

EUROPEAN AVIATION SAFETY AGENCY
ELECTRONIC FLIGHT BAG (EFB) EVALUATION REPORT



BOEING CLASS 3 EFB
&
CMA-1410 Class 3 EFB

Revision: 1.3
17 03 2014

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REVISION RECORD

REVISION NO:	DATED	SUMMARY
0	25 April 2006	Initial Issue as a JOEB Report.
1	26 07 2012	Updated Report to include the latest software applications and system evolution to BP 3.7 and 4.4.
1.1	04 10 2012	Updated report including the validation of the performance software application Amended: Chapters (4.2.1)- (4.2.1.1).- (5.3.1.) The CAUTION bullet paragraph 4.2.1 is deleted
1.2	30 08 2013	Attachment CMA-1410 operational evaluation. Vertical bars identify the new content of the main report. Appendix B is new. Minor update in §5.8.3.1 (Emphasis on AMMD during initial training).
1.3	17 03 2014	Update of the report to include windows AMM and enroute applications, and the corresponding new Boeing Blockpoints.

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Dated: 17 03 2014

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ACRONYMS AND ABBREVIATIONS

AMC	Acceptable Means of Compliance
AMMD	Airport Moving Map Display
CBT	Computer Based Training
EASA	European Aviation Safety Agency
EDB	Electronic Document Browser
EFB	Electronic Flight Bag
EFF	Electronic Flight Folder
ELB	Electronic Log Book
EMI	Electromagnetic Interference
FAA	United States Federal Aviation Administration
FDEVS	Flight Deck Entry Video System
FSTD	Flight Simulation Training Device
HMI	Human Machine Interface
ICBT	Interactive Computer Based Training
JOEB	Joint Operations Evaluation Board (JAA term)
LIFUS	Line Flying Under Supervision
LPC	Licence Proficiency Check
MFD	Multi-function Display
NAA	National Aviation Authority
OEB	Operations Evaluation Board (EASA term)
OPC	Operator Proficiency Check
OPT	Onboard Performance Tool
TGL	Temporary Guidance Leaflet

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PREAMBLE

This Report addresses the evaluation of the Boeing / Jeppesen Class 3 EFB conducted at various times between 2003 and 2014. This Issue of the Report is in a changed format to that of the previous Issue.

The first example of the installation of this EFB was on the Boeing B777-300ER and the first JOEB evaluation of the Class 3 EFB was carried out in conjunction with the JOEB established for the B777-300ER aeroplane. However, Boeing requested that the EFB be considered as generic equipment as it was optional equipment and not an integral part of the B777-300ER avionics. The EFB was considered to be applicable to all Boeing aeroplanes and the Boeing Class 3 EFB has subsequently been available for Boeing 737, 747-400, 747-8, 757, 767 and 787 aeroplanes.

This report also covers, in appendix B, the CMA-1410 Class 3 EFB. The CMA-1410 based Class 3 EFB system has been accepted for both line fit and retrofit installations on 737NG aircraft under EASA VSTC(s) 10044973 (retrofit installations), 10045157 (linefit installations), and 10046097 (EFB Core Software).

The Boeing Class 3 EFB System has evolved from Blockpoint 0 at the original evaluation to Blockpoint 3.8 and, coinciding with the release of Blockpoint 3.4, the Blockpoint 4.0 system was introduced that principally included new technology hardware and a Windows operating system upgrade.

Blockpoint 3.x systems using legacy hardware have continued to be developed to the current status at Blockpoint 3.7 whilst Blockpoint 4.x technology has been developed to its current Blockpoint 4.4 status. Blockpoint 3.7 and 3.8 and Blockpoint 4.4 to 4.6 systems are applicable for all Boeing types and variants and, as far as the applications are concerned, they may be considered to be equivalent systems. However, Blockpoint 4.4 to 4.6 systems require the new technology hardware. Other software applications have been developed since the time of the original evaluation and these are addressed in the current version of this Report.

This current evaluation has been performed using the following methods:

- Review of the Jeppesen eLearning CBT EFB Training Programme and the EFB User Guide produced by Jeppesen on behalf of Boeing;
- Desktop review of enhancements and upgrades to the EFB and its software;
- Inspection of the EFB and the conduct of functional tests.

Requirements contained in Annex III to Commission Regulation (EC) No 859/2008 of 20 August 2008 (EU-OPS) paragraphs 1.135(b) and 1.1040 (m) together with EASA Part M Subpart C M.A.306 have been considered together with guidance material in JAA TGL 36 (Approval of Electronic Flight Bags) and Draft AMC 20-25, (Airworthiness and Operational Considerations for the Approval of Electronic Flight Bags), 2009 version. Revision 1.3 of the report deals with the AMM as a type B software application, considering the applicable guidance from the final AMC 20-25 and the associated ETSO-C165a.

Hardware evaluated for use in the Boeing Class 3 EFB system is described in Section 3 of this Report. Software applications evaluated for use with the Boeing Class 3 EFB system is described in Section 4 of this Report.

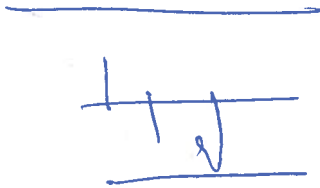
EXECUTIVE SUMMARY

The OEB evaluation found that the Boeing Class 3 Electronic Flight Bags (including the Boeing-CMC Class 3 EFB) and the available software applications as evaluated satisfy the guidelines of JAA TGL 36 and Draft AMC 20-25, 2009 version, and final AMC 20-25 (for the windows AMM). Some areas of compliance are left to the operator are identified in the report.

The Evaluation Team further found the Jeppesen eLearning CBT Training Programme and the EFB User Guide produced by Jeppesen on behalf of Boeing to be suitable for the provision of required EFB training and recommends the operational procedures proposed by Boeing as specified in this Report.

The MMEL for the specific aeroplane type or variant in which the EFB is installed, is the document recommended for approval by EASA.

The EASA-OEB sees no technical objections to the grant by the National authorities of an operational approval of the EFB class 3 for the Boeing aeroplane types listed in paragraph 2 of this Report, and of the CMA-1410 class 3 EFB as detailed in appendix B of this Report, provided the recommendations of the report are taken into account.



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EFB EVALUATION REPORT PART I

1 PURPOSE AND APPLICABILITY

1.1 Purpose

This Report specifies EASA requirements and recommendations applicable to operators seeking Operational Approval to use the Boeing Class 3 Electronic Flight Bag (EFB) under Annex III to Commission Regulation (EC) No 859/2008 of 20 August 2008 (referred to in this Report as “EU-OPS”), and it additionally provides guidance to National Aviation Authorities (NAAs) responsible for granting such approvals.

1.2 Applicability

This Report is applicable to the Boeing Class 3 EFB at Blockpoint 4.6 and previous and also to legacy systems at Blockpoint 3.8 and previous except where stated in this Report. The Boeing Class 3 EFB may be installed in all Boeing types and variants. Findings of compliance and recommendations of approval contained in this Report are consistent with the guidance specified in JAA TGL 36 and Draft AMC 20-25 (2009 Version). Revision 1.3 of the report deals with the AMM as a type B software application, considering the applicable guidance from the final AMC 20-25 and the associated ETSO-C165a.

This Report assumes that appropriate airworthiness certification for the installation of the EFB is, or will be, accomplished.

The CMA-1410 Class 3 EFB is covered in appendix B.

This report includes:

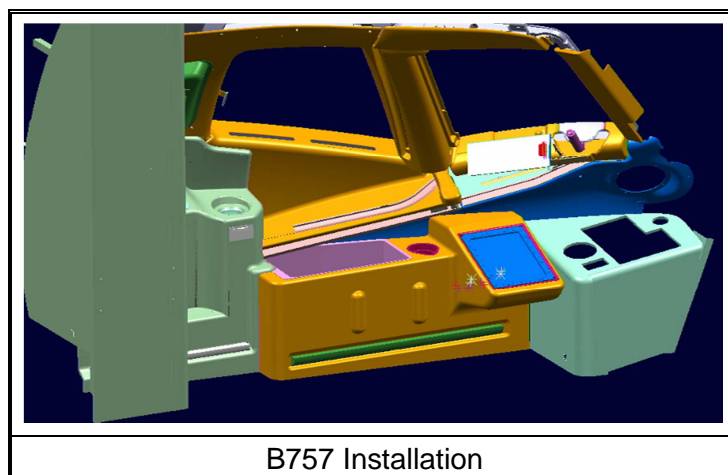
- Minimum requirements which should be applied by the NAA when considering the grant of an Operational Approval;
- Information which is advisory in general, but is mandatory for particular operators if the designated configurations apply and if approved for that operator.

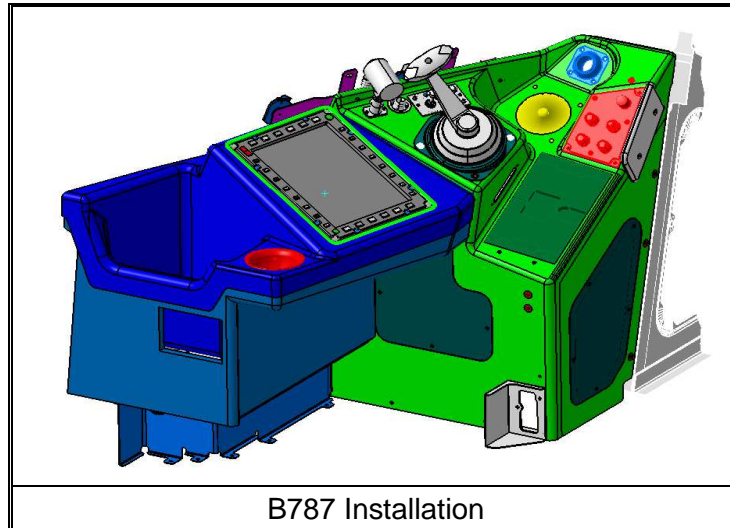
Various sections within this Report are qualified as to whether compliance is required under EU-OPS or whether it is advisory in nature. The system configuration described in this document is intended to be generic, meaning that it does not describe a configuration unique to any specific applicant or aeroplane type or variant unless stated.

Provisions of this Report are effective until amended, superseded, or withdrawn.

2 GENERAL DESCRIPTION OF THE EFB SYSTEM

The Boeing Class 3 Electronic Flight Bag (EFB) is intended for installation on Boeing 737 / 747 / 757 / 767 / 777 and 787 aeroplanes and variants.





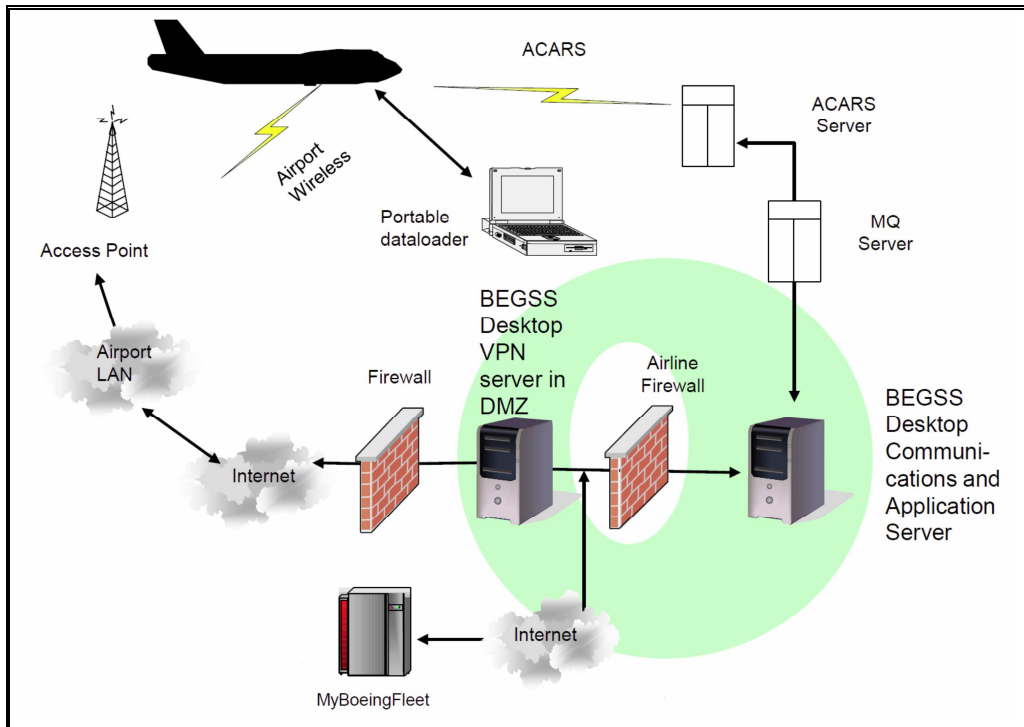
The EFB system provides the flight crew with display and user-interface devices with which to access the functional capabilities of the EFB System.

Global Positioning, Flight Management, Air Data and Inertial Reference functions provide the basic inputs required by the EFB system. Optional aeroplane interfaces include: a flight deck printer, ACARS data link (via AIMS / DCMF), Flight Deck Entry Video Surveillance System (FDEVSS) system, Terminal Wireless LAN Unit (TWLU), and Network File Server (NFS). When installed on B777 and B787 aeroplanes, the EFB system also interfaces with the flight deck Cursor Control Devices (CCDs).

Functionality of an installed Flight Deck Printer is dependent on the type of printer installed. An ARINC 740 (narrow) printer or an ARINC 744 (wide) printer is able to print text only. An ARINC 744A (wide) printer is able to print both text and graphics. A printer may be connected directly to both EFBs via an ARINC 429 connection and to the right EFB via an Ethernet connection. If a Network File Server (NFS) is installed, the printer's Ethernet connection is to the NFS.

An optional NFS is a key component of the e-Enabling System. The NFS is intended for use on Boeing 737 / 747 / 757 / 767 / 777 and 787 aeroplanes where it is installed in an Electronic Equipment (EE) bay location. It is part of a system architecture designed to expand the network connectivity of the EFB system and to provide operators with a platform to host software applications with airborne components. Airborne components of aeroplane applications can reside on either the EFB or the NFS. Their ground peers can reside on a Boeing ePlane Ground Support System (BEGSS) installation, within the operator's own management system, or on MyBoeingFleet.

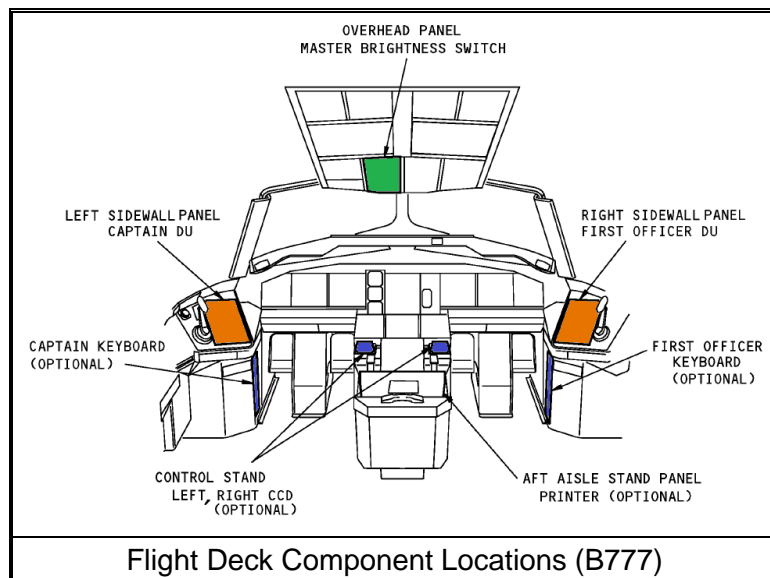
BEGSS is a ground communications system, hosted at the operator, and it enables all EFB communications modes. BEGSS supports operator management of fleet communication over the wide variety of networks utilized. BEGSS provides a secure means of messaging, data transfer and staging of loadable software parts over shared and open Internet Protocol (IP) networks. It also provides an ACARS messaging capability. It offers an interface to other operator systems and applications that communicate directly with EFB-provisioned aeroplanes.



2.1 Flight Deck Features

The EFB system is comprised of several devices located on the flight deck. Others are located in the Electronic Equipment (EE) bay. Crew interface devices consist of the following components:

- Two Display Units (DU);
- Two External Keyboard Ports;
- Two keyboards (optional);
- One Data Load Port.



The DUs are installed in the flight deck sidewalls forward of each pilot, while the keyboard and data load ports are installed in the flight deck according to aeroplane type and variant. Each DU interfaces with one of the dedicated Electronic Units (EUs) located in the Electronic Equipment (EE) Bay.

3 EFB HARDWARE

3.1 Electronics Unit

The Electronics Unit (EU) operates as the central processing unit for the Electronic Flight Bag (EFB).

The aeroplane has two EUs (left and right) that operate independently, but are connected together by Ethernet. Each EU contains the hardware, operating systems, and software necessary to calculate and show data on the applicable Display Unit (DU).

The EUs are rack mounted in the EE bay and are line-replaceable. There is no hardware difference between the left and right EU. They are interchangeable provided the software is identical.

