EASA and the FAA have developed new hardware and software classifications to keep pace with the growth in EFB options and capability. The new means of compliance are designed to make the implementation process easier for airlines and regulators. The potential benefits of the new classifications are addressed here.

EFB regulation & classification update

Electronic Flight Bag (EFB) solutions have grown in popularity and functionality in recent years. This has corresponded with the development of consumer off-the-shelf (COTS)-based tablet computer devices.

The European Aviation Safety Agency (EASA) and Federal Aviation Administration (FAA) have responded to the growth in EFB sophistication by recommending new classifications for hardware and software.

Airlines looking to introduce an EFB solution for the first time, move to a different solution, or add capability to an existing system, need to understand the new classifications and the associated means of compliance.

Aircraft Commerce has analysed the new EFB classifications, how they relate to the previous definitions, and what the changes might mean for airlines.

EFB definition

An EFB solution is a combination of particular types of software with visual display and interface hardware. It is a tool for flight and cabin crew members that allows them to carry out operational functions electronically. These functions would have previously been performed using paper or manual processes.

Typical examples of EFB functions include document readers for accessing electronic copies of paper-based manuals, applications for calculating take-off performance, and electronic aeronautical charts.

EFB benefits

Most of the initial business cases for EFB implementation centred on the advantages of removing paper from the flightdeck. These include a reduction in weight and associated savings in fuel burn. Electronic documents are also quicker to update than paper versions.

The increasing sophistication of EFB solutions has led to additional benefits, particularly from a connectivity perspective. Some EFB systems can now connect to aircraft systems to upload or download data. These systems may also be capable of transmitting data to and from airline back-office systems while the aircraft is at the gate or in flight.

These developments mean an EFB solution can connect the flightdeck with an airline's main IT infrastructure. This can lead to greater efficiency in areas such as operations, maintenance, ground handling, loading and fuelling.

EFB vendors

The growth in EFB implementation has led to an increase in the number of hardware and software providers.

Some airlines prefer to use COTS-based hardware for their EFB solutions. There are also a number of vendors that provide hardware tailored to the flightdeck environment, including: Astronautics Corporation of America, CMC Electronics, Global Eagle Entertainment (GEE) through its navAero subsidiary, and UTC Aerospace Systems (UTAS).

The largest growth in suppliers has come in the software market, where there are many providers of individual applications. There are also vendors that provide a full suite of multiple software functions. Examples include AeroDocs by Arconics, AVIOBOOK® by Aviovision, and PFB™ Paperless Flight Bag by International Flight Support.

EFB implementation

Aviation regulatory authorities including EASA and the FAA responded to the introduction of EFBs by publishing recommended compliance guidelines for operators. The purpose of these was to indicate which type of approval operators would require, based on the types of EFB solution they were looking to implement.

Some components of an EFB might require airworthiness approval. All EFB solutions need an operational assessment.

Under the FAA's procedures an operational assessment involves the operator achieving 'OpSpec' authorisation. "OpSpec authorisation for EFBs is provided by flight standards and has no aircraft certification approval component," explains Brian Hint, aviation safety inspector (operations) at the FAA. "It involves a standard five-phase authorisation process and has the potential to be much quicker than an airworthiness approval.

"To gain OpSpec authorisation the operator must prove that its EFB application has equivalent levels of safety to the paper process it is replacing," continues Hint. "The operator must provide evidence that its training and procedures allow for the safe use of EFB hardware and software. The time this takes depends on the application. Simple applications that require little training and no changes to checklists should be authorised faster than more complex applications which may require changes to crewmember training and procedures."

EASA's operational assessment requirements do not currently subject EFB solutions to a formal authorisation process. Assessments are performed by the operator's competent local authority and essentially evaluate whether the EFB system's planned use is in accordance with the EASA's guidelines.

EFB solutions with components that need airworthiness approval are likely to have higher levels of operational capability. The disadvantage is that they are likely to cost more and potentially take longer to implement.

