European Aviation Safety Agency

Notice of Proposed Amendment 2016-12

Transposition of provisions on electronic flight bags from ICAO Annex 6

RMT.0601 — 4.10.2016

EXECUTIVE SUMMARY

This Notice of Proposed Amendment (NPA) addresses the transposition of the International Civil Aviation Organization (ICAO) Annex 6 provisions on electronic flight bags (EFBs), applicable since November 2014, into Regulation (EU) No 965/2012 (the Air Operations Regulation).

The specific objective of this rulemaking task is to maintain a high level of safety with regard to the use of EFBs by ensuring a harmonised implementation of the current provisions of AMC 20-25.

This NPA proposes to introduce an operational approval for the use of EFB applications by commercial air transport (CAT) operators and to introduce proportionate EFB provisions for non-commercial operations with complex motor-powered aircraft (NCC), non-commercial operations with other-than-complex motor-powered aircraft (NCO), and specialised operations (SPO) operators.

The proposed changes are expected to maintain the current level of safety while ensuring compliance with ICAO and limiting the regulatory burden due to the introduction of the operational approval for CAT operations.

Applicability		**Process map**	
Affected regulations and decisions:	Regulation (EU) No 965/2012 (Definitions, Part-ARO, Part-CAT, Part-SPA, Part-NCC, Part-NCO, Part-SPO) and associated Decisions; ED Decision No. 2003/12/RM (AMC-20)	Concept paper:	No
		Terms of reference:	5.10.2015
		Rulemaking group:	Yes
		RIA type:	Full
Affected stakeholders:	Competent authorities; operators	Technical consultation during NPA drafting:	No
		Duration of NPA consultation:	3 months
Driver/origin:	Level playing field	Review group:	TBD
		Focused consultation:	Yes
Reference:	ICAO Annex 6, Part I, Amdt 38; ICAO Annex 6, Part II, Amdt 33; ICAO Annex 6, Part III, Amdt 19	Publication date of the Opinion:	2018/Q2
		Publication date of the Decision:	2019/Q2

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1. Procedural information

1.1. The rule development procedure

The European Aviation Safety Agency (hereinafter referred to as 'EASA') developed this NPA in line with Regulation (EC) No 216/2008[1] (hereinafter referred to as the 'Basic Regulation') and the Rulemaking Procedure[2].

This rulemaking activity is included in EASA's Rulemaking Programme for 2014–2017 under RMT.0601[3].

The text of this NPA has been developed by EASA based on the input of Rulemaking Group RMT.0601 & RMT.0602 for CAT, NCC and SPO with complex motor-powered aircraft (CMPA) operations and for NCO based on the outcome of a technical consultation with general aviation stakeholders organised by EASA to ensure proportionate requirements for this type of operations.

It is hereby submitted to all interested parties[4] for consultation.

The process map on the title page contains the major milestones of this rulemaking activity to date and provides an outlook of the timescales of the next steps.

1.2. The structure of this NPA and related documents

Chapter 1 of this NPA contains the procedural information related to this task. Chapter 2 (Explanatory Note) explains the core technical content. Chapter 3 contains the proposed text for the new requirements. Chapter 4 contains the regulatory impact assessment (RIA) showing which options were considered and what impacts were identified, thereby providing the detailed justification for this NPA.

1.3. How to comment on this NPA

Please submit your comments using the automated **Comment-Response Tool (CRT)** available at **http://hub.easa.europa.eu/crt/**[5].

The deadline for submission of comments is **6 January 2017**.

1.4. The next steps in the procedure

EASA will publish the related comment-response document (CRD) with the Opinion.

The Opinion contains proposed changes to EU regulations and it is addressed to the European Commission, which will use it as a technical basis to prepare a legislative proposal.

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1 Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 February 2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency, and repealing Council Directive 91/670/EEC, Regulation (EC) No 1592/2002 and Directive 2004/36/EC (OJ L 79, 19.3.2008, p. 1).

2 The Agency is bound to follow a structured rulemaking process as required by Article 52(1) of the Basic Regulation. Such process has been adopted by the Agency's Management Board and is referred to as the 'Rulemaking Procedure'. See MB Decision N° 18-2015 of 15 December 2015 replacing Decision 01/2012 concerning the procedure to be applied by the Agency for the issuing of opinions, certification specifications, acceptable means of compliance and guidance material (https://www.easa.europa.eu/system/files/dfu/EASA%20MB%20Decision%2018-2015%20on%20Rulemaking%20Procedure.pdf).

3 http://www.easa.europa.eu/system/files/dfu/2013-029-R-Revised%204-year%20RMP%20%282014-2017%29%20-%20Detailed%20view.pdf

4 In accordance with Article 52 of the Basic Regulation and Articles 5(3) and 6 of the Rulemaking Procedure.

5 In case of technical problems, please contact the CRT webmaster (crt@easa.europa.eu).

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The Decision containing acceptable means of compliance (AMC) and guidance material (GM) will be published by EASA when the related implementing rules (IRs) are adopted by the European Commission.

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2. Explanatory Note

2.1. Overview of the issues to be addressed

The main issue to be addressed by this NPA is level playing field.

This level playing field issue is linked with the following current conditions:

— There is a lack of requirements in the area of EFBs, as only AMC 20-25 is available;

— There are currently no provisions for the use of EFBs in NCC, NCO and SPO, as AMC 20-25 is only applicable to CAT operations;

— The current ICAO provisions for EFBs in Annex 6 Part I, II and III, applicable since November 2014, have not yet been transposed into the European regulatory framework.

For more detailed analysis of the issues addressed by this proposal, please refer to the RIA Section 4.1. 'Issues to be addressed'.

2.2. Objectives

The overall objectives of the EASA system are defined in Article 2 of the Basic Regulation. This proposal will contribute to the achievement of the overall objectives by addressing the issues outlined in Chapter 2 of this NPA.

The specific objective of this proposal is to:

— ensure compliance with the ICAO Standards and Recommended Practices (SARPs);

— provide specific requirements on the use of EFBs in the Air Operations Regulation for CAT operations;

— provide requirements proportionate to the complexity of the operations and/or propose safety promotion actions related to the use of EFBs for non-commercial operations and specialised operations; and

— conduct a first review of AMC 20-25 based on the experience gained so far by competent authorities since its publication.

2.3. Summary of the regulatory impact assessment (RIA)

Considering the objectives of this rulemaking task as well as the type of operations (CAT, NCC, NCO and SPO) within the scope of the task, it has been decided to develop several RIAs, since these types of operations have specific characteristics and since the starting points from a regulatory point of view are different.

Consequently, one RIA has been established for CAT, one for NCC/SPO with CMPA, and one RIA for NCO/SPO with non-complex motor-powered aircraft (NCMPA).

With regard to the RIA for CAT, since the objective concerns the introduction of an operational approval, the different options are related to the scope of the operational approval. Apart from the baseline option (Option 0), two main categories of options were considered:

— two options defining the scope of the operational approval based on characteristics of the EFB applications used;

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— one option introducing a framework approval for the use of EFBs which would recognise the capability of the operator to appropriately manage an EFB programme.

The impacts of the different options were analysed and the option introducing an operational approval for the use of type B EFB applications has been selected as the most appropriate for the following reasons:

— It ensures the easiest transition from the current situation;

— It ensures compliance with the ICAO Annex 6 SARPs; and

— It addresses all the identified risks associated with the use of EFBs.

With regard to NCC/SPO with CMPA, apart from Option 0, four other options have been defined. Three of them are related to the transposition of parts of AMC 20-25, with a different scope for each of them. The fourth option is about providing the operator with some tools to easily identify the applicable provisions by establishing a table of applicability with provisions applicable for CAT.

After assessment of the impacts of the different options, the option related to the transposition of the hardware provisions, the software provisions for type B EFB applications and Chapter 7 of AMC 20-25 has been selected as the most appropriate option, for the following reasons:

— It provides proportionate requirements which are also consistent with the equivalent ones for CAT;

— It addresses all the identified risks associated with the use of EFBs; and

— It ensures compliance with the ICAO Annex 6 SARPs.

With regard to NCO, considering the characteristics of the operations, only two options were defined: the 'do nothing' option, and the introduction of EFB provisions to address the specific risks related to the use of EFBs by NCO operators and to ensure compliance with the ICAO SARPs.

This second option was selected by the group consulted during the technical consultation as the most appropriate one to reach the defined objectives. It ensures that proportionate requirements are defined, while addressing the risks entailed by the use of EFBs by NCO operators and allowing compliance with the ICAO Annex 6 Part II SARPs.

2.4. Overview of the proposed amendments

(1) With regard to CAT operations, the main changes are the introduction of an operational approval for the use of EFBs by CAT operators and the transposition of the OPS elements of AMC 20-25 into AMC to Part-CAT and Part-SPA.

As the scope of the operational approval depends on the type of the EFB application, some provisions, and especially those related to the hardware, have been separated from the provisions linked with the approval. Indeed, even if it is considered unlikely, an operator may use an EFB without any type B EFB applications, so therefore the hardware requirements need to be applicable in all cases. As a consequence, the hardware requirements were introduced into Part-CAT, while the provisions related to the approval were introduced into Part-SPA.

The new AMC to Part-CAT and Part-SPA that are being introduced are all transpositions of AMC 20-25 with only limited changes.

2.4.1. Annex I (Definitions)

The following changes are proposed:

(2) The introduction of new EFB-related definitions transposed from AMC 20-25 (for airport moving map displays (AMMD), controlled portable electronic devices (C-PEDs), EFB system, EFB host platform, portable EFBs, installed EFBs, EFB installed resources and viewable stowage).

2.4.2. Annex II (Part-ARO)

The following changes are proposed:

(3) The introduction of a specific approval for the use of type B EFB applications into the operations specification template.

2.4.3. Annex IV (Part-CAT)

The following changes are proposed:

(4) The introduction of a new IR related to the use of EFBs. This IR is mostly focused on the hardware part of the EFB, but also specifies that an approval in accordance with Part-SPA is required for the use of EFB applications that may have an adverse effect on the safe operation of an aircraft.

(5) The introduction of new AMC to the new IR. These AMC are all transpositions with only minor changes to the related content of AMC 20-25 (for hardware provisions and the classification of EFB applications).

2.4.4. Annex V (Part-SPA)

The following changes are proposed:

(6) The introduction of a new Subpart M to Part-SPA, named SPA.EFB, including a new IR related to the approval of the use of EFB applications that may have an adverse effect on the safe operation of aeroplanes. This IR focuses on the risk assessment to be developed by the operator, on the human–machine interface (HMI) assessment to be performed by the operator, and on the procedures and training requirements to be established by the operator.

(7) The introduction of new AMC to the new IR. These AMC are all transpositions with limited changes to the related content of AMC 20-25 (in the areas of risk assessment, HMI assessment, procedures and training). The main changes to the initial text of AMC 20-25 are the following:

— The introduction of provisions for the use of commercial off-the-shelf global navigation satellite system (COTS GNSS) receivers with AMMD applications;

— A clarification of the provisions related to the management of changes to EFBs;

— A clarification of the operational evaluation test provisions; and

— The introduction of new provisions for in-flight weather applications.

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2.4.5. Annex VI (Part-NCC)

The following changes are proposed:

(8) The introduction of a new IR related to the use of EFBs. This IR deals with the hardware part of EFBs, but also with the risk assessment to be developed by the operator and with the procedures and training requirements to be defined by the operator.

(9) The introduction of new AMC to the new IR:

— All the AMC related to the hardware and software classification parts refer to the related CAT AMC;

— A new AMC related to the risk assessment part has been developed. It is mostly based on the one for CAT with some additions related to the human factors aspects to be considered in the operator's risk assessment;

— A new AMC with provisions related to the management of the EFB programme by the operator has been introduced;

— A new AMC related to the procedures to be defined by the operator has been introduced;

— A new AMC related to flight crew training considerations has been introduced;

— New AMC related to the use of some specific type B EFB applications have been introduced. Those provisions are identical to the ones for CAT.

2.4.6. Annex VII (Part-NCO)

The following changes are proposed:

(10) An amendment of the existing IR related to portable electronic devices (PEDs) to align it with the ICAO provisions.

(11) Two new AMC related to EFB hardware and to EFB functions have been introduced.

(12) A new GM related to the loose equipment hazard has been introduced.

2.4.7. Annex VIII (Part-SPO)

The following changes are proposed:

(13) The introduction of a new IR related to the use of EFBs. This IR deals with the hardware part of EFBs, but also with the risk assessment to be developed by the operator and with the procedures and training requirements to be defined by the operator.

(14) The introduction of new AMC to the new IR:

— The two new AMC for complex aircraft related to the hardware and software classification parts refer to the related CAT AMC and to the related NCO AMC;

— A new AMC related to the risk assessment part has been developed. It is mostly based on the one for CAT with some additions related to the human factors aspects to be considered in the operator's risk assessment;

— A new AMC with provisions related to the management of an EFB programme by the operator has been introduced;

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— A new AMC related to the procedures to be defined by the operator has been introduced;

— A new AMC related to flight crew training considerations has been introduced;

— New AMC related to the use of some specific type B EFB applications have been introduced. Those provisions are identical to the ones for CAT.

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3. Proposed amendments

The text of the amendment is arranged to show deleted text, new or amended text as shown below:

(a) deleted text is marked with ~~strike through~~;

(b) new or amended text is highlighted in grey;

(c) an ellipsis '[…]' indicates that the remaining text is unchanged.

3.1. Draft Regulation (Draft EASA Opinion)

3.1.1. Annex I (Definitions)

Annex I

Definitions and terms used in Annexes II to VIII

[…]

'Airport moving map display (AMMD)' means a software application displaying airport maps and using a navigation source to depict the aircraft current position on this map while on ground;

[…]

'Controlled portable electronic device (C-PED)' means a PED subject to administrative control by the operator using it. This includes, inter alia, tracking the allocation of the devices to specific aircraft or persons and ensuring that no unauthorised changes are made to the hardware, software, or databases;

[…]

'EFB host platform' means, when considering an EFB system, the equipment (i.e. hardware) in which the computing capabilities and basic software (e.g. operating system, input/output software) reside;

'EFB installed resources' means certified EFB hardware components external to the EFB host platform itself, such as input/output components (installed remote display, keyboard, pointing device, switches, etc.) or a docking station;

'EFB mounting device': an EFB mounting device is an aircraft certified part which secures a portable or installed EFB, or EFB system components;

'EFB system' means the hardware (including any battery, connectivity provisions, I/O devices) and software (including databases) needed to support the intended EFB function(s);

'EFB system supplier': the company responsible for developing, or for having developed, the EFB system or part of it. The EFB system supplier is not necessarily a host platform or aircraft manufacturer;

'Human–machine interface (HMI)': an HMI is a component of certain devices that is capable of handling human–machine interactions. The interface consists of hardware and software that allow user inputs to be interpreted and processed by machines or systems that, in turn, provide the required result to the user;

'Installed EFB' means an EFB host platform installed in the aircraft, capable of hosting type A and/or type B EFB applications. It may also host certified applications. It is considered as an aircraft part, covered, thus, by the aircraft airworthiness approval;

'Miscellaneous (non-EFB) software applications': miscellaneous software applications are non-EFB applications, supporting function(s) not directly related to operations conducted by the flight crew on the aircraft;

'Portable EFB' means a portable EFB host platform, used on the flight deck, which is not part of the certified aircraft configuration;

'Transmitting PED (T-PED)': a portable electronic device (PED) that has intentional radio frequency (RF) transmission capabilities;

'Viewable stowage' means a non-certified device that is secured on the flight crew (e.g. kneeboard) or in/to an existing aircraft part (e.g. suction cups) with the intended function to hold charts or to hold acceptable low-mass portable devices viewable to the flight crew at their assigned duty station.

3.1.2. Annex II (Part-ARO)

Appendix II

OPERATIONS SPECIFICATIONS (subject to the approved conditions in the operations manual)				
Issuing authority contact details Telephone[1]: ____________________; Fax: ____________________; E-mail: ____________________				
AOC[2]: Operator name[3]: Date[4]: Signature: Dba trading name Operations specifications#:				
Aircraft model[5]: Registration marks[6]:				
Types of operations: Commercial air transport ☐ Passengers ☐ Cargo ☐Others[7]: ______				
Area of operation[8]:				
Special limitations[9]:				
Specific approvals:	Yes	No	Specification[10]	Remarks
Dangerous goods	☐	☐		
Low-visibility operations Take-off Approach and landing	☐	☐	CAT[11] .... RVR[12]: m DA/H: ft RVR: m	

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RVSM[13] ☐ N/A	☐	☐		
ETOPS[14]☐ N/A	☐	☐	Maximum diversion time[15]: min.	
Complex navigation specifications for PBN operations[16]	☐	☐		[17]
Minimum navigation performance specification	☐	☐		
Single-engined turbine aeroplane operations at night or in IMC (SET-IMC)	☐	☐	[22]	
Helicopter operations with the aid of night-vision imaging systems	☐	☐		
Helicopter hoist operations	☐	☐		
Helicopter emergency medical service operations	☐	☐		
Helicopter offshore operations	☐	☐		
Cabin crew training[18]	☐	☐		
Issue of CC attestation[19]	☐	☐		
Use of type B EFB applications	☐	☐	[23]	
Continuing airworthiness	☐	☐	[20]	
Others[21]				

1. Telephone and fax contact details of the competent authority, including the country code. E-mail to be provided if available.

2. Insertion of associated air operator certificate (AOC) number.

3. Insertion of the operator's registered name and the operator's trading name, if different. Insert 'Dba' (for 'Doing business as') before the trading name.

4. Issue date of the operations specifications (dd-mm-yyyy) and signature of the competent authority representative.

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5. Insertion of ICAO designation of the aircraft make, model and series, or master series, if a series has been designated (e.g. Boeing-737-3K2 or Boeing-777-232).

6. The registration marks are either listed in the operations specifications or in the operations manual. In the latter case, the related operations specifications must make a reference to the related page in the operations manual. If not all specific approvals apply to the aircraft model, the registration marks of the aircraft could be entered in the remark column to the related specific approval.

7. Any other type of transportation to be specified (e.g. emergency medical services).

8. Listing of geographical area(s) of authorised operation (by geographical coordinates or specific routes, flight information region or national or regional boundaries).

9. Listing of applicable special limitations (e.g. VFR only, day only, etc.).

10. List in this column the most permissive criteria for each approval or the approval type (with appropriate criteria).

11. Insertion of applicable precision approach category: LTS CAT I, CAT II, OTS CAT II, CAT IIIA, CAT IIIB or CAT IIIC. Insertion of minimum runway visual range (RVR) in meters and decision height (DH) in feet. One line is used per listed approach category.

12. Insertion of approved minimum take-off RVR in metres. One line per approval may be used if different approvals are granted.

13. Not Applicable (N/A) box may be checked only if the aircraft maximum ceiling is below FL290.

14. Extended range operations (ETOPS) currently applies only to two-engined aircraft. Therefore, the Not Applicable (N/A) box may be checked if the aircraft model has more or less than two engines.

15. The threshold distance may also be listed (in NM), as well as the engine type.

16. Performance-based navigation (PBN): one line is used for each complex PBN-specific approval (e.g. RNP AR APCH), with appropriate limitations listed in the 'Specifications' and/or 'Remarks' columns. Procedure-specific approvals of specific RNP AR APCH procedures may be listed in the operations specifications or in the operations manual. In the latter case, the related operations specifications should have a reference to the related page in the operations manual.

17. Specify if the specific approval is limited to certain runway ends and/or aerodromes.

18. Approval to conduct the training course and examination to be completed by applicants for a cabin crew attestation as specified in Annex V (Part-CC) to Commission Regulation (EU) No 1178/2011.

19. Approval to issue cabin crew attestations as specified in Annex V (Part-CC) to Commission Regulation (EU) No 1178/2011.

20. The name of the person/organisation responsible for ensuring that the continuing airworthiness of the aircraft is maintained and a reference to the regulation that requires the work, i.e. Annex I (Part-M), Subpart G to Commission Regulation (EU) No 1321/2014.

21. Other approvals or data can be entered here, using one line (or one multi-line block) per authorisation (e.g. short landing operations, steep approach operations, helicopter operations to/from a public interest site, helicopter operations over a hostile environment located outside a congested area, helicopter operations without a safe forced-landing capability, operations with increased bank angles, maximum distance from an adequate aerodrome for two-engined aeroplanes without an ETOPS approval, aircraft used for non-commercial operations).

22. Insertion of the particular airframe/engine combination.

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23. Insertion of the list of type B EFB applications together with the reference of the EFB hardware. Either this list is contained in the operations specifications or in the operations manual. In the latter case, the related operations specifications must make a reference to the related page in the operations manual.

3.1.3. Annex IV (Part-CAT)

SUBPART A — GENERAL REQUIREMENTS

[…]

SECTION 1 — MOTOR-POWERED AIRCRAFT

[…]

CAT.GEN.MPA.141 Use of electronic flight bags (EFBs)

(a) Where an EFB is used on-board an aircraft, the operator shall ensure that it does not adversely affect the performance of the aircraft systems or equipment, or the ability to operate the aeroplane.

(b) The operator shall not use an EFB application which may have an adverse effect on the safe operation of an aircraft, unless approved in accordance with Subpart M of Annex V (Part-SPA).

3.1.4. Annex V (Part-SPA)

SUBPART M — ELECTRONIC FLIGHT BAGS

SPA.EFB.100 Use of electronic flight bags (EFBs) — operational approval

(a) An operator shall only use an EFB application which may have an adverse effect on the safe operation of an aircraft if the operator has been granted an approval by the competent authority for such use.

(b) In order to obtain an operational approval from the competent authority for the use of such an EFB application, the operator shall provide evidence that:

(1) a risk assessment related to the use of the devices and the EFB application and its associated function(s) has been conducted, identifying the associated risks and ensuring that they are appropriately managed and mitigated;

(2) the human–machine interfaces of the EFB devices and the EFB application have been assessed against human factors principles; and

(3) it has established an EFB administration system and that procedures and training requirements for the administration and use of the devices and the EFB application have been established and implemented.

This demonstration shall be specific to the EFB application and the hardware involved.

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3.1.5. Annex VI (Part-NCC)

SUBPART A — GENERAL REQUIREMENTS

NCC.GEN.131 Use of electronic flight bags (EFBs)

(a) Where an EFB is used on-board an aircraft, the operator shall ensure that it does not adversely affect the performance of the aircraft systems or equipment, or the ability to operate the aeroplane.

(b) Prior to using an EFB with applications which may have an adverse effect on the safe operation of an aircraft, the operator shall:

(1) conduct a risk assessment related to the use of the devices and the EFB applications concerned and associated function(s), identifying the associated risks and ensuring that they are appropriately managed and mitigated; the risk assessment shall address risks associated with the human–machine interface of the EFB device and the EFB applications concerned; and

(2) establish an EFB administration system, including procedures and training requirements for the administration and use of the devices.

3.1.6. Annex VII (Part-NCO)

SUBPART A — GENERAL REQUIREMENTS

NCO.GEN.125 Portable electronic devices

The pilot-in-command shall not permit any person to use a portable electronic device (PED), including an electronic flight bag (EFB), on board an aircraft that could adversely affect the performance of the aircraft's systems and equipment or the ability to operate it.

3.1.7. Annex VIII (Part-SPO)

SUBPART A — GENERAL REQUIREMENTS

SPO.GEN.131 Use of electronic flight bags (EFBs)

(a) Where an EFB is used on-board an aircraft, the operator shall ensure that it does not adversely affect the performance of the aircraft systems or equipment, or the ability to operate the aircraft.

(b) Prior to using an EFB with applications which may have an adverse effect on the safe operation of an aircraft, the operator shall:

(1) conduct a risk assessment related to the use of the devices, the EFB applications concerned and their associated function(s), identifying the associated risks and ensuring that they are appropriately mitigated; the risk assessment shall address risks associated with the human–machine interface of the EFB device and the EFB applications concerned; and

(2) establish an EFB administration system, including procedures and training requirements for the administration and use of the devices and the EFB application.

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3.2. Draft Acceptable Means of Compliance and Guidance Material (Draft EASA Decision)

3.2.1. Draft AMC and GM to Part-CAT

AMC1 CAT.GEN.MPA.140 Portable electronic devices
TECHNICAL PREREQUISITES FOR THE USE OF PEDS

[…]

(d) Demonstration of electromagnetic compatibility

[…]

(2) Alternative EMI assessment of controlled PEDs (C-PEDs)

(i) For front door coupling:

(A) C-PEDs should comply with the levels as defined by:

(a) EUROCAE/RTCA, 'Environmental conditions and test procedures for airborne equipment', ED-14D/RTCA DO-160D (or later revisions), Section 21, Category M, for operation in the passenger compartment and the flight crew compartment; and

(b) EUROCAE ED-14~~E~~D/RTCA DO-160~~E~~D (or later revisions), Section 21, Category H, for operation in areas not accessible during the flight.

(B) If the C-PEDs are electronic flight bags used in the flight crew compartment and if the DO-160 testing described in (A) identifies inadequate margins for interference or has not been performed, it is necessary to test the C-PED in each aircraft model in which it will be operated. The C-PED should be tested in operation on the aircraft to show that no interference with aircraft equipment occurs. This testing should be conducted in an actual aircraft during non-revenue flights, and credit may be given to other similarly equipped aircraft of the same make and model as the one tested.~~, an alternative compliance method described in EASA, 'General acceptable means of compliance for airworthiness of products, part and appliances', AMC-20, AMC 20-25 ('Airworthiness and operational considerations for electronic flight bags'), may be used.~~

(ii) ~~For~~ To address back door coupling susceptibility for C-PEDs with transmitting capabilities, the EMI assessment described in (1)(ii) should be performed.

[…]

GM1 CAT.GEN.MPA.140 Portable electronic devices
DEFINITIONS

(a) Definitions and categories of PEDs

[...]

~~(b) Controlled PEDs (C-PEDs)~~

~~A controlled PED (C-PED) is a PED subject to administrative control by the operator using it. This will include, inter alia, tracking the allocation of the devices to specific aircraft or persons and ensuring that no unauthorised changes are made to the hardware, software or databases. C-PEDs can be assigned to the category of non-intentional transmitters or T-PEDs.~~

(b~~c~~) Cargo tracking device

A cargo tracking device is a PED attached to or included in airfreight (e.g. in or on containers, pallets, parcels or baggage). Cargo tracking devices can be assigned to the category of unintentional transmitters or transmitting PEDs (T-PEDs). If the device is a T-PED, it should comply with the European Norms (EN) for transmissions.

(c~~d~~) Definition of the switched-off status

Many PEDs are not completely disconnected from the internal power source when switched off. The switching function may leave some remaining functionality e.g. data storage, timer, clock, etc. These devices can be considered switched off when in the deactivated status. The same applies to devices having no transmitting capability that are operated by coin cells without further deactivation capability, e.g. wrist watches.

(d~~e~~) Electromagnetic interference (EMI)

The two classes of EMI to be addressed can be described as follows:

(1) Front door coupling is the possible disturbance to an aircraft system that is received by the antenna of the system and is mainly in the frequency band used by the system. Any PED internal oscillator has the potential to radiate low-level signals in the aviation frequency bands. Due to this disturbance, especially the instrument landing system (ILS) and the VHF omnirange (VOR) navigation system may indicate erroneous information.

(2) Back door coupling is the possible disturbance of aircraft systems by electromagnetic fields generated by transmitters at a level which could exceed at short distance (i.e. within the aircraft) the electromagnetic field level used for the aircraft system certification testing. This disturbance may then lead to system malfunctions.

GM1 CAT.GEN.MPA.141 Use of electronic flight bags (EFBs)
DEFINITIONS

For the purpose of EFBs, the following definitions apply:

(a) Aircraft administrative communications (AAC):

AAC are defined by ICAO as non-safety communications used by aeronautical operating agencies related to the business aspects of operating their flights and transport services. This communication is used for a variety of purposes, such as flight and ground transportation, bookings, deployment of crew and aircraft or any other logistical purposes that maintain or enhance the efficiency of overall flight operation. AAC data links receive/transmit information that includes but is not limited to the support of EFB applications.

(b) Aeronautical operational communications (AOC):

AOC are defined in ICAO as communications required for the exercise of authority over the initiation, continuation, diversion or termination of flight for safety, regularity and efficiency reasons.

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(c) Minor failure conditions:

Failure conditions which would not significantly reduce aeroplane safety, and which involve crew actions that are well within their capabilities. Minor failure conditions may include, for example, a slight reduction in safety margins or functional capabilities, a slight increase in crew workload, such as routine flight plan changes, or some physical discomfort to passengers or cabin crew. Further guidance can be found in AMC 25.1309.

GM2 CAT.GEN.MPA.141 Use of electronic flight bags (EFBs)
BACKGROUND INFORMATION

Further related information on EFB hardware and EFB applications can be found in the following documents:

(a) EASA AMC 20-25 Airworthiness considerations for EFBs;

(b) EASA AMC 25.1309 System Design and Analysis;

(c) EUROCAE ED-14D/DO-160D (or later revisions) Environmental Conditions and Test Procedures for Airborne Equipment;

(d) EASA ETSO-C165A Electronic Map Systems for Graphical Depiction of Aircraft Position;

(e) FAA AC 120-76() Authorization for an Electronic Flight Bag Program;

(f) FAA AC 120-78 Acceptance and use of Electronic Signatures;

(g) ICAO Doc 10020 Manual of Electronic Flight Bags (EFBs).

AMC1 CAT.GEN.MPA.141(a) Use of electronic flight bags (EFBs)
HARDWARE

Before using a portable EFB, the following considerations should be assessed by the operator:

(a) General

A portable EFB is a portable electronic device (PED) and may host type A and/or type B EFB software applications. In addition, it may host miscellaneous (non-EFB) software applications. Portable EFBs are controlled PEDs (C-PEDs).

A portable EFB should be capable of operation autonomously inside and outside the aircraft.

The mass, dimensions, shape and position of the portable EFB should not compromise flight safety.

The power supply of a portable EFB may be provided from aircraft sources through an adequate power source.

If mounted or stowed, the portable EFB should be easily removable from its mounting device/viewable stowage device or attached to it, without the use of tools by the flight crew. The attachment or removal should not constitute a maintenance action.

A portable EFB may be part of a system containing installed EFB resources which are part of the certified aircraft configuration. The intended functions of the installed EFB components may be to mount the EFB to the aircraft and/or connect it to other systems.

Portable EFBs may be used in all phases of the flight if secured to a certified mount or securely attached to a viewable stowage device in a manner which allows its normal use.

Portable EFBs not meeting the above characteristics should be stowed during critical phases of the flight.

Any EFB component that is either not accessible in the flight crew compartment by the flight crew members or not removable by the flight crew members should be installed as 'certified equipment' covered by a type certificate (TC), change to TC or supplemental (S)TC.