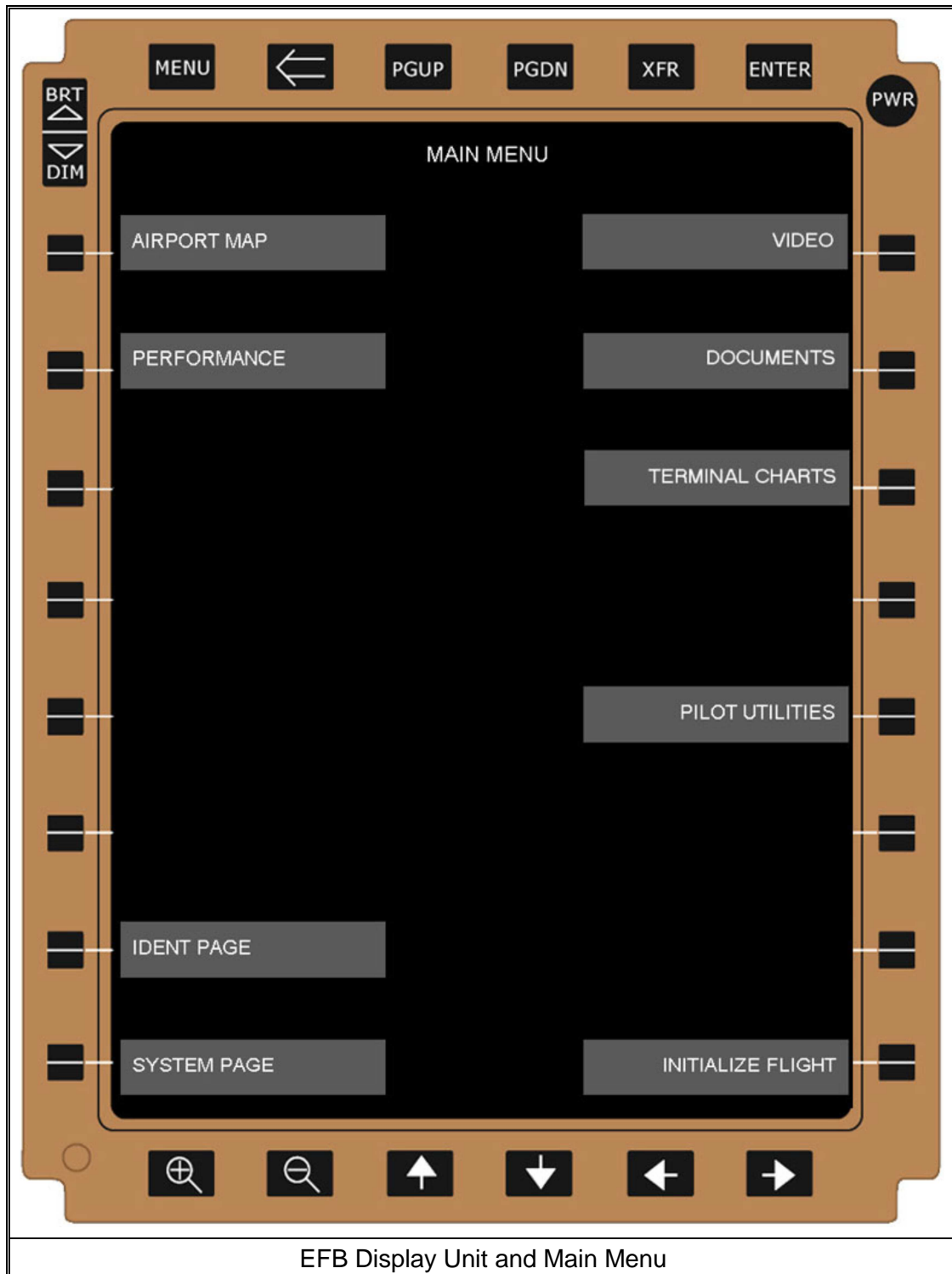
The rack location of each EU determines the right or left designation. The EU-L tray always connects to the captain's DU. The EU-R tray always connects to the first officer's DU.

3.2 Display and Controls

Interaction with the EFB display applications can occur through the display bezel keys, a separate cursor control device (B777 and B787 only), integral touch screen panel installed as part of the EFB DU LCD glass assembly or an optional external QWERTY keyboard. These controls are identical for each pilot and both pilots have equal access to any of these controls at their option. On the touch screen, finger contact with the screen highlights the desired function and releasing contact with the screen selects the function.






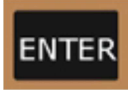





3.2.1 Display Unit



Each EFB Display Unit (DU) consists of an active matrix LCD (LED backlit in Blockpoint 4.4 DUs) surrounded by a bezel. The bezel consists of pushbutton dedicated function keys, pushbutton line select keys, a rocker switch to control display brightness, a power switch to turn display backlighting on/off and a bezel light sensor for automatic control of display brightness. Depending on the aeroplane model, DU brightness may also be controlled by a master brightness control.



3.2.1.1 Bezel Keys

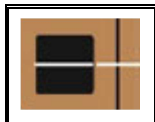
Twelve pushbutton dedicated function keys, located across the top and bottom of the EFB bezel, are used as follows:

KEY	FUNCTION
TOP	
	Immediately displays the top-level EFB Application Manager Main Menu on demand and overrides all other operations in flight mode only (when <i>not</i> in ground maintenance mode).
 (Back)	Each actuation returns user to the previous navigation level <i>within</i> the active application, but does not navigate from the application back to the Main Menu. At the highest navigation level in the active application, the key is non-functional.
	Displays the next page for those displays that exceed one display page in length. PGUP displays the next complete page, so that no lines or text from the previous page are displayed.
	Displays the previous page for those displays that exceed one display page in length when the display is at page 2 or higher. PGDN displays the previous complete page, so that no lines or text from the previous page are displayed.
	The first actuation of the XFR key slaves the screen to the (video) image of the off-side EFB display. No manipulation of the XFR displayed image is possible (from the side requesting XFR). The second actuation of the XFR key returns the user to his own on-side display and all its functions. When in XFR mode, only the MENU and XFR keys are active. Pressing the MENU key performs its normal function and cancels the XFR function.
	Executes the function of the current focus item.
	Turns the EFB backlight on and off.
BOTTOM	
 (Zoom In)	Enlarges the display image through x levels of zoom. The centre of the display remains centred. Default levels of zoom and the initialization default zoom level are application dependent.
 (Zoom Out)	Decreases the display image through x levels of zoom. The centre of the display remains centred. Default levels of zoom and the initialization default zoom level are application dependent.
	Within a format or a list, moves the focus point up. (If a list extends beyond the upper edge of the screen, the list scrolls down so that the focus point just remains on the screen). Also used to pan graphic presentations, such as airport maps or terminal area charts.
	Within a format or list, moves the focus point down. (If a list extends beyond the lower edge of the screen, the list scrolls up so that the focus point just remains on the screen). Functions as a tab when selection lists are oriented horizontally. Also used to pan graphic presentations, such as airport maps or terminal area charts.

KEY	FUNCTION
BOTTOM (continued)	
	Within a format or horizontally-oriented set of selections, moves the focus point to the left. Also used to pan graphic presentations, such as airport maps or terminal area charts.
	Within a format or horizontally-oriented set of selections, moves the focus point to the right. When selection lists are oriented vertically, this key functions as a tab. Also used to pan graphic presentations, such as airport maps or terminal area charts.

Note: Not all keys are active for each application.

Sixteen side-mounted line-select keys (LSK), located along the left and right sides of the EFB bezel (eight on each side) activate the displays or functions described by the labels on their corresponding soft (programmable) menu buttons, which are centrally aligned adjacent to each key.



Each EFB is equipped with an individual display brightness control rocker switch, mounted on the upper left corner of the bezel, to provide for manual adjustment of the DU brightness. Pressing on the bottom portion of the rocker decreases the brightness, while pressing on the top portion of the rocker increases the brightness.



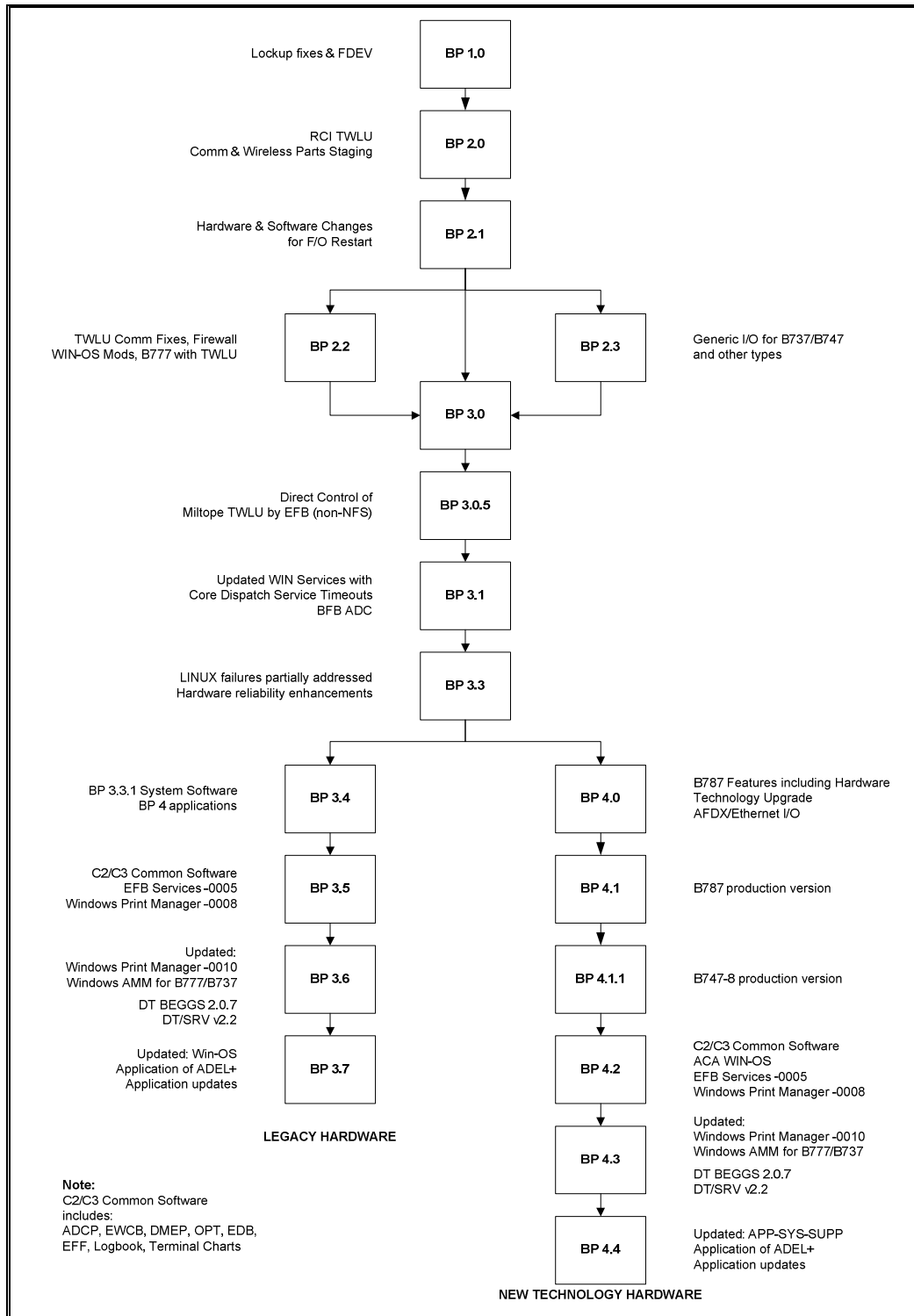
A (bezel) light sensor mounted in the lower left hand corner of the bezel provides automatic brightness control for the EFB display. The EFB automatic brightness control function controls display luminance as a function of inputs from these four sources: DU brightness control manual input, the bezel light sensor, master brightness control inputs, and remote light sensor input.

The PWR button controls the display back light only. Pressing the PWR button once turns the display backlight off but the system remains active. Pressing the PWR button a second time instantaneously turn the display backlight back on, restoring the last setting set by the pilot using the BRT/DIM switch to control the backlight intensity.

3.3 Version

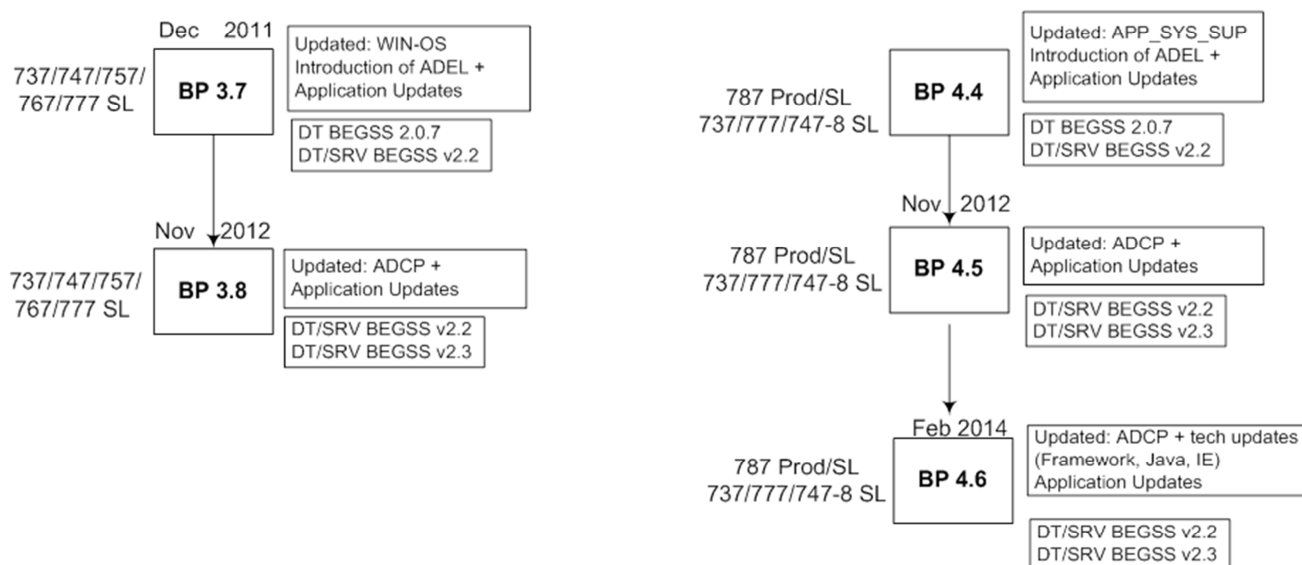
The Boeing Class 3 EFB system is currently at Blockpoint (BP) 3.7 for legacy hardware installations and at BP 4.4 for the new technology hardware that was first introduced at Blockpoint 4.0 (coinciding with the release of BP 3.4) and which is now standard for all new-build Boeing types and is available for retrofitting to other aeroplanes.

3.3.1 Block Point Evolution Highlights



(Continued on next page)

Block Point Evolution (continued):



3.4 Components

The following major software components are applicable to the Boeing Class 3 EFB.

3.4.1 *Blockpoint 3.8 Loadable Software Aeroplane Parts (LSAPS)*

COMPONENT DESCRIPTION	LSAP NUMBER
DACORE	ACZ53-8500-0475
ADM	ACZ57-8600-0450
FLIGHT_MM	ACZ56-9363-0450
APP_SYS_SUP	ACZ5A-8568-0450
WINDOWS OS	BFB34-W2KT-0008
ADC APPLICATION	BFB51-ADCP-0010
ADC SUPPLIER CONFIG	BFB50-ADCS-0012
EFB SERVICES	BFB52-ESRV-0006
EFB WIRELESS SW	OPT5B-EWCB-0407
WPM APPLICATION	BFB4E-WPMA-0012
WPM CFG AND DRIVERS	BFB49-WPMC-0006
DDM APPLICATION	JEP30-DMEP-B010

3.4.2 *Blockpoint 4.6 LSAPS*

COMPONENT DESCRIPTION	LSAP NUMBER
DACORE	ACZ34-7YWU-0110
ADM	ACZ26-811F-0110
FLIGHT_MM	ACZ27-811G-0110

APP_SYS_SUP	ACZ24-805A-0145
WINDOWS OS	ACZ53-8241-0150
MAINTENANCE MODE	ACZ5F-8049-0130
ADC APPLICATION	BFB53-ADCP-0012
ADC SUPPLIER CONFIG	BFB50-ADCS-0012
EFB SERVICES	BFB5C-ESRV-0008
EFB WIRELESS SW	OPT54-EWCB-0408
WPM APPLICATION	BFB4F-WPMA-0013
WPM CFG AND DRIVERS	BFB49-WPMC-0006
DDM APPLICATION	JEP43-DMEP-0011

3.5 Operating System and Version

This EFB until BP 4.4 and 3.7 has been demonstrated with Windows XP (BP 4.4) and Windows 2000 (BP 3.7) for all software applications except the Airport Moving Map Display (AMMD).

Until BP 4.4 / 3.7, the AMMD is hosted on a Linux partition and is subject to airworthiness certification.

A Linux partition resides on each EU and is required for full Class 3 EFB operation

On BP 4.6 and 3.8 the AMM application is hosted on Windows XP.

3.6 EFB Mounting System and Stowage

Not applicable.

3.7 Power Source

The EFB system interfaces to 115 VAC (essential level) busses for electrical power on all relevant aeroplanes except the B787 where power is supplied by an Electronic Unit (EU). The EU converts 115Vac/400Hz power from the main power bus for use internally by the EU and to provide 28Vdc power used by the associated DU. Each of the two EUs is capable of supplying electrical power to only a single DU.

3.8 Data Connectivity

See paragraph 3.13.

3.9 Lithium Battery Compliance

Not applicable.

3.10 Electromagnetic Interference (EMI)

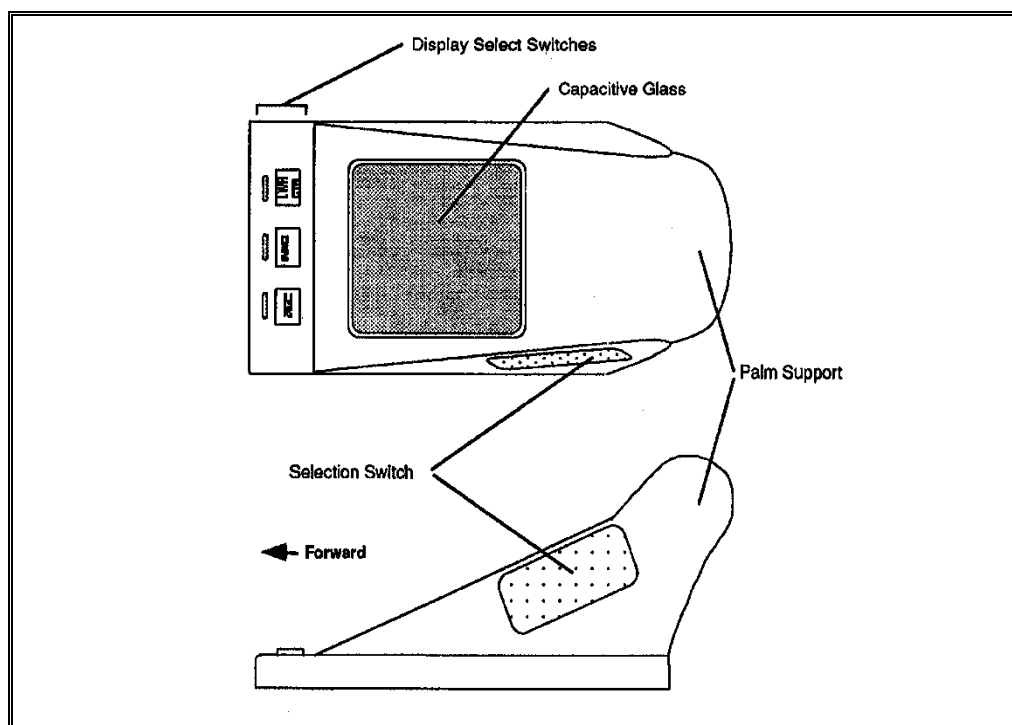
The Boeing Class 3 EFB is installed avionics and the demonstration of EMI compliance is a function of avionics certification.

