Abstract

Air carrier operators have long recognized the benefits of adapting portable computing devices, such as commercially available laptop computers or special purpose computers, to perform a variety of functions traditionally delegated to the flight crew. One of the original applications of EFB systems was to reduce the 40 pounds of paper products that the flight crew typically carries onboard aircraft (e.g., airplane flight manuals, checklists, aeronautical charts including approach plates). These devices have been approved as a direct replacement of hard copy chart information contained in the crew flight bag, thus the term Electronic Flight Bag (EFB) has entered aviation vernacular.

Operators have increasingly sought additional EFB capability, as well as expanding the scope of operational use. Operators are now seeking approval for EFB use during normal operations. A commensurate expansion of EFB functionality and aircraft interface complexity has also taken place to include the capability to perform various combinations including: (1) calculation of flight manual performance data, (2) display of normal and non-normal checklist items, (3) display of approach plate overlays, (4) display of video security camera images and infrared camera images, (5) depiction of near real-time weather information and aeronautical data, (6) display of traffic information, (7) upload of flight planning information into the aircraft Flight Management System, (8) data communication capability with a ground station, (9) Internet connectivity, etc.

This expansion of capability resulted in the need to establish joint certification and operational guidance material to assess hazards associated with EFB loss or malfunction (misleading information being presented to the flight crew). Certain EFB systems are used for wire-less communication with Airline Operations Centers (AOC) which could improve maintenance and dispatch times.

Introduction

The purpose of this paper is to provide information and provide answers to frequently asked questions (FAQs) for the certification, airworthiness and suitability of operations for Electronic Flight Bag (EFB) systems. This paper is intended to provide the reader with a description and overview of the various regulatory documents that are used during the EFB approval process.

As the purpose of this paper is for information only and is not regulatory, it is recommended that you contact your local Aircraft Certification Office (ACO) for specific guidance on EFB issues.

EFB systems are primarily intended for flight deck use by the pilots or in the cabin by the flight attendants. Certain operators use the same EFB systems in the flight deck as the flight attendants use in the main cabin. This allows easier provisioning for spares and back-up systems. The software applications used by the flight attendants are typically related to E-commerce. Most EFB systems have internet connectivity and certain EFB systems transmit information to aircraft avionics systems. Many different types of EFB systems are now used in thousands of aircraft world-wide.

There are many different types of aircraft operating in the United States National Air Space including Transport Category Airplanes, Small Airplanes, Military Aircraft and Rotorcraft. The rule basis, system architectures and vulnerabilities are different across these aircraft types. EFB policy and guidance is being developed and structured to address different rule basis, architectures and vulnerabilities across all aircraft types.

FAA EFB Guidance Material

The Aircraft Certification and Flight Standards Services provide oversight for the use of EFB systems on aircraft. This section will explain the different FAA documents that provide guidance for EFB systems and their inter-relationships. Aircraft Certification is responsible for the design approval of installed equipment in aircraft including aircraft
power connectors, mounting brackets and data bus connectivity for EFB systems. Aircraft Certification is not responsible for design approval of portable equipment used anywhere in the aircraft including the flight deck or main cabin.

**Portable EFB Systems Overview**

Portable EFB systems may be modular or stand-alone and are required to be accessible to the flight crew without the use of tools to connect or remove from the aircraft flight deck. Portable EFB systems may be assigned to flight crew members and removed from the flight deck frequently or be resident in the flight deck for extended periods of time.

A portable EFB system is a controlled device that is subject to administrative control oversight by the operator. This will include tracking the location of the EFB systems to specific aircraft or persons and ensuring that no unauthorized changes are made to the hardware, software or databases. A controlled EFB system will also require procedures to ensure that it is maintained and configuration controlled.

To better understand the requirements for portable EFB systems, a good analogy would be the docking station concept. Many of us have docking stations in our offices where we are able to plug our laptop computers in and out of. The docking station which is installed in the aircraft would require an Aircraft Certification design approval as it is permanently connected to the aircraft and normally requires tools to install and remove the bracket. The docking station typically includes a mounting bracket, aircraft power port and data bus connectivity wired, wire-less or both.

