENCES AND REQUIREMENTS

2.1 Reference Documents

(1) It is intended that the following reference materials be used in conjunction with this document:

(a) Part I, Subpart 3 of the *Canadian Aviation Regulations* (CARs)—*General Provisions*;

(b) Subpart 602 of the CARs—*Operating and Flight Rules*;

(c) Subpart 604 of the CARs—*Private Operator Air Transportation*;

(d) Subpart 702 of the CARs—*Aerial Work*;

(e) Subpart 703 of the CARs—*Air Taxi Operations*;

(f) Subpart 704 of the CARs—*Commuter Operations*;

(g) Subpart 705 of the CARs—*Airline Operations*;

(h) Chapter 523 of the *Airworthiness Manual* (AWM)—*Normal, Utility, Aerobatic and Commuter Category Aeroplanes*;

(i) Chapter 525 of the AWM—*Transport Category Aeroplanes*;

(j) Chapter 527 of the AWM—*Normal Category Rotorcraft*;

(k) Chapter 529 of the AWM—*Transport Category Rotorcraft*;

(l) Advisory Circular (AC) 700-005, Issue 02, 2011-07-06—*Use of Transmitting Portable Electronic Devices*;

(m) Federal Aviation Administration (FAA) Title 14, Code of Federal Regulations (CFR), Part 21—*Certification Procedures for Products and Parts*;

(n) FAA Advisory Circular (AC) 20-110L, 2000-10-10 —*Index of Aviation Technical Standard Orders*;

(o) FAA AC 20-159, 2007-04-30—*Obtaining Design and Production Approval of Airport Moving Map Applications Intended for Electronic Flight Bag Systems*;

(p) FAA AC 120-64, 1996-04-24—*Operational Use & Modification of Electronic Checklists*;

(q) FAA AC 120-76A, 2003-03-17—*Guidelines for the Certification, Airworthiness, and Operational Approval of Electronic Flight Bag Computing Devices*;

(r) FAA Order 8900.1—*Flight Standards Information Management System* (FSIMS);

(s) Radio Technical Commission for Aeronautics (RTCA) DO–178C—*Software Considerations in Airborne Systems and Equipment Certification*; and

(t) RTCA DO-294C—*Guidance on Allowing Transmitting Portable Electronic Devices (T-PEDS) on Aircraft*.

2.2 Cancelled Documents

(1) As of the effective date of this document, the following documents are cancelled:

(a) Commercial and Business Aviation Advisory Circular (CBAAC) 0231, Issue 01, 2004-07-02 —*Electronic Flight Bags*; and

(b) Aircraft Certification Policy Letter (PL) 500-017, Issue 01, 2004-09-02—*Certification of Electronic Flight Bags*.

(2) By default, it is understood that the publication of a new issue of a document automatically renders any earlier issues of the same document null and void.

2.3 Definitions and Abbreviations

(1) The following definitions and abbreviations are used in this document:

(a) **Aircraft Flight Manual (AFM):** For the purposes of this AC the term AFM applies equally to aeroplanes, rotorcraft, and airships.

(b) **Aircraft Administrative Communications (AAC):** AAC data link that can receive/transmit information that includes but is not limited to, the support of applications identified in Appendices A and B of this AC.

(c) **Electronic Flight Bag (EFB):** An electronic display system intended primarily for cockpit or cabin use. EFB devices can display a variety of aviation data or perform calculations such as performance data and fuel calculations. 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 forms of communication. These devices are sometimes referred to as auxiliary performance computers (APC) or laptop auxiliary performance computers (LAPC).

(d) **EFB System:** An EFB system includes the hardware and software needed to support an intended function.

(e) **Hosted Application:** Software installed on an EFB system that allows specific operational functionality.

(f) **Interactive Information:** Information presented on the EFB that, via software applications, can 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.

(g) **Operating System:** Software that controls the execution of programs and that may provide services such as resource allocation, scheduling, input-output control, and data management.

(h) **Principle Maintenance Inspector (PMI):** A TCCA employee having principal responsibilities associated with a particular Air Operator for maintenance related issues.

(i) **Principle Operating Inspector (POI):** A TCCA employee having principal responsibilities associated with a particular Air Operator for operational issues.

(j) **Portable Electronic Device (PED):** A self contained electronic device that is not permanently connected to any aircraft system, although it may be connected temporarily to an aircraft’s electrical power system, externally mounted antenna, data bus, or mounting device. PED’s include numerous communications and computing devices as detailed in AC 700-005—*Use of Transmitting Portable Electronic Devices*. As defined in this AC, Class 1 and 2 EFBs are considered PEDs.

(k) **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.

3.0 BACKGROUND

(1) EFBs perform a variety of functions traditionally accomplished using paper references by electronically storing and retrieving documents required for flight operations, such as the Flight Crew Operations Manual (FCOM) and Minimum Equipment Lists (MEL). EFBs are developed to support functions during all phases of flight operations. EFBs may be authorised for use in conjunction with or to replace some of the hard copy material that pilots typically carry in their flight bags.

(2) Before this AC was issued, TCCA had based the Canadian approval of EFBs on Federal Aviation Administration (FAA) AC 120-76A, which was given as a primary reference in two TCCA documents. These two documents were CBAAC No. 0231, which addressed operations considerations, and Transport Canada Aircraft Certification PL 500-017, which addressed certification considerations. The FAA AC 120-76A was not directly applicable in Canada as the specified approval processes are particular to the FAA organization and much of the approval task is assigned to the FAA Aircraft Evaluation Group (AEG). TCCA does not have a group that is functionally equivalent to the FAA AEG, and is not equipped to perform these approval processes. Furthermore some of the processes described in FAA AC 120-76A have been superseded by 0pspec/Mspec A061 contained in FAA Order 8900.1.

(3) In addition, there was a need to combine the two TCCA documents to meet new TCCA document protocols. It was therefore decided that, rather than continuing to reference FAA AC 120-76A with its known applicability issues, it would be preferable to produce a new TCCA AC based as closely as possible on the text of FAA AC 120-76A, but clarifying some aspects of the certification and operational approval processes. Thus, there would be a single document that would apply to Canadian regulations.

4.0 IMPLEMENTATION PROCESS

(1) This AC describes how the implementation of an EFB into an air operator’s operations will affect the following:

(a) EFB installation;

(b) EFB certification, where applicable; and

(c) Operational approval.