(b) Characteristics and placement of the EFB display

For a portable EFB, the considerations on the location of the display proposed below should apply at the proposed location of the display when the EFB is in use.

The EFB display and any other element of the EFB system should be placed in such a way that they do not unduly impair the flight crew's external view during any of the phases of the flight. Equally, they should not impair the view of or access to any flight crew compartment control or instrument.

The location of the display unit and the other EFB system elements should be assessed for impact on egress requirements.

When the EFB is in use (intended to be viewed or controlled), its display should be within 90 degrees on either side of each flight crew member's line of sight.

Glare and reflection on the EFB display should not interfere with the normal duties of the flight crew.

(c) Power source

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

(d) EFB data connectivity

Portable EFBs having data connectivity to aircraft systems, either wired or wireless, may receive or transmit data to and from aircraft systems, provided the connection (hardware and software for data connection provisions) and adequate interface protection devices are incorporated into the aircraft type design.

A portable EFB may receive any data from aircraft systems, but data transmission from EFBs should be limited to aircraft systems that have been certified for this intended purpose (refer to AMC 20-25 for more details).

(e) External connecting cables (to avionics and/or power sources)

When external cables are used to connect a portable EFB to the aircraft systems and/or to a power source, the following should apply:

(1) cables should not hang loosely in a way that compromises task performance and safety; flight crew members should be able to easily secure the cables out of the way during operations (e.g. cable tether straps); and

(2) cables should be of sufficient length in order not to obstruct the use of any movable device (e.g. flight controls, switches, seats, windows) in the flight crew compartment.

(f) Electromagnetic interference (EMI) demonstrations

See paragraph (b), (c) and (d) of AMC1 CAT.GEN.MPA.140.

The EMI demonstration should cover any cable connected to the EFB as well as non-certified power chargers.

(g) Batteries

See paragraph (f) of AMC1 CAT.GEN.MPA.140.

(h) Viewable stowage

The evaluation of the viewable stowage should be performed for a given location in the flight deck. This location should be documented and this information should be part of the EFB policy.

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

(1) The viewable stowage and associated mechanisms should not impede the flight crew members in the performance of any task (whether normal, abnormal, or emergency) associated with operating any aircraft system;

(2) When the viewable stowage is used to secure an EFB display, it should be able to be locked in position easily. If necessary, the selection of positions should be adjustable enough to accommodate a range of flight crew member preferences. In addition, the range of available movement should accommodate the expected range of users' physical abilities (i.e. anthropometric constraints). Locking mechanisms should be of a low-wear type that will minimise slippage even after extended periods of normal use;

(3) Crashworthiness considerations should be taken into account in the design of this device. This includes the appropriate restraint of any device when in use;

(4) A provision should be available to secure or lock the device in a position out of the way of flight crew operations when not in use. When stowed, the device and its securing mechanism should not intrude into the flight crew compartment space to the extent that they cause either visual or physical obstruction of flight controls/displays and/or ingress/egress routes;

(5) Possible mechanical interference issues of the viewable stowage, either on the side panel (side stick controller) or on the control yoke in terms of full and free movement under all operating conditions and non-interference with buckles, etc., should be prevented;

(6) Adequate means should be provided (e.g. hardware or software) to shut down the portable EFB when its controls are not accessible by the flight crew members when strapped in the normal seated position; and

(7) The viewable stowage device should be easily removable from the aircraft without the use of tools.

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Some types of viewable stowage securing means may have characteristics that degrade noticeably with ageing or due to various environmental factors. In that case, the documentation should include procedures (e.g. crew procedures, checks, or maintenance actions) to ensure that the stowage characteristics remain within acceptable limits for the proposed operations. Securing means based on vacuums (e.g. suction cups) have holding capacities that decrease with pressure. It should be demonstrated that they will still perform their intended function at operating cabin altitudes or in case of rapid depressurisation.

In addition, it should be demonstrated that if the EFB moves or is separated from its stowage, or if the viewable stowage is unsecured from the aircraft (as a result of turbulence, manoeuvring, or other action), it will not jam flight controls, damage flight deck equipment, or injure flight crew members.

AMC1 CAT.GEN.MPA.141(b) Use of electronic flight bags (EFBs)
APPLICATION CLASSIFICATION

An EFB software application is a non-certified application installed on an EFB system that allows specific operational functions. The classification of the applications, based on their respective safety effects, is intended to provide clear divisions among such applications and, therefore, the assessment process applied to each.
For the purpose of the following definitions, ‘malfunction or misuse’ means any failure, malfunction of the application, or design-related human errors that can be reasonably expected in service.
The following two classes of EFB applications are defined:

(a) Type A application

Type A applications are EFB applications whose malfunction or misuse has no safety effect.

(b) Type B application

Type B applications are EFB applications which may have an adverse effect on the safe operation of an aircraft.

They are applications:

(1) whose malfunction or misuse is limited to a minor failure condition; and

(2) which neither substitute nor duplicate any system or functionality required by airworthiness regulations, airspace requirements, or operational rules .

Examples of type A and type B EFB applications can be found in AMC2 CAT.GEN.MPA.141(b) and AMC3 CAT.GEN.MPA.141(b).

(c) Determination of an application type:

AMC2 CAT.GEN.MPA.141(b) and AMC3 CAT.GEN.MPA.141(b) may be used for justifying a classification, provided that the application does not feature design or functional novelties introducing new ways of interaction or unusual procedures.

An application may also be recognised as a type A or type B EFB application through an appropriate ETSO authorisation granted by the Agency.

If an application is not listed in AMC2 and AMC3 to CAT.GEN.MPA.141(b), presents a high degree of novelty, or is not covered by an ETSO authorisation, the classification should be established using the definitions and criteria provided hereafter.

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As a first step, it should be verified that the application does not belong to the following list of applications that are not eligible for classification as either type A or B:

Applications:

(1) displaying information which may be tactically used by the flight crew members to check, control or deduce the aircraft position or trajectory, either to follow the intended navigation route or to avoid adverse weather, obstacles or in-flight traffic;

(2) displaying information which may be directly used by the flight crew members to assess the real-time status of aircraft critical and essential systems, as a replacement for existing installed avionics, and/or to manage aircraft critical and essential systems following a failure;

(3) communications with air traffic services;

(4) sending data to the certified aircraft systems other than the certified EFB installed resources.

Then, this process should:

(1) identify any failure conditions resulting from potential losses of function or malfunction (detected and undetected erroneous output) with consideration of any relevant factors (e.g. aircraft/system failures, operational or environmental conditions) and established mitigation (e.g. flight crew procedures, flight crew training) which would intensify or alleviate the effects; and

(2) classify the failure conditions according to the severity of their effects (using the AMC 25.1309 definitions).

Software applications with failure conditions classified more severe than minor are ineligible as EFB type A or B applications.

Notes:

— The severity of the failure conditions linked to displaying a function already existing in the certified type design, or already authorised through an ETSO, and used with same concept of operation, cannot be less than already assessed for this function;

— The data resulting from this process may be reused by the operators in the context of the EFB risk assessment process.

(d) Miscellaneous (non-EFB) software applications

Miscellaneous software applications are non-EFB applications, supporting function(s) not directly related to operations conducted by the flight crew on the aircraft.

The configuration of those applications (e.g. application updates, installation of new applications) should be managed by the EFB administrator.

Examples of miscellaneous software applications are web browsers (not used for operational purposes), e-mail clients, picture management applications, or even applications used by ground crews (e.g. for maintenance purposes).

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AMC2 CAT.GEN.MPA.141(b) Use of electronic flight bags (EFBs)
TYPICAL TYPE A EFB APPLICATIONS

Type A EFB applications might typically be but are not limited to:

(a) browsers displaying:

(1) the certificates and other documents required to be carried by the applicable operational regulations, including digitally created documents such as:

(i) the certificate of registration;

(ii) the certificate of airworthiness (CofA);

(iii) the noise certificate, and its English translation if applicable;

(iv) the air operator certificate (AOC);

(v) the operations specifications relevant to the aircraft type, issued with the AOC; and

(vi) the third-party liability insurance certificate(s);

(2) some manuals and additional information and forms required to be carried by the applicable operational regulations such as:

(i) notifications of special categories of passenger (SCPs) and special loads; and

(ii) passenger and cargo manifests, if applicable; and

(3) other information within the operator's aircraft library such as:

(i) airport diversion policy guidance, including a list of special designated airports and/or approved airports with emergency medical service (EMS) support facilities;

(ii) maintenance manuals;

(iii) emergency response guidance for aircraft incidents involving dangerous goods (see ICAO Doc 9481-AN/928);

(iv) aircraft parts manuals;

(v) service bulletins/published airworthiness directives, etc.;

(vi) current fuel prices at various airports;

(vii) trip scheduling and bid lists;

(viii) passenger information requests;

(ix) check airman and flight instructor records; and

(x) flight crew currency requirements;

(b) interactive applications for crew rest calculation in the framework of flight time limitations;

(c) interactive forms to comply with the reporting requirements of the competent authority and the operator;

(d) applications that make use of the aircraft administrative communications (AAC) to collect, process and then disseminate data that has no effect on the safe operation of an aircraft.

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AMC3 CAT.GEN.MPA.141(b) Use of electronic flight bags (EFBs)
TYPICAL TYPE B EFB APPLICATIONS

A non-exhaustive list of possible type B EFB applications is provided below. It includes:

(a) Document browsers displaying the manuals and additional information and forms, required to be carried by regulations, such as:

(1) the operations manual (including the minimum equipment list (MEL) and configuration deviation list (CDL));

(2) the aircraft flight manual;

(3) the operational flight plan;

(4) the aircraft continuing airworthiness records, including the technical log (flight crew view thereof);

(5) meteorological information with graphical interpretation;

(6) air traffic services (ATS) flight plan;

(7) notices to airmen (NOTAMs) and aeronautical information service (AIS) briefing documentation.

(b) Electronic aeronautical chart applications including en-route, area, approach, and airport surface maps; these applications may offer features such as panning, zooming, scrolling, and rotation, centring and page turning, but without a display of aircraft/own-ship position, except in the specific case of day VFR operations only.

(c) Airport moving map displays (AMMD) applications that comply with the means set forth in Part-SPA, in particular with ETSO-C165a.

(d) Applications that make use of the aircraft operational communications (AOC) to collect, process and then disseminate operational data.

(e) Cabin-mounted video and aircraft exterior surveillance camera displays.

(f) Aircraft performance calculation applications that use algorithmic data or calculate using software algorithms to provide:

(1) take-off, en-route, approach and landing, missed approach, etc., performance calculations providing limiting masses, distances, times and/or speeds;

(2) power settings, including reduced take-off thrust settings.

(g) Mass and balance calculation applications used to establish the mass and centre of gravity of the aircraft and to determine that the load and its distribution is such that the mass and balance limits of the aircraft are not exceeded.

(h) Applications providing in-flight weather information.

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GM3 CAT.GEN.MPA.141(b) Use of electronic flight bags (EFBs)
HMI FOR TYPE A EFB APPLICATIONS

An HMI assessment is not required for a type A EFB application. However, type A EFB applications should be designed in accordance with human factor principles in order to minimise their impacts on crew workload.

3.2.2. Draft AMC and GM to Part-SPA

AMC1 SPA.EFB.100(b) Use of electronic flight bags (EFBs) — operational approval
SUITABILITY OF THE HARDWARE

(a) Placement of the display

In addition, consideration should be given to the potential for confusion that could result from the presentation of relative directions when the EFB is positioned in an orientation inconsistent with that information. For example, it may be misleading if the aircraft heading indicator points to the top of the display and the display is not aligned with the aircraft longitudinal axis. This does not apply to charts that are presented in a static way (e.g. with no human–machine interface (HMI) mechanisation such as automatic repositioning), and that can be considered as similar to paper charts.

(b) Display characteristics

Consideration should be given to the long-term degradation of a display as a result of abrasion and ageing. AMC 25-11 (paragraph 3.16a) may be used as appropriate guidance material to assess luminance and legibility aspects.

Information displayed on the EFB should be legible to the typical user at the intended viewing distance(s) and under the full range of lighting conditions expected in a flight crew compartment, including use in direct sunlight.

Users should be able to adjust the screen brightness of an EFB independently of the brightness of other displays in the flight crew compartment. In addition, when incorporating an automatic brightness adjustment, it should operate independently for each EFB in the flight crew compartment. Brightness adjustment using software means may be acceptable provided that this operation does not adversely affect the crew workload.

Buttons and labels should have adequate illumination for night use. 'Buttons and labels' refers to hardware controls located on the display itself.

All controls should be properly labelled for their intended function.

The 90-degree viewing angle on either side of each flight crew member's line of sight may be unacceptable for certain EFB applications if aspects of the display quality are degraded at large viewing angles (e.g. the display colours wash out or the displayed colour contrast is not discernible at the installation viewing angle).

(c) Power source

The design of a portable EFB system should consider the source of electrical power, the independence of the power sources for multiple EFBs, and the potential need for an independent battery source. A non-exhaustive list of factors to be considered includes:

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(1) the possibility to adopt operational procedures to ensure an adequate level of safety (for example, a minimum level of charge at preflight);

(2) the possible redundancy of portable EFBs to reduce the risk of exhausted batteries;

(3) the availability of backup battery packs to assure an alternative source of power.

Battery-powered EFBs that have aircraft power available for recharging the internal EFB batteries are considered to have a suitable backup power source.

For EFBs that have an internal battery power source and that are used in place of paper documentation required by the operating rules, the operator should either have at least one EFB connected to an aircraft power bus or established and documented mitigation means and procedures to ensure that sufficient power will be available during the whole flight with acceptable margins.

(d) Environmental testing

Environmental testing, in particular testing for rapid depressurisation, should be performed when the EFB hosts applications that are required to be used during flight following a rapid depressurisation and/or when the EFB environmental operational range is potentially insufficient with respect to the foreseeable flight crew compartment operating conditions.

The information from the rapid depressurisation test of an EFB is used to establish the procedural requirements for the use of that EFB device in a pressurised aircraft. Rapid decompression testing should follow the EUROCAE ED-14D/RTCA DO-160D (or later revisions) guidelines for rapid decompression testing up to the maximum operating altitude of the aircraft on which the EFB is to be used. The EFB should be operative for at least 10 minutes after the start of the decompression.

(1) Pressurised aircraft: When a portable EFB has successfully completed rapid depressurisation testing, then no mitigating procedures for depressurisation events need to be developed. When a portable EFB has failed the rapid depressurisation testing while turned ON, but successfully completed it when OFF, then procedures should ensure that at least one EFB on board the aircraft remains OFF during the applicable flight phases or that it is configured so that no damage will be incurred should rapid decompression occur in flight above 10 000 ft above mean sea level (AMSL).

If an EFB system has not been tested or has failed the rapid depressurisation test, then alternate procedures or paper backup should be available.

(2) Non-pressurised aircraft: Rapid decompression testing is not required for an EFB used in a non-pressurised aircraft. The EFB should be demonstrated to reliably operate up to the maximum operating altitude of the aircraft. If EFB operation at the maximum operating altitude is not attainable, procedures should be established to preclude operation of the EFB above the maximum demonstrated EFB operational altitude while still maintaining availability of any required aeronautical information displayed on the EFB.

Testing done on a specific EFB model configuration may be applied to other aircraft installations and these generic environmental tests may not need to be duplicated. The operator should collect and retain:

(1) evidence of these tests that have already been accomplished; or

(2) suitable alternate procedures to deal with the total loss of the EFB system.

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Testing for rapid depressurisation does not need to be repeated when the EFB model identification and the battery type do not change.

The testing of operational EFBs should be avoided when possible to preclude the infliction of unknown damage to the unit during testing.

This testing is not equivalent to a full environmental qualification. Operators should account for the possible loss or erroneous functioning of the EFB in abnormal environmental conditions.

The safe stowage and the use of the EFB under any foreseeable flight crew compartment environmental conditions, including turbulence, should be evaluated.

AMC2 SPA.EFB.100(b) Use of electronic flight bags (EFBs) — operational approval
CHANGES

Modifications to an EFB system may have to be introduced either by the EFB system suppliers, the EFB applications developers, or by the operator itself.

Those modifications which:

(a) do not bring any change to the calculation algorithms of a type B EFB application;

(b) do not bring any change to the HMI of a type B EFB application that requires a change to the flight crew training programme or operational procedures;

(c) introduce a new type A EFB application or modify an existing one (provided its software classification remains type A);

(d) do not introduce any additional functionality to an existing type B EFB application; or

(e) update an existing database necessary to use an existing type B EFB application;

may be introduced by the operator without the need to be approved by its competent authority.

These changes should, nevertheless, be controlled and properly tested prior to use in flight.

The modifications in the following non-exhaustive list are considered to meet these criteria:

(a) operating system updates;

(b) chart or airport database updates;

(c) updates to introduce fixes (i.e. patches); and

(d) installation and modification of a type A EFB application.

For all other types of modification, the operator should apply the change management procedure approved by the competent authority in accordance with ARO.GEN.310(c). This includes the extension of the use of an EFB system, for which the operator already holds an approval, to another aircraft type of the operator's fleet.

AMC3 SPA.EFB.100(b) Use of electronic flight bags (EFBs)
OPERATIONAL EVALUATION TESTS

(a) The operator should conduct an operational evaluation test which should allow verification that the relevant provisions of SPA.EFB have been satisfied before a final decision is made on the operational use of the EFB.

The operator should notify its competent authority of its intention to conduct an operational evaluation test by sending a plan, which should contain at least the following information:

(1) the starting date of the operational evaluation test;

(2) the duration;

(3) the aircraft involved;

(4) the EFB hardware and type(s) of software(s);

(5) the EFB policy and procedure manual;

(5) for type B EFB applications, their EFB risk assessment; and

(6) for type B EFB applications without initial retention of a paper backup:

(i) a simulator line-oriented flight training (LOFT) session programme, and

(ii) proposed flights for the competent authority observation flights.

The operational evaluation test should consist of an in-service proving period no longer than 6 months. A reduction may be considered taking into account the following criteria:

(1) the operator's previous experience with EFBs;

(2) the intended use of the EFB system; and

(3) the mitigation means defined by the operator.

An operator wishing to reduce the 6-month operational evaluation test should provide its competent authority with the appropriate justification in its operational evaluation plan.

The competent authority may ask for an operational evaluation test lasting more than 6 months if the number of flights operated in this period is not considered sufficient to evaluate the EFB system.

The purpose of the in-service proving period is for the operator to demonstrate that an EFB system that hosts applications replacing paper documentation provides at least the levels of accessibility, usability and reliability required by the applicable operational requirements. In particular, the proving period should show that:

(1) the flight crew members are able to operate the EFB applications without reference to paper;

(2) the operator's administration procedures are in place and function correctly;

(3) the operator is capable of providing timely updates to the applications on the EFB, where a database is involved;

(4) the introduction of the EFB without paper backup does not adversely affect the operator's operating procedures and that alternative procedures for use when the EFB system is not available provide an acceptable equivalent;

(5) for a system including uncertified elements (hardware or software), that the system operates correctly and reliably; and

(6) the EFB risk assessment is adequate for the type of operations intended after the operational evaluation test (with or without paper backup).

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The results of the demonstration may be documented in the form of a report from the in-service proving period on the performance of the EFB system.

The operator may remove the paper backup once it has shown that the EFB system is sufficiently robust.

(b) For applications replacing paper documentation without any paper backup at commencement of operations, and other type B EFB applications.

Where an operator seeks to start operations without any paper backup, the operational evaluation test should include the following elements:

(1) a simulator LOFT session to verify the use of the EFB under operational conditions including normal, abnormal and emergency conditions; and

(2) observation by the competent authority of the initial operator's line flights.

The operator should demonstrate that it will be able to continue to maintain the EFB to the required standard.

(c) Final operational report

The operator should produce and retain a final operational report, which summarises all the activities conducted and the means of compliance used, supporting the operational use of the EFB system.

AMC4 SPA.EFB.100(b) Use of electronic flight bags (EFBs)
EFB APPLICATION WITH ETSO AUTHORISATION

EFB software applications may be approved by the Agency e.g. by means of an ETSO Authorisation. Such EFB applications are considered compliant with the requirements of SPA.EFB.100(b) that are covered in the approval scope, provided the EFB software is installed and used in conformity with its installation and operational instructions and limitations.

GM1 SPA.EFB.100(b) Use of electronic flight bags (EFBs) — operational approval
FINAL OPERATIONAL REPORT

An example of the typical items the operator may include in the final operational report is provided below:

(a) System description and classification of the EFB system:

(1) A general description of the proposed EFB system;

(2) The EFB system (hardware and software applications) proposed.

(b) Software applications:

(1) A list of the type A EFB applications installed;

(2) A list of the type B EFB applications installed;

(3) A list of the miscellaneous (non-EFB) software applications installed.

(c) Hardware:

For portable EFBs used without installed resources, relevant information or references for:

(1) the EMI compliance demonstration;

(2) the lithium battery compliance demonstration;

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(3) the depressurisation compliance demonstration; and

(4) details of the power source.

For portable EFBs served by installed resources:

(1) Details of the airworthiness approval for the mounting device;

(2) A description of the placement of the EFB display;

(3) Details of the use of installed resources;

(4) Information on the EMI compliance demonstration;

(5) Information on the lithium battery compliance demonstration;

(6) Information on the depressurisation compliance demonstration;

(7) Details of the power source;

(8) Details of any data connectivity.

For installed EFBs:

Details of the airworthiness approval as installed equipment.

(d) Certification documentation:

(1) EFB limitations contained within the AFM;

(2) Guidelines for EFB application developers; and

(3) Guidelines for EFB system suppliers.

(e) Specific considerations for performance applications:

Details of performance data validation conducted.

(f) Operational assessment:

(1) Details of the EFB risk assessment conducted;

(2) Details of the human–machine interface assessment conducted for type A and type B software applications;

(3) Details of flight crew operating procedures:

(i) procedures for using EFB systems with other flight crew compartment systems;

(ii) flight crew awareness of EFB software/database revisions;

(iii) procedures to mitigate and/or control workload; and

(iv) flight crew responsibilities for performance calculations.

(4) Details of proposed compliance monitoring oversight of the EFB system;

(5) Details of EFB system security measures;

(6) Details of EFB administration procedures, including provision of the EFB policy and procedures manual;

(7) Details of the electronic signatures procedure;

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(8) Details of the system for routine EFB system maintenance;

(9) Details of flight crew training:

(i) initial training;

(ii) differences training; and

(iii) recurrent training;

(10) Report of the operational evaluation test:

(i) proposals for the initial retention of paper backup;

(ii) proposals for the commencement of operations without paper backup;

(11) EFB platform/hardware description;

(12) A description of each software application to be included in the assessment;

(13) A risk assessment summary for each application and the mitigation means put in place;

(14) A human factors assessment for the complete EFB system, human–machine interface and all the software applications that covers:

(i) the flight crew workload in both single-pilot and multi-pilot flown aircraft;

(ii) the size, resolution, and legibility of symbols and text;

(iii) for navigation chart displays: access to desired charts, access to information within a chart, grouping of information, general layout, orientation (e.g. track-up, north-up), depiction of scale information;

(15) Operator training;

(16) EFB administrator qualification.

GM2 SPA.EFB.100(b) Use of electronic flight bags (EFBs) — operational approval
EVALUATION BY THE AGENCY

Operators may use the results of an EFB application evaluation performed by the Agency to support their application to their competent authority for an operational approval.

AMC1 SPA.EFB.100(b)(1) Use of electronic flight bags (EFBs) — operational approval
RISK ASSESSMENT

(a) General

Prior to the entry into operation of any EFB system, the operator should carry out for all type B EFB applications a risk assessment as part of its hazard identification and risk management process.

If an operator makes use of a risk assessment established by the software developer, the operator should ensure that its specific operational environment is taken into account.

The risk assessment should:

(1) evaluate the risks associated with the use of an EFB;

(2) identify potential losses of function or malfunction (with detected and undetected erroneous outputs) and the associated failure scenarios;

(3) analyse the operational consequences of these failure scenarios;

(4) establish mitigating measures; and

(5) ensure that the EFB system (hardware and software) achieves at least the same level of accessibility, usability, and reliability as the means of presentation it replaces.

In considering the accessibility, usability, and reliability of the EFB system, the operator should ensure that the failure of the complete EFB system as well as of individual applications, including any corruption or loss of data and any erroneously displayed information, has been assessed and that the risks have been mitigated to an acceptable level.

This risk assessment should be defined before the beginning of the trial period and should be amended accordingly, if necessary, at the end of this trial period. The results of the trial should establish the configuration and use of the system. Once the operator has been granted the operational approval for the use of the related EFB applications, it should ensure that the related risk assessment is maintained and kept up to date.

When the EFB system is intended to be introduced alongside a paper-based system, only the failures that would not be mitigated by the use of the paper-based system need to be addressed. In all other cases, and especially when an accelerated introduction with a reduced trial period or paperless entry into service of a new EFB system is intended, a complete risk assessment should be carried out.

(b) Assessing and mitigating the risks

Some parameters of EFB applications may depend on entries by crew/dispatchers, whereas others may be default parameters from within the system that are subject to an administration process (e.g. the runway line-up allowance in an aircraft performance application). In the first case, mitigation means would concern mainly training and crew procedures aspects, whereas in the second case mitigation means would more likely focus on administrator and data management aspects.

The analysis should be specific to the operator concerned and should address at least the following points:

(1) The minimisation of undetected erroneous outputs from applications and assessment of the worst-case scenario;

(2) Erroneous outputs from the software application including:

(i) a description of the corruption scenarios; and

(ii) a description of the mitigation means;

(3) Upstream processes including:

(i) the reliability of root data used in applications (qualified/verified input data);

(ii) the software application validation and verification checks according to appropriate industry standards; and

(iii) the independence between application software components, e.g. robust partitioning between type A, type B and other certified software applications.

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(4) Description of the mitigation means following the detected loss of an application, or of a detected erroneous output due to an internal EFB error;

(5) The need for access to an alternate power supply in order to achieve an acceptable level of safety for certain software applications, especially if they are used as a source of required information.

As part of the mitigation means, the operator should consider establishing a reliable alternative means of providing the information available on the EFB system.

The mitigation means could be, for example, one or a combination of the following:

(1) the system design (including hardware and software);

(2) a backup EFB device, possibly supplied from a different power source;

(3) EFB applications being hosted on more than one platform;

(4) a paper backup (e.g. quick reference handbook (QRH));

(5) procedural means;

(6) training; and

(7) administration.

EFB system design features such as those assuring data integrity and the accuracy of performance calculations (e.g. a 'reasonableness' or 'range' check) may be integrated in the risk assessment performed by the operator.

AMC1 SPA.EFB.100(b)(2) Use of electronic flight bags (EFBs) — operational approval
HUMAN–MACHINE INTERFACE ASSESSMENT AND HUMAN FACTORS CONSIDERATIONS

The operator should carry out an assessment of the human–machine interface (HMI), the installation, and aspects governing crew resource management (CRM) when using the EFB system.

The HMI assessment is key to identifying acceptable mitigation means, e.g.:

(a) to establish procedures to reduce the risk of making errors; and

(b) to control and mitigate the additional workload related to EFB use.

The assessment should be carried out by the operator for each kind of device and application installed on the EFB. The operator should assess the integration of the EFB into the flight deck environment, considering both physical integration (e.g. anthropometrics, physical interferences, etc.) and cognitive ergonomics (the compatibility of look and feel, workflows, alerting philosophy, etc.).

(a) Human–machine interface

The EFB system should provide a consistent and intuitive user interface within and across the various hosted applications and with flight deck avionics applications. This should include but is not limited to data entry methods, colour-coding philosophies, and symbology.

(b) Input devices

In choosing and designing input devices such as keyboards or cursor control devices, applicants should consider the type of entry to be made and also flight crew compartment environmental factors, such as turbulence, that could affect the usability of that input device. Typically, the performance parameters of cursor control devices should be tailored for the intended application function as well as for the flight crew compartment environment.

(c) Consistency

(1) Consistency between EFBs and applications:

Particular attention should be paid to the consistency of all interfaces, in particular when a provider develops the software application and a different organisation integrates it into the EFB.

(2) Consistency with flight deck applications:

Whenever possible, EFB user interfaces should be consistent with the other flight deck avionics applications with regard to design philosophy, look and feel, interaction logics, and workflows.

(d) Messages and the use of colours

For any EFB system, EFB messages and reminders should be readily and easily detectable and intelligible by the flight crew under all foreseeable operating conditions.

While the regulations refer to lights, the intent should be generalised to extend to the use of colours on displays and controls. That is, the colour 'red' should only be used to indicate a warning level condition. 'Amber' should be used to indicate a caution level condition. The use of red and amber colours should be limited and carefully considered. Any other colour may be used for items other than warnings or cautions, providing that the colours used differ sufficiently from the colours prescribed in order to avoid possible confusion. EFB messages and reminders should be integrated with (or compatible with) the presentation of other flight crew compartment system alerts. EFB messages, both visual and aural, should be inhibited during critical phases of the flight.

Flashing text or symbols should be avoided in any EFB application. Messages should be prioritised and the message prioritisation scheme should be evaluated and documented.

Additionally, during critical phases of the flight, required flight information should be continuously presented without uncommanded overlays, pop-ups, or pre-emptive messages, except for those indicating the failure or degradation of the current EFB application. However, if there is a regulatory or Technical Standard Order (TSO) requirement that is in conflict with the recommendation above, that requirement should take precedence.

(e) System error messages

If an application is fully or partially disabled, or is not visible or accessible to the user, it may be desirable to have a positive indication of its status available to the user upon request. Certain non-essential applications such as those for e-mail connectivity and administrative reports may require an error message when the user actually attempts to access the function rather than an immediate status annunciation when a failure occurs. EFB status and fault messages should be prioritised and the message prioritisation scheme evaluated and documented.

(f) Data entry screening and error messages

If user-entered data is not of the correct format or type needed by the application, the EFB should not accept the data. An error message should be provided that communicates which entry is suspect and specifies what type of data is expected. The EFB system should incorporate input error checking that

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detects input errors at the earliest possible point during entry, rather than on completion of a possibly lengthy invalid entry.

(g) Error and failure modes

(1) Flight crew errors:

The system should be designed to minimise the occurrence and effects of flight crew errors and to maximise the identification and resolution of errors. For example, terms for specific types of data or the format in which latitude/longitude is entered should be the same across systems.

(2) Identifying failure modes:

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

(h) Responsiveness of application

The system should provide feedback to the user when a user input is accepted. If the system is busy with internal tasks that preclude the immediate processing of a user input (e.g. performing calculations, self-tests, or refreshing data), the EFB should display a 'system busy' indicator (e.g. a clock icon) to inform the user that the system is occupied and cannot process inputs immediately.

The timeliness of the system response to a user input should be consistent with an application's intended function. The feedback and system response times should be predictable in order to avoid flight crew distractions and/or uncertainty.