The docking station installation is also required to include protection mechanisms to ensure that any failures of the portable EFB systems will not have adverse effects on the installed aircraft systems. If the EFB systems connect to aircraft power or data busses (e.g. Aeronautical Radio Incorporated (ARINC)-429) then protection mechanisms to mitigate failures must be part of the Aircraft Certification design approval process. [1] FAA memorandum ANM-01-111-165 “Policy Statement on Certification of Power Supply Systems for Portable Electronic Devises on Part 25 Airplanes” also applies to portable EFB systems. [2] This memorandum provides policy on aircraft power and interfaces to portable equipment.

EFB Class 1 and 2 systems may use data connectivity in a “read-only” architecture to receive information from Aircraft Control Domain avionics systems. Receiving information from any aircraft avionics system using Aeronautical Radio Incorporated (ARINC)-429 data bus is acceptable provided protection mechanisms are design approved. Portable EFB systems are allowed to receive but not transmit information to the Aircraft Control Domain (ACD).

The ACD provides guidance and control related to continued safe flight during all flight phases including takeoff and landing. Automatic Flight Guidance and Control Systems (AFG&CS) including flight control computers, flight director, flight management computer systems, Global Positioning Systems (GPS) and primary flight displays are part of the ACD. EFB Class 1 and 2 systems may receive and transmit information to a certified avionics router with firewall protection to ensure that failures will have no safety effect on the aircraft avionics. Typically the router will have multiplex capability to switch to different ARINC 429 data busses to receive data. The aircraft data connectivity interface must be certified, but the portable EFB system may be operationally evaluated.

Ongoing discussions include the loading of weight and balance information from a portable EFB system into the Control Display Unit (CDU) of a Flight Management Computer System (FMCS). While it is recognized that errors may occur from reading information from the EFB display and manually loading the data into the CDU, the current FAA policy does not allow this operation for portable systems. Installed EFB Class 3 systems have been approved and are eligible for automatic loading of weight and balance information into the CDU.

Portable EFB Class 1 and 2 systems may receive and transmit information for Aircraft Administrative Control (AAC) process via wire-less connectivity including Aircraft Communication Addressing and Reporting Systems (ACARS). AAC are defined by International Civil Aviation Organization (ICAO) as communications used by aeronautical operating agencies related to the
business aspects of operating their flights and transport services. The airlines use the term Airline Operational Communication (AOC) for this type of communication. An example is receiving and transmitting information from wireless connectivity from an EFB system to an Aircraft Operations Center (e.g., gate link) for maintenance reporting. Portable EFB systems are not allowed to be used as a communication device with Air Traffic Control (ATC).

**Portable EFB Systems Safety Mechanisms**

Applicants must demonstrate that safety mechanisms are in place to prevent EFB data connectivity failures from having adverse effects on aircraft avionics systems. An EFB system certification demonstration may be required to ensure the intended function of the data connectivity. The certification demonstration should be limited to verifying that the data connectivity port(s) meets its intended function.

While desirable as part of the system design, certification credit for protection mechanisms that are part of the portable equipment for connectivity to aircraft power or data busses is not granted. Portable EFB systems that do not connect to aircraft (e.g., power connectors, data buss connectors) do not require external protection mechanisms. The relief that an operator is granted from the certification process is for the portable EFB system (all hardware and software). All software that is contained in a portable EFB system does not require an aircraft certification design approval or compliance to RTCA DO-178B “Software Considerations in Airborne Systems and Equipment Certification” with one exception. [3] The exception is surface moving map applications which will be discussed later in this paper.

Although portable EFB systems are not required to meet RTCA DO-178B, the software development process should be robust and perform as intended. Some industry members erroneously classify portable EFB software development assurance as RTCA DO-178B Level E which has no safety effect. It is important to recognize that some EFB applications if not correctly implemented could contribute to minor safety effects or greater for some aircraft operations.

