NOTICE OF PROPOSED AMENDMENT (NPA) NO 2012-02

DRAFT OPINION OF THE EUROPEAN AVIATION SAFETY AGENCY

for a Commission Regulation amending Regulation (EU) No xxx/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

and

DRAFT DECISION OF THE EXECUTIVE DIRECTOR OF THE EUROPEAN AVIATION SAFETY AGENCY

amending Decision No 2003/12/RM of the Executive Director of the European Aviation Safety Agency of 5 November 2003 on acceptable means of compliance for airworthiness of products, parts and appliances ('AMC-20')

and

amending Decision No 2003/10/RM of the Executive Director of the European Aviation Safety Agency of 24 October 2003 on certification specifications, including airworthiness codes and acceptable means of compliance, for European Technical Standard Orders ('CS-ETSO')

'Airworthiness and operational criteria for the approval for Electronic Flight Bags (EFBs)'

EXECUTIVE SUMMARY

The scope of this rulemaking activity is outlined in the Terms of Reference (ToR) 20.002, Issue 1, of 4 December 2006 (now RMT.0001).

The purpose of this NPA is to propose:

- a new AMC 20-25 on the airworthiness and operational approval criteria of Electronic Flight Bags (EFB) used by Commercial Air Transport (CAT) operators by aeroplanes or by helicopters;
- an associated new version of ETSO-2C165a on Airport Moving Map Display (AMMD); and
- a draft Opinion to amend the forthcoming Regulation on Air operations in relation to EFBs.

In general terms, the approach proposed in the present NPA includes three major aspects:

- Improved definitions of EFB classes and types to make them more precise and objective, i.e. better delimiting the boundary between what has to be considered as part of the on-board avionics and the 'non-avionics' part of the flight crew compartment;
- The proposed data connectivity between EFBs and avionics is:
  - not allowed for class I EFBs;
  - allowed from the avionics to the EFBs for class II (i.e. 'one way');
  - allowed in both directions for class III;
- redefinition of the roles and responsibilities of the competent authorities at national level and of the Agency, taking into account the provisions of the Basic Regulation and the related imminent Implementing Rules, in particular for air operations and for Operational Suitability Data (OSD).

The Agency is aware that the EFB issue can be controversial. Nevertheless, the Agency deems that:

- the improper use of EFBs may cause safety concerns;
- continuous progress of Information Technology on the commercial market outside aviation, leading to increasing use and requests for EFB applications, requires rulemaking initiative from the Agency in the earliest possible time;
- an NPA is the proper tool to consult the stakeholders' community on important issues, even if controversial.

In conclusion, the Agency considers this NPA as necessary and urgent. Nevertheless, it reserves the right to take any position after the consultation. These positions will be published in the subsequent Comment-Response Document (CRD).

The Agency also intends, in a longer time frame, to separate the regulatory material on EFB in different documents, among which is one or more AMC attached to the Regulation on Air Operations, and a revised AMC 20-25 limited to the Airworthiness aspects. The current mix of both domains in one document makes it difficult to define clear boundaries between the obligations of the aircraft operators and those of the aircraft manufacturer. This is the rationale for the proposed rule on air operations, which will later provide the basis for the said AMCs. These AMCs and all related Amendments to other 'soft rules' will be possibly carried out in the context of a specific new rulemaking task, to be launched in due time.

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A. Explanatory Note

I. General

1. The purpose of this Notice of Proposed Amendment (NPA) is to envisage:

   - amending Decision 2003/12/RM of the Executive Director of 5 November 2003 on general acceptable means of compliance for airworthiness of products, parts and appliances ('AMC-20') to introduce a **new AMC 20-25** providing acceptable means of compliance for the airworthiness and operational approvals of Electronic Flight Bags (EFB);
   - amending Decision 2003/10/RM of the Executive Director of 24 October 2003 on certification specifications, including airworthiness codes and acceptable means of compliance, for European Technical Standard Orders (currently published as CS-ETSO) and in particular proposing amended **ETSO-2C165a on Airport Moving Map Display (AMMD)**; and
   - proposing a draft **Opinion in order to insert a new rule addressed to Commercial Air Transport (CAT) operators** in a Commission Regulation amending Regulation (EU) No xxx/2012[1] 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.

2. The scope of this rulemaking activity is outlined in Terms of Reference (ToR) 20.002, Issue 1, of 4 December 2006, and is described in more detail below. In the Rulemaking Programme 2012-15 this task has been renumbered as RMT.0001.

3. The European Aviation Safety Agency (hereinafter referred to as the 'Agency') is directly involved in the rule-shaping process. It assists the Commission in its executive tasks by preparing draft regulations, and amendments thereof, for the implementation of the Basic Regulation[2] which are adopted as 'Opinions' (Article 19(1)). It also adopts Certification Specifications (CS), including Airworthiness Codes and Acceptable Means of Compliance (AMC) and Guidance Material (GM) to be used in the certification process (Article 19(2)).

4. When developing rules, the Agency is bound to follow a structured 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'[3].

5. This rulemaking activity is included in the Agency's rulemaking programme for 2009-2010 and subsequent editions. It implements the rulemaking task AMC-20.002 Airworthiness and Operational approval for Electronic Flight Bags (EFBs).

6. The text of this NPA has been developed by the Agency with the support of a Rulemaking Group. It is submitted for consultation of all interested parties in accordance with Article 52 of the Basic Regulation and Articles 5(3) and 6 of the Rulemaking Procedure.

II. Consultation

7. To achieve optimal consultation, the Agency is publishing the draft Opinion and the draft Decision of the Executive Director on its Internet site. Comments should be provided

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[1] As proposed by the Agency's Opinion 04/2011 of 1 June 2011: http://www.easa.europa.eu/agency-measures/opinions.php. Adoption by the European Commission and publication are expected in 2012.

[2] 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, 19.03.2008, p. 1). Regulation as last amended by Regulation (EC) No 1108/2009 of the European Parliament and of the Council of 21 October 2009 (OJ L 309, 24.11.2009, p. 51).

[3] Management Board decision concerning the procedure to be applied by the Agency for the issuing of opinions, certification specifications and guidance material ('Rulemaking Procedure'), EASAMB 08-2007, 13.6.2007.

within 3 months in accordance with Article 6(4) of the Rulemaking Procedure. Comments on this proposal should be submitted by one of the following methods:

CRT: Send your comments using the Comment-Response Tool (CRT) available at **http://hub.easa.europa.eu/crt/**.

E-mail: Only in case the use of CRT is prevented by technical problems, these should be reported to the CRT webmaster and comments should be sent by e-mail to NPA@easa.europa.eu.

Correspondence: If you do not have access to the Internet or e-mail, you can send your comment by mail to:
Process Support
Rulemaking Directorate
EASA
Postfach 10 12 53
D-50452 Cologne
Germany

Comments should be submitted **by 18 June 2012**. If received after this deadline, they might not be taken into account.

III. Comment-Response Document

8. All comments received in time will be responded to and incorporated in a Comment-Response Document (CRD). The CRD will be available on the Agency's website and in the Comment-Response Tool (CRT).

IV. Content of the draft Opinion/Decision

General Considerations

9. It should be noted that the Agency's initial responsibilities in the field of initial airworthiness and continuing airworthiness were first extended to cover the fields of air operations and flight crew licensing[4] and subsequently also to Air Navigation Services (ANS), Air Traffic Management (ATM) and safety of aviation operations at aerodromes[5]. The latter includes provisions for the certification and safety oversight of airspace designers and of providers of digital data for navigation in the air or on the movement area of an aerodrome.

10. For the first extension:

- Rules on Flight Crew Licensing were published as Annex I (Part-FCL) to Commission Regulation (EU) No 1178/2011 of 3 November 2011 laying down technical requirements and administrative procedures related to civil aviation aircrew pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council;
- For air operations the Agency issued:
  - Opinion 04/2011 of 1 June 2012, which is expected to be adopted (with possible modifications) and published by the European Commission (EC) before the end of the current year and whose principal content is rules applicable to CAT operators (by aeroplanes or helicopters);

[4] 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, 19.03.2008, p. 1). Regulation as last amended by Regulation (EC) No 1108/2009 of the European Parliament and of the Council of 21 October 2009 (OJ L 309, 24.11.2009, p. 51).

[5] Regulation (EC) No 1108/2009 of the European Parliament and of the Council of 21 October 2009 (OJ L 309, 24.11.2009, p. 51).

- Opinion 01/2012 of 1 February 2012, proposing rules for Non-Commercial operators of Complex motor-powered aircraft (Part NCC) and of other aircraft (Part NCO); and
- CRD to NPA 2009-02 containing revised draft CS, AMC and GM as regards air operations;

- Furthermore, Agency published, following NPA 2009-01, Opinion 07/2011 of 13 December 2011 on Operational Suitability Data (OSD), which includes provisions for evaluation of the said OSD during the aircraft design certification process.

11. In the fields of aerodromes and ATM/ANS towards a total system approach for safety in civil aviation, the following may be recalled in particular:

- Entry into force (November 2011) of the new 'common requirements' for ANS providers[6], triggering applicability of Article 8b of the Basic Regulation;
- Further 'common requirements' for airspace designers and providers of digital data for air navigation are planned in the context of the rulemaking task RMT.0149 (formerly ATM.001b).

12. Therefore, the references to some of the implementing measures used in the proposed draft AMC may be affected by the final rules resulting from the rulemaking tasks underway.

13. Basically, the proposed AMC is using the existing references: Annex III to Regulation (EEC) No 3922/91 (so-called 'EU-OPS')[7] as applicable operational requirements for commercial air transport of aeroplanes and JAR-OPS 3 and the related national operational requirements which are still applicable for Commercial Air Transport by helicopters. Depending on the progress of the above-mentioned rulemaking tasks, the references and the proposed text for operational criteria and considerations may be modified before issuing the final Executive Director Decision.

14. When the initial ToR were presented to the Advisory Group of National Authorities (AGNA) and Safety Standards Consultative Committee (SSCC)[8] for review, they advised the Agency to use a drafting group as the most appropriate rulemaking procedure to complete the task.

15. The ToR 20.002 envisaged a NPA to be published in June 2007. Due to the complexity of the subject and to the re-prioritising of the 2008 Rulemaking Programme, the initial planning of the NPA was revised after consultation with AGNA and SSCC.

Paperless: from paper to paperless

16. The EFBs is a very fast-growing and changing technology, mostly driven by commercial and technical developments originating outside aviation. The Guidance Material contained in JAA Temporary Guidance Leaflet (TGL) 36 that was published on 1 October 2004 not only needs to be integrated into the structure of the Agency's rules, but it also needs some enhancement in the technical content and update to reflect today's situation. The experience gained so far by stakeholders and competent authorities that have used the material contained in TGL 36, has shown that, in some cases, it is difficult to interpret and to apply such material. This is in particular valid in respect of the responsibilities and

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[6] Commission Implementing Regulation (EU) No 1035/2011 of 17 October 2011 laying down common requirements for the provision of air navigation services and amending Regulations (EC) No 482/2008 and (EU) No 691/2010 (OJ L 271, 18.10.2011, p. 23–41).

[7] Annex III to Council Regulation (EEC) No 3922/91 of 16 December 1991 on the harmonisation of technical requirements and administrative procedures in the field of civil aviation (OJ L 373, 31.12.1991, p. 4). Regulation as last amended by Commission Regulation (EC) No 859/2008 of 20 August 2008 (OJ L 254, 20.9.2008, p. 1).

[8] AGNA and SSCC advise the Agency on the rulemaking programme, revise the ToR and advise the Agency on the priorities and the rulemaking procedures to use for the task.

criteria to be used for evaluation and approval of the EFB's software applications on Class 2 hardware.

17. The drafting group established on the basis of the ToR 20.002 had a challenging task: to draft a generic AMC which would not need frequent updates for such a fast-growing technology. This was done as far as it was feasible but it was not always possible (e.g. the definition of software applications).

18. The initial intention of the Agency was to start a broader task addressing general issues related to 'paperless cockpit'. This task would have addressed not only the EFB but also Electronic Check List (ECL). The ECL is now out of the scope of this NPA, while covered by the separate task RMT.0004 (former 20.010). Equally out of the scope of this NPA is any other electronic feature replacing paper needed or used for the operation of the aircraft, beyond EFB. This idea of a very broad rulemaking task was abandoned based on the urgent need of the industry to have an AMC addressing EFB approval processes. Nevertheless, the Agency still considers that there is a need to have a general approach for the 'paperless cockpit' and therefore would welcome preliminary stakeholders' views on this approach for future tasks/NPAs (e.g. ECL).

19. It is important to highlight that the proposed AMC 20-25 represents a generic Acceptable Means of Compliance not only to Part-21 (including imminent rules on OSD) and the applicable Airworthiness Codes, but also to the applicable operational requirements. In particular, this generic AMC could be used in relation to the provisions in EU-OPS OPS 1.130 and 1.135, as well as to JAR-OPS 3.130 'Manuals to be carried' and OPS 1.135/JAR-OPS 1.135 'Additional information and forms to be carried'.

20. The content of the rules mentioned in the paragraph above is expected to be replaced by the end of 2012 for CAT operators by the new 'EASA-OPS' rules, as proposed in the above-mentioned Opinion 04/2011 (e.g. CAT.GEN.MPA.180 Documents, manuals and information to be carried). However, the EFB-based applications are evolving very quickly and currently they are often used to perform calculations (e.g. for mass and balance), to receive and exploit data coming from the avionics, or even to exchange data with the avionics. The Agency therefore believes that it is necessary to include a new rule in the 'EASA-OPS' to add clearer and specific provisions on any EFB Class and Type. For this purpose, the Agency submits to stakeholders' consultation the draft Opinion in part B of this NPA. Should it be supported and finally adopted by the European Commission, it will provide a solid legal basis for removing the operational provisions from the proposed AMC 20-25 and integrate them into one or more AMCs to the said new rule in 'EASA-OPS'.

JAA TGL 36 versus the proposed AMC (Reasons for changing)

21. As already explained above, the proposed AMC is, in general terms, a transposition of JAA TGL 36. However, there are some differences between the proposed AMC 20-25 and former JAA TGL 36. The main differences are highlighted in the following paragraphs.

22. The **applicability of the proposed AMC** and 'to whom' it applies (i.e. scope in paragraph 1 and applicability in paragraph 2 of the proposed AMC) have been clarified: **operators for CAT (both by aeroplanes and helicopters), applicants/holders of Type Certificates (TC) or Supplemental TC (STC) and applicants/holders of ETSO Authorisations,** when a specific ETSO exists (like e.g. proposed ETSO-2C165a on AMMD).

23. The **definition of EFB** has also been amended. The previous definition was valid in an earlier stage of the EFBs technology. The definition in former JAA TGL 36 does no longer match with today's EFB systems. The latter currently not only host manuals, documentation and information required by the operational requirements to be carried on board, but the applications residing therein go well beyond the simple replacement of paper documents for consultation. The new definition is much more general and it is also able to cover new applications to allow technology evolution.

24. Clarification of the technical specifications of the **three hardware classes** of EFB systems was also considered necessary. In fact, during the review of the existing material in JAA TGL 36, the drafting group deemed that some clarifications and enhancements were necessary not only to reflect today's technology but also to avoid inconsistencies existing in the wording of the said TGL 36.

25. Clarification of the technical specifications of the **software applications** for EFBs systems was equally necessary. Therefore, some clarifications and enhancements are proposed to reflect today's technology.