3.11 Rapid Depressurization Testing

The Boeing Class 3 EFB is installed avionics and the demonstration of Rapid Depressurisation compliance is a function of avionics certification.

3.12 Use of Installed Resources

On B777 and B787 aeroplanes only, interaction with and selection of the various functions of the EFB applications may also occur through the use of the external Cursor Control Device (CCD). On the CCD, selection of the various functions on an EFB display is via the selection switch.



The SIDE display selection switch activates the CCD to the onside pilot EFB display unit. To be consistent with other aeroplane system displays, the following techniques are not used with the CCD: press and move (drag function), double-click, multi-click, double-press, and multi-press.

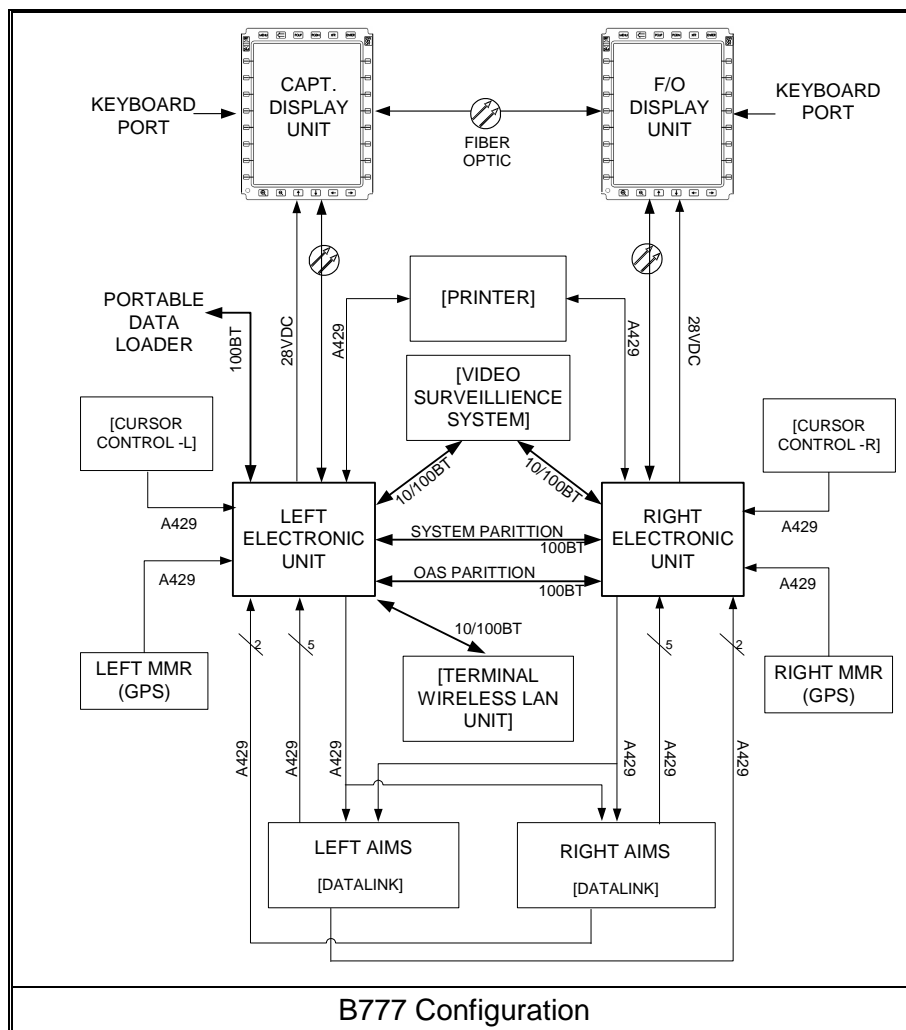
The DU integrated touch screen, however, allows the use of a drag function when interacting with displayed scroll bars and for drag-panning graphical presentations (such as the static map in the Airport Moving Map application).

3.13 EFB System Configuration

Two aeroplane configurations are available for EFB installation. The basic installation is EFB with optional text printer, Terminal Wireless LAN Unit (TWLU) and flight deck entry video surveillance. The optional configuration adds a Network File Server to enable connection to cabin services and additional communication capabilities.

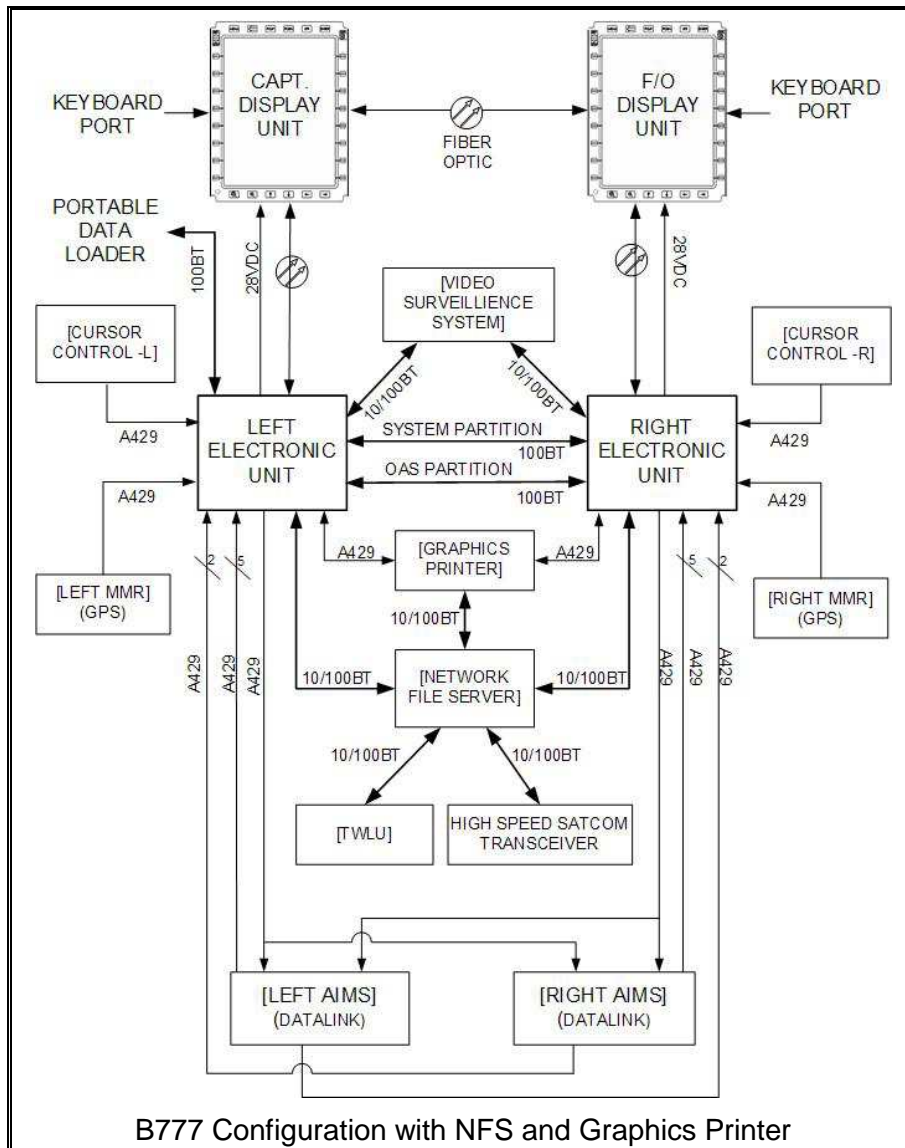
The two configurations are shown in the following schematic diagrams.

3.13.1 Basic Configuration



In this configuration, the EFB interfaces include analogue discrete signals, digital ARINC 429 signals, ARINC 664 Ethernet, as well as fibre optic point to point digital / video communication. The EFB is designed to work in multi-modes. The basic configuration on other Boeing types is similar.

3.13.2 Optional Configuration



In this configuration, each Electronic Unit Operationally Approved Software (OAS) Partition has two 10/100 BASE-T Ethernet ports capable of interfacing to operator selectable and compatible Ethernet capable devices. Devices which have previously been connected to these ports are the Video Surveillance System and the Terminal Wireless LAN Unit. BP3 and later offers connection to the NFS and Graphics Printer as additional optional Ethernet devices. The optional configuration on other Boeing types is similar.

3.14 Airworthiness Approval

Airworthiness approval of the Boeing Class 3 EFB on B787, B747-8, B777 and B737-NG/BBJ aeroplanes is the subject of the type certification as installed avionics.

For other Boeing types and for retrofits, airworthiness approval is by a Supplemental Type Certificate (STC).

4 SOFTWARE APPLICATIONS

4.1 Type A Applications

- Electronic Document Browser

The OEB evaluation team found that this application satisfied the guidance of JAA TGL 36 and Draft AMC 20-25.

4.1.1 *Electronic Document Browser*

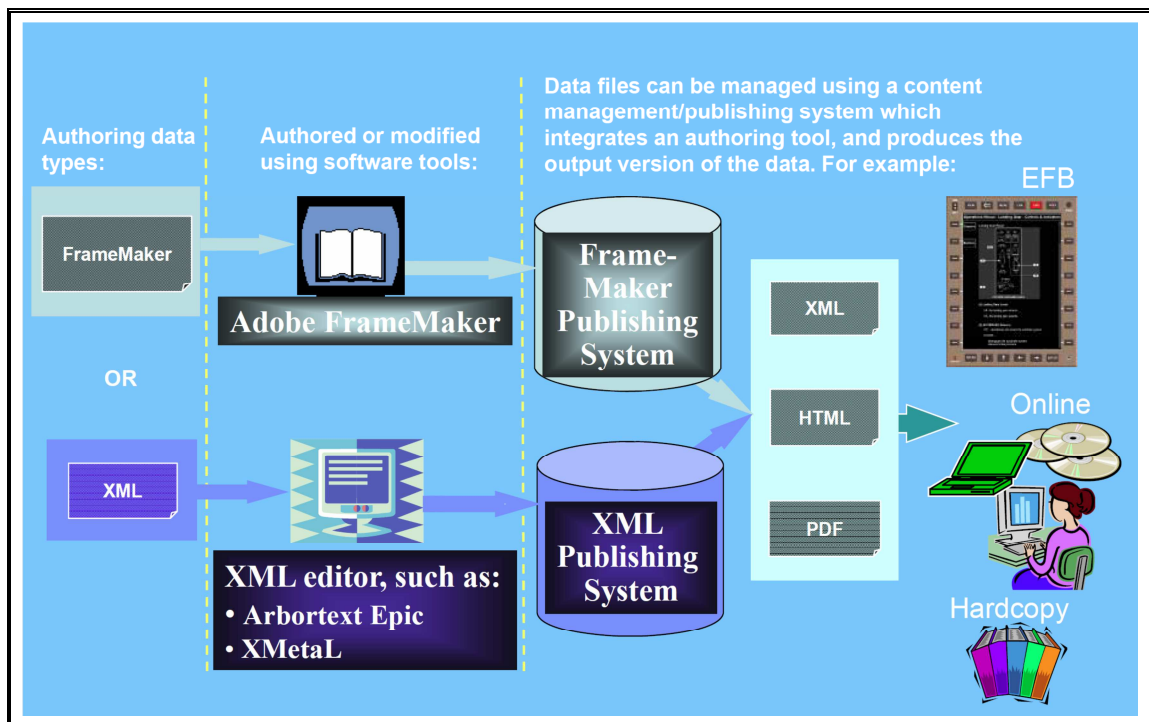
The Electronic Document Browser (EDB) application enables flight crew to view and search documents in a variety of electronic formats such as PDF, HTML and XML.

Documents intended for viewing on the EDB are uploaded through a web-based EDB Administration Tool, which manages configuration settings and effectivity dates and groups documents into EDB libraries. The Administration Tool then prepares the libraries for uploading to the aeroplane and to a ground viewer application.

Once documents are loaded on the EFB or ground viewer, users have access to a variety of search and linking tools that provide easy navigation through the flight library. Text and graphics zoom capability and day / night display modes provide readability in a variety of conditions and by individuals with various visual acuities.

The content of each document is determined by the operator. Boeing provides information on how to prepare documents for seamless operation in each supported format. With the presence of the Graphics Flight Deck Printer, text and graphics in EDB documents may be printed. With the presence of the optional text-only Flight Deck Printer, only text in EDB documents may be printed.

4.1.1.1 *Digital Data Authoring*



4.2 Type B Applications

- Onboard Performance Tool (OPT);
- Terminal Charts;
- Electronic Log Book (ELB);
- Electronic Flight Folder (EFF);
- Flight Deck Entry Video System (FDEVS).

The OEB evaluation team found that the applications listed above satisfied the guidance of JAA TGL 36 and Draft AMC 20-25. All were found capable of meeting the requirements of EU-OPS subject to being configured appropriately.

4.2.1 On-Board Performance Tool (OPT)

OPT is designed to be used as the primary means of determining runway-specific take-off and landing performance, and for determining weight and balance information. The Take-Off Performance feature is active in the default configuration; however, the Landing Performance feature and the Weight and Balance feature are options that must be activated by the operator.

On B777 and B787 aeroplanes, data may be exchanged with the FMC.

The configuration and policies governing the use of OPT are set by the operator's EFB Administrator who it is recommended should be a qualified performance engineer or supported by a qualified performance engineer.

For take-off, both EFBs are used to calculate performance in order that an independent cross-check of the output can be conducted. The Landing Performance feature can be used to determine landing performance at the destination aerodrome before departure or the calculation may be delayed until in-flight (prior to the approach phase) to account for any changes at the destination or for failed equipment that may occur whilst en-route.

Weight and Balance calculations allow the flight crew to determine the aeroplane's mass and its centre of gravity (CG) position. Proper loading data (such as passengers, baggage, cargo, and fuel) input is required for the performance tool to produce accurate mass and CG values for the FMC.

4.2.1.1 Special Considerations for Performance Applications

The original performance application for the Boeing Class 3 EFB was based on the Boeing Laptop Tool (BLT) and this was subject to a data verification process conducted by the OEB evaluation team in respect of the Boeing 777-200. The method was to compare outputs for take-off and landing performance derived from the performance application across the allowable envelope with the certified AFM-DPI data. The results were found to be acceptable. However, the BLT-based version of the performance software is no longer available and it has been replaced by an application based on Boeing's Onboard Performance Tool (OPT). Most of the differences between the two applications will be transparent to the user.

OPT version 3.5 was subject to a new evaluation in 2012.

This evaluation has covered the performance calculation verification methodology, and the software HMI.

The OPT verification methodology and the performance computation accuracy are deemed satisfactory, provided that the operator uses Boeing SCAP databases from the certified electronic AFM and implements proper crew training and procedures (refers to §5.3 and §5.8).

Some suggestions were discussed and agreed upon concerning the HMI, and will be implemented in future software releases.

For both BLT and OPT based performance applications the weight and balance module was not fully evaluated. Operators should ensure, and NAAs should verify, that appropriate policies and procedures are in place to ensure that issues involved with the use of derived and alternate Centre of Gravity (CG) positions are addressed before operational approval is granted.

4.2.1.1.1 Administration of OPT

The OPT Administrator module is configured by the selection of a number of options. The OEB evaluation team found that OPT was capable of being configured in compliance with EU-OPS but each option must be configured appropriately to maintain compliance with EU-OPS Subparts F and G.

The operator should ensure, and the NAA should verify, that OPT is configured appropriately to maintain compliance with EU-OPS and/or local performance regulations. NAAs should consider whether it is appropriate for the Administrator module to be made available to flight crew or whether access should be restricted to the Administrator. The OEB recommends that flight crew should not be allowed access to the Administrator module unless they have received comprehensive training on the appropriate configuration of the various options.

4.2.1.2 Advisory Data

The use of advisory data is a matter for operator policy, NAA operational approval and national legislation. The status of such operational data must be determined to be appropriate before operational approval is granted. Similarly, NAAs may wish to consider requiring that flight crew be clearly advised of the status of such data.

4.2.2 Terminal Charts

The Terminal Charts application displays Terminal Area procedural charts and chart NOTAMs to the pilot. The charts are pre-composed digitally to replicate paper Terminal Area charts. The Terminal Charts button on the EFB MAIN MENU page leads to the display of the Terminal Charts application. ORIGINATION and DESTINATION data are pre-populated within the application after a FLIGHT INIT event. Upon initial selection of the application after a FLIGHT INIT, the ROUTE SETUP screen is displayed. The pilot can check the ORIG and DEST information in the ROUTE SETUP page as well as enter up to four ALTERNATE airports. The pilot can also SEARCH for an airport in the Terminal Charts database following the entry of any search string.

The main Terminal Charts page is the CHART CLIP page. The CHART CLIP page borrows from the familiar pilot chart clip metaphor to display pilot selected chart clips for Origin, Destination, and all Alternate aerodromes. For each aerodrome, the main airport chart (10-9, 10-8, etc.) and chart NOTAMs for the airport are pre-selected into the chart clip. The pilot can add or remove individual charts to or from the chart clip through the EDIT CHART CLIP function. The EDIT CHART CLIP function also allows pilots to PREVIEW individual chart content for inclusion into the chart clip. In the EDIT CHART CLIP mode, charts are organized by Chart Index number and all chart procedures are clearly listed on PROCEDURE ID menu buttons. Charts can also be filtered according to chart type (AIRPORT, INFORMATION, APPROACHES, DEPARTURES, ARRIVALS). Charts in the CHART CLIP may be

printed.