Previous classifications

The EASA and FAA EFB guidelines have developed over time, but the initial approach focused on defining EFB hardware under three 'Class' categories, and software under three 'Type' classifications.

Hardware

EFB hardware has traditionally been categorised as Class 1, 2 or 3.

A Class 1 hardware device is often a COTS-based portable electronic device (PED), like a laptop or tablet computer. It is permitted to host Type A or B software, and can temporarily connect to an aircraft power supply. It does not, however, have a permanent connection to power or any data connectivity with the aircraft.

Class 1 EFB hardware is not fixed permanently to an aircraft. The use of Class 1 devices was originally restricted to non-critical phases of flight. Some regulatory authorities later permitted the use of Class 1 EFBs in all phases of flight, provided it could be demonstrated that the hardware was appropriately secured.

A Class 1 EFB solution does not need airworthiness approval, but does need some form of operational assessment.

COTS-based devices are also commonly used for Class 2 EFB solutions. Class 2 hardware is portable, but can be attached to a flightdeck mounting device and used in all phases of flight. A Class 2 EFB can host Type A and B software, temporarily connect to an aircraft power supply, and send and receive data to and from aircraft systems. Data connectivity requires the inclusion of an aircraft interface device (AID) as part of the Class 2 Solution.

The only components of a Class 2 solution that require airworthiness approval are the flightdeck mounting device and AID. The whole system would require an operational assessment.

Class 3 EFB hardware is installed avionics equipment that can host Type A, B or C software. A Class 3 EFB requires airworthiness approval, since it is considered as part of the certified aircraft. It also needs an operational assessment.

Software

EFB software was initially classed under one of three 'Type' categories.

Under the original classifications, Type A software is categorised as pre-composed, non-interactive applications that would generally be used while on the ground or during non-critical phases of flight. This might include electronic browsers for formerly paper-based documents, such as Operations Specifications (OpSpecs), Weight and Balance (W&B) manuals, maintenance manuals and service bulletins (SBs) or published airworthiness directives (ADs).

Type B software applications are classified as dynamic and interactive, and capable of managing data for operational purposes, such as performance calculation applications. Once they have been populated with the appropriate data, these applications use algorithms to calculate the optimum aircraft configuration for different scenarios such as take-off, landing and missed approach.

Other examples of Type B software include electronic checklists and aeronautical charts and electronic technical logs (ETLs).

Type A and B software would not require airworthiness approval, but would need to be operationally assessed.

Type C software applications require an operational assessment and airworthiness approval, since they are classified as certified avionics functions that could be used on integrated Class 3 hardware. Type C functions include those relating to communication, navigation and surveillance.

Applications showing live aircraft position information, such as an airport moving map display (AMMD) were considered to be Type C software.

The need for change

The growing number and sophistication of EFB solutions encouraged EASA and the FAA to re-think their approach to the original classification system.

Grey areas began to emerge between definitions of Class 1 and 2, and Class 2 and 3 devices, making it more difficult for operators to determine the approval or certification requirements for their chosen solution.

"The main driver for the new classifications was total confusion on the part of the operators," claims David Connolly, senior project manager at Arconics. "As technology developed, unofficial hybrid system definitions began to emerge, such as Class 1.5 and Class 2.5.

"The addition of viewable stowage devices for Class 1 devices and the ability to connect them to aircraft power led to

The previous Class 1, 2 and 3 EFB hardware classifications have been replaced by new portable and installed categories. EASA has been using this new classification system since 2014, and the FAA is expected to adopt it in 2016.

the Class 1.5 hybrid," says Connolly.

When appropriate stowage and securing techniques were developed for Class 1 systems, some regulatory authorities permitted their use in all phases of flight. This undermined the largest original differentiator between Class 1 and 2 systems, and also led to an unofficial Class 1.5 designation. It understandably caused confusion among operators trying to determine the official classification of their EFB solution.