**Installed EFB Systems**

Installed EFB systems are required to meet all of the Aircraft Certification design requirements with one important exception. All software applications that are allowed on EFB portable systems are also allowed on installed EFB systems with the same guidance as described in Advisory Circular (AC) 120-76A “Guidelines for the Certification, Airworthiness and Operational Approval of Electronic Flight Bag Computing Devices”. [4] AC 120-76A has two appendices. Appendix A “Examples of Type “A” EFB Applications Requiring Principal Inspector Approval” and Appendix B “Examples of Type “B” EFB Applications Requiring Aircraft Evaluation Group Evaluation (AEG) in Addition to Principal Inspector (PI) Approval”.

These appendices list over seventy EFB software applications. Type “A” and “B” software applications that are hosted on EFB systems support operations that have traditionally been the responsibility of the Aircraft Evaluation Group (AEG) and Principal Inspectors (PI). Although the media supporting these operations has changed (from paper to electronic format), the aircraft operational requirements and rule basis remain the same.

**Note:** EFB Type “A” and “B” software applications are not the same or related to RTCA DO-178B software levels “A” and “B”. In hindsight we probably should have called the EFB Type “A” and “B” software application Type “X” and “Y” to avoid this confusion.

The reason that Type “A” and “B” applications have the same approval process for portable versus installed EFB systems is for standardization purposes, increase safety, reduce the cost and encourage the use of EFB class 3 systems. Some operators will use only Type “A” and “B” applications in the Class 3 EFB systems (sometimes referred to as EFB Class 3 light).

Other operators will use both Type “A” and “B” application and RTCA DO-178B software applications. EFB Class 3 systems enable additional software applications that have traditionally had the
oversight of the Aircraft Certification Service. The EFB Class 3 system is a powerful tool because it allows both operationally approved (Type “A” and “B” software applications) and RTCA DO-178B software to reside on the same platform with partitioning.

User-loadable and User-Modifiable Type “A” and “B” software applications may be installed in a Class 3 EFB system without an aircraft certification design approval if the airplane network architecture or EFB system interfaces have protection (e.g., physical partitioning, read-only access, etc.) which will not allow these software applications to have any adverse effects on other airplane systems. The EFB operating system and Type “C” applications must also be protected from any adverse effects of the user-loadable Type “A” and “B” applications. Type “C” applications as defined in AC 120-76A are Aircraft Certification approved and are required to comply with RTCA DO-178B or equivalent.

All EFB Class 3 systems must meet Code of Federal Regulations (CFR) 14 §25.773 Pilot compartment view. §25.773 (2) states “Each pilot compartment must be free of glare and reflection that could interfere with the normal duties of the minimum flight crew (established under §25.1523). This must be shown in day and night flight tests under non-precipitation conditions.” This requirement does add cost to the EFB installed equipment as portable equipment is not required to meet this regulation.

EFB Advisory Circulars and Orders

Type “A” and “B” software applications do not require a Aircraft Certification Design approval, but do require an operational suitability evaluation by the Flight Standards Service. FAA Order 8900.1 Change 47 “Volume 4 Aircraft Equipment and Operational Authorizations Chapter 15 EFB Authorization for Use” provides guidance for conducting an operational suitability evaluation. [5] This document provides the most current information on EFB policy and guidance. The FAA is in the process of revising all of the EFB guidance material to have all of the information up to date and consistent. In the interim it is recommended that FAA Order 8900.1 be used to obtain the most current guidance information. Some of the topics covered in FAA Order 8900.1 are as follows:

- Flow Diagrams that aid in EFB classification determination
- Principal Inspector Review Checklists including Human Factors Guidance
- Electromagnetic Interference and Non-Interference Testing
- Requirements for Rapid Depressurization Testing on EFB systems

Rapid Depressurization Testing

According to FAA Order 8900.1 rapid depressurization testing for Class 1 and 2 EFB systems must be conducted when Type “B” applications are used in lieu of paper-based aeronautical charts in pressurized aircraft during flight. The reason for this requirement is availability of the aeronautical charts for flight operations. If an operator removes the paper charts from the flight deck and relies on EFB displays for this information, then a rapid depressurization in a mountainous area could cause loss of all aeronautical chart information which could cause an unsafe condition. It is interesting to note that many IPADs that are intended to be used as EFB systems have successfully passed rapid de-pressurization testing.