26. Introduction of **Type C applications**. During recent years some applicants have already applied for hosting in the EFBs applications which could neither be classified as Type A nor as Type B. Currently the FAA provides guidance in AC 120-76A, but this Circular is expected to be replaced by a new version 'B'. Type A and Type B software applications can be hosted in any EFBs Class (EFBs Class 1, Class 2 or Class 3), Type C applications are generally hosted on Class 3 EFBs. The proposed AMC 20-25 takes all the above into account.

27. Introduction of **Airport Moving Map Display (AMMD)** application as Type C application. As proposed in this draft AMC, the peculiarity of this Type C application is that it can also be hosted on Class 2 EFBs, provided that several airworthiness and operational criteria are complied with as explained in Appendix H of proposed AMC 20-25.

28. In this context one should recall that within the scope of the second extension of the Agency's mandate[9] the definition of 'parts and appliances' in Article 3(d) of the Basic Regulation was amended to mean any instrument, equipment, mechanism, part, apparatus, appurtenance, **software** or accessory, including communications equipment, that is used or intended to be used in operating or controlling an aircraft in flight. Hence, this gives the possibility of issuing ETSO Authorisations only for software modules or for software modules integrated into EFB platforms. This offers the possibility for substantial revision of ETSO-C165[10] on the matter. This substantial revision, proposed by the present NPA would introduce differences with the corresponding FAA TSO. Therefore, the proposed ETSO-2C165a will have to be included in Index 2 of CS-ETSO.

29. Clarifications were also introduced in relation to **separation of responsibilities** between the software developer, the EFB system integrator and (S)TC applicant/holder in the domain of airworthiness, distinct from the operational considerations of EFB approval, under the responsibility of the aircraft operator. These identification of responsibilities and clarifications were missing in the above-mentioned JAA TGL 36.

30. Furthermore, the **role of each competent authority** with regards to the approval process of EFBs was clarified. As already explained, the EFB systems go beyond the simple electronic display of pre-composed documents, manuals and information required to be carried by the applicable operational requirements. For instance, Class 3 hardware is installed in the aircraft and it therefore requires an airworthiness approval as part of the Type Certification (TC) or Supplemental TC (STC) process. For some type of applications, as the Type B performances and weight and balance calculations applications, assessment of the former **Joint Operational Evaluation Board (JOEB)** and airworthiness performance experts was deemed necessary by the JAA community to assess the impact on operations. Today, the JAA JOEB assessment has been replaced, as a temporary measure, by the Agency's OEB. In any case, the output of this 'Board' is only a recommendation to the individual competent authority in charge of granting the final operational approval to the operator. The former JAA JOEB (or Agency's OEB) is now being integrated into the Agency's regulatory framework through the rulemaking task RMT 21.039.

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[9] Regulation (EC) No 1108/2009 of the European Parliament and of the Council of 21 October 2009 amending Regulation (EC) No 216/2008 in the field of aerodromes, air traffic management and air navigation services and repealing Directive 2006/23/EC (OJ L 309, 24.11.2009, p. 51–70).

[10] Adopted through ED Decision 2010/010/R of 14 December 2010.

31. In particular, Opinion 07/2011[11] of 13 December 2011 proposed a new Article 2f (**Operational Suitability Data**) to be inserted in Commission Regulation 1702/2003 (i.e. Part-21), reading:

"1. The holder of an aircraft type-certificate issued before the entry into force of this Regulation intending to deliver a new aircraft to a European Union operator on or after the entry into force of this Regulation shall obtain approval in accordance with Part 21A.21(e) except for the minimum syllabus of maintenance certifying staff type rating training and except for aircraft validation source data to support the objective qualification simulator(s). The approval …."

32. In turn, the referenced new paragraph (e) to be introduced in rule 21A.21 establishes that, in the context of a design certification programme:

'(e) In the case of an aircraft type-certificate, it is shown that the operational suitability data meets the applicable operational suitability data certification basis designated in accordance with 21A.17B.'

33. Hence all the matters belonging to OSD will be evaluated (or assessed) by the Agency during the certification process. At the level of working procedures, this may still be organised through a 'Board' (in cooperation with the competent authorities).

34. Since, however, the draft OSD rules mentioned in the three paragraphs above have neither yet been adopted, nor published, in the proposed AMC 20-25 the term 'JOEB', to which the community of the authorities is used, has been kept. Nevertheless, taking into account the possible adoption of Opinion 07/2011 by the EC before the end of 2012, the Agency may change the references to JOEB in the proposed AMC in the final Executive Director Decision, as appropriate in terms of the text finally published in the Official Journal of the European Union (EU).

35. In summary, based on the new legislation on OSD recalled above, the operational evaluation made by the Agency will no longer produce a 'recommendation' to the operator's competent authority, but limitations linked to the aircraft type, that the operator should respect and that the competent authority shall consider prior to granting the operational approval to the operator.

36. In the proposed AMC 20-25 the relationship between all the parties involved has been clarified, taking into account the foreseen evolution explained above.

37. Approval by the Agency of the OSD, linked to aircraft type, does not in itself constitute an operational approval to use the EFB. Therefore, further assessment by the competent authority of the State of Operator is usually needed. Also this assessment is currently covered by JOEB. Some stakeholders, mainly from the industry, considered that the involvement of the former JAA JOEB was, however, an administrative burden without further safety benefits. In their opinion, it should be left to the individual applicants or operators together with their competent authority whether assistance from the Agency regarding the operational assessment would be required not only for initial applications but also for changes to their initial application. This decision will be balanced in the Regulatory Impact Assessment below. Based on the RIA explanation below, the Agency would be interested to know the stakeholders' opinion regarding the draft text of Chapter 7 'Operational Approval of EFBs' in the proposed AMC 20-25.

38. Enhancement and clarification of the text in former TGL 36, based on the experience gained since its publication, was also necessary in the Chapter on **Operational Approval**, in particular in relation to: intent of Operational Risk Assessment, flight crew training, MEL requirements for EFBs aspects, EFB administrator role and introduction of training, introduction of electronic signatures, clarification of the EFB system security, etc.

[11] http://www.easa.europa.eu/agency-measures/docs/opinions/2011/07/Commission%20Regulation%201702%20-%20OSD.pdf.

39. Finally, clarification and improvement of the existing **appendices** in JAA TGL 36 and introduction of new appendixes was also considered necessary to complete the draft AMC 20-25 to align it with the current state of the art.

References to other regulatory material

40. As already explained above, the initial responsibilities of the Agency in the field of airworthiness and continuing airworthiness have been extended to cover the fields of air operations, flight crew licensing, third-country aircraft operated by third-country operator, aerodromes and ATM/ANS[12].

41. The references used in this NPA are not only affected by Opinion 07/2011 stemming from the rulemaking task 21.039 on Operational Suitability Data (OSD), but also by Opinion 04/2011, resulting from the rulemaking task OPS.001 and proposing rules for air operations, mainly addressing Commercial Air Traffic (CAT) operators (by both aeroplanes and helicopters). As already explained above, the proposed AMC 20-25 is currently using the existing references: JOEB, rule 1.135 in EU-OPS[13] applicable to CAT but only if by aeroplanes and JAR-OPS 3 and national operational requirements which are still applicable for CAT by helicopters. Depending of the progress of the above-mentioned rulemaking tasks, the references may be changed when the Agency issues the final Decision of its Executive Director.

Alignment with the International Civil Aviation Organisation (ICAO)

42. **Presently there is no provision in ICAO Annexes to deal with the approval processes of EFBs**. There has been a proposal for amending ICAO Annex 6 Part I and ICAO Annex 8 to deal with the operational and airworthiness approval of EFBs. However, the proposal, presented to the ICAO Air Navigation Commission in May 2007, was rejected and sent back to the Airworthiness (AIRP) and Operations (OPSP) Panels for further work. This work is currently being carried out by sub-groups in those Panels.

43. According to Article 2.2(e) of the Basic Regulation, the Agency will promote Community views regarding EFB in proper ICAO forums based on this NPA and on the comments received from stakeholders. This may influence the future ICAO standards on the matter.

44. On the other hand, once these possible new ICAO standards are available, based on Article 2.2(d) of the same Basic Regulation, the Agency will assist Member States in fulfilling their obligations under the Chicago Convention by providing, through common rules, a basis for a common interpretation and uniform implementation of ICAO provisions, and by ensuring that such provisions are duly taken into account in developing Agency's regulatory material.

Alignment with evolving EASA rules

45. In this context it is noted that **ICAO Annex 6 does not provide a clear taxonomy and definition of the various cases of 'operational approvals'**. Currently the Agency uses the following semantics:

- '**exercise of privileges**' (e.g. for pilot licenses) which, according to the present NPA, would apply to use of Type A applications hosted by Class 1 EFB;
- '**notification**' to the competent authority (which replaces the widely used term 'acceptance') and which, according to this NPA, applies to Amendments to the

[12] Air Traffic Management/Air Navigation Services as defined in Article 3 of Basic Regulation and subject to the essential requirements in Annex Vb therein.

[13] Commission Regulation (EC) No 859/2008 of 20 August 2008 amending Council Regulation (EEC) No 3922/91 as regards common technical requirements and administrative procedures applicable to commercial transportation by aeroplane and in particular rules: OPS 1.243, OPS 1.865(d), OPS 1.873 and par. 8.3.2(c) of Appendix to OPS 1.1045 (so called 'EU-OPS').

Operations Manual (OM) concerning the use of Class 1 hardware and type A application software; should changes to the MEL or flight crew training programmes be however necessary, those would be subject to explicit operational approval by competent authority;

- '**operational approval**' (major changes, MEL, flight crew training programmes and others), or, if so wanted, 'normal' approval, which is based on a regulatory process whose input is an application and whose output is a formal reply (e.g. letter) by the competent authority, but whose outcome is not explicitly mentioned in the OPS Specs attached to the Air Operator Certificate (AOC), or in another list for non-commercial operator (this is the most common process in relation to EFB); and
- '**specific approval**' (type of operation or specific operation) or certain operations defined under 'other' (e.g. steep approaches), the common feature of which is to be listed in the OPS SPECs for commercial operators, or 'list of approvals' for non-commercial; this latter case is not considered applicable to EFB.

46. Since the publication of TGL 36, additional safety defences have been added in the total aviation system and in particular:
    - Mentioned Opinion 04/2011, in compliance with current ICAO Annex 6, introduces Safety Management by CAT operators; this goes beyond the current provisions in EU-OPS and gives the possibility of relying on operators for some processes (e.g. approval of 'minor' changes);
    - ETSO Authorisations for specific software modules will channel responsibilities (and liability) to applicants/holders of such authorisations, in turn under direct safety oversight by the Agency;
    - 'data houses', already holding the so-called 'Letters of Acceptance[14]' will become fully fledged Air Navigation Service Providers (ANSP) and hence will also carry specific responsibilities and liabilities.
47. The evolution summarised in the above paragraph allows a cautious reduction of the number of cases in which an operational approval is required. In the proposed AMC 20-25 this is limited to the use of Type A applications hosted by Class 1 EFB, which could happen only on the basis of normal 'exercise of privileges' and without additional administrative paperwork.
48. In all other cases 'operational approvals' would remain necessary.

Harmonisation with Federal Aviation Administration regulations and advisory circulars

49. The proposed AMC is largely harmonised with FAA AC 120-76A 'Guidelines for the Certification, Airworthiness, and Operational Approval of Electronic Flight Bag Computing Devices'. For some subjects the proposed AMC goes more into details and for other ones the AC is more specific. This is explained by the complementary material contained in the different regulations.
50. However, according to the information available to the Agency, the FAA intends to replace the version 'A' of the above-mentioned AC 120-76, by version 'B'. Furthermore, in September 2011 the FAA published AC 20-173[15] covering installation of Electronic Flight Bag components, but also some necessary clarifications to the text of AC 120-76A.
51. The introduction of Airport Moving Map Display (AMMD) in the proposed AMC 20-25 as a Type C application and the possibility to host these Types of applications on a Class 2

[14] Based on Opinion 01/2005.

[15] http://www.faa.gov/documentLibrary/media/Advisory_Circular/AC%2020-173.pdf.

hardware, was triggered by the FAA AC 20-159 'obtaining design and production approval of airport moving map display applications intended for Electronic Flight Bag systems' issued in April 2007. However, due to the rapidly developing EFB applications, in the proposed AMC there are differences, in particular in relation to the airworthiness requirements, in comparison with the mentioned FAA regulatory material issued about five years ago. Since this software (or software integrated into a Class 2 EFB) may be produced by organisations different from the aircraft manufacturer or the aircraft operator, the proposed ETSO-2C165a offers the possibility of issuing a specific authorisation to the equipment manufacturer, which would reduce the burden of demonstrating compliance for either the aircraft manufacturer or operator.

52. As already explained above, additional reasons for this different approach, beyond the technical evolution, are the different regulatory frameworks, being the Agency the European competent authority responsible for airworthiness approval and 27 different European competent authorities established by Members States of the EU, responsible for the operational approval. In principle, applications to obtain airworthiness approvals of installed hardware (HW), software (SW) or integration of the two, having demonstrated compliance with applicable requirements, is responsibility of manufacturers and not of operators.

53. In the present NPA there is no equivalent proposal to the FAA Notice No 8200.98 'Electronic Flight Bag Job Aid', since this document was cancelled by the FAA a long time ago (i.e. 2007). However, some of the most important ideas contained in that 'old' document were included in the proposed AMC.

54. In the proposed AMC 20-25 there is no equivalent Guidance Material to the FAA AC 91-78 'Use of Class 1 or Class 2 Electronic Flight Bag (EFB)' issued in June 2007. In fact, the applicability of the proposed AMC is limited only to aircraft used in commercial air transport and related operators. This is because the proposal is mainly a transposition of former JAA TGL 36, developed for use only by commercial air transport operators.

Possible evolution of EASA rules on EFB

55. As explained in paragraph 46 above, the Agency's rules will progressively cover all the actors in the total aviation system, while aircraft operators will implement safety management. This will pave the way for allocating some responsibilities to manufacturers (also of only packages of computational software) and to providers of 'data for navigation', while also delegating some more responsibility to aircraft operators, without detriment to safety.

56. Therefore, once the Implementing Rules for air operations ('EASA-OPS') are in place also for 'special operations' (alias 'aerial work'; i.e. Part-SPO proposed by the already mentioned Opinion 04/2011) and for non-commercial operators, following Opinion 01/2012 of 1 February 2012[16], the Agency will consider the possible applicability of the proposed AMC 20-25 but also the need to modify it to take advantage of the additional safety provisions mentioned above. In this case a **new specific rulemaking task could be launched** in consultation with stakeholders. Preliminary indications by stakeholders on this matter, in reply to the present NPA, are welcome.

57. This rulemaking task could, in particular, review the necessity for obtaining operational approvals for all kinds of EFB Classes and related software Types, while possibly splitting the regulatory material into:

- AMC to OPS rules concerning procedures and means to be used by aircraft operators;
- one or more ETSOs (in addition to the proposed ETSO-2C165a) applicable by equipment (or even only computational software) manufacturers; and

[16] http://www.easa.europa.eu/agency-measures/docs/opinions/2012/01/Opinion%2001-2012.pdf.

- revised AMC 20-25 addressed to aircraft manufacturers, applying or holding TC or STC, in turn based on any of the existing airworthiness codes (e.g. CS-23, CS-25, or else).

