

ED-273

MINIMUM OPERATIONAL PERFORMANCE STANDARD (MOPS) FOR ELECTRONIC FLIGHT BAG (EFB) APPLICATION

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EXECUTIVE SUMMARY

The rapid development of Electronic Flight Bags (EFBs) and their widespread adoption over recent years has made them a very common and important tool for flight operations. Not only has EFB replaced paper in most flight decks, it has provided many functions that increase flight operational effectiveness and enhanced situation awareness for pilots.

The growth of EFB has helped operators achieve important operational and safety goals and has been a strong contributor to the global aviation initiative to leverage innovation for the next century of air travel. At the same time, the increased scope and usage of EFB makes it more difficult and complex for national aviation authorities to efficiently evaluate and approve for the use in operations of EFB applications.

This document provides a modern and systematic means to address the design, development, evaluation and validation of EFB applications and functions, proportionally to the safety risk of their intended use in flight operations.

This standard may be used by any organisation that develops EFB applications (e.g. airlines, OEMs, EFB manufacturers and EFB application suppliers).

This standard provides Minimum Operational Performance Standards (MOPS) for the following aspects of EFB applications:

- Determination of whether functions are eligible as EFB functions,
- Safety Risk Assessment,
- Human Machine Interface,
- Development Assurance,
- Databases,
- Security,
- Operational and installation instructions.

The standard provides also additional MOPS applicable to specific EFB functions, existing at the time of development of this document.

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CHAPTER 1

INTRODUCTION

1.1 PURPOSE AND SCOPE

This document may be used by any organisation that develops EFB applications (e.g., airlines, OEMs, EFB manufacturers and EFB application suppliers).

It provides MOPS for the design, development, evaluation and validation of EFB applications and their functions. The MOPS include requirements, recommended practices and guidelines. The MOPS are proportionate to the safety risk of the intended use of the EFB functions in flight operations.

An Electronic Flight Bag (EFB) is an electronic information system, comprised of equipment and applications for flight crew, which allows for the storing, updating, displaying and processing of EFB functions to support flight operations or duties.

EFBs were initially introduced in the flight decks to supplement and/or replace conventional paper products traditionally carried in the pilot's flight bag, such as airport and navigation charts, aircraft performance and mass and balance charts or flight operational manuals.

The usage of EFBs also includes functions intended to increase the flight operational effectiveness and enhance the pilot situation awareness. Examples of those functions include electronic airport and en-route moving maps, in-flight weather function.

This continuous trend makes it more difficult for national aviation authorities to evaluate whether these new functions and applications, which are typically hosted on commercial-off-the-shelf (COTS) hardware and operating system, can be safely used in flight operations. This evaluation proved to be particularly complex for EFB functions similar to functions hosted in the aircraft certified avionics (e.g. presentation of the aircraft position on a moving map) and that generate a safety risk if not properly used by the flight crew. National aviation authorities may not have the resources and the expertise needed for this assessment, which create delays and hurdles for the introduction of these innovative functions in flight operations of operators.

To address this challenge, EUROCAE created Working Group WG-106 to develop an industry standard specifically applicable to EFB applications, which may be used as a basis for the approval of EFB application software (and its associated installation and operating data) by an authority.

The scope of the work given to WG-106 was to develop a standard adapted for EFB applications that unambiguously define the perimeter of EFB functions without preventing future innovation in that domain. The standard should also not contradict existing guidance such as that contained in the European regulation or in the ICAO EFB Manual Doc 10020 but could implement objectives to achieve completeness. WG-106 verified also consistency of its work with other EFB policies such as the FAA AC 120-76.

WG-106 was composed of EFB application suppliers, aircraft manufacturers, equipment suppliers, operators, regulators, authorities and association representatives. This panel of participants covered a large spectrum of the stakeholders involved in the EFB ecosystem and ensured that the standard is adapted to the needs.

This industry standard addresses the following general EFB aspects:

Determination of whether functions are eligible as EFB functions:

The standard provides a clear and systematic process for determining whether a given function is authorised on an EFB or not. This process is consistent with the definitions and principles of the EFB regulatory materials and relies on the conclusive completion of a safety risk assessment. This process is simple and streamlined for the EFB functions already authorised by the EFB regulatory materials at the time of writing this standard. This process could be applied onto any kind of functions proposed to be hosted on an EFB.

Safety Risk Assessment:

The standard provides a safety risk assessment process developed on the model of the “bowtie” method. This process addresses an issue that has been existing since the onset of the EFB regulations.

By the current regulatory definition, EFB includes functions with failure effect no greater than minor after considerations of the operational/procedural mitigation means (typically pilot procedures and training).

