# VOLUME 4 AIRCRAFT EQUIPMENT AND OPERATIONAL AUTHORIZATIONS

## CHAPTER 15 ELECTRONIC FLIGHT BAG AUTHORIZATION FOR USE

### Section 1 Electronic Flight Bag Operational Authorization Process

**4-1641 GENERAL.** This section contains specific policy, guidance, and procedures to be used by principal operations inspectors (POI) for processing an operator's request for "authorization to use" an Electronic Flight Bag (EFB). All POI specialties should coordinate the review of an operator's EFB program. Once the POIs have completed their review of an EFB application, and have determined that the request is valid, authorization to use an EFB will be made by issuing the appropriate operations specifications (OpSpecs)/management specifications (MSpecs) paragraphs. The final result will be an authorization to use an EFB without issuing any sort of approval to any particular hardware system or software application. The Federal Aviation Administration (FAA) evaluation process for an EFB follows the general process for approval and acceptance as described in Volume 3, Chapter 1, Section 1.

**4-1642 APPLICABILITY.** This process for EFB authorization is to be used in combination with the current edition of Advisory Circular (AC) 120-76, Guidelines for the Certification, Airworthiness, and Operational Approval of Electronic Flight Bag Computing Devices, and the issuance of an OpSpec or MSpec, in accordance with paragraph A061, as described in Order 8900.1. The processes described in this section may also be used to determine if an EFB may be substituted for aeronautical charts and data used within aircraft operated under Title 14 of the Code of Federal Regulations (14 CFR) part 91. No written authorization is required for part 91 operators except those conducted under part 91 subpart K (91K).

**A. Evaluation Process for Class 1 or 2 EFBs Using Type A and/or B Software.** The evaluation process described in this section is applicable to Class 1 or 2 EFBs using Type A and/or B software applications. Aircraft Evaluation Group (AEG) involvement in the authorization to use Class 1 or 2 EFBs is at the AEG's discretion. AEG involvement may be expected when an EFB has new or novel functions not addressed in this guidance and/or when there are concerns about EFB use and standardization. When an AEG report exists for a particular Class 1, 2, or 3 EFB or Type A and/or B application, that AEG report is controlling for the determination of operational suitability.

**B. Evaluation Process for Class 3 Hardware and/or Class C Software.** Class 3 hardware and/or Type C software applications are evaluated by the AEG in conjunction with type certification (TC), amended TC, Supplemental Type Certificate (STC), or Technical Standard Order Authorization (TSOA) processes. The AEG determines operational suitability and pilot training, checking, and currency requirements. The AEG determination of suitability for Class 3 EFB hardware may be referenced in the Flight Standardization Board (FSB) report for the particular model aircraft or other AEG report of operational suitability. If Class 3 EFB hardware is not addressed in an AEG report, the FSB chairman for the affected aircraft should be contacted to determine if the AEG has accomplished an operational suitability evaluation. Authorization for EFB Class 3 with Type C software application is subject to existing operator requirements for implementing new or modified certificated equipment, including compliance with FSB reports for differences training, checking, and currency. The operator must address the

development of procedures and training associated with EFBs prior to receiving authorization to use each EFB Class 3 and Type C software application.

**4-1643 EFB HARDWARE CLASSES.** Figure 4-75, Flow Chart for Determining EFB Hardware Class, is provided to aid in the determination of the EFB hardware classes. The EFB must meet the following hardware specifications to be used in an aircraft during flight operations. It is the user's/operator's responsibility to document compliance with these specifications for each EFB and aircraft operating combination.

**A. Class 1.** These EFBs are portable, commercial off-the-shelf (COTS), devices which are part of a pilot's flight kit and are not attached to the aircraft. An EFB attached to the pilot's leg (e.g., kneeboard type) may still be considered a Class 1 EFB because it is not attached to the aircraft. Class 1 EFBs that have Type B applications for aeronautical charts, approach charts or electronic checklist must be secured and viewable during critical phases of flight and must not interfere with flight control movement. The need for aeronautical charts, approach charts and electronic checklists to be immediately available for viewing for all phases of flight is essential for an electronic format to be equivalent to the paper format being replaced. The ability to have departure and arrival charts, approach charts and airport diagrams continuously in view is essential for situational awareness during critical phases of flight and very important to runway incursion prevention during takeoff, landing and taxi operations. This view ability requirement is consistent with current FAA policy that pilot crewmembers have approach charts and airport diagrams viewable during those respective operations.

**B. Class 2.** These EFBs are typically attached to the aircraft by a mounting device, and may be connected to a data source, a hard-wired power source, and an installed antenna. In order to be considered portable, tools must not be required to remove an EFB from the flight deck and a pilot crewmember must be able to perform the task. Portable EFBs must be located on the flight deck and controlled by the flightcrew during all flight operations. Although attached to the aircraft via a mounting device, Class 2 EFB hardware must be accessible to the flightcrew and must be removable without the use of tools. The components of the Class 2 EFB include all the hardware and software needed to support EFB intended functions. A Class 2 EFB may consist of modular components (e.g., computer processing unit, display, controls). Any EFB hardware not located on the flight deck and not accessible by the flightcrew must be a certified installation via TC, amended TC, or STC. Any EFB hardware not accessible on the flight deck by the flightcrew and/or not portable must be installed and certificated equipment covered by a TC, amended TC, or STC. The one exception to being accessible on the flight deck is a remotely mounted antenna that provides signal reception to a Class 1 or 2 EFB.

NOTE: Normally, portable EFBs are limited to hosting Type A and B software applications or Technical Standard Order (TSO) functions limited to a minor failure effect classification. However, Type C software associated with the provision of own-ship position on airport moving map displays (AMMDs) may be hosted on Class 1 or Class 2 portable EFBs. See the current edition of AC 20-159, Obtaining Design and Production Approval of Airport Moving Map Display Applications Intended for Electronic Flight Bag Systems, for details.

**C. Class 3.** These EFBs employing any type software application must be approved by TC, amended TC, or STC and are discussed further in paragraph 4-1646, subparagraph C. Type A or B software applications and user-modifiable software are not subject to FAA certification when installed on a Class 3 EFB. Type A, B, or user-modifiable software must not interfere with FAA-certificated Type C software or software having received FAA design approval by Aircraft Certification Service (AIR).

**4-1644 HARDWARE SPECIFICATIONS.** Class 1 and Class 2 EFBs. Major components such as motherboards, processors, Random-Access Memory (RAM), video cards, hard drives, power supplies, and connections (modem, wireless, etc.) must be configuration controlled. Any change to these components will require the EFB to be re-evaluated to demonstrate that the EFB still meets its intended function, non-interference, and reliability requirements. Figure 4-76, Hardware Description Template, is a template that has been provided to facilitate the documentation of these components.

**A. Display.** The following display requirements are specified when a Type B application is available on an EFB during certain critical phases of flight (e.g., taxi, takeoff, approach, and landing).

1) Legibility. The screen size and resolution must be proven to display information in a comparable manner to the aeronautical charts and data it is intended to replace. The screen must display an approach chart in an acceptable aeronautical chart format similar to a published paper approach chart. The screen must be large enough to show an entire instrument approach procedure chart at once, with the equivalent degree of legibility and clarity as a paper chart. This requirement is not meant to preclude panning and zooming features, but is intended to prevent a workload increase during the approach phase of flight. Alternate representations of approach charts will need to be evaluated and approved by the FSB process for functionality and human factors.

2) Brightness. The display must be proven to be readable in all anticipated lighting conditions by each pilot and in each aircraft in which it is to be used. The display must have a dimming capability that would prevent the EFB from being a distraction or impairment to night vision in a night flight deck environment. The display must also be demonstrated to be readable on the flight deck in direct sunlight. Display brightness must be equally adjustable whether the EFB is operating on battery or aircraft power. Users should be able to adjust the screen brightness of an EFB independently of the brightness of other displays on the flight deck. When automatic brightness adjustment is incorporated, it should operate independently for each EFB on the flight deck. Buttons and labels should be adequately illuminated for night use. All controls must be properly labeled for their intended function.

3) Viewing Angle. The display must be viewable from an offset angle to preclude difficulty in positioning the EFB on the aircraft flight deck. When screen protectors are used, they must be maintained and be proven not to impede viewing of the screen. (See AC 120-76, paragraph 10b(3) for important issues concerning viewing angle.)

4) Stylus. For a stylus screen, there must be an easily accessible stowage position for the stylus and an accessible spare stylus (or substitute stylus) must be available.

5) Digitizer Pen. When a digitizer pen is used to operate the EFB, the digitizer pen must have an easily accessible stowage position and be tethered. A spare digitizer must be immediately available and adjusted for use on each EFB.

6) Touch-screen. If a touch-screen is used it must be evaluated for ease of operation. The touch-screen must be responsive and not require multiple attempts to make a selection, but not be so sensitive that erroneous selections occur.

**B. Rapid Decompression (RD) Testing.** RD testing is required to determine an EFB's functional capability when Type B software applications are used in pressurized aircraft where no alternate procedures or paper backup are available. RD testing is not required when only Type A applications are used on the EFB. The information from the RD test is used to establish the procedural requirements for the use of that EFB in a pressurized aircraft. RD testing should follow the guidelines in Radio Technical Commission for Aeronautics (RTCA)/ Document (DO)-160, Environmental Conditions and Test Procedures for Airborne Equipment, for RD testing up to the maximum operating altitude of the aircraft in which the EFB is to be used. It is the operator's responsibility to provide the POI with documented results of the RD testing.

1) Pressurized Aircraft. Rapid decompression testing for Class 1 and/or 2 EFBs must be conducted when Type B applications are used in lieu of paper-based aeronautical charts in pressurized aircraft in flight. When a Class 1 or 2 EFB is turned *on* and operates reliably during the RD test, no mitigating procedures need to be developed beyond redundancy. When a Class 1 or 2 EFB is turned *off* during the RD test and is fully functional following the RD, then procedures must be in place to ensure one of the two EFBs on board the aircraft remains *off* or configured so no damage will be incurred should an RD occur in flight above 10,000 feet mean sea level (MSL).

2) Unpressurized Aircraft. RD testing is not required for a Class 1 or 2 EFB used in an unpressurized aircraft. The EFB must be demonstrated to reliably operate up to the maximum operating altitude of the aircraft. If EFB operation at maximum operating altitude is not attainable, procedures must be established to preclude operation of the EFB above the maximum demonstrated EFB operation altitude while still maintaining availability of required aeronautical information.

**C. Electromagnetic Interference/Non-Interference Testing.** It is the user's/operator's responsibility to determine that the operation of a portable electronic device (PED) will not interfere, in any way, with the operation of aircraft equipment. The current edition of AC 91.21-1, Use of Portable Electronic Devices Aboard Aircraft, addresses non-interference testing for non-critical phases of flight only and is not adequate when Type B applications are used for all phases of flight. AC 91.21-1 and the additional guidance for non-interference contained in this order are required for Class 1 and 2 EFBs.

1) PEDs. In order to operate a PED in other than a non-critical phase of flight, the user/operator is responsible for ensuring that the PED will not interfere in any way with the operation of aircraft equipment. The following methods are applicable to Class 1 and 2 EFBs

with Type B applications required for use during all phases of flight. Either Method 1 or Method 2 may be used for non-interference testing.

a) Method 1 for compliance with PED non-interference testing for all phases of flight is completed in the 2 following steps.

- Step 1 is to conduct an electromagnetic interference (EMI) test in accordance with RTCA/DO-160, section 21, paragraph M. This Step 1 test can be conducted for an EFB user/operator by an EFB vendor or other source. The results of the RTCA/DO-160 EMI test must be evaluated to determine an adequate margin exists between the EMI emitted by the PED and the interference susceptibility threshold of aircraft equipment. If Step 1 testing determines adequate margins exist for all interference, both "front door" and "back door" susceptibility, then method 1 is complete. If Step 1 testing identifies inadequate margins for interference, either "front door" or "back door" susceptibility, then Step 2 testing must be completed; and
- Step 2 testing is specific to each aircraft model in which the PED will be operated, but testing only the specific equipment and/or equipment operation. Step 2 testing must be conducted in an actual aircraft and may be credited to similarly equipped aircraft of the same make/model as tested. Step 2 testing must show that no interference of aircraft equipment occurs from the operation of the PED.

b) Method 2 for compliance with PED non-interference testing for all phases of flight is a complete test in each aircraft using an industry standard checklist. This industry standard checklist must be of the extent normally considered acceptable for non-interference testing of a PED in an aircraft for all phases of flight. Testing for a particular aircraft make/model may be credited to other similarly equipped aircraft of the same make/model.