There has been further ambiguity for operators attempting to distinguish between Class 2 and 3 devices, with the occasional use of an unofficial Class 2.5 distinction. "The unofficial use of Class 2.5 related to portable Class 2 systems sharing installed resources with aircraft avionics, such as keyboards or screens," explains Hervé Julienne, air operations standardisation team leader at EASA.

"EASA and the FAA understood that classifying EFBs based on the original hardware categories was outdated," explains Simone Giordano, vice president of operations solutions at Global Eagle Entertainment, and president of navAero. "The mix of hybrid solutions pushed them to redefine the EFB from a pure avionic concept into something that is more related to the function the EFB is intended to support."

EASA and the FAA both acknowledge that growing confusion among operators, and a desire to re-focus attention on EFB functionality rather than hardware, were the main factors behind the new classifications.

"The main driver was simplification," claims Julienne. "The previous system often led to confusion, particularly when identifying which EFBs did and did not require certification.

"On the hardware side, there was confusion between classes 1 and 2, and 2 and 3," adds Julienne. "This was exacerbated on one hand by the advent of tablet computers and their great portability, and on the other by highly integrated computers with more and more connectivity to aircraft systems."

"When the original EFB classifications were released we could not have predicted the impact that PEDs, such as the iPad, would have on the market," explains Hint.

"We did not realise how robust tablets would prove to be or how they would improve over such a short period of time," continues Hint. "These developments led to many different hardware and software options for EFBs. It became apparent that the Class 1, 2 and 3 definitions no longer made sense. The most important aspect of an EFB solution is the functions it provides."

New EFB guidelines

EASA and the FAA have drafted new EFB classifications to address the shortfalls associated with the previous hardware-focused approach. EASA has already published its new guidelines and the FAA is expected to follow in 2016.

EASA released new acceptable means of compliance for EFB systems in February 2014. The new provisions are explained in its AMC 20-25 document.

The FAA has drafted a new EFB advisory circular for EFBs which will become AC 120-76D. "The AC will be published for public review later this year or early next year," says Hint. "Once comments have been adjudicated, final publication of the AC will take place in 2016." The FAA's current EFB guidance is set out in AC 120-76C, and still refers to the original hardware classifications.

"We worked closely with the FAA when drafting AMC 20-25 and the changes the FAA will introduce in the next revision of its EFB Advisory Circular will harmonise the classification system with EASA's," explains Julienne.

The new provisions involve changes to the former hardware and software classifications.

Portable or installed

The previous Class 1, 2 and 3 categories for EFB hardware have been replaced by two new ones: portable and installed.

"A portable EFB is a host platform that is used on the flightdeck and is not part of the certified aircraft configuration," explains Julienne.

A portable EFB is considered to be a controlled PED and is permitted to host Type A and B software and other non-EFB applications. It can be operated inside and outside the aircraft, but is only referred to as an EFB when it is actively displaying an EFB application.

Portable EFBs can be part of a solution that includes installed resources for the purposes of mounting the EFB hardware device to the aircraft, and/or connecting the EFB to other aircraft systems. These installed resources will be part of the certified aircraft configuration and therefore need airworthiness approval. Examples of installed EFB resources include flightdeck mounts, and AIDs for data connectivity.

A portable EFB can be temporarily connected to aircraft power via a certified power source. It can be used in all phases of flight, provided it is securely attached to a viewable stowage device or mount. A mounting device will be a certified part, but this is not necessarily the case for a viewable stowage solution.

Mounted portable EFBs must be easy to attach or remove from their mounts without the use of tools.

"An installed EFB host platform requires airworthiness approval, since it is installed in the aircraft and considered as an aircraft part," explains Julienne.

An installed EFB can host Type A and B software applications. It can also host certified avionics applications, provided it can be demonstrated that these will not suffer from adverse interference from non-certified software. This might require the use of a partitioning mechanism.