Though, it is recognised that some EFB functions, such as the take-off and landing performance calculations, may have a failure effect greater than minor, for instance in case of a misleading calculation error that is not detected by the flight crew by the operational/procedural mitigations. To resolve this issue, the process uses the concept of residual risk and defines it as the risk associated to a hazard, which may contribute, after application of the operational/procedural mitigation, to a severity effect more than minor.

The existence of residual risk or not for a given function has been considered throughout the standard in order to ensure for the proportionality of the requirements to the criticality of the function. Application hosting function(s) without residual risk have to comply with the minimum set of requirements. Application hosting function(s) with residual risk have to apply additional requirements in order to provide assurance that the contributors to the hazard are prevented to an acceptable level.

Human Machine Interface:

The standard provides considerations for the design of the Human Machine Interface (HMI) of EFB applications. These considerations have been developed using the HMI provisions of the EFB regulatory materials as well as additional best industry practices. A human factors assessment of the HMI is required when HMI aspects are identified as a contributor to a residual risk. The standard specifies the characteristics of the protocol of a human factors assessment.

Development Assurance:

The standard provides development assurance considerations for the development of the EFB software application. As suggested in the Term of References of WG-106, these development assurance considerations have been derived and adapted from ED-215() for use in the context of EFB application software development. These considerations are now self-sufficient and are applicable to the various software development methods (e.g. classic waterfall method, agile method).

The applicant has to apply the adequate assurance level proportionate to the risk associated with the use of its EFB application. The terminology “Function Qualification Level” (FQL) is used to define the selected level of assurance. Two Function Qualification Levels are defined: Low and High. The FQL Low development process objectives are applied for all EFB applications. The additional FQL High development process objectives are applied when EFB software application errors are identified as contributor to a residual risk by the safety risk assessment.

Databases:

The standard provides considerations for addressing databases used by EFB applications and stored on the EFB host platform. The standard proposes two levels of considerations, depending on whether the databases contribute to a residual risk or not. The standard also provides two levels of considerations, adapted to whether the database is considered as part or not of the EFB application for the compliance demonstration with this standard. The decision to consider the database(s) with the application or not with respect to the compliance demonstration with this standard will be under the applicant's decision.

Security:

The standard provides considerations for addressing security threats. A minimum set of security measures has been developed based on existing best industry practices. This minimum set is applicable to all EFB applications. In case mitigation means are based on assets subject to security threats, they have to be evaluated from a security perspective. A comprehensive security assessment process specifically defined for EFB applications is also provided and must be applied in case a residual risk is identified for a given EFB function.

Operational and installation instructions:

The standard defines the operational and installation instructions to be provided by the applicant to the operators for the integration of the application into their operations. The objective is to ensure that the applicant provides the minimum set of data for ensuring the proper installation, administration, use, and maintenance of the application by the operators.

The data includes in particular important assumptions such as any validation activity (e.g. validation of mitigation or prevention means) that the operators are assumed to perform to ensure the validity of the safety risk assessment.

Specific considerations:

The standard provides also additional considerations applicable to specific existing EFB functions. These additional considerations complement the general considerations. The EFB functions specifically addressed in this document are the aircraft performance and mass and balance calculation functions, the airport moving map display (AMMD) function, the weather function, the functions displaying the aircraft position on maps or charts, the electronic checklist function and the electronic signature function. The other existing EFB functions are considered as not deserving specific considerations, i.e. the general considerations are deemed sufficient.

Additional specific considerations may be needed for new, emerging functions that were not in-service at the time of the development of this standard. If this is the case, these additional specific considerations would be identified and discussed during the development, evaluation or approval of these new, emerging functions.

1.2**DOCUMENT STRUCTURE**

The document structure is as follows:

- Chapter 1 introduces the standard and provides the stakeholders, the definitions, acronyms and reference documents.
- Chapter 2 contains general considerations applicable to all EFB functions.
- Chapter 3 contains additional specific considerations applicable to specific existing EFB functions.
- Chapter 4 defines the relevant operational and installation instructions to be provided by the applicant to the operator(s) for the proper integration of the EFB application into their operations.
- Appendices provide additional information to facilitate the use of this standard, such as guidance, templates, and examples.

1.3 WORDING RULES OF THE STANDARD

The following convention is used to graduate the different levels of requirements defined in the document.

1.3.1 Requirements

A requirement indicates a mandated criterion; i.e. compliance with the particular procedure or specification is mandatory and no alternative may be applied.

The following verbal forms are used to express requirement:

Intent	Basic Form	Equivalent expression
Requirement	Shall	is to... is required to... it is required that... has to... only ... is allowed must
	Shall not	... is not allowed is required to be not... is required that ... be not ... is not to be ... must not...

Requirements are numbered and identified in the document by [REQ XXX].