(i) Off-screen text and content

If the document segment is not visible in its entirety in the available display area, such as during 'zoom' or 'pan' operations, the existence of off-screen content should be clearly indicated in a consistent way. For some intended functions, it may be unacceptable if certain portions of documents are not visible. Likewise, some applications may not require an off-screen content indicator when the presence of off-screen content is readily obvious. This should be evaluated based on the application and its intended operational function. If there is a cursor, it should be visible on the screen at all times while in use.

(j) Active regions

Active regions are regions to which special user commands apply. The active region can be text, a graphic image, a window, frame, or some other document object. These regions should be clearly indicated.

(k) Managing multiple open applications and documents

If the electronic document application supports multiple open documents, or the system allows multiple open applications, an indication of which application and/or document is active should be continuously provided. The active document is the one that is currently displayed and responds to user actions. Under non-emergency, normal operations, the user should be able to select which of the open applications or documents is currently active. In addition, the user should be able to find which flight crew compartment applications are running and switch to any one of these applications easily. When the user returns to an application that was running in the background, it should appear in the same state as when the user left that application, with the exception of differences stemming from the progress or completion of processing performed in the background.

(l) Flight crew workload

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The positioning and procedures associated with the use of the EFB should not result in an unacceptable flight crew workload. Complex, multi-step data entry tasks should be avoided during take-off, landing, and other critical phases of the flight. An evaluation of the EFB intended functions should include a qualitative assessment of the incremental flight crew workload, as well as the flight crew–system interfaces and their safety implications.

AMC1 SPA.EFB.100(b)(3) Use of electronic flight bags (EFBs) — operational approval
EFB ADMINISTRATOR

The operator should appoint an EFB administrator responsible for the administration of the EFB system within the operator's organisation. The EFB administrator is the primary link between the operator and the EFB system and software suppliers.

The role of the EFB administrator is a key factor in the management of the EFB system of an operator. Complex EFB systems may require more than one individual to conduct the administration process, but one person should be designated as the EFB administrator responsible for the complete system, with appropriate authority within the operator's management structure.

The EFB administrator is the person in overall charge of the EFB system, and should be responsible for ensuring that any hardware conforms to the required specification, and that no unauthorised software is installed. They should also be responsible for ensuring that only the current version of the application software and data packages are installed on the EFB system.

The EFB administrator should be responsible:

(a) for all the applications installed, and for providing support to the EFB users on these applications;

(b) to check potential security issues associated with the applications installed;

(c) for hardware and software configuration management of the EFBs and for ensuring, in particular, that no unauthorised software is installed.

The EFB administrator should ensure that miscellaneous software applications do not adversely impact the operation of the EFB and should include miscellaneous software in the scope of the EFB configuration management.

This does not preclude EFB devices from being allocated to specific crew members.

However, and only in the cases where it is demonstrated that miscellaneous software applications run in a way that is fully segregated and partitioned from the EFB or avionics applications (e.g. on a separate operating system on a distinct 'personal' hard drive partition that is selected at the boot), the administration of these miscellaneous applications can be exercised by the flight crew members and not by the EFB administrator.

The EFB administrator should also be responsible:

(d) for ensuring that only valid versions of the application software and current data packages are installed on the EFB system; and

(e) for ensuring the integrity of the data packages used by the applications installed.

The operator should make arrangements to ensure the continuity of the management of the EFB system in the absence of the EFB administrator.

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Each person involved in EFB administration should receive appropriate training in their role and should have a good working knowledge of the proposed system hardware, operating system, and relevant software applications, and also of the appropriate regulatory requirements related to the use of EFBs. The content of this training should be determined with the aid of the EFB system supplier or application supplier.

The operator should ensure that the EFB administrator not only keeps their knowledge about the EFB system up to date, but also their knowledge about the security of EFB systems.

AMC2 SPA.EFB.141(b)(3) Use of electronic flight bags (EFBs) — operational approval
EFB POLICY AND PROCEDURES MANUAL

The operator should establish procedures, documented in an EFB policy and procedures manual, to ensure that no unauthorised changes take place. The EFB policy and procedures manual may be fully or partly integrated in the operations manual.

The EFB policy and procedures manual should also address means to ensure that the content and databases of the EFB are valid and up to date, in order to ensure the integrity of the EFB data. This may include establishing revision control procedures so that flight crew members and others can ensure that the contents of the system are current and complete. These revision control procedures may be similar to the revision control procedures used for paper or other storage means.

The EFB policy and procedures manual should as well clearly identify those parts of the EFB system that can be accessed and modified by the operator's EFB administration process and those parts that are only accessible by the EFB system supplier.

For data that is subject to a revision cycle control process, it should be readily evident to the user which revision cycle has been incorporated in the information obtained from the system. Procedures should specify what action to take if the applications or databases loaded on the EFB are outdated. This manual should at least include the following:

(a) Document changes to content/databases;

(b) Notifications to crews of updates;

(c) If any applications use information that is specific to the aircraft type or tail number, how to ensure that the correct information is installed on each aircraft;

(d) Procedures to avoid corruption/errors during changes to the EFB system; and

(e) In cases involving multiple EFBs in the flight crew compartment, procedures to ensure that they all have the same content/databases installed.

The EFB administrator should be responsible for the procedures and systems documented in the EFB policy and procedures manual that maintain EFB security and integrity. This includes system security, content security, access security, and protection against malicious software.

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AMC3 SPA.EFB.100(b)(3) Use of electronic flight bags (EFBs) — operational approval
PROCEDURES

(a) General

If an EFB system generates information similar to that generated by existing certified systems, procedures should clearly identify which information source will be the primary, which source will be used for backup information, and under which conditions the backup source should be used. Procedures should define the actions to be taken by the flight crew when information provided by an EFB system is not consistent with that from other flight crew compartment sources, or when one EFB system shows different information than the other.

(b) Flight crew awareness of EFB software/database revisions

The operator should have a procedure in place to verify that the configuration of the EFB, including software application versions and, where applicable, database versions, are up to date. Flight crew members should have the ability to easily verify database version effectivity on the EFB. Nevertheless, flight crew members should not be required to confirm the revision dates for other databases that do not adversely affect flight operations, such as maintenance log forms or a list of airport codes. An example of a date-sensitive revision is that applied to an aeronautical chart database. Procedures should specify what actions should be taken if the software applications or databases loaded on the EFB system are outdated.

(c) Procedures to mitigate and/or control workload

Procedures should be designed to mitigate and/or control additional workload created by using an EFB system. The operator should implement procedures to ensure that, while the aircraft is in flight or moving on the ground, flight crew members do not become preoccupied with the EFB system at the same time. Workload should be shared between flight crew members to ensure ease of use and continued monitoring of other flight crew functions and aircraft equipment. These procedures should be strictly applied in flight and should specify the times at which the flight crew may not use the EFB system.

(d) Dispatch

The operator should establish dispatch criteria for EFB systems. The operator should ensure that the availability of the EFB system is confirmed by preflight checks. Instructions to flight crew should clearly define the actions to be taken in the event of any EFB system deficiency.

Mitigation should be in the form of maintenance and/or operational procedures for items such as:

(1) replacement of batteries at defined intervals as required;

(2) ensuring there is a fully charged backup battery on board;

(3) the flight crew to check the battery charging level before departure; and

(4) the flight crew to switch off the EFB in a timely manner when the aircraft power source is lost.

In case of partial or complete failure of the EFB, alternative dispatch procedures should be followed. These procedures should be included either in the minimum equipment list (MEL) or in the operations manual, and should ensure an acceptable level of safety.

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Particular attention should be paid to alternative dispatch procedures to obtain operational data (e.g. performance data) in case of a failure of an EFB hosting application providing such calculated data.

When data input and output integrity is obtained by cross-checking and gross-error checks, the same checking principle should apply to alternative dispatch procedures to ensure equivalent protection.

(e) Maintenance

Procedures should be established for the routine maintenance of the EFB system and how unserviceability and failures are to be dealt with to ensure that the integrity of the EFB system is preserved. Maintenance procedures may also need to include the secure handling of updated information and how it is accepted and then promulgated in a timely manner and complete format to all users and aircraft platforms.

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

Should faults or failures of the system come to light, it is essential that such failures are brought to the immediate attention of the flight crew and that the system is isolated until rectification action is taken. In addition to backup procedures to deal with system failures, a reporting system should be in place so that the necessary corrective action, either to a particular EFB system or to the whole system, is taken in order to prevent the use of erroneous information by flight crew members.

(f) Security

The EFB system (including any means used for updating it) should be secure from unauthorised intervention (e.g. by malicious software). The operator should ensure that adequate security procedures are in place to protect the system at software level and to manage hardware (e.g. identification of the person to whom the hardware is released, protected storage when the hardware is not in use). These procedures should guarantee that prior to each flight, the EFB operational software works as specified and the EFB operational data is complete and accurate. Moreover, a system should be in place to ensure that the EFB does not accept a data load that contains corrupted contents. Adequate measures should be in place for compilation and secure distribution of the data to the aircraft.

The procedures should be transparent, easy to understand, to follow and to oversee:

(1) if an EFB is based on consumer electronics, e.g. a laptop, which can be easily removed, manipulated, or replaced by a similar component, then special consideration should be given to the physical security of the hardware;

(2) portable EFB platforms should be subject to allocation tracking to specific aircraft or persons;

(3) where a system has input ports and especially if widely known protocols are used through these ports or internet connections are offered, then special consideration should be given to the risks associated with these ports;

(4) where physical media are used to update the EFB system and especially if widely known types of physical media are used, then the operator should use technologies and/or procedures to assure that unauthorised content cannot enter the EFB system through these media.

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

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Beyond the level of security required to assure that the EFB can properly perform its intended functions, the level of security ultimately required depends on the abilities of the EFB.

(g) Electronic signatures

Part-CAT, Part-M and other regulations may require a signature to signify either acceptance or to confirm the authority (e.g. load sheet, technical logbook, notification to captain (NOTOC)). In order to be accepted as an equivalent to a handwritten signature, electronic signatures used in EFB applications need, as a minimum, to fulfil the same objectives and should, as a minimum, assure the same degree of security as the handwritten or any other form of signature it intends to replace. AMC1 CAT.POL.MAB.105(c) provides the means to comply with the required handwritten signature or its equivalent for the mass and balance documentation.

In the case of legally required signatures, an operator should have in place procedures for electronic signatures, acceptable to the competent authority, that guarantee:

(1) their uniqueness: a signature should identify a specific individual and be difficult to duplicate;

(2) their significance: an individual using an electronic signature should take deliberate and recognisable action to affix their signature;

(3) their scope: the scope of information being affirmed with an electronic signature should be clear to the signatory and to the subsequent readers of the record, record entry, or document;

(4) their security: the security of an individual's handwritten signature is maintained by ensuring that it is difficult for another individual to duplicate or alter it;

(5) their non-repudiation: an electronic signature should prevent a signatory from denying that they affixed a signature to a specific record, record entry, or document; the more difficult it is to duplicate a signature, the likelier the signature was created by the signatory; and

(6) their traceability: an electronic signature should provide positive traceability to the individual who signed a record, record entry, or any other document.

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

AMC4 SPA.EFB.100(b)(3) Use of electronic flight bags (EFBs) — operational approval
FLIGHT CREW TRAINING

(a) Flight crew members should be given specific training on the use of the EFB system before it is operationally used.

Training should include at least the following:

(1) an overview of the system architecture;

(2) preflight checks of the system;

(3) limitations of the system;

(4) specific training on the use of each application and the conditions under which the EFB may and may not be used;

(5) restrictions on the use of the system, including where some part or the entire system is not available;

(6) procedures for normal operations, including cross-checking of data entry and computed information;

(7) procedures to handle abnormal situations, such as a late runway change or a diversion to an alternate aerodrome;

(8) procedures to handle emergency situations;

(9) phases of the flight when the EFB system may and may not be used;

(10) human factors considerations, including crew resource management (CRM), on the use of the EFB; and

(11) additional training for new applications or changes to the hardware configuration.

As far as practicable, it is recommended that the training simulator environments include the EFBs in order to offer a higher level of representativeness.

Consideration should also be given to the role that the EFB system plays in operator proficiency checks as part of recurrent training and checking, and to the suitability of the training devices used during training and checking.

EFB training should be included in the relevant training programme established and approved in accordance with ORO.FC.

(b) EFB training and checking

(1) Assumptions regarding flight crew members' previous experience

Training for the use of the EFB should be for the purpose of operating the EFB itself and the applications hosted on it, and should not be intended to provide basic competence in areas such as aircraft performance, etc. Initial EFB training, therefore, should assume basic competence in the functions addressed by the software applications installed.

Training should be adapted to the crew's experience and knowledge.

(2) Programmes crediting previous EFB experience

Training programmes for the EFB may take credit for previous EFB experience. For example, previous experience of an aircraft performance application hosted on a portable EFB and using similar software may be credited toward training on an installed EFB with a performance application.

(3) Initial EFB training

Training required for the granting of an aircraft type rating may not recognise variants within the type nor the installation of particular equipment. Any training for the granting of a type qualification need not, therefore, recognise the installation or use of an EFB unless it is installed equipment across all variants of the type. However, where training for the issuing of the type rating is combined with the operator's conversion course, the training syllabus should recognise the installation of the EFB where the operator's standard operating procedures (SOPs) are dependent on its use.

Initial EFB training may consist of both ground-based and flight training, depending on the nature and complexity of the EFB system. An operator or approved training organisation (ATO) may use many methods for ground-based EFB training including written handouts or flight crew operating manual (FCOM) material, classroom instruction, pictures, videotapes, ground training devices, computer-based instruction, flight simulation training devices (FSTDs), and static aircraft training. Ground-based training for a sophisticated EFB lends itself particularly to computer-based training (CBT). Flight EFB training should be conducted by a suitably qualified person during line flying under supervision or during differences or conversion training.

The following areas of emphasis should be considered when defining the initial EFB training programme:

(i) The use of the EFB hardware and the need for proper adjustment of lighting, etc., when the system is used in flight;

(ii) The intended use of each software application together with limitations and prohibitions on their use;

(iii) If an aircraft performance application is installed, proper cross-checking of data inputs and outputs;

(iv) If a terminal chart application is installed, proper verification of the applicability of the information being used;

(v) If a moving map display is installed, the need to avoid fixation on the map display; and

(vi) Failures of component(s) of the EFB.

(4) Initial EFB checking

(i) Initial ground EFB checking

The check conducted following the ground-based element of initial EFB training may be accomplished by the use of a questionnaire (oral or written) or as an automated component of the EFB computer-based training, depending on the nature of the training conducted.

(ii) Skill test and proficiency check

Where the operator's SOPs are dependent on the use of the EFB on the particular aircraft type or variant, proficiency in the use of the EFB should be assessed in the appropriate areas (e.g. item 1.1, item 1.5, etc., of Appendix 9 to Annex I (Part-FCL) to Commission Regulation (EU) No 1178/2011).

(iii) Operator proficiency check

Where an operator's SOPs are dependent on the use of an EFB, proficiency in its use should be assessed during the operator proficiency check (OPC). Where the OPC is performed on an FSTD not equipped with the operator's EFB, proficiency should be assessed by another acceptable means.

(iv) Line check

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Where an operator's SOPs are dependent on the use of an EFB, proficiency in its use should be assessed during a line check.

(v) Areas of emphasis during EFB checking:

(A) Proficiency in the use of each EFB application installed;

(B) Proper selection and use of EFB displays;

(C) Where an aircraft performance application is installed, proper cross-checking of data inputs and outputs;

(D) Where a chart application is installed, proper checking of the validity of the information and the use of the chart clip function;

(E) Where a moving map display is installed, maintenance of a proper outside visual scan without prolonged fixation on the EFB, especially during taxiing; and

(F) Actions following the failure of component(s) of the EFB, including a hot EFB battery.

(c) Differences or familiarisation training

When the introduction of the use of an EFB requires differences or familiarisation training to be carried out, the elements of initial EFB training should be used, as described above.

(d) Recurrent EFB training and checking

(1) Recurrent EFB training

Recurrent training is normally not required for the use of an EFB, provided the functions are used regularly in line operations. Operators should, however, include normal EFB operations as a component of the annual ground and refresher training.

In the case of mixed fleet flying, or where the EFB is not installed across the fleet, additional recurrent training should be applied.

(2) Recurrent EFB checking

Recurrent EFB checking should be integrated in those elements of the licence proficiency check, the operator proficiency check and the line check applicable to the use of an EFB.

(e) Suitability of training devices

Where the operator's SOPs are dependent on the use of an EFB, the EFB should be present during the operator's training and checking. Where present, the EFB should be configured and operable in all respects as per the relevant aircraft. This should apply to:

(1) the operator's conversion course;

(2) differences or familiarisation training; and

(3) recurrent training and checking.

Where the EFB system is based on a portable device used without any installed resources, it is recommended that the device is present and operable and used during all phases of the flight during which it would be used under the operator's SOPs.

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For all other types of EFB systems, it is recommended that the device is installed and operable in the training device (FFS) and used during all phases of the flight during which it would be used under the operator's SOPs. However, an operator may define an alternative means of compliance when the operator's EFB system is neither installed nor operable in the training device.

Note: It is not necessary for the EFB to be available for that training and checking which is not related to the operator and to the operator's SOPs.

AMC5 SPA.EFB.100(b)(3) Use of electronic flight bags (EFBs) — operational approval
PERFORMANCE AND MASS AND BALANCE APPLICATIONS

(a) General

The performance and mass and balance applications should be based on existing published data found in the AFM or performance manual, and should deliver results that allow the crew to operate in compliance with the appropriate Air Operations regulations. The applications may use algorithms or data spreadsheets to determine results. They may have the ability to interpolate within but should not extrapolate beyond the information contained in the published data for the particular aircraft.

To protect against intentional and unintentional modifications, the integrity of the database files related to performance and to mass and balance (the performance database, airport database, etc.) should be checked by the program before performing calculations. This check can be run once at the start-up of the application.

Each software version should be identified by a unique version number. The compatibility between specific modules of the performance or mass and balance software application and specific software revisions, on a specific host (e.g. computer model), should be ensured. The performance and mass and balance applications should keep a trace of each computation performed (inputs and outputs) and the airline should have procedures in place to retain this information.

The operator should ensure that aircraft performance or mass and balance data provided by the application is correct compared with the data derived from the AFM (e.g. for take-off and landing performance data) or from other reference data sources (e.g. mass and balance manual or databases, in-flight performance manual or databases) under a representative cross-check of conditions (e.g. for take-off and landing performance applications: take-off and landing performance data on a dry, wet and contaminated runway, different wind conditions and aerodrome pressure altitudes, etc.).

Where there is already a certified mass and balance and performance application (e.g. hosted in the flight management system (FMS)), the operator should ensure the independence of the EFB and avionics-based algorithms.

The operator should establish procedures to define any new roles that the flight crew and dispatch office may have in creating, reviewing, and using performance calculations supported by EFB systems.

(b) Testing

The demonstration of the compliance of a performance or mass and balance application should include evidence of the software testing activities performed with the software version candidate for operational use.

The testing can be performed either by the operator or a third party, as long as the testing process is documented and the responsibilities identified.

The testing activities should include human–machine interface (HMI) testing, reliability testing, and accuracy testing.

HMI testing should demonstrate that the application is not error-prone and that calculation errors can be detected by the crew with the proposed procedures. The testing should demonstrate that the applicable HMI guidelines are followed and that the HMI is implemented as specified by the application developer and in paragraph (f).

Reliability testing should show that the application in its operating environment (OS and hardware included) is stable and deterministic, i.e. identical answers are generated each time the process is entered with identical parameters.

Accuracy testing should demonstrate that the aircraft performance or mass and balance computations provided by the application are correct in comparison with data derived from the AFM or other reference data sources, under a representative cross section of conditions (e.g. for take-off and landing performance applications: runway state and slope, different wind conditions and pressure altitudes, various aircraft configurations including failures with a performance impact, etc.).

The demonstration should include a sufficient number of comparison results from representative calculations throughout the entire operating envelope of the aircraft, considering corner points, routine and break points.

Operators are expected to justify that the accuracy testing covered a sufficient number of testing points with respect to the design of their software application and databases.

Any difference compared to the reference data that is judged significant should be examined and explained. When differences come from a reduced conservatism or reduced margins that were purposely built into the approved data, this approach should be clearly mentioned. Compliance with the applicable certification and operational rules need to be demonstrated in any case.

The testing method should be described. The testing may be automated when all the required data is available in an appropriate electronic format, but in addition to a thorough monitoring of the correct functioning and design of the testing tools and procedures, operators are strongly suggested to perform additional manual verification. It could be based on a few scenarios for each chart or table of the reference data, including both operationally representative scenarios and ‘corner-case’ scenarios.

The testing of a software revision should, in addition, include non-regression testing and testing of any fix or change.

Furthermore, an operator should conduct testing related to its customisation of the applications and to any element pertinent to its operation that was not covered at an earlier stage (e.g. airport database verification).

(c) Procedures

Specific care is needed regarding the crew procedures concerning take-off and landing performance or mass and balance applications. The crew procedures should ensure that:

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(1) calculations are conducted independently by each crew member before data outputs are accepted for use;

(2) a formal cross-check is made before data outputs are accepted for use; such cross-checks should utilise the independent calculations described above, together with the output of the same data from other sources on the aircraft;

(3) a gross-error check is conducted before data outputs are accepted for use; such a gross-error check may use either a 'rule of thumb' or the output of the same data from other sources on the aircraft; and

(4) in the event of a loss of functionality of an EFB through either the loss of a single application, or the failure of the device hosting the application, an equivalent level of safety can be maintained; consistency with the EFB risk assessment assumptions should be confirmed.

(d) Training

The training should emphasise the importance of executing all take-off and landing performance calculations in accordance with the SOPs to assure fully independent calculations.

Furthermore, due to the optimisation at different levels brought by performance applications, the flight crew members may be confronted with new procedures and different aircraft behaviour (e.g. the use of multiple flap settings for take-off). The training should be designed and provided accordingly.

Where an application allows the computing both of dispatch results (from regulatory or factored calculations) and other results, the training should highlight the specificities of those results. Depending on the representativeness of the calculation, the flight crew members should be trained on the operational margin that might be required.

The training should also address the identification and the review of default values, if any, and assumptions about the aircraft status or environmental conditions made by the application.

(e) Specific considerations for mass and balance applications

The basic data used for the mass and balance calculations should be modifiable by the EFB administrator or by the software application provider on behalf of the EFB administrator.

In addition to the figures, a graph displaying the mass and its associated centre-of-gravity (CG) position should be provided.

(f) Human-factors-specific considerations

Input and output data (i.e. results) shall be clearly separated from each other. All the information necessary for a given calculation task should be presented together or be easily accessible.

All the data required for the performance and mass and balance applications should be asked for or displayed, including correct and unambiguous terms (names), units of measurement (e.g. kg or lbs), and when applicable, an index system and a CG-position declaration (e.g. Arm/%MAC). The units should match the ones from the other flight crew compartment sources for the same kinds of data.

Airspeeds should be provided in a way directly useable in the flight crew compartment, unless the unit clearly indicates otherwise (e.g. KCAS). Any difference in the type of airspeed provided by the EFB application and the type provided by the aircraft flight manual (AFM) or flight crew operating manual (FCOM) performance charts should be mentioned in the flight crew guides and training material.

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If the landing performance application allows the computation of both dispatch (regulatory, factored) and other results (e.g. in-flight or unfactored), the flight crew members should be made aware of the computation mode used.

(1) Inputs:

The application should allow users to clearly distinguish user entries from default values or entries imported from other aircraft systems.

Performance applications should enable the flight crew to check whether a certain obstacle is included in the performance calculations and/or to include new or revised obstacle information in the performance calculations.

(2) Outputs:

All critical assumptions for performance calculations (e.g. the use of thrust reversers, full or reduced thrust/power rating) should be clearly displayed. The assumptions made about any calculation should be at least as clear to the flight crew members as similar information would be on a tabular chart.

All output data should be available in numbers.

The application should indicate when a set of entries results in an unachievable operation (for instance a negative stopping margin) with a specific message or colour scheme. This should be done in accordance with the relevant provisions on messages and the use of colours.

In order to allow a smooth workflow and to prevent data entry errors, the layout of the calculation outputs should be such that it is consistent with the data entry interface of the aircraft applications in which the calculation outputs are used (e.g. flight management systems).

(3) Modifications:

The user should be able to modify performance calculations easily, especially when making last-minute changes.

Calculation results and any outdated input fields should be deleted when:

(i) modifications are entered;

(ii) the EFB is shut down or the performance application is closed; and

(iii) the EFB or the performance application has been in a standby or 'background' mode too long, i.e. such that it is likely that when it is used again, the inputs or outputs will be outdated.

AMC6 SPA.EFB.100(b)(3) Use of electronic flight bags (EFBs) — operational approval
AIRPORT MOVING MAP DISPLAY (AMMD) APPLICATION WITH OWN-SHIP POSITION

(a) General

An AMMD application should not be used as the primary means of navigation for taxiing and should be only used in conjunction with other materials and procedures identified within the operating concept (see paragraph e)).

When an AMMD is in use, the primary means of navigation for taxiing remains the use of normal procedures and direct visual observation out of the flight crew compartment window.

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Thus, as recognised in ETSO-C165a, an AMMD application with a display of own-ship position is considered as having a minor safety effect for malfunctions causing the incorrect depiction of aircraft position (own-ship), and the failure condition for the loss of function is classified as 'no safety effect.'

(b) Minimum requirements

AMMD software that complies with the European Technical Standard Order ETSO-C165a is considered to be acceptable.

In addition, the system should provide the means to display the revision number of the software installed.

To achieve the total system accuracy requirements of ETSO-C165a, an airworthiness-approved sensor using the global positioning system (GPS) in combination with a EUROCAE ED-99C/RTCA DO-272C medium-accuracy-compliant database is considered one acceptable means.

Alternatively, the use of non-certified commercial off-the-shelf global navigation satellite system (COTS GNSS) receivers may be acceptable in accordance with (g).

(c) Data provided by the AMMD software application developer

The operator should ensure that the AMMD software application developer provides the appropriate data including:

(1) the executable object code in an acceptable transfer medium;

(2) installation instructions or equivalent as per ETSO-C165a Section 2.2 addressing:

(i) the identification of each target EFB system computing platform (including hardware platform and operating system version) with which this AMMD software application and database was demonstrated to be compatible;

(ii) the installation procedures and limitations to address the AMMD installation requirements for each applicable platform such as target computer resource requirements (e.g. memory resources) to ensure the AMMD will work properly when integrated and installed;

(iii) the interface description data including the requirements for external sensors providing data inputs; and

(iv) the verification means required to verify proper integration of the AMMD into the target platform environment, including identification of additional activities that the integrator of an EFB must perform to ensure the AMMD meets its intended function, such as testing in the aircraft.

(3) Any AMMD limitations, and known installation, operational, functional, or performance issues on the AMMD.

(d) AMMD software installation in the EFB

The operator should review the documents and the data provided by the AMMD developer, and ensure that the installation requirements of the AMMD software in the specific EFB platform and aircraft are addressed. Operators are required to:

(1) ensure that the software and databases are compatible with the EFB system computing platform on which they are intended to function, including the analysis of the compatibility of the AMMD with other type A and B EFB software applications residing in the same platform; operators should follow

the program installation instructions provided by the software supplier, as applicable to the compatible EFB computer;

(2) check that the objectives for installation, assumptions, limitations and requirements for the AMMD, as part of the data provided by the AMMD software application developer, are satisfied;

(3) perform any verification activities proposed by the AMMD software application developer, as well as to identify and perform additional integration activities to be completed;

(4) ensure the compatibility and the compliance with requirements for data provided by other installed systems, such as a GNSS sensor and latency assumptions.

(e) Operating concept

The operating concept should include, as a minimum:

(1) flight crew operation, including confirmation of the effectivity;

(2) the handling of updates;

(3) the quality assurance function;

(4) the handling of NOTAMS; and

(5) the provision of current maps and charts to cover the intended operation of the aircraft.

Changes to operational or procedural characteristics of the aircraft (e.g. flight crew procedures) should be documented in the operations manual or user's guide as appropriate. In particular, the following text should be included in the related procedure:

'This EFB airport moving map display (AMMD) with its own-ship position symbol is designed to assist flight crew members in orienting themselves on the airport surface to improve the flight crew members' positional awareness during taxiing. The AMMD function is not to be used as the basis for ground manoeuvring. This application is limited to ground operations only.'

(f) Training requirements

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

Any mitigation to hazards that are mitigated by flight crew procedures should be included in flight crew training. Details of AMMD training should be included in the operator's overall EFB training.

(g) Use of COTS GNSS receivers

(1) Characterisation of the receiver:

The COTS GNSS receiver candidate for use with the AMMD EFB application should be fully characterised in terms of technical specifications. It should feature an adequate number of channels (12 or more). The COTS GNSS receiver initial acquisition time for 20 metres or better accuracy should be 2 minutes or less.

The AMMD application should, in addition to position velocity time (PVT) data, receive a sufficient number of parameters related to the fix quality and integrity (e.g. EPU, HIL, integrity flags, number

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of space vehicles (SV) in view and tracked, etc.). The data provided to the AMMD application should be based exclusively on GPS or satellite-based augmentation system (SBAS) augmented GPS.

(2) Installation aspects:

COTS GNSS receivers are PEDs and their installation and use should follow the provisions of CAT.GEN.MPA.140.

If the external receiver transmits wirelessly, security aspects have to be considered.

Non-certified securing systems should be assessed according to paragraph (h) of AMC1 CAT.GEN.MPA.141(a).

(3) Practical evaluation:

As variables are introduced by the placement of the COTS GNSS antenna in the aircraft and the characteristics of the aircraft itself (e.g. heated and/or shielded windshield effects), the tests have to take place on the type of aircraft in which the EFB will be operated, with the antenna positioned at a reference location.

The test installation should record the data provided by the COTS GNSS receiver to the AMMD application, as well as data from a suitable reference position source. The GNSS antenna of the reference receiver should be located outside of the flight crew compartment with the best possible view of the sky.

The tests should consist of a statistically relevant sample of taxiing. It is recommended to include taxiing at airports that are representative of more complex airports typically accessed by the operator. Taxiing segment samples should include data that is derived from runways and taxiways, and should include numerous turns. Taxiing segment samples should include parts in areas of high buildings such as terminals. The analysis must include at least 25 inbound and/or outbound taxiing segments between the parking location and the runway.

During the tests, any unusual events, such as observing the own-ship in a location on the map that is notably offset compared to the real world, the own-ship changing to non-directional when the aircraft is moving, and times when the own-ship disappears from the map display, should be noted.

The analysis should measure the recorded COTS GNSS availability, latency, and accuracy in comparison to the source. The analysis should be used to demonstrate that the AMMD requirements are satisfactorily complied with in terms of total system accuracy (taking into account database errors, latency effects, display errors, and uncompensated antenna offsets) within 50 metres (95 %).