2) Transmitting Portable Electronic Devices (T-PED). In order to operate a T-PED in other than a non-critical phase of flight, the user/operator is responsible to ensure the T-PED will not interfere with the operation of the aircraft equipment in any way. The following method is applicable to all Class 1 or 2 EFBs with Type B applications required for use during all phases of flight. Non-interference testing for T-PEDs consists of two separate test requirements.

a) Test Requirement 1. Each T-PED must have a frequency assessment based on the frequency and power output of the T-PED. This frequency assessment must consider Federal Communications Commission (FCC) frequency standards and be in accordance with applicable processes set forth in RTCA/DO-294B, Guidance on Allowing Transmitting Portable Electronic Devices (T-PEDs) on Aircraft. This frequency assessment must confirm that no interference of aircraft or ground equipment will occur as a result of intentional transmissions from these devices.

b) Test Requirement 2. Once a frequency assessment determines there will be no interference from the T-PED's intentional transmissions, each T-PED must then be tested while operating using either Method 1 or Method 2 for basic non-interference testing requirements

described above. This basic non-interference testing is applicable to both a T-PED that is integrated into an EFB and a T-PED that is remote to an EFB. When a T-PED is integrated into an EFB, the basic non-interference testing must be completed both with and without the T-PED function being operative. If a T-PED is located remote from the EFB, the T-PED basic non-interference testing is independent from the EFB non-interference testing. T-PED position is very critical to T-PED non-interference testing, therefore the operating/testing locations of a T-PED must be clearly defined and adhered to in T-PED operating procedures.

**D. Antennas.**

1) Satellite Weather Antennas. A satellite weather antenna may be built into a Class 1 or 2 EFB or external to the EFB. A portable satellite antenna is considered ancillary PED equipment and must be included in EFB evaluation and testing. Installed antennas for satellite weather may be used to provide signal reception for EFB intended functions. When a satellite receiver is installed separate from the portable EFB, it must meet appropriate installation requirements.

2) Global Positioning System (GPS) Antennas. A GPS antenna may be built into a Class 1 or 2 EFB or external to an EFB. A portable GPS antenna is considered ancillary PED equipment and must be included in EFB evaluation and testing. An installed GPS antenna may be used to provide signal reception to an EFB and must support the intended function of the EFB.

- GPS data may be used for map centering when en route charts are displayed on an EFB. Map centering may be used as an en route chart feature only and may not be used when an approach chart is displayed;
- "Own-ship position" may never be displayed on a Class 1 or 2 EFB in flight; and
- A GPS installation in compliance with AC 20-159 is required for the depiction of own-ship position on an airport moving map display.

NOTE: If a portable GPS is used to provide position information to an EFB, the portable GPS is subject to the same requirements as the EFB. The EFB must demonstrate its intended functions with the GPS both enabled and disabled. In addition, the EFB must be non-interference tested with the portable GPS attached and operative, as well as with the portable GPS not attached (unless the EFB is considered inoperative without the portable GPS). Class 1 or 2 EFBs may use position information from a portable GPS only for en route map centering or page-turning, but must not display own-ship position on the EFB. (Exception: See AC 20-159 for use of own-ship position on an AMMD.)

**E. Power Sources.**

1) Battery Primary. For Class 1 or 2 EFB s where the primary power source is a battery, useful battery life must be established and documented for the EFB. When procedures are not established for aircraft power to provide battery recharging during flight operations, at least one fully charged spare battery must be provided for each EFB that is providing a paperless

source of aeronautical information pertinent to flight. When EFB battery charging is not possible in the aircraft, additional fully charged EFB batteries must be available to ensure operational performance for the planned duration of the flight, plus one hour.

2) Battery Maintenance. EFB battery maintenance needs to be addressed as either a maintenance or operating procedure to ensure battery life, change intervals, and safety. EFB batteries, including those carried as spares, must be maintained in an appropriate state of charge. Batteries must be replaced at the EFB manufacturer's recommended interval.

3) Aircraft Power Secondary. Where the EFB primary power source is a battery, procedures may be established to use aircraft power for battery recharging during flight operations. In this case, aircraft power is secondary and not considered essential to EFB operation because the EFB will operate without aircraft power.

4) Aircraft Power Primary (Class 2 Only). When an EFB uses aircraft power as the primary power source, design approval is required for this connection and power source by TC, amended TC or STC. This type of EFB power source will normally be hardwired to the EFB mounting device or directly to aircraft power source through a connector.

**F. Data Connectivity (Class 2 Only).** EFB data connections to aircraft data sources require design approval by TC, amended TC, or STC to ensure the aircraft systems are protected from any EFB failure modes. These data connections should be "read only," except for non-essential Airline Administrative Communications (AAC) or Airline Operational Communications (AOC) systems. Data connection from the aircraft navigation system may not be used to display own-ship position on a Class 1 or 2 EFB in flight. Aircraft navigation system source data may be used for AMMD position on taxi diagrams in accordance with AC 20-159.

**G. Data Loading/Database Changes.** Class 1 or 2 EFBs must have a reliable means for revising the EFB databases. Database currency is determined by what required aeronautical information the EFB is replacing. Each method of data revision must ensure integrity of the data being loaded and not negatively impact the reliability of EFB operation. Procedures must exist to protect the EFB from corruption, especially when internet and/or wireless means are used. Database revision does not include application software or operating system changes. Application software and/or operating system program changes must be controlled and tested prior to use in flight. Database and/or application software changes may not be performed during operations (taxi, takeoff, in-flight, landing).

NOTE: External drives for data loading are considered ancillary EFB equipment and not subject to specific requirements beyond those identified for data loading/database revision above.

**H. Mounting Devices (Class 2 Only).** The EFB, when attached to its appropriately designed mounting device, must be evaluated to ensure operational suitability in all ground and flight operations and conditions. When attached to its mounting device, the EFB must not interfere with flightcrew duties and must be easily and safely stowed when not in use. In addition, the attached EFB must not obstruct flightcrew primary and secondary fields of view, nor impede safe egress. (See AC 120-76.)

**4-1645 EFB SOFTWARE SPECIFICATIONS.** Figure 4-77, Flowchart for Determining EFB Software Application Type, is provided to aid in the determination of the EFB software application type.

**A. Type A.** Type A applications are those applications intended for use on the ground or during non-critical phases of flight when pilot workload is reduced. AC 120-76, appendix A, lists examples of Type A applications. Malfunction of a Type A application must be limited to a "minor failure effect" classification for all flight phases and have no adverse effect on the completion of a flight operation.

1) Type A applications for aeronautical charts are applications that require all aeronautical charts pertinent to the flight to be printed prior to departure of the flight.

2) Type A applications for Weight and Balance (W&B) are applications that present existing information found in the applicable Aircraft Flight Manual (AFM) or pilot's operating handbook (POH). Type A W&B applications may accomplish basic mathematics, but must not use algorithms to calculate results. Type A W&B applications must retrieve and apply existing published information.

3) Type A applications for aircraft performance are applications that present existing information found in the applicable AFM or POH. Type A applications for performance may be software applications that retrieve and apply existing published information. Type A performance applications must not use algorithms to calculate results.

**B. Type B.** Type B applications are applications that are intended for use during critical phases of flight or have software and/or algorithms that must be tested for accuracy and reliability. AC 120-76, appendix B, may be referred to for examples of Type B Applications.

1) Type B aeronautical chart applications are applications that display aeronautical charts in electronic format. These applications must be available for use during all phases of flight. These applications do not require paper printing of aeronautical charts and the viewable electronic format allows chart manipulation.

2) Type B electronic checklist applications provide cockpit checklists in compliance with regulatory requirements. These applications must be available for use during all phases of flight. Electronic checklist (systems) must be tested for flight operations suitability and must not adversely impact pilot workload.

3) Type B W&B applications are applications with algorithms to calculate weight and balance results. Type B W&B applications are produced for a specific aircraft and therefore, must be tested and proven accurate by the applicant.

4) Type B aircraft performance applications are performance applications with algorithms to calculate performance results. Type B aircraft performance applications are produced for a specific aircraft and therefore, must be tested and proven accurate by the applicant.

**C. Type C.** These software applications are RTCA/DO-178B, Software Considerations in Airborne Systems and Equipment Certification, compliant and require Aircraft Certification design approval. Type C applications can be used on Class 3 EFB equipment which are approved by TC, amended TC, or STC. Type C applications that receive a TSOA and meet the safety condition for "minor failure effect" or "no safety effect," per AC 120-76, may be authorized for use on Class 1 or Class 2 EFBs. For AMMD applications and installation eligibility refer to AC 20-159.

**4-1646 OPERATIONAL SUITABILITY REQUIREMENTS.** The user/operator is responsible for ensuring that a Class 1 or 2 EFB along with Type A and B applications will reliably perform its intended function while not interfering with other aircraft equipment or operations.

**A. Application Documentation.** The user/operator must present application documentation to the POI demonstrating that the EFB meets its intended function. The attached flow charts illustrated in Figures 4-75 and 4-77 will assist the user/operator with the identification and documentation of EFBs. Determining the operational suitability of a particular EFB is the responsibility of the user/operator and may be subject to specific guidelines from the applicable AEG reports.

1) When an operator has completed the evaluation of a Class 1 or 2 EFB, the operator must submit an application requesting authorization to use the EFB. The POI will review the application submitted by the operator and authorize/not authorize the use of the EFB based on the findings of the POI Review Checklist 3, illustrated in Figure 4-78, POI Review Checklist.

2) When a new aircraft model is added to an existing EFB authorization, the suitability of the EFB for that aircraft must be addressed as part of aircraft conformity using this evaluation process. When a new EFB is added to an existing EFB authorization, the suitability of the new EFB must be addressed using this same evaluation process.

**B. Operational Evaluation of Class 1 or 2 Hardware/Type A or B Software.** The user/operator must evaluate the EFB for suitability of intended functions in each aircraft model.

1) The user/operator must use the checklist as illustrated in Figure 4-79, Checklist 1-Tabletop EFB Evaluation, to evaluate the operational suitability of the proposed EFB intended functions and aircraft model suitability. The intended functions of software applications must be appropriate to the individual aircraft make and model.

- Electronic Documents,
- Electronic Checklist Software,
- W&B Software,
- Performance Software,
- Electronic Aeronautical Chart Software, and
- Weather Information.

2) The user/operator should use the checklist shown in Figure 4-80, Checklist 2-EFB Operational Evaluation, to develop a flight scenario for final EFB testing when initial EFB use is being evaluated. Operators requesting initial EFB authorization must include their POI in the flight/simulator evaluation of an initial EFB implementation. Operational evaluations for subsequent additions of EFBs or aircraft models need not conduct flight/simulator evaluations provided intended functions remain substantively the same as previously evaluated EFBs.

**C. Operational Suitability of Class 3 Hardware/Type C Software.** Class 3 hardware and/or Type C software applications are evaluated by the AEG in conjunction with a TC, amended TC, or STC certification process. The AEG determines operational suitability and pilot training, checking, and currency requirements. The AEG determination of suitability for Class 3 EFB hardware may be referenced in the FSB report (FSB reports are found at opspecs.com) for the particular model aircraft or other AEG report of operational suitability. If Class 3 EFB hardware is not addressed in an AEG report, the FSB chairman for that aircraft should be contacted to determine if the AEG has completed an operational suitability evaluation. Class 3 EFB and Type C software application authorization is subject to existing operator requirements for certified equipment. The operator must address the development of procedures and training associated with EFBs prior to receiving authorization to use each Class 3 EFB and Type C software application.