(2) This AC discusses these aspects and describes two evaluation processes: one is directed at the evaluation of the EFB installation, and the other is directed at the operational implementation. The operational evaluation is further divided into an evaluation of company procedures and processes and an aircraft evaluation.

(3) Depending on the circumstances the aircraft evaluations may be carried out separately or as a combined exercise.

(4) The discussion of the evaluation of the installation aspects of the EFB covers both certified and non-certified aspects. It is expected that most evaluations will be conducted by non-TCCA personnel, and where this is the case, the only determination that the evaluator has to make with regard to the certified aspects of the EFB (e.g. the mounting provisions of a class 2 EFB) is that they have been approved by TCCA. In other words the non-TCCA evaluator is not expected to re-evaluate aspects of the EFB that have already been approved by TCCA.

(5) Checklists are provided in the Appendices of this AC to assist with the evaluation of the installation and operational aspects of EFBs. Those aspects which are expected to be evaluated as part of the Transport Canada certification process are annotated “certification”.

5.0 CLASSIFICATION OF ELECTRONIC FLIGHT BAGS SYSTEMS

(1) The hardware and software classes of EFB systems defined by FAA AC 120-76A are retained in this AC to maintain commonality with the FAA and European Aviation Safety Agency (EASA) classification of EFB systems. Below is a description of the hardware and software classifications.

5.1 Hardware Classes of Electronic Flight Bags

(1) Hardware classification is based on the type of the installation of the EFB in the aircraft.

(a) **Class 1** EFBs:

(i) are portable;

(ii) are not attached to an aircraft mounting device;

(iii) are considered Portable Electronic Devices (PEDs); and

(iv) do not require aircraft certification approval.

(b) **Class 2** EFBs:

(i) are portable;

(ii) are connected to an approved aircraft mounting device during normal operations;

(iii) are considered PEDs;

(iv) require aircraft certification approval for their mounting device, data connectivity and power connections; and

(v) do not require certification approval for their operating system.

(c) **Class 3** EFB systems are installed equipment that require certification approval of all hardware, mounting and connectivity aspects.

5.2 Software Applications for Electronic Flight Bags Systems

(1) This AC defines three types of software applications: Type A, B and C.

(a) **Type A software applications:**

(i) may be hosted on any of the hardware classes;

(ii) do not require an aircraft certification approval; and

(iii) examples of Type A software applications are provided in Appendix A of this AC;

(b) **Type B software applications:**

(i) may be hosted on any of the hardware classes;

(ii) do not require an aircraft certification approval; and

(iii) examples of Type B software applications are provided in Appendix B of this AC.

(c) **Type C Software applications:**

(i) Type C software applications require aircraft certification approval.

6.0 ELECTRONIC FLIGHT BAGS INSTALLATIONS AND RELATED EVALUATION REQUIREMENTS

6.1 Class 1 Electronic Flight Bags Hardware

(1) Class 1 EFB hardware may:

(a) be used on the ground and during flight;

(b) connect to ship's power through a certified power source;

(c) recharge batteries onboard the aircraft;

(d) require quick-disconnect from power and/or data sources for egress;

(e) have read-only data connectivity to other aircraft systems; and

(f) have receive/transmit data connectivity for Aircraft Administrative Communications (AAC) only.

(2) This AC specifies an evaluation of Class 1 EFBs as detailed in Appendix D and the checklist provided in Appendix E of this AC. An organisation or individual acceptable to TCCA may carry out this evaluation. The evaluation is to confirm that the EFB with installed software:

(a) meets basic human factors and functionality criteria;

(b) can be properly stowed for take-off and landing; and

(c) does not interfere with other aircraft systems or equipment.

6.2 Class 2 Electronic Flight Bags Hardware

(1) Class 2 EFB hardware is attached to the aircraft by a mounting device. In addition to being attached to aircraft mounting devices, Class 2 EFB systems may connect to aircraft power and data ports during normal operation and use.

(a) This AC specifies an evaluation of Class 2 EFBs as detailed in Appendix D and the checklist provided in Appendix F of this AC. An organisation or individual acceptable to TCCA may carry out this evaluation. The evaluation is to confirm that the EFB with installed software:

(i) is suitable equipment for use onboard an aircraft;

(ii) meets basic human factors and functionality criteria;

(iii) can be properly stowed for take-off and landing; and

(iv) does not interfere with other aircraft systems or equipment.

(2) An evaluation by TCCA Aircraft Certification or a designated representative is required for approval of the applicable mounting device, crashworthiness, data connectivity, and EFB power connection(s). The evaluation should include human factors aspects relating to the mounting device and flight deck location. For convenience, aspects relating to the TCCA approval are included in the checklist in Appendix F of this AC and are annotated as certification.

(a) EFB data connections require TCCA Aircraft Certification approval to ensure non-interference and isolation from aircraft systems during transmission and reception. The EFB data connection may receive information from any aircraft system as well as receive or transmit information for AAC purposes. Connectivity may be wired or wireless.

(b) Class 2 EFBs do not require compliance with RTCA/DO-160D, *Environmental Conditions and Test Procedures for Airborne Equipment*.

(c) Class 2 EFBs mounting devices, power, and data connectivity provisions that are installed by supplemental type certificates (STC) may require an *Aircraft Flight Manual Supplement* (AFMS) update.

6.3 Class 3 Electronic Flight Bags Hardware

(1) Class 3 EFB hardware is installed equipment and requires TCCA Aircraft Certification design approval for all hardware, mounting and connectivity aspects. When certification processes for EFBs first appeared all software aspects of a Class 3 EFB were to be approved together with the hardware aspects. However, Class 3 systems have been subsequently designed that incorporated software partitioning in accordance with RTCA DO-178B so that non-approved software, could be installed. This concept then evolved one more step to Class 3 EFBs which contained no certified software at all. For uncertified software running on a Class 3 EFB, the following provisions apply:

(a) For Type A and B applications running on an uncertified operating system residing in the same EFB as Type C applications running on a certified operating system, it must be demonstrated that there is no interaction between the partitioned certified and uncertified parts of the EFB. The following statement must be added to the Aircraft Flight Manual (AFM) or AFMS:

(i) “The EFB is partitioned into certified and uncertified parts. The suitability, integrity and accuracy of the applications in the uncertified part of the EFB have not been assessed, and the capability of these applications to perform their intended function has not been verified or certified. Approval of the installation of the EFB in the aircraft does not constitute operational approval for any use of the EFB."

(b) Uncertified software may not transmit data to any aircraft system except that data may be transmitted to cabin service systems not associated with flight safety.

