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

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13 **ED-273**

14 [December 2019]

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28 **ED-273**

29 [December 2019]

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FOR CS-ETSO AMENDMENT 17 THAT PROPOSES THE NEW ETSO-2C521.

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FOREWORD

31

32 1. This document was prepared by EUROCAE Working Group 106 “Electronic Flight Bag (EFB)”
33 and was approved by the Council of EUROCAE on [Day Month Year].

34 2. EUROCAE is an international non-profit making organisation in Europe. Membership is open to
35 manufacturers and users of equipment for aeronautics, trade associations, national civil aviation
36 administrations, and, under certain conditions, non-European organisations. Its work programme
37 is principally directed to the preparation of performance specifications and guidance documents
38 for civil aviation equipment, for adoption and use at European and world-wide levels.

39 3. The findings of EUROCAE are resolved after discussion amongst Members of EUROCAE

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42 as statements of official policy only when adopted by a particular government or conference of
43 governments.

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EXECUTIVE SUMMARY

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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 operation. Not only has EFB replaced paper in most cockpits, it has provided many functions that increase flight operational effectiveness and enhanced situation awareness for pilots.

The growth of EFB has helped airlines 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 is a EUROCAE industry standard that 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 is applicable to EFB application suppliers. It was initially developed to support the approval of EFB applications by the European Union Aviation Safety Agency (EASA).

This standard provides MOPS for the following aspects of EFB application:

- Determination of whether emerging functions are suitable for EFB,
- Operational Risk Assessment,
- Human Machine Interface,
- Development Assurance,
- Databases,
- Security,
- Operational and installation data.

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

This standard does not replace the requirements and/or conditions applicable to operators to obtain an operational approval or authorisation by their national aviation authorities for the usage of EFB applications. These requirements and/or conditions are provided by the operational regulations and/or policies established by the national aviation authorities.

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DRAFT

CHAPTER 1 INTRODUCTION

189
190

1.1 PURPOSE AND SCOPE

192 This document is an industry standard applicable to EFB application suppliers. It provides MOPS for the
193 design, development, evaluation and validation of EFB applications and functions.

194 The MOPS include requirements, recommended practices and guidelines.

195 The MOPS are proportionate to the safety risk of the intended use of the EFB functions in flight
196 operations.

197

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

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

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

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

215 To address this challenge, EUROCAE created the Work Group 106 and invited its members to develop
216 an industry standard specifically applicable to EFB applications. The standard had to be structured and
217 formatted in order to be used as a basis for the approval of EFB application software (and its associated
218 installation and operating data) by an authority.

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

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

229

230 This industry standard address the following general EFB aspects:

231

Determination of whether emerging functions are suitable for EFB:

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

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239

240 Operational Risk Assessment:

241 The standard provides an operational risk assessment process developed on the model of the “bowtie”
242 method. This process addresses an issue that has been existing since the onset of the EFB regulations.
243 By the current regulatory definition, EFB includes functions with failure effect no greater than minor after
244 considerations of the operational/procedural mitigation means (typically pilot procedures and training).
245 Though, it is recognized that some EFB functions, such as the takeoff and landing performance
246 calculations, may have a failure effect greater than minor, for instance in case of a misleading calculation
247 error that is not detected by the flight crew by the operational/procedural mitigations. To resolve this
248 issue, the process uses the concept of residual risk and defines it as the risk associated to hazard which
249 may contribute after application of the operational/procedural mitigation to a severity effect more than
250 minor. The existence of residual risk or not for a given function has been applied throughout the standard
251 in order to ensure for the proportionality of the requirements to the criticality of the function. Application
252 hosting function(s) without residual risk have to comply with the minimum set of requirements.
253 Application hosting function(s) with residual risk have to apply additional requirements in order to provide
254 assurance that the contributors to the hazard are prevented to an acceptable level.

255

256 Human Machine Interfaces:

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

262

263 Development Assurance:

264 The standard provides development assurance considerations for the development of the EFB software
265 application. These development assurance considerations have been defined using existing industry
266 standard and best practices that have been fully reviewed and adapted for use in the context of EFB
267 application software development. These considerations are applicable to the various software
268 development methods (e.g. classic waterfall method, agile method). The applicant has to apply the
269 adequate assurance level proportionate to the risk associated with the use of its EFB application. The
270 terminology “Function Qualification Level” (FQL) is used to define the selected level of assurance. Two
271 FQL levels are defined: Low and High. The FQL Low development process objectives are applied for
272 all EFB application. The additional FQL High development process objectives are applied when EFB
273 software application errors are identified as contributor to a residual risk by the risk assessment.

274

275 Databases:

276 The standard provides considerations for addressing databases used by EFB applications and stored
277 on the EFB host platform. In addition to proposing two levels of considerations depending whether the
278 database contributes to a residual risk or not, the standard also provides considerations adapted to
279 whether the database is approved or not with the application. It will be up to the applicant to make this
280 decision to approve database(s) with the application or not.

281

282 Security:

283 The standard provides considerations for addressing the security threats. A minimum set of security
284 measures has been developed based on existing best industry practices. This minimum set is applicable
285 to all EFB applications. A comprehensive security assessment process specifically defined for EFB
286 applications is also provided and must be applied in case of residual risk identified for EFB function(s).

287

288 Operational and installation data:

289 The standard defines the operational and installation data to be provided by the EFB application supplier
 290 to the operators for the integration of the application into their operations. The objective is to ensure that
 291 the EFB application supplier provide the adequate set of data for ensuring the proper installation,
 292 administration, use and maintenance of the application by the operators.

293

294 Specific considerations:

295 The standard provides also additional considerations applicable to specific existing EFB functions.
 296 These additional considerations complements the general considerations. The EFB functions
 297 specifically addressed in this document are the aircraft performance and weight and balance calculation
 298 function, the airport moving maps (AMM) function, the weather function, the functions displaying the
 299 aircraft position on maps or charts, the electronic checklist function and the electronic signature function.
 300 The other existing EFB functions are considered as not deserving specific considerations i.e. that the
 301 general considerations are deemed sufficient.

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

306

307 **1.2 DOCUMENT STRUCTURE**

308 The document structure is as follows:

- 309 • Chapter 1 introduces the standard and provides its intended use, the stakeholders, the
 310 definitions, acronyms and reference documents.
- 311 • Chapter 2 contains general considerations applicable to all EFB applications.
- 312 • Chapter 3 contains additional specific considerations applicable to specific EFB functions.
- 313 • Chapter 4 defines the relevant operational and installation data to be provided to the operator(s)
 314 for integration of the EFB application into their operations.
- 315 • Appendixes provide additional information to facilitate the use of this standard, such as
 316 guidance, templates, and examples.

317

318 **1.3 USE OF THE STANDARD**

319 This standard is applicable to EFB application suppliers. The standard has been developed to support
 320 the approval of EFB applications by the European Union Aviation Safety Agency (EASA) using the
 321 certification procedures and specification as established by EASA.

322

323 **1.4 WORDING RULES OF THE STANDARD**

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

325 **1.4.1 Requirements**

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

328

329 The following verbal forms are used to express requirement:

330

Intent	Basic Form	Equivalent expression
Requirement	Shall	is to... is required to... it is required that...

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		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...

331

332 **1.4.2 Recommendations**

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

336

337 The following verbal forms are used to express recommendation:

338

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

339

340 **1.4.3 Guidance materials**

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

343

344 The following verbal forms are used to express guidance:

345

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...

346

347 1.5 STAKEHOLDERS

348 The following stakeholders are referred in the document.

349 **Applicant:** The EFB application supplier applying to demonstrate compliance with this standard.

350 **Operator:** The organization that will integrate the EFB application in its operations.

351 **Flight Crew:** The pilot or any flight crew member that will use the EFB application.

352 **Authority:** Any agency verifying the compliance to the standard.

353

354 1.6 DEFINITIONS

355 **Airport moving map display:** A software application that displays an airport map on a display device
356 and uses data from a navigation source to depict the aircraft current position on this map while the
357 aircraft is on the ground.

358 **Approval of an EFB application:** The application has been recognized compliant by the competent
359 authority to the requirements defined by this standard.

360 **Authoritative source:** A State authority or an organization formally recognized by the State authority
361 to originate and/or publish data which meets the data quality requirements (DQRs) as specified by that
362 State;

363 **Checklist** includes

- 364 • Checklist i.e. a means to ensure that some actions of a procedures have been completed (“read
365 and check”) and
- 366 • Procedure i.e. a means to ensure a logical progression of actions, decisions, or both in a
367 sequence which is prescribed to achieve a specified objective (“read and do”).

368 **Coding Standards:** Guidelines and recommendations to establish secure code best practices as well
369 as stylistic preferences and conventions. Coding standards are specific to a programming language.

370 **Code Review:** A process by which someone reviews source code authored by someone else to ensure
371 it conforms to the company's coding standards and all applicable specifications (e.g. functional,
372 architecture, design). A code review differs from static analysis insofar as it relies on people instead of
373 software tools. Because code reviews are intrinsic to collaborative software development methodologies
374 -- e.g. Extreme Programming (XP) -- additional code reviews can be optional.

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

378 **Configuration item:** One or more development data treated as a unit item for the configuration
379 management purposes.

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

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

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

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

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

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

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

- 395 **EFB function:** A software function intended to be used by the flight crew to support their flight operations
396 tasks and duties.
- 397 **EFB host platform:** The hardware equipment in which the computing capabilities and basic software
398 reside, including the operating system and the input/output software.
- 399 **EFB system:** The hardware equipment (including any battery, connectivity provisions, input/output
400 components) and software (including databases and the operating system) needed to support the
401 intended EFB application(s).
- 402 **Electronic checklist:** An EFB application which displays checklists to the flight crew by means of a
403 display.
- 404 **Electronic flight bag:** An electronic information system, comprised of equipment and applications for
405 flight crew, which allows for the storing, updating, displaying and processing of EFB functions to support
406 flight operations or duties.
- 407 **Electronic signature:** The electronic means used a primary means for acceptance or for confirmation
408 of authority.
- 409 **Hardening:** Process of securing a system by reducing its surface vulnerability.
- 410 **Human Factors:** Is the discipline of studying how a system is compatible for a human to use.
- 411 **Human Factor's Assessment:** An evaluation of an application aimed at identifying shortcomings that
412 may lead to human performance issues (such as errors or workload issues).
- 413 **Human-machine interface:** A component of certain devices that is capable of handling human-
414 machine interactions. The interface consists of hardware and software that allow user inputs to be
415 interpreted and processed by machines or systems that, in turn, provide the required results to the user.
- 416 **Installation Guidelines:** includes all information for the operator to ensure that EFB application is
417 installed in the EFB host platform.
- 418 **Minor safety effect:** Conditions which would not significantly reduce aircraft safety, and which involve
419 crew actions that are well within their capabilities. Minor safety effect may include, for example, a slight
420 reduction in safety margins or functional capabilities, a slight increase in crew workload, such as routine
421 flight plan changes, or some physical discomfort to passengers or cabin crew.
- 422 **Miscellaneous (non-EFB) function:** Functions that are part of the EFB application and that are not
423 directly related to the tasks performed by the flight crew in the aircraft.
- 424 **Mitigations means:** Means that mitigate the severity of the consequences of a hazard.
- 425 **Night mode:** Night mode (or dark mode) is a software feature that makes the user interface darker. It
426 generally changes light backgrounds to a dark color and changes text from dark to light color. Dark or
427 night mode is not necessarily a simple color inversion of the light mode, but the palette can be adapted
428 to retain the significance of some colors such as for example red, amber, blue.
- 429 **No safety effect:** A condition which would have no effect on safety: For example conditions which would
430 not affect the operational capability of the airplane or increase crew workload.
- 431 **Operational requirements:** Requirements which define the EFB function and its intended use.
- 432 **Parameter data items:** A set of data that, when in the form of a Parameter Data Item File, influence the
433 behavior of the software without modifying the Executable Object Code and that is managed as a
434 separate configuration item.
- 435 **Prevention means:** Means that prevent the occurrence of a hazard or reduce its likelihood to an
436 acceptable level.
- 437 **Refutation:** Acts as an independent set of assurance activities beyond analysis and requirements. As
438 an alternative to exhaustive testing, refutation can be used to provide evidence that an unwanted
439 behavior has been precluded to an acceptable level of confidence. Refutation is also known as Security
440 Evaluation in some contexts.
- 441 **Release:** An official version of an EFB application delivered for operational use.
- 442 **Residual risk:** Risk associated to hazard which may contribute after operational/procedural mitigation
443 to a severity effect more than minor.