After the pilot populates his or her CHART CLIP with selected charts, the charts can be viewed at any time by selecting the appropriate PROCEDURE ID menu buttons. Once displayed, the zoom feature allows zoom -in or zoom-out, panning using either arrow bezel keys or touch screen or rotated on the EFB DU. The charts can be viewed in order using the PGUP and PGDN bezel keys. Charts are automatically ordered according to phase of flight.

From the CHART CLIP page, the pilot also has access to an AIRPORT SEARCH page as well as a CHART UTILITIES function that provides NEAREST AIRPORT information based on GPS position data, as well as a CHART CLIP sharing function that allows one pilot to select the manually composed CHART CLIP data for Origin, Destination and alternate airports from the offside EFB. For instance, the First Officer can manually pre-populate chart clips for the to-be-briefed airports and the Captain can then review the First Officer's chart clips and automatically populate the chart clips on his own EFB based on the First Officer's chart selection.

Airport diagram data (10-9 chart or equivalent) is available with a single button press from the Airport Moving Map application.

4.2.3 *Electronic Logbook (ELB)*

The Electronic Logbook (ELB) creates an information flow between flight and maintenance operations. It consists of the following features:

FEATURE	DESCRIPTION
Manage Flight Log Records	This feature enables flight crews to create and view flight log records.
Manage Fault Reports	This feature enables flight crews and maintenance personnel to record fault reports in the technical and cabin logbooks. There will be two methods to find a fault description, using an ATA chapter-based Fault Locator Tool or a textual based search.
Manage Maintenance Actions	Three types of maintenance actions can be recorded in the system: <ul style="list-style-type: none"> • Deferrals; • Closing Actions; • Information.
Manage Service Logs	The Service Log Entry is used to capture maintenance activities including the replenishment of engine oil and hydraulic fluid.
Manage Maintenance Release	The system will serve as the official Technical Log for the aeroplane and can be used to document the airworthiness release. A release can only be performed after all Technical Log fault reports have been deferred or rectified.
Reviewing Logbook and Fault History	The system will store Technical and Cabin Log data in the aeroplane and ground databases. Each application will provide a way for users to browse or search past logbook records.
Signing Records	Any record that will be submitted as an official Technical Log record will require a signature.
Printing	The system will allow the printing of Technical and Cabin Log records.

ELB is contains a number of parameters that are fully configurable by the operator. The operator should ensure, and the NAA should verify, that any customisation applied does not compromise compliance with EASA Part M.

4.2.3.1 Communication Links

The ELB System supports both ACARS (VHF, HF, SATCOM) and IP-based communication (Gatelink, Satellite) links between the aeroplane and the ground.

Any airborne ELB component application exchanges messages with the ground (ELBG) through e-Communication Management Function (eCMF) middleware, located on each EFB and on the cabin server. The eCMF Service selects the optimal (with respect to business rules) communication channel for data transmission. An eCMF Client hosted on the Desktop or Server Boeing EFB Ground Support System (BEGSS) receives and routes messages to the ELB ground application. ELBG acknowledges the arrival of new logbook content via messages back to the originating aeroplane.

ELBG hosted at the airline exchanges messages with the airborne ELB component applications through the same e-Communication Management Function (eCMF) infrastructure. The eCMF Service at Desktop or Server BEGSS selects the optimal (with respect to business rules) communication channel for data transmission from ELBG to a particular aeroplane. The eCMF Client at the recipient aeroplane routes an acknowledgment message back to BEGSS and ELBG for received messages.

4.2.3.2 Electronic Signatures

The ELB System provides for the electronic signing of various forms of acceptance, certification and confirmation of authority in relation to fault reporting and maintenance action.

The OEB team found that the ELB system met the requirements for electronic signatures in terms of:

- Their uniqueness: A signature should identify a specific individual and be difficult to duplicate;
- Their significance: An individual using an electronic signature should take deliberate and recognizable action to affix his or her signature;
- Their scope: The scope of information being affirmed with an electronic signature should be clear to the signatory and to subsequent readers of the record, record entry, or document;
- Their security: The security of an individual's handwritten signature is maintained by ensuring that it is difficult for another individual to duplicate or alter it;
- Their non-repudiation: An electronic signature should prevent a signatory from denying that he or she affixed a signature to a specific record, record entry, or document. The more difficult it is to duplicate a signature, the likelier the signature was created by the signatory;
- Their traceability: An electronic signature should provide positive traceability to the individual who signed a record, record entry, or any other document.

For records requiring user identity validation, a user will type in their company issued unique personnel employee identifier and a personal identification number (PIN) known only to the user. A cryptographic hash of the combination of these two will be applied to a maintenance record and act as an electronic signature for that record. The PIN number is never stored or transmitted. The signature will be sent to the ground system to be validated in real time. The feedback (Confirmed or Sign Failed) will be provided immediately back to the user onboard the aeroplane. The user will have the option to re-apply his signature information or print the record for physical signing.

After the validation check has been performed, the logbook record will be marked with the result of the validation. If the result is a "match" (Confirmed) then the record will be marked as being validated and no further action is required. If the result is that they do not match (Sign Failed), then the record will be

marked as being invalid. The user must then resolve the failed result.

Invalid records require the user to re-apply his electronic signature to the record, or to print it onboard and sign with a pen.

When problems with aeroplane to ground system communication are encountered, preventing transmission of the records to the ground for validation, then the user must use the Paper Sign process. He must print and physically sign two copies of the records he entered. One copy of any Paper Signed record will remain with the aeroplane and the other will be kept on the ground for return to the operator.

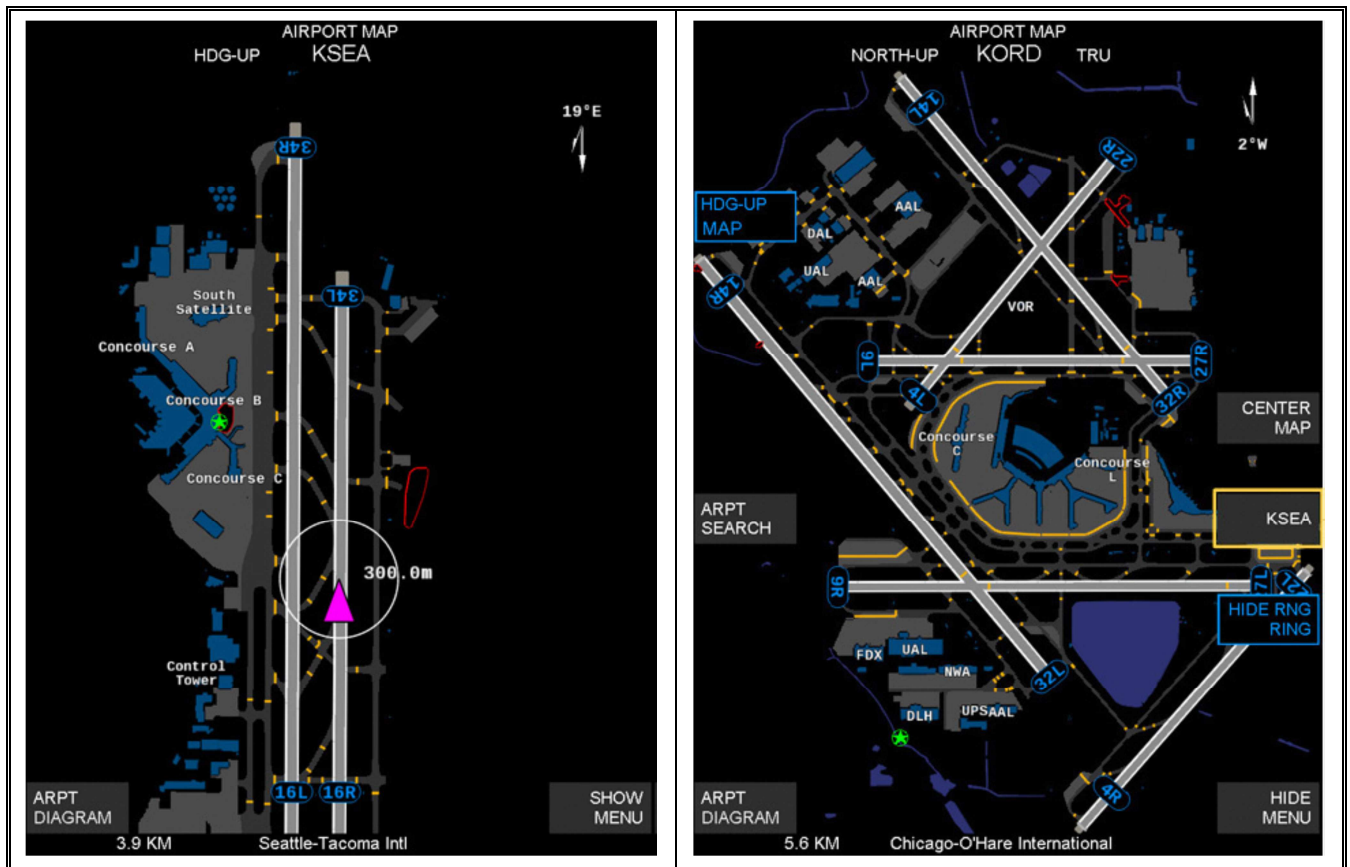
4.2.4 *Airport Moving Map Display (AMMD) – Windows (from BP 4.6 / 3.8)*

The airport moving map application running under Windows has been considered as a type B application and evaluated against the guidance of AMC 20-25 and ETSO-C165a.

The Airport Moving Map Display (AMMD) has two modes for displaying an airport map:

- In Moving Map mode, the taxi map is in a Heading-Up orientation. That is, the map moves, translates, and rotates, under a stationary aeroplane symbol to show the aeroplane's relative position on the airport. The aeroplane symbol position and orientation is fixed with respect to the viewing area. The aeroplane must be on the ground at the airport being viewed and the EFB must be receiving valid heading and position input to use this mode.

- In Static Map mode, the aeroplane symbol moves on a stationary map that is orientated North-Up. If valid aeroplane position and heading information is not being received or if the aeroplane is not on the ground at the airport selected for viewing, the aeroplane symbol does not appear (see below right). However, the map is still available for viewing.



The page that displays when Airport Map is selected depends on the aeroplane location and whether it is in the air or on the ground:

- If the aeroplane is on the ground at the origin airport, and the origin airport is defined in the Taxi Map Database, the AMMD will display the origin airport in Moving Map mode.
- If the aeroplane is in the air and the destination airport is defined in the Taxi Map database, the AMMD will display the destination airport in Static Map mode.
- If the aeroplane is in the air and the destination airport is not defined in the Taxi Map database, the AMMD will display the Search Airport display.
- If the aeroplane is on the ground at the destination airport, and the destination airport is defined in the Taxi Map database, the AMMD will display the destination airport in Moving Map mode.

Upon flight initialization (INITIALIZE FLT (Menu button)), the AMMD receives information about the new flight from the aeroplane's FMC (If the FMC was previously set up and the route was activated and executed). This information includes both the origin and destination airports. The new flight information received at flight initialization effectively removes all previously stored flight information, including the origin and destination airports for the previous flight for those airports. Flight closeout does not affect this application.

In general, the AMMD line select keys on the left side of the display take the user to a different screen,

while those on the right side manipulate the view of the current page.

4.2.4.1 *Intended Use*

Flight crew must use existing normal taxi procedures and visual observation of external references as the primary means of taxi navigation. The AMMD is intended as a supplemental flight crew aid to provide increased positional awareness to support taxi planning and assist in monitoring taxi progress and orientation. This capability must incorporate, or be supplemented by, applicable operational information from electronic or paper airport diagrams and any applicable NOTAMs. Reference to an airport diagram and NOTAMs provides the pilot with information (e.g. radio frequency change points, taxiway weight restrictions) relevant to own-ship operation on the aerodrome movement areas. Runway, Taxiway, Ramp, Concourse and Gate identifiers on the airport map aid the flight crew to do either of the following:

- Cross check the ATC cleared taxi route using external visual references;
- Ascertain an appropriate taxi route to the runway, ramp, or the terminal, in the absence of specific taxi instructions.

The AMMD is **NOT** intended to replace outside visual references, the required paper or digital aerodrome diagrams (10-9 chart etc.), nor to provide taxi navigation guidance. Specifically, the AMMD is **NOT** intended to enable:

- A pilot to establish the own-ship position or orientation on the aerodrome solely by reference to the airport map;
- Taxi operations without adequate external visual references (poor weather or low visibility);
- Taxi operations below normal approved weather minima;
- Initiation or termination of a turn or stop by reference to the depicted own-ship position on the aerodrome map.

4.2.4.1.1 *On the Ground*

Crews must use normal taxi procedures and use direct visual observation from the cockpit window as the primary taxi navigation reference for planning and initiating turns and required stops etc. During AMMD use, the flight crew are expected to detect any significant difference in displayed and actual own-ship position by cross-checking displayed position with outside visual references, such as signage and geometry. The AMMD enhances own-ship position awareness and can be used by the crew to:

- Aid taxi planning per the ATC assigned route;
- Monitor taxi progress and direction;
- Cross-check present position, upcoming turns and required stops (pilot not taxiing).

4.2.4.1.2 *In-Flight*

The pilot briefing the approach and landing may review the airport diagrams (e.g. 10-8, 10-9) and then display the Airport Map as a visual aid to discuss runway exit planning, runway length, width, the probable taxi route, restrictions, and NOTAMs. The other pilot may also display the Airport Map during the briefing, as required, to gain a mutual understanding of the plan.

Upon completion of briefing of the runway exit plan and selecting the appropriate zoom level for viewing, the pilot may “arm” the Heading-Up mode which will enable the application to automatically activate upon touchdown.

4.2.5 *Electronic Flight Folder (EFF)*

The Electronic Flight Folder (EFF) provides information to the pilot in the form of flight folders that can contain the following topics:

- The Operational Flight Plan (OFP);
- Weather information;
- NOTAM information;
- Loadsheet information;
- NOTOC.

Each topic is assigned a button on the EFF – HOME page.

Data input to topics such as the OFP is via pilot manual input or from automatic avionics functions. On B777 and B787 aeroplanes, data may be exchanged with the FMC.

EFF is fully configurable by the operator. The operator should ensure, and the NAA should verify, that any customisation applied does not compromise compliance with EU-OPS requirements such as OPS 1.1055 and 1.1060.

4.2.6 *Flight Deck Entry Video System (FDEVS)*

The video display is used to verify the identity of persons requesting flight deck access while the flight deck door is locked.

4.2.7 *Enroute Application (EAA)*

The intended function of the enroute application is to provide the flight crew with access to the same information as contained on enroute paper charts. The application may automatically display the chart relevant to the airplane current position and phase of flight if configured by the company, but not the ownship symbol. The enroute application is not intended to be used for navigation guidance.

The primary operational mission of the enroute application is to provide aeronautical information of the enroute airspace structure and data to support the safe and effective conduct of the flight.

4.3 *Type C Applications*

- Airport Moving Map Display (AMMD) (not an EFB application on B787 or B747-8) – Linux

The AMMD was the subject of an airworthiness approval and the application underwent a full airworthiness and OEB evaluation including flight and ground testing. The application was found to meet airworthiness requirements and to satisfy the guidance of JAA TGL 36 and Draft AMC 20-25, 2009 version.

4.3.1 *Airport Moving Map Display (AMMD) – Linux (until BP 4.4 / 3.7)*

The Type C AMMD running under Linux on older Blockpoints is similar to the Windows version described in chapter 4.2.4.

4.4 Non-EFB Applications

- Pilot Utilities

Pilot Utilities consists of a number of tools provided for the convenience of the flight crew.

As a non-EFB application, Pilot Utilities was not evaluated by the OEB team.

5 OPERATIONAL EVALUATION

5.1 Operational Risk Analysis (ORA)

See Appendix A.

5.2 Human Machine Interface (HMI) Assessment

Basic HMI features of the hardware were addressed by the airworthiness certification of this Class 3 EFB. The OEB's evaluation of the HMI features related to the operation of the hardware and the software applications installed found that they satisfied the guidance provided by JAA TGL 36 and Draft AMC 20-25.

The OEB evaluation team found that the Class 3 EFB system provides a consistent and intuitive user interface, within and across the various hosted applications.

5.2.1 *EFB Display Lighting and Reflectivity*

5.2.1.1 *Display Lighting*

The OEB evaluation team found the display lighting to be satisfactory in all ambient lighting conditions.

5.2.1.2 *Reflectivity*

The OEB evaluation team found the degree of reflectivity to be satisfactory in all ambient lighting conditions.

5.2.2 *Legibility of Text*

Text displayed on the EFB is legible to the typical user at all likely and reasonable viewing distances and under the full range of lighting conditions expected on a flight deck, including use in direct sunlight.

The electronic charting system provides a graphically superior product to the traditional paper alternative though the format is consistent with current paper charts.

5.2.3 *Input Devices*

The OEB evaluation team found that making inputs was consistent and intuitive whether using the touchscreen, line select keys or, on the B777 and B787, the cursor control device.













The optional separate keyboard was not evaluated.

5.2.4 Messages and Use of Colours

5.2.4.1 Use of Colour

In general, the Class 3 EFB and its installed applications satisfied the guidance provided by JAA TGL 36 and Draft AMC 20-25. However, the overall Boeing flight deck message colour conventions apply.

5.2.4.2 Graphical Conventions

STATE	COLOUR KEY	FUNCTIONALITY
	White text on a grey field	Available to respond to the focus and to selected states. When these areas appear shaded, they provide visual indicators of functions that are selectable using the cursor control device, a line select key (LSK), the touch screen, or keyboard. Shading allows the user to quickly see the actions that are available on each screen.
	White border Magenta border (B787)	Border colour changes to provide user feedback when the cursor (or user's finger) is within the active area for selection of the control. Supports user selection of the intended function when multiple active areas are immediately adjacent to each other. Controls remain in the in-focus state until another control is selected, so that users can easily see their navigation path.
	Green field (retains white border)	Indicates that the control/button is selected and is initiating its function. Selection can occur via CCD button press, finger-off touch screen, LSK push button, or on external keyboards, Enter.
	Cyan text and border on a black field	Indicates that a normally active control is unavailable for selection. This state occurs when the function associated with the control is temporarily unavailable, such as a print control that is unavailable due to a printer malfunction.
	White-outlined text field	Indicates field that is in focus. Begin typing to enter information in this field.
	Amber-coloured text	Indicates a caution or a failure.
	White-coloured text	Indicates current data or good application status.
	Magenta-coloured text	Indicates data that came from another source, such as the FMS.
	Red-coloured text	Indicates a warning and applicable warnings are operator configurable.
	Green-coloured text	Replaces a pull-out (fly-out) or drop-down menu label and indicates the selected value.
	Green check marks or diamonds	Indicate selections.
	Magenta asterisk	Indicates required information.