Under the new hardware classifications, Class 1 and 2 EFBs would be defined as portable host devices. A traditional Class 1 EFB with no data connectivity or mount would be categorised as a portable EFB and require an operational assessment only.

A traditional Class 2 system would be qualified as a portable host device with installed EFB resources. The installed resources might include a mounting device and an AID, and would need airworthiness approval. The whole solution would require an operational assessment.

Class 3 EFBs would be considered as installed systems, and the hardware would require airworthiness approval and an operational assessment.

Software functions

Changes have also been made to EFB software classifications. "The previous software definitions were developed in the paper era and had become outdated," says Julienne. "Applications started appearing that were not replacing paper material. The new classifications solve this issue."

Under the new classifications, only two types of software are considered to be EFB applications. These retain the Type A and B designations. The definition of what constitutes a Type A or B application has also changed, and is now based on the potential effect on the aircraft's safety following software failure or misuse.

The classification of EFB software based on potential safety effects is designed to provide a clear division between certain types of application and the assessment considerations that might apply.

Under the new system, Type A EFB software is defined as those applications that would produce no safety effect following a malfunction or misuse. They can be hosted on portable or installed EFBs.

The malfunction or misuse of a Type B application could result in a minor failure condition. This is defined as a situation in which the safety of the aircraft is not significantly compromised, and which requires crew actions that are well within their capabilities. It could result in slight reductions in functional capabilities and safety margins, or a slight increase in crew workload.

Type B software is not permitted to replace or duplicate any functions required by airworthiness regulations, airspace requirements or operational rules, except for the paper it replaces.

Type B applications can be hosted on portable or installed EFBs.

Neither Type A nor Type B software requires airworthiness approval, but both will be subject to operational assessments.

Most EFB applications have retained their original categorisation, despite the amended definitions for Type A and B software.

One slight change is the re-categorisation from Type A to Type B of some documents that are required to be on-board the aircraft and accessible for regulatory purposes.

Examples of Type A and B applications under the new classifications can be found in Annex A and B of EASA's AMC 20-25 document.

Type A applications might include document browsers for certain certificates, forms, or manuals, such as the Air Operator's Certificate (AOC), maintenance manuals, aircraft parts manuals, and SBs or published ADs.

Type B applications could include a document browser displaying manuals and forms that are carried for regulatory purposes. These could be interactive and will not be in pre-composed format. Examples include the operations manual, the aircraft flight manual, the operational flight plan, meteorological information, notices to airmen (NOTAMs) and the aircraft continuing airworthiness records.

Other listed examples of Type B

software include electronic aeronautical chart applications, aircraft performance calculations and ETLs.

Under the new software classifications, AMMD applications with own-ship position functions can be categorised as Type B software.

"The use of own-ship position on the ground is a big change," explains Brian Keery, product strategy manager at Astronautics Corporation of America. "The depiction of an own-ship position symbol is permitted under Type B guidelines, but only for airport surface operations and for ground speeds of less than 80 knots.

"Applications showing own-ship position en-route are still restricted to certified avionics applications," adds Keery.

The Type C software category no longer exists under the new classifications. "Applications that do not fall within the definition of Type A or B, and which have failure conditions that are major or above, are certified as normal avionics functions," explains Julienne.

A new 'miscellaneous' software category has been introduced to keep pace with the growing number of applications that do not support flight operations. Miscellaneous software is defined as non-EFB applications that have no influence on the operation of the aircraft, so their malfunction would have no safety effect.

Recommendations, not regulation

The recommendations in EASA's AMC 20-25, and those to be published in the FAA's AC 120-76D, are not mandatory. They offer operators means of compliance with the regulations.

It is possible that operators will find it quicker to gain approval for an EFB solution if they follow the guidance in AMC 20-25 and AC 120-76D. This is because any alternative means of compliance will need to be examined to see if it ensures an equivalent level of safety to that established by the EASA and FAA documents.