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

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

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

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

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

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

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

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

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

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

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

473

474 1.7 ACRONYMS

475 **AMMD:** Airport Moving Map Display

476 **AMDB:** Airport Map Data Base

477 **DQR:** Data Quality Requirements

478 **EASA:** European union Aviation Safety Agency

479 **ECL:** Electronic Checklist

480 **EFB:** Electronic Flight Bag

481 **FQL:** Function Qualification Level

482 **GNSS:** Global Navigation Satellite System

483 **HMI:** Human Machine Interface

484 **SSA:** Software Security Asset

485

486 1.8 REFERENCES

487 **ICAO Doc 10020** EFB Manual

488 **FAA AC 120-76()** Authorization for Use of Electronic Flight Bags

489 **(EU) No 965/2012** Air operations regulation

490 **EUROCAE ED-76()** Standard for processing aeronautical data

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491 **EUROCAE ED-99()** User Requirements for Aerodrome Mapping Information
492 **RTCA DO-257()** Minimum Operational Performance Standards for the Depiction of Navigational
493 Information on Electronic Maps
494

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CHAPTER 2 GENERAL MINIMUM OPERATIONAL PERFORMANCE STANDARD

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499

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

2.1 EFB APPLICATIONS AND FUNCTIONS

501 This section addresses the determination of whether a function can be defined as an EFB function. This
502 determination is exclusively process-based. If this determination is not conclusive, the function cannot
503 be hosted on an EFB and should be considered to be hosted on an airworthiness approved platform.
504

505 All functions of the application intended to be approved shall be demonstrated as EFB functions in
506 accordance with the process specified in §2.2
507

2.2 EFB FUNCTIONS ELIGIBILITY

509 The process presented in this chapter aims at determining whether the functions of the software
510 application may be considered EFB functions. Until functions are demonstrated as such, they are termed
511 "candidate EFB functions."

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

514 Only the candidate EFB functions or sub-functions must be demonstrated as compliant with the
515 standard.
516

2.2.1 Functional breakdown

518 A functional breakdown of the EFB application shall be performed.

519 The EFB application should be broken down in functions and sub-functions.
520

521 The functional breakdown of the EFB application shall clearly list the candidate EFB functions and the
522 functions not intended for approval.
523

524 The scope of all functions shall cover the full scope of the EFB application.

525 The scope of all sub-functions shall cover the full scope of each function.
526

527 An EFB application may host EFB functions (intended for approval) as well other functions or sub-
528 functions not intended for approval.
529

530 *Note: Although an applicant may elect not to demonstrate compliance of all the application functions or*
531 *sub-functions with this standard, the acceptability for use in flight of the functions or sub-functions not*
532 *intended for approval will be left under operator responsibility and be governed by the applicable*
533 *operational regulation.*
534

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

- 537 • The level of detail used in defining an EFB function should ensure that the scope of each EFB
538 function is large enough to, from a flight crew perspective, contribute to the same flight
539 operations task or duty. An EFB function should be a logical subset of the application.

- 540 • The level of detail used in defining sub-functions should support the Risk Assessment process
 541 with sufficient details. Keeping the scope of the sub-functions small enough will improve the
 542 confidence that all significant risks can be assessed and then mitigated or prevented at the
 543 adequate level.

544

545 2.2.2 Intended use

546 The intended use of each candidate EFB function shall be defined and include the following information:

- 547 • Definition of the type of data and service provided by the function to the flight crew,
 548 • The phases of flight and the types of operations during which the function is intended to be used
 549 (as applicable),
 550 • Whether the function provides data needed to perform the flight,
 551 • Whether the function is intended to be used as a primary means, and if not, proposal of a
 552 reference source of information,
 553 • If applicable, definition of whether the function is intended to replace existing means,
 554 • Whether the function is intended to address an operational regulatory requirement.

555

556 If certain considerations are left at the discretion of the operator, this shall appear in the intended function
 557 definition.

558

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

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

565 Common examples of using EFB applications for primary means include calculating aircraft
 566 performance without crosschecking the AFM and access to documents and charts.

567

568 The intended use of each non-EFB function shall be defined

569

570 2.2.3 EFB functions eligibility

571 In order for a candidate EFB function to be considered eligible, the following shall be demonstrated:

- 572 • The function is intended to be used by flight crew to support flight operation tasks and duties,
 573 and
 574 • The intended use is authorized, and
 575 • The risk assessment process was performed.

576

577 2.2.3.1 Flight crew operation tasks and duties

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

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

584

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

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- 609
- “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 (e.g. weather, terrain and obstacles, traffic, FIR, Country boundaries, etc.).
 - “Support Mission” refers to:
 - Flight crew’s consultation of reference information (e.g. flight operational manuals, navigation charts, EOSID, etc.), the computation of “flight-related” information (e.g. aircraft performance, Mass & 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 Authorized Intended Uses

610 2.2.3.2 Intended uses

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

612

Category	Prohibited Intended uses
All	<ul style="list-style-type: none"> • Any use substituting or duplicating the intended use of instruments or equipment required by airworthiness regulations, airspace requirements, or operational rules. • Alerting uses i.e. uses that require immediate crew awareness and/or responses for safety of the flight.
Aviate or Fly	<ul style="list-style-type: none"> • All uses.
Navigate	<ul style="list-style-type: none"> • All uses.
Communicate	<ul style="list-style-type: none"> • Communication with ATC.
Manage systems	<ul style="list-style-type: none"> • 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 checklists taking inputs from aircraft to reflect the status as primary means of aircraft systems or switch positions

613

Table 1 Prohibited intended uses

614

615 The following list contains examples of possible intended uses for EFB functions. This list is non-

616 exhaustive and is based on EFB applications in-service at the time of writing this standard.

617

Category	Intended uses

Communicate	<ul style="list-style-type: none"> • Communication with ground services (such as OCC or MCC), • Communication with service providers.
Manage systems	<ul style="list-style-type: none"> • Use of contextual augmentation of information provided by aircraft systems.
Situational awareness	<ul style="list-style-type: none"> • 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.
Support Mission	<ul style="list-style-type: none"> • 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 Optimization, • 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	<ul style="list-style-type: none"> • Any non-safety related intended use.

618

Table 2 Possible intended uses

619

2.3 OPERATIONAL RISK ASSESSMENT

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

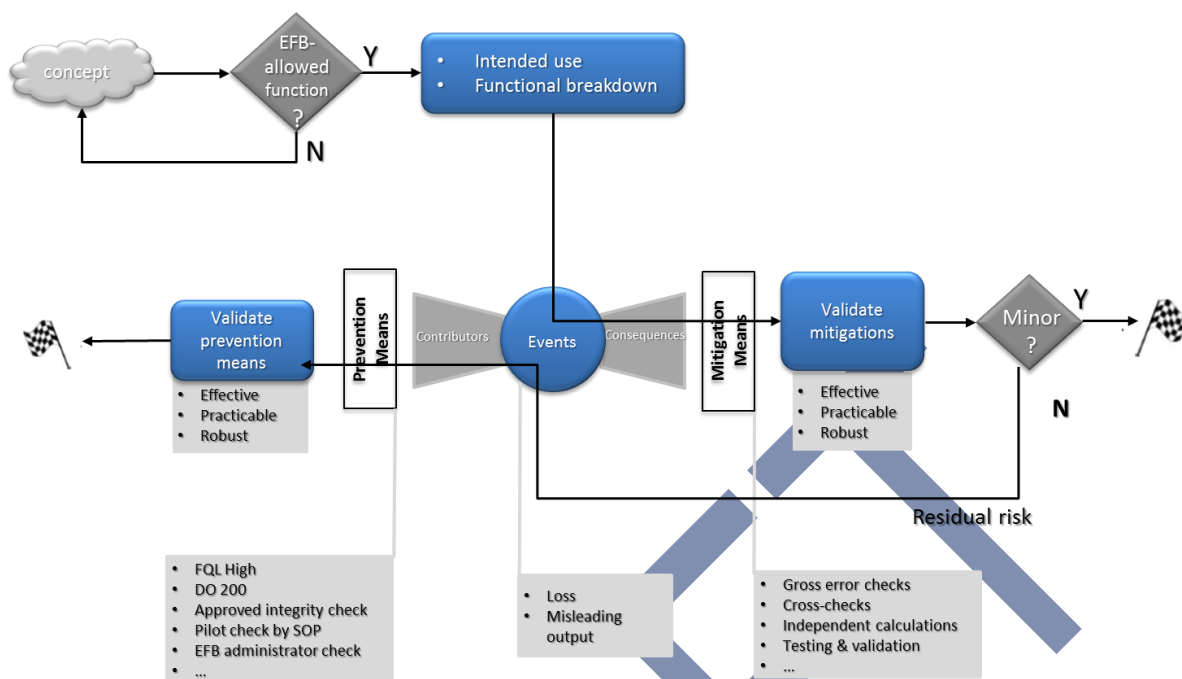
623

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

625

626 The picture here below gives an overview of the process

627



628

629

Figure 1 ORA overall process

630 The data needed to perform the risk assessment process shall be defined and include:

- 631 • Breakdown of the function into sub-functions (see §2.2.1),
- 632 • Inputs/Outputs of the function and its sub-functions, including as applicable:
 - 633 ○ Input: flight crew entries, databases, administrator settings, data provided from avionics or other sources;
 - 634 ○ Output: data displayed to the flight crew, data sent to avionics, data sent to other EFB functions or applications, data sent to the ground (connectivity);
- 635 • All operational assumptions supporting the risk assessment,

638

639 The operational assumptions may include:

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

643

644 For each sub-function, the following hazards shall be assessed and recorded:

- 645 • Loss of the sub-function,
- 646 • Display of erroneous output by the sub-function.

647 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 host platforms simultaneously.

649 Erroneous output: Only the display of erroneous 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 risk assessment of those other applications or systems.

653

654 Mitigation means may be proposed to mitigate the severity effect of each hazard.

655

656 If used in the risk assessment, a mitigation means shall be:

- 657 • Recorded, to ensure that it is communicated to the operator, and
- 658 • Validated.

659

660 Each mitigation means should be validated with respect to its:

- 661 • Effectiveness: When correctly applied, the mitigation mean will reduce or remove the
- 662 consequences of the hazard.
- 663 • Practicability: The mitigation mean can be applied by the crew without requiring exceptional
- 664 concentration or skills, and does not create unacceptable workload.
- 665 • Robustness: The mitigation mean will be effective over time for the considered operational
- 666 assumptions.

667

668 Any mitigation validation activity allocated to the operator should be recorded in the operational

669 information (see §4.3)

670

671 Mitigation means based on procedures and training should be validated with a flight crew involvement.

672

673 The effectiveness and robustness of the mitigation means should be validated from a security point of

674 view when based on assets subject to security threats.

675 For functions with residual risk, this validation is performed through the security risk assessment

676 process.

677

678 The objectives of the means of mitigations are:

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

684

685 The severity effect at aircraft level of each hazard, with consideration of all mitigation means, shall be

686 evaluated and classified according to the following criteria:

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

689

690 The severity effect of the hazards should be assessed in accordance with the intended use and the

691 operational assumptions (e.g. use with paper backup or not, use only during certain phases of flight,

692 etc.).

693 Example of scenarios that could lead to residual risks:

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

699

700 The contributors to each hazard with residual risk shall be identified and recorded.

- 701 • At least the following contributors should be analysed to determine if they will cause the hazard:
- 702 • Misbehaviour of the host platform,
- 703 • Misbehaviour of the software due to design errors,
- 704 • Erroneous database,

- 705
- 706
- 707
- 708
- Erroneous crew input,
 - Security threats,
 - Erroneous inputs coming from another system or EFB application,
 - Erroneous configuration or customization settings.

709

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

713

714 Acceptable prevention means for misbehaviour of the host platform include:

- 715
- 716
- 717
- 718
- Operational procedures for cross-checking results from two EFBs (acknowledging that
misbehaviour events of the host platform are random in nature), or
 - Other means that ensure detection of the misbehaviour of the host platform, or
 - Development assurance on the host platform itself.

719 An acceptable prevention means for misbehaviour of the software caused by design errors is to reduce
720 its likelihood by using the FQL high development assurance level.

721 An acceptable prevention means for erroneous databases is the use of the proper Database processes
722 (see section §2.6).

723 An acceptable prevention means for erroneous crew input is the increase of Human Factors assessment
724 scrutiny. (see section §2.4)

725 Acceptable prevention means for security threats are to be defined carrying a security risk assessment
726 (see section §2.7)

727

728 Other prevention means not listed above shall be validated.

729

730 In order to validate a prevention means it should be ensured that it is:

- 731
- 732
- 733
- 734
- 735
- 736
- 737
- Effective: When correctly applied, the prevention mean will prevent the hazard or reduce its
likelihood to an acceptable level.
 - Practicable (When the prevention means is under flight crew responsibility) it can be applied
without requiring exceptional concentration or skills, and does not create unacceptable
workload.
 - Robust: The prevention means will be effective over time for the considered operational
assumptions.

738

739 Any prevention means validation activity allocated to the operator should be recorded in the operational
740 information (see section §4.3)

741

742 **2.4 HUMAN MACHINE INTERFACES**

743 This section addresses the design of the Human Machine Interface of EFB applications. This section
744 includes, but is not limited to, data entry methods, colour-coding philosophies and symbology.
745 Considerations are given to the environment (aircraft type, host platform, integration in flight deck),
746 operating system and other applications as specified below.

747

748 Graphic and text displayed on the EFB shall be legible to the flight crew in the intended operation
749 environment.

- 750
- 751
- 752
- Considerations should be given to the hardware intended to host the EFB application, the
intended viewing distance, the typical range of lighting conditions expected (including extreme
illumination conditions such as direct sunlight or night.) and environmental conditions.

