CIVIL AVIATION ADVISORY PUBLICATION

CAAP 18

ELECTRONIC FLIGHT BAG (EFB)

INFORMATION AND POLICY REGARDING THE CERTIFICATION, AIRWORTHINESS, AND OPERATIONAL APPROVAL OF ELECTRONIC FLIGHT BAG COMPUTING DEVICES

1.   PURPOSE

This Civil Aviation Advisory Publication (CAAP) provides information and the GCAA 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. It is not the only means for an applicant to obtain both the certification and operational use of the EFB.

2.   STATUS OF THIS CAAP

This is the first edition of CAAP18 – Electronic Flight Bag and is dated 1st March, 2004. It will remain current until withdrawn or superseded.

3.   APPLICABILITY

These guidelines and policy material apply to all UAE operators (private and commercial) seeking EFB approval.

4. CONTENTS

5. REFERENCES

This CAAP is based on the information contained in FAA AC 120-76A. This document has been universally accepted as the defining reference on this subject.

6. 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.

7. DEFINITIONS

Electronic Flight Bag - An electronic display system intended primaril*y* 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 GCAA). 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).

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

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

Data Link Connectivity for Class 2 EFB Systems.   Supports functions for which failures or design errors could not degrade aircraft capability or flight crew ability.

Portable Electronic Device (PED).   Class 1 and 2 EFBs are considered PEDs.

8.   HARDWARE CLASSES OF EFB SYSTEMS

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

8.1   Class 1

From an operational use perspective, Class 1 EFB systems are generally commercial off-the-shelf (COTS)-based computer systems used for aircraft operations. It is portable and not attached to an aircraft mounting device. Class 1 EFB systems do not require to go through an administrative control process for use in the aircraft (if using only type A application) and is considered a PEDs.

8.2   Class 2

From operational use perspective, Class 2 EFB systems are generally COTS-based computer systems used for aircraft operations. It is portable and connected to an aircraft mounting device during normal operations. Class 2 EFB systems require an administrative control process to add, remove, or use in the aircraft. It is also considered a PED.

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

8.3   Class 3

From an operational use perspective, Class 3 EFB systems are installed equipment that requires the GCAA approval based on the State of Manufacturer or Design approval, except for the user modifiable software that may be used to host Type A and B application.

9.   SOFTWARE APPLICATION FOR EFB SYSTEMS

This CAAP defines three types of software applications: Type A, B and C. For applications or functions not listed in appendix A or B, the applicant should coordinate evaluation and approval with the GCAA through the Principal Inspector.

9.1   Type A software application.

Type A software application may be hosted on any of the hardware classes. It requires an evaluation made by the Flight Operations and Airworthiness Inspectors before granting the GCAA approval. The software application however does not require design approval. Examples of Type A applications are provided in Appendix A

9.2   Type B Software Applications

Type B software application may be hosted on any of the hardware classes. It requires an evaluation by both the Flight Operations and Airworthiness Inspectors before granting the necessary GCAA approval. The Airworthiness Inspector must ensure that the operators or manufacturer of the software submits an aircraft evaluation report made by the State of Manufacturer or Design. This report is to be reviewed to determine its suitability. This software application does not require a design approval. Examples of Type B software applications are provided in Appendix B

9.3   Own-ship Position

This chapter by itself may not be used to install own-ship position on moving map on Class 1 and 2 EFB systems.

10.   EFB CLASSIFICATIONS

The EFB criteria listed in Table 1, EFB Classification matrix, combined with the text contained in the body of this paragraph, should be used by the applicant to determine the EFB system classification and derived certification and operational approval basis. All applications and information contained in the EFB intended for operational use must be current and up-to-date. The following are therefore the procedures and guidance to determine EFB system classification, roles and responsibilities.

10.1 Class 1 EFB Hardware

Class 1 EFB hardware may be used on the ground and in flight. It must be connected to ship's power through a certified power source. There must be recharge batteries onboard the aircraft and the system must possess a quick-disconnect capability from power and/ or data sources for egress purposes. Class 1 EFB hardware should;

(a)   Have read-only data connectivity to other aircraft systems.

(b)   Have receive/transmit data connectivity for AAC only

The operator should provide evidence, demonstrating that the Class 1 EFB is properly stowed or mounted for takeoff and landing.

10.2 Class 2 EFB Hardware

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. For Class 2 EFB systems with aircraft specific software application, operators will need to establish procedures to remove and reinstall this equipment. The following are the specific examples of certification, operational and operator requirements that Class 2 EFB systems need to meet before receiving approval to use this equipment:

(a)   Class 2 EFB systems represent a class of COTS electronics equipment (eg; pen tablet computers) that has been adapted for use in the aircraft. The GCAA needs to document EFB class 2 suitability for its use onboard an aircraft.