1.3.2 Recommendations

A recommendation indicates a means of compliance as the preferred option to comply with a requirement, alternative means of compliance may be applied, provided that the applicant can provide information or data to adequately support and justify the alternative.

The following verbal forms are used to express recommendation:

Intent	Basic Form	Equivalent expression
Recommendation	Should	it is recommended that ... ought to...
	Should not	it is recommended that ... not... ought not to...

Recommendations are numbered and identified in the document by [REC XXX].

1.3.3 Guidance materials

Requirements and recommendations may be completed by additional guidance to help the applicant to comply with a requirement or a recommended means of compliance.

The following verbal forms are used to express guidance:

Intent	Basic Form	Equivalent expression
Guidance	May	is permitted... it is allowed.....
	need not	it is not required that ... no ... is required
	Can	to be able to... to be in a position to... there is a possibility of... it is possible to...

	Cannot	to be unable to... to not be in a position to... there is no possibility of ... it is impossible to...
--	--------	---

1.4

STAKEHOLDERS

The following stakeholders are referred to in the document.

- **Applicant:** The EFB application supplier applying to demonstrate compliance with this standard.
- **Operator:** The organization that will integrate the EFB application in its operations.
- **Flight Crew:** The pilot or any flight crew member that will use the EFB application.
- **Authority:** Any agency verifying the compliance to the standard.

1.5

DEFINITIONS

Aeronautical data: Representation of aeronautical facts, concepts or instructions in a formalised manner suitable for communication, interpretation or processing.

Airport moving map display (AMMD): A software application that displays an airport map on a display device and uses data from a position source to depict the aircraft current position on this map while the aircraft is usually on the ground.

Authoritative source: A State authority or an organisation formally recognized by the State authority to originate and/or publish data, which meets the data quality requirements (DQRs) as specified by that State.

Checklist includes

- Checklist, i.e. a means to ensure that some actions of a procedures have been completed ("challenge and respond") and
- Procedure, i.e. a means to ensure a logical progression of actions, decisions, or both in a sequence, which is prescribed to achieve a specified objective ("read and do").

Coding Standards: Guidelines and recommendations to establish coding best practices as well as stylistic preferences and conventions. Coding standards are specific to a programming language.

Configuration baseline: A defined and recorded configuration of one or more configuration items, that thereafter serves as the basis for further development, and that is changed only through change control procedures.

Configuration item: A defined aggregation of development data treated as single entity in configuration management.

Database: One or more files of data structured to enable data to be extracted from the files and for them to be updated. This primarily refers to data stored electronically and accessed by computer rather than in files of physical records.

NOTE: *This definition does not include Data Base Managements Systems (DBMS) which are considered external services.*

Data Quality Requirement: The specification of the characteristics of data (i.e. accuracy, resolution, integrity (or equivalent assurance level), traceability, timeliness, completeness, and format) to ensure that the data is compatible with its intended use.

Development assurance: All the planned and systematic actions used to substantiate, to an adequate level of confidence, that errors in requirements, design, and implementation have been identified and corrected such that the application satisfies its intended function under the supported operational environment.

Development data: All the data used for or produced during the EFB application development process.

Development environment: Encompasses all means used to develop the EFB application (framework, tools, compiler, etc.).

Derived requirement: Requirement produced by the software development processes which specify behaviour beyond that specified by the operational requirements and thus are not fully traceable to operational requirements.

Distribution information: Includes guidelines and steps for the operator to ensure that the EFB application and associated databases are delivered in the EFB host platform.

EFB Application: A software application installed on an EFB host platform that contains at least one EFB function.

EFB function: A software function intended to be used by the flight crew to support their flight operations tasks and duties.

EFB host platform: The hardware equipment, in which the computing capabilities and basic software reside, including the operating system and the input/output software.

EFB system: The hardware equipment (including any battery, connectivity provisions, input/output components) and software (including databases and the operating system) needed to support the intended EFB application(s).

Electronic checklist: An EFB application, which displays checklists to the flight crew by means of a display.

Electronic flight bag: An electronic information system, comprised of equipment and applications for flight crew, which allows for the storing, updating, displaying, and processing of EFB functions to support flight operations or duties.

Electronic signature: The electronic means used a primary means for acceptance or for confirmation of authority.

Environmental Conditions: Turbulence, Vibration etc.

Hardening: Process of securing a system by reducing its surface vulnerability.

Human Factors: The discipline of studying how a system is compatible for a human to use.

Human Factors Assessment: An evaluation of an application aimed at identifying shortcomings that may lead to human performance issues (such as errors or workload issues).

Human-machine interface: A component of certain devices that is capable of handling human-machine interactions. The interface consists of hardware and software that allow user inputs to be interpreted and processed by machines or systems that, in turn, provide the required results to the user.