(c) Uncertified software may not be used to display own ship position information either on the ground or in the air.

(d) The non-approved software should also be subjected to the evaluation process described in Appendices D and G of this AC. An alleviation of this restriction is provided for Airport Moving Map Displays (AMMD) approved using the guidance in FAA AC20-159.

6.4 Type A Electronic Flight Bags Software Applications

(1) Appendix A of this AC lists examples of EFB hosted software applications. Type A applications include pre-composed, fixed presentations of data currently presented in paper format.

(a) Type A application software does not require compliance with RTCA DO-178B, Software Considerations in Airborne Systems and Equipment Certification.

(b) Type A software is to be installed for and included in the evaluations described in paragraphs 6.1, 6.2 and 6.3 of this AC. These evaluations include demonstrating that the EFB operating system and hosted application software meet the criteria for the appropriate intended function and do not provide false or hazardously misleading information. A checklist for the evaluation of installed software is provided in Appendix G of this AC.

6.5 Type B Electronic Flight Bags Software Applications

(1) Appendix B of this AC lists examples of EFB Type B applications, which include dynamic, interactive applications that can manipulate data and the presentation of that data.

(a) Type B application software does not require compliance with RTCA DO-178B.

(b) Type B software is to be installed for and included in the evaluations described in paragraphs 6.1, 6.2, and 6.3 of this AC. These evaluations include demonstrating that the EFB operating system and hosted application software meet the criteria for the appropriate intended function and do not provide false or hazardously misleading information. A checklist for the evaluation of installed software is provided in Appendix G of this AC.

(c) Particular attention must be given to the Type B software that provides interactive performance applications. These applications should be evaluated to ensure that the possibility of entering incorrect data into performance calculations is minimised.

6.6 Type C Electronic Flight Bags Applications

(1) Type C applications are those which are ineligible for classification for Type A or B and which are required to go through a full aircraft certification approval process. Applications having the following characteristics would be considered Type C:

(a) any application displaying information which may be used by the crew as a primary means to control aircraft attitude, speed or altitude;

(b) any application displaying information which could be used by the crew as a primary means to check or control aircraft trajectory, either to follow the intended navigation route or to avoid weather, obstacles or traffic in flight or on the ground. AMMD or presentation of weather, terrain or traffic relative to own ship position could fall into this category if accuracy, refresh rate and resolution are sufficient;

(c) any application displaying own ship position (Note that AMMD may be approved using the guidance of FAA AC 20-159);

(d) any application displaying information which may be used as a primary means by the flight crew to assess aircraft critical and essential systems status, and/or to manage aircraft critical and essential systems following failures;

(e) 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; and

(f) applications, which would raise significant human factors issues due to automatic interactions with other aircraft systems, displays and controls.

(2) Type C applications require TCCA Aircraft Certification approval. The operating system supporting Type C applications also requires TCCA Aircraft Certification design approval.

(3) Type C applications may be installed on Class 1 and 2 EFBs, but because the equipment itself is uncertified, the Type C application running on a Class 1 or Class 2 EFB cannot be considered a certified application. An exception to this is an airport moving map display approved under FAA AC 20-159.

7.0 AIR OPERATOR ELECTRONIC FLIGHT BAGS OPERATIONAL IMPLEMENTATION PROCEDURES

7.1 General

(1) Operators incorporating EFBs into their operations should carefully review the contents of this AC to determine applicable requirements. For the most part the level of complexity associated with the operational implementation will depend on the class of hardware and type of software used and the intended application (e.g.: replace all paper approach charts with electronic charts).

(2) Table 1—EFB Classification Matrix in Appendix C of this AC summarizes the involvement of the various entities during the operational implementation of EFBs.

(3) Regardless of hardware class or software type, the operational implementation will require a structured sequence of events and actions to satisfy both the operator and the regulator that aircraft equipped with an EFB(s) can be operated safely.

(4) All software applications and information contained in the EFB intended for operational use must be current and up-to-date.

(5) From a process perspective it is envisaged that the operator will:

- (a) decide on the class and type of EFBs to use, based on a number of factors including the use of this AC;
- (b) discuss any implementation concerns with their respective Principle Operations Inspector (POI) or Principle Maintenance Inspector (PMI);
- (c) contact the appropriate Aircraft Certification authority, if the implementation requires changes or modifications to the aircraft;
- (d) complete all necessary assessment, evaluations, document updates, training, etc.;
- (e) submit changes to *Company Operations Manual* (COM) to POI for approval/acceptance;
- (f) submit changes to the maintenance schedule to the PMI for approval/acceptance as required.

(6) Operational evaluations are required as detailed in Appendices H, I, J and K of this AC.

- (a) The first evaluation detailed in Appendix H of this AC is to ensure that the operator has properly addressed company implementation of EFBs. An evaluation checklist is provided in Appendix I of this AC.
- (b) The second evaluation detailed in Appendix J of this AC is an aircraft level operational evaluation. Depending on the circumstances, this evaluation may be combined with the installation evaluation detailed in Appendix D of this AC. An associated operational evaluation checklist is provided in Appendix K of this AC.
- (c) The air operator is responsible for ensuring that these evaluations are conducted. This includes discussing with Transport Canada the content, methodology and level of Transport Canada involvement. These evaluations will normally be conducted by individuals with the requisite skill set hired by the air operator. If the air operator does not have individuals with the necessary skill set to conduct these evaluations, they may use an external individual or organization having the appropriate skills.

8.0 CONTACT OFFICE

Suggestions for amendment to this document are invited, and should be submitted to the following email address: AARTInfoDoc@tc.gc.ca

[original signed by Arlo Speer for]

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APPENDIX A—EXAMPLES OF "TYPE A" ELECTRONIC FLIGHT BAGS APPLICATIONS

Below is a non-exhaustive list of examples of Type A EFB applications.