Those operators that already had EFB solutions in place when the new means of compliance were introduced will need to change the description of their systems in their relevant policy or procedures manuals. They will not, however, be required to have their solutions reassessed from a certification or authorisation perspective.

Benefits of changes

Hint points out that some operational assessments for Type B software may be streamlined under AC 120-76D, but there are no significant differences in the certification or authorisation requirements for EFB solutions under the new means of compliance.

"The biggest benefit of the new classifications should be the elimination of confusion concerning which approval or certification process are required for a particular EFB solution," says Hint.

"The new hardware classifications allow for a better separation of which EFB systems should undergo an airworthiness approval, and which only require an operational evaluation process, while providing guidelines for both cases," adds Julienne.

"The FAA has recognised that the introduction of an EFB solution provides a real benefit to airlines, and has taken steps to make it easier for operators to select a system that best suits their operational goals," says Keery. "By focusing more on function and less on the device itself, the new classifications should make introducing an EFB less complicated, and could increase the rate of implementation throughout the industry."

The harmonisation of the new classifications across global regulators should also reduce the potential for confusion among operators and local

The new EFB classifications place more emphasis on system functionality rather than the hardware. They should benefit airlines by making the approval and assessment requirements easier to identify.

aviation authorities, and simplify the implementation or alteration of an EFB solution.

"EASA's and the FAA's decision to harmonise their classification systems has been greatly welcomed by the industry," claims Julienne. "The new system has also been made consistent with the International Civil Aviation Organisation (ICAO) Annex 6 standards and recommended practices (SARPs) and EFB Manual (Doc 10020)."

"Overall, it is beneficial when policy is harmonised at the ICAO level and all civil aviation authorities can come to an agreement," adds Hint.

The harmonisation of policy across EASA, the FAA and ICAO should lead to less confusion about which set of guidelines should be followed by operators and national regulatory authorities.

Bill Baumgarten, aircraft data management business development lead at UTAS, believes that the new EFB classifications will also make it easier for operators to identify development options for their EFB solutions.

"Under the old Class distinctions it was not always clear what an operator needed to achieve to add functionality to its EFB solutions," says Baumgarten. "The new classifications provide a clearer roadmap by laying out the potential growth paths."

Airline experience

Aircraft Commerce has spoken with several airlines that have recently introduced EFB solutions to determine the potential impact of the new classifications on the implementation process.

Air Greenland

Air Greenland is the national airline of Greenland and is headquartered in the capital city of Nuuk.

The carrier operates fixed and rotary-wing aircraft. Its fleet of commercial airliners consists of seven Dash 8-200s and a single A330-200.

Air Greenland has been running an EFB solution on its A330 since March 2014, and on its Dash-8-200s since June 2014. It decided to take a phased approach to its EFB implementation, introducing new capability in stages.

"Phase 1 was implemented in 2014, and consists of iPads running the Library, Reports, Operational Flight Planning (OFP), and Briefing modules from Aviovision's AVIOBOOK software suite," explains Thomas Dall Pedersen, Dash 8 First Officer and EFB administrator at Air Greenland.

"The iPads are securely stowed during critical phases of flight, and do not have any data connectivity with aircraft systems," adds Pedersen. "When the aircraft is on the ground, the EFBs can send and receive information between the flightdeck and the airline's back office systems via WiFi, with a cellular 3G connection as backup."

The Danish Air Transport Agency (DTA) is responsible for regulating civil aviation in Greenland. The DTA follows EASA's guidelines. When Air Greenland began operational evaluation testing for the first phase of its EFB solution, EASA still classified EFBs under the Class 1, 2 and 3 categories.

"Our system was defined as a Class 1 solution with Type A and B software applications," explains Pedersen.

When the new classifications were published under AMC 20-25 in February 2014, Air Greenland amended its EFB designation.

"Under the new classifications our Phase 1 EFB is defined as a portable host solution, with no installed systems operating Type A and B software," says Pedersen. "Some of the software changed from Type A to B as a result of the re-classification."