The analysis should also include a comparison of the typical degradation due to locating the antenna inside the flight crew compartment in terms of masking (e.g. comparing the number of tracked space vehicles (SV)).

The connectivity between the COTS GNSS receiver and the EFB should be shown to be sufficiently reliable.

When demonstrating compliance with the following requirements of DO-257A, the behaviour of the end-to-end system should be taken into account:

(i) indicating degraded position accuracy within 1 second (§2.2.4 (22)); and

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(ii) indicating a loss of positioning data within 5 seconds (§2.2.4 (23)); conditions to consider are both a loss of the GPS view (e.g. antenna failure) and a loss of communication between the receiver and the EFB.

AMC7 SPA.EFB.100(b)(3) Use of electronic flight bags (EFBs) — operational approval
HUMAN FACTORS CONSIDERATIONS FOR CHART APPLICATIONS

The navigation charts that are depicted should contain the information necessary, in an appropriate form, to conduct the operation safely. Consideration should be given to the size, resolution and position of the display to ensure legibility whilst retaining the ability to review all information required to maintain adequate situational awareness.

AMC8 SPA.EFB.100(b)(3) Use of electronic flight bags (EFBs) — operational approval
IN-FLIGHT WEATHER APPLICATIONS

(a) General

An in-flight weather (IFW) application is an EFB function or application enabling the crew to access meteorological information. It is designed to increase situational awareness and to support the flight crew when making strategic decisions.

An IFW function or application may be used to access both information required to be on board and supplemental weather information, but should not be the only source of information required to be on board for dispatch.

An IFW application should not be used to support tactical decisions or to substitute for certified aircraft systems (e.g. weather radar).

Any current information from the meteorological documentation required to be carried on board or from aircraft primary systems should always prevail in case there is a difference from the IFW application information.

The displayed meteorological information may be forecasted and/or observed, and may be updated on the ground and/or in flight. It should be based on data from certified meteorological service providers or other reliable sources.

The meteorological information provided to the flight crew should be as far as possible consistent with the information available to ground-based aviation meteorological information users (e.g. operations control centre (OCC), dispatchers, etc.) in order to establish common situational awareness and to facilitate collaborative decision-making.

(b) Display

Meteorological information should be presented to the flight crew in a format that is appropriate to the content of the information; graphical depiction is encouraged whenever practicable.

The display of information should include:

(1) information on the weather data (observed or forecasted);

(2) currency or age and validity time of the weather data;

(3) information necessary for interpreting the weather data (e.g. legend);

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(4) positive and clear indication of any missing information or data to enable the flight crew to determine areas of uncertainty when making decisions to avoid hazardous weather; and

(5) an indication of the validity (functionality) of the data link, if meteorological information is uploaded via data link.

Meteorological information in IFW applications may be displayed, for example, as an overlay over navigation charts, over geographical maps, or it may be a stand-alone weather depiction (e.g. radar plots, satellite images, etc.).

If meteorological information is overlaid on navigation charts, special considerations should be given to HMI issues in order to avoid adverse effects on the basic chart functions.

The meteorological information may require reformatting for flight crew compartment use to accommodate for example the display size or the depiction technology. However, any reformatting of the meteorological information should preserve both the geo-location and intensity of the meteorological conditions regardless of projection, scaling, or any other types of processing. To maintain adherence to human factors principles, and to avoid the introduction of confusion and increased workload to the flight crew members, the content of the meteorological information and graphics should be consistent and standard (to the extent possible) throughout airspace operational positions.

(c) Training and procedures

The operator should establish procedures for the use of an IFW application.

The operator should provide adequate training to the flight crew members before using an IFW application. This training should address:

(1) Limitations of the use of an IFW application:

(i) acceptable use (strategic planning only); and

(ii) information required to be on board;

(2) Information on the display of weather data:

(i) type of displayed information (forecasted, observed);

(ii) symbology (symbols, colours); and

(iii) interpretation of meteorological information;

(3) Identification of failures and malfunctions (e.g. incomplete uplinks, data link failures, missing info);

(4) Human factors issues:

(i) avoiding fixation; and

(ii) managing workload;

GM1 SPA.EFB.100(b)(3) Use of electronic flight bags (EFBs) — operational approval
EFB POLICY AND PROCEDURES MANUAL

These are the typical contents of an EFB policy and procedures manual that can be part of the operation manual. The proposed outline is very extensive. It may be adapted to the specific EFB system and to the size and complexity of the operations in which the operator is involved.

(a) Revision history;

(b) List of effective pages or paragraphs;

(c) Table of contents;

(d) Introduction:

(1) Glossary of terms and acronyms;

(2) EFB general philosophy, environment and dataflow;

(3) EFB system architecture;

(4) Limitations of the EFB system;

(5) Hardware description;

(6) Operating system description;

(7) Detailed presentation of the EFB applications;

(8) EFB application customisation;

(9) Data management:

(i) Data administration;

(ii) Organisation and workflows;

(iii) Data loading;

(iv) Data revision mechanisms;

(v) Approval workflow;

(vi) Data publishing and dispatch;

(vii) Customisation;

(viii) How to manage the airline-specific documents;

(ix) Airport data management;

(x) Aircraft fleet definition;

(10) Data authoring:

Navigation and customisation;

(e) Hardware and operating system control and configuration:

(1) Purpose and scope;

(2) Description of the following processes:

(i) Hardware configuration and part number control;

(ii) Operating system configuration and control;

(iii) Accessibility control;

(iv) Hardware maintenance;

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(v) Operating system updating;

(3) Responsibilities and accountabilities;

(4) Records and filing;

(5) Documentary references;

(f) Software application control and configuration:

(1) Purpose and scope;

(2) Description of the following processes:

(i) Version control;

(ii) Software configuration management;

(iii) Application updating process;

(3) Responsibilities and accountabilities;

(4) Records and filing;

(5) Documentary references;

(g) Flight crew:

(1) Training;

(2) Operating procedures (normal, abnormal, and emergency);

(h) Maintenance considerations;

(i) EFB security policy;

Security solutions and procedures.

GM2 SPA.EFB.100(b)(3) Use of electronic flight bags (EFBs) — operational approval
FLIGHT CREW TRAINING

The following might be a typical training syllabus, provided that it does not contradict the operational suitability data provided by the aircraft manufacturer.

(a) Ground-based training:

(1) System architecture overview;

(2) Display unit features and use;

(3) Limitations of the system;

(4) Restrictions on the use of the system:

(i) phases of the flight;

(ii) alternate procedures (e.g. MEL);

(5) Applications as installed;

(6) Use of each application;

(7) Restrictions on the use of each application:

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(i) phases of the flight;

(ii) alternate procedures (e.g. MEL);

(8) Data input;

(9) Cross-checking data inputs and outputs;

(10) Use of data outputs;

(11) Alternate procedures (e.g. MEL);

(b) Flight training:

(1) Practical use of the display unit;

(2) Display unit controls;

(3) Data input devices;

(4) Selection of applications;

(5) Practical use of applications;

(6) Human factors considerations, including CRM;

(7) Situational awareness;

(8) Avoidance of fixation;

(9) Cross-checking data inputs and outputs; and

(10) Practical integration of EFB procedures into SOPs.

GM3 SPA.EFB.100(b)(3) Use of electronic flight bags (EFBs) — operational approval
SECURITY

Examples of typical safety and security defences are contained in the following non-exhaustive list:

(a) Individual system firewalls;

(b) The clustering of systems with similar safety standards into domains;

(c) Data encryption and authentication;

(d) Virus scans;

(e) Keeping the OS up to date;

(f) Initiating air–ground connections only when required and always from the aircraft;

(g) 'Whitelists' for allowed internet domains;

(h) Virtual private networks (VPN);

(i) Granting of access rights on a need-to-have basis;

(j) Troubleshooting procedures should also consider security threats as potential root causes of EFB misbehaviour, and responses should be developed to prevent future successful attacks when relevant;

(k) Virtualisation; and

(l) Forensic tools and procedures.

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3.2.3. Draft AMC and GM to Part-NCC

AMC1 NCC.GEN.130 Portable electronic devices (PEDs)
TECHNICAL PREREQUISITES FOR THE USE OF PEDs

[…]

(d) Demonstration of electromagnetic compatibility

[…]

(2) Alternative EMI assessment of C-PEDs

(i) For front door coupling:

(A) C-PEDs should comply with the levels as defined by:

(a) EUROCAE/RTCA, 'Environmental conditions and test procedures for airborne equipment', ED-14D/DO-160D (or later revisions), Section 21, Category M, for operation in the passenger compartment and the flight crew compartment; and

(b) EUROCAE ED-14~~E~~D/RTCA DO-160~~E~~D (or later revisions), Section 21, Category H, for operation in areas not accessible during the flight.

(B) If the C-PEDs are electronic flight bags used in the flight crew compartment and if the DO-160 testing described in (A) identifies inadequate margins for interference or has not been performed, it is necessary to test the C-PED in each aircraft model in which it will be operated. The C-PED should be tested in operation on the aircraft to show that no interference with aircraft equipment occurs. This testing should be conducted in an actual aircraft, and credit may be given to other similarly equipped aircraft of the same make and model as the one tested.~~, an alternative compliance method described in EASA, 'General acceptable means of compliance for airworthiness of products, part and appliances', AMC-20, AMC 20-25 ('Airworthiness and operational considerations for electronic flight bags'), may be used.~~

(ii) ~~For~~ To address back door coupling susceptibility for C-PEDs with transmitting capabilities, the EMI assessment described in (1)(ii) should be performed.

[…]

AMC1 NCC.GEN.131(a) Use of electronic flight bags (EFBs)
HARDWARE

The following provisions should be considered in addition to the hardware provisions of AMC1 CAT.GEN.MPA.141(a):

(a) Display characteristics

Consideration should be given to the long-term degradation of a display as a result of abrasion and ageing. AMC 25-11 (paragraph 3.16a) may be used as appropriate guidance material to assess luminance and legibility aspects.

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Information displayed on the EFB should be legible to the typical user at the intended viewing distance(s) and under the full range of lighting conditions expected in a flight crew compartment, including use in direct sunlight.

Users should be able to adjust the screen brightness of an EFB independently of the brightness of other displays in the flight crew compartment. In addition, when incorporating an automatic brightness adjustment, it should operate independently for each EFB in the flight crew compartment. Brightness adjustment using software means may be acceptable provided that this operation does not adversely affect the crew workload.

Buttons and labels should have adequate illumination for night use. 'Buttons and labels' refers to hardware controls located on the display itself.

All controls should be properly labelled for their intended function.

The 90-degree viewing angle on either side of each flight crew member's line of sight may be unacceptable for certain EFB applications if aspects of the display quality are degraded at large viewing angles (e.g. the display colours wash out or the displayed colour contrast is not discernible at the installation viewing angle).

(b) Power source

The design of a portable EFB system should consider the source of electrical power, the independence of the power sources for multiple EFBs, and the potential need for an independent battery source. A non-exhaustive list of factors to be considered includes:

(1) the possibility to adopt operational procedures to ensure an adequate level of safety (for example, a minimum level of charge at preflight);

(2) the possible redundancy of portable EFBs to reduce the risk of exhausted batteries;

(3) the availability of backup battery packs to assure an alternative source of power.

Battery-powered EFBs that have aircraft power available for recharging the internal EFB batteries are considered to have a suitable backup power source.

For EFBs that have an internal battery power source and that are used in place of paper documentation required by the operating rules, the operator should either have at least one EFB connected to an aircraft power bus or established and documented mitigation means and procedures to ensure that sufficient power will be available during the whole flight with acceptable margins.

(c) Environmental testing

Environmental testing, in particular testing for rapid depressurisation, should be performed when the EFB hosts applications that are required to be used during flight following a rapid depressurisation and/or when the EFB environmental operational range is potentially insufficient with respect to the foreseeable flight crew compartment operating conditions.

The information from the rapid depressurisation test of an EFB is used to establish the procedural requirements for the use of that EFB device in a pressurised aircraft. Rapid decompression testing should follow the EUROCAE ED-14D/RTCA DO-160D (or later revisions) guidelines for rapid decompression testing up to the maximum operating altitude of the aircraft on which the EFB is to be used. The EFB should be operative for at least 10 minutes after the start of the decompression.

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(1) Pressurised aircraft: When a portable EFB has successfully completed rapid depressurisation testing, then no mitigating procedures for depressurisation events need to be developed. When a portable EFB has failed the rapid depressurisation testing while turned ON, but successfully completed it when OFF, then procedures should ensure that at least one EFB on board the aircraft remains OFF during the applicable flight phases or that it is configured so that no damage will be incurred should rapid decompression occur in flight above 10 000 ft above mean sea level (AMSL).

If an EFB system has not been tested or has failed the rapid depressurisation test, then alternate procedures or paper backup should be available.

(2) Non-pressurised aircraft: Rapid decompression testing is not required for an EFB used in a non-pressurised aircraft. The EFB should be demonstrated to reliably operate up to the maximum operating altitude of the aircraft. If EFB operation at the maximum operating altitude is not attainable, procedures should be established to preclude operation of the EFB above the maximum demonstrated EFB operational altitude while still maintaining availability of any required aeronautical information displayed on the EFB.

Testing done on a specific EFB model configuration may be applied to other aircraft installations and these generic environmental tests may not need to be duplicated. The operator should collect and retain:

(1) evidence of these tests that have already been accomplished; or

(2) suitable alternate procedures to deal with the total loss of the EFB system.

Testing for rapid depressurisation does not need to be repeated when the EFB model identification and the battery type do not change.

The testing of operational EFBs should be avoided when possible to preclude the infliction of unknown damage to the unit during testing.

This testing is not equivalent to a full environmental qualification. Operators should account for the possible loss or erroneous functioning of the EFB in abnormal environmental conditions.

The safe stowage and the use of the EFB under any foreseeable flight crew compartment environmental conditions, including turbulence, should be evaluated.

AMC1 NCC.GEN.131(b) Use of electronic flight bags (EFBs)
SOFTWARE

The same considerations as those in AMC1 CAT.GEN.MPA.141(b), AMC2 CAT.GEN.MPA.141(b) and AMC3 CAT.GEN.MPA.141(b) should apply in respect of EFB software.

AMC1 NCC.GEN.131(b)(1) Use of electronic flight bags (EFBs)
RISK ASSESSMENT

(a) General

Prior to the entry into operation of any EFB system, the operator should carry out for all type B EFB applications a risk assessment as part of its hazard identification and risk management process.

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The operator may make use of a risk assessment established by the software developer. However, the operator should ensure that its specific operational environment is taken into account.

The risk assessment should:

(1) evaluate the risks associated with the use of an EFB;

(2) identify potential losses of function or malfunction (with detected and undetected erroneous outputs) and the associated failure scenarios;

(3) analyse the operational consequences of these failure scenarios;

(4) establish mitigating measures; and

(5) ensure that the EFB system (hardware and software) achieves at least the same level of accessibility, usability, and reliability as the means of presentation it replaces.

In considering the accessibility, usability, and reliability of the EFB system, the operator should ensure that the failure of the complete EFB system as well as of individual applications, including any corruption or loss of data and any erroneously displayed information, has been assessed and that the risks have been mitigated to an acceptable level.

The operator should ensure that the type B EFB applications risk assessments are maintained and kept up to date.

When the EFB system is intended to be introduced alongside a paper-based system, only the failures that would not be mitigated by the use of the paper-based system need to be addressed. In all other cases, a complete risk assessment should be carried out.

(b) Assessing and mitigating the risks

Some parameters of EFB applications may depend on entries by crew/dispatchers, whereas others may be default parameters from within the system that are subject to an administration process (e.g. the runway line-up allowance in an aircraft performance application). In the first case, mitigation means would concern mainly training and crew procedures aspects, whereas in the second case mitigation means would more likely focus on EFB administration and data management aspects.

The analysis should be specific to the operator concerned and should address at least the following points:

(1) The minimisation of undetected erroneous outputs from applications and assessment of the worst-case scenario;

(2) Erroneous outputs from the software application including:

(i) a description of the corruption scenarios; and

(ii) a description of the mitigation means;

(3) Upstream processes including:

(i) the reliability of root data used in applications (qualified/verified input data);

(ii) the software application validation and verification checks according to appropriate industry standards; and

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(iii) the independence between application software components, e.g. robust partitioning between type A, type B and other certified software applications.

(4) Description of the mitigation means following the detected loss of an application, or of a detected erroneous output due to an internal EFB error;

(5) The need for access to an alternate power supply in order to achieve an acceptable level of safety for certain software applications, especially if they are used as a source of required information.

As part of the mitigation means, the operator should consider establishing a reliable alternative means of providing the information available on the EFB system.

The mitigation means could be, for example, one or a combination of the following:

(1) the system design (including hardware and software);

(2) a backup EFB device, possibly supplied from a different power source;

(3) EFB applications being hosted on more than one platform;

(4) a paper backup (e.g. quick reference handbook (QRH));

(5) procedural means;

(6) training; and

(7) administration.

Depending on the outcome of their risk assessment, the operator may also consider conducting an operational evaluation test before allowing unrestricted use of its EFB devices and applications.

EFB system design features such as those assuring data integrity and the accuracy of performance calculations (e.g. 'reasonableness' or 'range' checks) may be integrated in the risk assessment performed by the operator.

(c) Changes

The operator should update its EFB risk assessment based on the planned changes to its EFB system.

However, modifications to the operator's EFB system which:

(1) do not bring any change to the calculation algorithms and/or to the interface of a type B EFB application;

(2) introduce a new type A EFB application or modify an existing one (provided its software classification remains type A);

(3) do not introduce any additional functionality to an existing type B EFB application;

(4) update an existing database necessary to use an existing type B EFB application; or

(5) do not require a change to the flight crew training or operational procedures,

may be introduced by the operator without having to update its risk assessment.

These changes should, nevertheless, be controlled and properly tested prior to use in flight.

The modifications in the following non-exhaustive list are considered to meet these criteria:

(1) Operating system updates;

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(2) Chart or airport database updates;

(3) Updates to introduce fixes (patches); and

(4) Installation and modification of a type A EFB application.

AMC1 NCC.GEN.131(b)(2) Use of electronic flight bags (EFBs)
EFB ADMINISTRATION

The operator should ensure:

(a) that adequate support is provided to the EFB users for all the applications installed;

(b) that potential security issues associated with the application installed have been checked;

(c) that the hardware and software configuration is appropriately managed and that no unauthorised software is installed.

The operator should ensure that miscellaneous software applications do not adversely impact the operation of the EFB and should include miscellaneous software in the scope of EFB configuration management;

(d) that only a valid version of the application software and current data packages are installed on the EFB system; and

(e) the integrity of the data packages used by the applications installed.

AMC2 NCC.GEN.131(b)(2) Use of electronic flight bags (EFBs)
PROCEDURES

(a) General:

If an EFB system generates information similar to that generated by existing certified systems, procedures should clearly identify which information source will be the primary, which source will be used for backup information, and under which conditions the backup source should be used. Procedures should define the actions to be taken by the flight crew members when information provided by an EFB system is not consistent with that from other flight crew compartment sources, or when one EFB system shows different information than the other.

(b) Flight crew awareness of EFB software/database revisions

The operator should have a procedure in place to verify that the configuration of the EFB, including software application versions and, where applicable, database versions, are up to date. Flight crew members should have the ability to easily verify database version effectivity on the EFB. Nevertheless, flight crew members should not be required to confirm the revision dates for other databases that do not adversely affect flight operations, such as maintenance log forms or a list of airport codes. An example of a date-sensitive revision is that applied to an aeronautical chart database. Procedures should specify what actions should be taken if the software applications or databases loaded on the EFB system are outdated.

(c) Procedures to mitigate and/or control workload

Procedures should be designed to mitigate and/or control additional workload created by using an EFB system. The operator should implement procedures to ensure that, while the aircraft is in flight or moving on the ground, flight crew members do not become preoccupied with the EFB system at the same time. Workload should be shared between flight crew members to ensure ease of use and continued monitoring of other flight crew functions and aircraft equipment. These procedures should be strictly applied in flight and should specify the times at which the flight crew members may not use the EFB system.

(d) Dispatch

The operator should establish dispatch criteria for the EFB system. The operator should ensure that the availability of the EFB system is confirmed by preflight checks. Instructions to flight crew should clearly define the actions to be taken in the event of any EFB system deficiency.

Mitigation may be in the form of maintenance and/or operational procedures for items such as:

(1) replacement of batteries at defined intervals as required;

(2) ensuring that there is a fully charged backup battery on board;

(3) the flight crew to check the battery charging level before departure; and

(4) the flight crew to switch off the EFB in a timely manner when the aircraft power source is lost.

In case of a partial or complete failure of the EFB, alternative dispatch procedures should be followed. These procedures should be included either in the minimum equipment list (MEL) or in the operations manual and should ensure an acceptable level of safety.

Particular attention should be paid to alternative dispatch procedures to obtain operational data (e.g. performance data) in case of a failure of an EFB hosting application providing such calculated data.

When data input and output integrity is obtained by cross-checking and gross-error checks, the same checking principle should apply to alternative dispatch procedures to ensure equivalent protection.

(e) Maintenance

Procedures should be established for the routine maintenance of the EFB system and how unserviceability and failures are to be dealt with to ensure that the integrity of the EFB system is preserved. Maintenance procedures may also need to include the secure handling of updated information and how it is accepted and then promulgated in a timely manner and complete format to all users and aircraft platforms.

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

Should a fault or failure of the system come to light, it is essential that such failures are brought to the immediate attention of the flight crew and that the system is isolated until rectification action is taken. In addition to backup procedures, to deal with system failures, a reporting system should be in place so that the necessary action, either to a particular EFB system or to the whole system, is taken in order to prevent the use of erroneous information by flight crew members.

(f) Security

The EFB system (including any means used for updating it) should be secure from unauthorised intervention (e.g. by malicious software). The operator should ensure that adequate security procedures are in place to protect the system at software level and to manage hardware (e.g. identification of the person to whom the hardware is released, protected storage when the hardware is not in use). These

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procedures should guarantee that prior to each flight the EFB operational software works as specified and the EFB operational data is complete and accurate. Moreover, a system should be in place to ensure that the EFB does not accept a data load that contains corrupted contents. Adequate measures should be in place for compilation and secure distribution of the data to the aircraft.

The procedures should be transparent, easy to understand, to follow and to oversee:

(1) if an EFB is based on consumer electronics, e.g. a laptop, which can be easily removed, manipulated, or replaced by a similar component, then special consideration should be given to the physical security of the hardware;

(2) portable EFB platforms should be subject to allocation tracking to specific aircraft or persons;

(3) where a system has input ports and especially if widely known protocols are used through these ports or internet connections are offered, then special consideration should be given to the risks associated with these ports;

(4) where physical media are used to update the EFB system and especially if widely known types of physical media are used, then the operator should use technologies and/or procedures to assure that unauthorised content cannot enter the EFB system through these media.

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

Beyond the level of security required to assure that the EFB can properly perform its intended functions, the level of security ultimately required depends on the abilities of the EFB.

(g) Electronic signatures

Some applicable requirements may require a signature to signify either acceptance or to confirm the authority (e.g. load sheet, technical logbook, notification to captain (NOTOC)). In order to be accepted as an equivalent to a handwritten signature, electronic signatures used in EFB applications need, as a minimum, to fulfil the same objectives and should, as a minimum, assure the same degree of security as the handwritten or any other form of signature it intends to replace. AMC1 CAT.POL.MAB.105(c) provides means to comply with the required handwritten signature or its equivalent for the mass and balance documentation.

In the case of legally required signatures, an operator should have in place procedures for electronic signatures, acceptable to the competent authority, that guarantee:

(1) their uniqueness: a signature should identify a specific individual and be difficult to duplicate;

(2) their significance: an individual using an electronic signature should take deliberate and recognisable action to affix their signature;

(3) their scope: the scope of information being affirmed with an electronic signature should be clear to the signatory and to the subsequent readers of the record, record entry, or document;

(4) their security: the security of an individual's handwritten signature is maintained by ensuring that it is difficult for another individual to duplicate or alter it;

(5) their non-repudiation: an electronic signature should prevent a signatory from denying that they affixed a signature to a specific record, record entry, or document; the more difficult it is to duplicate a signature, the likelier the signature was created by the signatory; and

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(6) their traceability: an electronic signature should provide positive traceability to the individual who signed a record, record entry, or any other document.

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

AMC3 NCC.GEN.131(b)(2) Use of electronic flight bags (EFBs)
FLIGHT CREW TRAINING

Flight crew members should be given specific training on the use of the EFB system before it is operationally used.

Training should include at least the following:

(a) an overview of the system architecture;

(b) preflight checks of the system;

(c) limitations of the system;

(d) specific training on the use of each application and the conditions under which the EFB may and may not be used;

(e) restrictions on the use of the system, including where some part or the entire system is not available;

(f) procedures for normal operations, including cross-checking of data entry and computed information;

(g) procedures to handle abnormal situations, such as a late runway change or diversion to an alternate aerodrome;

(h) procedures to handle emergency situations;

(i) phases of the flight when the EFB system may and may not be used;

(j) human factors considerations, including crew resource management (CRM), on the use of the EFB; and

(k) additional training for new applications or changes to the hardware configuration.

AMC4 NCC.GEN.131(b)(2) Use of electronic flight bags (EFBs)
PERFORMANCE AND MASS AND BALANCE APPLICATIONS

(a) General

The performance and mass and balance applications should be based on existing published data found in the AFM or performance manual, and should deliver results that allow the crew to operate in compliance with the appropriate Air Operations regulations. The applications may use algorithms or data spread sheets to determine results. They may have the ability to interpolate within but should not extrapolate beyond the information contained in the published data for the particular aircraft.

To protect against intentional and unintentional modifications, the integrity of the database files related to performance and mass and balance (the performance database, airport database, etc.) should be checked by the program before performing calculations. This check can be run once at the start-up of the application.

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Each software version should be identified by a unique version number. The performance and mass and balance applications should keep a trace of each computation performed (inputs and outputs) and the airline should have procedures in place to retain this information.

The operator should ensure that aircraft performance or mass and balance data provided by the application is correct compared with the data derived from the AFM (e.g. for take-off and landing performance data) or from other reference data sources (e.g. mass and balance manual or databases, in-flight performance manual or databases) under a representative cross-check of conditions (e.g. for take-off and landing performance applications: take-off and landing performance data on a dry, wet and contaminated runway, different wind conditions and aerodrome pressure altitudes, etc.).

Where there is already a certified mass and balance and performance application (e.g. hosted in the flight management system (FMS)), the operator should ensure the independence of the EFB and avionics-based algorithms.

The operator should establish procedures to define any new roles that the flight crew and dispatch office may have in creating, reviewing, and using performance calculations supported by EFB systems.

(b) Testing

The demonstration of the compliance of a performance or mass and balance application should include evidence of the software testing activities performed with the software version candidate for operational use.

The testing can be performed either by the operator or a third party, as long as the testing process is documented and the responsibilities identified.

The testing activities should include human–machine interface (HMI) testing, reliability testing, and accuracy testing.

HMI testing should demonstrate that the application is not error-prone and that calculation errors can be detected by the crew with the proposed procedures.

Reliability testing should show that the application in its operating environment (OS and hardware included) is stable and deterministic, i.e. identical answers are generated each time the process is entered with identical parameters.

Accuracy testing should demonstrate that the aircraft performance or mass and balance computations provided by the application are correct in comparison with data derived from the AFM or other reference data sources, under a representative cross section of conditions (e.g. for take-off and landing performance applications: runway state and slope, different wind conditions and pressure altitudes, various aircraft configurations including failures with a performance impact, etc.).

The demonstration should include a sufficient number of comparison results from representative calculations throughout the entire operating envelope of the aircraft, considering corner points, routine and break points.

Operators are expected to justify that the accuracy testing covered a sufficient number of testing points with respect to the design of their software application and databases.

Any difference compared to the reference data that is judged significant should be examined and explained. When differences come from a reduced conservatism or reduced margins that were

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purposely built into the approved data, this approach should be clearly mentioned. Compliance with the applicable certification and operational rules need to be demonstrated in any case.

The testing method should be described. The testing may be automated when all the required data is available in an appropriate electronic format, but in addition to a thorough monitoring of the correct functioning and design of the testing tools and procedures, operators are strongly suggested to perform additional manual verification. It could be based on a few scenarios for each chart or table of the reference data, including both operationally representative scenarios and 'corner-case' scenarios.

The testing of a software revision should, in addition, include non-regression testing and testing of any fix or change.

Furthermore, an operator should conduct testing related to its customisation of the applications and to any element pertinent to its operation that was not covered at an earlier stage (e.g. airport database verification).

(c) Procedures

Specific care is needed regarding the crew procedures concerning take-off and landing performance or mass and balance applications. The crew procedures should ensure that:

(1) calculations are conducted independently by each crew member before data outputs are accepted for use;

(2) a formal cross-check is made before data outputs are accepted for use; such cross-checks should utilise the independent calculations described above, together with the output of the same data from other sources on the aircraft;

(3) a gross-error check is conducted before data outputs are accepted for use; such a gross-error check may use either a 'rule of thumb' or the output of the same data from other sources on the aircraft; and

(4) in the event of a loss of functionality of an EFB through either the loss of a single application, or the failure of the device hosting the application, an equivalent level of safety can be maintained; consistency with the EFB risk assessment assumptions should be confirmed.

(d) Training

The training should emphasise the importance of executing all take-off and landing performance calculations in accordance with the SOPs to assure fully independent calculations.

Furthermore, due to the optimisation at different levels brought by performance applications, the flight crew members may be confronted with new procedures and different aircraft behaviour (e.g. the use of multiple flap settings for take-off). The training should be designed and provided accordingly.

Where an application allows the computing of both dispatch results (from regulatory and factored calculations) and other results, the training should highlight the specificities of those results. Depending on the representativeness of the calculation, the crew should be trained on the operational margin that might be required.

The training should also address the identification and the review of default values, if any, and assumptions about the aircraft status or environmental conditions made by the application.

(e) Specific considerations for mass and balance applications

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The basic data used for the mass and balance calculation should be modifiable by the operator or by the software application provider on behalf of the operator.

In addition to the figures, a graph displaying the mass and its associated centre of gravity (CG) should be provided.

(f) Human-factors-specific considerations

Input data and output data (i.e. results) shall be clearly separated from each other. All the information necessary for a given calculation task should be presented together or be easily accessible.

All the data required for the performance and mass and balance applications should be asked for or displayed, including correct and unambiguous terms (names), units of measurement (e.g. kg or lbs), and when applicable, an index system and a CG-position declaration (e.g. Arm/%MAC). The units should match the ones from the other flight crew compartment sources for the same kinds of data.

Airspeeds should be provided in a way directly useable in the flight crew compartment unless the unit clearly indicates otherwise (e.g. KCAS). Any difference in the type of airspeed provided by the EFB application and the type provided by the AFM or flight crew operating manual (FCOM) performance charts should be mentioned in the flight crew guides and training material.