**4-1647 EFB PROCEDURES.** The operator's operations and maintenance procedures must be specific to each EFB and the operations conducted. The operator's manual must identify each model of EFB authorized and each model of aircraft.

**A. EFB Configuration Control.** Standard EFB configuration control must be established and base lined (i.e., initial hardware and software version at time of application) along with procedures to ensure the EFB configuration control is maintained during system updates/revisions. Class 1 or 2 EFB configuration affects usability and battery life through setup of suspend/sleep modes. All classes of EFBs must have established standard operating procedures (SOP) to ensure reliable use of hardware and software. Procedures must be established for EFB database revision. This should include verification of continued intended function prior to use in flight operations following an EFB database revision.

NOTE: Software updates, especially in the EFB operating system, must have extensive test procedures prior to use in flight operations. Software revision procedures must be comprehensive to ensure continued reliability of the EFB and verification of reliable intended function.

**B. Normal and Abnormal Operating Procedures.**

1) Normal procedures for flight operations must be developed for all flight operations with EFBs. Preflight must address battery charging, EFB database revision and data currency, EFB configuration control, and SOP for EFB setup. In-flight procedures must include standard application operating procedures, and EFB standard flight operating procedures for use.

2) Abnormal procedures must be established to address likely EFB function failures. Procedures for single and dual EFB failure must be established.

3) Class 1 or 2 EFB operating procedures and limitations must be established if the EFB being used has not demonstrated rapid decompression testing while *on* and operating. (See paragraph 4-1644, subparagraph B.)

4) Checklists must be established or revised to include normal and abnormal EFB procedures to be used by pilots in flight. This may be accomplished by amending checklists when approved operator customized cockpit checklists are used or by creating an EFB checklist supplement when aircraft manufacturer cockpit checklists are used.

**C. Minimum Equipment List (MEL).** When MEL relief is requested, the MEL must be amended in compliance with the aircraft's Master Minimum Equipment List (MMEL). An inoperative Class 1 EFB may be removed from the aircraft without MEL relief being utilized, provided redundancy is maintained, or paper backups for all Type B applications are available.

**D. Maintenance.** Regular maintenance procedures are required for Class 1 and 2 EFBs including measures to ensure the continued readability of the viewing screen. EFB battery maintenance needs to be addressed to ensure battery life, change intervals, and safety. Class 3 EFB maintenance must comply with the aircraft instructions for continued airworthiness (ICA).

**E. Risk Mitigation.** Procedures must be established for a transition to paperless authorization. Initial procedures establish an independent backup during the EFB validation period. Procedures must be established for continuous reporting of problems with EFBs. There must be procedures in place for the user/operator to review these reports periodically to mitigate potential unreliability issues and correct operating procedures where necessary. Procedures must be established to notify flightcrews of EFB problems or use issues. (For more information on Risk Mitigation see Volume 10, Chapter 1.)

NOTE: When certain Type B applications (e.g., approach charts, aeronautical charts, electronic checklists, and flight manuals) are utilized on Class 1 or 2 EFBs to replace aeronautical charts or data required by regulation, risk mitigation is required per AC 120-76. Such mitigation methods may be satisfied by use of multiple EFB hardware and software or backup paper aeronautical charts and data. Redundancy in the form of traditional paper aeronautical charts or data, a second EFB, or other procedural means may satisfy acceptable risk. When determining the need for redundancy, take into consideration that no single failure or common mode error can cause the loss of required aeronautical information or data. The need for redundancy should also consider independent power sources or battery backup for the EFB. (See AC 120-76, paragraph 9, Risk Mitigation for EFB Systems).

**F. Training.** The operator must develop EFB training for all personnel involved with EFB use, database servicing, and maintenance. EFB training must comply with training identified in AC 120-76 and be FAA-approved where applicable.

**4-1648 AIRWORTHINESS REQUIREMENTS.** This paragraph outlines the airworthiness and return to service requirements for installed components or provisions of Class 1 or 2 EFBs. These airworthiness requirements are applicable to all installed provisions capable of supporting

EFB functions at flightcrew stations, regardless of any other stated intended function. The installer remains responsible to ensure all certification and airworthiness requirements are met for each installation. For provisional installations, each installer remains responsible for compliance with EFB airworthiness requirements and each operator is responsible for EFB operational use requirements of the installed provisions capability. All Class 3 EFB installations require certification under TC, amended TC, or STC, prior to installation.

**A. EFB Power Source.**

1) Class 1 EFB Power Source. This is defined as aircraft power being used to recharge the EFB battery during flight operation, but the EFB battery remains the primary EFB power supply. Airworthiness criteria for Class 1 aircraft power sources may be in accordance with existing airworthiness requirements for PED outlets installation. Such outlets, if installed must be labeled for exclusive use by the EFB.

NOTE: Special consideration must be given to the type of electrical power provided for the recharging of lithium ion batteries. Lithium ion batteries pose a safety hazard if overcharged or excessively discharged. Operators should have lithium ion battery charging procedures which are in total accordance with the battery manufacturer's charging instructions and prevent aggravation of lithium ion battery thermal hazards.

2) Class 2 EFB Power Source. This is aircraft power used as the primary EFB power supply and requires the power supply to be hardwired or connected with certified connectors to ensure reliability. This is an EFB that continuously depends on connection to aircraft power to perform its intended function (no sustaining battery power). The aircraft power for Class 2 EFB power supplies must be designed to remain available, at an acceptable level for required flight information, in the event of aircraft electrical malfunctions. Class 2 EFB power supplies require design approval by AIR under TC, amended TC, or STC which excludes the installation from eligibility for field approval.

**B. EFB Data Connectivity.** This read-only data is provided to an EFB from the aircraft's systems (e.g., flight management system, GPS, air data, fuel system, etc.) through a certified ARINC 429, RS-232, RS-485, or other compatible interfaces or certified router. EFB data connectivity does not include raw antenna reception data from an installed antenna going directly to the EFB. EFB data connectivity must include isolation to preclude the EFB from interfering with any aircraft system and all associated wiring must be protected from damage and secured. EFB data connectivity requires design approval. Such design approval must be accomplished under TC, amended TC, or STC by AIR and excludes the installation from eligibility for field approval.

NOTE: Data converters (e.g., ARINC 429 to RS-232, etc.) that are capable of supporting EFB functions at flightcrew stations must have design approval issued by the FAA.

**C. EFB Mounting Devices.**

1) Yoke-Mounted EFBs must be certificated by a design approval by AIR under TC, amended TC, or STC. All the structural and dynamic, as well as wiring protection and security requirements affecting the flight controls, (including autopilot (AP), stall warning, stick pusher, crashworthiness, human factors, etc.), must be addressed prior to installation. Field approval or Designated Engineering Representative (DER) approval without a design approval from AIR by TC, amended TC, or STC, is not permitted for Yoke-Mounted EFBs.

2) Cockpit Mounted EFB is a Class 2 EFB mounted in the cockpit other than on the control yoke. The EFB mounting device requires airworthiness approval by AIR. FAA policy excludes this installation from eligibility for field approval.

**D. Installed Antennas.** Installed antennas are those antennas permanently installed in the aircraft. Portable antennas attached to a portable EFB, but not attached to the aircraft, are not subject to these airworthiness requirements. Portable antennas and temporary antenna holders, like suction cups, are subject to EFB evaluation requirements only. Installation of antennas capable of supporting EFB functions at flightcrew stations must be accomplished using existing guidance for antenna airworthiness considerations.

1) Antennas combining reception for both aircraft navigation and EFB must be TSO approved for this intended function providing isolation to preclude the EFB from interfering with antenna reception for aircraft navigation.

2) TSO or STC approved antennas may be used to independently provide GPS and/or satellite weather for an EFB in accordance with existing installation airworthiness requirements.

3) Portable EFB-only antennas without a TSO may be used to provide a GPS or satellite weather signal for EFB-only use. Non-interference testing by the installer is required.

**E. Installed Satellite Receivers (e.g., WX Worx, XM Weather, WSI In Flight).** If any component of a weather receiver is installed in an aircraft separate from a portable EFB on the flight deck, it is subject to avionics installation requirements and may not be considered a PED. If the result of the received weather data is capable of being displayed on an EFB, the individual components of the weather receiver system cannot be installed as STC provisions only because the installation cannot meet 14 CFR part 43 requirements for testing of non-interference without performing its intended function. (See current edition of FAA Order 8110.4, Type Certification, for more information on this subject.) The weather receiver must be non-interference tested with the intended EFB installed and operative even though the installation only applies to the weather receiver. The airworthiness for the weather receiver installation is independent of EFB/PED suitability responsibility of the user/operator. The user/operator is responsible for EFB non-interference as a PED and the installer is responsible for non-interference for the weather receiver as part of installation requirements. This installation requires design approval under TC, amended TC, or STC which excludes the installation from eligibility for field approval.

**4-1649 AUTHORIZATION PROCESSES.**

**A. General.** The operator is responsible to ensure all operational requirements are met for an EFB. The operator must submit documentation demonstrating compliance with all operational requirements for EFB's to their POI. The FAA evaluation process for an EFB follows the general process for approval and acceptance as described in Volume 3, Chapter 1, The General Process for Approval or Acceptance.

**B. Phase One, Initiation.** Phase one of the process begins when the operator requests authorization to use the EFB from the FAA. During this phase, the FAA and the operator reach a common understanding of the role of the FAA and what documents and actions the operator is responsible for during each phase of the authorization process.

**C. Phase Two, Required Application Information.** Phase two begins when the operator submits a formal EFB plan to the POI for evaluation. The plan is reviewed for completeness and the POI facilitates coordination with other inspectors and FAA offices, as necessary. During phase two, the POI may coordinate with the appropriate AEG for guidance on EFBs having functions not addressed in this guidance. Once the plan is accepted, the operator follows that plan to produce a complete EFB program. The operator must submit the following information in the application package:

- EFB hardware and application specification (Figures 4-76 and 4-81, Evaluation Report Information Template),
- EFB operator procedures/manual revisions,
- EFB cockpit procedures checklists,
- EFB training program,
- EFB evaluation report (Figure 4-79 and 4-80),
- Rapid decompression test data (when required),
- Completed non-interference test results, and
- Airworthiness documents for Class 2 equipment (mounting device, aircraft data connection, aircraft power primary, remote antenna).

**D. Phase Three, POI Review.** The POI must use the checklist found in Figure 4-78, to conduct a review of the application submitted by an operator. All POI specialties should coordinate the review of an operator's EFB program. The POI should participate in the simulator evaluation or flight evaluation of an EFB when a user/operator is requesting initial EFB authorization. Additional simulator/flight evaluations are not required for adding a new EFB to an existing authorization unless there is a substantial change in EFB intended functions. When a new aircraft is added to a certificate with existing EFB authorization, the suitability of the EFB for that aircraft must be addressed as part of aircraft conformity and configuration control process. Inspectors should examine the technical content and quality of the proposed EFB program and other supporting documents and procedures. The user/operator's program for EFB management is critical to EFB reliability and must be well documented for EFB users.

**E. Phase Four, Interim Authorization to Use an EFB.** An interim EFB authorization is granted to allow the user/operator to proceed with EFB validation testing. During this validation phase, the operator must maintain a paper backup of all electronic information. The

user/operator does not need OpSpecs/MSpecs A061 issued at this time because a paper backup of all required operating information is required to be available and accessible to the flightcrew during operation. The validation phase begins when the operator formally begins use of the EFB combined with paper backup for an established period of time. Use Figure 4-82, Checklist 4-EFB Line Evaluation Job Aid, for data collection during the validation phase. Validation testing should follow guidelines in AC 120-76.