58. The Agency has preliminary views on this possible evolution, which can be summarised in the table below:

Possible EASA approach to EFB approvals

(CAT operators by aeroplanes and helicopters)

SW / HW	Class 1	Class 2	Class 3
Type A	OPS(1): **Notification** of amendment to OM HW(1): No approval SW(1) : No approval	OPS: **Notification** of amendment to OM HW: No approval(3) SW: No approval	OPS: **Notification** of amendment to OM HW: **Approved**(4) SW: No approval
Type B	OPS: **Notification** of amendment to OM HW: No approval SW: No approval(2)	OPS: **Notification** of amendment to OM HW: No approval(3) SW: No approval(2)	OPS: **Notification** of amendment to OM HW: **Approved**(4) SW: No approval(2)
Type C		OPS: **Notification** of amendment to OM HW: No approval(3) SW: : **Approved**(5)	OPS: **Notification** of amendment to OM HW: **Approved**(4) SW: **Approved**(5)

NOTES:

(1) Notification or operational approval, under responsibility of aircraft operator; HW and/or SW airworthiness approval under responsibility of manufacturer of equipment or aircraft.

(2) Except for Mass & balance applications (approval already required in the proposed rule CAT.POL.MAB.105 attached to Opinion 04/2011), and performance calculation applications.

(3) Airworthiness approval required for installed components (mounting device, etc. …)

(4) As component of the aircraft design; guidance in AMC 20-25 for aircraft manufacturers.

(5) As component of the aircraft design (possibly, in some cases such as e.g. AMMD, facilitated by ETSO Authorisation for the system as delivered by the equipment manufacturer).

59. Stakeholders' views on the above table and more in general on the possible future evolution of the Agency's rules on EFB are welcome.

Urgency of the task

60. The Agency is aware that the EFB issue can be controversial. Nevertheless, the Agency deems that:

- the improper use of EFBs may cause safety concerns;
- continuous progress of Information Technology on the commercial market outside aviation, leading to increasing use and requests for EFB applications, requires rulemaking initiative from the Agency in the earliest possible time;
- an NPA is the proper tool to consult the stakeholders' community on important issues, even if controversial.

61. In conclusion, the Agency considers this NPA as a necessary and urgent step. But nevertheless, it reserves the right to take any position after the consultation on the present NPA. These positions will be published in the subsequent Comment-Response Document (CRD).

V. Regulatory Impact Assessment

1. Purpose and Intended Effect

a. Issue which the NPA is intended to address

Electronic Flight Bags (EFBs) are getting more and more sophisticated and integrated into the flight crew compartments. They are now providing applications that are likely to substitute some functions that were traditionally residing on the avionics side of the aircraft (performances computation, moving maps and charts, AMMD, voice and data communication means, electronic checklists). However, most of the time they are not manufactured according to the same design and approval standards as the ones that are used in the frame of airworthiness.

Currently, in the absence of guidance from the Agency, most EU Member States still use TGL 36 issued by the former JAA in 2004. While technology has progressed, this TGL is somewhat obsolete and unable to offer guidance in view of the new safety challenges posed by the new EFB applications. Therefore, Rulemaking action by the Agency is necessary and urgent.

It is not within the scope of the present NPA to impose additional operational requirements regarding the manuals, information and documentation that an operator shall carry on board during each flight. The carriage in electronic format of an EFB is only an alternative means to the paper format.

b. Scale of the issue

Due to the large number of organisations and competent authorities involved in the EFBs system, it is not possible to provide a precise quantitative scale of the issue. A qualitative assessment is therefore provided.

More and more operators involved in commercial air transport are seeking to replace paper in the cockpit by electronic means mainly for the long-term cost reductions when the operators will become a 'fully paperless' company and when all the necessary infrastructures, resources and procedures will be in place to allow it. The proposed AMC is to be used by the European operators involved in commercial air transport (CAT) by aeroplanes and by helicopters, whose number can be estimated in few hundreds.

Furthermore, several aircraft manufacturers already apply for type-certification (or STC) with EFB's hardware in the aircraft and with a variety of applications for the buyers to select. Their number is estimated in the order of few tens.

The market of hardware and software suppliers and system integrators has also increased enormously in the past years. Few hundreds of companies may be involved presently or in the near future, in developing, manufacturing, selling, supporting or maintaining EFB elements.

Furthermore, tens of 'data houses' are involved, since providing not the computational software, but the data bases necessary to feed it.

From the regulatory side, both the competent authorities at national level (i.e. to receive notifications or to issue explicit operational approval) and the Agency (i.e. for airworthiness), receive nowadays more and more applications for approval of EFBs' systems.

c. Brief statement of the objectives of the NPA.

The objective of this NPA is to propose:

(1) a new AMC 20-25 with enough technical specifications to be used by the applicant, by the Agency and by the competent authorities, which:

  (a) clarifies the roles of the different parties involved in the EFBs approval process;

  (b) enhances the technical specifications based on previous experience with the applicability of JAA TGL 36 and to align with today's state of art;

(c) introduces type C applications including AMMD applications; and

(2) a new rule to be added to the 'EASA-OPS' in Part-CAT, Subpart B — Operating procedures, Section 1 — Motor-powered aircraft (MPA), i.e. addressing both aeroplane and helicopter CAT operators, specifically covering EFB and offering in the future the possibility of 'migrating' the material related to operational approval, from AMC 25-25 proposed by the present NPA, to one or more AMCs in the said 'EASA-OPS'.

2. Options

Four options have been identified:

0. **Do nothing** which means that the Agency will approve the EFB aspects linked to airworthiness and OSD, while the competent authorities at national level will continue to use JAA TGL 36 for operational approval of EFB.

1. **Transpose JAA TGL 36 into AMC 20-25** without changing its technical content.

2. **Enhance and amend the material existing in JAA TGL 36** to align it with current state of the art and in parallel propose to add a new rule to 'EASA-OPS' for progressive migration of the provisions into the structure of Agency's rules.

3. Issue AMC 20-25 containing the airworthiness requirements for EFB and a **separate set of AMCs to the 'EASA-OPS'** for the operational approval.

3. Sectors concerned

The sectors of the civil aviation community that are concerned within the scope of the present NPA are operators involved in commercial air transport, flight crews, training organisations, competent authorities at national level, (S)TC's applicants and holders, software (both computational and data bases) and EFB suppliers and the Agency.

4. Impacts

All identified impacts are qualitatively assessed ('light' RIA) and expressed in terms of a score = a numerical single digit from –3 (highly negative) to +3 (highly positive).

Safety scores, since safety is the primary objective of the Agency as per Article 2 of the Basic Regulation, are assigned a 'weight' of 3. Environmental scores, based on the same Article, have a weight of 2. Other scores have a weight of 1.

i. Safety

Some recent events highlight that the design of EFBs may directly contribute to the occurrence of incidents or accidents. A few examples can be mentioned:

- As a result of its investigation of the July 31, 1997, accident involving a McDonnell Douglas MD-11 that crashed while landing on runway 22R at Newark International Airport, the NTSB determined that some flight crew members may lack proficiency in the operation of airplane performance computing devices and that confusion about calculated landing distances may result in potentially hazardous miscalculations of available runway distances after touchdown;
- On 14 October 2004, a B747-200 crashed on take-off from Halifax International Airport, Canada, and was destroyed by impact forces and a post-crash fire. The crew had calculated incorrect V speeds and thrust setting using an EFB take-off performance application. The TSB determined that among the causes and contributing factors, it is likely that the flight crew member who used the EFB to generate take-off performance data did not recognise that the data were incorrect for the planned take-off weight in Halifax. Furthermore, the company did not have a formal training and testing programme on the EFB, and it is likely that the user of the EFB in this occurrence was not fully conversant with the software;
- On December 8, 2005, a Boeing 737 ran off the departure end of runway 31C after landing at Chicago Midway International Airport. Contributing to the accident were the

programming and design of its on-board performance computer, which did not present inherent assumptions critical to pilot decision-making.

Another factor observed by the NTSB was that the airplane performance data programmed into the performance application by the airline was less conservative than the performance data recommended by the manufacturer. The NTSB concluded that if the manufacturer's recommended airplane performance data were used in the airline performance calculations, the resulting negative stopping margins would have required the pilots to divert;

- On August 16, 2008, a Boeing 737 left the ground 160 m beyond the provisional end of the runway (there was ongoing construction work). The airplane struck some lights, then, during the rotation, destroyed some markers on the safety-barrier positioned in front of the construction zone. The investigation determined that this serious incident was caused by the crew's failure to take into account the length of the runway available for take-off in their on-board performance application. The airline had not established any procedure for the use of this application;
- On March 20, 2009, an Airbus A340-541 with 18 crew and 257 passengers, sustained a tail strike and overran the end of the runway on departure from Melbourne. The investigation found that the accident resulted from the use of erroneous take-off performance parameters. Those erroneous parameters were themselves a result of an incorrect take-off weight inadvertently entered into the EFB (262.9 tonnes instead of 362.9 tonnes) during pre-departure. Due to a number of factors, the incorrect data entry passed through all the subsequent checks without detection. The report highlights that the design flow of information from the EFB into the aircraft systems and flight documentation was complex, increasing the risk of error;
- On November 26, 2010, an Airbus A340 attempted to take-off on a taxiway, at Hong Kong International airport. The abnormal manoeuvre was detected by the ground controller, who promptly instructed the crew to stop rolling. In view of the serious nature of the incident, a detailed investigation was conducted and identified that one of the causal factors were the difficulties experienced by both the Captain and the First Officer in stowing the EFB at a critical point of taxiing shortly before take-off. There was no evidence to suggest that the use of the EFB computers in the cockpit had been subject to thorough safety assessment and a sufficiently comprehensive study on the ergonomics aspects of their usage in the cockpit.

Furthermore, a study from the Volpe Center[17] identified a total of 67 EFB-related occurrences that were extracted from the online ASRS database dating from 1995 through 2009. In addition, ATSB[18] (Australia) and BEA[19] (France) studies reported that there were numerous incidents and accidents related to erroneous take-off parameters. The studies highlighted that serious take-off performance parameter-related events occurred at a rate of at least one per year.

If nothing is done, with the proliferation of the umber of the EFB and the number of applications residing on them, the situation may deteriorate even further in the future.

[17] Chandra, D.C. and Kendra, A. (2009). *Review of Safety Reports Involving Electronic Flight Bags*. (DOT-VNTSC-FAA-10-08.) USDOT Volpe Center: Cambridge, MA.

[18] ATSB AR2009-052 Take-off Performance Calculation and Entry Errors: A Global Perspective.

[19] Laboratory of Applied Anthropology. (2008). *Use of erroneous parameters at take-off* (No. DOC AA 556/2008). Paris: Laboratory of Applied Anthropology.

The four options can therefore be compared from the safety perspective in the table below:

i. Safety

Options	0	1	2	3
	Do nothing	**No changes to TGL 36**	**Modernisation of TGL 36**	**Operational criteria in AMC to 'EASA-OPS'**
Assessment	Progressive deterioration of safety, due to increasing number of EFBs and related applications.	AS 0, since the technical content of the guidance would not be affected.	Positive impact on safety thanks to clearer guidelines to applicant and competent authority, starting from the definitions	As 2
Score (un-weighted)	–1	-1	2	2
Weight	Multiply the un-weighted score by: 3			
Score (weighted)	**–3**	**-3**	**6**	**6**

ii. Environment

Options	0	1	2	3
	Do nothing	**No changes to TGL 36**	**Modernisation of TGL 36**	**Operational criteria in AMC to 'EASA-OPS'**
Assessment	Absence of clear guidance to face the challenges posed by EFBs, may delay their widespread use, so leading to more paper used by aircraft operators even in flight, and consequently more fuel burnt	Absence of guidance aligned with the state of the art, may delay the widespread use, of EFB, so leading to more paper used by aircraft operators even in flight, and consequently more fuel burnt	Further exploitation of EF promoted, so reducing the need for paperwork and for carrying it on board	As 2
Score (un-weighted)	–2	-1	2	2
Weight	Multiply the un-weighted score by: 2			
Score (weighted)	**–4**	**-2**	**4**	**4**

iii. Economic

Options	0	1	2	3
	Do nothing	**No changes to TGL 36**	**Modernisation of TGL 36**	**Operational criteria in AMC to 'EASA-OPS'**
Assessment	European industry penalised by the absence of Agency's guidance, while the FAA is close to the third edition of its AC on the matter	European industry penalised by rules not aligned with the state of the art	Need for manufacturers and operators to gradually adapt to new rules	As 2
Score (un-weighted)	–2	-3	–1	–1
Weight	Multiply the un-weighted score by: 1			
Score (weighted)	**–2**	**-3**	**–1**	**–1**

iv. Social

Options	0	1	2	3
	Do nothing	**No changes to TGL 36**	**Modernisation of TGL 36**	**Operational criteria in AMC to 'EASA-OPS'**
Assessment	Less jobs created due to the absence of clear and common rules on EFB at EU level	Less jobs created, or even job losses, due to less competitiveness, caused by obsolete rules on EFB at EU level	More competitiveness and hence more high-quality jobs for all organisations involved in EFB	As 2
Score (un-weighted)	–1	-2	2	2
Weight	Multiply the un-weighted score by: 1			
Score (weighted)	**–1**	**-2**	**2**	**2**

v. Other aviation requirements outside the EASA scope

Options	0	1	2	3
	Do nothing	**No changes to TGL 36**	**Modernisation of TGL 36**	**Operational criteria in AMC to 'EASA-OPS'**
Assessment	Rules applied by competent authorities (i.e. TGL 36) not even aligned with FAA AC 120-76A	Rules applied by competent authorities (i.e. TGL 36) not even aligned with FAA AC 120-76A	Availability of up-to-date material in a short time, developed with limited use of resources. But not yet aligned with imminent edition 'B' of FAA AC	Not possible before adding a new rule to 'EASA-OPS'
Score (un-weighted)	–2	-2	1	-3
Weight	Multiply the un-weighted score by: 1			
Score (weighted)	**–2**	**-2**	**1**	**-3**

b. Equity and fairness in terms of distribution of positive and negative impacts among concerned sectors.

All applicants are equally affected.

5. Summary and final assessment

a. Comparison of the positive and negative impacts for each option evaluated

Using the Multi-Criteria Analysis (MCA) methodology, the 'weighted' scores assigned above are algebraically summed:

Options	0	1	2	3
	Do nothing	**No changes to TGL 36**	**Modernisation of TGL 36**	**Operational criteria in AMC to 'EASA-OPS'**
	Weighted score			
Safety	–3	-3	6	6
Environment	–4	-2	4	4
Economic impact	–2	-3	–1	–1
Social impact	–1	-2	2	2
Regulatory harmonisation	–2	-2	1	-3
TOTAL	**-12**	**-12**	**12**	**8**

b. Final assessment and recommendation of a preferred option

Option 0 ('do nothing') and 1 ('no changes to TGL 36' ='obsolete rules') are clearly the worst and they show a significantly negative score, including in terms of safety.

The remaining two options exhibit a positive total (weighted) score and are equivalent and positive in terms of safety. Among them, however, option 2 has the highest total score and, in particular, it is the best one in terms of regulatory harmonisation (i.e. progressive alignment with the structure of Agency's rules for the 'total system').

Therefore, Option 2 is the preferred one.

B. Draft Opinion and Decisions

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

1. deleted text is shown with a strike through: ~~deleted~~
2. new text is highlighted with grey shading: new
3. …
   indicates that remaining text is unchanged in front of or following the reflected amendment.