Installation instructions: All information for the operator to ensure that an EFB application is properly installed onto the EFB host platform.

Minor safety effect: Failure conditions, which would not significantly reduce aircraft safety, and which involve crew actions that are well within their capabilities. Minor safety effect 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.

Miscellaneous (non-EFB) function: Functions that are part of the EFB application and that are not directly related to the tasks performed by the flight crew in the aircraft (e.g. integrated calculator function or data back-up function).

Mitigations means: Means that mitigate the severity of the consequences of a hazard (once that hazard has occurred).

No safety effect: A failure condition, which would have no effect on safety: For example failure conditions, which would not affect the operational capability of the airplane or increase crew workload.

Operational requirements: Requirements, which define the EFB function and its intended use.

Parameter data items: A set of data that, when in the form of a Parameter Data Item File, influence the behaviour of the software without modifying the Executable Object Code and that is managed as a separate configuration item.

Prevention means: Means that prevent the occurrence of a hazard or reduce its likelihood to an acceptable level.

Refutation: Acts as an independent set of assurance activities beyond analysis and requirements. As an alternative to exhaustive testing, refutation can be used to provide evidence that an unwanted behaviour has been precluded to an acceptable level of confidence. Refutation is also known as Security Evaluation in some contexts.

Release: A version of an EFB application delivered for operational use.

Residual risk: Risk associated to hazard, which may contribute after consideration of operational/procedural mitigation means to a severity effect more than minor.

Security Measure: Used to mitigate or prevent a threat condition. Security measures may be features, functions, or procedures, both on-board and off-board. Security measures can be technical, operational, or process oriented.

Software requirement: Part of the specification of an EFB function. These requirements are the ones used by the software developers to implement the function.

Security Asset: The logical and physical resources of the EFB application which contribute to the application operation, including but not limited to functions, software, interfaces, data flows, and data.

- **Primary Assets:** All software components necessary that make up the EFB application and data controlled by application. This may include but not limited to the EFB Software core application, third part libraries (COTS), databases, and configuration files.
- **Supporting Assets:** Hardware and software components, which are not part of the EFB application deliverable. These are components which the EFB application relies on to operate properly.

Static Code Analysis: Tool-driven analysis of source or object code to detect possible security vulnerabilities and to ensure adherence to industry standards and general code quality.

Supported Operational Environment: The EFB Host Platform(s) and software environment where the function may be implemented and the additional resources which may be required for the use of the function. For instance, additional resources for the use of a function may be input devices, external or internal sensors such as: GNSS, interfaces to aircraft systems, remote display, keyboard. The supported operational environment corresponds to the minimum configurations for which the performance and integrity of the function is guaranteed by the applicant.

Taxi Route: In the context of an airport moving map function, the term “taxi route” refers to any sequence of taxiway and/or runway fixes (e.g., “turn left at Echo”) that are interconnected and depict the desired taxi path.

Third Party Software: Software that would be used by an application provider as part of their application. Additionally, this would include commercial off the shelf (COTS) items.

Threat: A potential for violation of security, which exists when there is an entity, circumstance, capability, action, or event that could cause harm.

Validation: The determination that the requirements for a product are correct and complete. [Are we building the right function/data?]

Verification: The evaluation of an implementation of requirements to determine that they have been met. [Did we build the function/data right?]

Vulnerability: Weakness in an information system, system security procedures, internal controls, or implementation that could be exploited or triggered by a threat source.

1.6

ACRONYMS

AFM: Aircraft Flight Manual

AID: Aircraft Interface Device

AIP: Aeronautical Information Publication

AMMD: Airport Moving Map Display

AMDB: Airport Map Data Base

ATC: Air Traffic Control

CDL: Configuration Deviation List
CG: Centre of Gravity
DB: Data Base
DQR: Data Quality Requirements
ECL: Electronic CheckList
EFB: Electronic Flight Bag
EFF: Electronic Flight Folder
EOSID: Engine Out Standard Instrument Departure
FLS: Field Loadable Software
FQL: Function Qualification Level
GNSS: Global Navigation Satellite System
HMI: Human Machine Interface
ICAO: International Civil Aviation Organisation
IFW: In-Flight Weather
KCAS: Knots Calibrated AirSpeed
MCC: Maintenance Control Centre
MEL: Minimum Equipment List
MOPS: Minimum Operational Performance Standard
NOTAM NOTice To Air Men
OCC: Operations Control Centre
OEM: Original Equipment Manufacturer
QNH: Atmospheric pressure at nautical height
SOP: Standard Operating Procedure
SA: Security Asset
TOGA: Take Off / Go Around
VFR: Visual Flight Rules