EFB Evaluation Process

Part of the evaluation process is for the applicant to demonstrate 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. The evaluation should address the adequacy of the human/machine interface, accessibility of controls, ability to view controls, annunciations, displays and printers, and the effect of flight crew workload and heads-down time.

For both portable and installed EFB systems, the Type “A” and “B” applications are considered user loadable / user modifiable software and do not require and Aircraft Certification design approval.

AC 120-76A contains an error which states “Class 2 EFB systems do not require compliance
with RTCA DO-160D Environmental Conditions and Test Procedures for Airborne Equipment”. This has been corrected in 8900.1 Change 47 and will be corrected in the next revision of AC 120-76A.

CFR Part §91.21 requires that any operator ensure that an EFB or any other electronic device does not cause interference with aircraft systems. Operators may reference the current version of AC 91.21-1 “Use of Portable Electronic Device aboard Aircraft” which provides guidance on the use of RTCA DO-160D. [6]

AC 120-76A is being revised and when published will be called “Guidelines for the Airworthiness and Operational Use of EFB”. In combination with this new AC 120-76B a new 20 series AC for the “Installation of EFB Components” has been developed and is available for public comment. [7, 8] Both advisory circulars are planned to be published during the fourth quarter of 2011. These new advisory circulars are philosophically consistent with AC 120-76A and provide additional clarification and guidance to improve the standardization of the EFB approval process.

The FAA has published AC 91-78 “Use of Class 1 or Class 2 Electronic Flight Bag. [9] This advisory circular provides aircraft owners, operators, and pilots operating aircraft under Title 14 of the Code of Federal Regulations (14 CFR) Part 91, with information for removal of paper aeronautical charts and other documentation from the flight deck through the use of either portable or installed flight deck displays (e.g., EFB systems).

According to AC 91-78 a display device could present a comprehensive depiction of interactive information and/or pre-composed information that is the functional equivalent of a paper aeronautical chart. Pre-composed information is a static non-interactive depiction. Interactive information presented on the EFB 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.

FAA Transport Standard Staff Issue Papers

The FAA Transport Airplane Directorate (TAD) has published several Issue Papers that are related to the EFB approval process; (1) Provisions for Docking a Class 2 EFB Systems in the Flight Deck, (2) Installation of Wireless Local Area Networks (WLAN), and (3) Guidance and Installation Approval of Class 3 EFB Systems. [10, 11, 12] A brief summary of these TAD issues papers that are related to the EFB approval process is included in this section. It is highly recommended that an applicant contact the FAA TAD early in the certification process to obtain a copy of these issue papers. [13] The TAD Issue Papers are intended to provide supplemental information to the EFB approval process and are intended to be used in combination with EFB advisory circulars and orders.

Provisions for Docking Class 2 EFB Systems in the Flight Deck

This issue paper provides guidance for airworthiness approval of the provisions for docking Class 2 EFB systems in the flight deck. It clarifies the certification, operational and design approval holders’ responsibility. This installation and approval of this provisioning and subsequent operational approval/authorization has several unique stakeholders; the Original Equipment Manufacturer (OEM) and FAA ACO for the design aspect, the Airlines/Operators and operations inspectors for the operational aspects, and the FAA Aircraft Evaluation Group (AEG) and the Airlines/operator for the Maintenance and continued airworthiness aspects.

The approval for an installed Class 2 EFB provisions is the responsibility of several organizations. The installed provisions require an aircraft certification design approval. The operational authorization of the actual EFB system rests with FAA Flight Standards, AEG and Principal Operations Inspectors, and the maintenance rests with the AEG and the Principal Maintenance Inspectors while configuration control is the responsibility of the airline/ operators. The provisions would typically include the cradle/docking station, power, cooling and any other structure and cabin safety related requirements.