- Flight Crew Operating Manuals (FCOM);
- Company Standard Operating Procedures (SOP);
- Airport diversion policy guidance, including a list of Special Designated Airports and/or approved airports with emergency medical service (EMS) support facilities;
- Operations Specifications (OpSpecs);
- Cockpit observer briefing cards;
- Aircraft Flight Manuals (AFM) and Aircraft Flight Manual Supplements (AFMS);
- For smaller aircraft, Pilot Operating Handbooks (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 take-off 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 autoland records;
- Flight Management System/Flight Management and Guidance System problem report forms;
- Aircraft parts manuals;
- Service bulletins/published Airworthiness Directives, etc.;
- Air Transport Association (ATA) 100 format maintenance discrepancy write-up codes;
- Required VHF Omnidirectional Range (VOR) check records;
- Minimum Equipment Lists (MEL);
- Configuration Deviation Lists (CDL);
- Airport-specific rules and regulations;
- Airport/Facility Directory (A/FD) data (e.g., fuel availability, LAHSO distances for specific runway combinations, etc.); Canada Flight Supplement (CFS) in Canada
- Noise abatement procedures for arriving and departing aircraft;
- Published (graphical) pilot Notices to Airmen (NOTAM);
- International Operations Manuals, including regional supplementary information and International Civil Aviation Organization (ICAO) differences;
- Aeronautical Information Publications (AIP);
- Aeronautical Information Manual (AIM);
- Oceanic navigation progress logs;
- Pilot flight and duty-time logs;

- Flightcrew required rest logs;
- Flightcrew qualification logs
- Captain's report (i.e., captain's incident reporting form);
- Flightcrew survey forms (various);
- Flight Attendant 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 collision (NMAC) reports, National Aeronautics and Space Administration's (NASA) Aviation Safety Reporting System (ASRS), bird and wildlife encounters, owner-initiated Service Difficulty Reports (SDR), 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 pilot 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, e.g., company-specific forms, NASA's ASRS reports, NMAC reports, wildlife strike and hazard reports, etc.;
- Maintenance personnel sign-off of discrepancy form.
- Pilot-in-Command (PIC) currency requirements;
- 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).

APPENDIX B—EXAMPLES OF "TYPE B" ELECTRONIC FLIGHT BAGS APPLICATIONS

Below is a non-exhaustive list of examples of Type B EFB applications.

- Take-off, en route, approach and landing, missed approach, go-around, performance calculations. Data derived from algorithmic data or performance calculations based on software algorithms;
- Power settings for reduced thrust settings;
- Runway limiting performance calculations;
- Cost index modeling;
- Master flight plan/updating;
- Interactive Plotting for Class II navigation;
- Mission rehearsals;
- Weight and balance calculations;
- Maintenance discrepancy sign-off logs;
- Cabin maintenance discrepancy reporting forms;
- Non-interactive electronic approach charts in a pre-composed format from accepted sources;
- Panning, zooming, scrolling, and rotation 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 of aircraft/own-ship position;
- Electronic checklists, including normal, abnormal, and emergency. See the current version of FAA AC 120-64, Operational Use & Modification of Electronic Checklists, for additional guidance. EFB electronic checklists cannot be interactive with other aircraft systems;
- Applications that make use of the Internet and/or other Aircraft Operational Communications (AOC);
- AOC 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 and aeronautical data;
- Cabin-mounted video and aircraft exterior surveillance camera displays.

APPENDIX C—ELECTRONIC FLIGHT BAGS CLASSIFICATION MATRIX

This table provides criteria to aid in determining the involvement of TCCA, operators, installers and manufacturers in EFB evaluation and approval.

Table 1: EFB Classification Matrix

Hardware	EFB Applications	TCCA Certification Involvement	TCCA Operations Involvement	Operator/Installer/Manufacturer Involvement
Class 1	Type A Type B	None	POI review and approval of COM	Evaluation of human factors and functionality as specified in this AC and other relevant TCCA advisory material.
Class 2	Type A Type B	For mounting power supply and connectivity provisions.	POI review and approval of COM	Evaluation of human factors and functionality evaluation as specified in this AC and other TCCA advisory material.
Class 3	Type A Type B Type C (Partitioned from Types A and B)	For all aspects including installation.	POI review and approval of COM	Evaluation of human factors and functionality for Type A and B software as specified in this AC and other TCCA advisory material.

APPENDIX D—ELECTRONIC FLIGHT BAGS EVALUATION PROCESS

This Appendix gives details of the evaluation process required prior to the use of new EFB hardware and/or software on an aircraft. It should be noted that the associated evaluations specified in Appendix E, F, and G should be completed for each application to be installed in the EFB. The evaluation should consider the aspects below.

D1.0 Hardware

(1) **Stowage**

(a) Stowage need only be considered for Class 1 units as Class 2 and 3 devices are by definition mounted to the aircraft. If it is contemplated that Class 2 units may be removed from their mounting during flight operations then stowage considerations would also apply in this case.

(b) A stowage area with a securing mechanism for these EFBs is recommended for storage of portable units when they are not in use. Stowage provisions should be readily accessible by the crew in flight and should not cause any obstruction or hazard during foreseeable aircraft operations. EFB systems that are not secured in a mounting device during use should be designed and used in a manner that prevents the device from jamming flight controls, damaging flightdeck equipment, or injuring flight crew members should the device move about as a result of turbulence, manoeuvring, or other action.

(2) **Cabling**

Certification is required for any cabling associated with class 2 or 3 devices. The cabling should not hang loosely in a way that compromises task performance or safety. Flight crew members should be able to easily secure cables out of the way during aircraft operations. Cables should be of sufficient length to perform the intended function. Cables too long or too short could present an operational or safety hazard.

(3) **Connections**

(a) **Class 1 EFB**

(i) Class 1 EFB systems may connect to aircraft power through a certified power source. An electrical load analysis should be conducted to replicate a typical Class 1 or 2 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. A means (other than a circuit breaker) for the flight crew member to de-power the EFB power source or system charger should be provided.

(ii) Class 1 EFB systems may have read only data connectivity to other aircraft systems. The design of the connection should ensure that there is no possibility of the EFB affecting the aircraft systems from which data is being acquired.

(b) **Class 2 EFB**

(i) Class 2 EFB power connections and data connections both require Aircraft Certification approval. An electrical load analysis should be conducted to replicate a typical Class 1 or 2 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. A means (other than a circuit breaker) for the flight crew member to de-power the EFB power source or system charger should be provided.

(ii) Class 2 EFB data connections require Aircraft Certification approval to ensure non-interference and isolation from aircraft systems during transmission and reception. The EFB data connection may receive information from any aircraft system as well as receive or transmit information for AAC purposes.

(iii) When connected to other aircraft data buses and/or communication systems, EFB failures should not adversely affect other installed aircraft systems.

(iv) Class 2 EFB power and data connectivity provisions that are installed by Supplemental Type Certificates (STC) may require an Aircraft Flight Manual Supplement (AFMS) update.