5.2.4.3 System Error Messages

If an application requires attention, the EFB displays a MEMO notification at the top left of the screen and next to the button of the affected application on the MAIN MENU screen. If any of the loaded software fails the EFB's integrity check or fails to start, the EFB displays a FAULT notification at the top left of the screen. See also paragraph 5.2.4.2 and paragraph 5.2.5.2.

5.2.4.4 Data Entry Screening

If user-entered data is not of the correct format or type needed by the application, or if the data entered is out of range, the application will not accept the data.

5.2.5 Error and Failure Modes

5.2.5.1 Flight Crew Error

Certain error types such as incorrect format or out of range entries are trapped by the individual software application. However, the use of safety critical applications such as OPT should be the subject of effective and independent crew cross-checking and gross error checks.

Operators should ensure, and NAAs should verify, that such checks are included in flight crew procedures. Additionally, alternative procedures that maintain an equivalent level of safety should be developed to be used in the event of the non-availability (either partial or total) of software applications (see also paragraph 5.3.3).

5.2.5.2 Identifying Failure Modes



The top 0.5 inch of the EFB screen is controlled and managed by the Application Manager. This area is reserved for the display header and EFB-related fault alerting (FAULT, MEMO AND MSG (Message)). When the system displays a FAULT, MEMO, and/or MSG flag in the header, the user can return to the MAIN MENU page to determine which application generated the fault and to access the System page for additional information.

The display header uses graphical conventions as follows:

TYPE	MEANING
FAULT	Indicates a fault identified within an application or the system.
MEMO	Indicates that one or more applications need attention.
MSG	Communication message – indicates one or more applications have an uplink available for crew review. Used only if the EFB system is connected to an external communications device.
XFR	Indicates the display is in transfer mode to view the content of the other EFB display. While in this mode, the display cannot be manipulated. Pressing the display bezel XFR key again removes the EFB from transfer mode.

5.2.6 *Responsiveness of Applications*

The responsiveness of the applications is deemed acceptable.

5.2.7 *Off-Screen Text and Content*

In some applications, page navigation tools allow for a large range of configurations of a page such as:

- Panning and zooming;
- Orientation;
- Scrolling options.

If the document segment is not visible in its entirety in the available display area, such as during “zoom” or “pan” operations, the existence of off-screen content is identified by Windows-style scroll bars.

5.2.8 *Active Regions*

See paragraph 5.2.4.2.

5.2.9 *Managing Multiple Open Applications and Documents*

All applications that start successfully run in the background until specifically accessed from the MAIN MENU screen. However, it is not possible to display more than a single application or document at a time.

5.2.10 *Flight Crew Workload*

The OEB evaluation team found that the EFB procedures proposed in the Boeing generic FCOM resulted in acceptable or favourable levels of flight crew workload when compared with the use of the traditional paper alternative.

If the generic Boeing procedures are modified, the operator should ensure, and the NAA should verify, that flight crew workload is maintained at an acceptable level.

5.2.11 *Specific Application Considerations*

5.2.11.1 *Terminal Charts*

The OEB evaluation team found that the Terminal Charts application maintained an acceptable or superior level of accessibility and usability compared with the traditional paper charts it replaces.

5.2.11.2 *On-Board Performance Tool (OPT)*

In general, the OEB evaluation team found that the OPT application maintained an acceptable or superior level of accessibility and usability compared with the traditional graphical or tabular presentation it replaces.

It is of particular importance that the flight crew are aware of input fields that are populated automatically by calculation or by data provided from the aeroplane's data busses. The means of identifying data input fields that had been populated by means other than by pilot input was found to be acceptable (see paragraph 5.2.4.2).

5.2.11.3 *Airport Moving Map (AMM) - Windows*

In order to be classified as a type B EFB application, the AMM application shall not be used as the primary means of taxiing navigation, and used only in conjunction with other materials and procedures identified in the operator's operating concept (see AMC 20-25 Appendix H chapter H.3).

The evaluation of the Windows AMM against guidance and requirements of AMC 20-25 and ETSO-C165a (and DO-257A as modified by the ETSO) has been conducted for those parts where compliance could be demonstrated by Boeing or Jeppesen.

Some areas of compliance are left to the operator:

- **AMC 20-25 H.2.3:** Installation in the EFB, in coordination with Jeppesen - See below
- **AMC 20-25 H.3:** Operating concept
- **AMC 20-25 H.4:** Training requirements – See chapter 5.8 of this report.

The evaluation also identified the following specific considerations:

Evaluation Scope:

The evaluation has covered the Boeing AMM releases 5.0.0, 5.1.0, 5.1.1, 5.1.2, and 5.1.3, and taken credit from the FAA TSOA (TSO-C165) obtained by those applications.

Deviations to ETSO:

Several formal deviations to the ETSO-C165a chapter 2.2.4 (items 18 and 25) have been identified and were to be expected for applications running on a non-real-time operating system. The evaluation has nevertheless found that the AMM is satisfactory provided the recommendations provided in this report are followed.

AMM Installation and verification:

Jeppesen does not provide installation instructions as required per AMC 20-25 H.2.2 (b) and (c). The evaluation has therefore found that in order to be acceptable, the installation and verification activities mentioned in AMC 20-25 appendix H.2.3 need to be conducted in operator's facilities by a Jeppesen deployment team.

Antenna lever arm setup:

The AMM should be configured during the installation process so as to compensate the antenna lever arm (i.e. the lever arm should account for 0 meter in the total system accuracy budget).

Total System Accuracy:

The installation should ensure that the Total System Accuracy of the AMM system as installed and configured for a specific operator and aircraft type does not exceed 50 meters (95%) – See AMC 20-25 H.2.1.

The formula to compute the Total System Accuracy is provided in ETSO-C165a.

5.2.11.4 *Enroute application*

The evaluation found that the enroute application maintained an acceptable or superior level of accessibility and usability compared with the traditional paper charts it replaces. It is however recommended that initial pilot training includes simulator scenarios such as FMC failure prior to oceanic track entry and re-routes in high density airspace (such as Southern Germany), Paperless approval should ensure that such scenarios have been identified and considered by the operator.

In order to be classified as a type B application, the ownship position function shall not be activated.

5.3 **Flight Crew Procedures**

5.3.1 **Normal Procedures**

Flight crew Normal Procedures associated with the EFB are described in the Amplified Procedures Section of the Boeing Flight Crew Operating Manual (FCOM) for the relevant aeroplane type.

The OEB found the Boeing generic Normal Procedures to be acceptable but, where an operator modifies Boeing generic Normal Procedures to integrate with the operating policies that define their own Standard Operating Procedures, the operator should ensure, and the NAA should verify, that the operator's SOPs do not compromise the operating philosophy and level of safety established by the Boeing generic Normal Procedures.

The operator's Normal EFB procedures should contain guidance on the intended use of each software application together with limitations and prohibitions on their use. Where software applications that impact safety-critical areas of operation such as OPT and Terminal Charts are installed, normal EFB procedures should address the need for careful confirmation of its applicability, independent cross-checking by both pilots of the data being used, and other checks (e.g. gross errors checks) to ensure that erroneous data are detected.

The Operations Manual should establish precedence where alternative sources of information are available from other aeroplane systems (e.g. performance data from the FMC).

As a minimum, the operator's EFB procedures for flight crew should include the following:

- Procedures for using the Class 3 EFB with other flight deck systems;
- Flight crew awareness of EFB software / database revisions;
- Procedures to mitigate and/or control workload;
- Flight crew responsibilities for performance calculations.

5.3.1.1 *User Guide*

The Jeppesen Electronic Flight Bag Pilot User Guide has been evaluated by the OEB team and found to be suitable as the basis of a technical description of the device and for the establishment of operational procedures for EFB application use, complementing the Boeing generic Normal Procedures described in the FCOM for the specific aeroplane type.

5.3.2 **Non-Normal Procedures**

There are no Non-Normal Procedures associated with the Boeing Class 3 EFB.

5.3.3 *Alternative Procedures*

Where alternate procedures (O) are required by the MEL for dispatch with the Class 3 EFB partially or completely inoperative, alternative procedures must be established in advance and described in either the operator's MEL or in another document as agreed with the NAA.

Where an aeroplane performance application is installed, any alternative procedure must establish an equivalent level of safety for the independent cross-checking of data input and output.

Where a terminal or enroute charts application is installed, an alternative procedure must ensure that each pilot, whilst seated at his station, retains independent and direct access to charts for the departure, destination and destination alternate aerodromes, and the intended route taking into account possible diversions.

5.4 *Quality Assurance*

Quality Assurance functions in the Administration of the Boeing Class 3 EFB are the responsibility of the operator and its Quality Assurance programme.

All navigation databases used by the operator in relation to the Boeing Class 3 EFB must be provided by a navigation database supplier who holds a Type 2 Letter of Acceptance (LoA) or equivalent (EU-OPS 1.873).

5.5 *EFB System Security*

The operator's EFB Administration procedures must be capable of ensuring an appropriate level of EFB security.

Where physical media is used to load software parts on a data loader, especially if widely available types of physical media are used (such as USB drives), the operator should use technologies and/or procedures to assure that unauthorized content cannot enter the EFB system through these media.

5.6 *EFB Administration*

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

The EFB Administrator should have received detailed training in both the ground systems hardware and the software applications used to configure the EFB. Where OPT is installed as the performance application, the Administrator should be, or be supported by, a qualified performance engineer.

Administration procedures for the configuration of the EFB system, its updating, operational feedback, quality assurance functions and software configuration control should be established by the operator and documented in an EFB Policy and Procedures Manual. Details of the content of a typical EFB Policy and Procedures Manual may be found in Draft AMC 20-25 at Appendix G.

5.6.1 *Configuration Control*

Appropriate configuration control procedures should be in place to ensure that each Class 3 EFB is maintained at the appropriate configuration according to the policy defined by the Administrator and these procedures should be documented in the EFB Policy and Procedures Manual.

5.6.2 EFB Data Revision Process

An acceptable data revision process is to use the Data Distribution and Management system established by Boeing and Jeppesen. Data will be loaded to the EFB via an ARINC 615 data loader, an approved maintenance laptop or via a Terminal Wireless LAN Unit using procedures documented in the Aeroplane Maintenance Manual.

5.6.2.1 Flight Crew Awareness of EFB Software / Database Revisions

The EFB IDENT screen displays information about the effectivity of all software and databases installed on the EFB:

The screenshot shows the EFB IDENT screen with the following information:

FAULT MEMO (top left) **IDENT** (top center) **SHOW** (top right)

A/C MODEL: 787-8

TAIL ID: N787BA

DATE: MAY13/11 TIME: 1701z

EFB EFFECTIVITY CONFIGURATION

770P31_	BOE3A-77P3-W00F	
PUG_	BOE43-PUGX-W00F	
777MEL_	BOE58-77ML-W00F	
77FCTM_	BOE5C-77FC-W00F	
87FM12_	BOE5D-87FM-W00F	
CHORD_	BOE3C-CORD-W00F	
CHATL_	BOE43-CATL-W00F	
777QRH_A	BOE42-77RH-W00G	OCT20/09-DEC31/09
77FOM_	BOE52-77FM-W00F	JAN01/09-DEC01/09
TERM CHARTS DATABASE	JEP22-JDS1-00VG	FEB04/11-FEB23/11
CIC DATABASE	ANA57-CHTD-0002	MAR14/11-APR14/11

The currency of each EFB database is required to be checked by the flight crew during pre-flight checks.

5.7 System Maintenance

EFB system maintenance should be included in the approved aeroplane maintenance programme and documented in the Aeroplane Maintenance Manual (AMM). There are no user maintainable elements in the Boeing Class 3 EFB system.

5.8 Flight Crew Training

5.8.1 Assumptions Regarding Flight Crew Previous Experience

Training for the use of the Boeing Class 3 EFB should be for the purpose of operating the EFB itself and the applications hosted on it and it should not be intended to provide basic competence in areas such as aeroplane performance etc. Initial EFB training, therefore, should assume basic competence in the functions addressed by the software applications installed. Where flight crew do not have the necessary experience, additional requirements may have to be applied by the NAA.

5.8.2 Programmes Crediting Previous EFB Experience

Training programmes for the Boeing Class 3 EFB may take credit for previous EFB experience. For example, previous experience of an aeroplane performance application hosted on a Class 1 or Class 2 EFB and using similar software may be credited toward training for the performance application on the Boeing Class 3 EFB.

5.8.3 Initial EFB Training

Training required for the grant of an aeroplane type rating as specified by JAR-FCL may not recognise variants within the type nor the installation of particular equipment. Any training for the grant of a type qualification need not, therefore, recognise the installation or use of an EFB unless it is installed equipment across all variants of the type. However, where the operator is the Type Rating Training Organisation (TRTO) and training for the issue of the type rating is combined with the operator's conversion course required by OPS 1.945, the training syllabus should recognise the installation of the EFB where the operator's SOPs are dependent on its use.

Initial EFB Training should consist of both ground-based and in-flight training. The requirement for ground-based training may be satisfied by the Boeing CBT-based training material and this is the recommended method. In-flight EFB training should be conducted by a suitably qualified person during Line Flying Under Supervision or during Differences and Familiarisation Training required by OPS 1.950.

5.8.3.1 Areas of Emphasis During Initial EFB Training

- The use of the EFB hardware and the need for proper adjustment of lighting etc. when the system is used in-flight;
- The intended use of each software application together with limitations and prohibitions on their use;
- If an aeroplane performance application is installed, proper cross-checking of data input and output;
- If a terminal chart application is installed, proper verification of the applicability of the information being used;
- If the enroute map application is installed and used, the use of the application in case of FMC failure or in complex operational environments should be trained, as well as mitigations procedures in case of application failure;

- When moving map functions are used, the need to avoid fixation on the map display:
 - The AMMD should not be used as primary means and should always be cross-checked with external references;
 - The enroute moving map function should not be used to check, control, or deduce the aircraft position or trajectory;
- Failure of component(s) of the EFB.

5.8.4 Initial EFB Checking

5.8.4.1 Initial Ground EFB Checking

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

5.8.4.2 Skill Test and Proficiency Check

Proficiency in EFB use is not shown in the required items for the Skill Test required by JAR-FCL for the issue of a type rating following type conversion training or for the Proficiency Check required by JAR-FCL for the renewal of a type rating. However, where the operator is the TRTO and the Skill Test is being conducted following training that is integrated with the operator's conversion course, or where a Licence Proficiency Check for the renewal of a type rating is being conducted concurrently with the Operator Proficiency Check required by OPS 1.965(b), and where the operator's SOPs are dependent on the use of the EFB on the particular type or variant, proficiency in the use of the EFB should be assessed in the appropriate areas.

5.8.4.3 Operator Proficiency Check

Flight crew must demonstrate their competence in carrying out normal procedures during the Operator Proficiency Check required by OPS 1.965(b). Therefore, where an operator's SOPs are dependent on the use of an EFB, proficiency in its use should be assessed.

5.8.4.4 Line Check

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

5.8.4.5 Areas of Emphasis During EFB Checking

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

5.8.5 Differences and Familiarisation Training

When the introduction of the use of an EFB requires the Differences or Familiarisation Training required by OPS 1.950(a) to be carried out, the requirement can be satisfied by conducting Initial EFB Training.

5.8.6 Recurrent EFB Training

Recurrent training is not normally required for the use of an EFB provided the functions are used regularly during line operations. Operators are encouraged, however, to include normal EFB operations as a component of the annual Ground and Refresher Training required by OPS 1.965(a)(3)(i).

Where an operator has established alternative procedures to be used for dispatch with an EFB inoperative or not available, these alternative procedures should be included in the recurrent Aeroplane / STD Training required by OPS 1.965(a)(3)(ii).

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

5.8.7 Recurrent EFB Checking

Recurrent EFB Checking should consist of those elements of the Licence Proficiency Check, the Operator Proficiency Check and the Line Check applicable to the use of an EFB.

5.8.8 Suitability of Training Devices

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

- The Operator's Conversion Course;
- Differences or Familiarisation Training;
- Recurrent Training and Checking.

It is recommended that the EFB flight deck components are installed and operable in the training device (simulator) and used during all phases of flight during which they would be used under the operator's SOPs. The supporting infrastructure for the EFB flight deck components need not be replicated provided the flight deck components and the installed software operate in a manner representative of the system installed on the aeroplane.

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

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

5.8.9 Alternate Means of Compliance

Alternate means of compliance for Flight Crew Training may be approved by the operator's NAA. If alternate compliance is sought, operators should be required to establish that any proposed alternate means provides an equivalent level of training and checking to those described above.

5.9 Operational Evaluation Test

Before the granting of an Operational Approval, the operator should ensure, and the NAA should verify by means of an Operational Evaluation Test, that the guidance and recommendations of JAA TGL 36, Draft AMC 20-25 and those contained in this OEB Report have been satisfied.

5.9.1 Initial Retention of Paper Back Up

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

- The operator's flight crew are able to operate the EFB applications without reference to paper;
- The operator's administration procedures are in place and function correctly;
- The operator is capable of providing timely updates to the applications on the EFB where a database is involved;
- The introduction of the EFB without paper back up does not adversely affect the operator's operating procedures and that alternative procedures for use when the EFB system is not available provide an acceptable equivalent;

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

The operator may then be granted an Operational Approval of the EFB to allow removal of the paper back up by their NAA if they have shown that the EFB system is sufficiently robust.