1.7

REFERENCES

Commission Regulation (EU) No 965/2012 *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*
ICAO Doc 10020 *Manual of Electronic Flight Bags (EFBs)*
FAA AC 120-76() *Authorization for use of Electronic Flight Bags*
EUROCAE ED-12() / RTCA DO-178() *Software considerations is airborne systems and equipment certification*
EUROCAE ED-76() / RTCA DO-200() *Standard for Processing Aeronautical Data*
EUROCAE ED-99() / RTCA DO-272() *User Requirements for Aerodrome Mapping Information*
RTCA DO-257() *Minimum Operational Performance Standards for the Depiction of Navigational Information on Electronic Maps*
EUROCAE ED-215() / RTCA DO-330() *Software Tool Qualification Considerations*

CHAPTER 2

GENERAL MINIMUM OPERATIONAL PERFORMANCE STANDARD

This chapter includes the requirements applicable to all EFB applications and functions.

2.1 FUNCTIONS ELIGIBILITY

The process presented in this chapter aims at determining whether functions are allowed to be hosted in the EFB application.

[REQ 001] All functions of the EFB application shall be subject to the eligibility process provided in chapter §2.1.

For a given EFB application, the process is completed when all functions have successfully demonstrated the eligibility criteria.

2.1.1 Functional Breakdown

An EFB application may host EFB functions as well as other miscellaneous (non-EFB) functions.

[REQ 002] A functional breakdown of the EFB application in EFB functions and miscellaneous (non-EFB) functions shall be performed.

[REQ 003] The list of all functions for the EFB application shall cover the complete application functionality.

[REQ 004] A functional breakdown of each EFB function in sub-functions shall be performed.

The identification of the scope of functions and of an EFB function's sub-functions is left at the discretion of the applicant. It is recommended to consider the following:

- [REC 001] The level of detail used in defining an EFB function should ensure that the scope of each EFB function is large enough to, from a flight crew perspective, contribute to a single flight operations task or duty. An EFB function should be a logical subset of the application.
- [REC 002] The level of detail used in defining sub-functions should support the Safety Risk Assessment process with sufficient details. Keeping the scope of the sub-functions small enough will improve the confidence that all significant risks can be assessed and then mitigated or prevented at the adequate level.

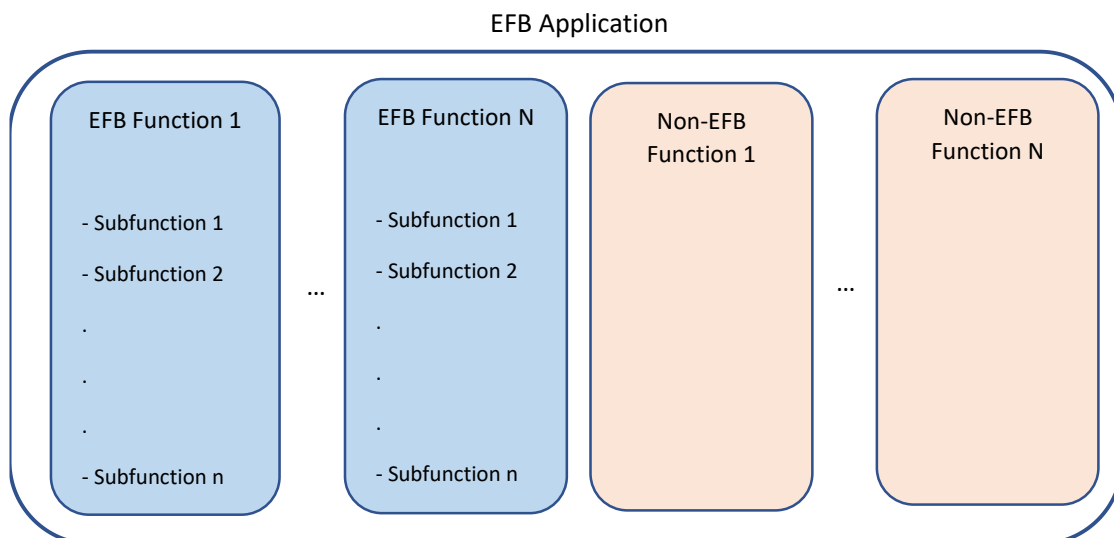


FIGURE 1: FUNCTIONAL BREAKDOWN

2.1.2 Intended use of EFB functions

[REQ 005] The intended use of each EFB function shall be defined and include the following information:

- Definition of the type of data provided and objectives of the EFB function (i.e. how it will help and support the flight crew to perform their duties),
- The phases of flight and the types of operations during which the function is intended to be used (as applicable),
- Whether the function provides data needed to perform the flight,
- Whether the function is intended to be used as a primary means, and if not, proposal of a reference source of information,
- If applicable, definition of whether the function is intended to replace existing means,
- Whether the function is intended to address an operational regulatory requirement.