(c) **Class 3 EFB**

Class 3 EFBs must be approved by TCCA Aircraft Certification and meet all applicable certification requirements.

(4) **Mounting Provisions**

(a) This paragraph applies to Class 2 EFBs only as by definition, Class 1 systems are not mounted to the aircraft and Class 3 systems are permanently installed. Mounting provisions must be approved by TCCA Aircraft Certification and must meet all applicable certification requirements.

(b) The mounting device (or other securing mechanism) that attaches or allows mounting of the EFB system should ensure that the EFB is positioned in a way that it does not obstruct visual or physical access to aircraft controls and/or displays, flight crew member ingress or egress, or external vision. The design of the mount should allow the user easy access to the EFB controls and a clear view of the EFB display while in use. The following design practices should be considered:

(i) The mount and associated mechanism should not impede the flight crew member in the performance of any task (normal, abnormal, or emergency) associated with operating any aircraft system.

(ii) Mounting devices 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. anthropometric constraints). Locking mechanisms should be of the low-wear type that will minimize slippage after extended periods of normal use. Crashworthiness considerations will need to be considered in the design of this device. This includes the appropriate restraint of any device, when in use.

(iii) A provision should be provided to secure, lock, or stow the mount in a position out of the way of flight crew member operations when not in use.

(iv) An unsafe condition must not be created when attaching any EFB control yoke attachment/mechanism or mounting device. For example, the weight of the EFB and mounting bracket combination may affect flight control system dynamics, even though the mount alone may be light enough to be insignificant. The equipment when mounted and/or installed should not present a safety-related risk or associated hazard to any flight crew member. A means to store or secure the device when not in use should be provided. Additionally, the unit (or its mounting structure) should not present a physical hazard in the event of a hard landing, crash landing, or water ditching. EFBs and their power cords should not impede emergency egress.

(5) **Position**

If it has a stowed position the EFB should be easily accessible when stowed. When the EFB is in use and is intended to be viewed or controlled, it should be within 90 degrees on either side of each pilot's line of sight. If an EFB is being used to display flight critical information such as for navigation, terrain and obstacle warnings that require immediate action, take-off and landing V-speeds, or for functions other than situational awareness, then such information needs to be in the pilot's primary field of view. This requirement 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 speed bugs or are entered into the AFMS, and the airspeed indicator is the sole reference for the V-speeds. In this case, the EFB 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 colors wash out or the displayed color 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 should be evaluated with regard to these requirements. See Chapter § 523.1321 of the AWM and section 525.1321 of the CARs.

(6) **Reflection**

In the position in which it is intended to be used, the EFB should not produce objectionable glare or reflections that could adversely affect the pilot's visual environment.

(7) **Lighting**

Users should be able to adjust the screen brightness of an EFB independently of the brightness of other displays on the flightdeck. In addition, when automatic brightness adjustment is incorporated, it should operate independently for each EFB in the flightdeck. Buttons and labels should be adequately illuminated for night use. Consideration should be given to the long-term display degradation as a result of abrasion and aging.

(8) **Readability**

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 flightdeck, including use in direct sunlight.

(9) **Controls**

(a) All controls should be properly labeled for their intended function.

(b) All controls should be within reach of the appropriate crewmember seated normally on the fightdeck.

(c) In choosing and designing input devices such as keyboards or cursor-control devices, applicants should consider the type of entry to be made and flightdeck 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 flightdeck environment.

(10) **Disabling of installed EFBs**

For installed EFBs there should be a means other than a circuit breaker to disable the EFB in the event of unwanted operation such as continuous flashing. Circuit breakers may not be used as switches.

(11) **Interference with Other Aircraft Systems**

Class 1 and Class 2 EFB systems should demonstrate that they meet appropriate industry-adopted environmental qualification standards for radiated emissions for equipment operating in an airborne environment. Any Class 1 or Class 2 EFB used in aircraft flight operations should be demonstrated to have no adverse impact on other aircraft systems (non-interference). The manufacturer, installer, or operator may accomplish the testing and validation to ensure proper operation and non-interference with other installed systems. Possible interference when portable EFB systems are moved about in the cockpit should be addressed. Guidance for conducting interference testing of Transmitting Portable Electronic Devices may be found in RTCA DO-294C—*Guidance on Allowing Transmitting Portable Electronic Devices (T-PEDs) on Aircraft*.

(12) **Rapid Depressurization Testing**

Testing for rapid depressurization, may need to be performed. However, since many Class 1 and Class 2 EFBs were originally commercial off-the-shelf (COTS) electronic systems adopted for aviation use, testing done on a specific EFB model configuration may be applied to other aircraft installations and these generic environmental tests need not be duplicated. It is the responsibility of the operator seeking approval to provide documentation that these tests have been accomplished.

D2.0 Hardware with installed software

(1) **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 flightcrew distractions and/or uncertainty.

(2) **Readability**

(a) Text size and font for each application should ensure readability at the intended viewing distance and page layout should ensure clarity and prevent any ambiguity.

(b) 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.

(c) 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 flightdeck 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.

(3) **Colours**

For any EFB system, EFB messages and reminders should meet the requirements in sections 523.1322 or 525.1322 of the CARs, 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” should be used only to indicate a warning level condition. “Amber” should 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.

(4) **Messages**

EFB messages and reminders should be integrated with (or compatible with) presentation of other flightdeck 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,

except those indicating the failure or degradation of the current EFB application. However, if there is a regulatory or Technical Standard Order (TSO) requirement that conflicts with the recommendation above, those requirements supersede this guidance.

(5) **Interface**

The EFB user interface should provide a consistent and intuitive user interface within and across various EFB applications. The interface design, including, but not limited to, data entry methods, color-coding philosophies, and symbology, should be consistent across the EFB and various hosted applications. These applications should also be compatible with other flightdeck systems.

(6) **Data Entry**

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 and application software 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.

(7) **Possibility for Error/Confusion**

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 flightdeck systems. Entered data should be displayed with the associated results of each calculation.

(8) **Workload**

EFB software should be designed to minimize flight crew workload and head-down time. Please see sections 523.1523, 525.1523, 527.1523, 529.1523 of the CARs, and the most current version of associated FAA AC 25.1523-1—*Minimum Flight crew*. Much of the guidance in this AC is general and may prove useful for other aircraft categories as well. The positioning, use, and stowage of the EFB should not result in unacceptable flight crew workload. Complex, multi-step data entry tasks should be avoided during take-off, landing, and other critical phases of 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. If an EFB is to be used during critical phases of flight, such as during take-off and landing or during abnormal and emergency operations, its use should be evaluated during simulated or actual aircraft operations under those conditions.