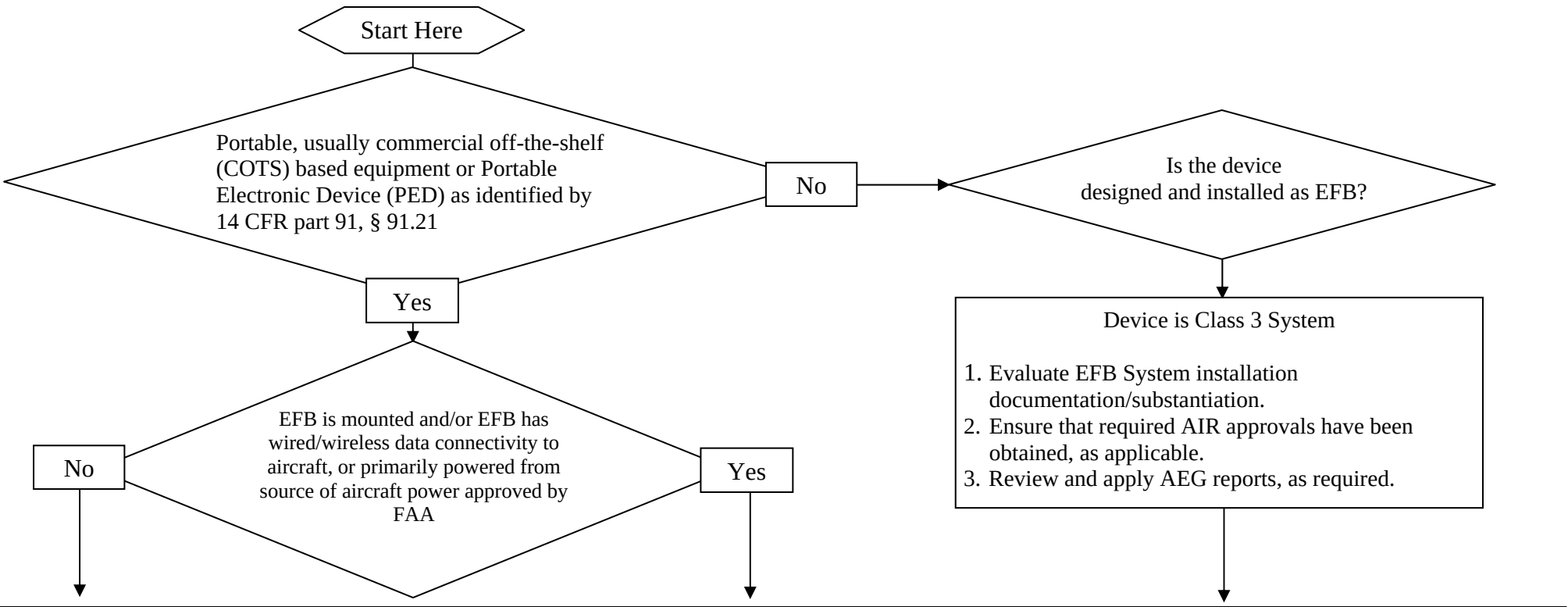
1) Unacceptable Validation Results. If the POI finds the proposed EFB reliability and/or function to be unacceptable by the conditions of this EFB guidance, the POI should contact the operator for corrective action. EFB deficiencies must be corrected and the EFB function revalidated prior to paperless authorization being issued.

2) Acceptable Validation Results. If the POI finds the proposed EFB reliability and/or function to be acceptable based on validation data then paperless authorization may be issued.

**F. Phase Five, Authorization to Use an EFB.** An operator subject to regulations under 14 CFR parts 91K, 121, 125 (including part 125M), and 135 is granted authorization to use an EFB through OpSpecs A061 only after acceptable completion of validation testing (see Volume 3, Chapter 18). Any subsequent change to EFB hardware or intended functions must be validated at a level appropriate to the effect of the change on the EFB program.

**Figure 4-75, Flow Chart for Determining EFB Hardware Class**

Note: If you wish to print this diagram, A3 size paper must be used.




## Class 1 EFB

**Note:** Ensure that EFB software does not require additional AEG or ACO evaluation.

**a.** Class 1 EFB Device description and authorization criteria:

**(1)** May be used on ground and in-flight; and,

**(2)** May connect to protected, non-essential aircraft power source for purpose of charging internally installed batteries within the Class 1 EFB Device.

**b.** AIR and AEG Involvement:

NONE, provided mounting fixture is not utilized, there is no connection to aircraft power, and EFB Device is not receiving data from another aircraft system or signal from an installed remote antenna.

**c.** Operator Requirements:

**(1)** Develops program for usage;

**(2)** Completes operational evaluation; and

**(3)** Demonstrates and documents non-interference compliance to AC 91-21-1 (current edition).

**d.** POI Involvement:

**(1)** Device and interface criteria & operator requirements are met;

**(2)** Data update procedures are in place and followed;

**(3)** The aircraft power source is qualified and connection is made to assure adequate egress;

**(4)** Applicable checklists, including human factors evaluation, are completed, as applicable;

**(5)** Training, checking, and currency programs are approved, as applicable;

**(6)** MSpec or OpSpec A061 is issued, as applicable, upon completion of authorization process; and

**(7)** Class 1 EFB configurations with only Type A software applications do not require entry into aircraft records.

## Class 2 EFB

**Note:** Entry into aircraft records is required to add or remove installed elements.

**e.** Installation and Operational Approval:

**(1)** An applicant must obtain approval for the initial alteration for installation of a mounting fixture, power, and/or data connectivity on the basis of type certification (TC) or by issuance Supplemental Type Certification (STC). Follow-on installations must be accomplished using FAA-approved data;

**(2)** The manufacturer, provider, or installer must assure testing is accomplished on the Class 2 EFB equipment to ensure interference-free operation. If a data transmitter is used to transmit data to the Class 2 EFB Device it must also be tested to requirements conducted and radiated emissions must be shown to not exceed maximum allowable levels specified in RTCA/DO-160E, section 21, category M; and

**(3)** An applicant must obtain approval by TC, STC, or by an FAA DER for installation of antennas that provide sources for navigation, weather, etc.

**f.** AIR, AEG, and POI Involvement:

**(1)** AIR upon making satisfactory findings, issues approval of the type design data for the installation of the EFB for inclusion into the TC or it awards STC for alteration to the applicant for airworthiness approval of mounting bracket or fixture, crashworthiness, data connectivity, and power connections;

**(2)** AEG may evaluate new or novel EFBs and prepare an Operational Suitability Report (OSR); and

**(3)** POI conducts review and issues authorization for use by Mspec or OpSpec, as applicable.

**g.** Operator Requirements:

**(1)** Develops program for usage;

**(2)** Completes operational evaluation;

**(3)** Ensures system performs its intended function;

**(4)** Documents non-interference per AC 91-21-1;

**(5)** Ensures non-interference with and isolation from aircraft systems during transmission and reception; and,

**(6)** Determines usage of hardware architectural features, persons, procedures, and equipment to eliminate, reduce, or control risks associated with a hardware failure.

## Class 3 EFB

**Note:** POI and Operator conditions in d. and g. apply.

**h.** Class 3 System Description and Approval:

An installed processor unit that may contain a database and a permanently mounted or removable display unit that may contain a processor used for control and display of information to the flightcrew is Class 3. If such display is removable by the flightcrew the permanently installed mounting bracket or fixture must be AIR approved. If a removable display unit is used within the system, it must undergo testing comparable to the requirements of a permanently mounted one.

The following steps are qualifiers:

**(1)** An applicant must obtain approval for the initial alteration for installation of a Class 3 EFB system on the basis of TC or by issuance STC. Follow-on installations must be accomplished using data approved by the FAA;

**(2)** The manufacturer, provider, or installer must assure testing is accomplished to ensure interference-free operation of the Class 3 EFB. Conducted and radiated emissions must be shown to not exceed maximum allowable levels specified in RTCA/DO-160E, section 21, category M; and

**(3)** The manufacturer may be required to obtain FAA Parts Manufacturer Approval (PMA) for both the processor and the display if intended for installation into an aircraft in which the TC or STC does not cover variations in configurations or if the processor contains performance data specific to the make, model and series of aircraft only for which the original TC or STC applies.

**i.** AIR, AEG, and POI Involvement:

**(1)** AIR evaluates and approves the design, including satisfactory completion of tests to assure environmental suitability of the Class 3 EFB system hardware and operating system software;

**(2)** AIR upon making satisfactory findings, issues to the manufacturer of the Class 3 EFB System; Technical Standard Order Authorization (TSOA) or PMA based upon TC or STC;

**(3)** AIR upon making satisfactory findings, issues approval of the type design data for the installation of the EFB for inclusion into the TC or it awards STC for alteration to the applicant;

**(4)** AEG evaluates operations/maintenance suitability; and

**(5)** POI ensures that FSB report is complied with and issues authorization for use by MSpec or OpSpec.

**Figure 4-76, Hardware Description Template**

Major components such as a motherboard, processor, Random-Access Memory (RAM), video card, hard drive, power supply, and connections (modem, wireless, etc.) must be identified. Any change to these components subsequent to initial evaluation and authorization will require the Electronic Flight Bag (EFB) device to be evaluated again to demonstrate the EFB still meets all requirements, including reliability. The template below has been provided to facilitate the documentation of these components.

a) Aircraft Owner or Applicant's Name:

b) Aircraft Make/Model:

c) Operating Rule 14 CFR parts 121, 125, 129, 135, and 91 subpart K, subpart F, and other applicable 91 subparts 91:

d) EFB Manufacturer/Model/Part Number:

e) The following major components are included with this make/model of EFB:

| Component | Manufacturer | Model | Part Number |
|---|---|---|---|
| Motherboard | | | |
| BIOS | | | |
| Processor | | | |
| Video Card | | | |
| Hard Drive | | | |
| CD-ROM | | | |
| DVD Drive | | | |
| Wireless Connection | | | |
| Power Supply | | | |

f) Operating System and Version: (insert Windows operating system name), version (insert version number) service pack (insert service pack number), build (insert build number).

g) Identify the Classification of Hardware Proposed (Class 1, 2 or 3).

h) List All Proposed "Type A," "Type B," and "Type C" applications on this EFB device:

i) EFB Mounting System:

- Has the mounting device or system been certificated under 14 CFR parts 23, 25, 27, or 29:
  ☐ Yes ☐ No (check one)

- Type certificate (TC), Amended TC, or Supplemental Type Certificate (STC) number:

- Manufacturer and model number of mounting device or system:

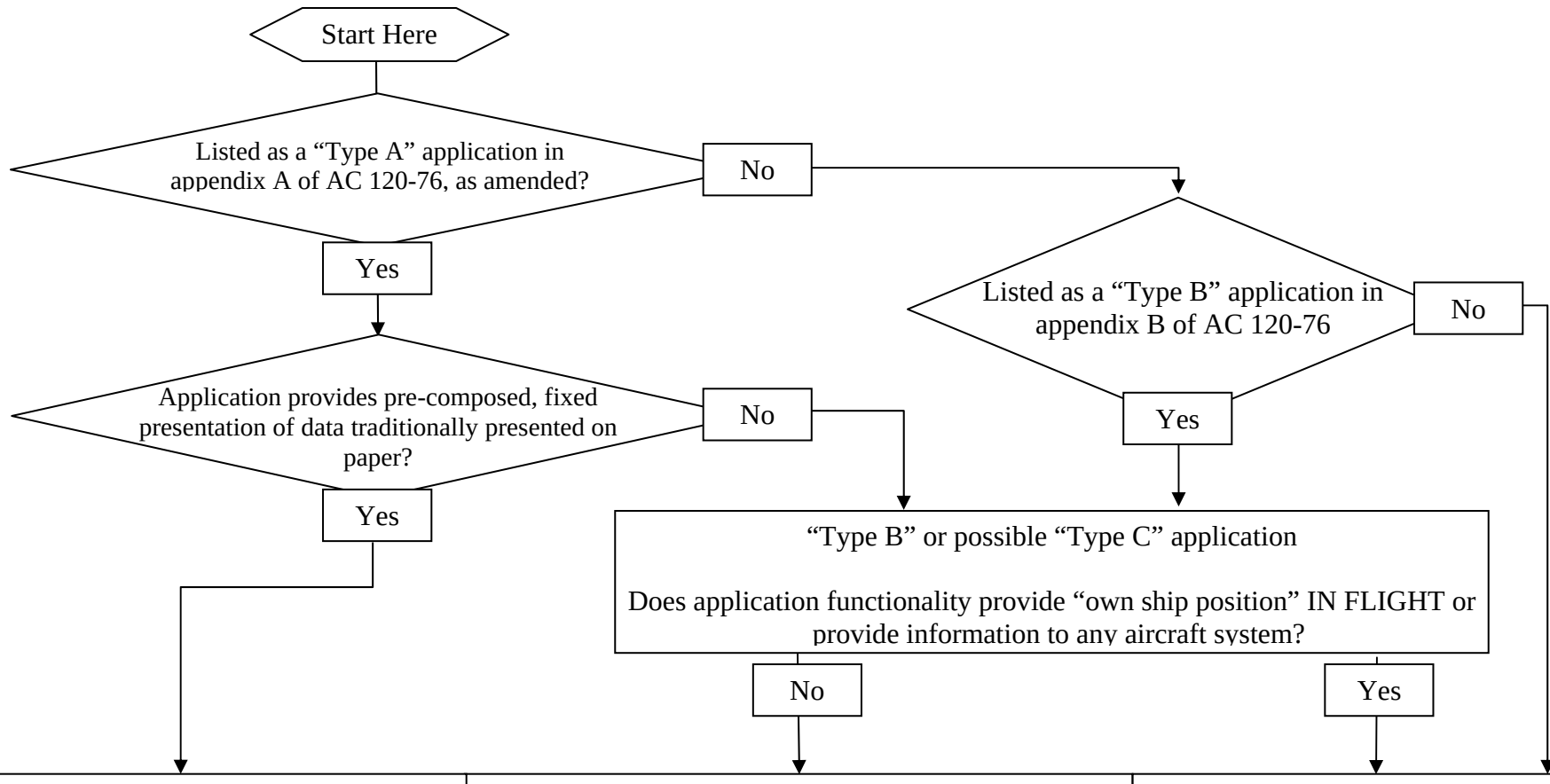
- Mounting description:

j) Identify If The EFB Will Use The Aircraft As The Primary Power Supply:

k) Identify Any/All Aircraft Systems That Will Connect To The EFB Device:

**Figure 4-77, Flowchart for Determining EFB Software Application Type**

Note: If you wish to print this diagram, A3 size paper must be used.




## Type A

**j.** Aircraft Certification Service (AIR) and Aircraft Evaluation Group (AEG) Involvement: NONE.

**k.** Operator Requirements:

**(1)** Determines usage, architectural features, people, procedures, and equipment to eliminate, reduce, or control risks associated with an identified failure in a system; and

**(2)** Provides evidence to the POI that:

**(a)** The EFB operating system and hosted application software meet the criteria for the appropriate intended functions and do not provide false or hazardously misleading information; and

**(b)** Software revision loading won't corrupt data integrity of original software.

**l.** POI Involvement:

Verifies that:

**(1)** Application criteria and operator requirements are met;

**(2)** Data updates follow maintenance manual and inspection program procedures;

**(3)** Applicable job aids, including human factors evaluation, are completed;

**(4)** Training, checking, and currency programs are approved;

**(5)** Operational evaluation report from operator is appropriately reviewed and

**(6)** OpSpec or Mspec A061 is issued upon completion of authorization process, as applicable.

## Type B

**m.** Type "B" Applications:

**(1)** May be hosted by any device/system class; does not require AIR design approval or AEG evaluation; does not require compliance with RTCA/DO-178B; Operator and POI requirements of note **l.** and **n.** are met; may display pre-composed information such as navigation or approach charts; required flight information should be presented for each applicable phase of flight; pending human factors evaluation, panning, scrolling, zooming, rotating, or other active manipulation is permissible; electronic navigation charts should provide a level of information integrity equivalent to paper charts; ensure application functions (such as display of 'own-ship' position) do not require AIR approval;

**(2)** Flight Standards (AFS) initial operational authorization granted for hosted performance applications based on AIR recommendations and AEG determination of flightcrew training, checking and currency requirements; and

**(3)** Hosted interactive Performance/Weight and Balance (W&B) applications procedures should be developed per 14 CFR part 121, § 121.133. These procedures should define the roles that the flightcrew and dispatch/flight following have in creating, reviewing and using performance calculations supported by EFBs.

**(a)** Authorization for use is placed in OpSpec or Mspec A061, as applicable; and

**(b)** OpSpec E096, Weight and Balance Control Procedures, lists EFB as approved method for W&B calculation, as applicable.

**n.** Operator Requirements: Demonstrates EFB meets operational and certification requirements:

**(1)** Determines usage, architectural features, people, procedures, and equipment to eliminate, reduce, or control risks associated with an identified failure in a system;

**(2)** Performs 6 month operational validation per authority granted in OpSpec or Mspec A061, as applicable;

**(3)** Uses both EFB device/system and conventional paper copies during evaluation period;

**(4)** Submits final evaluation report to POI, as appropriate, after evaluation;

**(5)** Operating system and hosted application software meet criteria for appropriate intended functions and do not provide false or hazardously misleading information; and

**(6)** Software revision loading won't corrupt data integrity of original software.

## Type C

**o.** Type C Applications:

**(1)** Primary flight displays are examples of Type C applications;

**(2)** A means for obtaining AIR design approval is a Technical Standard Order Authorization (TSOA), which is a dual FAA certification design and production approval with a streamlined approval process;

**(3)** An index of TSO standards is published in the current version of AC 20-110, Index of Aviation Technical Standards Orders; and

**(4)** The regulatory basis for TSOA is defined in 14 CFR part 21 subpart O.

**p.** AIR & AEG Involvement:

**(1)** AIR design approval required, except for user modifiable software, which may be utilized to host Type "A" and "B" applications. No user modifiable application may affect any Type "C" application software. RTCA DO-178B and FAA Order 8110.49 detail user modifiable software applications;

**(2)** Manipulation of dynamic performance or load data requires AIR review; and

**(3)** AEG determines operational suitability during certification process.

**q.** Operator requirements:

**(1)** Applies for a TSOA for certain Type C application software; and

**(2)** Follows airworthiness determination for installation and operational approvals.

**Figure 4-78, POI Review Checklist**

## Used by POI for Review of EFB Applications

This section contains questions for use by POIs to review an EFB application. In general, these questions are specific to initial installations and training for a given aircraft. References to other checklists of this document may be helpful in understanding the intent of specific subject areas of this checklist.

Before using this checklist, the POI will review the results of checklist #1 and #2 with the operator to ensure that the operator has conducted a complete evaluation of the proposed EFB.

**I. General EFB.**

**A. General Considerations.**

Research if any of the EFB hardware or software is covered by an existing Aircraft Evaluation Group (AEG) report.

**Workload:**

1. Is an in-flight evaluation necessary? (An in-flight evaluation may be necessary if you are not able to adequately evaluate each function intended for this specific operation while on the ground.) If so, verify the-flight evaluation confirms that the overall workload is acceptable.
2. Review user/operator responses to evaluation questions for "Workload" from Figure 4-80, Checklist 2-EFB Operational Evaluation.
3. Verify procedures are published and available to all EFB users and maintainers.
4. Verify preflight procedures and checklists are revised to include EFB.
5. Verify procedures are established for single and dual failure of EFB.

**B. Physical Placement.**

**Design and Placement of Structural Cradle:**

1. Verify user/operator procedures specify locations for both EFB stowage and use.
2. Verify EFB specified locations do not obstruct visual or physical access to flight controls and/or displays.
3. Verify EFB locations do not obstruct the emergency egress path.
4. Verify EFB locations provide for security in flight.
5. Does mounting device have appropriate airworthiness documentation per EFB requirements?
6. Does mounting device lock in position easily?
7. Does mounting device adjustable enough to accommodate a range of flight crewmember preferences and does range of adjustment accommodate the expected range of user's physical abilities?
8. Locking mechanisms should be durable enough to minimize slippage after extended periods of normal use.
9. Crashworthiness considerations must be addressed as well as appropriate restraint of EFB when in use.

**C. Training/Procedures Considerations.**

**EFB Documentation and Policy:**

1. Verify written policy adequately addresses each specific EFB application, and that any published AEG recommendations have been incorporated into the operator's EFB program.
2. Verify procedures are in place to communicate upgrades or malfunctions of EFBs to users in a timely manner.
3. Verify the EFB information from the manufacturer is incorporated into operating procedures.

**EFB Training:**

1. Verify the initial EFB training includes evaluation of knowledge and skill requirements. The training should include demonstration of key tasks.
2. Verify the recurrent training includes evaluation of proficiency with the EFB.
3. Verify minimum training, checking and currency requirements are specified in training programs.
4. Verify EFB training is customized to EFB applications being used.

**D. Validation Phase and Continued Data Collection.**

**Validation Phase Data Collection:**

1. Verify 6-month validation phase requires pilots/users of the EFB to document evaluations and that there is a formal process for gathering feedback about the EFB and its performance.
2. Verify procedures specify personnel responsible for maintenance and database management.
3. Ensure that the operator has an ongoing data collection and feedback/correction process that ensures the suitability/reliability of the data. The data collection processes in place should be factored into the operator's Safety Management System (SMS).

**E. Safety Management System (SMS) Interface.**

1. Verify that the hazards associated with the use and integration of the EFB have been identified, eliminated, or controlled to an acceptable level throughout the life cycle. Consider such hazards as: misuse, hazardous misleading information due to failure or malfunction, loss of information when needed, miscalculation, masking of information, confusion, corruption of data, excessive complexity of use, accidental damage, and human error in use, setup, and operation.
2. Verify applicant's SMS has procedures to mitigate identified hazards availability, and reliability of design, cross-checking of calculation/data, crew training, and misuse potential.
3. Verify applicant's SMS incorporates EFB hazard analysis, risk assessment, and related safety reports.

**F. Software Considerations.**

Verify procedures are established for testing of each software revision or database update prior to operational use.

**G. Hardware Considerations.**

1. Verify display lighting and reflectivity has been evaluated for acceptability in each aircraft model.
2. Verify EFB maintenance procedures are in place for batteries, displays, display interaction devices (pens, etc.), display pixel burnout, and component condition.

**II. ELECTRONIC DOCUMENTS.**

1. Verify electronic documents are easily accessed and clearly controlled as to revision and currency.
2. Verify use of electronic documents is incorporated in training program for initial and recurrent.

**III. ELECTRONIC CHECKLIST (ECL) SYSTEMS.**

1. Verify ECL system is customized to aircraft being operated.
2. If checklist is "interactive," verify the checklist is subject to 6 month validation phase.
3. If checklist is "automatically linked," ensure AEG involvement and concurrence is obtained.
4. Verify use of ECL system is incorporated into training program for initial and recurrent.

**IV. WEIGHT AND BALANCE.**

1. Verify EFB procedures provide means to comply with load manifest record keeping requirements.
2. Verify procedures clearly identify if EFB W&B program is for "planning purposes only" when not an approved means for calculating W&B.
3. Verify use of W&B is incorporated into training program for initial and recurrent.

**V. FLIGHT PERFORMANCE CALCULATIONS.**

1. Verify EFB procedures provide means to comply with load manifest/flight plan record keeping requirements.
2. Verify procedures clearly identify if EFB aircraft performance program is for "planning purposes only" when not an approved means for calculating aircraft performance.
3. Verify use of aircraft performance is incorporated into training program for initial and recurrent.

**VI. ELECTRONIC CHARTS.**

1. Verify Electronic Charts Application does not display "own-ship position" except on the ground in compliance with AC 20-159, Obtaining Design and Production Approval of Airport Moving Map Display Applications Intended for Electronic Flight Bag Systems, (current edition).
2. Verify preflight procedures are established to ensure currency of electronic chart information.
3. Verify EFB display. The screen must be large enough to show an entire instrument approach procedure chart at once, with the equivalent degree of legibility and clarity as a paper chart.
4. Verify use of electronic charts is incorporated into training program for initial and recurrent.

**VII. VALIDATION PHASE.**

Verify procedures are established to collect user data for both normal and abnormal EFB functions during the validation phase and to provide a written report of reliability and problem resolution prior to authorization for paperless operation.