If the landing performance application allows the computation of both dispatch (regulatory, factored) and other results (e.g. in-flight or unfactored), the flight crew members should be made aware of the computation mode used.

(1) Inputs

The application should allow users to clearly distinguish user entries from default values or entries imported from other aircraft systems.

Performance applications should allow the flight crew to check whether a certain obstacle is included in the performance calculations and/or to include new or revised obstacle information in the performance calculations.

(2) Outputs

All critical assumptions for performance calculation (e.g. the use of thrust reversers, full or reduced thrust/power rating) should be clearly displayed. The assumptions made about any calculation should be at least as clear to the flight crew members as similar information would be on a tabular chart.

All output data should be available in numbers.

The application should indicate when a set of entries results in an unachievable operation (for instance, a negative stopping margin) with a specific message or colour scheme. This should be done in accordance with the relevant provisions on messages and the use of colours.

In order to allow a smooth workflow and to prevent data entry errors, the layout of the calculation outputs should be such that it is consistent with the data entry interface of the aircraft applications in which the calculation outputs are used (e.g. flight management systems).

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(3) Modifications

The user should be able to modify performance calculations easily, especially when making last-minute changes.

Calculation results and any outdated input fields should be deleted when:

(i) modifications are entered;

(ii) the EFB is shut down or the performance application is closed; and

(iii) the EFB or the performance application have been in a standby or 'background' mode too long, i.e. such that it is likely that when it is used again, the inputs or outputs will be outdated.

AMC5 NCC.GEN.131(b)(2) Use of electronic flight bags (EFBs)
AIRPORT MOVING MAP DISPLAY (AMMD) APPLICATION WITH OWN-SHIP POSITION

(a) General

An AMMD application should not be used as the primary means of navigation for taxiing and should be only used in conjunction with other materials and procedures identified within the operating concept (see paragraph (e)).

When an AMMD is in use, the primary means of navigation for taxiing remains the use of normal procedures and direct visual observation out of the flight crew compartment window.

Thus, as recognised in ETSO-C165a, an AMMD application with a display of own-ship position is considered as having a minor safety effect for malfunctions causing the incorrect depiction of aircraft position (own-ship), and the failure condition for the loss of function is classified as 'no safety effect.'

(b) Minimum requirements

AMMD software that complies with the European Technical Standard Order ETSO-C165a is considered to be acceptable.

In addition, the system should provide the means to display the revision number of the software installed.

(c) Data provided by the AMMD software application developer

The operator should ensure that the AMMD software application developer provides the appropriate data including:

(1) the executable object code in an acceptable transfer medium;

(2) installation instructions or equivalent as per ETSO-C165a Section 2.2 addressing:

(i) the identification of each target EFB system computing platform (including hardware platform and operating system version) with which this AMMD software application and database was demonstrated to be compatible;

(ii) the installation procedures and limitations to address the AMMD installation requirements for each applicable platform such as target computer resource requirements (e.g. memory resources) to ensure the AMMD will work properly when integrated and installed;

(iii) the interface description data including the requirements for external sensors providing data inputs; and

(iv) the verification means required to verify proper integration of the AMMD into the target platform environment, including identification of additional activities that the integrator of an EFB must perform to ensure the AMMD meets its intended function, such as testing in the aircraft.

(3) Any AMMD limitations, and known installation, operational, functional, or performance issues on the AMMD.

(d) AMMD software installation in the EFB

The operator should review the documents and the data provided by the AMMD developer, and ensure that the installation requirements of the AMMD software in the specific EFB platform and aircraft are addressed. Operators are required to:

(1) ensure that the software and database are compatible with the EFB system computing platform on which they are intended to function, including the analysis of the compatibility of the AMMD with other type A and B EFB software applications residing in the same platform; operators should follow the program installation instructions provided by the software supplier, as applicable to the compatible EFB computer;

(2) check that the objectives for installation, assumptions, limitations and requirements for the AMMD, as part of the data provided by the AMMD software application developer, are satisfied;

(3) perform any verification activities proposed by the AMMD software application developer, as well as to identify and perform additional integration activities to be completed;

(4) ensure the compatibility and the compliance with the requirements for data provided by other installed systems, such as a GNSS sensor and latency assumptions.

(e) Operating concept

The operating concept should include, as a minimum:

(1) flight crew operation, including confirmation of the effectivity;

(2) the handling of updates;

(3) the quality assurance function;

(4) the handling of NOTAMS; and

(5) the provision of current maps and charts to cover the intended operation of the aircraft.

Changes to operational or procedural characteristics of the aircraft (e.g. flight crew procedures) should be documented in the operations manual or user's guide as appropriate. In particular, the following text should be included in the related procedure:

'This EFB airport moving map display (AMMD) with its own-ship position symbol is designed to assist flight crew members in orienting themselves on the airport surface to improve the flight crew members' positional awareness during taxiing. The AMMD function is not to be used as the basis for ground manoeuvring. This application is limited to ground operations only.'

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(f) Training requirements

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

Any mitigation to hazards that are mitigated by flight crew procedures should be included in flight crew training. Details of AMMD training should be included in the operator's overall EFB training.

(g) Use of COTS GNSS receivers

(1) Characterisation of the receiver:

The COTS GNSS receiver candidate for use with the AMMD EFB application should be fully characterised in terms of technical specifications. It should feature an adequate number of channels (12 or more). The COTS GNSS receiver initial acquisition time for 20 metres or better accuracy should be 2 minutes or less.

The AMMD application should, in addition to position velocity time (PVT) data, receive a sufficient number of parameters related to the fix quality and integrity (e.g. EPU, HIL, integrity flags, number of space vehicles (SV) in view and tracked, etc.). The data provided to the AMMD application should be based exclusively on GPS or satellite-based augmentation system (SBAS) augmented GPS.

(2) Installation aspects:

COTS GNSS receivers are PEDs and their installation and use should follow the related provisions for PEDs.

If the external receiver transmits wirelessly, security aspects have to be considered.

The connectivity between the COTS GNSS receiver and the EFB should be shown to be sufficiently reliable.

(3) Practical evaluation:

As variables are introduced by the placement of the COTS GNSS antenna in the aircraft and the characteristics of the aircraft itself (e.g. heated and/or shielded windshield effects), the tests have to take place on the type of aircraft in which the EFB will be operated, with the antenna positioned at a reference location.

The test installation should record the data provided by the COTS GNSS receiver to the AMMD application, as well as data from a suitable reference position source. The COTS GNSS antenna of the reference receiver should be located outside of the flight crew compartment with the best possible view of the sky.

The tests should consist of a statistically relevant sample of taxiing. It is recommended to include taxiing at airports that are representative of more complex airports typically accessed by the operator. Taxiing segment samples should include data that is derived from runways and taxiways, and should include numerous turns. Taxi segment samples should include parts in areas of high buildings such as terminals. The analysis must include at least 25 inbound and/or outbound taxiing segments between the parking location and the runway.

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During the tests, any unusual events, such as observing the own-ship in a location on the map that is notably offset compared to the real world, the own-ship changing to non-directional when the aircraft is moving, and times when the own-ship disappears from the map display, should be noted.

The analysis should measure the recorded COTS GNSS availability, latency, and accuracy in comparison to the source. The analysis should be used to demonstrate that the AMMD requirements are satisfactorily complied with in terms of total system accuracy (taking into account database errors, latency effects, display errors, and uncompensated antenna offsets) within 50 metres (95 %).

The analysis should also include a comparison of the typical degradation due to locating the antenna inside the flight crew compartment in terms of masking (e.g. comparing the number of tracked space vehicles (SV)).

The connectivity between the COTS GNSS receiver and the EFB should be shown to be sufficiently reliable.

When demonstrating compliance with the following requirements of DO-257A, the behaviour of the end-to-end system should be taken into account:

(i) indicating degraded position accuracy within 1 second (§2.2.4 (22)); and

(ii) indicating a loss of positioning data within 5 seconds (§2.2.4 (23)); conditions to consider are both a loss of GPS view (e.g. antenna failure) and a loss of communication between the receiver and the EFB.

AMC6 NCC.GEN.131(b)(2) Use of electronic flight bags (EFBs)
HUMAN FACTORS CONSIDERATIONS FOR CHART APPLICATIONS

The navigation charts that are depicted should contain the information necessary, in an appropriate form, to conduct the operation safely. Consideration should be given to the size, resolution and position of the display to ensure legibility whilst retaining the ability to review all information required to maintain adequate situational awareness. The identification of risks associated with the human–machine interface, as part of the operator's risk assessment, is key to identifying acceptable mitigation means, e.g.:

(a) to establish procedures to reduce the risk of making errors;

(b) to control and mitigate the additional workload related to EFB use;

(c) to ensure the consistency of colour-coding and symbology philosophies between EFB applications and their compatibility with other flight crew compartment applications; and

(d) to consider aspects of crew resource management (CRM) when using an EFB system.

AMC7 NCC.GEN.131(b)(2) Use of electronic flight bags (EFBs)
IN-FLIGHT WEATHER APPLICATIONS

(a) General

An in-flight weather (IFW) application is an EFB function or application enabling the crew to access meteorological information. It is designed to increase situational awareness and to support the flight crew when making strategic decisions.

An IFW function or application may be used to access both information required to be on board and supplemental weather information, but should not be the only information required to be on board for dispatch.

An IFW application should not be used to support tactical decisions or to substitute for certified aircraft systems (e.g. weather radar).

Any current information from the meteorological data required to be carried on board or from aircraft primary systems should always prevail in case there is a difference from the IFW application information.

The displayed meteorological information may be forecasted and/or observed, and may be updated on the ground and/or in flight. It should be based on data from certified meteorological services providers or other reliable sources.

The meteorological information provided to the flight crew should be as far as possible consistent with the information available to ground-based aviation meteorological information users (e.g. operations control centre (OCC), dispatchers, etc.) in order to establish common situational awareness and to facilitate collaborative decision-making.

(b) Display

Meteorological information should be presented to the flight crew in a format that is appropriate to the content of the information; graphical depiction is encouraged whenever practicable.

The display of information should include:

(1) information on the weather data (observed or forecasted);

(2) currency or age and validity time of the weather data;

(3) information necessary for interpreting the product (e.g. legend);

(4) positive and clear indication of any missing information or data to enable flight crew to determine areas of uncertainty when making decisions to avoid hazardous weather; and

(5) an indication of the validity (functionality) of the data link, if meteorological information is uploaded via data link.

Meteorological information in IFW applications may be displayed, for example, as an overlay over navigation charts, over geographical maps, or it may be a stand-alone weather depiction (e.g. radar plots, satellite images, etc.).

If meteorological information is overlaid on navigation charts, special considerations should be given to HMI issues in order to avoid adverse effects on the basic chart functions.

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The meteorological information may require reformatting for flight crew compartment use to accommodate, for example, the display size or the depiction technology. However, any reformatting of the meteorological information should preserve both the geo-location and intensity of the meteorological conditions regardless of projection, scaling, or any other types of processing. To maintain adherence to human factors principles, and to avoid the introduction of confusion and increased workload to the flight crew members, the content of the meteorological information and graphics should be consistent and standard (to the extent possible) throughout airspace operational positions.

(c) Training and procedures

The operator should establish procedures for the use of an IFW application.

The operator should provide adequate training to the flight crew members before using an IFW application. This training should address:

(1) Limitations of the use of an IFW application:

(i) acceptable use (strategic planning only); and

(ii) information required to be on-board;

(2) Information on the display of weather data:

(i) type of displayed information (forecasted, observed);

(ii) symbology (symbols, colours); and

(iii) interpretation of meteorological information;

(3) Identification of failures and malfunctions (e.g. incomplete uplinks, data link failures, missing info);

(4) Human factors issues:

(i) avoiding fixation; and

(ii) managing workload.

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3.2.4. Draft AMC and GM to Part-NCO

AMC1 NCO.GEN.125 Portable electronic devices (PEDs)
ELECTRONIC FLIGHT BAGS (EFBs) — HARDWARE

(a) EFB viewable stowage

When a viewable stowage device is used, the pilot-in-command should ensure that if the EFB moves or is separated from its stowage, or if the viewable stowage is unsecured from the aircraft (as a result of turbulence, manoeuvring, or other action), it will not jam flight controls, damage flight deck equipment, or injure flight crew members.

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

(b) Cables

If cables are used to connect an EFB to an aircraft system, power source or any other equipment:

(1) cables should not hang loosely in a way that compromises task performance and safety; flight crew should be able to easily secure the cables out of the way during operations (e.g. cable tether straps); and

(2) cables should be of sufficient length in order not to obstruct the use of any movable device on the flight deck.

AMC2 NCO.GEN.125 Portable electronic devices (PEDs)
ELECTRONIC FLIGHT BAGS (EFBs) — FUNCTIONS

(a) Familiarisation

The pilot-in-command should familiarise themselves with the use of the EFB hardware and its applications on the ground before using them in flight for the first time.

The user guide established by the software developer should be available to the pilot-in-command.

(b) Check before flight

Before each flight, the pilot-in-command should conduct the following checks to ensure the continued safe operation of the EFB during the flight:

(1) general check of the EFB operation by switching it ON and checking that the applications they intend to use in flight are adequately operative;

(2) check of the remaining available battery power, if applicable, to ensure the availability of the EFB during the planned flight;

(3) check of the version effectivity of the EFB databases, if applicable (e.g. for charts, performance calculation and weight and balance applications); and

(4) check that an appropriate backup is available when a chart application or an application displaying aircraft checklists is used.

(c) Chart applications

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The navigation charts that are depicted should contain the information necessary, in an appropriate form, to conduct the operation safely. Consideration should be given to the size of the display to ensure legibility.

(d) Performance calculation and weight and balance functions

Prior to the first use of a performance or weight and balance function, and following any update of the database supporting the function, a check should be performed on the ground to verify that the output of the application corresponds with the data derived from the AFM (or other appropriate sources);

(e) Airport moving map display (AMMD) application

An AMMD application should not be used as a primary means of navigation for taxiing, but as a confirmation of outside visual references.

(f) Other functions

If advanced functions on non-certified devices are used that display information related to the aircraft position in flight, navigation, surroundings in terms of e.g. terrain or traffic, or attitude, the pilot-in-command should be aware of the potential misleading or erroneous information displayed and should only use these functions as an advisory or supplementary means.

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3.2.5. Draft AMC and GM to Part-SPO

AMC1 SPO.GEN.131(a) Portable electronic devices (PEDs)
ELECTRONIC FLIGHT BAGS (EFBs) — HARDWARE — COMPLEX AIRCRAFT

The following provisions should be considered in addition to the hardware provisions of NCC.GEN.131(a).

SUITABILITY OF THE HARDWARE — COMPLEX AIRCRAFT

(a) Display characteristics

Consideration should be given to the long-term degradation of a display as a result of abrasion and ageing. AMC 25-11 (paragraph 3.16a) may be used as appropriate guidance material to assess luminance and legibility aspects.

Information displayed on the EFB should be legible to the typical user at the intended viewing distance(s) and under the full range of lighting conditions expected in a flight crew compartment, including use in direct sunlight.

Users should be able to adjust the screen brightness of an EFB independently of the brightness of other displays in the flight crew compartment. In addition, when incorporating an automatic brightness adjustment, it should operate independently for each EFB in the flight crew compartment. Brightness adjustment using software means may be acceptable provided that this operation does not adversely affect the crew workload.

Buttons and labels should have adequate illumination for night use. ‘Buttons and labels’ refers to hardware controls located on the display itself.

All controls should be properly labelled for their intended function.

The 90-degree viewing angle on either side of each flight crew member’s line of sight may be unacceptable for certain EFB applications if aspects of the display quality are degraded at large viewing angles (e.g. the display colours wash out or the displayed colour contrast is not discernible at the installation viewing angle).

(b) Power source

The design of a portable EFB system should consider the source of electrical power, the independence of the power sources for multiple EFBs, and the potential need for an independent battery source. A non-exhaustive list of factors to be considered includes:

(1) the possibility to adopt operational procedures to ensure an adequate level of safety (for example, a minimum level of charge at preflight);

(2) the possible redundancy of portable EFBs to reduce the risk of exhausted batteries;

(3) the availability of backup battery packs to assure an alternative source of power.

Battery-powered EFBs that have aircraft power available for recharging the internal EFB batteries are considered to have a suitable backup power source.

For EFBs that have an internal battery power source and that are used in place of paper documentation required by the operating rules, the operator should either have at least one EFB connected to an aircraft power bus or established and documented mitigation means and procedures to ensure that sufficient power will be available during the whole flight with acceptable margins.

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(c) Environmental testing

Environmental testing, in particular testing for rapid depressurisation, should be performed when the EFB hosts applications that are required to be used during flight following a rapid depressurisation and/or when the EFB environmental operational range is potentially insufficient with respect to the foreseeable flight crew compartment operating conditions.

The information from the rapid depressurisation test of an EFB is used to establish the procedural requirements for the use of that EFB device in a pressurised aircraft. Rapid decompression testing should follow the EUROCAE ED-14D/RTCA DO-160D (or later revisions) guidelines for rapid decompression testing up to the maximum operating altitude of the aircraft on which the EFB is to be used. The EFB should be operative for at least 10 minutes after the start of the decompression.

(1) Pressurised aircraft: When a portable EFB has successfully completed rapid depressurisation testing, then no mitigating procedures for depressurisation events need to be developed. When a portable EFB has failed the rapid depressurisation testing while turned ON, but successfully completed it when OFF, then procedures should ensure that at least one EFB on board the aircraft remains OFF during the applicable flight phases or that it is configured so that no damage will be incurred should rapid decompression occur in flight above 10 000 ft above mean sea level (AMSL).

    If an EFB system has not been tested or has failed the rapid depressurisation test, then alternate procedures or paper backup should be available.

(2) Non-pressurised aircraft: Rapid decompression testing is not required for an EFB used in a non-pressurised aircraft. The EFB should be demonstrated to reliably operate up to the maximum operating altitude of the aircraft. If EFB operation at the maximum operating altitude is not attainable, procedures should be established to preclude operation of the EFB above the maximum demonstrated EFB operational altitude while still maintaining availability of any required aeronautical information displayed on the EFB.

Testing done on a specific EFB model configuration may be applied to other aircraft installations and these generic environmental tests may not need to be duplicated. The operator should collect and retain:

(1) evidence of these tests that have already been accomplished; or

(2) suitable alternate procedures to deal with the total loss of the EFB system.

Testing for rapid depressurisation does not need to be repeated when the EFB model identification and the battery type do not change.

The testing of operational EFBs should be avoided when possible to preclude the infliction of unknown damage to the unit during testing.

This testing is not equivalent to a full environmental qualification. Operators should account for the possible loss or erroneous functioning of the EFB in abnormal environmental conditions.

The safe stowage and the use of the EFB under any foreseeable flight crew compartment environmental conditions, including turbulence, should be evaluated.

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AMC1 SPO.GEN.131(a) Portable electronic devices (PEDs)
ELECTRONIC FLIGHT BAGS (EFBs) — HARDWARE — NON-COMPLEX AIRCRAFT

The same considerations as those in AMC1 NCO.GEN.125 should apply in respect of EFB hardware.

AMC2 SPO.GEN.131(b) Use of electronic flight bags (EFBs)
ELECTRONIC FLIGHT BAGS (EFBs) — SOFTWARE — COMPLEX AIRCRAFT

The same considerations as those in AMC1 CAT.GEN.MPA.141(b), AMC2 CAT.GEN.MPA.141(b) and AMC3 CAT.GEN.MPA.141(b) should apply in respect of EFB software.

AMC2 SPO.GEN.131(b) Use of electronic flight bags (EFBs)
ELECTRONIC FLIGHT BAGS (EFBs) — SOFTWARE — NON-COMPLEX AIRCRAFT

The same considerations as those in AMC2 NCO.GEN.125 should apply in respect of EFB software.

AMC1 SPO.GEN.131(b)(1) Use of electronic flight bags (EFBs)
RISK ASSESSMENT— COMPLEX AIRCRAFT

The same considerations as those in AMC1 NCC.GEN.131(b)(1) should apply in respect of EFB risk assessment.

(a) General

Prior to the entry into operation of any EFB system, the operator should carry out for all type B EFB applications a risk assessment as part of its hazard identification and risk management process.

The operator may make use of a risk assessment established by the software developer. However, the operator should ensure that its specific operational environment is taken into account.

The risk assessment should:

(1) evaluate the risks associated with the use of an EFB;

(2) identify potential losses of function or malfunction (with detected and undetected erroneous outputs) and the associated failure scenarios;

(3) analyse the operational consequences of these failure scenarios;

(4) establish mitigating measures; and

(5) ensure that the EFB system (hardware and software) achieves at least the same level of accessibility, usability, and reliability as the means of presentation it replaces.

In considering the accessibility, usability, and reliability of the EFB system, the operator should ensure that the failure of the complete EFB system as well as of individual applications, including any corruption or loss of data and any erroneously displayed information, has been assessed and that the risks have been mitigated to an acceptable level.

This risk assessment should be defined before the beginning of the trial period and should be amended accordingly, if necessary, at the end of this trial period. The results of the trial should establish the configuration and use of the system.

When the EFB system is intended to be introduced alongside a paper-based system, only the failures that would not be mitigated by the use of the paper-based system need to be addressed. In all other cases, a complete risk assessment should be carried out.

(b) Assessing and mitigating the risks

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Some parameters of EFB applications may depend on entries by crew/dispatchers, whereas others may be default parameters from within the system that are subject to an administration process (e.g. the runway line-up allowance in an aircraft performance application). In the first case, mitigation means would concern mainly training and crew procedures aspects, whereas in the second case mitigation means would more likely focus on EFB administration and data management aspects.

The analysis should be specific to the operator concerned and should address at least the following points:

(1) The minimisation of undetected erroneous outputs from applications and assessment of the worst-case scenario;

(2) Erroneous outputs from the software application including:

  (i) a description of the corruption scenarios; and

  (ii) a description of the mitigation means;

(3) Upstream processes including:

  (i) the reliability of root data used in applications (qualified/verified input data);

  (ii) the software application validation and verification checks according to appropriate industry standards; and

  (iii) the independence between application software components, e.g. robust partitioning between type A, type B and other certified software applications;

(4) Description of the mitigation means following the detected loss of an application, or of a detected erroneous output due to an internal EFB error;

(5) The need for access to an alternate power supply in order to achieve an acceptable level of safety for certain software applications, especially if they are used as a source of required information.

As part of the mitigation means, the operator should consider establishing a reliable alternative means of providing the information available on the EFB system.

The mitigation means could be, for example, one or a combination of the following:

(1) the system design (including hardware and software);

(2) a backup EFB device, possibly supplied from a different power source;

(3) EFB applications being hosted on more than one platform;

(4) a paper backup (e.g. quick reference handbook (QRH));

(5) procedural means;

(6) training; and

(7) administration.

Depending on the outcome of its risk assessment, the operator may also consider conducting an operational evaluation test before unrestricted use of its EFB devices and applications.

EFB system design features such as those assuring data integrity and the accuracy of performance calculations (e.g. a 'reasonableness' or 'range' check) may be integrated in the risk assessment performed by the operator.

(c) Changes

The operator should update its EFB risk assessment based on the planned changes to its EFB system:

However, modifications to the operator's EFB system which:

(1) do not bring any change to the calculation algorithms and/or to the HMI of a type B EFB application;

(2) introduce a new type A EFB application or modify an existing one (provided its software classification remains type A);

(3) do not introduce any additional functionality to an existing type B EFB application;

(4) update an existing database necessary to use an existing type B EFB application; or

(5) do not require a change to the flight crew training or operational procedures,

may be introduced by the operator without having to update its risk assessment.

These changes should, nevertheless, be controlled and properly tested prior to use in flight.

The modifications in the following non-exhaustive list are considered to meet these criteria:

(1) operating system updates;

(2) chart or airport database updates;

(3) updates to introduce fixes (patches); and

(4) installation and modification of a type A EFB application.

GM1 SPO.GEN.131(b)(1) Use of electronic flight bags (EFBs)
RISK ASSESSMENT— NON-COMPLEX AIRCRAFT

The operator of non-complex motor powered aircraft should at least perform the check before flight actions described in paragraph b) to AMC2 NCO.GEN.125.

AMC1 SPO.GEN.131(b)(2) Use of electronic flight bags (EFBs)
EFB ADMINISTRATION

The operator should ensure:

(a) that adequate support is provided to the EFB users for all the applications installed;

(b) that potential security issues associated with the application installed have been checked;

(c) that the hardware and software configuration is appropriately managed and that no unauthorised software is installed.

The operator should ensure that miscellaneous software applications do not adversely impact the operation of the EFB and should include miscellaneous software in the scope of EFB configuration management;

(d) that only a valid version of the application software and current data packages are installed on the EFB system; and

(e) the integrity of the data packages used by the applications installed.

AMC2 SPO.GEN.131(b)(2) Use of electronic flight bags (EFBs)
PROCEDURES

(a) General

If an EFB system generates information similar to that generated by existing certified systems, procedures should clearly identify which information source will be the primary, which source will be used for backup information, and under which conditions the backup source should be used. Procedures should define the actions to be taken by the flight crew when information provided by an EFB system is not consistent with that from other flight crew compartment sources, or when one EFB system shows different information than the other.

(b) Flight crew awareness of EFB software/database revisions

The operator should have a procedure in place to verify that the configuration of the EFB, including software application versions and, where applicable, database versions, are up to date. Flight crew members should have the ability to easily verify database version effectivity on the EFB. Nevertheless, flight crew members should not be required to confirm the revision dates for other databases that do not adversely affect flight operations, such as maintenance log forms or a list of airport codes. An example of a date-sensitive revision is that applied to an aeronautical chart database. Procedures should specify what actions should be taken if the software applications or databases loaded on the EFB system are outdated.

(c) Procedures to mitigate and/or control workload

Procedures should be designed to mitigate and/or control additional workload created by using an EFB system. The operator should implement procedures to ensure that, while the aircraft is in flight or moving on the ground, flight crew members do not become preoccupied with the EFB system at the same time. Workload should be shared between flight crew members to ensure ease of use and continued monitoring of other flight crew functions and aircraft equipment. These procedures should be strictly applied in flight and should specify the times at which the flight crew members may not use the EFB system.

(d) Dispatch

The operator should establish dispatch criteria for the EFB system. The operator should ensure that the availability of the EFB system is confirmed by preflight checks. Instructions to flight crew should clearly define the actions to be taken in the event of any EFB system deficiency.

Mitigation may be in the form of maintenance and/or operational procedures for items such as:

(1) replacement of batteries at defined intervals as required;

(2) ensuring that there is a fully charged backup battery on board;

(3) the flight crew to check the battery charging level before departure; and

(4) the flight crew to switch off the EFB in a timely manner when the aircraft power source is lost.

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In case of a partial or complete failure of the EFB, alternative dispatch procedures should be followed. These procedures should be included either in the minimum equipment list (MEL) or in the operations manual and should ensure an acceptable level of safety.

Particular attention should be paid to alternative dispatch procedures to obtain operational data (e.g. performance data) in case of a failure of an EFB hosting application providing such calculated data.

When data input and output integrity is obtained by cross-checking and gross-error checks, the same checking principle should apply to alternative dispatch procedures to ensure equivalent protection.

(e) Maintenance

Procedures should be established for the routine maintenance of the EFB system and how unserviceability and failures are to be dealt with to ensure that the integrity of the EFB system is preserved. Maintenance procedures may also need to include the secure handling of updated information and how it is accepted and then promulgated in a timely manner and complete format to all users and aircraft platforms.

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

Should a fault or failure of the system come to light, it is essential that such failures are brought to the immediate attention of the flight crew and that the system is isolated until rectification action is taken. In addition to backup procedures, to deal with system failures, a reporting system should be in place so that the necessary action, either to a particular EFB system or to the whole system, is taken in order to prevent the use of erroneous information by flight crew members.

(f) Security

The EFB system (including any means used for updating it) should be secure from unauthorised intervention (e.g. by malicious software). The operator should ensure that adequate security procedures are in place to protect the system at software level and to manage hardware (e.g. identification of the person to whom the hardware is released, protected storage when the hardware is not in use). These procedures should guarantee that prior to each flight the EFB operational software works as specified and the EFB operational data is complete and accurate. Moreover, a system should be in place to ensure that the EFB does not accept a data load that contains corrupted contents. Adequate measures should be in place for compilation and secure distribution of the data to the aircraft.

The procedures should be transparent, easy to understand, to follow and to oversee:

(1) if an EFB is based on consumer electronics, e.g. a laptop, which can be easily removed, manipulated, or replaced by a similar component, then special consideration should be given to the physical security of the hardware;

(2) portable EFB platforms should be subject to allocation tracking to specific aircraft or persons;

(3) where a system has input ports and especially if widely known protocols are used through these ports or internet connections are offered, then special consideration should be given to the risks associated with these ports;

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(4) where physical media are used to update the EFB system and especially if widely known types of physical media are used, then the operator should use technologies and/or procedures to assure that unauthorised content cannot enter the EFB system through these media.

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

Beyond the level of security required to assure that the EFB can properly perform its intended functions, the level of security ultimately required depends on the abilities of the EFB.

(g) Electronic signatures

Some applicable requirements may require a signature to signify either acceptance or to confirm the authority (e.g. load sheet, technical logbook, notification to captain (NOTOC)). In order to be accepted as an equivalent to a handwritten signature, electronic signatures used in EFB applications need, as a minimum, to fulfil the same objectives and should, as a minimum, assure the same degree of security as the handwritten or any other form of signature it intends to replace. AMC1 CAT.POL.MAB.105(c) provides means to comply with the required handwritten signature or its equivalent for the mass and balance documentation.

In the case of legally required signatures, an operator should have in place procedures for electronic signatures, acceptable to the competent authority, that guarantee:

(1) their uniqueness: a signature should identify a specific individual and be difficult to duplicate;

(2) their significance: an individual using an electronic signature should take deliberate and recognisable action to affix their signature;

(3) their scope: the scope of information being affirmed with an electronic signature should be clear to the signatory and to the subsequent readers of the record, record entry, or document;

(4) their security: the security of an individual’s handwritten signature is maintained by ensuring that it is difficult for another individual to duplicate or alter it;

(5) their non-repudiation: an electronic signature should prevent a signatory from denying that they affixed a signature to a specific record, record entry, or document; the more difficult it is to duplicate a signature, the likelier the signature was created by the signatory; and

(6) their traceability: an electronic signature should provide positive traceability to the individual who signed a record, record entry, or any other document.

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

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AMC3 SPO.GEN.131(b)(2) Use of electronic flight bags (EFBs)
FLIGHT CREW TRAINING

Flight crew members should be given specific training on the use of the EFB system before it is operationally used.