(b)   The EFB non-interference compliance must be documented by the GCAA. The applicable mounting device, crashworthiness, data connectivity and EFB power connection (s) must be approved. Class 2 EFB hardware does not require type design approval.

(c)   Class 2 EFB mounting devices, power and data connectivity provisions that are installed by Supplemental Type Certificate (STC) may require an Aircraft Flight Manual Supplement (AFMS) update.

(d)   Class 2 EFB hardware is removable from the aircraft; the operator must possess an administrative control process (eg logbook entry).

(e)   Operators must determine non-interference with existing aircraft system for all flight phases and ensure that the system performs the intended function.

(f)   Operators are expected to conduct a human factors evaluation of the EFB mounting device and flight deck location.

(g)   Operators must determine the usage of hardware architectural features, persons, procedures, and/or equipment to eliminate, reduce or control risks associated with an identified failure in the EFB.

10.3 Class 3 EFB Hardware

Class 3 EFB hardware is installed equipment and requires type design approval.

10.4 Type A EFB Software Application.

Appendix A lists examples of EFB hosted software application that requires the GCAA approval. Type A applications include pre-composed, fixed presentation of data currently presented in paper format. The operator should provide evidence, demonstrating that the operational and certification requirements are met when requesting approval to use the applications defined in Appendix A.

(a)   Type A application software does not require compliance in airborne systems and equipment certification.

(b)   The granting of the initial operational approval by Flight Operations will include flight crew training, checking and currency requirements.

(c)   The initial operational approval is for a period of 6 months and during the stated period an operational evaluation will be conducted by the operator. This evaluation period requires the operator to carry both the EFB system and paper copies before the final approval to allow reduction or elimination of paper copies on the flight deck

(d)   Operators must submit a final report to the GCAA after the 6 month evaluation period of the ESB system. Final approval by the GCAA will be granted per Operations Specifications or Letter of Approval.

(e)   Operators must determine the usage of hardware and/or software architectural features, people, procedures and/or equipment to eliminate, reduce or control risks associated with an identified failure in the system.

(f)   The operator should provide evidence, 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. This evidence includes a demonstration that the software revisions will not corrupt the data integrity of the original software version when it was first installed and 'base lined' and meets its intended function.

10.5 Type B EFB Software Application

Appendix B lists examples of EFB hosted software applications that require the GCAA approval. Type B applications include dynamic, interactive applications that can manipulate data presentation. The operator should provide evidence, demonstrating that the operational and certification requirements are met when requesting approval, specifically;

(a)   Type B application software does not require airborne systems and equipment certification

(b)   The granting of the initial operational approval by Flight Operation will include flight crew training, checking and currency requirements.

(c)   The Flight Operations Inspector after consultation with the Chief of Flight Operations will grant authority for a 6 month operational evaluation. This evaluation period requires the operator to carry both the EFB system and paper copies to be carried before the final approval, allowing the EFB to reduce or eliminate paper copies on the flight deck.

(d)   Operators must submit a final report to the GCAA after the 6 month evaluation period of the ESB system. Final approval by the GCAA will be granted per Operations Specifications or Letter of Approval

(e) Type B applications may be used to display pre-composed information such as navigation or approach charts. Required information should be presented for each applicable phase of flight.

(f) Operators must determine the usage of hardware and/or software architectural features, people, procedures and/or equipment to eliminate, reduce or control risks associated with an identified failure in the system.

(g) Additional Type B applications may require a separate approval.

(h) The operator should provide evidence, 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. This evidence includes a demonstration that the software revisions will not corrupt the data integrity of the original software version when it was first installed and 'base lined' and meets its intended function.

Panning, scrolling, zooming, rotating or other active manipulation can be considered for Type B application even if there is a pending human factor evaluation s. Electronic navigation charts should provide a level of information integrity equivalent to paper charts.

10.6 Interactive performance Applications

Operational approval can be granted, as appropriate, for hosted interactive performance applications which include flight crew training, checking, and currency requirements. Additionally, hosted interactive performance/weight and balance applications should meet the following criteria:

(a) Operational procedures should be developed. These procedures should define the roles that the flight crew and dispatch/flight following personnel have in creating, reviewing and using performance calculations supported by the EFB.

(b) An EFB that provides interactive performance calculations must have baseline software programmes and functions approved by the State of Design.

(c) If the EFB is used for weight and balance calculations, an approved method for weight and balance calculations including its control procedure should be presented.