5.9.2 Commencement of Operations Without Paper Back Up

Where an operator seeks credit to start operations without paper backup, the Operational Evaluation Test should consist of the following elements:

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

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

6 APPLICATION OF EFB EVALUATION REPORT

This OEB EFB Evaluation Report is applicable to both operators and NAAs when considering an application for Operational Approval of the Boeing Class 3 EFB. The OEB has found that the Boeing Class 3 EFB and its software as evaluated satisfy the guidance of JAA TGL 26 and Draft AMC 20-25. However, this finding does not, in itself, constitute an Operational Approval and individual operators must obtain approval from their NAA prior to use of this Class 3 EFB system.

7 ALTERNATE MEANS OF COMPLIANCE

Alternate means of compliance to the recommendations contained in this Report may be approved by the operator's NAA. If alternate means of compliance are proposed, operators may be required to establish that any proposed alternate means provides an equivalent level of safety to the recommendations of JAA TGL 36, AMC 20-25 and this OEB Report. Analysis, demonstrations, proof of concept testing, differences documentation, or other evidence may be required.

8 LIST OF REQUIRED DOCUMENTS

Operators will need to develop, or have available, the following documents to support their application for Operational Approval:

- Aeroplane Flight Manual;
- Flight Crew Operations Manual;
- Flight Crew Training Manual;
- MEL;
- EFB Policy and Procedures Manual;
- Training syllabus and courseware for:
 - Flight Crew;
 - EFB Administrator and ground support personnel;
 - Maintenance.
- Software:
 - Data revision process;
 - Configuration Control process;
 - Quality Control and Quality Assurance processes.
- Relevant Maintenance documents for EFB :
 - Aircraft Maintenance Manual (Chapter 46);
 - Fault Reporting Manual;
 - Fault Isolation Manual;
 - Illustrated Parts Catalogue.
- Maintenance Procedures.

9 APPENDICES

The following Appendices are attached:

Appendix A Operational Risk Assessments (ORA)

- A.1: EFB Hardware
- A.2: Electronic Document Browser
- A.3: Onboard Performance Tool
- A.4: Terminal Charts
- A.5: Electronic Logbook
- A.6: Electronic Flight Folder
- A.7: Airport Moving Map Display
- A.8: Enroute Application

APPENDIX B ADDENDUM – BOEING CMC (CMA-1410) CLASS 3 EFB

APPENDIX A: OPERATIONAL RISK ASSESSMENTS

A.1: EFB Hardware

The objective of this operational risk assessment is to demonstrate that the EFB hardware achieves at least the same level of integrity and availability as the 'traditional' means that it replaces.

The following Table is a summary of the identified operational risks associated with the use of the EFB hardware. The availability and conduct of maintenance action is not considered.

FAILURE CASE	MITIGATION MEANS
BEFORE DISPATCH	
Unable to start one EFB.	<i>Note: Any EFB function that operates normally may be used.</i> Use the off-side EFB and, if available, the XFR facility. Dispatch under the MEL is available using pre-defined alternative procedures for task sharing and cross-checking. Use may be made of an available backup source of essential information and data ⁽¹⁾ that is suitable for dispatch purposes.
Unable to start both EFBs.	Dispatch under the MEL is available using pre-defined alternative procedures for task sharing and cross-checking. Use may be made of an available backup source of essential information and data ⁽¹⁾ that is suitable for dispatch purposes. If essential information and data are not available and cannot be obtained – NO DISPATCH .
Unable to access or use an external input device (e.g. keyboard or cursor control device) on either or both EFBs.	Use virtual keyboard and/or LSKs as appropriate.
Input on touch screen on either or both EFBs does not give any result, or input on touch screen does not give the expected result.	EFB(s) is/are considered to be inoperative. Refer to "Unable to start one / both EFBs".
Power supply input to EFB not available.	EFB is considered to be inoperative. Refer to "Unable to start one EFB".
EFB data connection port(s) not available.	Load data manually. Dispatch under the MEL is available using pre-defined alternative procedures for data management between flight deck systems.
Cross-talk not available between EFBs.	Transfer function not available. Use EFB systems independently and use pre-defined alternative procedures for task sharing and cross-checking.
Off-side transfer not available.	Use pre-defined alternative procedures for task sharing and cross-checking.
Ambient environmental conditions in the cockpit prone to cause an EFB limitations exceedance (e.g. operating temperature, humidity, etc.)	Plan to restrict EFB use to conditions within operating limitations. If limitations cannot be met or are already exceeded, do not start EFBs and refer to "Unable to start both EFBs".

FAILURE CASE	MITIGATION MEANS
IN-FLIGHT	
Unable to start one EFB.	<i>Note: Any EFB function that operates normally may be used. Use the off-side EFB and, if available, the XFR facility. Use pre-defined alternative procedures for task sharing and cross-checking. Use may be made of any available backup source of essential information and data ⁽¹⁾.</i>
Unable to start both EFBs.	Use pre-defined alternative procedures for task sharing and cross-checking. Use may be made of any available backup source of essential information and data ⁽¹⁾ .
Unable to access or use an external input device (e.g. keyboard or cursor control device) on either or both EFBs.	Use virtual keyboard and/or LSKs as appropriate.
Input on touch screen on either or both EFBs does not give any result, or input on touch screen does not give the expected result.	EFB(s) is/are considered to be inoperative. Refer to "Unable to start one / both EFBs" in In-Flight Section.
Power supply input to EFB not available.	EFB is considered to be inoperative. Refer to "Unable to start one EFB" in In-Flight Section.
EFB data connection port(s) not available.	Load data manually. Use pre-defined alternative procedures for data management between flight deck systems.
Cross-talk not available between EFBs.	Transfer function not available. Use EFB systems independently and use pre-defined alternative procedures for task sharing and cross-checking.
Off-side transfer not available.	Use pre-defined alternative procedures for task sharing and cross-checking.
Ambient environmental conditions in the cockpit prone to cause an EFB limitations exceedance (e.g. operating temperature, humidity, etc.)	Attempt to maintain conditions within operating limitations but anticipate dual EFB failure. If one or both EFBs fail, refer to "Unable to start one / both EFBs" in In-Flight Section.

Note ⁽¹⁾: Available backup sources of essential information and data may include:

- a) Paper documents available in-flight (including the QRH);
- b) A Class 1 EFB or a PED on which the information or data is available;
Note: A Class 1 EFB must be stowed during critical phases of flight.
- c) The operator's flight support services that can be contacted by radio, SATCOM, ACARS etc;
- d) Air Traffic Services.

A.2: Document Browser

The objective of this operational risk assessment is to demonstrate that the Document Browser achieves at least the same level of integrity and availability as the 'traditional' means that it replaces.

The following Table is a summary of the identified operational risks associated with the use of the Document Browser. The availability and conduct of maintenance action is not considered.

FAILURE CASE	MITIGATION MEANS
BEFORE DISPATCH	
Unable to access document(s) due to software failure on one EFB.	Restart Windows ⁽¹⁾ on the affected EFB. If restart is unsuccessful, use the off-side EFB and the XFR facility. Dispatch under the MEL is available using pre-defined alternative procedures for task sharing.
Unable to access document(s) due to software failure on both EFBs.	Restart Windows ⁽¹⁾ on both EFBs. If restarts are unsuccessful, dispatch under the MEL is available using pre-defined alternative procedures for task sharing. Use may be made of an available backup source of essential information and data ⁽²⁾ that is suitable for dispatch purposes. If essential information and data are not available and cannot be obtained – NO DISPATCH .
Document library out of date.	[Crew Procedure]: Check that specific information and data required for the intended flight is, and remains, current for the duration of the flight.
Incomplete display of document(s).	Restart Windows ⁽¹⁾ . If document(s) do not display successfully, use the off-side EFB and the XFR facility. If both EFBs are affected: [Crew Procedure]: Check that information and data required for intended flight is available from documents that are displayed correctly. If information and data required for intended flight is not available, refer to "Unable to access document(s) due to software failure on both EFBs".
Loss of document viewer function (search, document navigation etc.).	<i>Note: Any document browser function that operates normally may be used.</i> Restart Windows ⁽¹⁾ . If function(s) do not return successfully, use the off-side EFB and the XFR facility. Alternative functions such as page scrolling, Table of Contents, bookmarks etc. are also available.
Loss of acquisition and/or processing of information by means of hyperlink.	Use the off-side EFB and the XFR facility or use alternative functions such as page scrolling, Table of Contents, bookmarks etc.
Erroneous acquisition and/or processing of information by means of hyperlink leading to the display of irrelevant or misleading information.	[Crew Procedure]: Check the title of the displayed content before reading.

FAILURE CASE	MITIGATION MEANS
IN-FLIGHT	
Unable to access document(s) due to software failure on one EFB.	Restart Windows ⁽¹⁾ on affected EFB. If restart is unsuccessful, use the off-side EFB and the XFR facility.
Unable to access document(s) due to software failure on both EFBs.	Restart Windows ⁽¹⁾ on both EFBs. If restarts are unsuccessful, use any available backup source of essential information and data ⁽²⁾ . Use pre-defined alternative procedures for task sharing.
Incomplete display of document(s).	Restart Windows ⁽¹⁾ . If document(s) do not display successfully, use the off-side EFB and the XFR facility. If both EFBs are affected: [Crew Procedure]: Check that information and data required for intended flight is available from documents that are displayed correctly. If information and data required for flight are not available, refer to "Unable to access document(s) due to software failure on both EFBs" in the IN-FLIGHT Section.
Loss of document viewer function (search, document navigation etc.).	<i>Note: Any document browser function that operates normally may be used.</i> Restart Windows ⁽¹⁾ . If function(s) do not return successfully, use the off-side EFB and the XFR facility. Alternative functions such as page scrolling, Table of Contents, bookmarks etc. are also available.
Loss of acquisition and/or processing of information by means of hyperlink.	Use the off-side EFB and the XFR facility or use alternative functions such as page scrolling, Table of Contents, bookmarks etc.
Erroneous acquisition and/or processing of information by means of hyperlink leading to the display of irrelevant or misleading information.	[Crew Procedure]: Check the title of the displayed content before reading.

Note ⁽¹⁾: Restart Windows by Main Menu Page ---> System Page ---> Restart EFB (takes 5 minutes).

Note ⁽²⁾: Available backup sources of essential information and data may include:

- a) Paper documents available in-flight (including the QRH);
- b) A Class 1 EFB or a PED on which the information or data is available;
Note: A Class 1 EFB must be stowed during critical phases of flight.
- c) The operator's flight support services that can be contacted by radio, SATCOM, ACARS etc;
- d) Air Traffic Services.

A.3: Onboard Performance Tool

The Onboard Performance Tool (OPT) is used to calculate required operational performance data during the pre-flight preparation phase. It may also be used to obtain updated data before take-off in the event of changes to environmental parameters.

The landing performance element may be used before flight to calculate landing performance expected at the destination (Landing – Dispatch) and in-flight to update inputs due to changes to environmental or aircraft configuration data and to recalculate landing performance in accordance with the factorisation applicable to the in-flight condition (Landing – En-Route).

The objective of this operational risk assessment is to demonstrate that OPT achieves at least the same level of integrity and availability as the ‘traditional’ means that it replaces. The following Table is a summary of the identified operational risks associated with the use of the performance application. The availability and conduct of maintenance action is not considered.

FAILURE CASE	MITIGATION MEANS
BEFORE TAKE-OFF	
Loss of OPT before take-off on one EFB due to software failure.	Restart Windows ⁽¹⁾ on the affected EFB. If restart is unsuccessful, use the off-side EFB and the XFR facility. Dispatch under the MEL is available using pre-defined alternative procedures for task sharing and data output cross-checking.
Loss of OPT before take-off on both EFBs due to software failure.	Restart Windows ⁽¹⁾ on both EFBs. If restarts are unsuccessful, use may be made of an available backup source of performance data ⁽²⁾ that is suitable for dispatch purposes. Dispatch under the MEL is available using pre-defined alternative procedures for task sharing and data output cross-checking. If performance data is not available and cannot be obtained – NO DISPATCH .
Out of date aerodrome database.	[Crew Procedure]: Check currency of database on IDENT PAGE. If out of date, check that specific information and data required for performance calculations for the intended aerodromes of departure and destination is, and remains, current for the duration of the flight. Alternatively, use may be made of a suitable and available backup source of performance data ⁽²⁾ that is suitable for dispatch purposes.
Database incomplete for the planned flight (e.g. planned taxiway for runway entry not available in the database).	[Crew Procedure]: Plan operation according to data available from performance application or use may be made of a suitable and available backup source of performance data ⁽²⁾ .

FAILURE CASE	MITIGATION MEANS
BEFORE TAKE-OFF (CONTINUED)	
Erroneous database loaded in the application (e.g. database for another type of aircraft).	CRC check would cause the application to become unavailable (application shown in cyan on Main Menu page). Refer to “Loss of the take-off performance calculation application before take-off on one/both EFB(s) due to software failure”.
Erroneous take-off data input (crew input error or corrupted data from onboard source).	[Crew Procedure]: Conduct independent cross-check and gross error (reasonableness) check before accepting any data output.
No take-off data output (application fails to calculate data).	Performance application is unusable. Refer to “Loss of the take-off performance calculation application before take-off on one/both EFB(s) due to software failure”.
Erroneous detected display of take-off performance data output.	Performance application is unusable. Refer to “Loss of the take-off performance calculation application before take-off on one/both EFB(s) due to software failure”.
Erroneous undetected take-off data output.	[Crew Procedure]: Conduct independent cross-check and gross error (reasonableness) check before accepting any data output.
Loss of the Landing – Dispatch element before take-off on one or both EFBs due to software failure.	Use may be made of a suitable and available backup source of performance data ⁽²⁾ that is suitable for dispatch purposes.

FAILURE CASE	MITIGATION MEANS
AFTER TAKE-OFF	
Loss of the Landing – En-Route element after take-off on one EFB due to software failure.	Restart Windows ⁽¹⁾ on the affected EFB. If restart is unsuccessful, use the off-side EFB and the XFR facility. Use pre-defined alternative procedures for task sharing and data output cross-checking.
Loss of the Landing – En-Route element after take-off on both EFBs due to software failure.	Restart Windows ⁽¹⁾ on both EFBs. If restarts are unsuccessful, use may be made of any available backup source of performance data ⁽²⁾ . Use pre-defined alternative procedures for task sharing and data output cross-checking.
Erroneous landing data input (crew input error or corrupted data from onboard source).	[Crew Procedure]: Conduct independent cross-check and gross error (reasonableness) check before accepting any data output.
No landing data output (application fails to calculate data).	Performance application is unusable. Refer to “Loss of the take-off performance calculation application after take-off on one/both EFB(s) due to software failure” in the AFTER TAKE-OFF Section.
Erroneous detected display of landing performance data output.	Performance application is unusable. Refer to “Loss of the take-off performance calculation application after take-off on one/both EFB(s) due to software failure” in the AFTER TAKE-OFF Section.
Erroneous undetected landing data output.	[Crew Procedure]: Conduct independent cross-check and gross error (reasonableness) check before accepting any data output.

FAILURE CASE	MITIGATION MEANS
AFTER TAKE-OFF (CONTINUED)	
Loss of the take-off performance element after take-off on one or both EFBs due to software failure.	No effect. Take-off performance calculations will be conducted on the ground before the next take-off.

Note ⁽¹⁾: Restart Windows by Main Menu Page ---> System Page ---> Restart EFB (takes 5 minutes).

Note ⁽²⁾: Available backup sources of performance information and data may include:

- a) Paper-based performance data such as from the FCOM, runway analysis charts, the QRH etc;
- b) A Class 1 EFB or a PED on which performance information and data is available;

Note: A Class 1 EFB must be stowed during critical phases of flight.

- c) The operator's flight support services that can be contacted by radio, SATCOM, ACARS etc;
- d) Air Traffic Services (for aerodrome data).

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A.4: Terminal Charts

The objective of this Operational Risk Assessment is to demonstrate that the application achieves at least the same level of integrity and availability as the ‘traditional’ means that it replaces.

The following Table is a summary of the identified operational risks associated with the use of the Terminal Charts application. The availability and conduct of maintenance action is not considered.

FAILURE CASE	MITIGATION MEANS
BEFORE DISPATCH	
Unable to access the charting application on one EFB due to software failure.	Restart Windows ⁽¹⁾ on the affected EFB. If restart is unsuccessful, use the off-side EFB and the XFR facility. Dispatch under the MEL is available using pre-defined alternative procedures for task sharing.
Unable to start the charting application on both EFBs due to software failure.	Restart Windows ⁽¹⁾ on both EFBs. If restarts are unsuccessful, dispatch under the MEL is available using pre-defined alternative procedures for task sharing. Use may be made of an available backup source of Terminal Charts ⁽²⁾ that is suitable for dispatch purposes. Note: The minimum required current terminal charts to be available to each pilot include: <ul style="list-style-type: none"> • Departure aerodrome; • Destination aerodrome; • Destination alternate; • En-route alternates used for flight planning (ETOPS, reduced contingency fuel etc.) If Terminal Charts are not available and cannot be obtained – NO DISPATCH.
Charting application fails to respond to user inputs due to software failure.	Restart Windows ⁽¹⁾ on the affected EFB. If restart is unsuccessful, refer to “Unable to access the charting application on one EFB due to software failure”. If both EFBs are affected, refer to “Unable to start the charting application on both EFBs due to software failure”.
Charting application database is out of date.	[Crew Procedure]: Check that specific Terminal Chart information and data required for the intended flight is, and remains, current for the duration of the flight.
Unable to fully utilise charts due to the failure of zooming or panning facility.	<i>Note: Any viewing facility that operates normally may be used.</i> Restart Windows ⁽¹⁾ . If facility(s) do not return successfully, use the off-side EFB and the XFR facility. Dispatch under the MEL is available using pre-defined alternative procedures for task sharing.
Erroneous detected acquisition and/or processing of information leading to the display of irrelevant or incorrect information.	Application is unusable. Refer to “Unable to access the charting application on one EFB due to software failure”.
Erroneous undetected display of irrelevant or incorrect information.	[Crew Procedure]: Crew to check the title of the displayed content before accepting and to cross-check chart information against another source (e.g. FMS).