Training should include at least the following:

(a) an overview of the system architecture;

(b) preflight checks of the system;

(c) limitations of the system;

(d) specific training on the use of each application and the conditions under which the EFB may and may not be used;

(e) restrictions on the use of the system, including where some part or the entire system is not available;

(f) procedures for normal operations, including cross-checking of data entry and computed information;

(g) procedures to handle abnormal situations, such as a late runway change or a diversion to an alternate aerodrome;

(h) procedures to handle emergency situations;

(i) phases of the flight when the EFB system may and may not be used;

(j) human factors considerations, including crew recourse management (CRM); and

(k) additional training for new applications or changes to the hardware configuration.

AMC4 SPO.GEN.131(b)(2) Use of electronic flight bags (EFBs)
PERFORMANCE AND MASS AND BALANCE APPLICATIONS — COMPLEX AIRCRAFT

(a) General

The performance and mass and balance applications should be based on existing published data found in the AFM or performance manual, and should deliver results that allow the crew to operate in compliance with the appropriate Air Operations regulations. The applications may use algorithms or data spread sheets to determine results. They may have the ability to interpolate within but should not extrapolate beyond the information contained in the published data for the particular aircraft.

To protect against intentional and unintentional modifications, the integrity of the database files related to performance and mass and balance (the performance database, airport database, etc.) should be checked by the program before performing calculations. This check can be run once at the start-up of the application.

Each software version should be identified by a unique version number. The performance and mass and balance applications should keep a trace of each computation performed (inputs and outputs) and the airline should have procedures in place to retain this information.

The operator should ensure that aircraft performance or mass and balance data provided by the application is correct compared with the data derived from the AFM (e.g. for take-off and landing performance data) or from other reference data sources (e.g. mass and balance manual or databases, in-flight performance manual or databases) under a representative cross-check of conditions (e.g. for

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take-off and landing performance applications: take-off and landing performance data on a dry, wet and contaminated runway, different wind conditions and aerodrome pressure altitudes, etc.).

Where there is already a certified mass and balance and performance application (e.g. hosted in the flight management system (FMS)), the operator should ensure the independence of the EFB and avionics-based algorithms.

The operator should establish procedures to define any new roles that the flight crew and dispatch office may have in creating, reviewing, and using performance calculations supported by EFB systems.

(b) Testing

The demonstration of the compliance of a performance or mass and balance application should include evidence of the software testing activities performed with the software version candidate for operational use.

The testing can be performed either by the operator or a third party, as long as the testing process is documented and the responsibilities identified.

The testing activities should include human–machine interface (HMI) testing, reliability testing, and accuracy testing.

HMI testing should demonstrate that the application is not error-prone and that calculation errors can be detected by the crew with the proposed procedures.

Reliability testing should show that the application in its operating environment (OS and hardware included) is stable and deterministic, i.e. identical answers are generated each time the process is entered with identical parameters.

Accuracy testing should demonstrate that the aircraft performance or mass and balance computations provided by the application are correct in comparison with data derived from the AFM or other reference data sources, under a representative cross section of conditions (e.g. for take-off and landing performance applications: runway state and slope, different wind conditions and pressure altitudes, various aircraft configurations including failures with a performance impact, etc.).

The demonstration should include a sufficient number of comparison results from representative calculations throughout the entire operating envelope of the aircraft, considering corner points, routine and break points.

Operators are expected to justify that the accuracy testing covered a sufficient number of testing points with respect to the design of their software application and databases.

Any difference compared to the reference data that is judged significant should be examined and explained. When differences come from a reduced conservatism or reduced margins that were purposely built into the approved data, this approach should be clearly mentioned. Compliance with the applicable certification and operational rules need to be demonstrated in any case.

The testing method should be described. The testing may be automated when all the required data is available in an appropriate electronic format, but in addition to a thorough monitoring of the correct functioning and design of the testing tools and procedures, operators are strongly suggested to perform additional manual verification. It could be based on a few scenarios for each chart or table of the reference data, including both operationally representative scenarios and 'corner-case' scenarios.

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The testing of a software revision should, in addition, include non-regression testing and testing of any fix or change.

Furthermore, an operator should conduct testing related to its customisation of the applications and to any element pertinent to its operation that was not covered at an earlier stage (e.g. airport database verification).

(c) Procedures

Specific care is needed regarding the crew procedures concerning take-off and landing performance or mass and balance applications. The crew procedures should ensure that:

(1) calculations are conducted independently by each crew member before data outputs are accepted for use;

(2) a formal cross-check is made before data outputs are accepted for use; such cross-checks should utilise the independent calculations described above, together with the output of the same data from other sources on the aircraft;

(3) a gross-error check is conducted before data outputs are accepted for use; such a gross-error check may use either a 'rule of thumb' or the output of the same data from other sources on the aircraft; and

(4) in the event of a loss of functionality of an EFB through either the loss of a single application, or the failure of the device hosting the application, an equivalent level of safety can be maintained; consistency with the EFB risk assessment assumptions should be confirmed.

(d) Training

The training should emphasise the importance of executing all take-off and landing performance calculations in accordance with the SOPs to assure fully independent calculations.

Furthermore, due to the optimisation at different levels brought by performance applications, the crew members may be confronted with new procedures and different aircraft behaviour (e.g. the use of multiple flap settings for take-off). The training should be designed and provided accordingly.

Where an application allows the computing of both dispatch results (from regulatory and factored calculations) and other results, the training should highlight the specificities of those results. Depending on the representativeness of the calculation, the crew should be trained on the operational margin that might be required.

The training should also address the identification and the review of default values, if any, and assumptions about the aircraft status or environmental conditions made by the application.

(e) Specific considerations for mass and balance applications

The basic data used for the mass and balance calculation should be modifiable by the operator or by the software application provider on behalf of the operator.

In addition to the figures, a graph displaying the mass and its associated centre of gravity (CG) should be provided.

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(f) Human-factors-specific considerations

Input data and output data (i.e. results) shall be clearly separated from each other. All the information necessary for a given calculation task should be presented together or be easily accessible.

All the data required for the performance and mass and balance applications should be asked for or displayed, including correct and unambiguous terms (names), units of measurement (e.g. kg or lbs), and when applicable, an index system and a CG-position declaration (e.g. Arm/%MAC). The units should match the ones from the other flight crew compartment sources for the same kinds of data.

Airspeeds should be provided in a way directly useable in the flight crew compartment, unless the unit clearly indicates otherwise (e.g. KCAS). Any difference in the type of airspeed provided by the EFB application and the type provided by the AFM or flight crew operating manual (FCOM) performance charts should be mentioned in the flight crew guides and training material.

If the landing performance application allows the computation of both dispatch results (regulatory, factored) and other results (e.g. in-flight or unfactored), the flight crew members should be made aware of the computation mode used.

(1) Inputs

The application should allow users to clearly distinguish user entries from default values or entries imported from other aircraft systems.

Performance applications should allow the flight crew to check whether a certain obstacle is included in the performance calculation and/or to include new or revised or new obstacle information in the performance calculations.

(2) Outputs

All critical assumptions for performance calculation (e.g. the use of thrust reversers, full or reduced thrust/power rating) should be clearly displayed. The assumptions made about any calculation should be at least as clear to the flight crew members as similar information would be on a tabular chart.

All output data should be available in numbers.

The application should indicate when a set of entries results in an unachievable operation (for instance, a negative stopping margin) with a specific message or colour scheme. This should be done in accordance with the relevant provisions on messages and the use of colours.

In order to allow a smooth workflow and to prevent data entry errors, the layout of the calculation outputs should be such that it is consistent with the data entry interface of the aircraft applications in which the calculation outputs are used (e.g. flight management systems).

(3) Modifications

The user should be able to modify performance calculations easily, especially when making last-minute changes.

Calculation results and any outdated input fields should be deleted when:

(i) modifications are entered;

(ii) the EFB is shut down or the performance application is closed; and

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(iii) the EFB or the performance application has been in a standby or 'background' mode too long, i.e. such that it is likely that when it is used again, the inputs or outputs will be outdated.

AMC5 SPO.GEN.131(b)(2) Use of electronic flight bags (EFBs)
AIRPORT MOVING MAP DISPLAY (AMMD) APPLICATION WITH OWN-SHIP POSITION — COMPLEX AIRCRAFT

(a) General

An AMMD application should not be used as the primary means of navigation for taxiing and should be only used in conjunction with other materials and procedures identified within the operating concept (see paragraph (e)).

When an AMMD is in use, the primary means of navigation for taxiing remains the use of normal procedures and direct visual observation out of the flight crew compartment window.

Thus, as recognised in ETSO-C165a, an AMMD application with a display of own-ship position is considered as having a minor safety effect for malfunctions causing the incorrect depiction of aircraft position (own-ship), and the failure condition for the loss of function is classified as 'no safety effect.'

(b) Minimum requirements

AMMD software that complies with the European Technical Standard Order ETSO-C165a is considered to be acceptable.

In addition, the system should provide the means to display the revision number of the software installed.

(c) Data provided by the AMMD software application developer

The operator should ensure that the AMMD software application developer provides the appropriate data including:

(1) the executable object code in an acceptable transfer medium;

(2) installation instructions or equivalent as per ETSO-C165a Section 2.2 addressing:

(i) the identification of each target EFB system computing platform (including hardware platform and operating system version) with which this AMMD software application and database was demonstrated to be compatible;

(ii) the installation procedures and limitations to address the AMMD installation requirements for each applicable platform such as target computer resource requirements (e.g. memory resources) to ensure the AMMD will work properly when integrated and installed;

(iii) the interface description data including the requirements for external sensors providing data inputs; and

(iv) the verification means required to verify proper integration of the AMMD into the target platform environment, including identification of additional activities that the integrator of an EFB must perform to ensure the AMMD meets its intended function, such as testing in the aircraft;

(3) any AMMD limitations, and known installation, operational, functional, or performance issues on the AMMD.

(d) AMMD software installation in the EFB

The operator should review the documents and the data provided by the AMMD developer, and ensure that the installation requirements of the AMMD software in the specific EFB platform and aircraft are addressed. Operators are required to:

(1) ensure that the software and databases are compatible with the EFB system computing platform on which they are intended to function, including the analysis of the compatibility of the AMMD with other type A and B EFB software applications residing in the same platform; operators should follow the program installation instructions provided by the software supplier, as applicable to the compatible EFB computer;

(2) check that the objectives for installation, assumptions, limitations and requirements for the AMMD, as part of the data provided by the AMMD software application developer, are satisfied;

(3) perform any verification activities proposed by the AMMD software application developer, as well as to identify and perform additional integration activities to be completed;

(4) ensure the compatibility and the compliance with requirements for data provided by other installed systems, such as a GNSS sensor and latency assumptions.

(e) Operating concept

The operating concept should include, as a minimum:

(1) flight crew operation, including confirmation of the effectivity;

(2) the handling of updates;

(3) the quality assurance function;

(4) the handling of NOTAMS; and

(5) the provision of current maps and charts to cover the intended operation of the aircraft.

Changes to operational or procedural characteristics of the aircraft (e.g. flight crew procedures) should be documented in the operations manual or user's guide as appropriate. In particular, the following text should be included in the related procedure:

'This EFB airport moving map display (AMMD) with its own-ship position symbol is designed to assist flight crew members in orienting themselves on the airport surface to improve the flight crew members' positional awareness during taxiing. The AMMD function is not to be used as the basis for ground manoeuvring. This application is limited to ground operations only.'

(f) Training requirements

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

Any mitigation to hazards that are mitigated by flight crew procedures should be included in flight crew training. Details of AMMD training should be included in the operator's overall EFB training.

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(g) Use of COTS GNSS receivers

(1) Characterisation of the receiver:

The COTS GNSS receiver candidate for use with the AMMD EFB application should be fully characterised in terms of technical specifications. It should feature an adequate number of channels (12 or less). The COTS GNSS receiver initial acquisition time for 20 metres or better accuracy should be 2 minutes or less.

The AMMD application should, in addition to position velocity time (PVT) data, receive a sufficient number of parameters related to the fix quality and integrity (e.g. EPU, HIL, integrity flags, number of space vehicles (SV) in view and tracked, etc.). The data provided to the AMMD application should be based exclusively on GPS or SBAS-augmented GPS.

(2) Installation aspects:

COTS GNSS receivers are PEDs and their installation and use should follow the related provisions for PEDs.

If the external receiver transmits wirelessly, security aspects have to be considered.

The connectivity between the COTS GNSS receiver and the EFB should be shown to be sufficiently reliable.

(3) Practical evaluation:

As variables are introduced by the placement of the COTS GNSS antenna in the aircraft and the characteristics of the aircraft itself (e.g. heated and/or shielded windshield effects), the tests have to take place on the type of aircraft in which the EFB will be operated, with the antenna positioned at a reference location.

The test installation should record the data provided by the COTS GNSS receiver to the AMMD application, as well as data from a suitable reference position source. The COTS GNSS antenna of the reference receiver should be located outside of the flight crew compartment with the best possible view of the sky.

The tests should consist of a statistically relevant sample of taxiing. It is recommended to include taxiing at airports that are representative of more complex airports typically accessed by the operator. Taxiing segment samples should include data that is derived from runways and taxiways, and should include numerous turns. Taxiing segment samples should include parts in areas of high buildings such as terminals. The analysis must include at least 25 inbound and/or outbound taxiing segments between the parking location and the runway.

During the tests, any unusual events, such as observing the own-ship in a location on the map that is notably offset compared to the real world, the own-ship changing to non-directional when the aircraft is moving, and times when the own-ship disappears from the map display, should be noted.

The analysis should measure the recorded COTS GNSS availability, latency, and accuracy in comparison to the source. The analysis should be used to demonstrate that the AMMD requirements are satisfactorily complied with in terms of total system accuracy (taking into account database error, latency effects, display errors, and uncompensated antenna offsets) within 50 metres (95 %).

The analysis should also include a comparison of the typical degradation due to locating the antenna inside the flight crew compartment in terms of masking (e.g. comparing the number of tracked space vehicles (SV)).

The connectivity between the COTS GNSS receiver and the EFB should be shown to be sufficiently reliable.

When demonstrating compliance with the following requirements of DO-257A, the behaviour of the end-to-end system should be taken into account:

(i) indicating degraded position accuracy within 1 second (§2.2.4 (22)); and

(ii) indicating a loss of positioning data within 5 seconds (§2.2.4 (23)); conditions to consider are both a loss of the GPS view (e.g. antenna failure) and a loss of communication between the receiver and the EFB.

AMC6 SPO.GEN.131(b)(2) Use of electronic flight bags (EFBs)
HUMAN FACTORS CONSIDERATIONS FOR CHART APPLICATIONS — COMPLEX AIRCRAFT

The navigation charts that are depicted should contain the information necessary, in an appropriate form, to conduct the operation safely. Consideration should be given to the size, resolution and position of the display to ensure legibility whilst retaining the ability to review all information required to maintain adequate situational awareness. The identification of risks associated with the human–machine interface, as part of the operator's risk assessment, is key to identifying acceptable mitigation means, e.g.:

(a) to establish procedures to reduce the risk of making errors;

(b) to control and mitigate the additional workload related to EFB use;

(c) to ensure the consistency of colour-coding and symbology philosophies between EFB applications and their compatibility with other flight crew compartment applications; and

(d) to consider aspects of crew resource management (CRM) when using an EFB system.

AMC7 SPO.GEN.131(b)(2) Use of electronic flight bags (EFBs)
IN-FLIGHT WEATHER APPLICATIONS — COMPLEX AIRCRAFT

(a) General

An in-flight weather (IFW) application is an EFB function or application enabling the crew to access meteorological information. It is designed to increase situational awareness and to support the flight crew when making strategic decisions.

An IFW function or application may be used to access both information required to be on-board and supplemental weather information, but should not be the only source of information required to be on board for dispatch.

An IFW application should not be used to support tactical decisions or as a substitute for certified aircraft systems (e.g. weather radar).

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Any current information from the meteorological documentation required to be on board or from aircraft primary systems should always prevail in case there is a difference from the IFW application information.

The displayed meteorological information may be forecasted and/or observed, and may be updated on the ground and/or in flight. It should be based on data from certified meteorological services providers or other reliable sources.

The meteorological information provided to the flight crew should be as far as possible consistent with the one available to ground-based aviation meteorological information users (e.g. operations control centre (OCC), dispatchers, etc.) in order to establish common situational awareness and to facilitate collaborative decision-making.

(b) Display

Meteorological information should be presented to the flight crew in a format that is appropriate to the content of the information; graphical depiction is encouraged whenever practicable.

The display of information should include:

(1) information on the weather data (observed or forecasted);

(2) currency or age and validity time of the weather data;

(3) information necessary for interpreting the weather data (e.g. legend);

(4) positive and clear indication of any missing information or data to enable the flight crew to determine areas of uncertainty when making decisions to avoid hazardous weather; and

(5) an indication of the validity (functionality) of the data link, if meteorological information is uploaded via data link.

Meteorological information in IFW applications may be displayed, for example, as an overlay over navigation charts, over geographical maps, or it may be a stand-alone weather depiction (e.g. radar plots, satellite images, etc.).

If meteorological information is overlaid on navigation charts, special considerations should be given to HMI issues in order to avoid adverse effects on the basic chart functions.

The meteorological information may require reformatting for flight crew compartment use to accommodate, for example, the display size or the depiction technology. However, any reformatting of the meteorological information should preserve both the geo-location and intensity of the meteorological conditions regardless of projection, scaling, or any other types of processing. To maintain adherence to human factors principles, and to avoid the introduction of confusion and increased workload to the flight crew members, the content of the meteorological information and graphics should be consistent and standard (to the extent possible) throughout airspace operational positions.

(c) Training and procedures

The operator should establish procedures for the use of an IFW application.

The operator should provide adequate training to the flight crew members before using an IFW application. This training should address:

(1) Limitations of the use of an IFW application:

  (i) acceptable use (strategic planning only); and

  (ii) information required to be on-board;

(2) Information on the display of weather data:

  (i) type of displayed information (forecasted, observed);

  (ii) symbology (symbols, colours); and

  (iii) interpretation of meteorological information;

(3) Identification of failures and malfunctions (e.g. incomplete uplinks, data link failures, missing info);

(4) Human factors issues:

  (i) avoiding fixation; and

  (ii) managing Workload.

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3.2.6. Draft AMC 20-25

The entire Section 6.2, Chapter 7 and Appendices A to K are deleted.

AMC 20-25 Rev. 1

Airworthiness ~~and operational~~ considerations for Electronic Flight Bags (EFBs)

Contents

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1 PURPOSE AND SCOPE

This Acceptable Means of Compliance (AMC) is one, but not the only, means to obtain an airworthiness approval ~~and to satisfactorily assess the operational aspects for the use of~~ for installed Electronic Flight Bags (EFBs) and for EFB installed resources. Additional guidance material can be found in ICAO Doc 10020 'Manual of Electronic Flight Bags'.

Operational considerations for the evaluation and approval of the use of EFB applications can be found in Commission Regulation (EU) No 965/2012.

~~It is considered an acceptable means of complying with the requirements contained in CAT.GEN.MPA.180 concerning carriage of electronic documents and manuals, Commission Regulation (EC) No 2042/2003 and Commission Regulation (EU) No 748/2012.~~

~~Traditionally, some of the documentation and information available to flight crew for use on the flight crew compartment has been in paper format. Much of this information is now available in electronic format. In addition, many non-required information services, data, and company procedures may also be made available to flight or cabin crew electronically. Operators have long recognised the benefit of hosting these materials on the flight crew's EFBs.~~

~~This AMC does not contain additional or double set requirements to those already contained in the operational requirements for the basic information, documentation and data sources that would need to be carried on board. The operator remains responsible for ensuring the accuracy of the information used and that it is derived from verifiable sources. The use of EFBs was initially intended to cover an alternative method of storing, retrieving, and using the manuals and information required to be on board by the applicable operational requirements. Subsequent technical development has led to potentially hosting on EFBs even applications using computational software (e.g. for performances), databases (e.g. digital navigation data) or real-time data coming from the avionics (e.g. Airport Moving Map Display).~~

~~The evaluation of an EFB may have both an airworthiness and an operational aspect depending on the category/type of EFB/application used and, therefore, where necessary, to make a complete evaluation of an EFB system, there is a need for close coordination between the two processes.~~

~~In harmonisation with FAA, this AMC does not include a Type C software application classification as a potential EFB application. The Agency's policy is that any non-Type A (please refer to paragraph 5.2.1) or non-Type B (please refer to paragraph. 5.2.2) software application, unless it is miscellaneous (non-EFB) application, should undergo a full airworthiness approval and so become a certified avionics function. A non-exhaustive list of examples of Type A and B applications is provided in Appendices A and B.~~

~~2 APPLICABILITY~~

~~This AMC is to be used by:~~

~~(a) Operators of aeroplanes and helicopters;~~
~~(b) applicants or holders of an aircraft Type Certificate (TC) or Supplemental TC; and~~
~~(c) applicants or holders of ETSO authorisations covering software applications hosted in EFBs.~~

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3~~2~~ REFERENCE DOCUMENTS

~~3.1 Related Requirements~~

~~From Annexes III and IV to Commission Regulation (EU) No 965/2012 (‘Part ORO’ and ‘Part-CAT’)[6], the following articles are to be used as references:~~

~~CAT.GEN.MPA.140, CAT.GEN.MPA.180, ORO.GEN.130, ORO.GEN.140, ORO.GEN.200, ORO.MLR.100, CAT.POL.MAB.105, ORO.FC.230.~~

2~~3~~.~~2~~1 Related Certification Specifications

CS 25.561, 25.777, 25.789, 25.1301, 25.1302, 25.1309, 25.1316, 25.1321, 25.1322, 25.1357, 25.1431, 25.1529, 25.1581

CS 23.561, 23.1301, 23.1309, 23.1321, 23.1322, 23.1357, 23.1431, 23.1581

CS 29.1301, 29.1309, 29.1321, 29.1322, 29.1431, 29.1581

CS 27.1301, 27.1309, 27.1321, 27.1322, 27.1581

~~EASA CS-MMEL (Draft) Master Minimum Equipment List~~

Appendix G to CS-23, Appendix H to CS-25, and Appendices A to CS-27 and CS-29: Instructions for Continued Airworthiness

~~ETSO-C165a: Electronic map systems for graphical depiction of aircraft position~~

EASA Special Condition on Information Security (Network Security)

2~~3~~.~~3~~2 Related Guidance Material

2~~3~~.3.1 Europe

EASA AMC 25.1581	Appendix 1 – Computerised Aeroplane Flight Manual
EASA AMC 25.1309	System Design and Analysis
EASA AMC 25-11	Electronic Flight Deck Displays
EUROCAE ED-130()	Guidance for the Use of Portable Electronic Devices (PEDs) on Board Aircraft
EUROCAE ED-12()	Software Considerations in Airborne Systems and Equipment Certification
EUROCAE ED-14D/DO-160D (or later revisions)	Environmental Conditions and Test Procedures for Airborne Equipment
EUROCAE ED-76/RTCA DO-200A (or later revisions)	Standards for Processing Aeronautical Data
EUROCAE ED-80()	Design Assurance Guidance for Airborne Electronic hardware
~~UL 1642~~	~~Underwriters Laboratory Inc. (UL) Standard for Safety for Lithium Batteries~~

~~3.3.2 USA~~

~~FAA AC 20-159~~	~~Obtaining Design and Production Approval of Airport Moving Map Display Applications Intended for Electronic Flight Bag Systems~~
~~FAA AC 120-74A~~	~~Parts 91, 121, 125, and 135 Flight crew Procedures during Taxi Operations~~

[6] ~~Commission Regulation (EU) No 965/2012 of 05 October 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council. *(OJ L 296, 25.10.2012, p.1).*~~

FAA AC 120-76()	Guidelines for the Certification, Airworthiness, and Operational Approval of Electronic Flight Bag Computing Devices
~~FAA AC 120-78~~	~~Acceptance and use of Electronic Signatures~~
FAA AC 20-173	Installation of Electronic Flight Bag Components
EASA ETSO-C165A/FAA TSO-C165A	Electronic Map Display Equipment for Graphical Depiction of Aircraft Position
~~RTCA DO-160()~~	~~Environmental Conditions and Test Procedures for Airborne Equipment~~
RTCA DO-178()	Software Considerations in Airborne Systems and Equipment Certification
~~RTCA DO-200()~~	~~Standards for Processing Aeronautical Data~~
RTCA DO-254()	Design Assurance Guidance for Airborne Electronic Hardware
RTCA DO-257()	Minimum Operation Performance Standards for the Depiction of Navigational Information on Electronic Maps
~~RTCA DO-294()~~	~~Guidance on Allowing Transmitting Portable Electronic Devices (T-PEDs) on Aircraft~~
RTCA DO-311()	Minimum Operational Performance Standards for Rechargeable Lithium Battery Systems

3~~4~~ GLOSSARY OF TERMS IN THE CONTEXT OF THIS AMC

~~4.1 Aircraft Administrative Communications (AAC)~~

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

~~4.2 Airport Moving Map Display (AMMD)~~

~~A software application displaying airport maps and using a navigation source to depict the aircraft current position on this map while on ground.~~

3~~4~~.~~3~~1 Consumer device

Electronic equipment primarily intended for non-aeronautical use.

~~4.4 Controlled Portable Electronic Device (C-PED)~~

~~A controlled PED is a PED subject to administrative control by the operator using it. This will include, inter alia, tracking the allocation of the devices to specific aircraft or persons and ensuring that no unauthorised changes are made to the hardware, software, or databases.~~

3~~4~~.~~5~~2 Data connectivity for EFB systems

Data connectivity for EFB system supports either uni- or bi-directional data communication between the EFB and other aircraft systems (e.g. avionics).
Direct interconnectivity between EFBs or direct connectivity between EFBs and ground systems as with a T-PED (e.g. GSM, Bluetooth) are not covered by this definition.

3~~4~~.~~6~~3 Electronic Flight Bag (EFB)

An information system for flight deck crew members which allows the storing, updating, delivering, displaying, and/or computing of digital data to support flight operations or duties.

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~~**4.7 EFB administrator**~~

~~An EFB administrator is a person appointed by the operator, held responsible for the administration of the EFB system within the company. The EFB administrator is the primary link between the operator and the EFB system and software suppliers.~~

34.~~8~~4 EFB host platform

When considering an EFB system, the EFB host platform is the equipment (i.e. hardware) in which the computing capabilities and basic software (e.g. operating system, input/output software) reside.

~~**4.9 EFB risk assessment and mitigation**~~

~~A process that considers an EFB system, its software applications, and its integration inside a specific aircraft, to identify the potential malfunctions and failure scenarios, analyse their operational repercussions, and, if necessary, propose mitigation means.~~

34.~~10~~5 EFB software application

Software installed on an EFB system that ~~allows~~ provides specific operational functionality.

34.~~11~~6 EFB system

An EFB system comprises the hardware (including any battery, connectivity provision, I/O devices) and software (including databases) needed to support the intended EFB function(s).

34.~~12~~7 EFB system supplier

The company responsible for developing, or for having developed, the EFB system or part of it. The EFB system supplier is not necessarily a host platform or aircraft manufacturer.

~~**4.13 Minor failure conditions**~~

~~Failure conditions which would not significantly reduce aeroplane safety, and which involve crew actions that are well within their capabilities. Minor failure conditions may include, for example, a slight reduction in safety margins or functional capabilities, a slight increase in crew workload, such as routine flight plan changes, or some physical discomfort to passengers or cabin crew. Further guidance can be found in AMC 25.1309.~~

34.~~14~~8 Mounting device

A mounting device is an aircraft certified part which secures portable or installed EFB, or EFB system components.

~~**4.15 No safety effect**~~

~~Failure conditions that would have no effect on safety: for example, failure conditions that would not affect the operational capability of the aeroplane or increase crew workload. Further guidance can be found in AMC 25.1309.~~

34.~~16~~9 Portable Electronic Device (PED)

PEDs are typically consumer electronic devices, which have functional capabilit~~y~~ies for communications, entertainment, data processing, and/or utilit~~y~~ies. There are two basic categories of PEDs – those with and those without intentional transmitting capability; please refer to ED-130/RTCA DO-294().

34.~~17~~10 Software application developer

The company responsible for developing, or for having developed a particular software application.

34.~~18~~11 Transmitting PED (T-PED)

PEDs that have intended radio frequency (RF) transmission capabilities.

~~**4.19 Viewable stowage**~~

~~A device that is secured on the flight crew (e.g. kneeboard) or in/to an existing aircraft part (e.g. suction cups) with the intended function to hold charts or to hold acceptable light mass portable devices (for example an EFB of no more than 1 Kg) viewable to the pilot at her/his required duty station. The device is not necessarily part of the certified aircraft configuration.~~

~~4~~5 SYSTEM DESCRIPTION AND CLASSIFICATION OF EFB SYSTEMS

~~This section is divided into two parts. The first part deals with the host platform (e.g. the hardware and operating system) used to run the EFB software suite. The second part deals with this software suite which includes the EFB applications installed to provide the relevant functionality.~~

~~**5.1 EFB systems hardware**~~

This AMC defines two possibilities for the hardware of EFB systems: portable and installed.

~~4~~5.1~~.1~~Portable EFB

~~**Definition**~~

A portable EFB is a portable EFB host platform, used on the flight deck, which is not part of the certified aircraft configuration.

Except for installed components, portable EFBs are outside of the scope of this document.

~~**Complementary characteristics**~~

~~A portable EFB can be operated inside and outside the aircraft.~~

~~A portable EFB hosts type A and/or type B EFB software applications. In addition, it may host miscellaneous (non-EFB) software applications (see 6.2.2.3).~~

~~A portable EFB is a portable electronic device (PED) as defined in GM1 CAT.GEN.MPA.140[7].~~

~~The mass, dimensions, shape, and position of the portable EFB should not compromise flight safety.~~

~~A portable EFB may be provided with aircraft power through a certified power source (see 6.1.1.1.3).~~

~~If mounted, the portable EFB is easily removable from its mounting device or attached to it, without the use of tools by the flight crew. If mounted, the attachment or removal does not constitute a maintenance action.~~

~~A portable EFB may be part of a system containing EFB installed resources which are part of the certified aircraft configuration.~~

~~The installed EFB components are part of the certified aircraft configuration with the intended function to mount (see 6.1.1.1.1) the EFB to the aircraft and/or connect to other systems (see 6.1.1.1.4).~~

~~When a portable EFB is a T-PED, the conditions for use of its transmitting capability are established in the approved Aircraft Flight Manual (AFM). In absence of information in the AFM, the EFB transmitting capability may be allowed during non-critical phases of the flight (see 6.2.1.1.2).~~

~~Portable EFBs may be used in all phases of the flight if secured to a certified mount or securely attached to a viewable stowage device in a manner which allows its normal use (see 6.1.1.1.1, 6.1.1.1.2, and 6.2.1.6).~~

~~Portable EFBs not meeting the above characteristic, should be stowed during critical phases of the flight.~~

~~Portable EFBs are controlled PEDs (see paragraph 4.4).~~

Any EFB component that is either not accessible in the flight crew compartment by the flight crew members or not removable by the flight crew, should be installed as ‘certificated equipment’ covered by a Type Certificate (TC), changed TC or Supplemental (S)TC.