The approval holder of the provisions must make available data related to the maximum
allowable limits for electrical current usage, voltage, available cooling, and weight of PED that the cradle/docking station is designed to handle, venting requirements if applicable and any other specific requirements, that could have a safety effect on the airplane. This data should be listed as “not to exceed” parameters in the limitation section of the Instructions for Continued Airworthiness (ICA).

The approval holder must also provide an easily accessible power disconnect switch (reference FAA Policy ANM-01-111-165 and § 25.1357(f)) not located on the EFB/PED or cradle. It should be noted that approval/authorization of the internal EFB/PED batteries would be accomplished operationally by the end user of the EFB/PED.

**Installation of Wireless Local Area Networks Issue Paper**

Certain applicants are proposing to install wireless local area networks (WLAN) in aircraft. The WLAN could provide internet connection and EMAIL services to the flight crew and cabin passengers with access via portable electronic devices including EFB systems. Safety issues related to the installation and use of the WLAN system within the airplane include: (1) interference with avionics systems which might have catastrophic, hazardous or major failure effects, or for aircraft systems required by regulation, (2) operation of EFB systems which are not built to airborne equipment standards, (3) compatibility with the Satellite Communication (SATCOM) system, (4) vulnerability of airplane systems to intentional or spurious emission of RF energy from portable electronic devices, (5) access to airplane avionics systems buses via the wireless interface, (6) conformity, configuration control and maintenance of permanently installed COTS equipment and, (7) functional testing for each airplane installation.

The following RTCA documents; (1) RTCA DO-160E “Environmental Conditions and Test Procedures for Airborne Equipment”, (2) RTCA DO-199 “Potential Interference to Aircraft Electronic Equipment from Devices Carried Aboard”, and (3) RTCA DO-294B “Guidance on Allowing Transmitting Portable Electronic Devices (T-PEDS) in Aircraft” provide additional information on this subject. [14, 15, 16]

**Guidance and Installation Approval of EFB Class 3 systems Issue Paper**

This Issue Paper provides guidance on EFB capability, display and operations. The applicant should provide in their response to this issue paper, a list of Type “C” software applications including display, window sizes, display location, and the airplane phases of flight for each type of chart, graphic, text and information to be displayed. This description should also identify all applications to be installed on the aircraft systems/servers, and any limitations proposed on the application’s uses relative to the flight phase.

This description should identify specifically which display unit (e.g., primary flight display, navigation display, aircraft information display, dedicated EFB display) will be used to display EFB applications.

The applicant is required to describe the portion (entire window or partial window) of each display unit used for the charts, graphics and text. AC 25-11, “Electronic Flight Deck Displays” provides guidance for the design, installation, integration, and approval of electronic flight deck displays, components, and systems installed in Transport Category airplanes. [17]

The applicant should also describe interfaces of the EFB system to the FMCS and other aircraft systems and databases, including information of whether the interfaces are read only, read/write, data bus message types and other details of the installation.

**EFB NextGen Applications**

Portable EFB systems will not be allowed to host any communication, navigation, surveillance NextGen applications for airborne applications with own-ship position. Installed EFB systems are eligible to host communication, navigation, surveillance NextGen applications with own-ship position. Display location of the EFB system (primary field of view issues) may limit the types of NextGen
applications that may be hosted on the installed EFB systems.

**EFB Development Assurance Standards**

During the development of EFB policy and guidance there was considerable debate on the types of standards that should be required when transitioning from a paper to electronic display environment. Examination of the development process to create the 40 pounds of paper products that flight crews carry on board aircraft revealed that these paper products were not approved by Aircraft Certification and were evaluated for suitability of operations by the Flight Standards Service.