Air Greenland rewrote its policy and procedures manual to take account of the new EFB definitions in accordance with AMC 20-25. It was not, however, required to apply for any additional approvals or evaluations of its existing solution.

Air Greenland is now working on the phased introduction of additional EFB capability, which will be introduced according to the new recommended means of compliance.

This includes the introduction of new Type B software applications, such as electronic aeronautical charts, and mounting devices for its EFB host platforms.

The mounting solutions on the Dash 8-200s will be different to those used for the A330.

"On the A330 the iPad will be mounted on the windows using RAM mounts with suction cups," explains Pedersen. "On the Dash 8-200s, the iPads will be attached to a fixed mount, covered by a supplementary type certificate (STC), and provided by Fokker Services."

The A330 mounts will not affect the classification of the EFB solution on that aircraft, since they do not include any installed components. The fixed mounts on the Dash 8-200s will require airworthiness approval and re-classify the system as a portable solution with installed EFB resources.

"We had to ensure that the EFBs would not run out of battery power, in order to comply with power source requirements," says Pedersen. "The A330 already has a power outlet available on the flightdeck, so we chose the most cost-effective attachment solution, which in this case was the RAM suction cup mount. The Dash 8-200 does not have a power outlet available, so we need to have one installed. We decided to opt for a fixed mount, in addition to the power outlet, since there was little difference in cost."

Both mounting solutions will be implemented during 2016.

Pedersen believes that the new EFB classifications are beneficial for operators. "The new classifications provide a better tool for operators, since approval and certification requirements for different EFB solutions are more clearly laid out. We found the section on viewable stowage requirements particularly helpful when planning the next phase of our EFB implementation."

Pedersen also highlights how the introduction of the new classifications should reduce confusion between operators and national aviation regulators regarding which compliance documents should be followed during EFB implementation.

The harmonisation of the new EFB classifications across EASA, the FAA and ICAO should help to reduce any similar confusion on a global level.

easyJet

easyJet is one of the largest airlines in Europe, serving more than 30 countries with a network in excess of 600 routes.

It has a fleet of 243 A320 family aircraft, including 147 A319s and 96 A320s.

easyJet became one of the first operators to have an EFB solution approved in accordance with AMC20-25.

The airline first introduced an EFB system in 2003. This was a Class 1 solution with Type A and B software.

"We used Panasonic CF-18/CF-19 Toughbooks; and the software functions included manuals, performance, and mass and balance," explains Taylor Bradbury, manager of flight operations delivery at easyJet. "The Class 1 EFBs were not used during critical phases of flight."

In 2013 easyJet began trials of a new EFB solution. The airline wanted increased functionality, including electronic aeronautical charts.

"The trail began in 2013, by which time the EASA was close to adopting AMC20-25," explains Bradbury. "The UK Civil Aviation Authority (CAA) encouraged easyJet to follow the guidelines in EASA's NPA 2012-02 document, which was soon to become AMC20-25. Our operational trial was based on NPA 2012-02 with the final approval and the formal submission based on AMC20-25. Formal approval was obtained in March 2014.

"The new EFB system uses Panasonic Toughpads with fixed mounting devices and various Type A and B software applications," explains Bradbury. "It is used in all phases of flight, but does not currently have any data connectivity with the aircraft, although this is planned for the future."

"The type A applications include Airbus airn@v and Vistair Docunet, while the Type B software includes Airbus Flysmart and the Lido eroute electronic charts functions," adds Bradbury.

Under AMC20-25, easyjet's new EFB solution is classified as portable, with installed EFB resources and Type A and B software.

"The mounting devices feature a power supply and therefore require airworthiness approval," explains Bradbury. The whole system required operational assessment.

Bradbury believes the new EFB guidelines are an improvement on previous regulations. "AMC20-25 offered clearer structure and guidance to both regulator and airline." AC