~~4~~5.~~1~~.2 Installed EFB

Definition

~~[7] PEDs are any kind of electronic device, typically but not limited to consumer electronics, brought on board the aircraft by crew members, passengers, or as part of the cargo and that are not included in the approved aircraft configuration. All equipment that is able to consume electrical energy falls under this definition. The electrical energy can be provided from internal sources as batteries (chargeable or non-rechargeable) or the devices may also be connected to specific aircraft power sources.~~

An EFB host platform installed in the aircraft and considered as an aircraft part, covered, thus, by the aircraft airworthiness approval.

Complementary characteristics

An installed EFB is managed under the aircraft type design configuration.

In addition to hosting type A and B applications (refer to CAT.GEN.MPA.141 for the definition and characteristics of EFB applications), an installed EFB may host certified applications, provided the EFB meets the certification requirements for hosting such applications, including assurance that the non-certified software applications do not adversely affect the certified application(s). For example, a robust partitioning mechanism is one possible means to ensure the independence between certified applications and the other types of applications.

~~**5.2 Software applications for EFB systems**~~

~~The functionality associated with the EFB system depends, in part, upon the applications loaded on the host platform. The classification of the applications, based on respective safety effects, is intended to provide clear divisions among such applications and, therefore, the assessment process applied to each.~~

~~Appendices A and B provide support regarding the classification of traditional EFB software applications. They may be used for justifying a classification provided that the application does not feature design or functional novelties introducing new ways of interaction or unusual procedures.~~

~~If an application is not listed in the appendices or presents a high degree of novelty, the classification should be established using the definitions provided hereafter and the guidance in Appendix C.~~

~~For the purpose of the following definitions, 'malfunction or misuse' means any failure, malfunction of the application, or design-related human errors that can be reasonably expected in service.~~

~~**5.2.1 Type A**~~

~~**Definition**~~

~~Type A applications are EFB applications whose malfunction or misuse have no safety effect.~~

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~~Complementary characteristics~~

~~Type A applications:~~

~~(a) may be hosted on either portable or installed EFBs;~~

~~(b) do not require any approval (see paragraph 6.2.2.1);and~~

~~(c) should follow guidance provided in Appendix D, paragraph D.2.~~

~~Examples of Type A applications can be found in Appendix A.~~

~~5.2.2 Type B~~

~~Definition~~

~~Type B applications are applications:~~

~~(a) whose malfunction or misuse are limited to a minor failure condition; and~~

~~(b) which do neither substitute nor duplicate any system or functionality required by airworthiness regulations, airspace requirements, or operational rules[8].~~

~~Complementary characteristics~~

~~Type B applications:~~

~~(a) may be hosted on either portable or installed EFBs;~~

~~(b) require an operational assessment as described in paragraph 6.2.2.2; and~~

~~(c) do not require an airworthiness approval.~~

~~Examples of Type B applications can be found in Appendix B.~~

~~5.2.2.1 Airport Moving Map Display (AMMD) application with own-ship position~~

~~AMMD with own-ship position is a Type B application that is subject to the specific conditions described in Appendix H of this AMC.~~

~~5.2.3 Miscellaneous (non-EFB) software applications~~

~~Miscellaneous software applications are non-EFB applications, supporting function(s) not directly related to operations conducted by the flight crew on the aircraft.~~

~~This does not preclude Type B software applications from being used to present the documents, manuals, and information required by CAT.GEN.MPA.180.~~

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5~~6~~ AIRWORTHINESS CRITERIA ~~HARDWARE AND SOFTWARE PROCESSES~~

~~The table below provides a summary of the different processes presented in this chapter.~~

~~EFB constituent~~		~~Portable EFB paragraph 5.1.1~~		~~Installed EFB paragraph 5.1.2~~	
		~~Assessment~~	~~Records or approvals~~	~~Assessment~~	~~Records or approvals~~
~~Hardware~~	~~EFB Installed resources mounting device~~	~~EASA Airworthiness process and approval paragraph 6.1.1.1~~		~~EASA Airworthiness process and approval paragraph 6.1.1.1~~	
	~~EFB host platform~~	~~Evaluation paragraph 6.2.1~~	~~As a minimum, operations Manual amended as required~~	~~EASA Airworthiness process and approval paragraph 6.1.1.2~~	
~~Software~~	~~Miscellaneous software paragraph6.2.2.3~~	~~Operator evaluation paragraph6.2.2.3~~	~~Operations Manual amended as required~~	~~Operator evaluation paragraph6.2.2.3~~	~~Operations Manual amended as required~~
	~~Software Type A paragraph5.2.1~~	~~Operator evaluation paragraph6.2.2.1~~	~~Operations Manual amended as required~~	~~Operator evaluation paragraph6.2.2.1~~	~~Operations Manual amended as required~~
	~~Software Type B paragraph5.2.2~~	~~Evaluation paragraph6.2.2.2~~	~~As a minimum, operations Manual amended as required~~	~~Evaluation paragraph6.2.2.2~~	~~As a minimum, operations Manual amended as required~~

~~**6.1 Airworthiness approval**~~

Airworthiness approval is necessary for installed EFB systems~~(see paragraph5.1.2)~~, as well as EFB installed resources and mounting devices.
~~A portable EFB device does not require an airworthiness approval but its presence and use in the cockpit needs to be evaluated (see paragraph6.2.1).~~

5~~6~~.1~~.1~~ Hardware airworthiness approval

5~~6~~.1.1~~.1~~ Installed resources

Installed resources are the input/output components external to the EFB host platform itself, such as an installed remote display, a control device (e.g. a keyboard, pointing device, switches, etc.) or a docking station.

The installed resources should be dedicated to EFB functions only, or in the case of use of resources shared with avionics, this possibility shall be part of the approved type design. It should be demonstrated, using the appropriate level of assessment, that the integration in the aircraft of the EFB and the EFB software applications does not jeopardise the compliance of the aircraft installed systems and equipment (including the shared resources) to airworthiness requirements such as CS 25.1302 or 25.1309.

Installed resources require an airworthiness approval.

5~~6~~.1.1.2~~1.1~~ Mounting device

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

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

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

(b) When the mounting device is used to secure an EFB display (e.g. portable EFB, installed EFB side display), the mount should be able to be locked in position easily. If necessary, the selection of positions should be adjustable enough to accommodate a range of flight crew member preferences. In addition, the range of available movement should accommodate the expected range of users' physical abilities (i.e. anthropometrics constraints). Locking mechanisms should be of a low-wear type that will minimise slippage after extended periods of normal use.

(c) Crashworthiness considerations should be taken into account in the design of this device. This includes the appropriate restraint of any device when in use.

(d) When the mounting device is used to secure an EFB display (e.g. portable EFB, installed EFB side display), a provision should be provided to secure or lock the mounting device in a position out of the way of flight crew operations when not in use. When stowed, the device and its securing mechanism should not intrude into the flight crew compartment space to the extent that they cause either visual or physical obstruction of flight controls/displays and/or egress routes.

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

(f) Adequate means should be provided (e.g. hardware or software) to shut down the portable EFB when its controls are not accessible by the ~~pilot~~ flight crew when strapped in the normal seated position. This objective can be achieved through a dedicated installed resource certified according to 5.1.1~~6.1.1.1~~ (e.g. button accessible from ~~pilot~~ the flight crew seated position).

5~~6~~.1.3~~1.1.2~~ Characteristics and placement of the EFB display

(a) <u>Placement of the display</u>

The EFB display and any other element of the EFB system should be placed in such a way that they do not unduly impair the ~~pilot's~~ flight crew's external view during any of the phases of the flight. Equally, they should not impair the view of or access to any flight crew compartment ~~cockpit~~ control or instrument.

The location of the display unit and the other EFB system elements should be assessed for impact on egress requirements.

When the EFB is in use (intended to be viewed or controlled), its display should be within 90 degrees on either side of each ~~pilot's~~ flight crew member's line of sight.

Glare and reflection on the EFB display should not interfere with the normal duties of the flight crew or unduly impair the legibility of the EFB data.

The EFB data should be legible under the full range of lighting conditions expected in a flight crew compartment, including use in direct sunlight.

In addition, consideration should be given to the potential for confusion that could result from the presentation of relative directions when the EFB is positioned in an orientation inconsistent with that information. For example, it may be misleading if the aircraft heading indicator points to the top of the display and the display is not aligned with the aircraft longitudinal axis. This does not apply to charts that are presented in a static way (e.g. with no HMI mechanisation such as automatic repositioning), and that can be considered as similar to paper charts.

(b) Display characteristics

Consideration should be given to the long-term degradation of a display as a result of abrasion and ageing. AMC 25-11 (paragraph3.16a) can be used as an appropriate guidance material to assess luminance and legibility aspects.

Users should be able to adjust the screen brightness of an EFB independently of the brightness of other displays in the flight crew compartment. In addition, when incorporating an automatic brightness adjustment, it should operate independently for each EFB in the flight crew compartment. Brightness adjustment using software means may be acceptable providing that this operation does not affect adversely the crew workload.

Buttons and labels should have adequate illumination for night use. 'Buttons and labels' refers to hardware controls located on the display itself.

The 90-degree viewing angle on either side of each ~~pilot's~~ flight crew member's line of sight may be unacceptable for certain EFB applications if aspects of the display quality are degraded at large viewing angles (e.g. the display colours wash out or the displayed colour contrast is not discernible at the installation viewing angle).

(c) Applicable specifications

Each EFB system should be evaluated with regard to the requirements in this section 5.1.3~~6.1.1.1.2~~: see CS 23.1321, CS 25.1321, CS 27.1321, and CS 29.1321.

If the display is an installed resource, it should be assessed against CS 25.1302 or in accordance with the applicable certification basis.

5~~6~~.1.4~~1.1.3~~ Power Source

Refer to the applicable EASA provisions related to power supply.

~~This section applies to design considerations for installing dedicated power port and cabling provisions for EFBs. EFB power provisions should comply with the applicable airworthiness specifications.~~

~~Connection of EFB power provisions to a non-essential, or to the least critical power bus, is recommended, so failure or malfunction of the EFB, or power supply, will not affect safe operation of aircraft critical or essential systems.~~

~~Connection to more critical aircraft power buses is, however, permitted if appropriate, taking into account the intended function of the EFB. Further considerations can be found in Appendix J of this AMC.~~

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

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

~~(a) A placard should be mounted beside the power outlet, containing the information needed by the flight or maintenance crews (e.g. 28 VDC, 115 VAC, 60 or 400 Hz, etc.).~~

~~(b) The EFB power source should be designed so that it may be deactivated at any time. If the flight crew cannot quickly remove the plug, which is used to connect the EFB to the aircraft electrical network, an alternate means should be provided to quickly stop powering and charging the EFB. Circuit breakers are not to be used as switches; their use for this purpose is prohibited.~~

~~(c) If a manual means (e.g. on/off switch) is used, this means should be clearly labelled and be readily accessible.~~

~~(d) If an automatic means is used, the applicant should describe the intended function and the design of the automatic feature and should substantiate that the objective of deactivating the EFB power source, when required to maintain safety, is fulfilled.~~

~~Further considerations can be found in 6.1.1.1.5 which deals with connecting cables.~~

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5~~6~~.1.5~~1.1.4~~ EFB data connectivity

Portable EFBs having data connectivity to aircraft systems, either wired or wireless, may receive or transmit data to and from aircraft systems, provided the connection (hardware and software for data connection provisions) and adequate interface protection devices are incorporated into the aircraft type design.

A connectivity resource for a ~~A~~ portable EFB can allow the EFB to receive any data from aircraft systems, but data transmission from EFBs is limited to:

(a) systems whose failures have no safety effect or minor safety effect at aircraft level (e.g. printer or ACARS);

(b) aircraft systems which have been certified with the purpose of providing connectivity to PEDs (e.g. SATCOM with a router) in accordance with the limitations established in the AFM;

(c) systems which are completely isolated (in both directions) from the certified aircraft systems (e.g. a transmission media that receives and transmits data for Aircraft Administrative Communications (AAC) purposes on the ground only); and

(d) EFB system installed resources according to section 5.1.1~~6.1.1.1~~.

EFB data connectivity should be validated and verified to ensure non-interference with and isolation from certified aircraft systems during data transmission and reception.

The safety assessment of the EFB data connectivity installation should include an analysis of vulnerabilities to new threats that may be introduced by the connection of the EFB to the aircraft systems (malware and unauthorised access) and their effect on safety. This assessment should be independent and should not take any credit from the operational assessment of EFB System Security ~~(see section 7.9)~~, which is intended to protect EFB systems themselves.

Certified aircraft systems should not be adversely affected by EFB system failures.

Any consequent airworthiness limitations should be included in the AFM (please refer to 5.2.1~~6.1.2.1~~).

5~~6~~.1.6~~1.1.5~~ Connecting cables

If cabling is installed to mate aircraft systems with an EFB,

(a) if the cable is not run inside the mount, the cable should not hang loosely in a way that compromises task performance and safety. Flight crew should be able to easily secure the cables out of the way during operations (e.g., cable tether straps);

(b) cables that are external to the mounting device should be of sufficient length in order not to obstruct the use of any movable device on the flight crew compartment; and

(c) for Part-25 ~~airplanes~~ aeroplanes, installed cables are considered electrical wiring interconnection systems and, therefore, need to comply with CS-25 subpart H.

5~~6~~.1.2~~1.2~~ Installed EFB

An installed EFB is considered as part of the aircraft and, therefore, requires a full airworthiness approval. This host platform includes the Operating System (OS).

The assessment of compliance with the airworthiness requirements would typically include two specific areas:

(a) the safety assessment addressing failure conditions of the EFB system hardware, of any certified application (or applications ineligible as type A and/or type B) installed on the EFB and the partition provided for uncertified applications and miscellaneous non-EFB applications; and

(b) hardware and operating system software qualification conducted in accordance with the necessary Development Assurance Level (DAL) for the system and its interfaces.

5~~6.1~~.2 Certification documentation

5~~6.1~~.2.1 Aircraft flight manual

For installed EFBs and certified installed resources, the AFM section or an Aircraft Flight Manual Supplement (AFMS) should contain:

(a) a statement of the limited scope of the airworthiness approval of EFBs provisions (e.g. these EFB provisions are only intended for type A and type B EFB applications in accordance with this AMC 20-25. The airworthiness approval does not replace the operational assessment for the use of the EFB system).

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(b) identification of the installed equipment, which may include a very brief description of the installed system or resources; and
(c) appropriate amendments or supplements to cover any limitations concerning:
  (1) the use of the EFB host platform for the installed EFB system; and
  (2) the use of the installed EFB provisions/resources for the portable EFB system.

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

5~~6.1~~.2.2 Guidelines for EFB software application developers (Installed EFB and certified installed resources)

TC/STC holders for EFB installed resources or installed EFBs should compile and maintain a guideline document to provide a set of limitations, considerations, and guidelines to design, develop, and integrate software applications into the installed EFB or with certified resources for portable EFB. The guidelines should address, at least, the following:

(a) a description of the architecture for the EFB installed components;
(b) The Development Assurance Level (DAL) of the EFB component and any assumptions, limitations, or risk mitigation means necessary to support this;
(c) information necessary to ensure the development of a software application consistent with the avionics interface and the human machine interface that is also accurate, reliable, secure, testable, and maintainable;
(d) integration procedures between any new software application and those already approved; and
(e) guidelines on how to integrate any new software application into the installed platform or installed resources.

The guideline document should be available, at least, to the aircraft operator, to the competent authority, and to EASA.

5~~6.1~~.2.3 Guidelines for EFB system suppliers (installed resources for portable EFBs)

TC/STC holders for installed resources of portable EFBs should provide a set of requirements and guidelines to integrate the portable EFB in the installed provisions, and to design and develop EFB software applications.

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

(a) A description of the installed EFB resources and associated limitations, if any. For example, the:
  (1) intended function, limitations of use, etc.;
  (2) characteristics of the mounting devices, display units, control and pointing devices, printer, etc.;
  (3) maximum authorised characteristics (dimensions, weight, etc.) of the portable parts of the EFB system supported by the mounting devices;
  (4) architectural description of the EFB provisions, including normal/abnormal/manual/ automatic reconfigurations; and
  (5) normal/abnormal/emergency/maintenance procedures including allowed phases of the flight.
(b) Characteristics and limitations, including safety and security considerations concerning:
  (1) the power supply;
  (2) the laptop battery; and
  (3) data connectivity.

The guidelines should be available at least to the operator, the competent authority and EASA.

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4. Regulatory impact assessment (RIA)

4.1. Issues to be addressed

Background information

Traditionally, flight crew members brought into the flight crew compartment a considerable volume of paper documents (e.g. charts, manuals, etc.), as some of them were mandated by regulations. Of course, all these documents add weight to the aircraft and occupy space. In addition, considering the amount of documentation, consulting a specific document or page in flight might prove to be complex.

Due to technology advancements, it became possible to use digital documents and, therefore, to replace voluminous paper documentation with portable electronic devices (PEDs) or installed computers to reduce weight and volume, while possibly adding functionality to support flight crew members in the execution of their tasks. In addition to the capability to contain digital documents, these PEDs or computers can also be used to support calculations performed by the flight crew on board (e.g. mass and balance, performance), or even to transmit and receive data (e.g. meteorological information).

In the early 21st century, the emergence of PEDs of very small dimensions and of a very low cost (e.g. tablets, etc.) compared to the existing 'installed' ones, which are considered part of the approved aircraft configuration, has led to the proliferation of portable electronic flight bags (EFBs) in the flight crew compartments. The enhanced processing power of these new-generation devices has allowed the inclusion of more and more complex functions, which are not replacing any paper documentation carried (e.g. airport moving map display (AMMD)).

Recent developments clearly show a trend among operators to further integrate these devices with avionics through a certified interface which allows data transmission from avionics to EFBs. This allows very high-level applications to be developed combining various parameters received from the avionics and other data, such as weather forecasts or aeronautical charts.

The use of such devices has undoubtedly the potential to offer operational, economic and safety benefits. However, they may also introduce new safety risks, such as battery fires, electromagnetic interference, human factors issues, etc., and may be subject to known risks, such as loose objects in the flight crew compartment. These risks need to be assessed and, where necessary, mitigated through proportionate regulatory measures and/or safety promotion actions.

Current European provisions on EFBs

Except for the use of on-board mass and balance computing systems (CAT.POL.MAB.105, NCC.POL.110 and SPO.POL.115) and also for the use of PEDs on board (CAT.GEN.MPA.140, NCC.GEN.130, NCO.GEN.125 and SPO.GEN.130), there is no specific requirement specifically related to the use of EFBs in the applicable Air Operations Regulation, i.e. Regulation (EU) No 965/2012.

Currently, the only European EFB-specific provisions are contained in AMC 20-25 'Airworthiness and operational consideration for Electronic Flight Bags (EFBs)', published in 2014, which is only applicable to commercial air transport (CAT). This stand-alone document provides detailed provisions for the use of EFBs by CAT operators, in the area of airworthiness and operations, but is not linked to any IR requirement of the Basic Regulation. Therefore, AMC 20-25, which is by nature non-binding, is not subject to the alternative means of compliance (AltMoC) process. In addition, the combination of operations and airworthiness considerations in one document introduces legal uncertainty as the implementation is under the responsibility of different competent authorities.

Also, it should be noted that this EFB-specific material does not yet address non-commercial and specialised operations.

ICAO provisions on EFBs

During the 15th meeting of the Operations Panel (OPSP-WH/WHL/15; March 2013), new specific EFB SARPs were proposed for inclusion in Part I (International Commercial Air Transport — Aeroplanes) of Annex 6 (Operation of Aircraft), as well as in Part II (International General Aviation — Aeroplanes) and Part III (International Operations — Helicopters). The ICAO Council adopted the final amendments to ICAO Annex 6 Part I, Part II and Part III in March 2014, with an applicability date in November 2014.

These amendments introduce general hardware and software requirements and, in specified cases, a formal operational approval with an entry in the operations specifications (OPSSPEC) of the operator, for the use of EFBs on aeroplanes and helicopters by CAT operators, together with some associated criteria this approval would rely on.

The provisions for non-commercial operations rely on the same operational criteria but no operational approval is required for these types of operations.

In parallel, the ICAO subgroup of the ICAO Flight Operations Panel has developed guidance, contained in ICAO Doc 10020, for Contracting States on the use of EFBs by operators. It includes, among other things, some criteria to determine whether an EFB application would require an operational approval for its use.

In the absence of a specific IR requirement on the use of EFBs in the Basic Regulation, it is considered that Regulation (EU) No 965/2012 is less prescriptive than the EFB provisions of ICAO Annex 6 Part I, II and III.

The main issue to be addressed by this NPA is level playing field.

It is linked with the following current conditions:

— There is a lack of requirements in the area of EFBs, as only AMC 20-25 is available;

— There are currently no provisions for the use of EFBs by NCC, NCO and SPO, as AMC 20-25 is only applicable to CAT operations;

— The current ICAO provisions for EFBs in Annex 6 Part I, II and III, applicable since November 2014, have not yet been transposed into the European regulatory framework.

4.1.1. Safety risk assessment

EFBs pose some general and functional risks. Some recent incidents have highlighted the fact that the improper use of EFBs had been one of the contributing factors to incidents. However, the analysis of those incidents showed that the issues associated with the use of an EFB, which were identified as a contributing factor, were already adequately addressed in the existing AMC 20-25.

Safety risks are therefore not considered to be a driver for RMT.0601 for CAT operations.

The potential lack of harmonisation in Europe for all types of operations is considered to have a low safety relevance.

With regard to NCC and SPO with CMPA, due to the lack of relevant safety data, no specific risk assessment has been conducted, but it is considered than the inherent risks are of a similar nature to those for CAT operations.

In the specific case of NCO operations, taking into account the objective to ensure proportionality and the specificities of this type of operations, a specific generic risk assessment has been conducted during the technical consultation in order to identify where mitigation would be necessary to keep the safety risks at an acceptable level. This risk assessment is provided in Appendix 6.1 to this NPA.

4.1.2. Who is affected?

Operators, flight crews and competent authorities are currently affected by the identified issue.

EFBs are now widely used by most CAT operators (815[9] AOC holders) and by many non-commercial and SPO operators, whatever the scope and extent of their activities, and therefore most operators, competent authorities and flight crews are considered to be affected by the issue.

4.1.3. How could the issue/problem evolve?

If the issue is not addressed and the regulatory framework is not changed, this would lead to maintaining numerous differences between the Member States and, therefore, the level playing field issue identified above would not be resolved and could even weaken over the years with technological advancements.

In addition, the European rules would remain non-compliant with the latest ICAO SARPs.

4.2. Objectives

The overall objectives of the EASA system are defined in Article 2 of the Basic Regulation. This proposal will contribute to the achievement of the overall objectives by addressing the issues outlined in Chapter 2 of this NPA.

The specific objective of this proposal is to:

— ensure compliance with the ICAO SARPs;

— provide specific requirements on the use of EFBs in Regulation (EU) No 965/2012 for commercial air transport operations; and

— provide requirements proportionate to the complexity of the operations and/or propose safety promotion actions related to the use of EFBs for non-commercial operations and specialised operations.

4.3. Policy options

Considering the different starting points for:

— CAT operations: AMC 20-25 is already existing and applicable;

[9] Standardisation information system data, 2015.

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— NCC/SPO with CMPA: there are currently no EFB provisions and the safety risks are considered to be similar to those for CAT operations;

— NCO operations: there are currently no EFB provisions and the safety risks are considered to be specific due to the nature of the operations and to the types of aircraft operated,

three different sets of options have been established: one for CAT operations, one for NCC/SPO with CMPA; and one for NCO operations.

Table 1: Selected policy options for CAT operations

Option No	*Short title*	**Description**
0	No change	Baseline option (no change in the rules; risks remain as outlined in the issue analysis).
1	Approval for the use of any EFB application	Require an operational approval for the use of any EFB application.
2	Approval to use type B EFB applications	Require an operational approval for the use of all type B EFB applications.
3	Approval to use some type B EFB applications	Require an operational approval for the use of some type B EFB applications, not contained in a predefined list at AMC level.
4	General approval to use an EFB	Require an organisational approval for the use of an EFB application, which recognises the ability of an operator to adequately manage an EFB programme.

Option 1 is about requiring an operational approval for the use of each and every individual EFB application.

Option 2 would limit this operational approval to the use of type B EFB applications, which would be aligned with a current practice among several Member States which already grant operational approval for the use of type B EFB applications.

Option 3 would further limit the scope to the use of some specific type B EFB applications, which would not be contained in a specific list of applications. This specific list would contain type A and simple type B EFB applications and would be established at AMC level to ensure the adequate flexibility.

Option 4, rather than requiring an individual approval per EFB application, would introduce a general approval for the use of an EFB system. This approval would not be linked to a specific EFB application and would recognise the capability of an operator to appropriately manage an EFB programme.

Operators already using an EFB and having shown compliance with AMC 20-25 are expected to be only very slightly impacted by Option 1, 2, 3 or 4 as the only expected impact with regard to an operational approval would be administrative.

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Table 2: Selected policy options for NCC/SPO with CMPA operations

Option No	*Short title*	**Description**
0	No change	Baseline option (no change in the rules; risks remain as outlined in the issue analysis).
1	IR and AMC 20-25 applicable	Introduce an IR related to the use of EFBs and transpose all the AMC 20-25 provisions.
2	IR and all elements of AMC 20-25 for type B EFB applications only	Introduce an IR related to the use of EFBs and transpose the following AMC 20-25 provisions: — all hardware requirements; — provisions for all type B EFB applications; — all Chapter 7 provisions (including HMI assessment and operational evaluation test) when type B EFB applications are used; and create a table of applicability to ensure easy use of the common provisions between CAT and NCC/SPO with CMPA.
3	IR and some elements of AMC 20-25 for type B EFB applications only	Introduce an IR related to the use of EFBs and transpose the following AMC 20-25 provisions: — all hardware requirements; — provisions for type B EFB applications; — Chapter 7 provisions which ensure proportionality; and create a table of applicability to ensure easy use of the common provisions between CAT and NCC/SPO with CMPA.

Option 1 is about making all the provisions currently contained in AMC 20-25 applicable to NCC and SPO with CMPA operators.

Option 2 would make all the hardware provisions of AMC 20-25, the provisions of Chapter 7 and all the software provisions for type B EFB applications applicable to NCC and SPO with CMPA operators.

Option 3 would make all the hardware provisions of AMC 20-25, the provisions of Chapter 7 and all the software provisions for some type B EFB applications applicable to NCC and SPO with CMPA operators.

Both Option 2 and Option 3 include the definition of a table of applicability for NCC/SPO with CMPA to determine easily the applicable provisions for such operations.

Table 3: Selected policy options for NCO operations

Option No	*Short title*	**Description**
0	No change	Baseline option (no change in the rules; risks remain as outlined in the issue analysis).
1	Complement PED IRs (NCO.GEN.125)	Complement the current PED IR (NCO.GEN.125) and related AMC/GM with some elements of AMC 20-25 selected on the basis of a specific risk assessment related to the use of EFBs by NCO operators to address the identified risk and to ensure compliance with ICAO Annex 6 SARPs for non-commercial operations.

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Option 1 relies on the risk assessment provided in Appendix 6.1 and on an ICAO compliance assessment provided in Appendix 6.2.

No necessary specific safety promotion action has been identified by the rulemaking group for CAT/NCC/SPO with CMPA operators and for general aviation operators during the technical consultation meeting with NCO stakeholders, as the proposed provisions were considered to be adequately proportionate to the operations concerned.

4.4. Methodology and data

4.4.1. Applied methodology

4.4.1.1. General

An impact assessment is a process to provide justifications supporting a proposal according to five logical steps:

Issue analysis	What is the problem?
Objective	What do I want to achieve?
Definition of options	What are the different solutions?
Analysis of options	What are the impacts of these options?
Conclusion	What do I decide?

These logical steps are also the core headings of the EASA RIA report.

Once the issues have been analysed, the objectives can be defined and options can be proposed to achieve these objectives and address the issues. The analysis of the impacts of these options can be performed with different methodologies depending on the availability and types of data. In addition, one of the main principles of impact assessment is to provide an in-depth analysis proportionate to the scale of the issue.

Considering the limited availability of data, which in addition is a mixture of qualitative and quantitative types of data, it was decided to use a multi-criteria analysis (MCA) to assess the options proposed to address the issues. The following section explains the principles of the MCA and how it was applied in a way that is proportionate to the scale of the issues.

4.4.1.2. Criteria for the impact analysis

MCA covers a wide range of techniques intended to combine a range of positive and negative impacts into a single framework to allow easier comparison of scenarios. Essentially, it applies cost–benefit thinking to cases where there is a need to present impacts that are a mixture of qualitative, quantitative, and monetary data, and where there are varying degrees of certainty. The MCA key steps generally include:

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— establishing the criteria to be used to compare the options (these criteria must be measurable, at least in qualitative terms);

— scoring how well each option meets the criteria; the scoring needs to be relative to the baseline scenario;

— ranking the options by combining their respective scores; and

— performing a sensitivity analysis on the scoring to test the robustness of the ranking.

The criteria used to compare the options were derived from the Basic Regulation and the guidelines for regulatory impact assessment developed by the European Commission. The principal objective of EASA is to 'establish and maintain a high uniform level of safety' (Article 2(1) of the Basic Regulation). As additional objectives, the Basic Regulation identifies environmental, economic, proportionality, and harmonisation aspects which are reflected below.

These principles were fully applied for the analysis of the changes related to this RIA. Each individual criterion (safety, economic) is assessed separately, using the tables 8A and 8B and the final assessment is made using the scale with score of impacts (Table 8). The final scoring of the impacts uses a scale of – 5 to + 5 to indicate the negative and positive impacts of each option (i.e. from 'very low' to 'very high' negative/positive impacts). Intermediate levels of benefit are termed 'low, 'medium' and 'high' to provide for a total of five levels in each one of the positive and negative directions, with also a 'no impact' score possible.