APPENDIX E—ELECTRONIC FLIGHT BAGS EVALUATION CHECKLISTS—HARDWARE CLASS 1

Item	Hardware Class 1 EFB	Acceptable Yes/No
1	**Stowage**	
	Is stowage readily accessible in flight?	
	Does the stowage cause obstruction during foreseeable aircraft operations?	
	Does the stowage cause any hazard during foreseeable aircraft operations?	
2	**Cabling**	
	If the EFB has associated cabling, is it long enough to perform the intended function?	
	Is it short enough that it will not hang loosely and compromise task or safety?	
	Is there a means to secure the cable?	
3	**Power Connection**	
	Is the power source certified?	
	Has a load analysis been conducted?	
	Is there a means other than a circuit breaker to de-power the EFB/Charger?	
4	**Data Connection**	
	Is the connection read only?	
	Has it been determined that the EFB cannot affect other aircraft systems?	
5	**Position**	
	Is it intended to use the EFB in flight?	
	Is it to be handheld and/or placed on the lap? Note that if it is mounted, it is a Class 2 EFB and the Class 2 EFB checklist should be used.	
	Can the EFB be used without obstructing controls or instruments?	
6	**Reflections**	
	Will the EFB cause any unacceptable reflections or glare in the intended use position?	
7	**Lighting**	
	Is the display brightness adequately adjustable for day/night operations?	
	Are controls and control labels adequately lit?	
8	**Readability**	
	Is display readable in all foreseeable lighting conditions including direct sunlight?	
9	**Controls**	

Item	Hardware Class 1 EFB	Acceptable Yes/No
	Are all controls clearly labeled for their intended function?	
	Are the controls suitable for use in the cockpit?	
	Are the controls useable in turbulence?	
10	**Means to Disable**	
	Is there a means other than a circuit breaker to disable the EFB in the event of unwanted operation?	
11	**Interference With Other Aircraft Systems**	
	Have ground tests been conducted to demonstrate non-interference with other aircraft systems?	
	Have flight tests been conducted to demonstrate non-interference with other aircraft systems?	
	Has non- interference with other aircraft systems been verified with movement of the EFB in the cockpit?	
12	**Rapid Decompression Testing**	
	Has documentation of rapid decompression testing been provided?	

Comments:

Limitations or procedures required for operational use:

APPENDIX F—ELECTRONIC FLIGHT BAGS EVALUATION CHECKLISTS—HARDWARE CLASS 2

Item	Hardware Class 2	Acceptable Yes/No
1	**Stowage (if applicable)**	
	Is stowage readily accessible in flight?	
	Has it been determined that the stowage does not cause obstruction during foreseeable aircraft operations?	
	Has it been determined that the stowage does not cause any hazard during foreseeable aircraft operations?	
2	**Cabling**	
	If the EFB has associated cabling, is it long enough to perform the intended function?	
	Is it short enough that it will not hang loosely and compromise task or safety?	
	Is there a means to secure the cable?	
3	**Power Connection**	
	Has the power connection been certified by TCCA?	
	Has a load analysis been conducted?	
	Is there a means other than a circuit breaker to de-power the EFB/Charger?	
4	**Data Connection**	
	Has the data connection been certified by TCCA?	
	Has it been determined that the EFB does not interfere with other aircraft systems?	
5	**Mounting**	
	Has the mounting device and crashworthiness been certified by TCCA?	
	Has it been determined that the mounted EFB does not obstruct aircraft displays? (Certification)	
	Has it been determined that the mounted EFB does not obstruct aircraft controls? (Certification)	
	Has it been determined that the mounted EFB does not impede ingress? (Certification)	
	Does the mounted EFB allow easy access to the EFB controls? (Certification)	
	Does the mounted EFB provide a clear view of the EFB displays?	

Item	Hardware Class 2	Acceptable Yes/No
	(Certification)	
	Is the mounting easily adjustable to accommodate flight crew member preferences? (Certification)	
	Can the mounting device easily be locked in place? (Certification)	
	Can the mounting device be stowed out of the way of crewmember operations when not in use? (Certification)	
	Have crashworthiness criteria been considered? (Certification)	
	If the mounting is on the control yoke, have flight control system dynamics been considered? (Certification)	
	Does the mounting present any hazard to any crewmember? (Certification)	
6	**Position**	
	Is the EFB used to display flight critical information and if so, is it within the pilot's primary field of view?	
	Otherwise, is the EFB within 90 degrees on each side of the pilot's line of sight?	
	Is the orientation of the EFB consistent with displayed information such as aircraft direction?	
7	**Reflections**	
	Will the EFB cause any unacceptable reflections or glare in the intended use position?	
8	**Lighting**	
	Is the display brightness adequately adjustable for day/night operations?	
	Are controls and control labels adequately lit?	
9	**Readability**	
	Is display readable in all foreseeable lighting conditions including direct sunlight?	
10	**Controls**	
	Are all controls clearly labeled for their intended function?	
	Are the controls suitable for use in the cockpit?	
	Are the controls useable in turbulence?	
11	**Means to Disable**	
	Is there a means other than a circuit breaker to disable the EFB in the event of unwanted operation?	
12	**Interference With Other Aircraft Systems**	
	Have ground tests been conducted to demonstrate non-interference with other aircraft systems?	

Item	Hardware Class 2	Acceptable Yes/No
	Have flight tests been conducted to demonstrate non-interference with other aircraft systems?	
	Has non-interference with other aircraft systems been verified with movement of the EFB in the cockpit?	
13	**Rapid Decompression Testing**	
	Has documentation of rapid decompression testing been provided?	