- 753 • The resulting hardware requirements and installation requirements should be the responsibility
754 of the operator.
755

756 The EFB application shall be designed in such a manner to not distract the flight crew from their duties

- 757 • There should be a means to inhibit both EFB visual and aural messages
758 • Flashing text or symbols should be avoided
759 • Messages should be prioritized and the message prioritization scheme evaluated and
760 documented
761 • During critical phases of the flight, information necessary to the pilot should be continuously
762 presented without uncommanded overlays, pop-ups, or pre-emptive messages, except for
763 those indicating the failure or degradation of the current EFB application
764

765 Red and amber shall be reserved for safety-related information.

- 766 • These colours should not be used for information (such as text, icons, figures and graphics) that
767 is not safety-related.
768 • Red may be used for keep-out zones such as severe weather or taxiway construction.
769 • Amber may be used for zones or conditions where caution is required, such as marginal weather
770 or failures that adversely affect performance of the EFB application.
771

772 The EFB application shall notify the flight crew if there is a detected failure in the EFB adversely affecting
773 performances or usability of the EFB application.
774

775 The EFB application response time shall be predictable to the user

- 776 • System busy or process indicator should be displayed
777 • Immediate feedback to touch indicators should be given to the user

778 The response time of the system to user inputs shall be consistent with an application's intended
779 function.
780

781 When the EFB application is busy it shall display a 'system busy' indicator (e.g. spinner, progress bar)
782

783 The application shall inform the user when a user input is mandatory or if a user input is not required.

- 784 • The pilot should be informed of the mandatory entries in order to ensure a good functioning of
785 the system
786

787 If user-entered data is not in the correct format or type expected by the EFB application, the EFB
788 application shall provide feedback to the user regarding which entry is erroneous or what type of data is
789 expected.
790

791 If user-entered data is not in the correct format or type expected by the EFB application, the EFB
792 application shall not accept the data.
793

794 The software version of the EFB application shall be accessible.

- 795 • A mechanism should allow the flight crew to check the validity of the software application
796

797 There shall be a means to check the validity of a database

- 798 • A mechanism should allow the flight crew to check the validity of the data base
799

800 The EFB application shall clearly distinguish pilot entries, default values and entries imported from other
801 EFB applications and aircraft systems.

802

803 The use of the EFB application shall not result in unacceptable flight crew workload.

- 804 • When the user returns to an EFB application that was running in the background, it should
- 805 appear in the same state as when the user left that EFB application with the exception of
- 806 differences stemming from the progress of the flight or completion of processing performed in
- 807 the background.
- 808 • A search function should be available if the EFB application can display a large amount of textual
- 809 information (e.g. data, charts, documents)
- 810 • The EFB application should be designed to minimize the number of steps needed to navigate
- 811 through information and/or functions.

812

813 If content is not visible in its entirety in its available display area, such as during “scroll”, “zoom” or “pan”
814 operations, the existence of off-screen content shall be clearly indicated in a consistent way, unless the
815 presence of that off-screen content is readily obvious.

- 816 • Off screen content should be shown through visual cues implemented in the application design.
- 817 (e.g. scrollbars)
- 818 • If there is a cursor, it should be visible on the screen at all times while in use
- 819 • The EFB application should always display the names or symbols of the active EFB function.

820

821 All software controls shall be properly identified and sized for their intended function.

- 822 • Active areas should be sized appropriately for accessibility in the intended position and for use
- 823 in turbulence
- 824 • Labels or icons may be used. It is recommended to utilize icons that are commonly recognized.

825

826 The EFB Application shall appear distinct from, but not conflict with, the installed avionics displays.

- 827 • Organize information in a manner that is consistent with other displays within flight deck yet
- 828 should clearly showing a distinction from certified displays, e.g. this can be done using different
- 829 fonts or colours
- 830 • Display of EFB applications on installed displays may require differentiation to enable the
- 831 flightcrew member to distinguish between the installed avionics display and the supplemental
- 832 or “secondary” EFB display.

833

834 Text Colours, Symbols shall be compatible with the flight deck environment

- 835 • An EFB application should not disturb the pilot’s night vision.
- 836 • The EFB application HMI may be configurable in order to ensure consistency with a specific
- 837 flight deck environment
- 838 • The EFB application may have the ability to be customized by the operator to ensure
- 839 commonality with their flight decks or any other operator’s policy.

840

841 Data entry methods, units of measure, colour-coding philosophies, and symbology shall be consistent
842 throughout the EFB application user interface

- 843 • Consistency between applications or airplane systems may be achieved.

844

845 The pilot shall easily understand clearly what units are being used for numerical data

- 846 • Where applicable measurement units should be displayed to ensure accuracy of information
- 847 • Applicable units should be displayed next to each data field.

848

849 The EFB application provider shall perform a human factors' assessment when HMI aspects are
850 identified as potential contributor to the residual risk by the risk assessment

851 This human factor's assessment should be carried out through a specific evaluation protocol.

852 This evaluation protocol and results should be validated by a human factor's specialist.

853 The definition of the evaluation protocol may include:

- 854 • The detailed objectives of the evaluation
- 855 • The description of the means and the operational environment
- 856 • The involvement of a flight crew panel representative to the foreseen end users
- 857 • The definition of detailed scenario to be executed or ad-hoc use case
- 858 • The way to record the observations and data collection

859 The evaluation report should record issues and the way to address or mitigate these issues

860 These mitigations for the recorded issues may contain but are not limited to:

- 861 • Design changes to EFB application as necessary
- 862 • Flight crew Training
- 863 • Flight crew procedure
- 864 • EFB Administrative recommendations

865

866 2.5 DEVELOPMENT ASSURANCE

867

868 This section defines development assurance considerations for the development of the EFB application.
869 The applicant has to apply the adequate assurance level proportionate to the risk associated with the
870 use of its EFB application. The terminology "Function Qualification Level" (FQL) will be used to define
871 the selected level of assurance. Two FQL levels are defined: Low and high.

872

873 FQL Low objectives shall be applied for any EFB application.

874

875 FQL High objectives shall be applied when EFB application errors are identified as contributor to a
876 residual risk by the operational risk assessment (see §2.3)

877

878 2.5.1 FQL objectives

879

880 The table below defines for each FQL level the applicable development process objectives as defined
881 in section 2.5.2.

882

	Development process objective		FQL allocation	
	Section	Description	High	Low
Development plan	2.5.2.1.1	Minimum considerations	x	x
	2.5.2.1.2	Additional considerations	x	
Operational requirements	2.5.2.2.1	EFB Function operational requirements definition	x	x
	2.5.2.2.2	EFB application architecture definition	x	x
	2.5.2.2.3	EFB Function Operational Requirements validation	x	x
	2.5.2.2.4	EFB Function compliance with operational requirements	x	x
Software development	2.5.2.3.1	EFB Function software requirements definition	x	
	2.5.2.3.2	EFB function software requirements validation	x	

	2.5.2.3.3	EFB function compliance with software requirements	x	
Configuration Management	2.5.2.4.1	Configuration items are identified.	x	x
	2.5.2.4.2	Baselines and traceability establishment	x	
	2.5.2.4.3	Problem reporting, change control, and change review	x	
	2.5.2.4.4	Archive, retrieval, and release establishment	x	x
	2.5.2.4.5	EFB Application development environment control	x	
Application Release	2.5.2.5.1	EFB Application conformity review is conducted.	x	x
	2.5.2.5.2	Impact analysis of known issues	x	x
Quality Assurance Process	2.5.2.6	Quality assurance	x	x

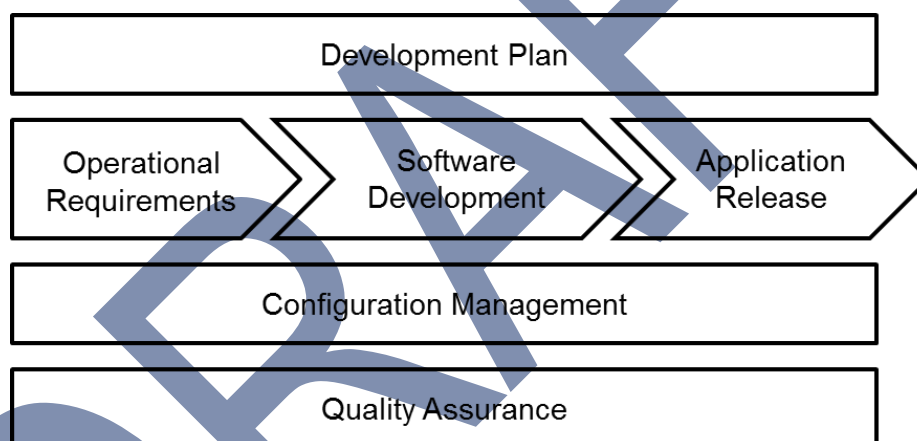
883

Table 3 FQL objectives884 **2.5.2 Development process objectives**

885

886 The following picture represents main processes of a typical EFB application development.

887



888

889 **Figure 2 Processes of an EFB application development**

890

891 **2.5.2.1 EFB Application development plan**892 **2.5.2.1.1 Minimum considerations**

893 The EFB application development plan shall be defined

894 The EFB application development plan should describe:

- 895 • The software development methodology and processes,
- 896 • The configuration management processes,
- 897 • The quality management processes,
- 898 • The development environment including frameworks and tools,

899 A development plan may be defined in a set of documents or may be made available in a shared team workspace or can discuss what common tools are being used by the team.

901 Existing procedures or guidelines defined by the applicant may be part of the development plan

902

903 2.5.2.1.2 Additional considerations

904 If necessary, the development plan may address additional considerations, such as those defined below.

905

906 2.5.2.1.2.1 Multi-functions EFB applications

907 An EFB application may host several different functions and the EFB application may be configurable
908 by the applicant or the operator to enable or disable some functions.

909

910 The appropriate FQL is determined for each function during the risk assessment process.

911

912 Low FQL functions shall not adversely impact high FQL functions

913 It is recommended that the entire EFB application should be qualified to the highest FQL.

914 When different FQLs are applied, the applicant should ensure that FQL Low functions do not adversely
915 affect high FQL functions.

916 Absence of adverse effects from low to high FQL functions may be demonstrated by:

917 • Software architecture analysis,

918 • Data flow analysis,

919 • Verification.

920

921 2.5.2.1.2.2 Usage of third party software

922 An EFB application may include third party software.

923 Any third party software included in the EFB application shall be identified

924 Third party software should be managed under configuration.

925 Third party software identification may include the editor, the version and the licenses.

926 The use of third party software should be assessed to identify the activities that need to be performed
927 or re-performed to ensure that the EFB application including this third party software complies with the
928 operational requirements and application requirements.

929

930 2.5.2.1.2.3 Usage of service history

931 If an applicant seeks approval of an EFB application or a function that is already in service, service
932 history may be used to demonstrate compliance with some requirements in this standard.933 In case service history is used to comply with some qualification requirements regarding this standard,
934 the applicant shall justify it with relevant evidence data.

935 The following aspects of an EFB application service history should be evaluated:

936 • Identify the service history data and its relevance to demonstrate compliance with qualification
937 requirements.

938 • Problem reporting is required to support service history.

939 • The similarity of the EFB application operational environment in which the service history data
940 was collected to the one used for establishing the service history credit.941 • Relevancy of the operational context of the EFB application for which service history credit is
942 claimed.

943

944 2.5.2.1.2.4 Alternative methods for EFB application qualification

945 Applicants may decide to use an alternative method than the one defined in chapter 2.5 for EFB
946 application software qualification

947 Alternative methods for EFB application qualification shall be identified and described.

948 The applicant should specify and obtain agreement from the subject matter expert on:

- 949 • The impact on the qualification process
- 950 • The equivalence with the method being replaced

951

952 2.5.2.2 Operational Requirements

953 The first step to develop an EFB application is to define how it will help and support the flight crew to
954 perform his duties; the objective is then to capture the operational requirements.

955

956 2.5.2.2.1 EFB Function operational requirements definition

957 The EFB function operational requirements shall be defined.

958 The EFB function operational requirements should describe, as applicable:

- 959 • The operational context and the intended use of the function
- 960 • The supported operational environment
- 961 • The inputs entered by the user or acquired from other sources.
- 962 • Behavior in normal operating conditions
- 963 • Behavior in degraded operating conditions (as required)
- 964 • Possible customization of the function by the applicant or the operator or the user (options,
965 configurations, parameters values, etc.)
- 966 • Requirements stemming from the risk assessment if applicable
- 967 • Non-functional requirements

968

969 2.5.2.2.2 EFB application architecture definition

970 EFB application architecture shall be defined.

971 The definition of the EFB application architecture should include

- 972 • High level architecture description relevant to identify potential degraded conditions that should
973 be addressed during the risk assessment process
- 974 • The functional links between the different software components
- 975 • EFB Function FQL Assignment

976

977 A FQL shall be assigned to each function of an EFB application.

978 The FQL assignment should be an outcome of the risk assessment process.

979

980 2.5.2.2.3 EFB Function Operational Requirements validation

981 The EFB Function Operational Requirements shall be validated.

982 Reviews and analyses should be performed on the EFB Function Operational Requirements to ensure
983 completeness, accuracy, verifiability and consistency.