## Figure 4-79, Checklist 1-Tabletop EFB Evaluation

Checklist 1 contains a list of questions for operators to use during a tabletop evaluation of the Electronic Flight Bag (EFB) focusing on the EFB hardware and software applications. The checklist starts with EFB hardware questions, then presents general user interface questions and ends with specific application questions (if applicable). The checklist is designed so that any question answered as "No" requires a comment that may include, "Not Applicable."

After the operator has completed this checklist, the results should be documented so the principal operations inspector (POI) can review the results with the operator.

**EFB Hardware**

| | | |
|---|---|---|
| 1. If the EFB is to be used outside of the flight deck can the EFB display be read under direct sunlight? | ❑ No | ❑ Yes |
| 2. Is the display brightness and contrast adjustable? | ❑ No | ❑ Yes |
| 3. Is the display brightness acceptable when it adjusts automatically? | ❑ No | ❑ Yes |
| 4. Are there any display artifacts such as jagged lines that impair functionality? | ❑ No | ❑ Yes |
| 5. Are controls labeled appropriately to describe their intended function? | ❑ No | ❑ Yes |
| 6. Are buttons and labels visible and readable under all flight deck illumination conditions? | ❑ No | ❑ Yes |
| 7. Can EFB inputs be made quickly and accurately in any operational environment? | ❑ No | ❑ Yes |
| 8. Does the input device provide sufficient tactile feedback in all environmental conditions? | ❑ No | ❑ Yes |
| 9. Are inadvertent or multiple activation of controls minimized? | ❑ No | ❑ Yes |
| 10. Does the EFB start up in a predictable state? | ❑ No | ❑ Yes |
| 11. Can the EFB be rebooted when power is cut to the EFB? | ❑ No | ❑ Yes |
| 12. Does the EFB function correctly when rebooted? | ❑ No | ❑ Yes |
| 13. Are all the EFB failure modes easy to see and identify? | ❑ No | ❑ Yes |
| 14. Is the failure annunciation/message appropriate for the EFB function that has failed? | ❑ No | ❑ Yes |
| 15. Are EFB recovery means easy to remember and apply when the EFB fails? | ❑ No | ❑ Yes |

**Provide the Number and a Comment for each EFB Hardware Question checked as "No."**

__ _____
__ _____
__ _____
__ _____

**General User Interface**

| | | |
|---|---|---|
| 16. Is the revision information and currency expiration date available and presented clearly? | ❑ No | ❑ Yes |
| 17. Does the device respond immediately to user inputs? | ❑ No | ❑ Yes |
| 18. Is the processing speed always appropriate for normal use? | ❑ No | ❑ Yes |
| 19. Are appropriate busy or progress indicators displayed when processing is delayed? | ❑ No | ❑ Yes |
| 20. Is the user interface including functions and navigation consistent throughout the EFB? | ❑ No | ❑ Yes |
| 21. Is all information that is needed displayed and easily accessible? Is there missing or difficult to find information? | ❑ No | ❑ Yes |
| 22. Are common actions and time-critical functions easy to access? | ❑ No | ❑ Yes |
| 23. Are there standard ways to perform common actions? | ❑ No | ❑ Yes |
| 24. Are the displays and controls used on the EFB similar across applications? Are a common set of controls and graphical elements used? | ❑ No | ❑ Yes |
| 25. Can all colors be distinguished under the various lighting conditions? | ❑ No | ❑ Yes |
| 26. Is color coding implemented with a secondary code such as shading or highlighting when used to display critical information? | ❑ No | ❑ Yes |
| 27. Are the colors red and yellow used appropriately only for warnings and cautions? | ❑ No | ❑ Yes |
| 28. Is the text easily readable? | ❑ No | ❑ Yes |
| 29. Do the characters stand out against the display background? | ❑ No | ❑ Yes |
| 30. Are upper case and italic text used infrequently? | ❑ No | ❑ Yes |
| 31. Is text that may be used in low-visibility conditions appropriate in size and easy to read? | ❑ No | ❑ Yes |
| 32. Is it easy to zoom in on text or graphics when they are too small? | ❑ No | ❑ Yes |
| 33. Is it obvious when information is out of view and can it easily be brought into view? | ❑ No | ❑ Yes |
| 34. Is the spacing between characters appropriate? | ❑ No | ❑ Yes |
| 35. Is the vertical spacing between lines appropriate? | ❑ No | ❑ Yes |
| 36. Are icons and symbols legible? | ❑ No | ❑ Yes |
| 37. Are icon and symbol functions obvious? | ❑ No | ❑ Yes |
| 38. Are the icons and symbols distinguishable from one another? | ❑ No | ❑ Yes |
| 39. Is each icon's meaning explained by a label or other means? | ❑ No | ❑ Yes |
| 40. Are the EFB icons and symbols consistent with their paper equivalents? | ❑ No | ❑ Yes |
| 41. Do EFB alerts and reminders meet the requirements in the appropriate regulations as noted in the current edition of FAA AC 120-76, Guidelines for the Certification, Airworthiness, and Operational Approval of Electronic Flight Bag Computing DevicesPara. 10 (i.e., The Human Factors Considerations for EFBs)? | ❑ No | ❑ Yes |
| 42. Are alerts and reminders consistent across all applications? | ❑ No | ❑ Yes |
| 43. Are alerts and reminders implemented so as not to distract? | ❑ No | ❑ Yes |
| 44. Is there control over when, and whether, the audio or video is activated? | ❑ No | ❑ Yes |
| 45. Is it easy to reset parameters to their default when they have been customized? | ❑ No | ❑ Yes |
| 46. Is EFB customization controlled through an administrative control process? | ❑ No | ❑ Yes |

**Provide the Number and a Comment for each General User Interface Question checked as "No."**

__ _____

__ _____

__ _____

__ _____

__ _____

**General Software Applications**

| | | |
|---|---|---|
| 47. Can required information be found quickly and accurately within all applications? | ❑ No | ❑ Yes |
| 48. Is the information within applications organized consistently? | ❑ No | ❑ Yes |
| 49. Is information layout consistent with the paper equivalent? | ❑ No | ❑ Yes |
| 50. Is the layout of information appropriate for all applications? | ❑ No | ❑ Yes |
| 51. Is high priority information easy to read? | ❑ No | ❑ Yes |
| 52. Is it easy to tell which application is currently open/active? | ❑ No | ❑ Yes |
| 53. Is it easy to switch between applications? | ❑ No | ❑ Yes |
| 54. Is extra acknowledgement required to open applications that are not flight related? | ❑ No | ❑ Yes |
| 55. Do all open applications function as intended on an individual basis? | ❑ No | ❑ Yes |
| 56. Is access or links to related information appropriately supported? | ❑ No | ❑ Yes |
| 57. Are similar types of information accessed in the same way? | ❑ No | ❑ Yes |
| 58. Is it easy to return to the place where the user started from? | ❑ No | ❑ Yes |
| 59. Is printing supported, and if so, is the hard copy usable? | ❑ No | ❑ Yes |
| 60. Can a portion of a document be selected to be printed? | ❑ No | ❑ Yes |
| 61. Can a print job be terminated immediately? | ❑ No | ❑ Yes |

**Provide the Number and a Comment for each General Software Applications Question checked as "No."**

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**Electronic Documents (If Applicable)**

| | | |
|---|---|---|
| 62. Is it easy to tell where one is in relation to the full document? | ❑ No | ❑ Yes |
| 63. Is it easy to move between documents quickly? | ❑ No | ❑ Yes |
| 64. Is it easy to tell what document is currently in view? | ❑ No | ❑ Yes |
| 65. Is there a list of available documents to choose from? | ❑ No | ❑ Yes |
| 66. Is the document search function appropriate? | ❑ No | ❑ Yes |
| 67. Are tables, especially complex ones, readable and usable? | ❑ No | ❑ Yes |
| 68. Are figures readable and usable? | ❑ No | ❑ Yes |

**Electronic Charts (If Applicable)**

| | | |
|---|---|---|
| 69. Is there a way to pre-select specific charts for easy access during a particular flight? | ❑ No | ❑ Yes |
| 70. Is there more than one way to search for a chart? | ❑ No | ❑ Yes |
| 71. Is It easy to access charts when a last minute change is necessary? | ❑ No | ❑ Yes |
| 72. If the chart application uses aircraft location to facilitate access to charts, is this function appropriate? (i.e., either approved by Aircraft Certification or explicitly allowed by the current edition of FAA AC 120-76. | ❑ No | ❑ Yes |
| 73. Is it easy to switch between a de-cluttered and normal display if de-cluttering is supported? | ❑ No | ❑ Yes |
| 74. Is there a clear indication when any chart elements are suppressed? | ❑ No | ❑ Yes |

**Provide the Number and a Comment for each Electronic Documents and Charts Question checked as "No."**

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**Electronic Checklists (If Applicable)**

| | | |
|---|---|---|
| 75. Are normal checklists available in the appropriate order of use? | ❑ No | ❑ Yes |
| 76. Can checklists be accessed individually for review or reference? | ❑ No | ❑ Yes |
| 77. During non-normal conditions, are relevant checklists easy to access? | ❑ No | ❑ Yes |
| 78. During non-normal conditions, does the device indicate which checklists and/or checklist items are required and which are optional? | ❑ No | ❑ Yes |
| 79. Is it clear where to find all checklists, whether on the EFB or on paper? | ❑ No | ❑ Yes |
| 80. Is the location of a paper document provided when it is referred to by the electronic checklist? | ❑ No | ❑ Yes |
| 81. Does each checklist have a constantly visible title distinct from other checklists? | ❑ No | ❑ Yes |
| 82. Is it easy to select a checklist from a set of open checklists? | ❑ No | ❑ Yes |
| 83. Is there a reminder to review incomplete items when closing an incomplete checklist? | ❑ No | ❑ Yes |
| 84. Can an incomplete checklist be closed after acknowledging it is not complete? | ❑ No | ❑ Yes |
| 85. Does the ECL discourage two or more checklists from being used simultaneously? | ❑ No | ❑ Yes |
| 86. Is progress through the ECL clear? | ❑ No | ❑ Yes |
| 87. It is easy to reset the ECL to start over again? | ❑ No | ❑ Yes |
| 88. Does the checklist provide appropriate reminders for tasks that require a delayed action? | ❑ No | ❑ Yes |
| 89. Does the checklist clearly highlight decision branches? | ❑ No | ❑ Yes |
| 90. Can one return to the checklist from links or related information in one step? | ❑ No | ❑ Yes |
| 91. Is there an indicator of which item in the checklist you are working on? | ❑ No | ❑ Yes |
| 92. Is the checklist's active item clearly indicated? | ❑ No | ❑ Yes |
| 93. Can the status of an item be easily changed? | ❑ No | ❑ Yes |
| 94. Does the next item automatically become active when the previous one is complete? | ❑ No | ❑ Yes |
| 95. Can the current item be deferred without completing it? | ❑ No | ❑ Yes |
| 96. Is it easy to view other items, even in a long checklist, without changing the active item? | ❑ No | ❑ Yes |
| 97. Is it easy to move between items within a checklist? | ❑ No | ❑ Yes |
| 98. Does the active item change to the next after an item is completed? | ❑ No | ❑ Yes |
| 99. Is there a clear indication that all items as well as the whole checklist are complete when finished? | ❑ No | ❑ Yes |

**Provide the Number and a Comment for each Electronic Checklists Question checked as "No."**

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**Performance Calculations (If Applicable)**

| | | |
|---|---|---|
| 100. Does the device identify entries that have an incorrect format or type and does it generate an appropriate error message? | ❑ No | ❑ Yes |
| 101. Does the error message clarify the type and range of data expected? | ❑ No | ❑ Yes |
| 102. Are units for performance data clearly labeled? | ❑ No | ❑ Yes |
| 103. Do the labels used in the EFB match the language of other operator documents? | ❑ No | ❑ Yes |
| 104. Is all the information necessary for a given task presented together or easily accessible? | ❑ No | ❑ Yes |
| 105. Can the crews modify performance calculations easily, especially when making last minute changes? | ❑ No | ❑ Yes |
| 106. Are outdated results of performance calculations deleted when modifications are entered? | ❑ No | ❑ Yes |

| | | |
|---|---|---|
| 107. Does the display and/or crew training provide information to the crew on the assumptions on which the calculations are based? | ❑ No | ❑ Yes |
| 108. Are crews trained to identify and review default values and assumptions about the aircraft status or environmental conditions? | ❑ No | ❑ Yes |
| 109. Are the assumptions made about any calculation as clear to pilots as similar information would be on a tabular chart? | ❑ No | ❑ Yes |

**Provide the Number and a Comment for each Performance Calculations Question checked as "No."**

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## Figure 4-80, Checklist 2-EFB Operational Evaluation

Checklist 2 contains a list of questions for operator consideration during an operational evaluation of the Electronic Flight Bag (EFB), its documentation, procedures, and training. The first four pages contain questions that can be answered in a training or operational environment by pilots, instructor/evaluators, or other operational personnel. The last page contains sample crew performance questions that can be addressed in a simulation environment. The checklist is designed such that any question answered as "No" requires a comment that in some cases may be "Not Applicable."