Comments

Limitations or procedures required for operational use

APPENDIX G—ELECTRONIC FLIGHT BAGS EVALUATION CHECKLISTS—INSTALLED SOFTWARE

Item	Installed Software	Acceptable Yes/No
1	**Responsiveness of Application**	
	Is feedback provided for user input?	
	Is there an indication that the system is busy if the system cannot process inputs immediately?	
	Is system response time predictable and consistent with intended function?	
2	**Readability**	
	Does the text size and font ensure readability at the intended viewing distance?	
	Does the page layout provide sufficient clarity?	
	Is the cursor always visible?	
	Is indication of the active application/document provided?	
	Is it easy to switch between applications?	
3	**Colour Usage**	
	Does the use of colour meet Chapter 523.1322/525.1322 of the AWM as appropriate to the aircraft?	
	• Is red only used to indicate a warning condition?	
	• Is amber only used to indicate a caution condition?	
4	**Message Compatibility**	
	Is there a means to inhibit visual and auditory messages during critical phases of flight?	
	Is the application free of flashing text or symbols?	
	Are messages prioritized?	
	Has the prioritization scheme been documented?	
5	**Interface**	
	Is the user interface consistent and intuitive?	
	Is the user interface consistent with other EFB applications?	
	Are the applications consistent with other flightdeck systems?	
6	**Data Entry**	
	Is the EFB prevented from accepting data of incorrect format or type?	
	Does the EFB provide error messages for incorrect data entries?	
	Are input errors detected at the earliest possible point in the input sequence?	
7	**Possibility for Error/Confusion**	
	Does the system minimize the occurrence of flight crew member error?	

Item	Installed Software	Acceptable Yes/No
	Does the system maximize the possibility of error detection?	
	Is entered data displayed with the results of each calculation?	
8	**Workload**	
	Has the effect of the EFB on pilot workload been evaluated in all applicable phases of flight?	
	Has the effect of the EFB on pilot workload been evaluated under applicable abnormal and emergency operations?	
9	**Type C Software**	
	If a Type C application is installed, has it been approved by TCCA?	

Comments

Limitations or procedures required for operational use

APPENDIX H—OPERATIONAL EVALUATION AT THE CORPORATE/COMPANY LEVEL

(1) This Appendix provides details of the evaluation process at the corporate/company level which is required prior to operational phase in of EFB hardware and/or software on company aircraft. The focus of this evaluation is for the air operator to consider all aspects which may be affected by the incorporation of EFB into flight operations.

(2) The scope of the evaluation may be greater than that provided below, dependent on the actual implementation. However, as a minimum the air operator should consider the items listed below. An associated checklist is contained in Appendix I. The operator is encouraged to create customized checklists as required.

EFB Administrator

(1) The operator should designate an EFB Administrator (EFBA) who should be suitably qualified and trained and provided with adequate resources.

Crew Procedures

(1) Clear limitations and crew procedures should be provided and documented for all phases of flight. A system description and operating philosophy should be included.

(2) Procedures should:

(a) Be properly integrated with existing Standard Operating Procedures (SOPs);

(b) Contain suitable crew crosschecks for verifying safety critical data;

(c) Mitigate and/or control any additional workload associated with the EFB;

(d) Provide contingency procedures for total or partial EFB failure;

(e) Cover system reboots, lock-ups and recovery from incorrect crew actions;

(f) Include a requirement to verify the revision status of software.

Operational Risk Analysis

(1) Operators should determine appropriate procedures to eliminate, reduce, or control risks associated with identified failures in the EFB system.

(2) These procedures will generally be the result of an operational risk analysis conducted by the operator that considers:

(a) Total and partial failures of the EFB;

(b) Loss of data;

(c) Corrupt/erroneous outputs; and

(d) MEL dispatch condition.

(3) The results of such an analysis may highlight the need for more than one EFB system for redundancy. It is also possible that the second EFB may have to be a different model (dissimilar system) to minimise common mode failures.

Training Program

(1) The operator should establish suitable training programs for ground staff and crew members. Once it is established, the training program must be evaluated to determine that:

(a) The program is fully documented;

(b) The training methodology matches the level of knowledge and experience of the participants;

(c) The operator has assigned adequate resources to deliver the training;

(d) Adequate EFB and/or EFB simulation equipment has been provided;

(e) Human factors and cockpit resource management are included in the training;

(f) The training material matches both the EFB equipment status and the published procedures;

(g) The training program incorporates training for system changes and upgrades;

(h) If applicable, the training program maintains crew proficiency in non-EFB (e.g.: paper charts) procedures.

Hardware Management Procedures

(1) The operator should establish documented procedures for the control of hardware and component stocks covering removal, repair, replacement, re-installation and maintenance.

Software and Management Procedures

(1) The operator should establish documented procedures for the control of installed software. These procedures must include:

(a) A clear definition of who has access rights to install or modify software;

(b) Adequate controls to prevent user corruption of operating systems and software;

(c) Adequate security measures to prevent viruses and unauthorized user access.

Data Management Procedures

(1) The operator should establish documented data management procedures. These procedures must:

(a) Interface satisfactorily with procedures used by external data providers;

(b) Define access rights for users and administrators;

(c) Provide adequate controls to prevent user corruption of data.

APPENDIX I—OPERATIONAL EVALUATION CHECKLIST—CORPORATE/COMPANY LEVEL

Item	Operational Evaluation Checklist – Corporate/company level	Acceptable Yes/No
1	**EFB Administrator**	
	Is the nominated EFBA suitably qualified and trained?	
	Do the listed responsibilities match the requirements of the system?	
	Are there adequate resources assigned to the EFBA function?	
2	**Crew Procedures**	
	Are there appropriate procedures for all phases of flight?	
	Are the procedures clearly presented, suitably illustrated and readily understood?	
	Is there a clear description of the system, its operating philosophy and operational limitations?	
	Has the information in the Aircraft Flight Manual Supplement (AFMS) been incorporated into the company Standard Operating Procedures (SOPs)?	
	Have crew procedures for EFB operation been integrated with existing SOPs?	
	Are there suitable crew cross-checks for verifying safety-critical data?	
	Is any additional workload mitigated/controlled?	
	Are there contingency procedures for total or partial EFB failure?	
	Do the procedures cover system re-boots, lock-ups and recovery from incorrect crew actions?	
	Do crew procedures include a requirement to verify the revision status of software and data?	
3	**Operational Risk Analysis**	
	Has the operator considered total and partial failures of the EFB?	
	Has the operator considered loss of data and corrupt/erroneous outputs?	
	Has the impact of the EFB on the MEL been assessed?	
	In cases where an operator is operating a number of variants, has the impact on training/checking and currency been assessed?	
4	**Training Program**	
	Are flight crew members and (where applicable) ground staff training programs fully documented?	
	Is the training methodology matched to the participants' level of experience and knowledge?	
	Has the operator assigned adequate resources (time/personnel/facilities) for training?	
	Is there access to actual or simulated EFB equipment for interactive training?	
	Does the training material match the EFB equipment status and published procedures?	