984

985 2.5.2.2.4 EFB Function compliance with its operational requirements

986 The EFB function shall comply with its operational requirements.

987 The verification of the compliance of the EFB function to the Operational Requirements should be
988 addressed:

- 989 • Test cases and procedures should be developed and executed to ensure that the function fulfills
990 the operational requirements

- 991 • Test results should be reviewed to ensure that they are correct and that discrepancies between
992 actual and expected results are justified.

993 Test cases and procedures may define the acceptable tolerance on expected results.

994

995 2.5.2.3 Software development

996 It is up to the applicant to choose their development methodology.

997 Software development activities described in this section may be done in an iterative way, with functional
998 increments at each iteration.

999

1000 2.5.2.3.1 EFB Function software requirements definition

1001 The EFB function software requirements shall be defined.

1002 The EFB function software requirements shall include:

- 1003 • Functional, non-functional and interface (i.e. interoperability) related requirements,
- 1004 • Degraded conditions and responses to these conditions as applicable,
- 1005 • Specification of user interface, error messages, and potential constraints for the user,
- 1006 • Specification of algorithms and associated boundaries,

1007 The EFB function software requirements should implement operational requirements.

1008 The EFB function software requirements should be verifiable and consistent.

1009 The EFB function software requirements should be developed following the processes described in the
1010 development plan.

1011 Expected calculation accuracy of algorithm should be defined.

1012 Coding rules may be used to insure adequate calculation accuracy.

1013 EFB function software requirements may be developed in different forms depending on the selected
1014 methodology (e.g. users stories for Agile methodology, shall statement classic requirements, model
1015 based requirements, formal methods...).

1016 Each EFB function software requirement should trace to one or more operational requirements, with the
1017 exception of derived requirements.

1018 Derived requirements are those for which the rationale is not linked to the operational requirements.

1019 The existence of derived requirements should be justified, and they should be evaluated to ensure that
1020 they do not negatively impact the expected functionality and outputs defined in the operational
1021 requirements.

1022 The EFB function software requirements should be defined to a level of detail appropriate to ensure
1023 proper implementation.

1024

1025 2.5.2.3.2 EFB function software requirements validation

1026 The EFB function software requirements shall be validated before implementation.

1027 Reviews and analyses should be performed on the EFB function software requirements at least to
1028 ensure completeness with recommendations from chapter 2.5.2.3.1.

1029

1030 2.5.2.3.3 EFB function compliance with software requirements

1031 Test cases and procedures shall be developed and executed to demonstrate that the function fulfills its
1032 software requirements.

1033 Each test case should be developed from the software requirements and identifies the set of inputs, the
1034 conditions, the expected results, and the pass/fail criteria.

1035 Test procedures should be defined from the test cases.

1036

- 1037 EFB function software requirements shall be fully covered by tests.
- 1038 Input data including user entries should be exercised in representative ranges including boundaries
1039 values.
- 1040 Expected accuracy and boundaries of algorithm calculation should be verified.
- 1041 Robustness tests should be performed to address:
- 1042 • The ability of the EFB application to respond to abnormal inputs or conditions.
 - 1043 • The prevention of invalid output.
- 1044 Test coverage analysis should be performed to demonstrate that all requirements have been tested.
- 1045 Software structural coverage assessment may be used for the test coverage analysis.
- 1046 Test results shall be reviewed and acceptable discrepancies between actual and expected results shall
1047 be explained.
- 1048
- 1049 2.5.2.4 Configuration management
- 1050 The configuration management process includes the activities of configuration identification, change
1051 control, application baseline establishment, and archiving of the EFB application product, including the
1052 related life-cycle data.
- 1053 2.5.2.4.1 Configuration items are identified.
- 1054 Each EFB application configuration item and its successive versions shall be identified unambiguously.
- 1055 The objective is to establish the basis for the control and reference of the application configuration items.
- 1056 Configuration identification should be established for each configuration item and for combinations of
1057 configuration items that constitute the EFB application.
- 1058 Configuration management process should be established.
- 1059 Change control process should be established.
- 1060 Revision identification scheme for configuration items should be established.
- 1061 Supported releases should be defined by the applicant and made available to the operators as required.
- 1062 Supported releases are those releases for which the applicant may provide support to operators (e.g.
1063 assistance, bug fixing...)
- 1064
- 1065 2.5.2.4.2 Baselines establishment
- 1066 A baseline shall be established for each EFB application release
- 1067 A configuration index shall define for each EFB application release:
- 1068 • The release configuration baseline
 - 1069 • All files required for the EFB application installation and use
 - 1070 • Each source component used to build the EFB application
- 1071
- 1072 2.5.2.4.3 Problem reporting, change control, and change review
- 1073 Anomalous behavior of the EFB application shall be recorded as a problem report.
- 1074 A method shall be defined for managing problem reports.
- 1075
- 1076 EFB application change control shall provide for recording, evaluation, resolution, and reviewing of
1077 changes throughout the EFB application development.
- 1078 Change review shall ensure problems and changes are assessed and then approved or disapproved.
- 1079 Each problem should be documented, along with its initial reported severity, characteristic, and effects
1080 and be managed into configuration.
- 1081 Any changes to any baselined configuration item should be managed.

- 1082
- 1083 2.5.2.4.4 Archive, retrieval, and release establishment
- 1084 Development data and development environment of supported releases shall be archived and
1085 retrievable.
- 1086 Development data and development environment retention and retrieval procedures should be
1087 established.
- 1088 Data retention time should ensure that recorded data of supported releases are available.
1089
- 1090 2.5.2.4.5 EFB Application development environment control
- 1091 The various environments used to support the development process shall be defined and controlled.
1092 Any change of the development environment should be assessed before implementation.
1093
- 1094 2.5.2.5 Application Release
- 1095
- 1096 2.5.2.5.1 EFB Application conformity review is conducted.
- 1097 The purpose of the conformity review is to obtain assurances, for an EFB application release, that the
1098 development processes and data are complete.
- 1099 Conformity review of EFB Application releases shall be conducted.
- 1100 A conformity review should be conducted prior to the delivery of the EFB application release for
1101 operational use.
- 1102 A conformity review may determine that:
- 1103 • Planned development activities have been completed and records of their completion are
1104 available,
- 1105 • Evidence exists that development data have been produced in accordance with defined
1106 processes, and is controlled in accordance with the configuration management process,
- 1107 • Evidence exists that EFB application Problem Reports have been evaluated and have their
1108 status recorded,
- 1109 • Development plan deviations are recorded and approved,
- 1110 • Problem Reports deferred from a previous conformity review are re-evaluated to determine their
1111 status.
1112
- 1113 2.5.2.5.2 Impact analysis of known issues
- 1114 Known issues and potential mitigations shall be recorded, assessed and made available to operators.
1115 Known issues are problem reports and functional limitations which are relevant for the operator/flight
1116 crew and not fixed for the considered release.
- 1117 The severity and the impact of known issues should be analyzed from a functional and operational
1118 perspective. It should be ensured that such issue does not compromise the intended function or any
1119 mitigation means used in the risk assessment.
1120
- 1121 2.5.2.6 Quality Assurance
- 1122 Assurance shall be obtained that actual development processes, including those of suppliers, comply
1123 with the development plan and the required FQL.
- 1124 The quality process should:
- 1125 • Ensure that the development plan is defined and complies with the required FQL

- 1126 • Ensure that the deviations from the defined development plan are identified, tracked and
- 1127 addressed
- 1128 • Produce records including evidence of completion of the EFB Application conformity review
- 1129 • Provide assurance that any supplier processes and outputs comply with the defined processes

1130 Those performing the quality process can take an active role in the activities of the EFB application
 1131 development processes, and have the authority, responsibility, and independence to ensure that the
 1132 quality process objectives are satisfied.

1133 Credit may be taken from already existing quality assurance processes.

1134

1135 **2.6 DATABASES**

1136 Data addressed here are databases used by EFB applications that are stored and not acquired in real
 1137 time from an interfaced system. Considerations for real time data are addressed through the risk
 1138 assessment, development process and security chapters.

1139

1140 This data includes those supporting the operational use of an EFB application by the operator. They
 1141 may be produced and managed either by the applicant, either by the operator or a third party
 1142 organization.

1143 A non-exhaustive list of operational databases used by EFB applications may include:

- 1144 • Navigation databases
- 1145 • Airport map databases
- 1146 • Aircraft performances databases
- 1147 • Obstacles databases
- 1148 • Terrain databases
- 1149 • Runway & airport databases
- 1150 • Aircraft Weight and Balance calculation databases
- 1151 • Electronic Checklist databases
- 1152 • Electronic Charts databases
- 1153 • Documentation databases

1154

1155 This section does not apply to parameters data items that may be used to enable/disable optional
 1156 functions, or to customize the HMI of an EFB application, etc....They may be produced and managed
 1157 either by the applicant, or by the operator. The definition of these files is done during the integration
 1158 phase of the EFB application in the operational environment of the operator. A revision or an update to
 1159 the parameter data items is an administration task that may impact the behavior of the EFB application
 1160 and thus then may be considered as a change of the EFB application from the operator point of view.

1161

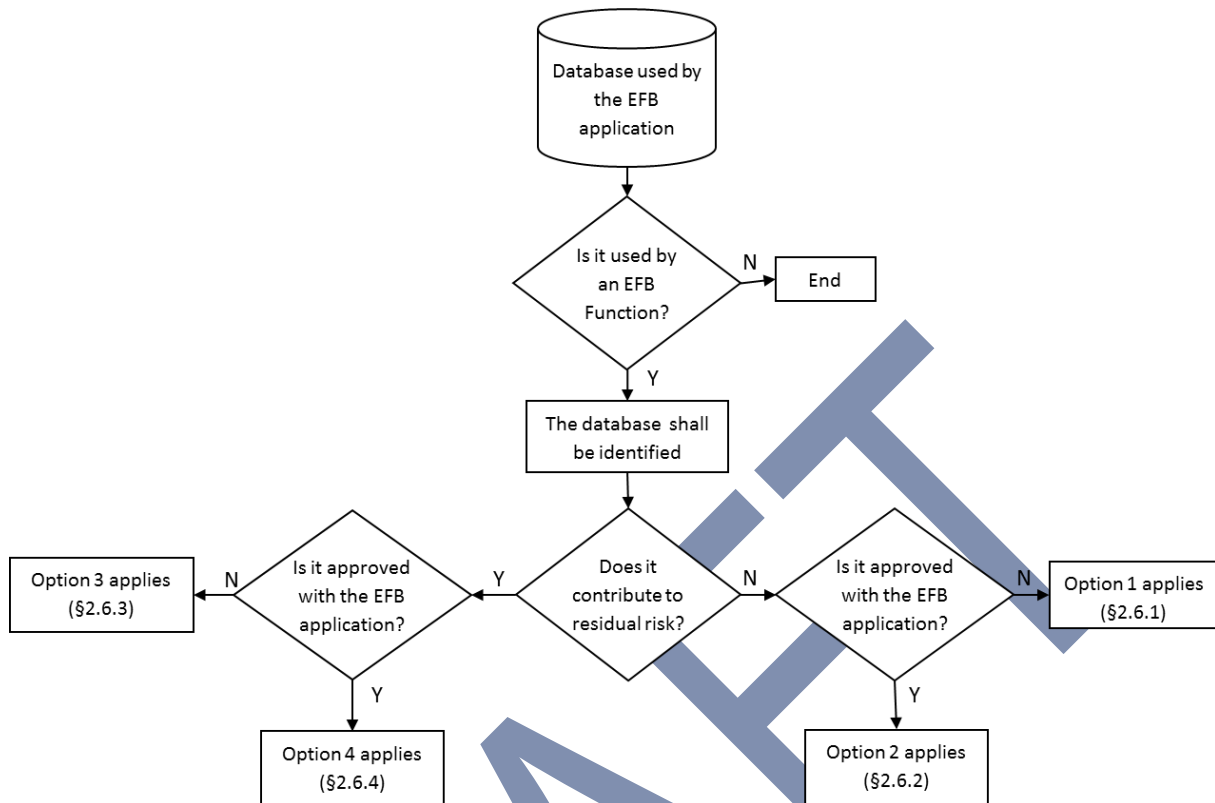
1162 Each database used by EFB functions shall be identified

1163 The following is not applicable to any EFB application database not used by an EFB function

1164

1165 Depending on the potential contribution to residual risk and if the database is approved with the EFB
 1166 application or not, one of the following options shall apply

1167



1168

1169

Figure 3 Databases consideration options

1170 A database approved with the EFB application means that the database is an item of the application
 1171 configuration (see section §2.5.2.4.1) and that the application has been verified using these data.

1172

1173 **2.6.1 Option 1 - Database is not identified as a contributor to residual risk and is not**
 1174 **approved with the EFB application**

1175 The applicant shall define and make available sufficient information regarding database for the data
 1176 provider to ensure that the data is compatible with its intended use.

1177 If the applicant is the data provider, sufficient information might not be formalized in a single document
 1178 and may instead be described in documented internal processes.