10.7 Type C EFB Applications

Type C applications require the verification and confirmation of the State of Manufacturer and Design approvals. The modifiable software which may be utilized to host Type A and B applications may be given exception. (User modifiable software may not have any effect on Type C applications.) Examples of Type C applications include primary flight display.

11. HUMAN FACTORS AND RISK MITIGATION CONSIDERATIONS

The risk mitigation and human factors/pilot interface characteristics of the ESB system should be evaluated by the applicant and submitted to he GCAA The guidelines on these subjects can be found in the FAA AC 120-76A. Applicants should also take note of the following when making the evaluation.

(a) Human factors guidance material described by the Advisory Circular

(b) EFB system design and usability

(c) Flight crew workload

(d) Messages and the use of colours

(e) Errors and failures modes

(f) Procedures

12. OPERATIONAL APPROVAL PROCESS

12.1 Approval Process

The introduction and the use of EFBs in the cockpit and cabin requires approvals in all operating procedures, pertinent training modules, checklists, operations manual, training manuals, maintenance programmes, MELs, other pertinent document and reporting procedures. The approval process consists of the following steps.

(a) Operator applies for authorisation from the GCAA. Common understanding of what the operator must do and what role the GCAA will have, what reports and documents must be prepared have to be reached by both parties.

(b) The operator submits a plan to the GCAA. The plan must be complete before the GCAA can conduct a thorough review and analysis.

(c) Review and analysis of the operator's plan for regulatory compliance, safe operating procedures, a logical sequence, and other areas such as flight crew and dispatchers qualification, acceptable procedures, and schedules for accomplishment.

(d) Validation testing where the operator conducts specific operations for the purpose of data collection or for GCAA observation.

(e) The GCAA may grant approval (or refuse the application).

In addition to the close co-ordination with the regulatory authority, the following job aid is provided for use by the applicant when seeking EFB approval.

(a) Make application in a form and manner acceptable by the GCAA.

(b)   Demonstrate a process of ensuring initial and continuing reliability of each specific unit.

(c)   Demonstrate that the radio magnetic interference/electromagnetic interference tests have been performed satisfactorily.

(d)   Demonstrate that the units can be properly stored or mounted in the aircraft.

(e)   Demonstrate that any electronic receptacles used for connection of the EFB to an aircraft system have been installed using GCAA approved procedures.

(f)   Develop a policy and procedures manual.

(g)   The final approval of the EFB is granted via a letter of approval or issuance of Operations Specification.

12.2 Operational Procedure Development

The intended functions of EFB may vary, depending on the device used and the software applications hosted by the computer. It is extremely important that the applicant and/or the operator specifically define the intended EFB functions in a clear and concise manner.

Operators are expected to have procedures that define how the flight crew is expected to use each EFB function during ground operations and under all flight conditions. Operators must provide procedures to the flight crew which includes normal, abnormal and emergency use. Operators must also review and determine whether to modify those existing policies and procedures affected by the introduction of EFBs into line operations.

12.3 EFB Configuration Control

The make and model of the approved EFB equipment must be approved through the above process and the following information may be listed in the Operations Specifications or specific authorization.

(a)   Operating system to include version control

(b)   Application programme version control.

(c)   Approved source for the data updates; and

(d)   Make and model of the EFB hardware, including a tracking process for major internal subcomponents whose replacement/upgrade may necessitate additional non-interference testing.

12.4 Database Update Process

The operator needs to establish specific procedures to verify that revisions to the database contained in the EFBs are current, complete and approved. Unauthorised 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.

12.5 Software Revision Process

Unauthorised modification of any database or the loading of any new or additional software intended for operational use is not permitted unless that software has been demonstrated to comply with the original approval basis. The GCAA has to approve updates for Type B applications. For Type C applications, the FAA-approved service bulletins or the minor change process defined in the current version of AC 21-40 will be used for EFB update approval.

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.

12.6 Special Data Storage and Retrieval Considerations

The EFB system needs to permit any authorised personnel from the GCAA to retrieve, view or print the information contained in any EFB system. Operators should establish procedures to archive or retain old data. The length of time that the data is kept is dependant on the kind of information being archive. Some information such as maintenance historical data should be kept for the life of the aircraft. It may also be necessary to keep old versions of the software and operating systems to properly retrieve archive data. Maintenance discrepancy logs need to be downloaded into a permanent record at least weekly.

12.7 Training

Training should address flight crew and maintenance personnel requirements, as appropriate. The following element should be included in each EFB training module;

(a)   A description of what an EFB is its capabilities and the applications for which the operator will use the EFB system and its components and peripherals. This should include theory of operation and the training should ensure that the flight crews understand the dependencies associated with the sources and the limitations of the information.