The standards used to create these paper products did not include compliance with RTCA DO-178B. Companies that produce EFB paper products were typically not approved FAA manufacturing facilities. EFB paper aeronautical charts are updated frequently, typically at 30 day intervals and transitioning to electronic aeronautical process requires frequent data base updates. RTCA DO-200A Standards for Processing Aeronautical Data and RTCA DO-201A Standards for Aeronautical Information are frequently used by data base manufacturers. [18, 19]

Another important issue was assessing the current safety impact of paper product errors on flight crew operations combined with transitioning to an electronic display environment. The electronic transition process has many potential safety benefits. Electronic configuration control of the EFB software and document updates across aircraft fleets is efficient and simpler than updating paper manuals and change pages. Partial or complete EFB software loads may be created on the Airline Operations Center workstations and transmitted to maintenance computer staging areas in the aircraft by wire-less communications. A maintenance technician is then able to transfer the software load to the EFB system using controlled procedures. Aircraft operators are able to maintain and monitor configuration control of the EFB systems across their fleet electronically reducing the risk of manual paper update errors.

Aeronautical chart updates may be electronically updated to the aircraft at any time. The EFB systems may now be used to receive Notice to Airmen (NOTAM) information which is typically sent by facsimile (FAX) to operators. A NOTAM is filed with an aviation authority to alert pilots of any hazards en route or at a specific location. NOTAMs are issued and reported for a number of reasons, including:

- Temporary Flight Restrictions
- Closed Runways
- Inoperable Radio Navigational Aids
- Military Exercises with Resulting Airspace Restrictions
- Temporary Erection of Obstacle Near Airfields (e.g., cranes)
- Passage of Flocks of Birds through Airspace
- Notification of runway/taxiway/apron status with respect to snow, ice and standing water

EFB system safety assessments should be conducted on new EFB applications to ensure that any safety impacts are identified, eliminated or mitigated. The EFB Type “A” applications involve the scanning of documents into a readable electronic format such as adobe acrobat. As it is relatively easy to compare a static electronic document with a hard copy version the safety risks of these document conversions to create hazardously misleading information is minimized. The EFB Type “B” applications allow the dynamic manipulation of aeronautical chart information. It is more likely to introduce errors during the dynamic manipulation of aeronautical charts then pre-composed static formats.

For this reason most of the EFB research studies were to evaluate safety and suitability of operations involving dynamic manipulation of charts combined with GPS centering and own-ship position.

In support of EFB software applications, several studies were conducted including an “Operational Safety Evaluation Paper Airport Charts for Use in Airport Surface Operations” by the United States Department of Transportation Volpe National Transportation Systems Center Surveillance and Assessment Division, DTS-53. [20] The primary purpose of the Volpe study was to investigate the
reliability of paper charts currently in use for airport operations and suitability of transitioning to moving maps. The Volpe study also included review of FAA guidance to pilots regarding airport surface movement in AC 120-74A “Parts 91, 121, 125 and 135 Flight Crew Procedures during Taxi Operations”. [21]

AC 120-74A provides guidelines for the development and implementation of standard operating procedures for conducting safe aircraft operations during taxi. This guidance focuses on the activities occurring with the flight deck (e.g., planning, communicating, and coordinating) as opposed to the actual control of the aircraft (e.g., steering, maneuvering).

The process of getting to and from a runway has become increasingly complex. This is mainly due to the increase in number of aircraft, takeoff times being held more closely to a schedule, and all of the varied combinations of weather, time of day, aircraft type, and language, to name a few. AC 120-74A also describes situation awareness and use of aeronautical charts for surface operations.

One of the key assumptions in the Volpe study was that paper or electronic maps are considered only “supplemental” information, not the sole basis for surface navigation. A supplemental source of surface situation awareness information is airport maps or diagrams, which are two-dimensional representations of the airport surface. They assist in safe surface movement by providing pilots with a handy one-page reference showing locations, designation of runways, taxiways, paved and unpaved areas, buildings and other surface features. Flight crews need to be aware of their situation as it relates to other aircraft operations going on around them as well as to other vehicles moving on the airport. Sometimes, this is a challenge, especially when flight crews are at an unfamiliar airport, the airport layout and taxi routes are complex, or the visibility is poor.