Table 8: Scale with scoring of the impacts

Positive impact	Score	Negative impact	Score
+ 5	Very high positive impact	– 5	Very high negative impact
+ 4	High positive impact	– 4	High negative impact
+ 3	Medium positive impact	– 3	Medium negative impact
+ 2	Low positive impact	– 2	Low negative impact
+ 1	Very low positive impact	– 1	Very low negative impact
0	Insignificant		

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As regards the safety impacts, the following scale is used:

Table 8A: Safety scale according to different levels of safety risks

Score		***For the top 10 safety risks in aviation sector***	***For the other safety risks (except when leading only to incidents)***	***For incidents without accidents***
Very high positive impact	+ 5	Almost all the accidents would be prevented	Not applicable	Not applicable
High positive impact	+ 4	Approximately 75 % of the accidents would be prevented	Almost all of the risks would be prevented	Not applicable
Medium positive impact	+ 3	Approximately 50 % of the accidents would be prevented	Approximately 60 % of the risks would be prevented	More than 50 % of the incidents would be prevented
Low positive impact	+ 2	Approximately 25 % of the accidents would be prevented	Approximately 40 % of the risks would be prevented	Approximately 20–50 % of the incidents would be prevented
Very low positive impact	+ 1	Minor positive impacts not quantifiable	Approximately 10 % of the risks would be prevented	Approximately a maximum of 20 % of the incidents would be prevented
No impact	0	Safety risks remain as today		
Negative impact	– 1 …	(make the opposite statement compared to above)		

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As regards the economic impacts, the following scale is used:

Table 8B: Economic scale in relation with stakeholder turnovers

			EASA	NAAs	ATM/ ANSP	Operators
	Scope: EASA Member States area					
	Yearly turnover (m EUR)		140	1 000	8 000	150 000
Score	**Turnover impact**		m EUR			
5	> + 1.5 %	>1.5 %				
	]1 to 1.5 %[	1.50 %	2.10	15.0	120	2 250
4	]0.8 to 1 %[	1.00 %	1.40	10.0	80	1 500
	]0.6 to 0.8 %[	0.80 %	1.12	8.0	64	1 200
5	]0.4 to 0.6 %[	0.60 %	0.84	6.0	48	900
	]0.2 to 0.4 %[	0.40 %	0.56	4.0	32	600
3	]0.1 to 0.2 %[	0.20 %	0.28	2.0	16	300
	]0.05 to 0.1 %[	0.10 %	0.14	1.0	8	150
2	]0.02 to 0.05 %[	0.05 %	0.07	0.5	4	75
1	]0 to 0.02 %[	0.02 %	0.03	0.2	2	30
0		0%	0.00	0.0	0	0

4.4.2. Data collection

Considering the options defined depending on the types of operations, the current non-harmonised situation within Europe and in addition the lack of accurate data for all types of operations with regard to the use of EFBs, only very general data were used by the RMT.0601 & RMT.0602 Rulemaking Group comprising operators, manufacturers, competent authorities and pilot associations. As such, all the impacts have been estimated by the RMT.0601 & RMT.0602 Rulemaking Group, which was considered as an appropriate sample of stakeholders to estimate the impacts for the different options.

However, in order to collect more precise data to support the assumptions made, stakeholders are kindly invited to provide answers to the questions posed in the following paragraphs.

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4.5. Analysis of impacts

4.5.1. Safety impact

4.5.1.1. CAT operations

	Impact	Rationales
Option 0 **No change**	– 1	All safety risks associated with the use of EFBs by CAT operators are considered to be currently adequately addressed by AMC 20-25. However, it is expected that without any change, the lack of requirements for the use of EFBs could lead to further discrepancies throughout Europe in the interpretation and the implementation of the provisions of AMC 20-25 by competent authorities and operators. Therefore, considering the constant development of more and more complex and integrated EFB applications, Option 0 is expected to have a low negative impact on safety.
Option 1 **Approval for the use of any EFB application**	2	The four other options would introduce an IR for the use of EFBs and would therefore bring the AltMoC process in accordance with ARO.GEN.120 applicable to the provisions of AMC 20-25. This would support a more uniform implementation of these provisions and would ensure that all provisions of AMC 20-25, or the alternative means of compliance providing for an equivalent level of safety, are implemented. In addition, it would introduce an operational approval with a different scope for each of the options. It would therefore introduce additional responsibilities on the competent authority side and would ensure an appropriate enforcement of these provisions. The safety effects of these four options are expected to be low positive.
Option 2 **Approval to use type B EFB applications**		
Option 3 **Approval to use some type B EFB applications**		
Option 4 **General approval to use an EFB application**		

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4.5.1.2. NCC/SPO with CMPA

	Impact	Rationales
Option 0 **No change**	– 3	Option 0 would leave the current situation with no regulatory provisions applicable for the use of EFBs by NCC/SPO with CMPA operators. Considering the rapid development of more and more complex applications and their accessibility, it is considered that their use without adequate mitigation in place would introduce a significant safety risk, and therefore Option 0 is considered to have a medium negative impact on safety.
Option 1 **IR and AMC 20-25 applicable**	3	Option 1, by introducing requirements for the use of all EFB applications, would avoid that the use of EFBs by NCC/SPO with CMPA proliferates without any control. It would therefore have a medium positive safety impact.
Option 2 **IR and all elements of AMC 20-25 for type B EFB applications only**	3	Options 2 is considered to have a medium positive safety impact of the same order as it would introduce provisions which would address the more safety-relevant EFB applications. Indeed, Option 2 includes all the type B EFB applications, including those considered to have a higher safety relevance.
Option 3 **IR and some elements of AMC 20-25 for type B EFB applications only**	2	Option 3 would have the same scope as Option 2, but with some specific provisions of AMC 20-25 (HMI assessment and operational evaluation test) not transposed due to the expected implementation difficulties and burden it would represent for NCC/SPO with CMPA operators. The positive safety impact is therefore expected to be slightly lower.

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4.5.1.3. NCO operations

	Impact	Rationales
Option 0 **No change**	– 1	Option 0 would leave the current situation with no regulatory provisions applicable for the use of EFBs by NCO operators. Considering the rapid development of more and more complex applications and their accessibility, it is considered that their use without adequate mitigation in place would introduce some additional safety risks. However, considering the complexity of these aircraft and the type of operations, these risks are considered minor. Therefore, Option 0 is considered to have a low negative impact on safety.
Option 1 **Complement PED rules NCO.GEN.125**	1	Based on the generic risk assessment conducted for NCO operations, it is considered that Option 1 would have a positive safety impact as the identified risks requiring mitigation would be addressed by the proposals.

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4.5.2. Environmental impact

No environmental impact is anticipated.

4.5.3. Social impact

No social impact is anticipated.

4.5.4. Economic impact

4.5.4.1. CAT operations

	Impact	Rationales
Option 0 **No change**	0	No economic impact is expected for Option 0 as neither additional compliance costs for the operators nor additional costs or administrative burden for the competent authorities are expected.
Option 1 **Approval for the use of any EFB application**	– 2	Option 1 would introduce an operational approval for all EFB applications. It would mean that for any new EFB application a formal approval process should be followed and a new approval should be granted to the operator. This process would use resources from the operators and would involve administrative costs as well. From a competent authority perspective, it would as well introduce some minor administrative costs. As it includes all EFB applications, it is considered to have a low negative impact.
Option 2 **Approval to use type B EFB applications**	– 1	Option 2 would introduce an operational approval for type B EFB applications. It would mean that for any new type B application a formal approval process should be followed and a new approval should be granted to the operator. The scope of this option is narrower than that of Option 1 as it includes only type B EFB applications. It is therefore considered to have a lower negative economic impact.
Option 3 **Approval to use some type B EFB applications**	– 1	Option 3 would introduce an operational approval for some type B EFB applications. It would mean that for any new application within the scope of the option a formal approval process should be followed and a new approval should be granted to the operator. The scope of this approval is slightly narrower than that of Option 2 as it includes only few type B EFB applications. It is therefore considered to have a slightly lower negative economic impact, but however still of the same order.
Option 4	0	Option 4 would introduce an operational approval associated with the use of an EFB. This operational approval would be

General approval to use an EFB application		granted before an operator starts using an EFB on board and would remain valid unless the operator ceases to use an EFB or if, in accordance with ARO.GEN.250, the competent authority revokes the approval. The economic impact is therefore expected to be very close to null.

Questions to stakeholders on economic impacts

To CAT operators:

1. *How many EFB applications (type A, type B) are you currently using?*

2. *What are the main anticipated economic impacts for you as a result of the operational approval for the use of EFB applications?*

To competent authorities:

3. *What is your current workload (in working hours per year) for activities related to the evaluation of the operators' EFB programmes?*

4. *How much do you expect your workload to increase (in working hours per year) for granting operational approvals for the use of EFB applications?*

4.5.4.2. NCC/SPO with CMPA

	Impact	Rationales
Option 0 **No change**	0	No economic impact is foreseen for Option 0 as the situation would remain the same with no regulatory provisions for the use of EFBs.
Option 1 **IR and AMC 20-25 applicable**	– 3	Option 1 would introduce high compliance costs compared to the current situation with no regulatory provisions. From a competent authority perspective, it would also have a negative economic impact since EFB provisions would have to be part of their oversight and it would therefore use resources.
Option 2 **IR and all elements of AMC 20-25 for type B EFB applications only**	– 2	Option 2 would also introduce compliance costs for the operators and oversight costs for competent authorities, but lower ones compared to Option 1 due to the fact that the scope of the EFB applications that would be subject to the provisions is considerably limited.
Option 3 **IR and some elements of**	– 1	Option 3 is expected to introduce even lower compliance costs for the operators compared to Option 2 since some provisions of

AMC 20-25 for type B EFB applications only		AMC 20-25 wouldn't be transposed (HMI evaluation and operational evolution test). From a competent authority perspective, the economic impact is similar to that of Option 2. The overall economic impact is therefore considered to be low.

Questions to stakeholders on economic impacts

To NCC/SPO with CMPA operators:

1. *How many EFB applications (type A, type B) are you currently using?*
2. *What are the main anticipated economic impacts for you as a result of the proposed new provisions for the use of EFB applications?*

To competent authorities:

3. *How much do you expect your workload to increase (in working hours per year) for the oversight of operators using EFB applications?*

4.5.4.3. NCO operations

	Impact	Rationales
Option 0 **No change**	0	No economic impact is expected for the two considered options. Indeed, Option 1, based on proportionality principles, doesn't introduce any additional costly requirements for the use of an EFB application.
Option 1 **Complement PED rules NCO.GEN.125**		

4.5.5. General aviation and proportionality issues

As stated in paragraph 2.2, one of the objectives of the task is to provide requirements proportionate to the complexity of the operations. To achieve this objective, as explained in paragraph 4.3, specific provisions are proposed for each type of operations (CAT, NCC, SPO and NCO). In addition, the impacts of those provisions have been evaluated by the RMT.0601 & RMT.0602 Rulemaking Group during its meetings and during the technical consultation meeting for general aviation to ensure adequate proportionality while achieving the other objectives.

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4.5.5.1. CAT operations

	Impact	Rationales
Option 0 **No change**	0	No impact on proportionality is expected from Option 0 as the current situation would remain unchanged.
Option 1 **Approval for the use of any EFB application**	– 1	Option 1 would introduce a burden for small operators since they would have to apply and go through an approval process for each and every EFB application they want to use. However, all the current technical provisions of AMC 20-25 would remain applicable and only a higher administrative burden is expected for Option 1. The impact of Option 1 is therefore considered to be very low negative.
Option 2 **Approval to use type B EFB applications**	0	Options 2 has a much more limited scope than Option 1 and therefore the impact is expected to be very close to null.
Option 3 **Approval to use some type B EFB applications**	0	Since the scope of Option 3 is even more limited compared to that of Option 2, as it includes only few EFB applications, the related burden for small operators is considered to be null.
Option 4 **General approval to use an EFB application**	+ 1	Option 4 would require an operator to apply for an operational approval as soon as it intends to use an EFB, whatever the type of application hosted on its EFB. On the one hand, it would therefore introduce an economic burden in the specific and very unlikely case of operators willing to use very simple applications, and one the other it would provide much flexibility once this approval has been granted since no additional approval would be required for new applications. In any case, all the technical provisions of AMC 20-25 would remain applicable. Therefore, the overall economic impact is expected to be low positive.

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4.5.5.2. NCC/SPO with CMPA

	Impact	Rationales
Option 0 **No change**	0	Option 0 would leave the current situation unchanged with no regulatory provisions for NCC/SPO and, therefore, leave NCC/SPO with CMPA operators to address the inherent risks through their management systems.
Option 1 **IR and AMC 20-25 applicable**	– 5	Option 1 is expected to introduce a high negative impact on general aviation and proportionality issues as all the current provisions of AMC 20-25 would be made applicable to those operators. It is indeed considered that some of the provisions of AMC 20-25 are specifically designed for CAT operators and would be difficult to implement for an NCC/SPO with CMPA aircraft.
Option 2 **IR and all elements of AMC 20-25 for type B EFB applications only**	– 3	Option 2 has a more limited scope than Option 1 but would nevertheless include many of the most currently used applications and would as well still include provisions which would be difficult to implement for an NCC/SPO with CMPA, therefore, the impact is expected to be slightly lower but still medium negative.
Option 3 **IR and some elements of AMC 20-25 for type B EFB applications only**	– 1	The scope of Option 3 is similar to that of Option 2, but since it doesn’t include some provisions which are considered to be difficult to be implemented by small operators, the related impact on general aviation and proportionality is considered to be only low negative.

4.5.5.3. NCO operations

	Impact	Rationales
Option 0 **No change**	0	Option 0 would leave the current situation unchanged and, therefore, would not have any impact on the general aviation and proportionality issues.
Option 1 **Complement PED rules NCO.GEN.125**	0	Option 1 would introduce some additional provisions for NCO operators and would, therefore, require NCO operators to comply with the new requirements. However, when drafting the new proposal with NCO stakeholders during the technical consultation, the ease of implementation of the new provisions was one of the main criteria taken into account. It is, therefore, expected that the impact of Option 1 will be null as well.

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4.5.6. Impact on 'better regulation' and harmonisation

4.5.6.1. CAT operations

	Impact	Rationales
Option 0 **No change**	0	Option 0 would leave the current situation unchanged, with EU regulations not compliant with the ICAO SARPs and also a non-harmonisation issue throughout Europe. The impact on harmonisation is considered to be null.
Option 1 **Approval for the use of any EFB application**	3	Option 1 would introduce IRs for the use of EFBs and would therefore ensure better harmonisation throughout Europe. In addition, an operational approval for the use of EFBs would be introduced and would, therefore, make the European regulatory framework more harmonised with the ICAO Annex 6 SARPs, which introduced an operational approval for EFB applications used for the safe operation of aircraft. Option 1 would be on the one hand very harmonised with the FAA provisions, as an authorisation is foreseen in the FAA regulatory provisions for every application used, and on the other hand more stringent than the ICAO Annex 6 Part I provisions for EFBs, as the scope of this operational approval would be wider. The impact on 'better regulation' and harmonisation is, therefore, expected to be medium positive.
Option 2 **Approval to use type B EFB applications**	5	It is considered that the harmonisation impact would be higher for Option 2. Indeed, it would be quite close to the FAA provisions, which foresee a much lighter authorisation process for type A EFB applications. In addition, Option 2 would ensure full harmonisation with the ICAO Annex 6 Part I provisions. Indeed, it refers to EFB applications which would be used for the safe operation of aircraft. ICAO Doc 10020 provides guidance on how to identify these applications and this guidance is similar to the characteristics of type B EFB applications, hence a higher harmonisation impact is expected.
Option 3 **Approval to use some type B EFB applications**	3	The impact of Option 3 is considered to be slightly lower and, therefore, medium positive because the level of harmonisation with the FAA and ICAO would be lower due the more limited scope for the operational approval.
Option 4 **General approval to use an EFB application**	1	Finally, the impact of Option 4 is also expected to be very low positive since an operational approval would be necessary for the use of any EFB application. However, further changes (e.g. the introduction of new EFB applications) would not be subject to a new operational approval, hence the lower harmonisation impact.

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4.5.6.2. NCC/SPO with CMPA

	Impact	Rationales
Option 0 **No change**	0	Option 0 would leave the European regulatory framework non-compliant with the ICAO Annex 6 SARPs for EFBs used by non-commercial operators. In addition, it would remain disharmonised with the current FAA provisions of AC 91-78 for Part 91 operators.
Option 1 **IR and AMC 20-25 applicable**	1	Options 1 would introduce IRs for EFBs and would, therefore, ensure better harmonisation throughout Europe. In addition, the current content of AMC 20-25 would be made applicable to NCC/SPO with CMPA and would, therefore, make the European regulatory framework more harmonised with the EFB provisions of ICAO Annex 6 for non-commercial operations. Due to the scope of the EFB applications to which the provisions would be applicable, many implementation difficulties are expected and the overall impact is, therefore, very low positive.
Option 2 **IR and all elements of AMC 20-25 for type B EFB applications only**	1	It is considered that the harmonisation impact would be similar for Option 2. On the one hand, it would be in line with the ICAO Annex 6 Part II provisions. Indeed, it refers to EFB applications which would be used for the safe operation of aircraft. ICAO Doc 10020 provides guidance on how to identify these applications and this guidance is similar to the characteristics of type B EFB applications, hence a higher harmonisation impact is expected. On the other hand, the expected implementation difficulties would be similar to those of Option 1 as mostly type B applications are concerned with these provisions (HMI assessment and operational evaluation test) The overall impact is, therefore, very low positive.
Option 3 **IR and some elements of AMC 20-25 for type B EFB applications only**	3	The impact of Option 3 is considered to be slightly higher and, therefore, medium positive. It would ensure compliance of the European regulatory framework with ICAO Annex 6 Part II while eliminating the provisions creating the main implementation difficulties.

4.5.6.3. NCO operations

	Impact	Rationales
Option 0 **No change**	0	Option 0 would leave the current situation unchanged and consequently the current European regulatory framework non-compliant with ICAO Annex 6 EFB SARPs for non-commercial operations. The impact on harmonisation is considered to be null.
Option 1 **Complement PED rules NCO.GEN.125**	3	Option 1, by addressing all the new ICAO provisions for non-commercial operations based on an ICAO cross-reference table, is considered to ensure compliance of Part-NCO with ICAO Annex 6 EFB SARPs for non-commercial operations. The impact is therefore considered to be medium positive.

The cross-reference table established to assess ICAO compliance is provided in Chapter 6 of this NPA.

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4.6. Comparison and conclusion

4.6.1. Comparison of options

4.6.1.1. CAT operations

The following table provides a summary of all the assessed impacts for CAT operations.

	Option 0 No change	**Option 1** Approval for the use of any EFB application	**Option 2** Approval to use type B EFB applications	**Option 3** Approval to use some type B EFB applications	**Option 4** General approval to use an EFB application
Safety impact	– 1	1	1	1	1
Environmental impact	0	0	0	0	0
Social impact	0	0	0	0	0
Economic impact	0	– 2	– 1	– 1	0
General aviation and proportionality issues	0	– 1	0	0	1
Impact on 'better regulation' and harmonisation	0	3	5	3	1
Total	**– 1**	**+ 1**	**+ 5**	**+ 3**	**+ 3**

Based on this assessment, it is considered that Option 3 is the one that provides the best global positive impact compared to the other options, while ensuring proportionality of the requirements.

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4.6.1.2. NCC/SPO with CMPA operations

The following table provides a summary of all the assessed impacts for NCC/SPO with CMPA operations.

	Option 0 No change	**Option 1** IR and AMC 20-25 applicable	**Option 2** IR and all elements of AMC 20-25 for type B EFB applications only	**Option 3** IR and some elements of AMC 20-25 for type B EFB applications
Safety impact	– 3	3	3	2
Environmental impact	0	0	0	0
Social impact	0	0	0	0
Economic impact	0	– 3	– 2	– 1
General aviation and proportionality issues	0	– 5	– 3	– 1
Impact on 'better regulation' and harmonisation	0	1	1	3
Total	**– 3**	**– 4**	**– 1**	**+ 3**

Based on this assessment, it is considered that Option 3 is the one that provides the best global positive impact compared to the other options, while keeping the proportionality impact associated with the introduction of new requirements to an acceptable level.

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4.6.1.3. NCO operations

The following table provides a summary of all the assessed impacts for NCO operations.

	Option 0 No change	**Option 1** Complement PED rules NCO.GEN.125
Safety impact	– 1	1
Environmental impact	0	0
Social impact	0	0
Economic impact	0	0
General aviation and proportionality issues	0	0
Impact on 'better regulation' and harmonisation	0	3
Total	**– 1**	**+ 4**

Based on this assessment, it is considered that Option 1 is the one that provides the best global positive impact compared to the other options.

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4.6.2. Monitoring and ex post evaluation

Monitoring is a continuous and systematic process of data collection and analysis about the implementation/application of a rule/activity. It generates factual information which enables future evaluation and impact assessments and helps to identify actual implementation problems. With respect to this proposal, the Agency would suggest to monitor the following:

Indicator	When it will be monitored	How it will be monitored	Who will be in charge of the monitoring
Related findings from standardisation inspections	Annually	Via standardisation inspections	EASA Flight Standards Department (FS.5)
Notified Article 14 flexibility provisions and outcome of the related EASA assessment	Annually	Via internal Article 14 database	EASA Flight Standards Department (FS.5)
Number of related AltMoC notified	Annually	Via internal AltMoC database	EASA Flight Standards Department (FS.5)

In addition, monitoring will be performed in terms of collecting and analysing data from different available sources through several tools (e.g. by conducting surveys). The responsible actors for collecting and providing the data (e.g. Member States, national authorities, operators, etc.) will be further specified in the implementation phase.

In addition, the proposal might be subject to interim/ongoing/ex post evaluation, which will judge how well the adopted rules have performed (or are working), taking account of earlier predictions made in this impact assessment. The evaluation will provide an evidence-based judgement of the extent to which the proposal has been relevant (given the needs and its objectives), effective and efficient, coherent, and has achieved EU added-value. The decision whether an evaluation will be necessary will be taken based also on the monitoring results.

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5. References

5.1. Affected regulations

— Commission Regulation (EU) No 965/2012 of 5 October 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (OJ L 296, 25.10.2012, p. 1)

5.2. Affected CS, AMC and GM

— Decision 2014/025/R of the Executive Director of the Agency of 28 July 2014 adopting Acceptable Means of Compliance and Guidance Material to Part-ARO of Regulation (EU) No 965/2012 and repealing Decision 2014/014/R of the Executive Director of the Agency of 24 April 2014 'AMC and GM to Part-ARO — Issue 3'

— Decision 2014/015/R of the Executive Director of the Agency of 24 April 2014 adopting Acceptable Means of Compliance and Guidance Material to Part-CAT of Regulation (EU) No 965/2012 and repealing Decision 2012/018/R of the Executive Director of the Agency of 24 October 2012 'AMC and GM to Part-CAT — Issue 2'

— Decision N° 2012/019/Directorate R of the Executive Director of the Agency of 24th October 2012 on Acceptable Means of Compliance and Guidance Material to Commission Regulation (EU) No 965/2012 of 5 October 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council 'Acceptable Means of Compliance and Guidance Material to Part-SPA'

— Decision N° 2013/021/Directorate R of the Executive Director of the Agency of 23 August 2013 on adopting Acceptable Means of Compliance and Guidance Material for Non-commercial operations with complex motor-powered aircraft (Part-NCC)

— Decision 2014/016/R of the Executive Director of the Agency of 24 April 2014 adopting Acceptable Means of Compliance and Guidance Material to Part-NCO of Regulation (EU) No 965/2012 and repealing Decision 2013/022/R of the Executive Director of the Agency of 23 August 2013 'AMC and GM to Part-NCO — Issue 2'

— Decision 2014/018/R of the Executive Director of the Agency of 24 April 2014 adopting Acceptable Means of Compliance and Guidance Material to Part-SPO of Regulation (EU) No 965/2012 'AMC and GM to Part-SPO'

5.3. Reference documents

— ICAO Annex 6

— ICAO Doc 10020 'Manual of Electronic Flight Bags (EFBs)'

— FAA AC 120-76C

— FAA AC 91-78

— Final Report EASA_REP_RESEA_2014_1, Research Project: EFB — Electronic Flight Bag, Aircraft performance calculations and mass & balance, Best practices for evaluation and use of EFB

6. Appendices

6.1. Risk assessment related to the use of EFBs by NCO operators

The following methodology was used when conducting the risk assessment for NCO operations:

Table 1: Likelihood scale

Extremely improbable	Almost inconceivable that the event will occur
Improbable	Very unlikely to occur
Remote	Unlikely, but could occur (has occurred rarely)
Occasional	Likely to occur sometimes (has occurred infrequently)
Frequent	Likely to occur many times (has occurred frequently)

Table 2: Severity scale

Catastrophic	Multiple deaths and equipment destroyed (hull loss)
Hazardous	A large reduction of safety margins Maximum two fatalities Serious injury Major equipment damage
Major	A significant reduction of safety margins Serious incident Injury of persons
Minor	Nuisance Operating limitations Use of emergency procedures Minor incident
Negligible	Little consequences

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Table 3: Risk acceptability

High significance (red)	Unacceptable under the existing regulatory circumstances. Rulemaking action required.
Medium/High significance (orange)	Based on feedback from stakeholders, this combination of probability and severity may be considered a high or a medium risk, depending on the issue. Reasoning to be provided in section 2.2 of the Pre-RIA.
Medium significance (yellow)	Tolerable based on risk mitigation by the stakeholders and/or rulemaking action.
Low significance (green)	Acceptable, but monitoring or non-rulemaking action required. Under certain circumstances, rulemaking may be required. Reasoning to be provided in section 2.2. of the Pre-RIA.

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Table 4: Risk assessment linked to hardware issues

Root causes/contributing factors	Undesired event	Safety benefit linked with the EFB application	Consequences	Risk evaluation			Current mitigation
				Likelihood	Severity	Risk level	
Diverse	Battery fire		Fire in the flight crew compartment	Improbable	Major	Green	SIB 2009-22R1 SIB 2015-28
Turbulence	EFB becoming loose during flight		Distraction	Occasional	Minor	Orange	NCO.GEN.105(a)(4)(v) SIB 2011-10
EFB not mounted and no viewable stowage			Damage to avionics. Flight controls jam	Improbable	Hazardous	Orange	
Use of viewable stowage	EFB used with viewable stowage becoming loose in flight		Loose object hazard. Increased workload	Improbable	Hazardous	Orange	None
Diverse	Interference (EMI) with avionics during critical phases of flight		Increased workload. Avionics affected	Improbable	Major	Green	NCO.GEN.125
Loose cables	Emergency evacuation		Flight controls jammed	Improbable	Hazardous	Orange	None
			Flight crew evacuation of the aircraft hindered	Extremely improbable	Minor	Green	
EFB sending data to avionics	Corruption of avionics		Avionics corrupted	Not applicable			NCO.GEN.125 (possible if avionics certified for this)

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Table 2: Risk assessment linked to software issues

Root causes/ contributing factors	Undesired event		Safety benefit linked with the EFB application	Consequences	Risk evaluation			Current mitigation
					Likelihood	Severity	Risk level	
Wrong algorithm. EFB not updated. Insufficient accuracy. Distraction. Information missing or not displayed.	Erroneous output of an EFB application	AMMD	Yes	Use of a wrong taxiway. Runway incursion	Occasional	Major	Orange	NCO.GEN.135(a)(10)
		Own-ship position in flight	Yes	VFR: Increased workload. Entering inadvertently in restricted areas. Compensated by benefits if no NAV equipment.	Occasional	Minor	Orange	NCO.IDE.A.120
				IFR: Increased workload. Aircraft inadvertently entering restricted areas. Possible confusion with primary NAV equipment available.	Occasional	Major	Orange	NCO.IDE.A.125
		Performance calculation application		Wrong performance calculations	Remote	Major	Orange	NCO.GEN.105(a)(4)(vi) NCO.POL.110
		Mass and balance calculation application		Wrong balance calculations. Possibly outside limits.	Remote	Major	Orange	NCO.GEN.105(a)(4)(iv) NCO.POL.100
		Chart application		Increased workload. Wrong charts/Missing info.	Remote	Major	Orange	NCO.GEN.135(a)(10) +GM1
Environmental conditions (heat, light, pressure, etc.) Loss of power. Technical failure.	EFB failure (hardware)	AMMD	Yes	Nil	Occasional	Negligible	Orange	
		Own-ship position inflight	Yes	Disorientation of the crew relying on the OSPIF	Occasional	Negligible	Orange	
		Performance calculation application		Performance application not available	Occasional	Negligible	Orange	NCO.GEN.105(a)(4)(vi)
		Mass and balance calculation application		W&B application not available	Occasional	Negligible	Orange	NCO.GEN.105(a)(4)(iv)
		Chart application		Increased workload. Loss of all charts.	Occasional	Minor	Orange	NCO.GEN.135(a)(10)
		Checklists (not sensed)		Increased workload. Loss of C/L.	Occasional	Minor	Orange	NCO.GEN.105(a)(3)

The consequence of a misuse of an EFB application has not been assessed as the outcome is expected to be similar to the erroneous output issue.

6.2. ICAO compliance table for NCO operations

ICAO Ref.	Requirement	Current existing requirement	Current text	Assessment
2.4.17.1	Where portable EFBs are used on board an aeroplane/helicopter, the pilot-in-command and/or the operator/owner shall ensure that they do not affect the performance of the aeroplane/helicopter systems, equipment or the ability to operate the aeroplane/helicopter.	NCO.GEN.125	The pilot-in-command shall not permit any person to use a portable electronic device (PED) on board an aircraft that could adversely affect the performance of the aircraft's systems and equipment.	The ability to operate the aircraft system is not mentioned in the requirement.
2.4.17.2.1	Where EFBs are used on board an aeroplane/helicopter the pilot-in-command and/or the owner/operator shall: a) assess the safety risk(s) associated with each EFB function;	None	None	Not addressed.
	b) establish the procedures for the use of, and training requirements for, the device and each EFB function; and			Not addressed
	c) ensure that, in the event of an EFB failure, sufficient information is readily available to the flight crew for the flight to be conducted safely.			Not addressed
2.4.17.2.2	The State of Registry shall establish criteria for the operational use of EFB functions to be used for the safe operation of aeroplanes/helicopters.			No EFB provisions for NCO operators
2.4.17.3	In establishing operational criteria for the use of EFBs, the State of Registry shall ensure that: a) the EFB equipment and its associated installation hardware, including interaction with aeroplane/helicopter systems if applicable, meet the appropriate airworthiness certification requirements;	M.A.304	Damage shall be assessed and modifications and repairs carried out using as appropriate: (a) data approved by the Agency; or (b) data approved by a Part-21 design organisation; or (c) data contained in the certification specifications referred to in point 21A.90B or 21A.431B of Annex I (Part-21) to Regulation (EU) No 748/2012.	Already compliant.
	b) the operator/owner has assessed the risks associated with the operations supported by the EFB function(s);	None	None	Not addressed.
	c) the operator/owner has established requirements for redundancy of the information (if appropriate) contained in and displayed by the EFB function(s);			Not addressed

	d) the operator/owner has established and documented procedures for the management of the EFB function(s) including any databases it may use; and			Not addressed
	e) the operator/owner has established and documented the procedures for the use of, and training requirements for, the EFB function(s).			Not addressed.

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