[REQ 006] If certain considerations are left at the discretion of the operator, this shall appear in the intended function definition.

“Primary means” refers to information that can be directly used for operating the aircraft or for fulfilment of an operational regulatory requirement, without the need to verify or crosscheck its validity with an independent reference source of information.

Independent reference sources of information may include approved digital performance data, referenced paper documentation, avionics information certified for use as primary means. A second EFB running an identical application is not considered as a reference source of information.

Common examples of using EFB applications for primary means include calculating aircraft performance without crosschecking the Aircraft Flight Manual (AFM) and access to documents and charts.

2.1.3 EFB functions eligibility process

[REQ 007] In order for an EFB function to be considered eligible, the following shall be demonstrated:

- The function is intended to be used by flight crew to support flight operation tasks and duties (§2.1.3.1), and
- The intended use is authorised (§2.1.3.2)

2.1.3.1 Flight crew operation tasks and duties

Flight crew operations tasks and duties are assigned by the operators for the purpose of conducting the flight. They may include pre-flight, flight and post-flight tasks and duties.

A function not intended to be used by flight crew for conducting the flight is a miscellaneous (non-EFB) function. A function from an EFB application may also be accessible to non-pilots and interface or overlap with tasks or duties governed under other regulations than operational regulations (e.g. Maintenance regulations for Technical Logbook).

For the purpose of this exercise, the following categories of flight operations tasks and duties can be considered:

- “Aviate” or “Fly” refers to the flight crew’s actions to monitor and control the aircraft flight parameters in order to achieve and maintain a desired flight path.
- “Navigate” refers to the flight crew’s actions to determine where the aircraft is (present position), where it should be, and where the aircraft should go, in accordance with published procedures and with appropriate navigation performance where applicable.
- “Communicate” refers to the communication between flight crew members, the flight crew and the Air Traffic Control (ATC) as well as between the flight crew and the cabin crew, the flight crew and the company ground staff.

- “Manage systems” refers to the flight crew’s actions to monitor and control the aircraft systems.
 - “Build & maintain situational awareness” refers to the flight crew actions to build and maintain a mental picture of the aircraft and its situation with respect to its environment, information, data and capabilities (e.g. weather, terrain and obstacles, traffic, FIR, boundaries, programmed or resident data, operational capabilities, etc.).”
 - “Support Mission” refers to:
 - Flight crew’s consultation of reference information (e.g. flight operational manuals, navigation charts, Engine Out Standard Instrument Departure (EOSID), etc.), the computation of “flight-related” information (e.g. aircraft performance, Mass and Balance (M&B), etc.) and any other information supporting the conduct of the flight.
 - The actions performed before the flight (e.g. flight planning, dispatch, etc.) or after the flight (e.g. post flight report, aeronautical administrative forms, etc.) in relation with the flight itself
 - “Manage Logistics” refers to the tasks non-related to the conduct of the flight
- Authorised Intended Uses

2.1.3.2 Intended uses

The following intended uses are explicitly not authorised for an EFB function:

TABLE 1: NOT AUTHORISED INTENDED USES

Category	Not authorised intended uses
All	• Any use substituting or duplicating the intended use of instruments or equipment required by airworthiness regulations, airspace requirements, or operational rules. • Alerting uses when immediate crew awareness or immediate crew response are required.
Aviate or Fly	• All uses.
Navigate	• All uses.
Communicate	• Communication with ATC.
Manage systems	• Monitoring as a primary means of the real-time status of aircraft critical and essential systems. • Control of aircraft critical and essential systems. • Consultation of read and do checklists taking inputs from aircraft to reflect the status as primary means of aircraft systems or switch positions

NOTE: *An alerting function is a function that provides flight deck indication meant to attract the attention of and identify to the flight crew a non-normal operational or aircraft system condition.*

NOTE: *The intended uses listed in TABLE 1 are not authorised due to possible unacceptably high safety effects in case of failure, notwithstanding mitigation and prevention means that can be determined during the Safety Risk Assessment process. Functions fulfilling these uses are expected to remain certified as part of aircraft type design. Performance calculation functions as primary means are not listed, but are subject to additional design requirements (see chapter §3.1).*

The following list contains examples of possible intended uses for EFB functions. This list is non-exhaustive and is based on EFB applications known at the time of writing this standard