After the operator has completed this checklist, the principal operations inspector ( POI) will review the results with the operator.

**General EFB Hardware**

| | | |
|---|---|---|
| 1. Is there a backup source in the flight deck for EFB information? | ❑ No | ❑ Yes |
| 2. Is the EFB display readable under all typical flight-deck lighting conditions? | ❑ No | ❑ Yes |
| 3. Does each type of EFB failure have minimum impact to crew tasks and workload? | ❑ No | ❑ Yes |
| 4. Is the EFB installation appropriate for use in high workload phases of flight? | ❑ No | ❑ Yes |
| 5. Are there appropriate MMEL/MEL items to handle EFB failures? | ❑ No | ❑ Yes |
| 6. Have EFB failure items been incorporated into FAA-approved checklists? | ❑ No | ❑ Yes |
| 7. Does the EFB mount allow appropriate access to flight controls and displays? | ❑ No | ❑ Yes |
| 8. Does the EFB mount allow appropriate access to the emergency egress path? | ❑ No | ❑ Yes |
| 9. Are crews able to adjust and lock the EFB for optimal viewing? | ❑ No | ❑ Yes |
| 10. Is there appropriate access to all flight controls during both ground and in-flight operations when the EFB is positioned for optimal viewing? | ❑ No | ❑ Yes |
| 11. Is there appropriate room to manipulate the EFB controls and to view its display? | ❑ No | ❑ Yes |
| 12. Are all EFB hardware components that are routinely used easy to access? | ❑ No | ❑ Yes |
| 13. Are the EFB hardware components usable and suitably durable for the flight deck? | ❑ No | ❑ Yes |

**Provide the Number and a Comment for each General EFB Hardware Question checked as "No."**

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**Stowage (If Applicable)**

| | | |
|---|---|---|
| 14. Is there a stowage area for the EFB? | ❑ No | ❑ Yes |
| 15. Is the stowage securing mechanism simple to operate? | ❑ No | ❑ Yes |
| 16. Is the stowage securing mechanism unobtrusive when not in use? | ❑ No | ❑ Yes |

| | | |
|---|---|---|
| 17. Does the stowage system allow appropriate access to flight controls/displays and egress routes? | ❑ No | ❑ Yes |
| 18. Is the design of the stowage area acceptable? | ❑ No | ❑ Yes |
| 19. Can the EFB be moved easily to and from the stowage area without blocking access to flight displays/controls? | ❑ No | ❑ Yes |
| 20. Are the device and/or the stowage area unlikely to be damaged under normal use? | ❑ No | ❑ Yes |

**Unsecured EFB (If Applicable)**

| | | |
|---|---|---|
| 21. Is there appropriate access to flight controls/displays when the unsecured EFB is in use? | ❑ No | ❑ Yes |
| 22. Is there an acceptable place to put an unsecured EFB when in use? | ❑ No | ❑ Yes |
| 23. Is there an acceptable place to put an unsecured EFB when not in use? | ❑ No | ❑ Yes |
| 24. Can the kneeboard EFB be positioned such that the pilot has full control authority? | ❑ No | ❑ Yes |
| 25. Is the kneeboard EFB comfortable for the pilot to wear under normal conditions? | ❑ No | ❑ Yes |

**Provide the Number and a Comment for each Stowage and Unsecured EFB Question checked as "No."**

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**General User Interface**

| | | |
|---|---|---|
| 26. Is the workload using the EFB the same or less than the current process? | ❑ No | ❑ Yes |
| 27. Is the workload acceptable when there is an EFB failure? | ❑ No | ❑ Yes |
| 28. Are other than critical EFB messages inhibited during high workload phases of flight? | ❑ No | ❑ Yes |
| 29. Is the EFB user interface consistent with other flight deck systems? | ❑ No | ❑ Yes |
| 30. Does the EFB use terms, icons, colors and symbols consistent with other flight deck systems? | ❑ No | ❑ Yes |

**Software Applications**

| | | |
|---|---|---|
| 31. Is the workload acceptable when configuring electronic charts while flying a procedure? | ❑ No | ❑ Yes |
| 32. Does using the electronic checklist produce the same crew actions that using the paper equivalent would? | ❑ No | ❑ Yes |

**Provide the Number and a Comment for each User Interface and Application Question checked as "No."**

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**EFB Procedures**

| | | |
|---|---|---|
| 33. Are there procedures for starting up and shutting down the EFB? | ❑ No | ❑ Yes |
| 34. Are there appropriate procedures for all the EFB failure modes? | ❑ No | ❑ Yes |
| 35. Are there EFB procedures for when other aircraft system failures could render the EFB unusable? | ❑ No | ❑ Yes |
| 36. Are there procedures for using EFB backup information? | ❑ No | ❑ Yes |
| 37. Are there procedures to mitigate EFB workload? | ❑ No | ❑ Yes |
| 38. Are there procedures for establishing which source of information is primary? | ❑ No | ❑ Yes |
| 39. Are there appropriate procedures for using EFB in high workload phases of flight? | ❑ No | ❑ Yes |
| 40. Are there procedures that specify what data to use when data is redundant or different form the EFB? | ❑ No | ❑ Yes |
| 41. Are there procedures for removal of a kneeboard EFB during emergency landing or egress (If | ❑ No | ❑ Yes |

Applicable)?

**Provide the Number and a Comment for each EFB Procedures Question checked as "No."**

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**Procedures for Keeping EFB Content/Data Current**

| | | |
|---|---|---|
| 42. Are there procedures to ensure data is accurate and current for each software application? | ❑ No | ❑ Yes |
| 43. Are changes to content/data appropriately documented? | ❑ No | ❑ Yes |
| 44. Are there procedures to notify crews of EFB updates? | ❑ No | ❑ Yes |
| 45. Are there procedures to ensure that the correct information is installed when EFBs use information that is specific to the aircraft type or tail number? | ❑ No | ❑ Yes |
| 46. Are operational control procedures consistent with regulations concerning preventative maintenance? | ❑ No | ❑ Yes |
| 47. Is there a procedure to avoid corruption/errors during changes to the EFB device? | ❑ No | ❑ Yes |
| 48. Is there a procedure to ensure that all EFBs have the appropriate content/data installed when there are multiple EFBs on the flight deck? | ❑ No | ❑ Yes |
| 49. Is there a procedure to ensure that EFB data in use is approved for use in flight? | ❑ No | ❑ Yes |
| 50. Is there a procedure for when the database is not approved for use in flight? | ❑ No | ❑ Yes |
| 51. Is there a procedure to ensure that all customized values are cleared from the EFB? | ❑ No | ❑ Yes |

**Procedures for User Feedback**

| | | |
|---|---|---|
| 52. Is there a procedure for EFB users to provide feedback? | ❑ No | ❑ Yes |
| 53. Is there a procedure for the operator to monitor feedback, correct EFB deficiencies, and/or notify the EFB manufacturer? | ❑ No | ❑ Yes |
| 54. Are there procedures or built-in limits that prevent defining customized color schemes that conflict with flight deck color conventions? | ❑ No | ❑ Yes |
| 55. Is there a policy regarding the use of supplemental audio and/or video in flight? | ❑ No | ❑ Yes |
| 56. Is the EFB audio set to minimize any interference with higher priority communications? | ❑ No | ❑ Yes |

**Procedures for Specific Applications (If Applicable)**

| | | |
|---|---|---|
| 57. Are there specific policy/procedures for using the electronic charts application? | ❑ No | ❑ Yes |
| 58. Does the policy specify what other EFB applications can be used while a procedure using the electronic charts is actively being flown? | ❑ No | ❑ Yes |
| 59. Are there procedures on how to use the electronic charts when the EFB uses aircraft status data to configure chart elements? | ❑ No | ❑ Yes |
| 60. Are there procedures to ensure that navigation/approach charts required for the flight are installed and available? | ❑ No | ❑ Yes |
| 61. Is there a procedure to identify the controlling copy of weight and balance? | ❑ No | ❑ Yes |
| 62. Is there a procedure to establish responsibility for completion of weight and balance software? | ❑ No | ❑ Yes |
| 63. Are there procedures to maintain required weight and balance records? | ❑ No | ❑ Yes |
| 64. Is there a procedure to ensure that EFB performance data can be stored outside the EFB? | ❑ No | ❑ Yes |

**Provide the Number and a Comment for each of the above EFB Procedure Question checked as "No."**

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**EFB Training**

| | | |
|---|---|---|
| 65. Are there appropriate EFB training, checking and currency requirements? | ❑ No | ❑ Yes |
| 66. Does the EFB training program address all EFB intended functions and applications? | ❑ No | ❑ Yes |
| 67. Is there training on how to use unique features of the software applications? | ❑ No | ❑ Yes |
| 68. Are crews proficient on the EFB at the completion of EFB training? | ❑ No | ❑ Yes |
| 69. Is EFB training customized for new users? | ❑ No | ❑ Yes |
| 70. Is the manufacturer's EFB documentation sufficient? | ❑ No | ❑ Yes |
| 71. Does the EFB training device provide an appropriate degree of fidelity when the actual EFB is not used? | ❑ No | ❑ Yes |
| 72. Does the EFB training device simulate the key aspects of the task? | ❑ No | ❑ Yes |
| 73. Does the EFB training appropriately address the meaning of icons and symbols? | ❑ No | ❑ Yes |

**Training for Charts (If Applicable)**

| | | |
|---|---|---|
| 74. Is training on the use of electronic charts appropriate? | ❑ No | ❑ Yes |
| 75. Is there training on unique features of the electronic charts? | ❑ No | ❑ Yes |
| 76. Is there training on differences in map scale, orientation, and data quality between the electronic charts and other flight deck displays? | ❑ No | ❑ Yes |
| 77. Is there training on the limitations of own aircraft position when it is displayed? | ❑ No | ❑ Yes |
| 78. Is there training on policies pertaining to use of the electronic charts? | ❑ No | ❑ Yes |
| 79. Can crews use the electronic charts as well as they can use paper charts? | ❑ No | ❑ Yes |
| 80. Can crews use the electronic charts to orient themselves and track their progress as they fly required procedures? | ❑ No | ❑ Yes |

**Training for Electronic Checklist Systems (If Applicable)**

| | | |
|---|---|---|
| 81. Is there appropriate training on how to use electronic checklists? | ❑ No | ❑ Yes |
| 82. Is there training on how to use unique features of the electronic checklists (e.g., how the EFB indicates that a checklist item has been deferred)? | ❑ No | ❑ Yes |
| 83. Is there training on which checklists are supported electronically and which are not? | ❑ No | ❑ Yes |
| 84. Is there training on the limitations of ECL automation when it uses aircraft status data? | ❑ No | ❑ Yes |