Pilots always have the option of requesting verification or clarification from Air Traffic Control (ATC) or other sources such as nearby traffic or airline ramp controllers if their map information does not appear to correspond to the reality that they are seeing out the window. It therefore, appears that even potentially hazardously misleading errors on a paper airport map or on a surface moving map display would be classified as minor hazards, as other information sources are readily available to pilots to mitigate the level of the hazard posed by these errors. According to FAA advisory circulars a minor failure condition would not significantly reduce aircraft safety, and would involve crew actions that are well within their capabilities. Minor failure conditions may include, for example, a slight reduction in safety margins or functional capabilities, a slight increase in crew workload, such as, routine flight plans changes, or some inconvenience to occupants.

Moving Maps

Moving maps **without own-ship position** on portable EFB systems Class 1 and 2 systems do not require an Aircraft Certification design approval. Moving maps on portable EFB systems without own-ship position may be used for both surface and airborne operations. EFB AC 120-76A provides guidance for GPS page-centering of charts, page turning for en route charts and panning and zooming of various display information without own-ship position. The GPS position source may be installed (aircraft certification design approval) or portable (AEG/PI operational approval).


The EFB airport moving map display (AMMD) with own-ship position symbol is designed to assist flight crews in orienting themselves on the airport surface to improve pilot positional awareness during taxi operations. The AMMD function is not to be used as the basis for ground maneuvering. This application is limited to ground operations only. Portable EFB systems are not allowed to depict own-ship position for airborne operations.
International EFB Guidance Material

European JAA Administrative & Guidance Material contained in Temporary Guidance Leaflet (TGL) No. 36 “Approval of Electronic Flight Bags” has been harmonized with the EFB AC 120-76A with the following differences:

1) The EFB TGL 36 is more restrictive in the use of color red on the EFB Display (e.g., weather information). [24]

2) The EFB TGL 36 requires that Lithium batteries meet the United Laboratories (UL) standards.

3) The EFB TGL states that the EFB Class 1 and 2 systems should comply with the requirements of ED-14/RTCA DO-160 Section 21 “Emission of Radio Frequency Energy.”

EFB Systems Security Considerations

Advisory Circular 120-76A provides the following general guidance for security considerations.

“The operator should identify a means to demonstrate that adequate security measures are in place to prevent malicious introduction of unauthorized modifications to the EFB operating system, its specific hosted applications, and any of the databases or data links used to enable its hosted applications. EFB systems need to be protected from possible contamination from external viruses.”

The FAA does not currently have specific guidance or policy for EFB system security and operators are required to demonstrate that adequate security measures are in place to obtain suitability of operations approval from the FAA Principal Inspector (PI) on a case-by-case basis. Depending on the types of software applications hosted on the EFB system platform the safety effect on airplane operations will vary based on EFB intended function.

The connectivity interface from the ACD domain to an EFB system must receive an Aircraft Certification Service design approval. The current FAA policy does not require a security assessment for Portable EFB Class I and II systems with access to read-only information from the ACD.

Portable EFB systems are authorized to read-write information to the Airline Service and Passenger Information and Entertainment Service Domains. The FAA does not currently have specific security policy on EFB connectivity to these aircraft domains. A draft industry proposal for “FAA guidance for EFB System Security Considerations and Intended Function” is currently under review by the FAA. [25] Current FAA plan is to develop performance based general security guidance and not prescriptive one-size fits all specific solutions for EFB systems.

A security risk assessment should be required for EFB Class III systems that are connected to an external network link and authorized to read-write information to the aircraft control domain.

Field Loadable Software (FLS) Considerations

Field-loadable airborne software refers to software or data tables that can be loaded without removing the system or equipment from its installation. The safety-related requirements associated with the software data loading function are part of the system requirements. If the inadvertent enabling of the software data loading function could cause erroneous loading of software parts, then a safety-related requirement for the software data loading function should be specified in the system requirements.