I. Draft Opinion

Add new rule in 'EASA-OPS' Part CAT to read as follows:

CAT.OP.MPA.325 Electronic Flight Bag (EFB)

(a) The operator shall only use an EFB under the following conditions:

(1) Clearly defined responsibilities and procedures to ensure configuration control and security of the EFB;

(2) Accuracy and integrity of all EFB data and all calculation performed by the EFB;

(3) Appropriate training and checking for flight crew in approved training programmes;

(4) Assessment and mitigation of the risk caused by any failure condition related to the complete EFB system or any individual component or application based on the EFB and including corruption or loss of data and erroneously displayed information;

(5) EFB system design and usability compatible with the intended use; and

(6) The competent authority has received notification of changes to the Operations Manual for the use of the EFB and granted its operational approval.

(b) paragraph (a)(6) does not apply to Class 1 EFB hardware and Type A EFB software.

II. Draft Decision AMC-20

Issue new AMC 20-25 EFB to read as follows:

AMC 20-25

Airworthiness and operational consideration for the approval of Electronic Flight Bags (EFBs)

1 PURPOSE AND SCOPE

This Acceptable Means of Compliance is one means but not the only means to obtain airworthiness and operational approval for the use of Electronic Flight Bags (EFBs).

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 applicant 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 EFB even applications using computational software (e.g. for performances), data bases (e.g. digital navigation data) or real-time data coming from the avionics (e.g. Airport Moving Map Display).

The evaluation of an EFB has both an airworthiness and operational aspect and, where necessary, to make a complete evaluation of an EFB system, there is a need for close coordination between two processes.

2 APPLICABILITY

This AMC is to be used by:

a) Commercial Air Transport operators by aeroplane or by helicopter;
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.

3 REFERENCE DOCUMENTS

3.1 Related Requirements

Annex III to Regulation (EEC) No 3922/91 ("EU-OPS")[20], the following articles are to be used as references:
EU-OPS 1.110, 1.125, 1.130, 1.135, 1.140, 1.150, 1.155, 1.175, 1.185, 1.200, 1.290, 1.625, 1.965, 1.1040, 1.1045, 1.1055, 1.1060, 1.1065, 1.1071
JAR-OPS 3 or applicable national operational requirements for commercial air transport of helicopters.

3.2 Related Certification Specifications

CS 25.1301, 25.1302, 25.1309, 25.1316, 25.1321, 25.1322, 25.1431, 25.1529, 25.1581
CS 23.1301, 23.1309, 23.1321, 23.1322, 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
Appendix G to CS-23, Appendix H to CS-25 and Appendices A to CS-27 and CS-29: Instructions for Continued Airworthiness
ETSO-2C165a: Electornic Map Systems for graphical depiction of aircraft position
EASA Special Condition on Information Security (Network Security)

3.3 Related Guidance Material

3.3.1 Europe

EASA AMC 25.1581	Appendix 1 – Computerised Aeroplane Flight Manual
JAA TGL No. 26	MEL Policy
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-14()	Environmental Conditions and Test Procedures for Airborne Equipment
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
FAA AC 120-76A	Guidelines for the Certification, Airworthiness, and Operational Approval of Electronic Flight Bag Computing Devices
FAA AC 20-173	Installation of Electronic Flight Bag Components
FAA TSO-C165	Electronic Map Display Equipment for Graphical Depiction of Aircraft Position
RTCA DO-294A and later versions	Guidance on Allowing Transmitting Portable Electronic Devices (T-PEDs) on Aircraft
RTCA DO-160()	Environmental Conditions and Test Procedures for Airborne Equipment
RTCA DO-178()	Software Considerations in Airborne Systems and Equipment Certification

[20] Annex III to Council Regulation (EEC) No 3922/91 of 16 December 1991 on the harmonisation of technical requirements and administrative procedures in the field of civil aviation (OJ L 373, 31.12.1991, p. 4). Regulation as last amended by Commission Regulation (EC) No 859/2008 of 20 August 2008 (OJ L 254, 20.9.2008, p. 1).

RTCA DO-257A Minimum Operation Performance Standards for the Depiction of Navigational Information on Electronic Maps

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. Aeronautical 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 Portable Electronic Device (PED)

PED are typically consumer electronic devices, which have functional capability for communications, entertainment, data processing, and/or utility. There are two basic categories of PEDs – those with and those without intentional transmitting capability. (Ref.: ED-130/RTCA DO-294())

4.3 Controlled Portable Electronic Device (PED)

A controlled PED is subject to administrative control by the operator using it. This will include, inter alia, tracking the location of the devices to specific aircraft or persons and ensuring that no unauthorised changes are made to the hardware, software or databases. A controlled PED will also be subject to procedures to ensure that it is maintained to the latest amendment state.

4.4 Data Connectivity for EFB Systems

Data connectivity for EFB system supports either uni- or bi-directional data communication between the EFB and other systems (e.g. avionics).

4.5 Electronic Flight Bag (EFB)

An electronic display system intended for flight crew or cabin crew members providing functions traditionally accomplished using paper references (e.g., navigation charts, operating manuals, performance calculations). The EFB may also support other functions that have no paper equivalent (e.g., a video surveillance display).

4.6 EFB Administrator

The EFB Administrator is the 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.

He/she will be the person in overall charge of the EFB system and will be responsible for ensuring that any hardware conforms to the required specification and that no unauthorised software is installed. He/she will also be responsible for ensuring that only the current version of the application software and data packages are installed on the EFB system.

4.7 EFB System

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

4.8 EFB Software Application

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

4.9 Interactive Information

Information presented on the EFB that, via software applications, could be selected and rendered in a number of dynamic ways. This includes variables in the information presented based on data-oriented software algorithms, concepts of de-cluttering, and real-time composition as opposed to pre-composed information.

4.10 Minor failure condition

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 the AMC 25.1309.

4.11 Mounting Device

A mounting device builds up portable equipment. It may include arm-mounted, kneeboard, cradle, or docking-stations, etc. It may have aircraft power and data connectivity. It may require quick-disconnect for egress.

4.12 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 the AMC 25.1309.

4.13 Pre-Composed Information

Information previously composed into a static composed state (non-interactive). The composed displays have consistent, defined and verifiable content, and formats that are fixed in composition. Applications based on pre-composed information may contain "contextual access" like hyperlink, bookmark.

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 Hardware Classes of EFB Systems

This AMC defines three hardware classes of EFB systems, Class 1, 2, and 3.

5.1.1 Class 1

Definition:

Class 1 EFB systems:

a. Are not attached to any aircraft mounting device;
b. Are without aircraft data connectivity.

Complementary characteristics:

Class 1 EFB may host Type A and B software

Class 1 EFB systems are stowed during critical phases of flight. However, in the case of electronic aeronautical chart applications, the competent authority may allow its use during critical phases of flight, provided the Class 1 EFB is used with a kneeboard system and is securely attached to the pilot in a manner which allows its normal use and meets the criteria specified in paragraphs 6.1.2.1 and 6.1.2.2.

They may be consumer electronics computing devices (e.g. laptop, tablet PC).

They may be provided with aircraft power through a certified power source (see section 6.1.1.3).

Class 1 EFB systems should be controlled PEDs (see paragraph 4.3).

A Class 1 EFB is not considered to be part of the certified aircraft configuration, i.e. not defined in the aircraft Type design nor installed by a change to the Type design. Therefore, Class 1 EFB systems do not require airworthiness approval.

5.1.2 Class 2

Definition:

Class 2 EFB systems are:

a) Attached to an aircraft mounting device and/or connected to aircraft systems, but without the capability to send data to the certified aircraft systems (with the exception of the EFB dedicated installed resources).
b) Not considered to be part of the certified aircraft configuration, i.e. not in the aircraft Type design nor installed by a change to the Type design nor added by a Supplemental Type Certificate.
c) Not sharing any display or other input/output device (e.g. keyboard, pointing device) with certified aircraft systems.

d) Based on a portable hardware platform that does not require any tool to be removed from the flight crew compartment; a flight-crew member should be able to perform the task reasonably easily and rapidly.
e) Able to receive data from aircraft system through a certified interface unit, but unable to send data, except to systems which are completely isolated (in both directions).

Complementary characteristics:

Class 2 EFB hardware may be used during all phases of flight. They may also receive data from the aircraft avionics.

They may be consumer electronic computing devices (e.g. laptop, tablet PC).

EFB Class 2 systems may only be connected to aircraft power through a certified power source (See section 6.1.2.3).

Class 2 EFB systems require airworthiness approval of the installation provisions as described in Section 6.

Any EFB components/hardware not accessible on the flight crew compartment by the flight crew members and/or not portable should be installed and certificated equipment covered by a Type Certificate (TC), changed TC or Supplemental (S)TC.

A class 2 EFB is considered to be a controlled PED (refer to section 4.3).

5.1.3 Class 3

Definition:

Any EFB which is not classified as class 1 or class 2.

Complementary characteristics:

Class 3 EFB are installed equipment requiring an airworthiness approval. This approval covers the EFB host platform and installed resources (e.g. server, display, control device, power, switching), including hardware and operating system software qualification. A Class 3 EFB platform and installed resources are part of the certified aircraft configuration.

Class 3 EFB may host Type C applications.

Class 3 EFB may host Type A and/or B applications provided the Type A and/or Type B EFB applications do not interfere with Type C applications (e.g. a partition, a segregation or by demonstration).

Data connectivity with certified aircraft systems in both directions is allowed for Type C applications.

Data connectivity is allowed for Type A or Type B applications hosted on a Class 3 EFB but without the capability to send data to other certified aircraft systems.

5.2 Software Applications for EFB Systems

The functionality associated with the EFB system depends upon the applications loaded on the host. The classification of the applications into three Types (A, B and C) is intended to provide clear divisions between the scope and therefore the approval process applied to each.

If there is any doubt as to the classification of an application, applicants should seek advice early on in the approval process from EASA.

For the purpose of the following definitions, "malfunction or misuse" means any failure, malfunction of the application, design-related human errors, or erroneous interpretation of information or controls.

5.2.1 Type A

Definition:

Type A applications are EFB applications whose malfunction or misuse would have no adverse effect on the safety of any flight operation, i.e. a hazard level defined as no greater than a "no safety effect" failure condition classification.

Complementary characteristics:

Type A applications:

a) May be hosted on any of the hardware classes;
b) Do not require any approval;
c) Should follow basic human factors guidance as described in Appendix D, paragraph 2.

Examples of Type A applications can be found in Appendix A.

5.2.2 Type B

Type B applications are applications that:

a) Do not substitute to or duplicate any system or functionality required by airworthiness regulation or operational rule; and
b) Whose malfunction or misuse would have an adverse safety effect, i.e. a hazard level no greater than a "minor" failure condition classification; and
c) Do not have any of the capabilities defining type C applications (see §5.2.3).

Complementary characteristics:

Type B applications:

a) May be hosted on any of the hardware classes;
b) Require an operational approval as described in §6 and §7;
c) Do not require an airworthiness approval.

Examples of Type B applications can be found in Appendix B.

5.2.3 Type C

Definition:

Type C applications are applications considered to be ineligible for classification as either Type A or B.

Any application enabling the following capabilities are considered as type C applications:

a) 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 other traffic, in flight or on ground.
b) Displaying information which may be directly used by the flight crew 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 failure.
c) Communicating as, primary means, to air traffic services, or whereby the flight path of the aircraft is authorised, directed or controlled.
d) Sending data to the certified aircraft systems other than the EFB installed resources.

Typical examples of Type C applications can be found in Appendix C.

Complementary characteristics:

Type C applications:

a) May only be hosted on Class 3 Hardware with the exception of AMMD (refer to § 5.2.3.1);
b) Require both Airworthiness and Operational approvals (refer to section 6.2.2).
c) May contain user-modifiable software or data. The boundaries of the user-modifiable parts should be defined as part of the airworthiness approval.

5.2.3.1 Airport Moving Map Display (AMMD) Application with Own-Ship Position

AMMD with own-ship position:

a) It is a type C application that may be installed on Class 2 or Class 3 host platform without segregation.

b) It is subject to the specific conditions and approval processes described in Appendix H of this AMC.

6 HARDWARE AND SOFTWARE APPROVAL PROCESSES

6.1 EFB Hardware Approval Process (Host Platform)

6.1.1 Class 1 EFB

A Class 1 EFB device does not require an airworthiness approval.
However, paragraphs 6.1.1.1 through 6.1.1.6 need to be assessed where applicable during the operational approval process.

6.1.1.1 Electromagnetic Interference (EMI) Demonstrations

For the purpose of EMI demonstrations, Class 1 EFB devices should satisfy the criteria contained within ED-130/RTCA DO-294A(). If the Class 1 EFB device is to remain powered (including being in stand-by mode) during take-off and landing, further EMI demonstrations (laboratory, ground or flight test) are required to provide greater assurance of non-interference and compatibility. Assessment should be made against the requirements of ED-14(D)change 3/DO-160(D)change 3 or ED-14(E)/DO-160(E) or ED-14(F)/DO-160(F)DO-160() Section 21, Emission of Radio Frequency Energy and results submitted to the competent authority for acceptance during the EFB operational approval.

6.1.1.2 Batteries

(a) During the procurement of Class 1 EFB devices, special consideration should be given to the intended use and maintenance of devices incorporating lithium batteries. In particular, the applicant should address the following issues:

(1) Risk of leakage;
(2) Safe storage of spares including the potential for short circuit;
(3) Hazards due to on-board continuous charging of the device, including battery overheat;
(4) Any other hazards due to battery technology.

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

(c) When EFBs with lithium battery systems are connected to the aircraft power system, the lithium battery should comply with the following criteria:

(1) Safe cell temperatures and pressures should be maintained during any foreseeable charging or discharging condition and during any failure of the charging or battery monitoring system. The lithium battery installation should preclude explosion in the event of those failures.
(2) Design of the lithium batteries should preclude the occurrence of self-sustaining, uncontrolled increases in temperature or pressure.
(3) No explosive or toxic gases emitted by any lithium battery in normal operation, or as the result of any failure of the battery charging system or monitoring system, may accumulate in hazardous quantities within the aircraft.
(4) No corrosive fluids or gases that may escape from any lithium battery may damage the surrounding structure or any adjacent systems, equipment, or electrical wiring of the aircraft.
(5) Each lithium battery should have provisions to prevent any hazardous effect on structure or essential systems caused by the maximum amount of heat the battery can generate during a short circuit of the battery or of its individual cells.

(d) There should be a capability to control the charging rate of the battery automatically, so as to prevent battery overheating or overcharging.

(e) As a minimum specification, the lithium battery incorporated within the EFB device should have been tested to Underwriters Laboratory Inc. (UL) Standard for Safety for Lithium Batteries reference UL 1642, user replaceable battery category.

6.1.1.3 Power Source

(a) A placard should be mounted beside the power outlet and containing the information needed by the flight or maintenance crews.

(b) The EFB power source should be designed such 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 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.

(e) In order to achieve an acceptable level of safety, certain software applications, especially when used as a source of required information, may require that the EFB system have access to an alternate power supply.

Further considerations can be found in Appendix J of this AMC.

6.1.1.4 Data Connectivity

Data connectivity with certified aircraft systems is not authorised.

6.1.1.5 Environmental Testing

(a) Environmental testing, in particular testing for rapid depressurisation, may need to be performed when the EFB host 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 cockpit operating conditions. However, since many Class 1 EFB devices were originally COTS electronic systems accepted for aviation use, 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 seeking approval should provide:

(1) Evidences of these tests that have already been accomplished; or
(2) Suitable alternate procedures to deal with the total loss of the EFB system.

(b) Further considerations can be found in Appendix K of this AMC.