FAILURE CASE	MITIGATION MEANS
IN-FLIGHT	
Unable to access the charting application on one EFB due to software failure.	Restart Windows ⁽¹⁾ on the affected EFB. If restart is unsuccessful, use the off-side EFB and the XFR facility.
Unable to start the charting application on both EFBs due to software failure.	Restart Windows ⁽¹⁾ on both EFBs. If restarts are unsuccessful, use any available backup or alternative source of Terminal Chart information ⁽²⁾ . Use alternative procedures for task sharing
Charting application fails to respond to user inputs due to software failure.	Restart Windows ⁽¹⁾ on the affected EFB. If restart is unsuccessful, refer to "Unable to access the charting application on one EFB due to software failure" in the IN-FLIGHT Section. If both EFBs are affected, refer to "Unable to start the charting application on both EFBs due to software failure" in the IN-FLIGHT Section.
Unable to fully utilise charts due to the failure of zooming or panning facility.	<i>Note: Any viewing facility that operates normally may be used.</i> Restart Windows ⁽¹⁾ . If facility(s) do not return successfully, use the off-side EFB and the XFR facility.
Erroneous undetected acquisition and/or processing of information leading to the display of irrelevant information.	[Crew Procedure]: Crew to check the title of the displayed content before accepting and to cross-check chart information against another source (e.g. FMS).
Erroneous detected display of irrelevant information.	Application is unusable. Refer to "Unable to access the charting application on one EFB due to software failure" in the IN-FLIGHT Section.

Note ⁽¹⁾: Restart Windows by Main Menu Page ---> System Page ---> Restart EFB (takes 5 minutes).

Note ⁽²⁾: Available backup sources of Terminal Chart information and data may include:

e) Paper Terminal Charts available in-flight;

f) A Class 1 EFB or a PED on which Terminal Charts are available;

Note: A Class 1 EFB must be stowed during critical phases of flight.

g) The operator's flight support services that can be contacted by radio, SATCOM, ACARS etc;

h) Air Traffic Services.

A.5: Electronic Logbook

The objective of this operational risk assessment is to demonstrate that the Electronic Logbook (ELB) application achieves at least the same level of integrity and availability as the 'traditional' means that it replaces.

The following Table is a summary of the identified operational risks associated with the use of the performance calculation application. The availability and conduct of maintenance action is not considered.

FAILURE CASE	MITIGATION MEANS
BEFORE DISPATCH	
Loss of the ELB application before dispatch on one EFB due to software failure.	Restart Windows ⁽¹⁾ on the affected EFB. If restart is unsuccessful, use the off-side EFB and the XFR facility. Dispatch under the MEL is available using pre-defined alternative procedures for task sharing and data cross-checking.
Loss of the ELB application before dispatch on both EFBs due to software failure.	Restart Windows ⁽¹⁾ on both EFBs. If restarts are unsuccessful, use may be made of an available backup source of logbook data and information ⁽²⁾ that is suitable for dispatch purposes. Dispatch under the MEL is available using pre-defined alternative procedures for task sharing and data cross-checking. If the required logbook data and information is not available and cannot be obtained – NO DISPATCH .
ELB data transmission failure.	Attempt to resend the data. If unsuccessful, data should be sent by any available means (on paper, via ACARS etc) for manual entry or use may be made of an available backup source of logbook data and information ⁽²⁾ that is suitable for dispatch purposes. If the required ELB data and information is not available and cannot be obtained – NO DISPATCH .
Incorrect or incomplete ELB data package uploaded to EFB.	Attempt to resend the data. If unsuccessful, data should be sent by any available means (on paper, via ACARS etc) for manual entry. If the required logbook data and information is not available and cannot be obtained – NO DISPATCH .
Erroneous ELB data input (crew input error or transmitted data corruption).	[Crew Procedure]: Conduct independent cross-check and gross error (reasonableness) check before accepting any data.
Cross-talk not available between ELB applications.	Load data manually in each affected application. Use pre-defined alternative procedures for data management between EFB applications.

FAILURE CASE	MITIGATION MEANS
IN-FLIGHT	
Loss of the ELB application in-flight on one EFB due to software failure.	Restart Windows ⁽¹⁾ on the affected EFB. If restart is unsuccessful, use the off-side EFB and the XFR facility. Use pre-defined alternative procedures for task sharing and data cross-checking.
Loss of the ELB application in-flight on both EFBs due to software failure.	Restart Windows ⁽¹⁾ on both EFBs. If restarts are unsuccessful, logbook is to be completed after flight by any available means.
Erroneous ELB data input (crew input error or corrupted data from onboard source).	[Crew Procedure]: Conduct independent cross-check and gross error (reasonableness) check before accepting any data.
Cross-talk not available between ELB applications.	Load data manually in each affected application. Use pre-defined alternative procedures for data management between EFB applications.

Note ⁽¹⁾: Restart Windows by Main Menu Page ---> System Page ---> Restart EFB (takes 5 minutes).

Note ⁽²⁾: Available backup sources of logbook data and information may include:

- a) Paper versions of applicable logbook data and information that are provided pre-flight;
- b) The operator's flight support services that can send applicable logbook data and information via ACARS for manual entry or for printing using the flight deck printer.

A.6: Electronic Flight Folder

The objective of this operational risk assessment is to demonstrate that the Electronic Flight Folder (EFF) application achieves at least the same level of integrity and availability as the 'traditional' means that it replaces.

The following Table is a summary of the identified operational risks associated with the use of the performance calculation application. The availability and conduct of maintenance action is not considered.

FAILURE CASE	MITIGATION MEANS
BEFORE DISPATCH	
Loss of the EFF application before dispatch on one EFB due to software failure.	Restart Windows ⁽¹⁾ on the affected EFB. If restart is unsuccessful, use the off-side EFB and the XFR facility. Dispatch under the MEL is available using pre-defined alternative procedures for task sharing and data cross-checking.
Loss of the EFF application before dispatch on both EFBs due to software failure.	Restart Windows ⁽¹⁾ on both EFBs. If restarts are unsuccessful, use may be made of an available backup source of pre-flight briefing material and OFP ⁽²⁾ that is suitable for dispatch purposes. Dispatch under the MEL is available using pre-defined alternative procedures for task sharing and data cross-checking. If no pre-flight briefing material and/or OFP is available and cannot be obtained – NO DISPATCH .
EFF data transmission failure.	The operator's flight dispatch service should resend data package. If unsuccessful, data should be sent by any available means (on paper, via ACARS etc). If no pre-flight briefing material or OFP is available and cannot be obtained – NO DISPATCH .
Incorrect or incomplete EFF package uploaded to EFB.	The operator's flight dispatch service should resend data package. If unsuccessful, data should be sent by any available means (on paper, via ACARS etc). If no pre-flight briefing material or OFP is available and cannot be obtained – NO DISPATCH .
Erroneous EFF data input (crew input error or transmitted data corruption).	[Crew Procedure]: Conduct independent cross-check and gross error (reasonableness) check before accepting any data.
Cross-talk not available between EFF applications.	Load data manually in each application. Use pre-defined alternative procedures for data management between EFB applications.

FAILURE CASE	MITIGATION MEANS
IN-FLIGHT	
Loss of the EFF application in-flight on one EFB due to software failure.	Restart Windows ⁽¹⁾ on the affected EFB. If restart is unsuccessful, use the off-side EFB and the XFR facility. Use pre-defined alternative procedures for task sharing and data cross-checking.
Loss of the EFF application in-flight on both EFBs due to software failure.	Restart Windows ⁽¹⁾ on both EFBs. If restarts are unsuccessful, the operator's flight dispatch service should resend required briefing information and OFP via ACARS which may then be printed using the flight deck printer.
Erroneous EFF data input (crew input error or corrupted data from onboard source).	[Crew Procedure]: Conduct independent cross-check and gross error (reasonableness) check before accepting any data.
Cross-talk not available between EFF applications.	Load data manually in each application. Use pre-defined alternative procedures for data management between EFB applications.

Note ⁽¹⁾: Restart Windows by Main Menu Page ---> System Page ---> Restart EFB (takes 5 minutes).

Note ⁽²⁾: Available backup sources of briefing material and the OFP may include:

- a) Paper-based versions of applicable briefing material and the OFP that may have been provided or printed pre-flight;
- b) The operator's flight support services that can send briefing material and the OFP via ACARS for printing using the flight deck printer;
- c) The FMS (some versions provide for the printing of the active route).

A.7: Airport Moving Map (AMM)

The objective of this Operational Risk Assessment is to account for AMM Failure Cases and means of mitigation. AMM does not replace pre-existing “traditional means” and therefore its loss and/or malfunction is not a dispatch consideration if relevant airport charts are available via a Terminal Charts function [Note: see Terminal Charts ORA in these appendices].

The following Table is a summary of the identified operational risks associated with the use of the Airport Moving Map application. The availability and conduct of maintenance action is not considered.

FAILURE CASE	MITIGATION MEANS
BEFORE DISPATCH	
Unable to access the application on one EFB due to software failure.	Restart Windows ⁽¹⁾ on the affected EFB. If restart is unsuccessful, use the off-side EFB and the XFR facility.
Unable to start the application on both EFBs due to software failure.	Restart Windows ⁽¹⁾ on both EFBs.
AMM application fails to respond to user inputs due to software failure.	Restart Windows ⁽¹⁾ on the affected EFB. If restart is unsuccessful, refer to “Unable to access the AMM application on one EFB due to software failure”. If both EFBs are affected, refer to “Unable to start the AMM application on both EFBs due to software failure”.
AMM application database is out of date.	[Crew Procedure]: Check that specific Terminal Chart (airport charts) information and data required for the intended flight is, and remains, current for the duration of the flight.
Unable to fully utilise AMM due to the failure of zooming or panning facility.	<i>Note: Any viewing facility that operates normally may be used.</i> Restart Windows ⁽¹⁾ . If facility(s) do not return successfully, use the off-side EFB and the XFR facility.
Erroneous detected acquisition and/or processing of information leading to the display of irrelevant or incorrect information.	Application is unusable. Refer to “Unable to access the AMM application on one EFB due to software failure”.
Erroneous undetected display of irrelevant or incorrect information.	[Crew Procedure]: Crew to check the title of the displayed content before accepting and to cross-check chart information against another source (e.g. Airport Chart).

FAILURE CASE	MITIGATION MEANS
IN-FLIGHT	
Unable to access the AMM application on one EFB due to software failure.	Restart Windows ⁽¹⁾ on the affected EFB. If restart is unsuccessful, use the off-side EFB and the XFR facility.
Unable to start the AMM application on both EFBs due to software failure.	Restart Windows ⁽¹⁾ on both EFBs. If restarts are unsuccessful, use any available backup or alternative source of airport information ⁽²⁾ . Use alternative procedures for task sharing
AMM application fails to respond to user inputs due to software failure.	Restart Windows ⁽¹⁾ on the affected EFB. If restart is unsuccessful, refer to “Unable to access the AMM application on one EFB due to software failure” in the INFLIGHT Section. If both EFBs are affected, refer to “Unable to start the AMM application on both EFBs due to software failure” in the IN-FLIGHT Section.

Unable to fully utilise charts due to the failure of zooming or panning facility.	<i>Note: Any viewing facility that operates normally may be used. Restart Windows⁽¹⁾. If facility(s) do not return successfully, use the off-side EFB and the XFR facility.</i>
Erroneous undetected acquisition and/or processing of information leading to the display of irrelevant information.	[Crew Procedure]: Crew to check the title of the displayed content before accepting and to cross-check chart information against another source (e.g. Airport Chart).
Erroneous detected display of irrelevant information.	Application is unusable. Refer to "Unable to access the AMM application on one EFB due to software failure" in the IN-FLIGHT Section.

Note⁽¹⁾ : Restart Windows by Main Menu Page ---> System Page ---> Restart EFB (takes 5 minutes).

Note⁽²⁾ : Available backup sources of airport information and data may include:

- e) Paper airport chart available in-flight;
- f) A Portable EFB or a PED on which Airport Moving Maps are available;
- g) The operator's flight support services that can be contacted by radio, SATCOM, ACARS etc;
- h) Air Traffic Services.

A.8: Enroute charts

The objective of this Operational Risk Assessment is to demonstrate that the application achieves at least the same level of integrity and availability as the ‘traditional’ means that it replaces.

The following Table is a summary of the identified operational risks associated with the use of the Enroute Charts application. The availability and conduct of maintenance action is not considered.

FAILURE CASE	MITIGATION MEANS
BEFORE DISPATCH	
Unable to access the charting application on one EFB due to software failure.	Restart Windows ⁽¹⁾ on the affected EFB. If restart is unsuccessful, use the off-side EFB and the XFR facility. Dispatch under the MEL is available using pre-defined alternative procedures for task sharing.
Unable to start the charting application on both EFBs due to software failure.	Restart Windows ⁽¹⁾ on both EFBs. If restarts are unsuccessful, dispatch under the MEL is available using predefined alternative procedures for task sharing. Use may be made of an available backup source of Enroute Charts ⁽²⁾ that is suitable for dispatch purposes. Note: The minimum required current Enroute content to be available to each pilot includes: <ul style="list-style-type: none"> • Enroute dataset covering entirety of planned route, including alternates If above Enroute dataset is not available and cannot be obtained – NO DISPATCH.
Charting application fails to respond to user inputs due to software failure.	Restart Windows ⁽¹⁾ on the affected EFB. If restart is unsuccessful, refer to “Unable to access the charting application on one EFB due to software failure”. If both EFBs are affected, refer to “Unable to start the charting application on both EFBs due to software failure”.
Charting application database is out of date.	[Crew Procedure]: Check that specific Enroute information and data required for the intended flight is, and remains, current for the duration of the flight.
Unable to fully utilise charts due to the failure of zooming or panning facility.	<i>Note: Any viewing facility that operates normally may be used.</i> Restart Windows ⁽¹⁾ . If facility(s) do not return successfully, use the off-side EFB and the XFR facility. Dispatch under the MEL is available using pre-defined alternative procedures for task sharing.
Erroneous detected acquisition and/or processing of information leading to the display of irrelevant or incorrect information.	Application is unusable. Refer to “Unable to access the charting application on one EFB due to software failure”.
Erroneous undetected display of irrelevant or incorrect information.	[Crew Procedure]: Crew to check the title of the displayed content before accepting and to cross-check chart information against another source (e.g. FMS).

FAILURE CASE	MITIGATION MEANS
IN-FLIGHT	
Unable to access the charting application on one EFB due to software failure.	Restart Windows ⁽¹⁾ on the affected EFB. If restart is unsuccessful, use the off-side EFB and the XFR facility.
Unable to start the charting	Restart Windows ⁽¹⁾ on both EFBs. If restarts are

application on both EFBs due to software failure.	unsuccessful, use any available backup or alternative source of Enroute information ⁽²⁾ . Use alternative procedures for task sharing
Charting application fails to respond to user inputs due to software failure.	Restart Windows ⁽¹⁾ on the affected EFB. If restart is unsuccessful, refer to “Unable to access the charting application on one EFB due to software failure” in the INFLIGHT Section. If both EFBs are affected, refer to “Unable to start the charting application on both EFBs due to software failure” in the IN-FLIGHT Section.
Unable to fully utilise charts due to the failure of zooming or panning facility.	<i>Note: Any viewing facility that operates normally may be used.</i> Restart Windows ⁽¹⁾ . If facility(s) do not return successfully, use the off-side EFB and the XFR facility.
Erroneous undetected acquisition and/or processing of information leading to the display of irrelevant information.	[Crew Procedure]: Crew to check the title of the displayed content before accepting and to cross-check chart information against another source (e.g. FMS).
Erroneous detected display of irrelevant information.	Application is unusable. Refer to “Unable to access the charting application on one EFB due to software failure” in the IN-FLIGHT Section.

Note⁽¹⁾: Restart Windows by Main Menu Page ---> System Page ---> Restart EFB (takes 5 minutes).

Note⁽²⁾: Available backup sources of Enroute information and data may include:

- e) Paper Enroute Charts available in-flight;
- f) A portable EFB or a PED on which Enroute Charts are available;
- g) The operator’s flight support services that can be contacted by radio, SATCOM, ACARS etc;
- h) Air Traffic Services.

APPENDIX B: ADDENDUM – BOEING CMC (CMA-1410) CLASS 3 EFB

B.1. Preamble

Boeing has applied to EASA for the operational evaluation of a CMC Electronics manufactured CMA 1410 Class 3 EFB (hereafter referred to as: Boeing-CMC Class 3 EFB system) on the 01/11/2010.

B.2. Purpose and applicability

This addendum is an extension of the initial Boeing Class 3 EFB report, to cover the differences and particularities of the Boeing-CMC Class 3 EFB system.

The Boeing-CMC Class 3 EFB system is intended for installation on Boeing 737,747,757, and 767 aeroplanes.

This reports covers the installation of the EFB in the 737-NG aircraft, covered by the EASA STCs 10045157 (EFB present in production aircraft) or 10044973 (EFB retrofitted).