System safety considerations relating to field-loadable software include:

- Detection of corrupted or partially loaded software.
- Determination of the effects of loading the inappropriate software.
- Hardware/software compatibility.
- Software/software compatibility.
- Aircraft/software compatibility.
- Inadvertent enabling of the field loading function.
- Loss or corruption of the software configuration identification display.
Summary & Conclusion

The purpose of this paper is to provide information on the certification, airworthiness, and suitability of operations for EFB systems. This paper is intended to provide the reader with a description and overview of the various regulatory documents that are used during the EFB approval process. As the purpose of this paper is for information only and is not regulatory, it is recommended that you contact your local ACO for specific guidance on EFB issues. Please send comments on this paper to the EMAIL address listed below.

Acronyms and Abbreviations

AAC Aircraft Administrative Control
AC Advisory Circular
ACARS Aircraft Communication Addressing and Reporting System
ACD Aircraft Control Document
ACO Aircraft Certification Office
AEG Aircraft Evaluation Group
AFG&CS Automatic Flight Guidance & Control Systems
AISD Airlines Information Services Domain
AMMD Airport Moving Map Display
AOC Airline Operations Center
ARINC Aeronautical Radio Incorporated
ATC Air Traffic Control
ATS Air Traffic Service
ATSP Air Traffic Service-Provider
CDU Control Display Unit
CFR Code of Federal Regulations
COTS Commercial Off-The-Shelf
DO Document
EFB Electronic Flight Bag
FAA Federal Aviation Administration
FAQs Frequently Asked Questions
FLS Field-Loadable Software
FMCS Flight Management Computer System
GPS Global Positioning System
GSE Ground Support Equipment
ICAO International Civil Aviation Organization
NextGen Next Generation Air Transportation System
NOTAM Notice to Airmen
OEM Original Equipment Manufacturer
PED Portable Electronic Devices
PI Principal Inspector
PIESD Passenger Information and Entertainment Services Domain
SAE Society of Automotive Engineers
TAD Transport Airplane Directorate
TPED Transmitting Portable Electronic Device
TSOA Technical Standard Order Authorization
TSO Technical Standard Order
USB Universal Serial Buss
WLAN Wireless Local Area Network

References
[1] Aeronautical Radio Incorporated (ARINC) provides standards for the use of ARINC-429 data busses
FAA Order 8900.1 Change 47 “Volume 4 Aircraft Equipment and Operational Authorizations Chapter 15 EFB Authorization for Use” provides guidance for conducting an operational suitability evaluation.

AC 91.21-1 “Use of Portable Electronic Device aboard Aircraft” which provides guidance on the use of RTCA DO-160D.

Draft AC 120-76B “Guidelines for the Airworthiness and Operational use of EFB”

Draft AC 20-EBF “Installation of EFB Components”

Draft AC 91-78 “Use of Class 1 or Class 2 EFB”


TAD Issue Paper “Installation of Wireless Local Area Networks”

TAD Issue Paper “Guidance and Installation Approval of Class 3 EFB System”

TAD, 1601 Lind Avenue SW, Renton, Washington, 98055, Mr. Varun Khanna, tel. (425) 227-1298

RTCA DO-160E “Environmental Conditions and Test Procedures for Airborne Equipment”

RTCA DO-199 “Potential Interference to Aircraft Electronic Equipment from Devices Carried Aboard”

RTCA DO-294B “Guidance on Allowing Transmitting Portable Electronic Devices (T-PEDS) in Aircraft”

AC 25-11 “Electronic Flight Deck Displays”

RTCA DO-200A “Standards for Processing Aeronautical Data”

RTCA DO-201A “Standards for Aeronautical Information”

“Operational Safety Evaluation Paper Airport Charts for Use in Airport Surface Operations” by the United States Department of Transportation Volpe National Transportation Systems Center Surveillance and Assessment Division, DTS-53

AC 120-74A “Parts 91, 121, 125 and 135 Flight Crew Procedures during Taxi Operations”

AC 20-159 “Obtaining Design and Production Approval of Airport Moving Map Display Applications Intended for EFB Systems”


Temporary Guidance Leaflet (TGL) No. 36 “Approval of Electronic Flight Bags”

Draft FAA Guidance for EFB Security Considerations, Mr. Dave Allen, The Boeing Company

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