(b)   A description of EFB controls, display, symbology and failure modes.

(c) An AFMS or other documentation that provides conditions, limitations and procedures for the use of the ESB system and its associated equipment.

(d) Description of any special flight manoeuvres, operations and procedures that the operator is authorized to conduct when using the EFB.

(e) Any special pilot/controller procedures when using EFB-based information.

(f) Geographical areas authorised for the specific EFB operations, if applicable.

(g) Authorised methods to defer inoperative EFB equipment.

Operator's training should also provide an opportunity for instruction, demonstration and practice using actual or simulated EFB equipment and display. Operators are required to conduct initial fleet training. A letter of initial approval authorising an operator to instruct personnel under the EFB curriculum segment, pending an evaluation of training effectiveness will be issued. This arrangement also allows the regulatory personnel who are responsible for approval to become familiar with the operator's EFB system and equipment. After satisfactory evaluation of the operator's EFB curriculum segment, an authorization will be issued to the operator. This authorises the operator to continue training in accordance with the operator's approved training programme.

All flight crew must complete an approved training programme before being authorised to use EFB equipment. Initial qualification with the EFB may require that the flight crew members demonstrate satisfactory proficiency with the EFB. This may be completed during a line check.

Simulators and other approved training devices may be used as a tool to enhance the overall quality of the training given and/or evaluate EFB system performance before granting operational approval.

12.8 Flight Evaluations

The number of flight evaluations required to validate a particular EFB system before operational approval, including its hosted applications, should be based on the type of aircraft, aircraft system architecture, flight crew workload considerations, credit given to previous certified installations and past simulator and ground testing.

13. SURVEILLANCE

Surveillance requirements should include specific aspects on performance data including;

(a) Validity, currency and control of data.

(b) Amendment process.

(c) Operator's guidance material.

(d) SOPs.

(e) Correct and appropriate use of data.

(f)   Compliance with approval limitations (if applicable).

(g)   Operator's records.

APPENDIX A

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

- Flight Operations Manuals (FOM)
- 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 modelling 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 manual
- Services Bulletins / published Airworthiness Directives, etc.
- Required VHF Omni directional Range (VOR) check records
- Minimum equipment list (MEL)
- Configuration Deviation List (CDL)
- UAE Law 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
- 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 Crew 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)

Note: Other proposed applications should be submitted to the GCAA for review.

APPENDIX B

**EXAMPLES OF "TYPE B" ELECTRONIC FLIGHT BAG (EFB)
APPLICATIONS**

- 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.
- Power settings for reduced thrust settings
- Runway limiting performance calculations
- Cost index modelling
- Master flight plan / updating
- Interactive Plotting for Class II navigation
- Mission rehearsals
- Weight and balance calculations
- 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, centring and page turning but without display or aircraft / own-ship position.
- Electronic checklists, including normal, abnormal, and emergency. EFB checklists cannot be interactive with other aircraft systems.
- Application that make use of the Internet and /or other aircraft operational communications (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 and aircraft exterior surveillance camera displays

Note: Other proposed applications should be submitted to the GCAA for review.

TABLE 1. EFB CLASSIFICATION MATRIX

EFB APPLICATIONS	HARDWARE CLASS	AIRWORTHINESS INVOLVEMENT	FLIGHT OPERATIONS INVOLVEMENT	OPERATOR REQUIREMENTS
Type A Refer to Appendix A	Class 1,2,3 – Mounting may not be required for class 1 or 2 – May require stowage – Availability for all flight phases as required – May require quick-disconnect from power / data sources for egress	Yes, for: – Mounting device – Power – Data connectivity – Data updates according to the maintenance manual or inspection programme	Approval, for: – Training – Checking – Currency	– Develop programme for usage – Non-interference
Type B Refer to Appendix B	Class 1,2,3 – Mounting may not be required for class 1 or 2 – Available for all phases of flight – May require quick-disconnect from power / data sources for egress	Yes, for: – Mounting device – Power – Data connectivity – Data updates according to the maintenance manual or inspection programme	Approval, for: – Training – Checking – Currency – Issue Ops Specs or Letter of Approval	– Develop programme for usage – Non-interference
Type C	Class 2,3	Yes, for: – Mounting device – Power – Data connectivity – EFB TSO/STC – Data updates according to the maintenance manual or inspection programme	Approval, for: – Training – Checking – Currency – Issue Ops Specs or Letter of Approval	Per current airworthiness and operational approval process