(c) Testing for rapid depressurisation, may need to be repeated when the EFB model identification changes, or battery type is changed.

6.1.1.6 Other aspects

Safe stowage, crashworthiness, safety and use under normal environmental conditions including turbulence should also be addressed.

6.1.2 Class 2 EFB

Class 2 EFB systems require an airworthiness approval of the installation provisions, limited in scope to the contents of paragraphs 6.1.2.1 through 6.1.2.5.

The EFB computer system hosting the EFB software applications and the Operating System do not require an airworthiness approval.

An evaluation of the EFB mounting device, flight crew compartment location, data connectivity, EFB power connection and the installed resources, if any, the evaluation of the remaining aspects should be conducted during an operational evaluation as described below in paragraphs 6.1.2.6 to 6.1.2.8.

6.1.2.1 Design of the Mounting Device

The mounting device (or other securing mechanism) attaches or allows 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 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 (normal, abnormal, or emergency) associated with operating any aircraft system.
b) The mounting device should be able to be locked in position easily. Selection of positions should be adjustable enough to accommodate a range of flight crew member preferences. In addition, the range of available movement should accommodate the expected range of users' physical abilities (i.e., anthropometrics constraints). Locking mechanisms should be of the low-wear types that will minimise slippage after extended periods of normal use.
c) Crashworthiness considerations should be considered in the design of this device. This includes the appropriate restraint of any device when in use.
d) 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) If the EFB requires cabling to mate with aircraft systems or other EFBs, and 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).

g) Cables that are external to the mounting device should be of sufficient length to not obstruct the use of any movable device on the flight crew compartment.
h) Adequate means should be provided (e.g. hardware or software) to shut down the portable EFB computer when its controls are not accessible by the pilot strapped in the normal seated position. This objective can be achieved through a dedicated installed resource certified according to 6.1.2.5 (e.g. button accessible from pilot seated position) or through dedicated software to be addressed in the guidelines for EFB system suppliers (see 6.1.4.3).

6.1.2.2 Characteristics and placement of the EFB Display

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 external view during all phases of the flight. Equally, they should not impair the view and access to any cockpit control or instrument.

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

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 on a flight crew compartment, including use in direct sunlight. Consideration should be given to the long-term display degradation as a result of abrasion and ageing.

Users should be able to adjust the screen brightness of an EFB independently of the brightness of other displays on the flight crew compartment. In addition, when incorporating an automatic brightness adjustment, it should operate independently for each EFB in the flight crew compartment.

Buttons and labels should have adequate illumination for night use.

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

In addition, consideration should be given to the potential for confusion that could result from presentation of relative directions when the EFB is positioned in an orientation inconsistent with that information. For example, it may be misleading if own aircraft heading is pointed to the top of the display and the display is not aligned with the aircraft longitudinal axis.

Each EFB system should be evaluated with regard to these requirements (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.

6.1.2.3 Power Source

See paragraph 6.1.1.3.

6.1.2.4 EFB Data Connectivity

A class 2 EFB can receive data from aircraft system through a certified interface unit, but does not have the capability to send data, except to systems which are completely isolated (in both directions) from the certified aircraft systems (e.g. EFB system connected to dedicated installed resources or a transmission media that receives and transmits data for Aircraft Administrative Communications (AAC) purposes on the ground only).

EFB data connectivity should be validated and verified to ensure non-interference and isolation from certified aircraft systems during data reception.

Certified aircraft systems should not be adversely affected by EFB system failures or the transmission media for AAC used on the ground.

Any consequent airworthiness limitations should be included in the Aircraft Flight Manual (ref. to 6.1.4.1).

6.1.2.5 Installed Resources

Installed resources are the input/output components external to the EFB hardware platform itself, such as an installed remote display, a control device (e.g. a keyboard, pointing device, switching etc.) or a docking station.

The installed resources should be dedicated to EFB functions only.

Installed resources require an airworthiness approval.

6.1.2.6 EMI Demonstrations

See paragraph 6.1.1.1

6.1.2.7 Batteries

See paragraph 6.1.1.2

6.1.2.8 Rapid Depressurisation Testing

See paragraph 6.1.1.5.

6.1.3 Class 3 EFB

A Class 3 EFB is considered as installed equipment and therefore requires a full airworthiness approval. Aspects linked to 6.1.1.1 to 6.1.1.6 above should be considered.

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 approved application installed on the Class 3 EFB and the partition provided for uncertified applications and non-EFB applications.

b) Hardware and operating system software qualification conducted in accordance with the necessary Design Assurance Level (DAL) for the system and its interfaces.

6.1.4 Certification Documentation

6.1.4.1 Aircraft Flight Manual

For Class 2 and 3 EFB, the Aircraft Flight Manual (AFM) section or an Aircraft Flight Manual Supplement (AFMS) should contain

a) A statement which identifies the equipment and aircraft build or modification standard as necessary. This may include a very brief description of the installed system.

b) Appropriate amendments or supplements to cover any limitations concerning:

   i. the use of the EFB host platform for Class 3 EFB system;

   ii. the use of the installed EFB provisions/resources for Class 2 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.

6.1.4.2 Guidelines for EFB Software Application Developers (Class 3)

The software application developers 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 EFB host platform. The guideline should address at least the following:

a) A description of the architecture for the host platform;
b) Information necessary in order to define a software application, including library routines etc.;
c) The EFB Design Assurance Level (DAL) and any assumptions, limitations or risk mitigations means necessary to support this;
d) Information necessary to ensure development of a software application consistent with the avionics interface and the human machine interface, that is also accurate, reliable, secure, testable, and maintainable;
e) Rules of co-habitation of any new software application with those already approved;
f) Guidelines on how to integrate any new software application into the platform; and,
g) A quality assurance process for developing software applications in the context of the host platform.

The guidelines document should be available to the aircraft manufacturer, to the aircraft operator, to the competent authority and to the Agency.

6.1.4.3 Guidelines for EFB system suppliers (Class 2)

EFB system suppliers should compile and maintain guidelines when EFB resources for a Class 2 EFB system are installed. These installed resources are considered as provisions, which are part of the aircraft configuration and therefore, are certificated.

The document should provide a set of requirements and guidelines to integrate the Class 2 EFB system 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:
   - Intended function, limitations of use, regulatory framework, etc.;

- Characteristics of the mounting devices, display units, control and pointing devices, printer, etc.;
- Maximum authorised characteristics (dimensions, weight, etc.) of the portable parts of the EFB system supported by the mounting devices;
- EFB provisions architecture description, including normal/abnormal/manual/ automatic reconfigurations; and
- Normal/abnormal/emergency/maintenance procedures including allowed phases of flight.

b) Characteristics and limitations, including safety and security considerations to protect the aircraft systems, concerning:
   a. power supply;
   b. laptop battery; and
   c. data connectivity.

The guidelines document should be available to the operator, the competent authority and the EASA.

6.2 EFB Software Approval Process

When seeking an evaluation of a software application for the purpose of an operational approval, the applicant (e.g. an operator supported by the vendor or developer) should make a submission to the competent authority (for further details refer to Appendix F).

6.2.1 Type A Software Applications

Type A software applications do not require an approval, but should follow the HMI and human factors guidance material provided in appendix D.

6.2.2 Type B Software Applications

Type B software applications do not require airworthiness approval, but should be approved through the operational approval process.

6.2.3 Type C Software Applications

Type C software applications require both airworthiness and operational approvals.

6.2.4 Non-EFB Software Applications

Software applications supporting function(s) not directly related to operations conducted by crew on the aircraft should be considered as non-EFB software applications and their use is outside of the scope of this document.

However, the EFB Administrator should ensure that non-EFB software applications do not adversely impact the operation of the EFB (refer to §7.8) and in particular include non-EFB software in the scope of EFB configuration management.

7 OPERATIONAL APPROVAL PROCESS

Type A applications hosted in Class 1 EFB can be used by properly trained pilots when exercising their privileges and without the need for any notification or application for operational approval to the competent authority.

In all other cases, before using an application hosted on EFB, operators apply to the competent authority for operational approval.

When an operator is seeking an operational approval for an EFB system, the evaluation should be conducted by the operator's competent authority when the system is based on a class 1 or 2 EFB and only hosts:

- Type A applications; and/or
- Type B applications belonging to the list hereafter:

  - Document Browser displaying the following documents, interactive or not, or not in pre-composed format, and not driven by sensed aircraft parameters:
    - The manuals and additional information and forms required to be carried by Regulations such as:
      - The Operations Manual (including the MEL and CDL);
      - Aircraft Flight Manual;
      - The Operational Flight Plan;
      - The aircraft continuing airworthiness records, including the technical Log;
      - Meteorological information including with graphical interpretation;
      - ATS Flight Plan;
      - NOTAMs and AIS briefing information;

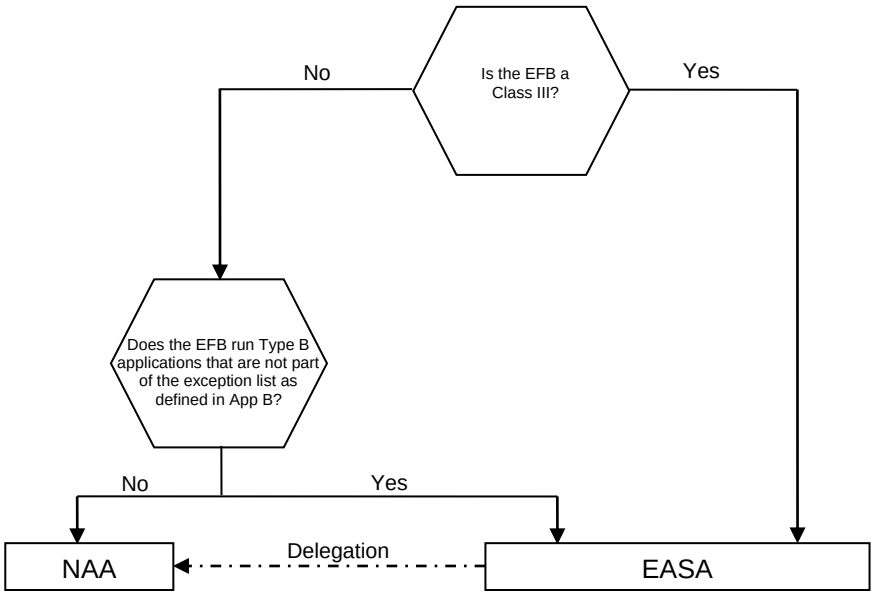
  - Electronic aeronautical chart applications including en-route, area, approach, and airport surface maps including panning, zooming, scrolling, and rotation, centring and page turning but without display of aircraft/own-ship position.

  - Applications that make use of the Internet and/or other aircraft operational communications (AAC) or company maintenance-specific data links to collect, process, and then disseminate data for uses such as spare parts and budget management, spares/inventory control, unscheduled maintenance scheduling, etc.

  - Cabin-mounted video and aircraft exterior surveillance camera displays.

In other cases the evaluation should be conducted by the Agency. The competent authority at national level should then base the granting of the operational approval on the results of the operational evaluation conducted by the Agency.

All required airworthiness evaluations will be conducted by EASA.



Decision tree for allocating the evaluation responsibility

When an aircraft manufacturer is seeking an operational evaluation of an EFB system or component of an EFB system prior to an operator seeking operational approval, the manufacturer should file an application for an evaluation by the Agency.

The operator may demonstrate the fidelity and reliability of the system in different ways. Where it is the intention to start EFB operations with no paper backup, a full Operational Risk Assessment and suitable means of mitigation against failure or malfunction should be required. Alternatively, the operator may choose to keep the paper backup as a cross-check against the EFB information and as a means of mitigation against failure or malfunction. A combination of the above methods where some risk assessment and limited paper backup is carried may also be used when it is acceptable for the operator's competent authority. The scope of the final Operational Evaluation Test (see paragraph 7.12) will depend on the method used.

Any modification of the previously approved process for database management or the loading of any new, modified or additional software intended for operational use should not be permitted unless it can be shown that the software does not contravene any applicable regulations, the conditions under which the initial operational approval was granted or any other applicable regulations.

For any changes requiring prior approval in accordance with Regulation (EC) No 216/2008 and its Implementing Rules (e.g. major changes which could cause events of major severity or worse), the operator is expected to apply for and obtain an approval issued by the competent authority.

All other changes (e.g. minor or no safety impact) not requiring prior approval shall be managed by the operator and notified to the competent authority as defined in the procedure approved by the competent authority in accordance with rule ARO.GEN.310(c)[21].

The competent authority may, through said procedure, obviate the need to notify changes related to loading new data bases into EFB.

Any new, modified or additional software should be acceptable to, or, where applicable, should be approved by the competent authority in accordance with the conditions specified under this AMC.

An operator should supply the competent authority with details of the intended modification of the previously approved process for database management or the loading of any new, modified or additional software in advance of the effective date. However, immediate modifications or changes that are required in the interest of safety may be applied and used immediately, provided that any approval required in accordance with the conditions established in this AMC has been applied for and the modifications and changes follow also the revision control procedures specified in paragraph 7.9.1.

Modifications and amendments of database and/or software may also be required by the competent authority. The operator should ensure that these modifications and amendments are incorporated and they follow the revision control procedures specified in paragraph 7.9.1.

7.1 Role of the EFB System Supplier

The EFB system supplier is the link between the application developer and the EFB administrator. In addition to what is stated in 7.9, the applicant is responsible for assuring that the initial EFB software package (batch) from the EFB system supplier is in conformance with this AMC at the time it is delivered to him. When an EFB software package is initially delivered to an operator seeking operational approval, the EFB system supplier may apply for an OEB evaluation to assess conformity against the appropriate regulations, to simplify the operator's approval process.

7.2 Risk Assessment for EFB Systems

Prior to the entry into operation of any EFB system, the operator will be required to demonstrate to the competent authority that the system has been subject to a risk assessment conducted under the overall operator's Management System (MS). The objective of the Risk Assessment is to demonstrate 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.

Where the EFB system is intended for introduction alongside a paper-based system for a trial period, no risk assessment is required beyond that conducted under the MS. The results of the trial should establish the configuration and use of the system.

Where an accelerated introduction with a reduced trial period or paperless entry-into-service of a new EFB system is intended, a detailed Operational Risk Analysis will be required.

7.2.1 Management System Risk Assessment

In considering the accessibility, usability and reliability of the EFB system, the operator should demonstrate to the competent authority that the failure of the complete EFB system as well as

[21] As proposed by Agency's Opinion 04/2011 expected to be adopted by the European commission and published in 2012: http://www.easa.europa.eu/agency-measures/docs/opinions/2011/04/Annexes%20to%20Regulation.pdf.

individual applications including corruption or loss of data and erroneously displayed information has been considered.

Operators will need to establish a reliable alternative means of providing the information available on the EFB system.

This may be accomplished by one or a combination of the following:

- System design,
- Alternative power sources,
- Redundant EFB applications hosted on different platforms,
- The relevant information as paper backup,
- Procedural means.

7.2.2 Operational Risk Analysis (ORA)

Where a detailed Operational Risk Analysis is required, the ORA process should:

- Identify potential losses of function or malfunction (detected erroneous output, undetected erroneous output) and associated failure scenarios;
- Analyse the operational repercussions of these failure scenarios; and
- Propose mitigation means e.g., software design features, availability of backup data, operational procedures, training, administration, method to ensure appropriate accuracy and currency of databases etc. linked to the use of this application.
  Note: Some EFB applications parameters may depend on crew entries whereas others may be parameters defaulted from within the system and subject to an administration process (e.g. the runway line-up allowance in an aircraft performance application). In the first case, mitigation means will concern mainly training and crew procedures aspects whereas in the second case, mitigation means will more likely focus on administrator and quality policy aspects.