1179

1180 **2.6.2 Option 2 - Database is not identified as a contributor to residual risk and is**
 1181 **approved with the EFB application**

1182 For a database approved with the EFB application, one of the three solutions should be considered:

1183 • The database is a low complexity database; meaning that the amount of data is limited and the
 1184 structure of the database is simple. The full database content has to be validated and verified
 1185 by the applicant, or

1186 • The database is developed with the function according to the Low FQL level, or

1187 • Applying ED-76() process

1188

1189 **2.6.3 Option 3 - Database is identified as a contributor to residual risk and is not**
 1190 **approved with the EFB application**

1191 For aeronautical data, the applicant shall define and make available DQR for the data provider
 1192 The DQR should specify the characteristics of data to ensure that the data is compatible with its intended
 1193 use:

- 1194 • Accuracy,
- 1195 • Resolution,
- 1196 • Integrity (or equivalent assurance level),
- 1197 • Traceability (ability to determine origin of the data),
- 1198 • Timeliness,
- 1199 • Completeness,
- 1200 • Format.

1201
 1202 For data other than aeronautical data (e.g. ECL database), the applicant shall define, as necessary in
 1203 the documentation, specification of the database and/or the methods and mitigation mean (e.g. guidance
 1204 on the use of a specific database processing tool to generate or modify the database)

1205
 1206 DQR Compliance for data provider: The applicant may recommend to the data provider the use of ED-
 1207 76(), in particular when the data provider is not the originator of the data and use “authoritative” sources
 1208 (e.g. from AIP, OEM, etc.)

1209 Maintaining DQR Compliance: Depending on the EFB application architecture, if data is transferred from
 1210 a ground repository to the EFB host platform, it should be protected against corruption and alteration

1211 If the applicant is the data provider, DQR might not be formalized in a single document and may instead
 1212 be described in documented internal processes.

1213

1214 **2.6.4 Option 4 - Database is identified as a contributor to residual risk and is approved**
 1215 **with the EFB application**

1216 For database approved with the EFB application, one of the three alternatives shall be used to prevent
 1217 the hazard identified as a contributor to a Residual risk

- 1218 • The database is a low complexity database; meaning that the amount of data is limited, the
 1219 structure of the database is simple, and the full database content is validated and verified by
 1220 the applicant, or
- 1221 • The database is developed with the function according to the High FQL level, or
- 1222 • Applying ED-76() process.

1223

1224 **2.7 SECURITY**

1225

1226 By nature an EFB application may be exposed to various security threats. Security is a concern which
 1227 requires attention during the whole software lifecycle:

- 1228 • At the development level to ensure no vulnerabilities are introduced; part of this topic is already
 1229 covered by development assurance.
- 1230 • During distribution between the applicant and the customer, to ensure that the EFB application
 1231 behaves as designed.
- 1232 • After delivery of the EFB application to monitor any new vulnerabilities.

1233

1234 Addressing security concerns are done in two steps:

- 1235 1. Apply the Minimum Requirements found in this chapter.
- 1236 2. Apply the Security Process if residual risk exists.

1237
 1238 See figure below
 1239

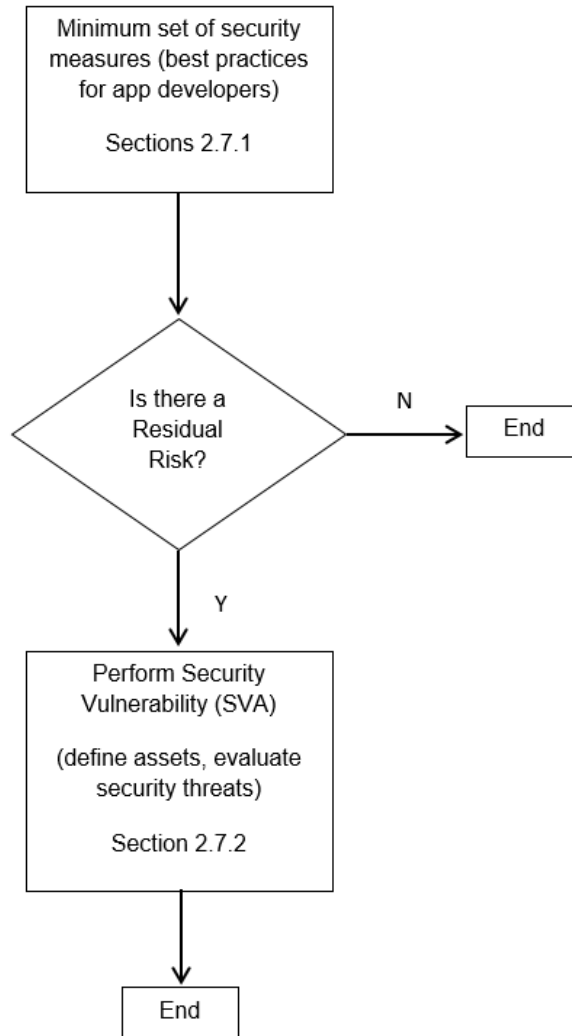


Figure 4 Security approach

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 1241
 1242
 1243 **2.7.1 Minimum set of security measures**

1244
 1245 The EFB application shall check the format and the range of all inputs.
 1246 Code reviews may be done to validate the format and range check before use of the input.
 1247 Detected erroneous input format or range may be recorded to ease further investigation.
 1248
 1249 Vulnerabilities published by third party software suppliers shall be assessed and cleared.
 1250 Vulnerability clearance means either mitigating the vulnerability or justifying there is no risk.

1251 It is recommended that the applicant defines its strategy to regularly monitor vulnerabilities in the
1252 development plan and throughout the entire lifecycle of the EFB application.

1253

1254 The authenticity and integrity of configuration items of the EFB application shall be established.

1255

1256 Distribution of EFB application binary files, parameters data items and database files shall ensure both
1257 the integrity of the files and the authentication of the originator.

1258

1259 The use of the EFB application shall not require permanent deactivation of security measures on
1260 supporting assets.

1261

1262 **2.7.2 Security Risk Assessment**

1263

1264 In the event residual risks have been identified in the safety assessment, a Security Risk Assessment
1265 shall be carried out as per "Figure 1 ORA overall process" to identify potential security vulnerabilities
1266 contributing to residual risks.

1267

1268 The following section defines the process that should be followed when performing a security risk
1269 assessment on an EFB application or function.

1270 The security assets shall be defined.

1271 The security assets of each EFB function should be defined, including but not limited to functions,
1272 software interfaces, network data flows and Third Party Software.

1273 This is an example of data flows, assets and supporting assets:

- 1274 • Data Flows:
 - 1275 ○ Wired or Wi-Fi connectivity to AID/installed EFB or Onboard Server
 - 1276 ○ Avionics Data retrieval
 - 1277 ○ Writing data out to Avionics
 - 1278 ○ Removable Media such as an USB stick
 - 1279 ○ Data exchange with ground system or operator
 - 1280 ○ HMI user entries
 - 1281 ○ Data Integrity Check
- 1282 • Primary Assets identification:
 - 1283 ○ EFB application components (including Third Parties Software)
 - 1284 ○ Avionics parameters
 - 1285 ○ Messages exchange
 - 1286 ○ Crew entries
- 1287 • Supporting Assets:
 - 1288 ○ Portable EFB hosting platform
 - 1289 ○ Services provider (AID or installed EFB)
 - 1290 ○ Wi-Fi
 - 1291 ○ Configuration or Data Base, Load installation
 - 1292 ○ Data from other EFB applications

1293

1294 Vulnerabilities in the EFB functions and assets shall be identified, evaluated and treated for their
1295 potential contribution on residual risk.

1296 The applicant should define an Acceptable Means to prevent vulnerabilities contributing to residual risk,
1297 this means being embedded into the function(s) or being a procedure to be applied by the operator.

1298 Vulnerabilities may be assessed on the basis of threats listed below (Table 4 Security threats).

1299 Hardening may be used to reduce vulnerability of libraries used within the EFB application. Reducing
 1300 available ways of attack typically includes the removal of unnecessary software, unnecessary
 1301 usernames or logins, and the disabling or removal of unnecessary services.

1302 A static code analysis scan may be used to prevent potential runtime errors.

1303 Vulnerability identification should be initiated during development lifecycle phase.

1304 A process should be established to evaluate vulnerabilities affecting the EFB functions (including Third
 1305 Party Software) on an ongoing basis.

1306

1307 - Catalogue of Threats

1308 The table below may be used by the applicant to determine which potential threats could affect assets
 1309 used by the EFB functions.

1310

Threat	Threat Description	Prevention means
ACCESS	An authorized user may gain unauthorized access to the EFB Application or to information controlled by the EFB Application via an attack for malicious purposes.	Implement Authentication and Credentials management
DEVELOP	Security failures may occur as the result of problems introduced during design, development, and implementation of the EFB Application.	Code review, coding rules, Static code analysis have to be done during the implementation life cycle
FAILURE	EFB Application system could be compromised or affected in the event of a system failure.	Identification of dummy data and restart with a functional context
INSTALL	The EFB Application may be delivered or installed in a manner that undermines security.	Check data at installation
MAINTAIN	The security of the EFB Application may be reduced or defeated due to errors or omissions in the administration and maintenance of the system.	Covered per installation (data load or configuration)
OBSERVE	Security events occur in EFB Application operation but the system, due to flaws in its specification, design, or implementation, may lead a competent user or technician to believe that the EFB Application is still secure.	Code and Design review, coding rules, Static code analysis
OPERATE	Security failures may occur because of improper operation of the EFB Application or systems interfacing with the EFB Application.	Code and Design review, coding rules, Static code analysis
PHYSICAL	Security-critical parts of the EFB Application may be subjected to a physical attack that may compromise security.	Refutation tests refutation activities
JAMMING	An attacker performs jamming on a communication physical medium.	Check on data EFB application input. Could be demonstrate by analysis or tests Refutation tests

FLOOD	An attacker performs flooding on a communication mean.	Check on data EFB application input. Could be demonstrate by analysis or tests Refutation tests
USURP	An attacker usurps the identity of an authorized external entity communicating with the EFB Application.	Implement Authentication and Credentials management
INJECTION-ALTER	An attacker injects or otherwise alters messages on a communication link in order to reduce the integrity of the EFB Application.	Check on data input Refutation tests
REPLAY	An attacker replays messages on a communication link in order to reduce the integrity of the system.	Check on data input
COMPROMISE	An attacker compromises EFB Application loadable components (FLS, DB, Digimaps etc.) in order to reduce the integrity, availability or confidentiality of the system.	Check data at installation
MALWARE	An attacker injects a malware within the EFB that aims at targeting the EFB Application, affecting the integrity, availability or confidentiality of this system.	

1311

Table 4 Security threats

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1314

CHAPTER 3 SPECIFIC MINIMUM OPERATIONAL PERFORMANCE STANDARD

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This chapter includes the additional requirements applicable to the following EFB functions:

- Aircraft performance and weight and balance calculation functions,
- Functions displaying the own-ship position,
- Airport moving maps (AMM) function,
- Weather function,
- Electronic checklist function,
- Electronic signature function,

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3.1 AIRCRAFT PERFORMANCE AND WEIGHT & BALANCE FUNCTIONS

These functions include:

- Computation of take-off and landing performance limitations for specific aircrafts, runways and conditions.
- Computation of weight & balance for specific aircrafts, chosen aircraft and crew/catering configurations and passengers, bags and fuel load.

1333

3.1.1 Human machine interfaces

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1336
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1339

Input and output data shall be clearly separated from each other.

Inputs designate the set of data that will be entered into the application by the user.

Inputs can also be prepopulated data that will be verified by the user as acceptable.

Outputs designate the set of data that are the results of the calculations.

All output data should be available in numbers except for commonly used terms in the environment, e.g. TOGA

1340
1341

For Take-Off and Landing performance calculation functions, at least the following input data shall remain visible on the screen after performing a calculation when applicable for the aircraft:

1342
1343
1344
1345
1346

- Aircraft mass,
- Selected runway, runway entry / exit, and runway condition,
- Wind, Temperature and Pressure Altitude,
- Status (active/inactive) of MEL, CDL, or non-normal performance penalties,
- Status (active/inactive) of NOTAM or other runway / obstacle modification.

1347

All other input data should remain accessible via a single user action (e.g. button press or swipe).

1348
1349

For En-Route, non-approved performance calculation functions, and mass & balance functions, flight crew inputs should remain accessible via a single user action after calculation.

1350

If input data is displayed after calculation, it should be the data actually used by the calculation function.

1351
1352
1353
1354
1355
1356

The application should indicate if a set of entries results in an unachievable operation (for instance a negative stopping margin) with a specific message and/or colour scheme. The software application may include the ability for the operator to rearrange the graphical user interface in order to provide consistency with different flight deck configurations. If that is the case, the applicant has to ensure that the application remains compliant with the criteria of this MOPS throughout the envelope of possible interface modifications, or provide clear guidelines to the operator regarding how to ensure this.

1357
1358

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

1359
1360

All the information necessary for a given calculation task shall be presented together or easily accessible.

1361 The layout of any software application calculation outputs shall be consistent with the data entry
 1362 interface of the aircraft system in which the calculation outputs are used (e.g. Flight Management
 1363 Systems), or this instruction forwarded to the operator customizing the interface.