TABLE 2: POSSIBLE INTENDED USES

Category	Intended uses
Communicate	• Communication with ground services (such as OCC or MCC), • Communication with service providers.
Manage systems	• Use of contextual augmentation of information provided by aircraft systems.
Situational awareness	• Improvement of situational awareness in flight via representation of ownship position on navigation charts, • Anticipation or management of flight events such as diversions (e.g. Nearest airport functions), • Consultation of graphical weather information in flight, • Video surveillance of cabin and aircraft exterior, • Obtain status and advisory messages (including for awareness about non-normal operating conditions).
Support Mission	• Consultation of aeronautical charts and maps, • Computation of aircraft performance and mass and balance, • Consultation of documents and manuals, • Electronic signature, • Consultation of checklists manually selected by the flight crew • Consultation of checklists automatically presented to the flight crew based on the aircraft context (flight phases, flight crew alert messages) • Aid to Flight Profile Optimisation, • Management of flight time and duty time limitations, • Monitoring of en-route navigation integrity coverage, • Flight briefing and following (Electronic Flight Folder), • Reporting, • Log Book consultation and entries.
Manage Logistics	• Any non-safety related intended use.

2.1.4 **Miscellaneous (non-EFB) functions eligibility**

[REQ 008] The intended use of miscellaneous (non-EFB) functions does not need to be defined in detail, however, in order for them to be considered eligible, it shall be verified that they are not directly related to the tasks performed by the flight crew in the aircraft.

[REQ 009] Miscellaneous (non-EFB) functions shall not adversely affect EFB functions.

2.2 **SAFETY RISK ASSESSMENT**

The process presented in this chapter aims at ensuring a systematic and step-by-step qualitative approach to the identification of the hazards introduced by an EFB function, the identification of adequate mitigation and prevention means, and their validation.

[REQ 010] All EFB functions of the application shall be subject to the safety risk assessment process provided in chapter §2.2.

It is recommended to perform this process as early as practicable during the development cycle.

The following figure provides an overview of the process:

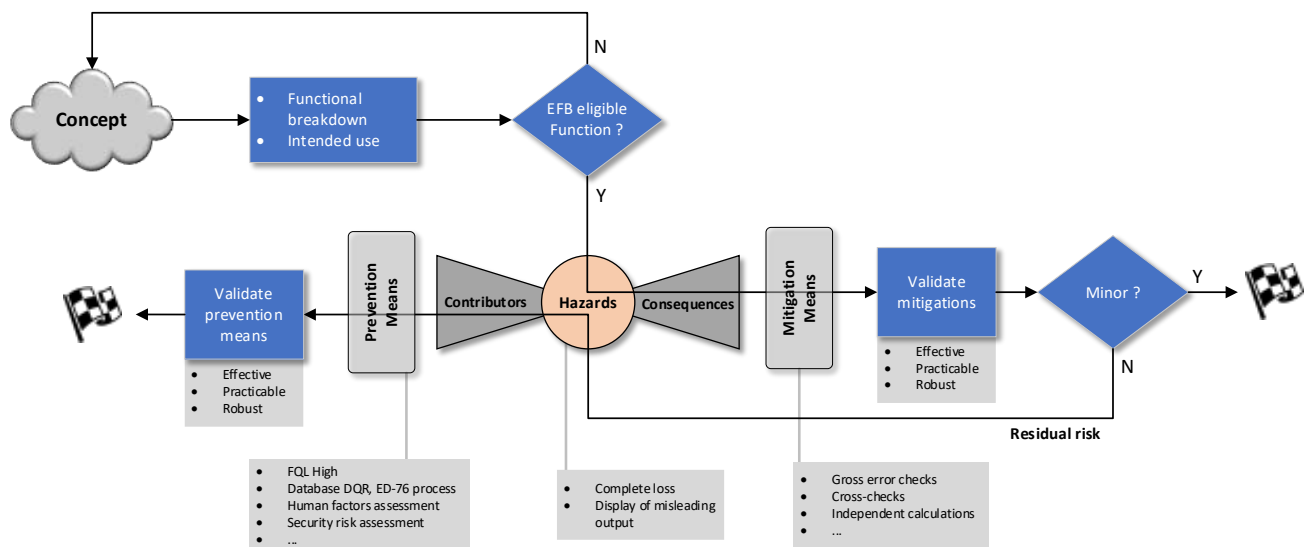


FIGURE 2: SAFETY RISK ASSESSMENT OVERALL PROCESS

Step 1

[REQ 011] The data needed to perform the safety risk assessment process shall be defined and include:

- Breakdown of the function into sub-functions (see §2.1.1),
- Inputs/Outputs of the function and its sub-functions, including as applicable:
 - Input: flight crew entries, databases, administrator settings, data provided from avionics or other sources;
 - Output data displayed to the flight crew;
- All operational assumptions supporting the safety risk assessment.

The operational assumptions may include for example:

- Access to backup means (i.e. independent from the EFB function),
- Type of operations,
- Phases of flight, etc.