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

- Minimisation of undetected erroneous application output;
- Erroneous outputs from the software application including:
  - Description of corruption scenarios;
  - Description of mitigation means.
- Upstream processes including:
  - Reliability of root data used in applications (qualified/verified input data);
  - Application verification and validation checks;
  - Non-interference of application software e.g., partitioning of Type A, B from Type C or other applications.
- Description of the mitigation means following detected loss of application, or detected erroneous output due to internal EFB error.

The availability of backup data, procedures etc. may be in the form of an alternative EFB possibly supplied from a different power source or some form of paper backup system e.g., Quick Reference Handbook (QRH).

EFB system design features such as those assuring data integrity and the accuracy of performance calculations (e.g. a "reasonableness" or "range" check) may have an impact on the ORA. The ORA methodology should be considered by the Original Equipment Manufacturer when developing the EFB system to allow the operational environment to be taken into account and to support the development of the ORA by the operator.

Note: The competent authority may still require a limited trial period during which paper documentation is retained to confirm the robustness of the system.

7.3 Dispatch Considerations

The operator should carry out an assessment of the dispatch considerations with regard to the EFB system. The operator should demonstrate how the availability of the EFB system is confirmed by pre-flight checks. Instructions to flight crew should clearly define the actions to be taken in the event of any EFB system deficiency.

In order to achieve an acceptable level of availability, certain software applications, especially when used as a source of required information, may require that the EFB system has an alternate power supply or that procedures exist to mitigate against an EFB power supply failures.

Mitigation may be in the form of maintenance and/or operational procedures; examples being:

- Scheduled maintenance task to replace batteries as required;
- Fully charged back-up battery on-board;
- Procedures for the flight crew to check the battery charging level before departure;
- Procedures for the flight crew to switch off the EFB in a timely manner when the aircraft power source is lost.

7.3.1 Dispatch with Inoperative EFB Elements

Alternative procedures used for dispatch with inoperative EFB elements, and described either in MEL or in the Operations Manual, should ensure that an acceptable level of safety is maintained. Particular attention should be paid to alternative procedures for applications providing calculated operational data such as a performance application.

The same degree of data input and output integrity in the form of cross-checking and gross error checks should be maintained by the alternative procedure as is obtained by the fully operative system.

Note: Further guidance and means of compliance relating to relief, which may be available under the MEL for inoperative EFB elements, is provided CS-MMEL[22], which is planned to replace JAA TGL No 26.

The purpose of the guidance within JAA TGL 26 is not to require inclusion of Class 1 and 2 EFBs in an operator's MEL, but to provide one means of controlling inoperative EFB equipment. Other means, such as control procedures described within the operator's Operations Manual, may be acceptable by the competent authority.

[22] http://www.easa.europa.eu/rulemaking/docs/npa/2011/NPA%202011-11.pdf.

7.4 Human Factors Assessment

The applicant will need to carry out an assessment of the human machine interface, installation, and aspects governing Crew Resource Management (CRM), when using the EFB system. This should include a review of the complete system to include the guidance and means of compliance provided in Appendix D.

7.5 Specific Considerations for mass and balance and performance Applications

Since performance and mass and balance software applications are typically type B, the EASA is directly involved in their evaluation.

A specific part of the evaluation will be dedicated to the verification that aircraft performance or mass and balance data provided by the application are correct in comparison with data derived from the AFM (or other appropriate sources) under a representative cross section of conditions (e.g. for performance applications: take-off and landing performance data on a dry, wet and contaminated runway, different wind conditions and aerodrome pressure altitudes, etc.).

7.6 Flight Crew Operating Procedures

7.6.1 Procedures for using EFB systems with other Flight crew compartment systems

Procedures should be designed to ensure that the flight crew know which aircraft system to use for a given purpose, especially when both the aircraft and EFB systems provide similar information. Procedures should also be designed to define the actions to be taken when information provided by an EFB system does not agree with that from other flight crew compartment sources, or when one EFB system disagrees with another. If an EFB system generates information similar to that generated by existing automation, procedures should clearly identify which information source will be the primary (the one provided by aircraft system), which source will be used for backup information, and under which conditions the backup source should be used.

7.6.2 Flight Crew Awareness of EFB Software/Database Revisions

The operator should have a procedure in place to allow flight crews to confirm prior to flight the revision number and/or date of EFB application software including, where applicable, database versions. However, flight crews 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 out-of-date.

7.6.3 Procedures to Mitigate and/or Control Workload

Procedures should be designed to mitigate and/or control additional workloads created by using an EFB system. The operator should develop procedures such that both flight crew members do not become preoccupied with the EFB system at the same time. Workload should be allocated 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.

7.6.4 Defining Flight Crew Responsibilities for Performance Calculations

Procedures should be developed 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.

7.7 Quality Assurance

The operator should establish procedures for inclusion of the EFB system in their Quality Assurance Programme that is required in accordance with EU-OPS 1.035. The purpose is to provide confidence that EFB operations and administration are conducted in accordance with all applicable requirements, standards and operational procedures.

7.8 EFB System Security

The EFB system (including any means used for its updating), should be secure from unauthorised intervention (e.g. malicious software). The applicant should demonstrate that adequate security procedures are in place to protect the system. These procedures should guarantee that prior to each flight the EFB operational software works as specified and as approved 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 of data and secure distribution of data to the aircraft.

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

- 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;
- Portable EFB platforms should be subject to location tracking to specific aircraft or persons;
- Where a system has input ports and especially if widely known protocols are using these ports and/or internet connections are offered, then special consideration should be given to the risks associated with these ports;
- Where physical media is 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 and integration level of the EFB. EFBs system which have the ability to send data to aircraft systems are required to have a higher level of security than EFBs without this capability, whatever the EFB Class and whatever the type of software hosted.

Examples of typical safety and security defences are:

- Individual system firewalls;
- Clustering of systems with similar safety standards into domains;
- Data encryption & authentication;
- Virus scans;
- Keeping the OS up-to-date;

- Initiating air/ground connections only when required and always from the aircraft;
- "Whitelists" for allowed Internet domains;
- VPNs;
- Granting of access rights on a need-to-have basis;
- Procedures for flight crews and other staff to report perceived security threats to the EFB administrator and to develop responses that will prevent future successful attacks.

The EFB Administrator should not only keep the EFB system, but also their knowledge about security of EFBs systems up to date.

7.9 Electronic signatures

EU–OPS 1, Part-M and other regulations may require a signature to signify either acceptance or to confirm the authority (e.g. load sheet, technical logbook, 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.

To ensure this, an operator should have in place procedures for electronic signatures that guarantee:

- **The uniqueness**: A signature should identify a specific individual and be difficult to duplicate.
- **The significance**: An individual using an electronic signature should take deliberate and recognisable action to affix his or her signature.
- **The scope**: The scope of information being affirmed with an electronic signature should be clear to the signatory and to subsequent readers of the record, record entry, or document.
- **The signature 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.
- **The non-repudiation**: An electronic signature should prevent a signatory from denying that he or she 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.
- **The 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 may be appropriate in providing positive traceability to the individual who appended it. Advanced electronic signatures, qualified certificates and secured signature-creation devices needed to create them are typically not required for EFBs operations.

Additional guidance from EASA or the operator's competent authority, if available, should be considered.

Note: The provision of secure access to EFB functions is outside the scope of this document.

7.10 Role of the EFB Administrator

For an operator, the role of the EFB Administrator is a key factor in the management of the EFB system. 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 responsible for hardware and software configuration management and for ensuring, in particular, that no unauthorised software is installed. The EFB Administrator is also responsible for ensuring that only a valid version of the application software and current data packages are installed on the EFB system.

The EFB Administrator is responsible for conducting internal quality control measures to ensure that all EFB administration personnel comply with the defined procedures. EFB administration should be subject to independent routine audits conducted by the operator's Quality Assurance Programme (see paragraph 7.6).

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 (EU-OPS 1, OPS 1.205). The content of this training should be determined with the aid of the EFB system supplier or application supplier.

The administrator training material should be made available on request to the competent authority and the EASA.

7.10.1 The EFB Policy and Procedures Manual

The (S)TC holder or the EFB system supplier should 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. The EFB administrator 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 part of the Operator's Operations Manual.

The EFB Policy and Procedures Manual should also address the validity and currency of EFB content and databases, thus ensuring the integrity of EFB data. This may include establishing revision control procedures so that flight crews 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.

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 out-of-date. This manual may include, but is not limited to, the following:

- Document changes to content/databases;
- Notification to crews of updates;
- If any applications use information that is specific to the aircraft type or tail number, ensuring that the correct information is installed on each aircraft;
- Procedures to avoid corruption/errors during changes to the EFB system;
- In case of multiple EFBs on 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 harmful software (see paragraph 7.8).

Note: An example of the subjects relevant for inclusion in the EFB Policy and Procedures Manual is included at Appendix G.

7.11 EFB System Maintenance

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

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 will need to 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 crews.

7.12 Flight Crew Training

Flight crew should be given specific training in the use of the EFB system before any operational approval is granted by the operator's competent authority. Training should include at least the following:

- An overview of the system architecture;
- Pre-flight checks of the system;
- Limitations of the system;
- Specific training on the use of each application and the conditions under which the EFB may and may not be used;
- Restrictions on the use of the system, including where some or the entire system is not available;
- Procedures for cross-checking of data entry and computed information;
- Phases of flight when the EFB system may and may not be used;
- CRM and human factor considerations on the use of the EFB;
- Additional training for new applications or changes to the hardware configuration.

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 training devices used during training and checking.

The flight crew training material should be made available on request to the competent authority and to the Agency.

Note: Further guidance and means of compliance are provided in Appendix E.

7.13 Operational Evaluation Test

The operator should conduct an Operational Evaluation Test which should allow verifying that the above elements have been satisfied before final approval by the competent authority for the use of the EFB in place of paper documentation.

7.13.1 Initial Retention of Paper Backup

Where paper is initially retained as backup, the operational evaluation test should consist of an in-service proving period typically lasting not less than six months. The purpose of the in-service proving period is for the operator to demonstrate to the competent authority that the EFB system provides an acceptable level of accessibility; usability and reliability to those required by the applicable operational requirements (see EU-OPS 1.135(b) and 1.1040(m)). In particular that:

- The flight crew are able to operate the EFB applications without reference to paper;
- The operator's administration procedures are in place and function correctly;
- The operator is capable of providing timely updates to the applications on the EFB, where a database is involved;
- The introduction of the EFB without paper backup does not adversely affect the operator's operating procedures and alternative procedures for use when the EFB system is not available provide an acceptable equivalent; and
- For a system including uncertified elements (hardware or software), that the system operates correctly and reliably;
- The Operational Risk Assessment is complete and correctly written.

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 be granted an approval to allow removal of the paper backup by their competent authority once they have shown that the EFB system is sufficiently robust.

7.13.2 Commencement of Operations without Paper Back Up

Where the applicant seeks credit to start operations without paper backup, the operational evaluation test should consist of the following elements:

- A detailed review of the Operational Risk Analysis (ORA);
- A simulator LOFT session to verify the use of the EFB under operational conditions including normal, abnormal and emergency conditions. Items such as a late runway change and diversion to an alternate should also be included;
- Observation by the NAA of the initial operator's line flights.

The operator should demonstrate to the competent authority that they will be able to continue to maintain the EFB to the required standard through the actions of the Administrator and Quality Assurance Programme.

7.14 Operational Approval Submission

The operator should produce a final operational report, which summarises all activities conducted as demonstrated means of compliance, supporting his/her request for an operational approval of the EFB system. An example of typical items that the operator should include in this report is provided in Appendix J.

The competent authority may grant an operational approval to the operator to use the EFB in place of, or as an alternative to paper-based information, when the operator has showed compliance with the relevant section of this AMC and as described in their initial submission.

Appendix A - Examples of Type A Software Applications

Type A applications are EFB applications whose malfunction or misuse would have no adverse effect on the safety of any flight operation, i.e. a hazard level defined as no greater than a "no safety effect" failure condition classification.

Such applications might typically be:

- Browser displaying:

  a. The certificates and other documents required to be carried by the applicable operational regulations and where copies are acceptable such as:
     - The Aircraft Noise Certificate;
     - The Air Operator Certificate;
     - The Third Party Liability Insurance Certificate.

  b. Some manuals and additional information and forms required to be carried by the applicable operational regulations such as:

     - Notification of special categories of passenger;
     - Notification of special loads and any other information that might be required such as passenger and cargo manifests.

  c. Other information within the operator's aircraft library such as:

     - Airport diversion policy guidance, including a list of Special Designated Airports and/or approved airports with emergency medical service (EMS) support facilities;
     - Maintenance Manuals;
     - Emergency Response Guidance for Aircraft Incidents Involving Dangerous Goods (ICAO Doc 948 1-AN/928);
     - Aircraft parts manuals;
     - Service bulletins/published Airworthiness Directives, etc.;
     - Current fuel prices at various airports.

- Interactive applications for crew rest calculation;
- Interactive forms to comply with the reporting requirements of the competent authority and the operator.

Appendix B - Type B Software Applications

Type B applications are applications that:
- Do not substitute to or duplicate any system or functionality required by airworthiness regulation or operational rule, and
- Whose malfunction or misuse would have an adverse safety effect, i.e. a hazard level no greater than a "minor" failure condition classification, and
- Do not have any of the capabilities defining type C applications (see § 5.2.3).

The following list of applications can be evaluated by the competent authorities at national level:

- Document Browser displaying the following documents, interactive or not, or not in pre-composed format, and not driven by sensed aircraft parameters:
    - The manuals and additional information and forms required to be carried by Regulations such as:
        - The Operations Manual (including the MEL and CDL);
        - Aircraft Flight Manual;
        - The Operational Flight Plan;
        - The Sector Record pages of the aircraft Technical Log;
        - Meteorological information with graphical interpretation;
        - The aircraft Technical Log other than the Sector Record pages;
        - ATS Flight Plan;
        - NOTAMs and AIS briefing information;
        - Meteorological information

- Electronic aeronautical chart applications including en-route, area, approach, and airport surface maps including panning, zooming, scrolling, and rotation, centring and page turning but without display of aircraft/own-ship position.

- Applications that make use of the Internet and/or other aircraft operational communications (AAC) or company maintenance-specific data links to collect, process, and then disseminate data for uses such as spare parts and budget management, spares/inventory control, unscheduled maintenance scheduling, etc.

-Cabin-mounted video and aircraft exterior surveillance camera displays.

In other cases the evaluation should be conducted by the Agency, as for instance for the following applications:

Aircraft performance calculation application that uses algorithmic data or calculates using software algorithms to provide:

- Take-off, en-route, approach and landing, missed approach, etc. performance calculations providing limiting masses, distances, times and/or speeds; and
- Power settings, including reduced take-off thrust settings;
- Mass and balance calculation application 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.

Appendix C - Type C Software Applications

Examples of Type C software applications:

- Airport Moving Map Display with own ship position;
- Performance applications sending data to the Flight Management System or any other certified avionic system;
- Applications supporting Controller-Pilot Data-Link Communications(CPDLC);
- Applications displaying traffic information;
- Any application displaying information which may be tactically used by the flight crew for example to check, control, or deduce the aircraft position or trajectory, either to follow the intended navigation route or to avoid adverse weather, obstacles or other traffic, in flight or on ground.