1364 Airspeeds shall be provided in a form directly usable in the cockpit unless the unit clearly indicates
 1365 otherwise (e.g. KCAS). Any difference in the type of airspeed provided by the EFB application and the
 1366 type provided by the AFM or FCOM performance data shall be discussed in the flight crew guides and
 1367 training material.

1368 If the application offers different calculation modes (e.g. dispatch landing performance and operational
 1369 landing performance), the active mode shall be unambiguously identifiable by the user.

1370 Calculation results and any outdated input fields shall be deleted when inputs are modified.

1371 Input and Output data shall be deleted when the EFB is shutdown or the EFB application closed.

1372 The results of calculations and any outdated input fields should be deleted whenever the application
 1373 has been in stand-by or 'background' mode or if data is no longer valid.

1374 The deletion time may be configurable by the administrator.

1375 Applications may use default input values where appropriate and when flight crew workload has not
 1376 been negatively affected.

1377 For Mass & Balance functions, the interface shall provide a diagram displaying the mass and its
 1378 associated centre-of-gravity (CG) position.

1379

1380 **3.1.2 Software considerations for Airplane Take-Off and Landing performance** 1381 **calculation functions**

1382 Except for:

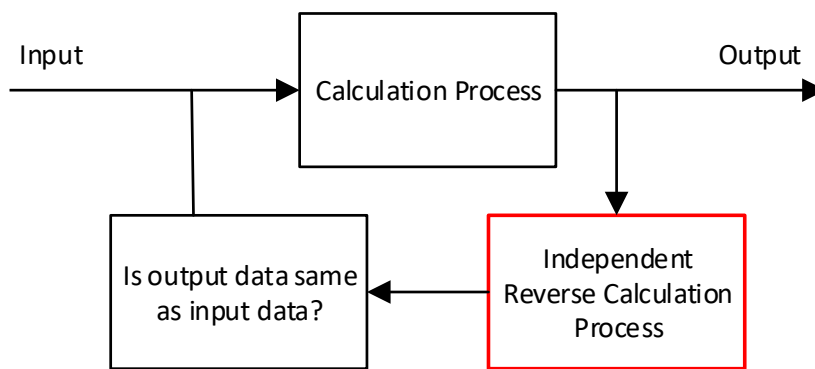
- 1383 • Airplane Take-Off and Landing performance calculation functions reusing computerized AFM
 1384 software approved as per airworthiness requirements (CS2x.1581 or equivalent), and
- 1385 • Airplane Take-Off and Landing performance calculation functions for which sufficient service
 1386 history exists and whose extent and relevance can be substantiated by the applicant,
 1387 demonstrating satisfactory operations,

1388 the functions intended to be used as a sole means of airplane take-off or landing performance
 1389 calculations shall be designed so as to ensure that a single software performance calculation error will
 1390 not lead to performance results above the mass specified in the AFM for the same ambient conditions.

1391 For this purpose, one of the following means developed at least to a FQL-Low level could be
 1392 implemented:

- 1393 • Independent reverse calculation flow with inputs cross-check:

1394



1395

1396

Figure 5 Perfo inputs cross-check

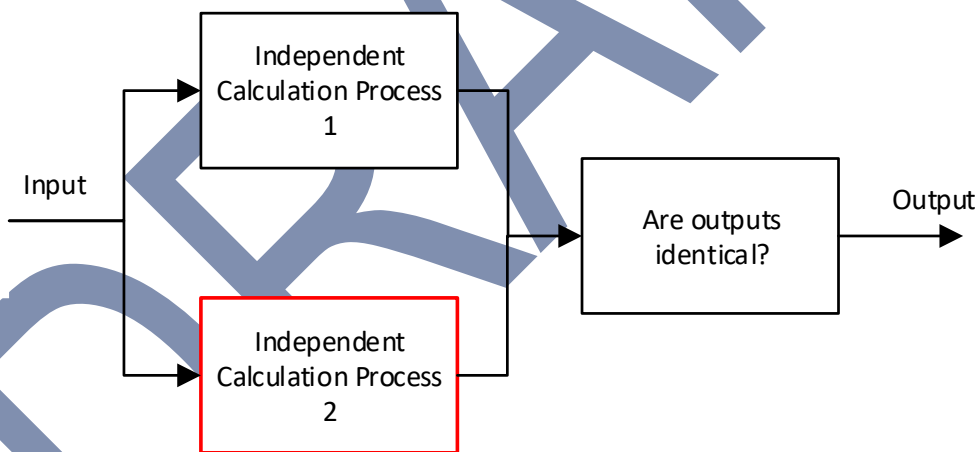
1397

1398

1399

1400

- Second independent calculation function with outputs cross-check:



1401

1402

Figure 6 Perfo outputs cross-check

1403 The functions not intended to be used a sole means of airplane take-off or landing performance
 1404 calculations shall have an operational means independent from the application e.g. gross-error check
 1405 based on pre-computed tables available on paper or electronically) specified and recorded, in order to
 1406 ensure that a software performance calculation error from the application can be detected.

1407

1408 **3.1.3 Recording of inputs and outputs**

1409 The performance and mass & balance functions shall record each computation performed (inputs and
 1410 outputs).

1411

1412 **3.1.4 Databases and calculations**

1413 Where it exists, performance and mass and balance functions should use existing approved data such
 1414 as the Aircraft Flight Manual performance data. The functions should take into account for the applicable
 1415 performance and mass and balance requirements from the Operational Regulations.

1416 Performance and mass and balance functions should not extrapolate beyond information contained in
 1417 approved data.

1418 Performance and mass and balance functions may have the capability to interpolate within the
 1419 information contained in approved data but they should not extrapolate beyond it.

1420

1421 **3.2 FUNCTIONS DISPLAYING OWN-SHIP POSITION**

1422 This chapter specifies considerations for the depiction of own-ship position on an aeronautical maps or
 1423 charts. It contains provisions that are generally applicable to all functions that display an own-ship
 1424 position. Special provisions related to AMMD and to In-flight Weather are detailed in chapter 3.3 and
 1425 3.4 respectively.

1426

1427 **3.2.1 Limitations**

1428 The display of own-ship position as an overlay on EFB functions shall not be intended for use as a
 1429 primary source of information to fly or navigate the aircraft.

1430 Except on VFR flights over routes navigated by reference to visual landmark, the limitations provided
 1431 with the EFB application should allow display of the own-ship symbol only in aircraft having a certified
 1432 navigation display (moving map).

1433 In the specific case of IFW functions, the limitations provided with the EFB application should restrict
 1434 the display of own-ship to aircraft equipped with a weather radar.

1435

1436 **3.2.2 Position Source and Accuracy**

1437 The display of own-ship position should be based on a GNSS or GNSS-based (e.g. GPS/IRS) position
 1438 from certified aircraft equipment or a suitable portable COTS position source.

1439 *Note: The selection of a position source in compliance with applicable operational regulations and the
 1440 provisions in this section and is under operator responsibility.*

1441 The own-ship symbol should be removed and the flight crew notified if:

- 1442 (1) The total system accuracy exceeds a certain threshold; or
- 1443 (2) No or invalid position data is received for 5 seconds.

1444 *Note: The term "total system accuracy" is defined and explained in RTCA DO-257().*

1445 The total system accuracy threshold should be acceptable for the specific implementation of the function
 1446 and should be selected such that erroneous misleading information is prevented. It may vary by chart
 1447 type, phase of flight or selectable zoom scales.

1448 For functions displaying own-ship position in flight, it may be sufficient to consider position source
 1449 accuracy only.

1450 Total system accuracy monitoring for the purpose of own-ship symbol removal may be unnecessary if
 1451 the applicant can plausibly demonstrate for their implementation that the total system accuracy generally
 1452 remains below the threshold because certain prerequisites are fulfilled (like certified aircraft equipment,
 1453 a sufficiently accurate database or a sufficiently high total system accuracy threshold).

1454 The zoom level of the application may be limited to prevent suggesting a level of accuracy that is
 1455 unrealistically high, which could lead to users misusing the function as a primary source of information.

1456

1457 **3.2.3 Charting Data Considerations**

1458 World Geodetic System (WGS-84) position reference system or an equivalent earth reference model
1459 shall be used for all displayed data.

1460 If the map involves raster images that have been stitched together into a larger single map, it should be
1461 demonstrated that the stitching process does not introduce distortion or map errors that would not
1462 correlate properly with a GNSS-based own-ship symbol.

1463

1464 **3.2.4 Human machine interface (HMI) Considerations**

1465 3.2.4.1 Interface

1466 The flight crew shall be able to unambiguously differentiate the EFB function from avionics functions
1467 available in the cockpit, and in particular with the navigation display.

1468 A sufficiently legible text label 'AIRCRAFT POSITION NOT TO BE USED FOR NAVIGATION' or
1469 equivalent should be continuously displayed by the application if the own-ship position depiction is
1470 visible in the current display area over a terminal chart (i.e. SID, STAR, or instrument approach) or a
1471 depiction of a terminal procedure.

1472 The 'not-to-be-used-for-navigation' limitation may be also covered by training.

1473

1474 3.2.4.2 Display of own-ship symbol

1475 The own-ship symbol shall be different from the ones used by certified aircraft systems intended for
1476 primary navigation.

1477 The depiction of a circle around the EFB own-ship symbol may be used to differentiate it from the
1478 avionics one.

1479 The pilot should be able to obtain information about the operational status of the own-ship function (e.g.
1480 active, deactivated, and degraded).

1481

1482 A means to disable the display of the own-ship position shall be provided to the flight crew.

1483

1484 If direction/track is not available, the own-ship symbol shall not imply directionality.

1485 If directional/track data is available, the own-ship symbol should indicate directionality

1486 If own-ship directionality information becomes unusable then this condition should be indicated.

1487 If the own-ship symbol is directional, the front of the symbol that conveys directionality should
1488 correspond to the aircraft nose location.

1489 If the own-ship symbol is non-directional, the aircraft location should correspond to the centre of the
1490 non-directional symbol.

1491

1492 3.2.4.3 Map orientation

1493 The current map orientation shall be clearly, continuously and unambiguously indicated (e.g., Track-up
1494 vs North-up).

1495 The display in track-up mode should not create usability or readability issues. In particular, labels should
1496 not be rotated in a manner that affects readability.

1497 When the flight crew has selected a display orientation (e.g. Track-up), that display orientation should
1498 be maintained until a pilot action that requires an orientation change occurs.

1499 If the North-up display is selected, the orientation of the map itself should be referenced to True North.

1500 If direction information is referenced to True North, this should be indicated.

1501 True bearings should be labelled with "°T" to the right of the bearing value.

1502

1503 3.2.4.4 Map scale/range, panning

1504 The function shall have the capability of manually changing the map range or scale

1505 The function should provide an indication of the map range or scale.

1506 The application zoom levels should be appropriate for the function and content being displayed and in
1507 the context of providing supplemental position awareness.

1508 If a scale is depicted, it should be indicated permanently.

1509 If the function is controlling the map range or scale automatically, the mode (e.g. auto map range) should
1510 be indicated.

1511 It is recommended that the range/scale indication be depicted on at least one of the charts/maps (e.g.
1512 airport moving map or static airport/ground map).

1513 If the function is controlling the map range or scale automatically, then the capability should exist to
1514 activate or deactivate the automatic map range.

1515 If a panning and/or range selection function is available, the capability to return to an own-ship-oriented
1516 display should be provided.

1517 When using the panning and/or range selection function, an indicator of own-ship current position should
1518 be provided within the overall displayed image. The indicator should be distinguishable from the own-
1519 ship symbol.

1520 When the display is switched to a previously viewed page then the display should maintain the map
1521 range associated with that previously viewed page.

1522

1523

1524 3.2.4.5 Data displayed

1525 All overlaid data shall be presented in the same map orientation and scale as the base map.

1526

1527 The following parameters must not be displayed in a way that allows deduction of the airplane status or
1528 deduction of information that could be used to steer the airplane:

- 1529 (i) Track/heading;
1530 (ii) Estimated time of arrival (ETA);
1531 (iii) Altitude;
1532 (iv) Geographical coordinates of the current location of the aircraft; and
1533 (v) Aircraft speed.