B.3. EFB Hardware

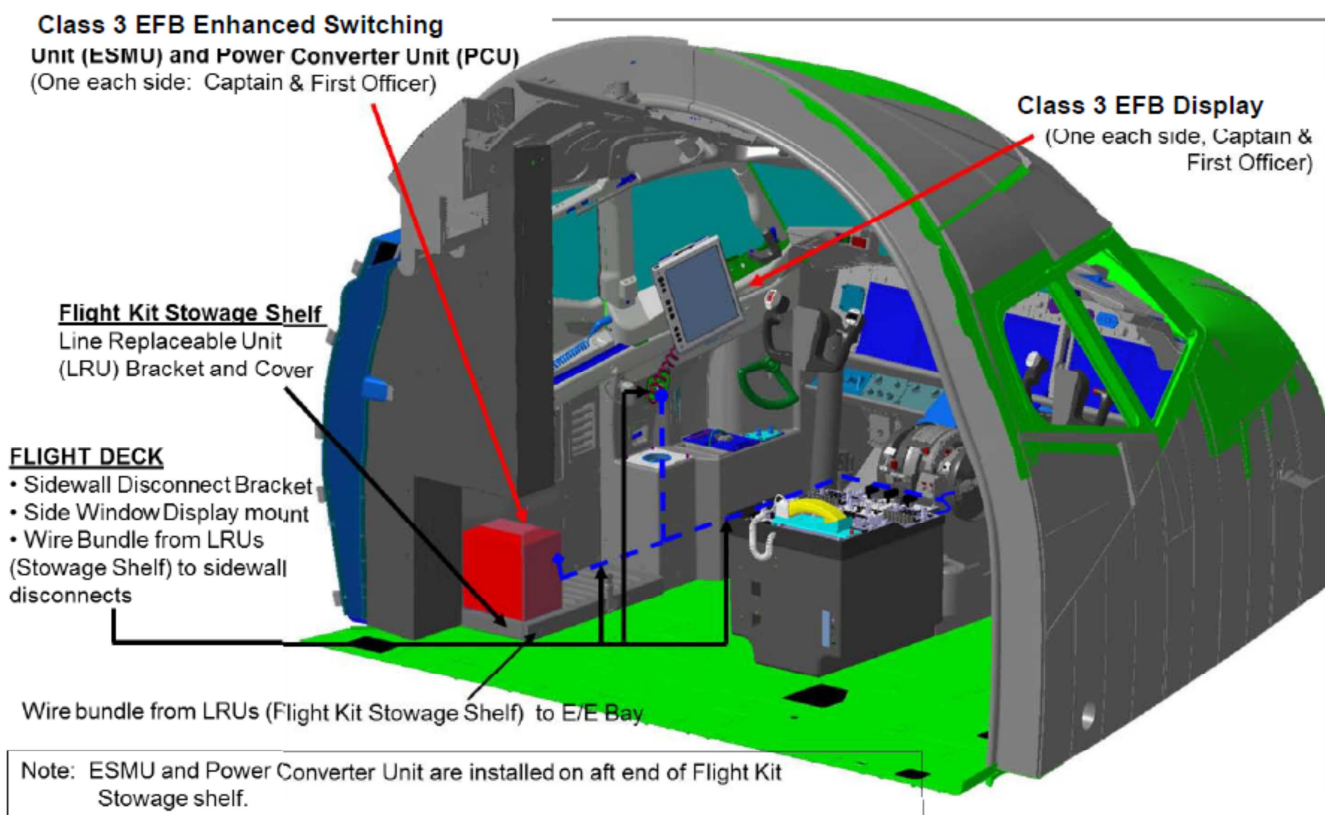
The Boeing-CMC Class 3 EFB system is composed of several devices located on the Flight Deck. Crew interface devices consist of the following components:

- Two Electronic Display Units (EDU) with the following characteristics/specifications:
 - Compact display-processor design (~1.8 kg)
 - 24.4 x 20.3 x 4 cm with 26.4 cm diagonal display
 - High performance sunlight readable touch screen display, 0.5 – 800 nits
 - LED backlit XGA (768x1024)
 - Dual USB 2.0 ports
 - 1.4Ghz Intel® Centrino Mobile with graphics co-processor
 - (2) 32G solid state disks (64 GB total)
 - (2) GB ECC DDR RAM (1 GB total)
 - Powered from ESMU/PCU by combined USB/Ethernet cable to dock connector
 - Dual internal lithium ion battery
- Two Enhanced Switching Module Units (ESMU) providing interface between the EDU's and Aircraft avionics, Ethernet cross talk between Capt and FO EFBs, and power to the EDU's.
 - Size: 17.5" x 12.9" x 6.6 cm
 - Mass: ~1.1 kg
 - 8 ARINC 429 receiver and 4 ARINC 429 transmitter interfaces
 - 4 Ethernet ports
 - Supports Customer Supplied GSM USB modem interface
- Two 115VAC/400Hz to 28 VDC Power Converter Units (PCU)
- One Data Load Port
- Each EFB connected to independent non-shedable Essential Power buses

In the 737 NG the EDUs are mounted on the Flight Deck window sill next to each pilot. Two ESMU/PCU sets, one for the Captain and the other for the FO, are installed on the floor in the Flight Deck at the aft of each pilot's flight

bag stowage. The data load port is integrated into the First Officer's (FO) Enhanced Switching Module Unit (ESMU).

EFB 737 NG Crew Compartment:

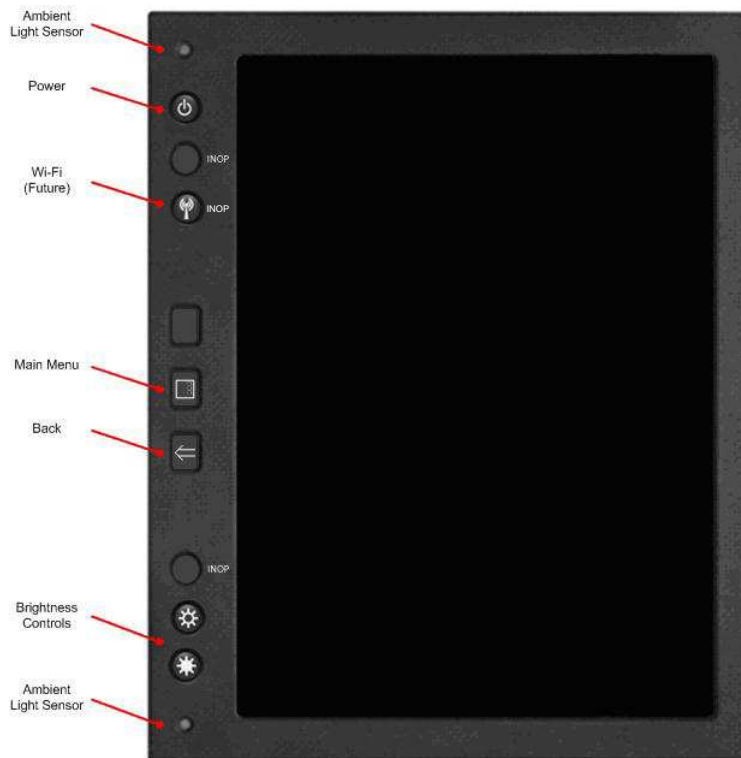


Display and Controls:






Interaction with the EFB applications can occur through the display bezel keys and integral touch screen panel installed as part of the EFB EDU Liquid Crystal Display (LCD) glass assembly. These controls are identical for each pilot and both pilots have equal access to any of these controls at their option.


Display Unit Function Keys:

Each EFB EDU consists of an active matrix liquid crystal display and bezel as illustrated here below. The bezel consists of pushbutton dedicated function keys, pushbuttons for display brightness, a pushbutton power switch to turn the EDU on/off and a bezel mounted ambient light sensor for automatic control of display brightness.



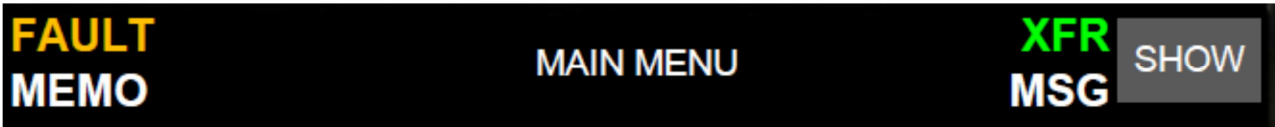
Five pushbutton dedicated function keys, located across the left side of the EFB bezel, are described in the table here below. The EFB is equipped with an individual display brightness control pushbutton, mounted on the lower left corner of the bezel, to provide for manual adjustment of the EDU brightness. Pressing on the top brightness pushbutton decreases the brightness, while pressing on the bottom brightness pushbutton increases the brightness. Bezel light sensors mounted in the upper and lower left corners of the bezel provide automatic brightness control for the EFB display. The EFB automatic brightness function controls display luminance as a function of inputs from the manual EDU brightness controls and the bezel light sensors.

Key	Function
 (Power)	The power pushbutton controls the display back light only. Pressing the power button once turns the display backlight off but the system remains active. Pressing the PWR button a second time instantaneously turns the display backlight back on, restoring the last setting set by the pilot.
 (Wireless Connectivity)	This button is currently unused. A future hardware and software enhancement may provide this functionality.
 (Menu)	Displays the top-level EFB Application Manager Main Menu on demand and overrides all other operations.
 (Back)	Each actuation returns user to the previous navigation level <i>within</i> the active application, but does not navigate from the application back to the Main Menu. At the highest navigation level in the active application, the key is non-functional.
 (Decrease Brightness)	Each actuation decreases the screen brightness by one interval.

 (Increase Brightness)	Each actuation increases the screen brightness by one interval.
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Display Header:

The top centimetre of the EFB screen is controlled and managed by the Application Manager. This area is reserved for the display header and EFB-related alert annunciation icons (FAULT, MEMO AND MSG (Message)). A fourth annunciation icon (XFR) indicates when the display is slaved to the off-side EFB. A SHOW button displays a control bar which enables bezel functionality (MENU, BACK, PGUP, PGDN, ZOOM OUT, ZOOM IN, and HIDE). The header is illustrated in the following picture:

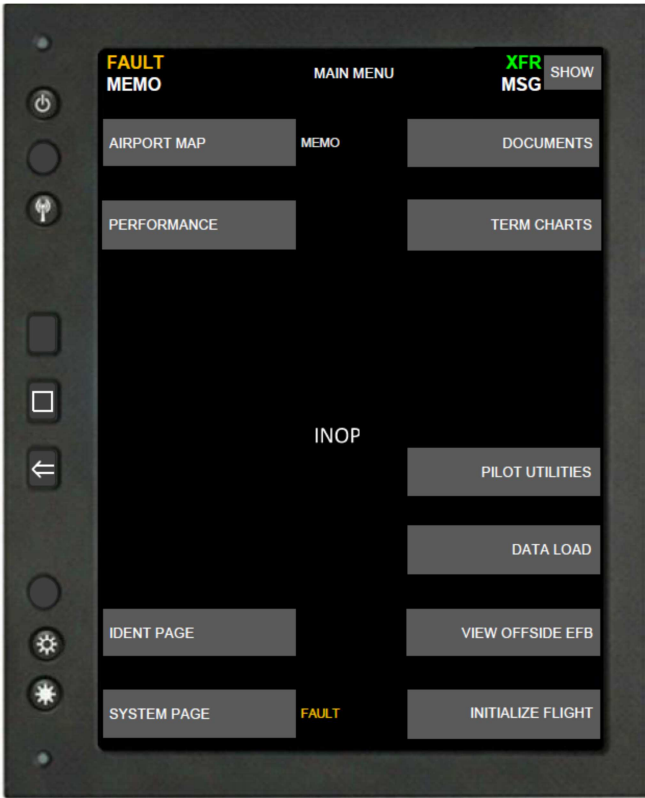


EFB Display Header with Control Bar Expanded:



NOTE: The Screen Title may occupy two lines. Two line titles display the name of the application on the top line and the name of the current (in focus) screen on the second line.

When the system displays a FAULT, MEMO, and/or MSG alert annunciation icon in the header, the user can return to the MAIN MENU page to determine which application generated the fault, as illustrated in picture here below, and to access the System page for additional information.



Display Header graphical conventions:

Type	Color	Meaning
FAULT	Amber	Indicates a fault identified within an application or the system.
MEMO	White	Indicates that one or more applications need attention.
MSG	White	Communication message – indicates one or more applications have an uplink available for crew review. Used only if the EFB system is connected to an external communications device.
XFR	Green	Indicates the display is in transfer mode to view the content of the other EFB display. While in this mode, the display cannot be manipulated. Pressing the display bezel XFR key again removes the EFB from transfer mode.

The menu command buttons display applications within the EFB that are activated via bezel buttons and/or touch screen.

The following graphical conventions for EFB display applications states apply:

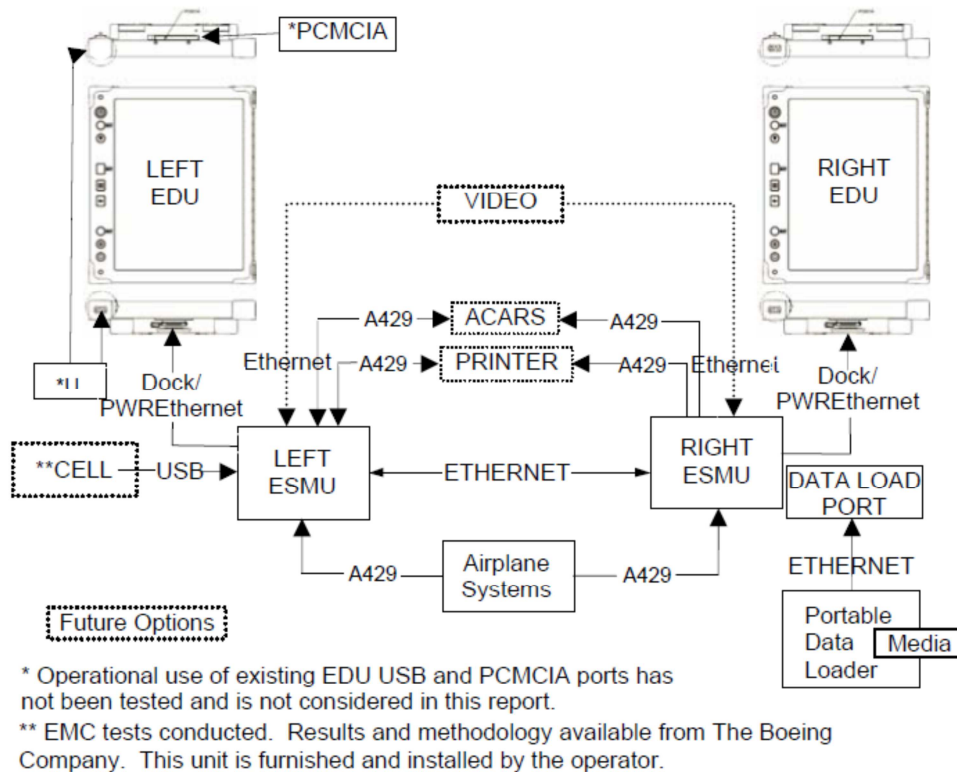
State	Color Key	Functionality
Active	White text on a grey field	Available to respond to the focus and to selected states. When these areas appear shaded, they provide visual indicators of functions that are selectable using the touch screen. Shading allows the user to quickly see the actions that are available on each screen.
In focus	White border	Border color changes to provide user feedback when the cursor (or user's finger) is within the active area for selection of the control. Supports user selection of the intended function when multiple active areas are immediately adjacent to each other. Controls remain in the in-focus state until another control is selected, so that users can easily see their navigation path.
Selected	Green field (retains white border)	Indicates that the control/button is selected and is initiating its function. Selection can occur via, finger-off touch screen.
Inhibited	Cyan text and border on a black field	Indicates that a normally active control is unavailable for selection. This state occurs when the function associated with the control is temporarily unavailable, such as a print control that is unavailable due to a printer malfunction.
Data Source	Green border	Data appropriate to that button has been pulled from aircraft data busses.

EFB System Configuration (737 NG):

The configuration of the EFB installation for a particular model aircraft is described in Chapter 46 of the appropriate Aircraft Maintenance Manual.

Two aircraft configurations are available for EFB installation. The basic installation is EFB with optional text printer, cellular modem, portable data loader, and media data loading. All optional equipment is shown in the following schematic diagrams. The evaluated configuration included data transfer via the optional cellular modem.

The EFB interfaces include Universal Serial Bus (USB), digital ARINC 429 signals, and ARINC 664 Ethernet. The EFB is designed to work in multi-models. The figure below illustrates the EFB interfaces from a 737 NG-model perspective:

Mounting System (737-NG):

The EFB mounting system is manufactured by CMC Electronics. The part numbers for each pilot station are: Capt, 245-604382-000, and F/O, 245-604382-001.

This mounting system ergonomics has been evaluated by the Seattle FAA AEG and found to be acceptable for use in all phases of flight. The EASA OEB team has discussed the aspects of this evaluation with the Seattle FAA AEG and agreed to take credit from the FAA AEG conclusions.

Operating system and Versions:

The Boeing-CMC Class 3 EFB system uses the BP 3.0 software. Refer to [chapters 3.3 to 3.5](#) of the main report.

Airworthiness approval:

The airworthiness approvals by STC (Linefit: EASA STC 10045157 / Retrofit: EASA STC 10044973) cover the hardware aspects such as EMI/EMC, rapid depressurization, and lithium battery.

EASA STC 1004697 covers the installation of the Operating System on the Boeing-CMC Class 3 EFB.

B.4. EFB Software Applications

This addendum does not cover specific software applications evaluation.

The software applications are considered common to all Boeing class 3 EFBs and are therefore addressed by chapters 4 and 5 of this report.

An exception is the AMMD application. On other Boeing Class 3 EFBs, it has in the past been airworthiness approved (EFB Type C application) and hosted on a segregated Linux partition.

The Linux partition is however not offered on the Boeing-CMC Class 3 EFB system. The AMMD may be hosted on the Windows partition as a type B application and under AMC 20-25 guidance. This requires however an evaluation to ensure that the AMMD is compliant to the provisions of AMC 20-25 (at least CRD version), in particular Appendix H. This evaluation has not been performed by EASA.

B.5. Operational Evaluation

B.5.1. Operational Risk Analysis

Refer to Appendix A.

B.5.2. Human Machine Interface Assessment

EASA has reviewed the HMI testing performed by Boeing and by the FAA AEG on the Boeing-CMC EFB in the 737 NG. This testing included evaluation of the ergonomics, display lightning, reflectivity, and legibility of text.

After discussion with the FAA, EASA considers that those topics have been satisfactorily evaluated and that the Boeing-CMC EFB is satisfactory in all ambient lightning conditions.

Concerning Input Devices, the EDU does not possess the bezel keys that were offered on the legacy Class 3 EFB. The OEB evaluation team however found that the input making through the touch screen was satisfactory, as the use of the hard function keys.

Considerations related to software are addressed in chapters 5.2.4 to 5.2.11.

B.5.3. Other aspects

Other considerations, such as flight crew procedures, training, etc, that are hardware independent, are addressed by chapters 5.3 to 5.9 of this report.

B.6 Conclusion

This appendix is applicable to both operators and NAAs when considering an application for Operational Approval of the Boeing-CMC Class 3 EFB system. The OEB has found that the Boeing-CMC Class 3 EFB system and its software as evaluated satisfy the guidance of JAA TGL 36 and Draft AMC 20-25, 2009 version.

This finding does not, in itself, constitute an Operational Approval and individual operators must obtain approval from their NAA prior to use of this Boeing-CMC Class 3 EFB system.