Appendix D - Human Machine Interface Assessment and Human Factors Considerations

D.1 General Principles

This Appendix provides Guidance Material for the assessment of the human machine interface associated with the EFB system. It provides general criteria that may be applied during assessments conducted during both the airworthiness and operational approvals and is restricted to human factors assessment techniques and means of compliance. The process for division of responsibilities and who does what is contained within the main body of the AMC.

Note: Where an assessment is conducted as part of an airworthiness approval e.g. for a Class 3 EFB system or Class 2 EFB installed resources, CS 25.1302 titled "Installed systems and equipment for use by the flight crew" or applicable airworthiness basis should be applied.

D.2 Common Considerations

D.2.1 Human Machine Interface

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

D.2.2 Legibility of Text

Text displayed on the EFB should be legible to the typical user at the intended viewing distance(s) and under the full range of lighting conditions expected on a 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 on the flight crew compartment. In addition, when automatic brightness adjustment is incorporated, it should operate independently for each EFB in the flight crew compartment. Buttons and labels should be adequately illuminated for night use. All controls should be properly labelled for their intended function. Consideration should be given to the long-term display degradation as a result of abrasion and aging.

D.2.3 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 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.

D.2.4 General EFB Design Guidelines

D.2.4.1 Consistency with the flight crew compartment

Whenever possible and without compromising innovation in design/use, EFB user interfaces should be consistent with the flight crew compartment design philosophy, including 'look&feel', interaction logics and workflows.

D.2.4.2 Messages and the Use of Colours

For any EFB system, EFB messages and reminders should meet the requirements in CS 23.1322, 25.1322 or applicable certification basis, as is appropriate for the intended aircraft. 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" is to be used only to indicate a

warning level condition. "Amber" is to be used to indicate a caution level condition. Red and Amber colours should be limited and considerate. Any other colour may be used for items other than warnings or cautions, providing that the colours used, differ sufficiently from the colours prescribed to avoid possible confusion. EFB messages and reminders should be integrated with (or compatible with) presentation of other flight crew compartment system alerts. EFB messages, both visual and auditory, should be inhibited during critical phases of flight.

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

Additionally, during critical phases of flight, required flight information should be continuously presented without un-commanded overlays, pop-ups, or pre-emptive messages, excepting 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, those should have precedence.

D.2.4.3 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 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.

D.2.4.4 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 detects input errors at the earliest possible point during entry, rather than on completion of a possibly lengthy invalid entry.

D.2.5 Error and Failure Modes

D.2.5.1 Flight Crew Error

The system should be designed to minimise the occurrence and effects of flight crew error and 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. Data entry methods, colour-coding philosophies and symbology should be as consistent as possible across the various hosted EFB applications. These applications should also be compatible with other flight crew compartment systems.

D.2.5.2 Identifying Failure Modes

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

D.2.6 Responsiveness of Application

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

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

D.2.7 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. This should be evaluated based on the application and intended operational function. If there is a cursor, it should be visible on the screen at all times while in use.

D.2.8 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 other document object. These regions should be clearly indicated.

D.2.9 Managing Multiple Open Applications and Documents

If the electronic document application supports multiple open documents, or the system allows multiple open applications, indication of which application and/or document is active should be continuously provided. The active document is the one that is currently displayed and responds to user actions. Under non-emergency, normal operations, the user should be able to select which of the open applications or documents is currently active. In addition, the user should be able to find which 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 – other than differences associated with the progress or completion of processing performed in the background.

D.2.10 Flight Crew Workload

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

D.3 Specific Application Considerations

D.3.1 Approach/Departure and Navigation Chart Display

The approach, departure, and navigation charts that are depicted should contain the information necessary, in appropriate form, to conduct the operation to at least a level of safety equivalent to that provided by paper charts. It is desirable that the EFB display size is at least as large as current paper approach charts and that the format be consistent with current paper charts. Alternate approach plate presentations may be acceptable, but will need to be evaluated and approved by the competent authority for functionality and human factors.
The Human Machine Interface assessment is key in identifying acceptable mitigation means, e.g.:

- To establish procedures to reduce the risk of making errors;
- To control and mitigate additional workload related to EFB use;
- To ensure consistency of colour coding and symbology philosophies, between EFB applications and their compatibility with other flight crew compartment applications;
- To consider aspects of Resource Management (CRM) when using an EFB system.

Appendix E - Flight Crew Training

The purpose of this Appendix is to describe considerations for training and checking when Standard Operating Procedures (SOP) are dependent on the use of an EFB system.

E.1 EFB Training and Checking

E.1.1 Assumptions Regarding Flight Crew 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 experience and knowledge.

E.1.2 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 Class 1 or Class 2 EFB and using similar software may be credited toward training on a Class 3 EFB with a performance application.

E.1.3 Initial EFB Training

Training required for the grant of an aircraft type rating may not recognise variants within the type nor the installation of particular equipment. Any training for the grant 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 the operator is the approved training organisation and training for the issue of the type rating is combined with the operator's conversion course required by EU-OPS 1.945, the training syllabus should recognise the installation of the EFB where the operator's SOPs are dependent on its use.

Initial EFB Training may consist of both ground-based and in-flight training depending on the nature and complexity of the EFB system. An operator/ATO may use many methods for ground-based EFB training including written handouts or FCOM material, classroom instruction, pictures, videotape, ground training devices, computer-based instruction, and static aircraft training. Ground-based training for a sophisticated EFB lends itself particularly to CBT-based instruction. In-flight EFB training should be conducted by a suitably qualified person during Line Flying Under Supervision or during Differences and Familiarisation Training.

E.1.3.1 Areas of Emphasis During Initial EFB Training

- The use of the EFB hardware and the need for proper adjustment of lighting etc. when the system is used in-flight;
- The intended use of each software application together with limitations and prohibitions on their use;
- If an aircraft performance application is installed, proper cross-checking of data input and output;
- If a terminal chart application is installed, proper verification of the applicability of the information being used;
- If a moving map display is installed, the need to avoid fixation on the map display;
- Failure of component(s) of the EFB.

E.1.3.2 Typical Initial EFB Training

The following might be a typical training syllabus for a Class 3 EFB system with a document browser, performance application and moving map display.

E.1.3.2.1 Ground-Based Training

- System architecture overview;
- Display Unit features and use;
- Limitations of the system;
- Restrictions on the use of the system;
  - Phases of flight;
  - Alternate procedures (MEL).
- Applications as installed;
- Use of each application;
- Restrictions on the use of each application;
  - Phases of flight;
  - Alternate procedures (MEL).
- Data input;
- Cross-checking data input and output;
- Use of data output.

E.1.3.2.2 Flight Training

- Practical use of the Display Unit;
- Display Unit Controls;
- Data input devices;
- Selection of applications;
- Practical use of applications;
- CRM and human factor considerations;
- Situational awareness;
- Avoidance of fixation;
- Cross-checking data input and output;
- Practical integration of EFB procedures into SOPs.

E.1.4 Initial EFB Checking

E.1.4.1 Initial Ground EFB Checking

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

E.1.4.2 Skill Test & Proficiency Check

Proficiency in EFB use is not shown in the required items in Annex I (Part FCL), App 9 to Regulation (EC) No 1178/2011for the Skill Test for the issue of a type rating following type conversion training or for the Proficiency Check for the renewal of a type rating. However, where the operator is the ATO and the Skill Test is being conducted following training that is integrated with the operator's conversion course as required by EU-OPS 1.945, or where the Proficiency Check is being conducted concurrently with the Operator's Proficiency Check required by EU-OPS 1.965, and where the operator's SOPs are dependent on the use of the EFB on the particular 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. in Annex I (Part FCL), App 9 to Regulation (EC) No 1178/2011.

E.1.4.3 Operator Proficiency Check

EU-OPS 1.965(b)(1)(i) requires that flight crew demonstrate their competence in carrying out normal procedures during the Operator Proficiency Check. Therefore, where an operator's SOPs are dependent on the use of an EFB, proficiency in its use should be assessed.

E.1.4.4 Line Check

EU-OPS 1.965(c) requires that flight crew demonstrate their competence in carrying out normal procedures during the Line Check. Therefore, where an operator's SOPs are dependent on the use of an EFB, proficiency in its use should be assessed.

E.1.4.5 Areas of Emphasis during EFB Checking

- Proficiency in the use of each EFB application installed;
- Proper selection and use of EFB displays;
- Where an aircraft performance application is installed, proper cross-checking of data input and output;
- Where a terminal chart application is installed, the proper check of the validity of the information and the use of the chart clip function;
- Where a moving map display is installed, the maintenance of a proper outside visual scan without prolonged fixation on EFB operation, especially during the taxying operations;
- Actions following the failure of component(s) of the EFB, including hot EFB battery.

E.2 Differences and Familiarisation Training

When the introduction of the use of an EFB requires Differences or Familiarisation Training to be carried out under EU-OPS 1.950, the requirement can be satisfied by conducting Initial EFB Training.

E.3 Recurrent EFB Training and Checking

E.3.1 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 be encouraged, however, to include normal EFB operations as a component of the annual Ground and Refresher Training required by App1 to EU-OPS 1.965(a)(1).

Where an operator has established alternative procedures to be used for dispatch with an EFB inoperative or not available, these alternative procedures should be included in the recurrent Aircraft/STD Training as required by App1 to EU-OPS 1.965(a)(2).

In the case of Mixed Fleet Flying, or where the EFB is not installed across the fleet, NAAs should consider applying additional recurrent training requirements.

E.3.2 Recurrent EFB Checking

Recurrent EFB Checking should consist of those elements of the Licence Proficiency Check, the Operator Proficiency Check and the Line Check applicable to the use of an EFB as described in paragraphs 1.4.2, 1.4.3 and 1.4.4. Areas of emphasis are as described in paragraph 1.4.5.

E.4 Suitability of Training Devices

Where the operator's SOPs are dependent on the use of an EFB, it is recommended that the EFB is 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:

- The Operator's Conversion Course required by EU-OPS 1.945;
- Differences or Familiarisation Training required by EU-OPS 1.950;
- Recurrent Training and Checking required by EU-OPS 1.965.

Where the EFB system is based on a Class 1 device, it is recommended that the device is present and operable and used during all phases of flight during which it would be used under the operator's SOPs.

Where the EFB system is based on a Class 2 or Class 3 device, it is recommended that the device is installed and operable in the training device (simulator) and used during all phases of flight during which it would be used under the operator's SOPs.

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

Where the EFB is not installed equipment in the basic aircraft type or variant (i.e. it is an operator option or aftermarket installation), the installation and use of the EFB in the training device is not required for the training and checking for the issue of the type rating nor for the checking for the renewal or revalidation of the type rating.

Appendix F - Software Application Approval Submission

The submission to the competent authority should contain the following:

- Functional Description Document (For the initial submission and any subsequent functional change);
- Release Notes (For both initial and all subsequent releases);
- Version Description Document (For both initial and all subsequent releases);
- First Article Inspection Report (refers to quality controlled release of the EFB Software Application);
- Ground Viewer (to enable user validation of the software releases and data base releases and updates);
    - Viewers should use the same software components as the airborne application;
    - Viewers should enable user validity checking of airborne data bases before installation on an aircraft.

Note: Software applications or components created by other than the end user should contain a Certificate of Compliance/Conformity showing under which standard that software was created.

F.1 Additional Requirements for Performance Applications for Take-off, Landing and Mass & Balance Calculations

When demonstrating compliance for a performance application, the submission should include a data validation report consisting of:

- The methodology and/or plans for validation;
- Representative calculations throughout the operating envelope considering corner points, routine and break points and typically containing at least 250 calculations (including wet and contaminated runway data if used);

Note: The data validation should be performed against the baseline certification document for the aircraft e.g., AFM or AFM DPI.

Performance applications databases are usually derived from computerised AFM information, approved against the applicable airworthiness regulations.

Only certain modules of the performance programme, a particular programme revision and a particular host are approved.

Appendix G - EFB Policy and Procedures Manual

Introductory note:
These are the typical contents of an EFB policy and procedures manual that can be part of the operator's operation manual. The proposed skeleton is very extensive. It should be adapted to the specific EFBs system and to the size and complexity of the operations in which the operator is involved.

EFB Policy & Procedures Manual
Typical Contents

1. **Revision History**

2. **List of Effective Pages or Paragraphs**
3. **Table of Contents**

4. **Introduction**
   - Glossary of Terms, Definitions and Acronyms
   - Hardware Description
   - Operating System Description
   - Software Application Description

5. **Hardware and Operating System Control and Configuration**
   - Purpose and scope
   - Description
     - Hardware Configuration and Part No Control
     - Operating System Configuration and Control
     - Accessibility Control
     - Hardware Maintenance
     - Operating System Updating
   - Responsibilities and Accountabilities
   - Records and filing
   - Documentary References

6. **Software Application Control and Configuration**
   - Purpose and scope
   - Descriptions
     - Part No Control
     - Software Configuration
     - Application Updating
   - Responsibilities and Accountabilities
   - Records and filing
   - Documentary References

7. **Maintenance considerations**

8. **EFB Security Policy**
   - EFB System architecture
   - Limitations of the EFB system
   - EFB general philosophy, environment and dataflow
   - Detailed presentation of the EFB applications
   - EFB application customisation
   - Data management:
     - Data administration
     - Organisation & workflows
     - Data Loading

    - Data revision mechanisms
    - Approval workflow
    - Data Publishing & dispatch
    - Customisation
    - How to manage Airline's specific documents
    - Airport data management
    - Aircraft fleet definition
- Data authoring
    - Navigation and customisation

Appendix H - Airport Moving Map Display (AMMD) Application with Own-Ship Position

H.1 General considerations

H.1.1 Preamble

This Appendix guides the applicant in how to obtain the certification and operational approval for AMMD applications to be hosted in EFBs. The airworthiness and operational aspects covered in this Appendix H are in addition to those which are applicable for the EFB considerations.

The AMMD has been classified as a Type C EFB software application that could only be hosted on a Class 3 EFB platform with an operating system and application software qualified to at least RTCA DO-178B/EUROCAE ED-12B 'Level D'. However, it is recognised that an AMMD can aid pilot positional awareness on the airport manoeuvring area and EASA proposes to allow AMMDs to be hosted on a non-certified Class 2 EFB or a Class 3 EFB without segregation with Type A and B applications, under the conditions established in this Appendix H. In order to prevent adverse effects in the operation of AMMD, malfunction of non-certified platforms should be mitigated or detected by the software application.

H.1.2 Assumptions of intended use of an AMMD

An AMMD application shall **not be used as the primary means of taxiing navigation** and shall only be used in conjunction with other materials and procedures identified within the Operating Concept – see paragraph H.3.3.

Note: When an AMMD is in use, the primary means of taxiing navigation remains the use of normal procedures and direct visual observation out of the cockpit window.

Thus, as recognised in ETSO-2C165a an AMMD application with display of own-ship position is considered as having a minor safety effect when displaying misleading information and the failure condition for the loss of function is classified as "no effect."

H.2 Airworthiness approval of AMMD in EFBs

H.2.1 Acceptable Means of Airworthiness Compliance

The AMMD software and database or complete display system including platform shall be approved in accordance with EASA European Technical Standard Order ETSO-2C165a, or an equivalent standard that is acceptable to EASA.