1534

1535 **3.3 AIRPORT MOVING MAP (AMM) FUNCTION (INCLUDING OWN-SHIP**
1536 **POSITION)**

1537 An airport moving map shall include the following minimum information and control elements:

- 1538 • Runways
1539 • Runway Identifiers
1540 • Taxiways
1541 • Ramp Areas
1542 • Indication of map/chart scale (should)
1543 • Indication of map/chart orientation
1544 • Ability to select map/chart orientation
1545 • Ability to select map range/scale
1546 • Ability to declutter the map/scale

1547

1548

1549 The function should have a consistent prioritization scheme for layering map data.

- 1550 To ensure the availability of appropriate information during surface operations, the order of display layer
1551 precedence (in case aerodrome features overlap) should be (higher priority layered on top):
- 1552 a. Own-ship symbol (must be unobstructed)
 - 1553 b. Taxi route
 - 1554 c. Runway identifiers
 - 1555 d. Runways
 - 1556 e. Taxiway identifiers
 - 1557 f. Taxiways
- 1558
- 1559 The depiction of runways shall be distinctive from all other symbology.
- 1560 With the exception of instances where two or more runways intersect, each runway should be depicted
1561 as a contiguous area (i.e., an unbroken rectangle).
- 1562
- 1563 Runways and taxiways should be depicted as filled areas, rather than outlined areas.
- 1564
- 1565 A capability should exist to depict runway identifiers on the display when the runway is within the
1566 selected map range/scale.
- 1567 At reduced map ranges, if only a small portion of the runway is visible, developers may choose to only
1568 depict one runway identifier.
- 1569
- 1570 If runway markings (e.g., runway centerline) are provided they should be depicted in their correct relative
1571 position.
- 1572 Runway identifiers should be distinguishable from the depiction of runway markings.
- 1573
- 1574 If taxiways are depicted then a capability should exist to depict taxiway identifiers on the display.
- 1575
- 1576 Additional data on the display (over and above the minimum required data) should be depicted in a
1577 consistent way and should not interfere with the usability of the minimum data.
- 1578
- 1579 The aerodrome designator (e.g., ICAO identifier) or name for the depicted aerodrome should be
1580 indicated on the display.
- 1581
- 1582 Taxi route information shall be distinguishable from all other AMM elements.
- 1583 The way taxi routes are depicted in a preview or edit mode should be distinctive from the depiction of
1584 the active taxi route.
- 1585 The depiction of taxi routes should not obscure runway or taxiway identifiers.
- 1586
- 1587 The function shall have the capability to present map information in at least one of the following
1588 orientations: North-up or Track/Heading-up (if direction/track is available).
- 1589
- 1590 All symbols shall be depicted in an upright orientation except for those designed to reflect a particular
1591 orientation.
- 1592 If symbols or fonts cannot be rotated, the map orientation should be limited to North-up – except for
1593 runway identifiers.
- 1594 Symbols used for one purpose on published paper charts should not be used for another purpose on
1595 the electronic function.
- 1596 The spatial relationships between labels and the objects that they reference should be clear, logical,
1597 and, where possible, consistent.

1598
1599 The function shall have the capability for de-cluttering (e.g. manual or automatic) during operational use.
1600
1601 Movement of map information should be smooth throughout the range of aircraft manoeuvres.
1602
1603 The system may provide the option to automatically remove the own-ship position when the aircraft is
1604 in flight or exceeds a certain ground speed.
1605
1606 The function should provide a means to compensate for installation dependent GNSS antenna offset
1607 (i.e., along-track aircraft reference point bias associated with GNSS antenna position relative to the nose
1608 of the aircraft). (see chapter 3.2.2)
1609 If the GNSS antenna offset cannot be compensated: operations with own-ship switched on may be
1610 limited to operations where the position source is in or near the flight deck.
1611
1612 The application shall provide an indication when the database is no longer valid
1613 The application should require a pilot action acknowledging an expired database.
1614
1615 Database corruption shall be detected and annunciated to the flight crew clearly and in a timely manner
1616
1617 The AMM database accuracy and resolution should meet medium category data quality as defined in
1618 EUROCAE ED-99()/RTCA DO-272().
1619
1620 **3.4 WEATHER FUNCTION**
1621 **3.4.1 General Considerations**
1622 An in-flight weather (IFW) application is an EFB function or application enabling the flight crew to access
1623 meteorological information. It is designed to increase situational awareness and to support the flight
1624 crew when making strategic decisions.
1625
1626 IFW data shall not be intended to support tactical decisions and/or as a substitute for certified aircraft
1627 systems (e.g. weather radar).
1628
1629 The use of IFW applications should be non-safety-critical and not necessary for the performance of the
1630 flight.
1631
1632 Any current information from the meteorological documentation required to be carried on board or from
1633 aircraft primary systems should always prevail over the information from an IFW application.
1634
1635 An IFW function or application may be used to access both information required to be on board (e.g.
1636 World Area Forecast Centre (WAFC) data) and supplemental weather information.
1637
1638 The displayed meteorological information may be forecasted and/or observed, and may be updated on
1639 the ground and/or in flight. It should be based on data from certified meteorological service providers or
1640 other reliable sources evaluated by the operator.
1641
1642 The meteorological information provided to the flight crew should be, as far as possible, consistent with
1643 the information available to users of ground-based aviation meteorological information (e.g. operations

1644 control centre (OCC) staff, flight dispatchers, etc.) in order to establish common situational awareness
 1645 and to facilitate collaborative decision-making.

1646

1647 **3.4.2 Display Considerations**

1648 Meteorological information should be presented to the flight crew in a format that is appropriate to the
 1649 content of the information.

1650 Coloured graphical depiction is encouraged whenever practicable.

1651

1652 The IFW display should enable the flight crew to:

- 1653 (1) Distinguish between observed and forecasted weather data;
- 1654 (2) Identify the currency or age and validity time of the weather data;
- 1655 (3) Access the interpretation of the weather data (e.g. the legend);
- 1656 (4) Obtain positive and clear indications of any missing information or data and determine areas of
 1657 uncertainty when making decisions to avoid hazardous weather; and
- 1658 (5) Be aware of the status of the data link that enables the necessary IFW data exchanges, as
 1659 applicable.

1660

1661 Meteorological information in IFW applications may be displayed, for example, as an overlay over
 1662 navigation charts, over geographical maps, or it may be a stand-alone weather depiction (e.g. radar
 1663 plots, satellite images, etc.).

1664 If meteorological information is overlaid on navigation charts, special consideration should be given to
 1665 HMI issues in order to avoid adverse effects on the basic chart functions.

1666

1667 The meteorological information may require reformatting to accommodate for example the display size
 1668 or the depiction technology. However, any reformatting of the meteorological information should
 1669 preserve both the geo-location and intensity of the meteorological conditions regardless of projection,
 1670 scaling, or any other types of processing.

1671

1672 **3.4.3 Procedures and training**

1673 The operator shall establish procedures for the use of an Inflight Weather (IFW) application.

1674

1675 This training should address:

- 1676 (1) Limitations of the use of an IFW application:
 - 1677 a. Acceptable use (strategic planning only);
 - 1678 b. Information required to be on board; and
 - 1679 c. Latency of observed weather information and the hazards associated with utilisation of
 1680 old information;
- 1681 (2) Information on the display of weather data:
 - 1682 a. Type of displayed information (forecasted, observed);
 - 1683 b. Symbolology (symbols, colours); and
 - 1684 c. Interpretation of meteorological information;
- 1685 (3) Identification of failures and malfunctions (e.g. incomplete uplinks, data-link failures, missing
 1686 info);
- 1687 (4) Human factors issues:
 - 1688 a. Avoiding fixation; and
 - 1689 b. Managing workload.

1690

1691 **3.5 ELECTRONIC CHECKLIST FUNCTION**

1692 This section is applicable to electronic checklist (ECL) function. The initial part of this section will address
 1693 the specific considerations for the risk assessment, for the Human Machine Interface (HMI) design and
 1694 the various human factors aspects such as browsing in the application, connectivity of the application
 1695 and accessibility to the ECL application from other applications. Finally, there will be a discussion on
 1696 the presentation of checklist within an aircraft context.

1697 **3.5.1 Scope**

1698 This specific requirement provides the considerations applicable to the intended uses of electronic
 1699 checklists as primary and sole means either when checklists are either manually selected by the flight
 1700 crew or presented to the flight crew based on the aircraft context (flight phases, flight crew alert
 1701 messages).

1702 **3.5.2 Risk assessment**

1703 The risk assessment shall evaluate the risks of the loss of the ECL function based on the intended uses
 1704 as primary and only means and in the corresponding environmental conditions.

1705 The ECL hardware may be compatible with the required temperature conditions required for fire and
 1706 smoke checklists

1707

1708 The risk assessment shall evaluate the risks of undetected erroneous data

1709

1710 The ECL hardware may be compatible with the required acceleration conditions (g loads) required for
 1711 emergency landing or evacuation checklists

1712

1713 The risk assessment shall evaluate the risks of accessibility to the response time of the checklists

1714

1715 **3.5.3 ECL HMI design and human factors considerations**

1716 These HMI considerations are broken-down in two aspects: access to the ECL application and the
 1717 browsing within the ECL application. The response time required to access the application depends on
 1718 each specific checklist.

1719 For example, some non-normal and emergency checklists are time critical and require quicker access
 1720 in comparison to other checklists such as normal checklists.

1721 **3.5.3.1 Checklist**

1722 This section applies to the browsing within the ECL application.

1723 **3.5.3.1.1 Accessibility**

1724 The response time of the checklist within the ECL application shall be compatible with its time criticality
 1725 aspects.

1726

1727 Within the ECL application, shortcuts to time critical checklists should be available.

1728 Time criticality criteria may be defined by the type certificate holder or if not available then the evaluation
 1729 will be done by the applicant.

1730

1731 It is recommended to organise the checklists in a specific order to improve the access time for the user.

1732 For example, Checklists may be organized by separating checklist and procedures, by flight phase or
 1733 by criticality where the most critical items may appear first.

1734

1735 3.5.3.1.2 Display

1736 The title of the checklist should be displayed and distinguished at all times when in use.

1737 The end of each checklist should be clearly indicated.

1738

1739 The field of view of each checklist should be limited to the viewing window of the hardware used by the
1740 flight crew to display the checklist.

1741

1742 Having information displayed outside the flight crew immediate field of view may result in the loss of
1743 information when executing a checklist

1744 3.5.3.1.3 ECL with interactivity

1745 ECL with interactivity refers to the possibility offered by an ECL HMI to reflect the actions of the flight
1746 crew. It offers a better situational awareness of the progress inside the checklist as well as an improved
1747 display of the checklist. Examples of actions include the recording of the completion of checklist or
1748 checklist items, the display of conditional branching of a checklist, the restart of checklist, etc.

1749

1750 The ECL HMI shall reflect the actions and the progress of the flight crew in the checklists execution

1751

1752 ECL shall provide a checklist overview displaying which checklists are completed and which are not.

- 1753 • ECL should display the completion status of action items within a checklist.
- 1754 • ECL should provide means to restart a checklist with a verification step to confirm the restart.
- 1755 • ECL should provide means to check or uncheck an action item in a checklist.
- 1756 • ECL should provide means to prevent the flight crew from missing the applicable conditional
1757 branching(s) within a checklist.

1758

1759 3.5.3.2 Access to the ECL application

1760 The access to ECL application depends upon the operational supporting environment. The operational
1761 supporting environment described in general section also applies to ECL applications and specific
1762 considerations are addressed through this section.

1763

1764 The ECL application shall be easily usable and quickly accessible to the flight crew in accordance with
1765 the intended use

1766

1767 Shortcut to directly access an ECL application, supporting the time critical checklists, should be available

1768

1769 The toggling between EFB applications on the same hardware may have an impact on the accessibility
1770 to the ECL application

1771

1772 3.5.3.3 Supporting environment

1773 The support hardware shall minimize the effort of the flight crew to interact between ECL and cockpit
1774 equipment.

1775 The hardware may be disconnected in order to achieve this capability.

1776

1777 3.5.3.4 ECL presented to the flight crew based on the aircraft context

1778 The intended use of those ECL is the capability to display automatically the normal check-list based on
1779 the flight phase and/or the abnormal/emergency checklists based on the data or events provided by the
1780 aircraft

1781
1782 The normal checklists shall be displayed at the right moment in the sequence of the flight
1783

1784 The non-normal/emergency checklists shall be displayed according to the alert messages
1785

1786 **3.6 ELECTRONIC SIGNATURE FUNCTION**

1787 This section provides considerations applicable to an electronic signature when used in EFB
1788 applications as sole and primary means.

1789

1790 **3.6.1 Uniqueness**

1791 The electronic signature shall identify a specific individual and shall be unique to this individual

1792

1793 A valid electronic signature shall be under the sole control of the signatory.

1794

1795 It shall be difficult for another individual to duplicate or alter one's electronic signature

1796

1797 Electronic signature requiring the signatory to use a unique user name and password (or PIN code) with
1798 limited validity to access the system and affix the signature should be considered as appropriate.

1799

1800 Advanced electronic signatures, qualified certificates and secured signature-creation devices are
1801 typically not required for this requirement.

1802

1803 **3.6.2 Association**

1804 The electronic signature shall be attached to or associated with the electronic record being signed.

1805

1806 The electronic signature should identify the scope of the information being affirmed with by the signature
1807 and it should be clear to the signatory and to the subsequent readers of the record, record entry, or
1808 document.

1809

1810 It should be clear to the signatory exactly what it is that they are signing. In an electronic environment,
1811 the signer should have an opportunity to review the record before signing it, and to clearly understand
1812 the parameters of the record they are signing. It is also critical that the signing process be established
1813 in a manner to ensure that the signatory's electronic signature is applied only to what they can review.

1814

1815 The electronic signature applied by the signer should be linked to the record being signed. Satisfying
1816 this requirement requires storing the data constituting the electronic signature and doing so in a way
1817 that permanently associates it with the electronic record that was signed.