**Training for Flight Performance Calculations (If Applicable)**

| | | |
|---|---|---|
| 85. Is there appropriate training on how and when to use the flight performance application? | ❑ No | ❑ Yes |
| 86. Is there training on critical performance calculation assumptions (e.g., runway length, W & B)? | ❑ No | ❑ Yes |
| 87. Is there training to review default values for aircraft status and environmental conditions? | ❑ No | ❑ Yes |
| 88. Is there training on how to enter information required by the performance software? | ❑ No | ❑ Yes |
| 89. Is there training on how to interpret and use results of the flight performance calculations? | ❑ No | ❑ Yes |
| 90. Is there training on where to obtain values when their normal sources are not available? | ❑ No | ❑ Yes |
| 91. Is there training on coordinating the roles of dispatchers and flightcrews? | ❑ No | ❑ Yes |

**Provide the Number and a Comment for each Training Question checked as "No."**

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**Crew Performance: Preflight Planning**

Do crews with EFB perform as well or better than crews with paper documents when…

| | | |
|---|---|---|
| 92. ….calculating aircraft weight and balance, takeoff, climb, and maneuvering speeds? | ❑ No | ❑ Yes |
| 93. ….crews maintain critical data for immediate reference? | ❑ No | ❑ Yes |
| 94. …there is a runway change and a need to reference deicing fluid requirements or an MEL item? | ❑ No | ❑ Yes |
| 95. ….there are time critical adjustments prior to block out/taxi and takeoff? | ❑ No | ❑ Yes |

**Crew Performance: Takeoff**

Do crews with EFB perform as well or better than crews with paper documents when…

| | | |
|---|---|---|
| 96. …there is a take-off on a runway that requires briefing a special operator engine-out procedure? | ❑ No | ❑ Yes |
| 97. …there is complex SID with an abnormal or an emergency during the departure climb-out? | ❑ No | ❑ Yes |
| 98. …there is an emergency that requires a return to the departure or alternate departure airport? | ❑ No | ❑ Yes |
| 99. …one EFB fails requiring one pilot to rely on the EFB of the other pilot immediately after takeoff? | ❑ No | ❑ Yes |

**Provide the Number and a Comment for each Preflight and Takeoff Question checked as "No."**

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**Crew Performance: Cruise**

Do crews with EFB perform as well or better than crews with paper documents when…

| | | |
|---|---|---|
| 100. …there is an engine-failure/fire with possible condition of destination below weather minimums? | ❑ No | ❑ Yes |
| 101. …there is electrical smoke in the cockpit requiring use of smoke mask/goggles while completing checklists or using EFB for approach briefing? | ❑ No | ❑ Yes |

**Crew Performance: Descent**

Do crews with EFB perform as well or better than crews with paper documents when…

| | | |
|---|---|---|
| 102. …there are conditions that require reference to SMGCS taxi routing or a complex clearance? | ❑ No | ❑ Yes |
| 103. …reported runway conditions require reference to operational limitations? | ❑ No | ❑ Yes |

**Crew Performance: Approach/Landing**

Do crews with EFB perform as well or better than crews with paper documents when…

| | | |
|---|---|---|
| 104. …there is runway change or the need to re-compute landing weight and V speeds during approach? | ❑ No | ❑ Yes |
| 105. …there are poor weather conditions or airports with complex taxi routes? | ❑ No | ❑ Yes |
| 106. …there is a request for a specific taxiway turn during rollout after landing? | ❑ No | ❑ Yes |

**Crew Performance: Destination Ground Operations**

Do crews with EFB perform as well or better than crews with paper documents when…

| | | |
|---|---|---|
| 107. …there is an EFB partial failure or erroneous output requiring maintenance discrepancy to be entered? | ❑ No | ❑ Yes |

Provide the Number and a Comment for each Crew Performance Question checked as "No."

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## Figure 4-81, Evaluation Report Information Template

This outline is used by user/operator to ensure that the minimum content requirements of the evaluation report have been met. The format of the report is optional, however the information below must have been included, as a minimum:

1. Electronic Flight Bag (EFB) evaluation identified by EFB make/model and aircraft make/model.
2. The manufacturer's name and model number of the mounting system evaluated.
3. EFB location and stowage suitability.
4. EFB display lighting and reflectivity.
5. Suitability of procedures for EFB use during all phases of flight.
6. Suitability of procedures to follow when one unit fails and when both units fail to include alternate means of accessing data.
7. A revision process procedure/method that ensures appropriate database accuracy and currency.
8. Training effectiveness and typical acceptable training course completion.
9. Usability of each application (for example):
    a. Electronic documents functional suitability,
    b. Aircraft performance, Weight and Balance (W&B), speeds reference functional suitability, and
    c. Electronic charts functional suitability.
10. Usability of multiple applications at one time.
11. Crew workload and currency for proficient use.
12. Effectiveness of procedures which govern the distribution of application software updates to the aircraft and confirmation of the aircraft EFB configuration.
13. Flight Report – when and how reports of malfunctions or anomalies are reported and resolved.

## Figure 4-82, Checklist 4, EFB Line Evaluation Job Aid

USED FOR DATA COLLECTION DURING VALIDATION PERIOD

This tool provides a starting point for Electronic Flight Bag (EFB) line-operations evaluations. The questions are primarily designed to aid the principal operations inspector (POI) but may also be useful to the operator for the collection of a structured set of observations about the use of the EFB before and during the 6-month validation phase. Use of this tool can be customized as appropriate for the situation.

This is a final check to ensure that there are no problems with the EFB design/interface, training, or procedures prior to the authorization for use.

The questions below encompass the operations and safety evaluation. In cases where a system shows weaknesses or limitations, mitigations must be developed in consultation with the applicant.

In some cases, an EFB may add to the complexity of flight operations. The key questions to be answered are:

1) Can the flight be conducted as safely with an EFB as with the methods/products it is intended to replace?

2) Does the EFB add an *unacceptable* level of complexity for any critical activity or phase of flight?

In order to answer these questions, it is helpful to consider more specific aspects of EFB usage, which are covered in Sections II through V below. Space is also provided in Section I to record general notes about the system and the evaluation.

**I. Describe system configuration description and flight conditions:**

| |
|---|
| |

**II. Overview. The main aspects to be assessed are encompassed by the following questions:**

| | | |
|---|---|---|
| 1. | Was training adequate to ensure that the pilot(s) could perform in a safe and efficient manner?<br>• Were individual pilot knowledge and skills adequate to allow normal coordinated flight deck activities?<br>• Was pilot knowledge regarding observed software applications adequate? | ☐ No ☐ Yes |
| 2. | Are adequate procedures in place to ensure that the EFB is integrated into the crew/operator's system (e.g., normal and abnormal/emergency operations and maintenance functions)? | ☐ No ☐ Yes |
| 3. | Was the EFB hardware or software adequate and appropriate during the flight? If there were any problems, particularly in a critical phase of flight, describe in the notes space below. | ☐ No ☐ Yes |
| 4. | Could the pilot(s) recover from usage errors without undue distraction or discussions? If usage errors were frequent or a distraction, describe in notes below. | ☐ No ☐ Yes |
| 5. | Was the workload required for completing a task with the EFB equal to or less than the workload for completing the task with the conventional method? If no, specify phase of flight and task for any marginal or unacceptable increases in workload in notes space below. | ☐ No ☐ Yes |

**Describe any problems noted as 'No' above:**

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|---|
| |

**III. General.**

6. Was each pilot able to use the cursor, track ball, touch screen, etc. for menu and functionality without frequent errors? ☐ No ☐ Yes

7. Was the device appropriate and operational when exposed to environmental factors (e.g., turbulence, cold weather, vibration)? ☐ No ☐ Yes

8. Was the device free of significant limitations in regard to display (e.g., off-axis view angles, or various different lighting conditions)? ☐ No ☐ Yes
   - The device had easy and adequate dimming functions in low light (nighttime) conditions?
   - The device was adequately backlit and/or was viewable by flight deck lighting in low light (nighttime) conditions?
   - The device was clearly visible in bright sunlight conditions?

9. Was the device display clear (adequate resolution)? Confirm that the display was never misinterpreted because of viewing limitations. If so, record issues in notes space below. ☐ No ☐ Yes

10. Did the pilot(s) ensure proper stowage and security (i.e., between flights, etc.) of EFB per standard operating procedures (SOP)? Temperature limitations acknowledged? ☐ No ☐ Yes

11. Does the display continue to be usable after prolonged use in the flight deck environment (if applicable)? ☐ No ☐ Yes

12. Normal functions (e.g., shut down, start up, etc.) are adequate and do not require undue pilot attention or concern? ☐ No ☐ Yes

13. Were procedures adequate for identifying currency of EFB data? ☐ No ☐ Yes

14. Could the pilot(s) easily find and use required items and functions? ☐ No ☐ Yes

15. Were the abbreviations and/or icons easy to understand? ☐ No ☐ Yes

16. If multiple applications are supported, could the pilot(s) easily switch between critical applications? ☐ No ☐ Yes

17. If critical (e.g., abnormal or emergency checklists) applications are authorized in the EFB configuration basis, is their use at least equal to or better than previously approved methods? ☐ No ☐ Yes ☐ N/A

18. The time to complete normal tasks was appropriate. ☐ No ☐ Yes

19. The audio features did not cause pilot distraction and/or were adjustable and appropriate for the flight deck environment. ☐ No ☐ Yes ☐ N/A

**Describe any problems noted as 'No' above:**

| | | |
|---|---|---|
| 20. | Were all necessary documents (including charts, checklists, and manuals) found, identified, and easily viewed by the pilot(s) without undue distraction? | ☐ No ☐ Yes |
| 21. | Was information contained in electronic charts, documents, and checklists complete, equal in quality to previously provided products, and easily accessible and understandable? | ☐ No ☐ Yes |
| 22. | Was pilot knowledge of chart/document/checklist selection and viewing adequate? | ☐ No ☐ Yes |
| 23. | Could the pilot(s) easily rearrange content on the screen to meet needs (e.g., by zooming, panning, or otherwise customizing the view)? | ☐ No ☐ Yes |
| 24. | If printers are used, are printouts acceptable? | ☐ No ☐ Yes |
| 25. | Did the pilot(s) exhibit adequate knowledge of EFB functions to efficiently brief and fly required procedures? | ☐ No ☐ Yes |
| 26. | Did the pilot(s) exhibit adequate knowledge of the software revision process procedure/method that ensures appropriate database accuracy and currency? | ☐ No ☐ Yes |
| 27. | Did the pilot(s) exhibit adequate knowledge of contingency procedures?<br>In the event of a failure of a single device.<br>In the event that both devices fail. | ☐ No ☐ Yes |
| 28. | Were both pilots able to monitor necessary electronic chart displays during critical phases of flight? | ☐ No ☐ Yes |
| 29. | Did the EFB allow quick entry of updates for last minute changes (e.g., flight plan/runway changes)? | ☐ No ☐ Yes |
| 30. | For electronic checklists, was it easy to track completed items? | ☐ No ☐ Yes ☐ N/A |

**Describe any problems noted as 'No' above:**

**V. Flight Performance Data/Calculations.**

| | | |
|---|---|---|
| 31. | Could the pilot(s) interpret and use flight performance data/calculations efficiently and accurately? | ☐ No ☐ Yes ☐ N/A |
| 32. | Did the device allow quick entry of updates for last minute changes (e.g., flight plan/runway changes)? | ☐ No ☐ Yes ☐ N/A |
| 33. | In the event that the weight & balance and/or performance calculation software is not approved by the Aircraft Certification Office, all crewmembers are aware of the software's limitations and understand that only approved calculation methods may be used as a primary means of computation. | ☐ No ☐ Yes ☐ N/A |

**Describe any problems noted as 'No' above:**

**VI. General Conclusions.**

34. Were any unique safety issues or events caused or exacerbated by using the EFB during this evaluation? ☐ No ☐ Yes

35. Can the flight be conducted as safely with an EFB as with the methods/products it is intended to replace? ☐ No ☐ Yes

36. Does the EFB add an unacceptable level of complexity for any critical activity or phase of flight? ☐ No ☐ Yes

**Assigned Aircraft:** _____ **Date:** _____ **Print Observer Name:** _____

**Observer Signature:** _____ **Certificate Number:** _____

**RESERVED.** Paragraphs 4-1650 through 4-1665.