H.2.2 Functional Features

Following AMMD system features are implemented and already demonstrated as per ETSO-2C165a system:

a) The system shall provide means to display the required ETSO marking and revision number of the software installed. Refer to section 4 of ETSO-2C165a.
b) The system shall be capable of accepting updated airport mapping information and shall provide means to display the validity period of the database to the flight crew. The Flight Crew should be able to easily ascertain the validity of the on-board map database. The application should provide an indication when the AMMD database is no longer valid. Refer to section 2.2.5 of RTCA DO-257A as per section 3.1.1 of ETSO-2C165a.
c) The Total System Error of the end-to-end system is specified and characterised. An accuracy threshold of 40 meters is considered to ensure that the own-ship symbol is depicted on the correct runway or taxiway. Refer to sections 1 and 2 in Appendix 1 of ETSO-2C165a.

Note: An approved sensor using the Global Positioning System (GPS) in combination with a RTCA DO-272 medium accuracy compliant database is considered one acceptable means to achieve this requirement.

d) The system shall remove automatically the own-ship position when the aircraft is in flight (e.g. weight on wheels, speed monitoring) and when the positional accuracy exceeds the maximum value. Refer to section 2 in Appendix 1 of ETSO-2C165a.
e) The AMMD integrated system shall detect and annunciate to the flight crew the failures associated to incorrect behaviour of the platform (memory corruption, frozen system, latency). Refer to section 3 in Appendix 1 of ETSO-2C165a.
f) Data Quality Requirements (DQRs) for the AMMD data base. Refer to section 4 in Appendix 1 of ETSO-2C165a and sections 2.2.5 and 2.3.5 of RTCA DO-257A.

H.2.3 Data provided by the AMMD supplier (only software approved ETSO-2C165a)

The AMMD software application supplier must provide the appropriate data to each integrator in an EFB:
a) The executable object code in an acceptable transferring medium which is compliant with CS-ETSO marking requirements;
b) Installation instructions or equivalent as per ETSO-2C165a section 2.2. addressing:
   - Identification of each target EFB system computing platform (including hardware platform, operating system version) with which this AMMD software application and database was demonstrated to be compatible.
   - 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.
   - Interface description data including the requirements for external sensors providing data inputs.
   - Verification means required to verify proper integration of the AMMD in 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.
c) Applicable instructions needed for continued airworthiness after installing the software on the target environment.
d) Any AMMD limitations, and known installation, safety, operational, functional, or performance issues including open problem reports on the AMMD.

H.3 Operational approval of AMMD application in EFBs

H.3.1 AMMD Software Installation in the EFB

The operator must review the documents and the data provided by the AMMD developer as per ETSO authorisation and ensure that installation requirements of the AMMD software in the specific EFB platform and aircraft are addressed. Following activities are required:

a) If only software/database is ETSO certified, ensure that the software and database is compatible with the EFB system computing platform on which it is intended to function, including the analysis of compatibility of the AMMD with other EFB Type A and B software applications residing in the same platform. Follow the programme installation instructions provided by the software supplier, as applicable to the compatible EFB computer.
b) The objectives for installation, assumptions, limitations and requirements for the AMMD, as part of the data provided by the AMMD supplier (see H.2.3), must be satisfied.
c) Perform any verification activities proposed by the AMMD software developer, as well as identify and perform additional activities to be completed. E.g. if the AMMD is to be displayed in another display not part of the EFB hardware (i.e. installed resource for Class 2 EFB), the display has to be reassessed for the suitability to present the AMMD data.

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

H.3.2 Configuration Control of the Integrated System

When the AMMD is installed in a platform with a non-qualified operating system, the applicant should provide a plan for assuring non-interference from future system updates (e.g. operating system or Type A and B software applications updates). As a minimum, this plan should address:

a) The new target EFB system computing platform (updated hardware platform or operating system version) is covered by the AMMD ETSO-2C165a approval.
b) The validation suite which will be run before any system update is performed.
c) The plan for assuring that third-party or operator-provided application additions or changes are subjected to that validation suite;
d) Notification to the competent authority of planned updates and submittal of the non-interference test report.

H.3.3 Operating Concept

The Operating Concept should include as minimum:

a) Pilot Operation, including confirmation of effectivity;
b) Handling of updates;
c) Quality Assurance function;
d) Handling of NOTAMS.
e) The provision of current maps and charts to cover the intended operation of the aeroplane**.**

Changes to operational or procedural characteristics of the aircraft (e.g. Flight crew procedures) must be documented in the Operating Manual or User's Guide as appropriate. In particular, the following text is required:

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

H.3.4 Training Requirements

The operator may use flight crew procedures to mitigate some hazards. This will 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 addressed in support of an AMMD's 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 applicant's overall EFB training submission (refer to Appendix E).

Appendix I - Example of Operational Approval Submission Report

The competent authority may use the operational approval submission report as a compliance matrix against this AMC. References to the relevant supporting documents should be included.

System Description and Classification Of EFB System

- A general description of the proposed EFB system
- Class of EFB System proposed (§ 5.1)

Software Applications

- List of Type A applications installed (§ 5.3.1)
- List of Type B applications installed (§ 5.3.2)
- List of Type C applications installed (§ 5.3.3)
- List of non-EFB applications installed (§ 6.2.3)

Hardware Approval(relevant information or references)

For a Class 1 EFB:

- EMI Compliance Demonstration (§ 6.1.1.1)
- Lithium Battery Compliance Demonstration (§ 6.1.1.2)
- Depressurisation Compliance Demonstration (§ 6.1.1.5)
- Details of the Power Source (§ 6.1.1.3)

For a Class 2 EFB:

- Details of the airworthiness approval for the Mounting Device (§ 6.1.2.1)
- Description of the placement of the EFB Display (§ 6.1.2.2)
- Details of the use of Installed Resources (§ 6.1.2.5)
- EMI Compliance Demonstration (§ 6.1.2.6)
- Lithium Battery Compliance Demonstration (§ 6.1.2.7)
- Depressurisation Compliance Demonstration (§ 6.1.2.8)
- Details of the Power Source (§ 6.1.2.3)
- Details of any Data Connectivity (§ 6.1.2.4)

For a Class 3 EFB:

- Details of the airworthiness approval as installed equipment (§ 6.1.3)

Certification Documentation

- Limitations to be be contained within the Aircraft Flight Manual (§ 6.1.4.1)
- Guidelines for EFB Application Developers (§ 6.1.4.2)
- Guidelines for EFB system suppliers (§ 6.1.4.3)

Specific Considerations for Performance Applications

- Details of performance data validation conducted (§ 6.2.4)

Operational Approval

- Details of Operational Risk Analysis (ORA) conducted (§ 7.1)
- Details of the Human Machine Interface Assessment conducted for Type A and B Software Applications (§ 7.2)
- Details of Flight Crew Operating Procedures (§ 7.3):
    - Procedures for Using EFB Systems with Other Flight crew compartment Systems (§ 7.3.1)
    - Flight Crew Awareness of EFB Software/Database Revisions (§ 7.3.2)
    - Procedures to Mitigate and/or Control Workload (§ 7.3.3)
    - Flight Crew Responsibilities for Performance Calculations (§ 7.3.4)
- Details of proposed Quality Assurance oversight of EFB system (§ 7.4)
- Details of EFB System Security measures (§ 7.5)
- Details of EFB Administration procedures including provision of the EFB Policy and Procedures Manual (§ 7.6 & § 7.6.1)
- Details of the system for routine EFB System maintenance (§ 7.7)
- Details of Flight Crew Training (§ 7.8):
    - Initial training
    - Differences training
    - Recurrent training
- Report of the Operational Evaluation Test (§ 7.9):
    - Proposals for the initial retention of paper back up (§ 7.9.1)
    - Proposals for the commencement of operations without paper back up (§ 7.9.2)
- EFB platform/hardware description;
- Description of each software application to be included in the approval (see Appendix F);
- Risk analysis summary for each application and mitigation means put in place;
- Human factor assessment for the complete EFB system, human machine interface and all software applications;
    - Pilot workload in both single-pilot and multi-crew flown aircraft
    - Size, resolution, and legibility of symbols and text
    - For navigation chart display: 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.
- Operator Training;
- EFB Administrator qualification.

Appendix J - Power Supply Considerations for Class 1 and 2 EFBs

If the aircraft is equipped with electrical power outlet(s) in the cockpit, 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.

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-load, electrical transients or harmonics, …).

If an EFB is permanently attached to the essential power network, it could affect the essential generation system (emergency generator and/or battery, bus bars, distribution system) to which it is connected.

Certification specifications require that an alternate high integrity electrical power supply system, independent of the normal electrical power system, be provided to power those services necessary for continued safe flight and landing, in case of loss of the normal system. Adding other unnecessary services/loads will affect the integrity of this alternate power system. Class 1 and 2 EFBs are not considered necessary for continued safe flight and landing and should not be connected to an essential power bus.

Appendix K - Considerations for Rapid Depressurisation Test

When the EFB system hosts applications that are required to be used during flight following a rapid depressurisation, testing is required to determine an EFB device's functional capability. The information from the rapid depressurisation test 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-14F/RTCA DO-160F guidelines for rapid decompression testing up to the maximum operating altitude of the aircraft in which the EFB is to be used. The EFB should be operative for at least 10 minutes after the start of the decompression.

- **Pressurised Aircraft:** When a Class 1 or 2 EFB has succesfully completed rapid depressurisation testing, then no mitigating procedures need be developed beyond dual redundancy. When a Class 1 or 2 EFB has succesfully completed rapid depressurisation testing while turned OFF, then procedures will need to be developed to ensure 1 of the 2 EFBs on board the aircraft remains OFF or configured so no damage will be incurred should rapid decompression occur in flight above 10,000 feet AMSL.

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

- **Non-Pressurised Aircraft**: Rapid decompression testing is not required for a Class 1 or 2 EFB used in an non-pressurised aircraft. The EFB should be demonstrated to reliably operate up to the maximum operating altitude of the aircraft. If EFB operation at maximum operating altitude is not attainable, procedures should be established to preclude operation of the EFB above the maximum demonstrated EFB operation altitude while still maintaining availability of required aeronautical information.

III. Draft Decision CS-ETSO

Amend ETSO-C165 to become 2C165a and to read as follows:

ETSO-2C165a
Date: xx.xx.2012

European Aviation Safety Agency

European Technical Standard Order

SUBJECT: ELECTRONIC MAP ~~DISPLAY EQUIPMENT~~ SYSTEMS FOR GRAPHICAL DEPICTION OF AIRCRAFT POSITION

1 - Applicability

This ETSO gives the requirements which Electronic Map ~~DISPLAY EQUIPMENT~~ Systems for the Graphical Depiction of Aircraft Position that are manufactured on or after the date of this ETSO must meet in order to be identified with the applicable ETSO marking.

2 - Procedures

2.1 - General

Applicable procedures are detailed in CS-ETSO Subpart A.

2.2 – Specific

~~None~~

To support Airport Moving Map Display (AMMD) applications for Electronic Flight Bags (EFB), EASA will accept applications to certify only the software without certifying the hardware and/or the operating system. Nevertheless, the applicant has to specify requirements for the hardware and/or the operating system to be used, the tests to be performed once the software is integrated into the final system, and the environment, which has been used to demonstrate the system functionality.

3 - Technical Conditions

3.1 - Basic

3.1.1 - Minimum Performance Standard (MPS)

New models of Electronic Map ~~Displays~~ Systems that are to be so identified and that are manufactured on or after the effective date of this ETSO must meet the standards set forth for moving map equipment in Section 2 of RTCA document DO-257A, "Minimum Operational Performance Standards for the Depiction of Navigational Information on Electronic Maps," dated June, 25, 2003.

1) Electronic Map ~~Displays~~ Systems for use in flight must meet the MPS in Sections 2.1 and 2.2 of DO-257A.

2) Electronic Map ~~Displays~~ Systems for use on the airport surface – AMMD applications - must meet the MPS in Sections 2.1, 2.2, and 2.3 of DO-257A as amended by Appendix 1 of this ETSO, and

3) Electronic Map ~~Displays~~ Systems including Vertical Situation Displays (VSD) for use in facilitating pilot's awareness of the aircraft's vertical flight path must meet the MPS in Sections 2.1, 2.2, and 2.4 of DO-257A.

3.1.2 - Environmental Standard

See CS-ETSO Subpart A paragraph 2.1.

3.1.3 – Computer Software

See CS-ETSO Subpart A paragraph 2.2.

3.1.4 - Electronic Hardware Qualification

See CS-ETSO Subpart A paragraph 2.3

3.2 - Specific

3.2.1 - Failure Condition Classification

See CS-ETSO Subpart A paragraph 2.4. For the definitions of the intended functions see RTCA DO-257A section 1.4.

Failure of the functions defined in paragraph 3.1.1 of this ETSO for Electronic Map ~~Displays~~ Systems used in flight and VSD equipment (airborne applications) have been determined to be a major failure condition for malfunctions causing the display of misleading information.

Loss of function for Electronic Map ~~Displays~~ Systems used in flight and VSD equipment (airborne applications) ~~have~~ has been determined to be a minor failure condition.

Failure of the function defined in paragraph 3.1.1.2 of this ETSO for Electronic Map ~~Displays~~ Systems used on the airport surface (ground applications) have been determined to be a minor failure condition for malfunctions causing the display of misleading information.

Loss of function for Electronic Map Displays used on the airport surface (ground applications) is determined to be a no safety effect failure condition.

4 - Marking

4.1 - General

Marking as detailed in CS-ETSO Subpart A paragraph 1.2.

4.2 - Specific

None

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

ETSO-2C165a

Additional Requirements for Airport Moving Map Display (AMMD) Applications

1. Taxiways

Modify RTCA DO-257A section 2.3.1.1.2.4, 2.3.1.1.1.6 and demonstrate the total database accuracy for taxiways and runways to 40 meter or less instead of 65/43 meters or less. The 40 meter requirement is based on half the separation of taxiways at aerodrome code letter E as specified in ICAO Annex 14.

2. Depiction of Own-ship Position

Add the following requirements to RTCA DO-257A section 2.3.1.2:

7. Consider the installation dependent antenna position bias error i.e. along track error associated to the GNSS antenna position to the flight deck by providing installation dependent compensation means.
8. The Horizontal Position Latency shall be less than 2 seconds (95% probability). This is the delay time between the validity of the position information and the time displaying that information.

   Note: The delay time of position data information provided on a data bus with a 1 Hz update rate may already be in the order of 1,2 seconds and further delay will be added in case data concentrators are used in the supply chain from the GNSS sensor to the display system. The equipment manufacturer has to provide the assumptions made on the data input and timing information for the worst case internal AMMD delay times.
9. AMMD applications limited to the airport surface (ground applications) and having only a minor failure classification shall remove the own-ship position at a ground speed above 40 knots. Means shall be provided to allow the use of lower values which may be required due to the actual aircraft performance or to mitigate installation dependent Horizontal Position Latency

3. Failure Annunciations

Add the following section to RTCA DO-257A:

2.3.4.2 Failure Annunciation

a) The AMMD system shall detect and annunciate to the flight crew the following failure conditions:

1. Loss of position input including loss of position integrity;
2. Loss of heading input;
3. Corruption of the map database.
4. Violation of the latency criteria. Such events shall be identified within 4.5 seconds.

Failure annunciation shall be performed within 0,5 seconds after the failure has been detected.

b) The system shall provide adequately indications to the flight crew in case of a frozen display.

4. Data Base

Add the following section to RTCA DO-257A:

2.3.5.3 When developing the AMMD application and the data base quality requirements the applicable requirements of EUROCAE ED-99B/RTCA DO-272B section 3 have to be demonstrated.