1818

1819 **3.6.3 Significance**

1820 The electronic signature shall show a deliberate and recognisable action for an individual to sign the
1821 electronic record to indicate a person's approval or affirmation of the information contained in the
1822 electronic record.

1823

1824 The signatory should be prompted before their signature is affixed. The electronic signature block should
1825 contain a word or statement of intent that definitively conveys the signatory's intent to affix his or her
1826 signature.

1827

1828 Acceptable deliberate actions for creating an electronic signature may include, but are not limited to, the
1829 following:

- 1830 • Using a digital signature;
- 1831 • Entering a user name and password;
- 1832 • Swiping a badge; and/or
- 1833 • Using an electronic stylus.

1834

1835 Examples of statements that do this may include, but are not limited to:

- 1836 • “Signed by,”
- 1837 • “Certified by,”
- 1838 • “Instructor’s signature/certification,”
- 1839 • “Signature,”
- 1840 • “Authorized by,”
- 1841 • “Signatory,”
- 1842 • “Authentication,”
- 1843 • “Acknowledged by,”
- 1844 • “Acknowledgement,” and/or
- 1845 • “Affirmed by.”

1846

1847 The EFB application may notify the signatory that the signature has been affixed.

1848

1849 **3.6.4 Non-repudiation**

1850 The electronic signature shall prevent a signatory from denying (repudiating) that they affixed a signature
1851 to a specific record, record entry, or document

1852

1853 An electronic signature should allow to ensure the authenticity of the signature and that the signer cannot
1854 deny having affixed the signature to a specific record, document, or body of data.

1855

1856 The more difficult it is to duplicate a signature, the likelier it is that the signature was created by the
1857 signatory

1858

1859 **3.6.5 Traceability**

1860 An electronic signature shall provide positive traceability to the individual who signed a record, record
1861 entry, or any other document.

1862

1863 The user shall be able to identify and retrieve the documents to which his or her electronic signature
1864 has been applied.

1865

1866 The electronic signature should have authentication capabilities that can identify a signature as
1867 belonging only to a particular signatory. An individual using an electronic signature should be required
1868 to use a method of authentication that positively identifies the individual within the electronic signature
1869 function.

1870

1871 **3.6.5.1 Specific considerations for mass and balance records**

1872 For electronic signature affixed to mass and balance records, the following requirements should be
1873 considered:

- 1874
- 1875 The individual's name and professional capacity should be printed-out on the relevant record(s) in such
1876 a way that it is evident, to anyone having a need for that information, who has signed the document
1877
- 1878 The system should log information to indicate when and where the record has been signed.
1879
- 1880 The requirements for record keeping remain unchanged by the requirements related to electronic
1881 signature
1882
- 1883 **3.6.6 Security**
- 1884 A valid electronic signature shall be a permanent part of the record or document to which it was affixed.
1885 The information to which the electronic signature is attached shall be unalterable without a new signature
1886 to validate the alteration.
1887
- 1888 There should be a means to preserve the integrity of the signed record.
1889
- 1890 An electronic signature process should be secure and should prevent unauthorized access to the system
1891 that affixes the signature to the intended documents or records. The process should ensure that only
1892 the intended signatory can affix his or her signature and should prevent unauthorized individuals from
1893 certifying required documents. The process should prevent modifications to information/data or
1894 additional entries to records or documents without requiring a new signature.
1895
- 1896 An electronic signature process should include a means to correct records or documents that were
1897 electronically signed in error, as well as those documents where a signature is properly affixed but the
1898 information or data is in error. An electronic signature should be invalidated any time a superseding
1899 entry is made to correct the record or document. The information or signature being corrected should
1900 be voided but remain in place. The new information and/or signature should be easily identifiable.

CHAPTER 4 OPERATIONAL AND INSTALLATION DATA

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This chapter defines the operational and installation data to be provided to the operators for integration of the EFB application into their operations. The objective is to ensure for the proper installation, administration, use and maintenance of the application by the operators.

4.1 EFB APPLICATION DESCRIPTION AND CHARACTERISTICS.

Applicants shall provide a description and characteristics of the EFB application including those established as means of compliance with the standard.

This description and characteristics may include an overall view of the EFB application and the functions. These will support the airline in defining its own risk assessment. This is based on:

- The information used in determining the application's eligibility to be hosted on an EFB (§2.2)
- The information used to conduct the risk assessment (§2.3)

Applicants should provide an overall description of the EFB application including the version number.

Applicants should provide the functional breakdown of the EFB application and the identification of non-EFB functions.

Applicants should provide the intended use of each EFB function and sub-function.

Applicants should provide a description of the supported operational environment.

Applicants should provide all operational assumptions that support the risk assessment.

Applicants should provide the relevant information from the risk assessment that allows the operator to conduct its risk assessment. It should contain the following information for each EFB function and sub-function.

- Hazards identified during the Risk Assessment process.
- Mitigation means including responsibilities allocated to the operator.
- Prevention means including responsibilities allocated to the operator.

It is responsibility of the operator to complete, apply and validate mitigation and prevention means.

4.2 EFB APPLICATION ADMINISTRATION

Applicants shall provide administration instructions and limitations including instructions and limitations established as means of compliance with the standard.

The administration instructions and limitations are based on the development assurance set by the applicant (§2.5). It also includes the information necessary for the administrator to manage the EFB application on all the users platforms, i.e. the identification of the database used (§2.6), the security preventions (§2.7) and the configuration of the EFB application software.

1946 Applicants should provide the minimum performance specifications required of any network connection
 1947 for usage of the EFB application.

1948

1949 The network connections include, but are not limited to:

- 1950 • Air/Ground Aircraft communication
- 1951 • EFB Cellular or WiFi connectivity
- 1952 • On-board networks

1953

1954 Applicants should provide all distribution information relevant to the operator.

1955

1956 If applicable, applicants should provide installation guidelines.

1957 Applicants should provide a description of the known issues and suggested solutions to address them.

1958

1959 Applicants should provide the identification of the database used by the EFB application. This includes
 1960 the identification of the databases that may be modified and administrated by the operator (i.e.
 1961 configuration files). If the database is not approved with the EFB application, it should include the
 1962 characteristics of the data.

1963

1964 When applicable, applicants should provide a description of the application configuration options
 1965 including configuration management guidelines.

1966

1967 Applicants shall provide security preventions expected to be followed by the operator on an ongoing
 1968 basis.

1969

1970 The provided security preventions may include:

- 1971 • Security prevention means not implemented at function level, expected in the integrated
 1972 environment of use of the EFB application
- 1973 • Security procedures to maintain the protection of the function

1974

1975 **4.3 EFB APPLICATION OPERATIONAL INFORMATION**

1976 Applicants shall provide operational information, instructions, limitations and any other means necessary
 1977 to ensure that the EFB application is adequately and safely used by the flight crew. Any operational
 1978 information, instructions, limitations or any other data established as means of compliance with the
 1979 standard shall be included.

1980

1981 Operational information is provided to ensure the use of the EFB application in accordance with the
 1982 intended use and the outcome of the risk assessment defined by the applicant.

1983

1984 Applicants should provide a user manual or other equivalent means describing the usage of the EFB
 1985 application.

1986

1987 Applicants may propose equivalent means to user manual such as: application instructions, in-app help
 1988 etc.

1989

1990 Intuitive user interfaces for basic functionalities may not require user manual descriptions.

1991

- 1992 Applicants should provide the operator with sufficient information to define flight crew procedures for the
1993 basic and safe use of the EFB application. Any flight crew procedures used as mitigation means for the
1994 Risk Assessment should be identified.
- 1995
- 1996 Flight crew procedures may cover application usage in normal and degraded conditions (e.g. degraded
1997 functionalities, loss of the EFB application in one platform, etc.)
- 1998
- 1999 Applicants should provide operators sufficient information to ensure appropriate flight crew training.
2000 Flight crew training items used as mitigation means for the Risk Assessment should be identified.
- 2001
- 2002 Applicants may provide training items for initial and recurrent training/checking.
- 2003
- 2004 Applicants may provide reference to recommended training means such as e-learning, on-site training,
2005 etc.

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APPENDIX 1

EXAMPLES OF HOW TO APPLY THE SECURITY RISK ASSESSMENT TO AN EFB APPLICATION

THREAT	VULNERABILITY	
Name		Proposed mitigations
OBSERVE.LOG-OVERKILL	application sends too much logging data	<ul style="list-style-type: none"> • Specify and Implement a security log policy to be able to detect any cyber security incident on the application over EFB application. • Apply a good design practice on the application system in order to <ul style="list-style-type: none"> ○ Ensure the maintainability and the evolution of the application logging system (define and use a dedicated homogeneous application logging function to be used by all the application system components). ○ use as much as possible the logging capabilities of the EFB platform OS (this will centralize the application logs with all the EFB logs, the log processing and management will rely on the OS responsibility, the aircraft operator or maintenance personnel will be able to tune the log policy directly from the EFB system) ○ make event log messages as clear / as simple as possible ○ rationalize event log messages frequency (e.g., manage a counter of identical event logs after a 1st occurrence is logged, group log messages with counter information, ...) ○ Define a severity level for each of the application log messages and map this severity with the severity scale associated with the EFB OS log system.
OBSERVE.LOG-PROTECT	Unprotected Events from application	<ul style="list-style-type: none"> • Apply a good design practice on the application system in order to <ul style="list-style-type: none"> - use as much as possible the logging capabilities of the EFB platform OS (this will centralize the application logs with all the EFB logs, the log processing and management will rely on the OS responsibility, the aircraft operator or maintenance personnel will be able to tune the log policy directly from the EFB system) • In the case the EFB logging system is not used, insure that the application log files access is protected against unauthorized access to prevent its deletion or alteration. <p>This can be managed by EFB OS application and users access rights allocated on the application log files (MAC policy). With such protection mean, an attacker would have to acquire application or user access rights before to be</p>

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THREAT		VULNERABILITY
Name		Proposed mitigations
		<p>able to delete or directly alter the content of the application log files.</p> <p>EFB system available data encryption and authentication mechanisms can also be used to protect the application, application resources files and logs against unauthorized access. (e.g., recommend to activate the EFB cyphering, ask that the EFB user authenticates itself on the EFB before to be able to use the application).</p>
OBSERVE.UNABLE	Lack of security event policy implementation	<ul style="list-style-type: none"> • Specify and Implement a security log policy to be able to detect any cyber security incident or corruption to the application. • Apply a good design practice on the application system in order to <ul style="list-style-type: none"> ○ Ensure the maintainability and the evolution of the application logging system (define and use a dedicated homogeneous application logging function to be used by all the application system components). ○ use as much as possible the logging capabilities of the EFB platform OS (this will centralize the application logs with all the EFB logs, the log processing and management will rely on the OS responsibility, the aircraft operator or maintenance personnel will be able to tune the log policy directly from the EFB system ○ make event log messages as clear / as simple as possible ○ rationalize event log messages frequency (e.g., manage a counter of identical event logs after a 1st occurrence is logged, group log messages with counter information, ...) ○ Define a severity level for each of the application log messages and map this severity with the severity scale associated with the EFB OS log system.
USURP	Weak of authentication in application dataflow exchanges	<ul style="list-style-type: none"> • Activate cyphering OS mechanism on the EFB + user login protection before unlock the access to the application binary and data. Or recommend the end user to • To implement a mechanism which increases the security (confidentiality, integrity and authenticity) of the dataflow exchanged between the involved legitimate application and application • <i>We could imagine establishing a secured communication tunnel (using TLS1.2 for instance) between each application and application which are involved in the application for EFB system before any application dataflow is exchanged.</i>

THREAT	VULNERABILITY	
Name		Proposed mitigations
INJECTION	No trusted path on application air-ground communication link	<ul style="list-style-type: none"> Assess the absence of implementation vulnerabilities of the application for EFB software by following the security coding rules, perform code review to validate that there is no vulnerability, use tooling to detect eventual defects and patch the found vulnerabilities. Perform regularly a COTS vulnerability assessment and provide patches or workaround procedures when relevant.

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APPENDIX 2

WG-106 MEMBERSHIP

2010
2011
2012
2013

Name	Company or Organisation

2014
2015

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2016

IMPROVEMENT SUGGESTION FORM

2017 Name: _____ Company: _____

2018 Address: _____

2019 City: _____ State, Province: _____

2020 Postal Code, Country: _____ Date: _____

2021 Phone: _____ Fax: _____

2022 Email: _____

2023

2024 Document : ED- / DO- _____ Sec: _____ Page: _____ Line: _____

2025

2026 [] Documentation error (Format, punctuation, spelling)

2027 [] Content error

2028 [] Enhancement or refinement

2029 Rationale (Describe the error or justification for enhancement): _____

2030 _____

2031 _____

2032

2033 Proposed change (Attach marked-up text or proposed rewrite): _____

2034 _____

2035 _____

2036 _____

2037 _____

2038 Please provide any general comments for improvement of this document: _____

2039 _____

2040 _____

2041 _____

2042

Return completed form to:

2044 EUROCAE

2045 Attention: Secretariat General

2046 9 – 23 rue Paul Lafargue

2047 93200 Saint-Denis

2048 France

2049 Email: eurocae@eurocae.net

2050