Item	Operational Evaluation Checklist – Corporate/company level	Acceptable Yes/No
	Does the training program include human factors/CRM in relation to EFB use?	
	Does the training program incorporate training for system changes and upgrades?	
	In cases where an operator is operating a number of variants of the same aircraft, has the impact on training/checking and currency been assessed?	
	Is there a published recurrent training, checking and currency program?	
	If applicable, does the training program maintain crew proficiency in non-EFB procedures (e.g. paper charts)	
5	**Hardware Management Procedures**	
	Are there controlled documented procedures for the control of hardware and component stocks?	
	Do the procedures include repair, replacement and maintenance of EFB equipment and peripherals?	
6	**Software Management Procedures**	
	Are there documented procedures for the control of installed software?	
	Are the access rights for personnel to install or modify software components clearly defined?	
	Are there adequate controls to prevent user corruption of operating systems & software?	
	Are there adequate security measures to prevent system degradation, viruses, and unauthorized access?	
	Are procedures defined to track database expiries and obtain and install monthly chart database updates?	
7	**Data Management Procedures**	
	Are there documented procedures for the control and management of data?	
	How do the procedures interface with procedures used by external data providers?	
	Are the access rights for users and administrators to manage data clearly defined?	
	Are there adequate controls to prevent user corruption of data?	

Comments

Limitations or procedures required for operational use

APPENDIX J—OPERATIONAL AIRCRAFT EVALUATION

(1) This Appendix provides details of an operational evaluation to ensure that operations can be safely conducted using the proposed EFB procedures. This evaluation may be combined with installation evaluation described in Appendix D or conducted separately as circumstances warrant.

(2) The scope of this operational evaluation may be greater than that provided below, dependent on the actual implementation. However, as a minimum the items listed below should be considered by the air operator. An associated checklist is contained in Appendix K. The operator is encouraged to create customized checklists as required.

General operation

(1) The guiding principle of operations with an EFB is that flights should able to be conducted as safely with an EFB as with the methods or products that the EFB is intended to replace. The EFB should not add an unacceptable level of complexity for any critical activity or phase of flight. For systems with multiple EFBs, in the event of an output discrepancy there should be a means for the crew to decide which output is correct.

Workload

(1) The implementation of EFBs should not cause a significant increase in crew workload, particularly during critical flight phases. Procedures should be put in place to minimise workload and prevent crew distraction. Factors which could increase pilot workload, such as loss of an EFB, should be considered.

Installation Aspects Specific to the Operation

(1) All aspects of the operator's proposed EFB procedures should be evaluated in the aircraft or a simulator representative of the aircraft to ensure that any installation issues specific to the proposed operation are identified and mitigated.

Aircraft Performance Calculations

(1) The operator should have a means to verify that the EFB outputs for aircraft performance calculations match the AFM. The EFB should have been determined during the installation evaluation to minimize the possibility of confusion and data entry errors. It should be confirmed that the operator's flight crew members using the operator's procedures find data entry to be easy and unambiguous. It should also be determined that the procedures allow for adequate crosscheck between crewmembers.

Electronic Navigation Charts

(1) It should be determined that crews are able to use the electronic navigation charts as readily as paper charts. The ability to easily select charts should be evaluated and the ability of the system to accommodate short notice changes such as a change of runway should be assessed. The possibility of crew confusion resulting from chart orientation, automatic chart selection or de-cluttering should be evaluated and mitigation should be proposed for any issues arising.

Electronic Checklists

(1) Electronic checklist features should be evaluated to determine whether crews are able to use them as well as paper checklists. The status of checklist items should be clear to the crew and it should be easy for the crew to change the status of each item. The potential to skip checklist items or assign incorrect actions should be minimized. The complete or incomplete status of the checklist should be clear to the crew.

APPENDIX K—OPERATIONAL EVALUATION CHECKLIST—AIRCRAFT

Item	Operational Evaluation Checklist – Aircraft	Acceptable Yes/No
1	**General**	
	Can flights be conducted as safely with an EFB as with the methods/products it is intended to replace?	
	Has it been determined that there are no noticeable conflicts between EFB and flight system interfaces, or between multiple EFBs?	
	Has it been determined that In the event of an output discrepancy, there is a means for the crew to know which output is primary?	
	Has it been determined that the EFB does not add an unacceptable level of complexity for any critical activity or phase of flight?	
2	**Workload**	
	Is the workload with an EFB less than or equal to the workload for equivalent tasks without an EFB?	
	Has it been determined that the EFB does not distract pilots during critical phases of flight?	
	Are there policies/procedures in place to mitigate workload/distraction problems?	
3	**Aircraft Performance Calculations**	
	Can the operator verify that aircraft performance data outputs match AFM performance data? How?	
	Is the entry and manipulation of data easy and unambiguous?	
	Does the system provide suitable error messages for inappropriate input/output?	
	Does the system allow adequate cross-checks between crew members in practice?	
4	**Electronic Navigation Charts**	
	Can crews use electronic charts as well as they use paper charts?	
	Can the system easily accommodate short notice changes (e.g. re-clearance, change of runway)?	
	Do zoom and pan features ensure that critical items are not lost from view? Do scale and orientation indications remain visible? Does the scale indication remain accurate?	
	Do display or orientation options ensure that crews do not become confused about display orientation?	
	Externally-sensed inputs (e.g. overlay of current aircraft position): • Does the system automatically select relevant charts? • Can the selection be manually overridden? • Is displayed position accurate within the displayed scale?	

Item	Operational Evaluation Checklist – Aircraft	Acceptable Yes/No
	Does the system ensure that: • critical items are not lost from view in 'de-cluttered' mode? • there is a clear indication that the de-cluttering feature is active? • printed charts are as accurate and usable as conventional paper charts?	
5	**Electronic Checklists**	
	Can crews use electronic checklists as well as they use paper checklists? How does crew coordination of checklist actions work in practice?	
	Is progress through the checklist and the status of items (complete/deferred/open) clear to the crew?	
	Can the crew easily change the status of an action item?	
	Can the crew remove completed actions in order to recommence the checklist from the beginning?	
	Is the potential to skip checklist items or assign incorrect actions minimised?	
	Can the crew easily navigate through the checklist? Are deferred actions appropriately displayed?	
	Is it clear when a checklist is incomplete?	
	Are 'decision branches' clearly displayed? Can the selection of an incorrect branch be reversed?	
	Are reminders displayed for delayed actions (e.g. fuel dumping)?	

Comment

Limitations or procedures required for operational use