Step 2

[REQ 012] For each sub-function, the following hazards shall be assessed and recorded:

- Complete loss of the sub-function,
- Display of misleading output by the sub-function.

NOTES:

Complete loss of the sub-function:

- the complete loss of the sub-function is to be considered i.e. the sub-function is lost on all EFB devices (host platforms) simultaneously.
- detected erroneous outputs are considered to be covered under this item.

Misleading output: Only the display of misleading (e.g. erroneous undetected) data to the flight crew by the sub-function is to be considered. The risk associated with the use of EFB output by other applications or systems (such as avionics, ground systems etc.) is to be assessed in the safety risk assessment of those other applications or systems.

Step 3

Mitigation means may be proposed to mitigate the severity effect of each hazard. The objectives of the mitigation means are:

- For loss of the sub-function: to reduce the operational impact by providing an alternative means to access equivalent data, such as for example paper, communication with operations centre or use a different EFB application/host platform;
- For display of misleading output: to increase the likelihood to detect the error and/or minimize the severity effect of the hazard.

Step 4

[REQ 013] Any mitigation means used shall be validated.

[REC 003] Validation should be done with respect to:

- Effectiveness: When correctly applied, the mitigation means will reduce or remove the consequences of the hazard.
- Practicability: The mitigation means can be applied by the flight crew without requiring exceptional concentration or skills, and does not create unacceptable workload.
- Robustness: The mitigation means will be effective during all the intended period of use of the EFB application.

Additional considerations regarding the validation of mitigation means:

- [REC 004] Any mitigation validation activity allocated to the operator should be recorded in the operational information (see §4.3).
- [REC 005] Mitigation means based on operational procedures and training should be validated with involvement of a pilot or correspond to established standard operational practices supported by in-service experience.
- [REC 006] The effectiveness and robustness of the mitigation means should be validated from a security point of view when based on assets subject to security threats, in accordance with section §2.6.

Step 5

[REQ 014] The severity effect at aircraft level of each hazard, with consideration of all mitigation means, shall be evaluated and classified according to the following criteria:

1. Severity effect is Minor at worst, or
2. Severity effect is greater than Minor, i.e. there is a residual risk.

[REC 007] The severity effect of the hazards should be assessed in accordance with the intended use and the operational assumptions (e.g. use with paper backup or not, use only during certain phases of flight, etc.).

Example of scenarios that could lead to residual risks:

- When the loss of a sub-function cannot be fully mitigated and has the potential for more than a minor safety effect,
- When the display of erroneous data by a sub-function could remain undetected by the flight crew (undetected erroneous data) despite the proposed mitigations and has the potential for more than a minor safety effect.

Steps 6 to 8 are applicable only if one or more residual risks are identified.

NOTE: *To simplify the analysis, this step deliberately does not require to evaluate the level of severity above minor failure effect. This standard is intended to be used for EFB applications, i.e. applications meant as a support to the flight crew. It is assumed that eligible functions (see chapter §2.1) will not lead to critical failure effects (e.g. hazardous or more in 25.1309 terminology). The prevention means provided thereafter would not be commensurate to such effects, and they would not be justifiable or acceptable for an EFB application.*

In the specific case of aircraft performance calculation applications, it is to be noted that chapter §3.1 provides additional design and software requirements that come on top of normal prevention means for residual risks, presented below. This is meant to address possible additional risks associated to these applications in a satisfactory manner, so that their use remains acceptable in terms of safety.

Step 6

[REQ 015] The contributors to each hazard with residual risk shall be identified and recorded.

[REC 008] At least the following contributors should be analysed to determine if they will cause the hazard:

- Malfunction of the host platform,
- Malfunction of the software due to design errors,
- Erroneous database,
- Erroneous crew input,
- Security threats,
- Erroneous inputs coming from another system or EFB application,
- Erroneous configuration or customization settings.

Step 7

[REQ 016] Prevention means shall be identified and recorded for every contributor to hazards with residual risk, unless it can be demonstrated that all hazards stemming from this contributor are already satisfactorily mitigated (e.g. errors can be detected).

- Acceptable prevention means for malfunction of the host platform include:
 - Operational procedures for cross-checking results from two EFBs (acknowledging that malfunction events of the host platform are random in nature), or
 - Other means that ensure detection of the malfunction of the host platform, or
 - Development assurance on the host platform itself.
- An acceptable prevention means for malfunction of the software caused by design errors is to reduce its likelihood by using the FQL high development assurance level.
- An acceptable prevention means for erroneous databases is the use of the proper Database processes (see section §2.5).
- An acceptable prevention means for erroneous crew input is the increase of Human Factors assessment scrutiny (see section §2.3).
- Acceptable prevention means for security threats are to be defined carrying a security risk assessment (see section §2.6).