More airlines are realising the potential benefits of adopting an EFB solution. The number of hardware and software vendors continues to increase even as technical classifications continue to develop. Some of the main vendors and their products are identified.

An introductory survey of EFB & ETL hardware, software & services vendors

More airlines are considering Electronic Flight Bag (EFB) solutions for the flightdeck as a means of providing cost and efficiency savings.

An EFB is the combination of electronic visual display hardware and software that can perform operational functions that previously relied on paper or manual processes. Examples include operations manuals, load sheers, performance calculations, and aeronautical charts, as well as aircraft-handling material that relied on paper and people to get information to and from the aircraft.

An EFB solution can save weight by removing paper from the flightdeck. It can also integrate the flightdeck into an airline's central IT system and workflows. This can lead to efficiency benefits in areas such as operations and maintenance, loading, airport operations, fuelling and other handling functions.

This survey attempts to identify some of the main EFB-related hardware, software and services vendors, and offers a brief introduction to their products. The focus is on flightdeck, rather than cabin, functionality. The EFB market is rapidly changing and expanding, so this survey does not claim to cover every supplier.

EFB hardware

Although these distinctions are changing, there are primarily three classes of EFB hardware. Class 1 devices are not fixed to the aircraft and have no data connectivity with aircraft systems. They are often consumer-off-the-shelf (COTS)-based portable electronic devices (PEDs). These include laptop computers and tablet devices. They support Type A and B software and do not require airworthiness approval. Provided that they are properly secured and viewable, some authorities now permit the use of Class 1 devices throughout all phases of flight.

Class 2 hardware can receive data from aircraft systems. It can also send data to aircraft systems via an approved aircraft interface device (AID). Class 2 EFBs can be attached to a mounting on the flightdeck for use in all phases of flight, but are often portable and can be COTS devices. They can support Type A and B software, and only require airworthiness approval for the mounting.

Class 3 EFBs are installed avionics equipment. They require airworthiness approval and can support all software types. Two-way connectivity with aircraft systems is possible for Type C software applications.

Initially most EFB solutions involved Class 2 and 3 hardware, specifically designed for flightdeck use. In the past few years the trend has shifted towards Class 1 and 2 solutions based on COTS tablets. This has led some traditional EFB hardware manufacturers to differentiate their products by offering mountings and AIDs for tablet-based systems alongside their existing solutions.

The main operating systems used on EFBs are iOS, for iPad-based solutions, and Windows for most other hardware types. Hardware that supports the Android operating system is also starting to become available.

Class 3 systems may have two operating systems. One may be certified for use with avionics-grade applications. They will normally also have the capability to host Windows-based Type A and B software.

EFB hardware suppliers fall into two groups: traditional hardware vendors, which offer devices specifically tailored for the flightdeck environment; and COTS hardware vendors, which have consumer products that have been assimilated to perform EFB functions.

Traditional hardware vendors

Astronautics Corporation of America

Astronautics Corporation of America has more than 50 years' experience in designing and integrating aircraft avionics. EFBs are now one of its core product lines. All Astronautics EFB hardware solutions consist of a computer/processor unit (EU) and a display unit (DU) in a two-box configuration. Its hardware offering comprises two generations of dual-processor EFBs designed for Boeing aircraft, a single-processor EFB, an on-board information terminal (OIT), and its latest commercial hardware: the NEXIS™ Flight-Intelligence System.

Astronautics' EFB hardware options include installed Class 3 systems or removable Class 2 solutions. The dual-processor EFBs are Class 3, while the single-processor EFB and the NEXIS EFB can be installed as a Class 2 or 3 device.

The dual- and single-processor EFBs support software compatible with the Windows 7, XP and Linux operating systems. The dual-processor EFB runs a Windows operating system on one processor and Linux on the other, with a hardware partition between them. The NEXIS system supports a Linux or Windows operating system. Astronautics' EFB hardware can be connected to aircraft systems via Ethernet, ARINC 429, ARINC 717, or discretes for data

The navAero t•Bag™C2² can be portable or installed. It is a Class 2 device that can run a Windows operating system and is certified for use on most Boeing and Airbus aircraft.

exchange. The Astronautics family of EFBs can connect to aircraft communication systems including ACARS and satellite communication (Satcom).

Astronautics Dual-Processor Class 3 EFBs are sold as standard installed equipment on the 787. They are also offered as optional equipment on the 777, 747, and 737. The majority of airline sales are line-fit on new aircraft. The NEXIS EFB has been granted a supplementary type certificate (STC) for installation on the A319, A320 and A321. Astronautics EFB hardware is currently operating with more than 85 airlines.

Astronautics also offers a PED tablet integration option. Using the NEXIS EU as an AID, a PED can communicate with aircraft systems. The interface between the PED tablet and NEXIS EU can be wired, wireless or Bluetooth.

DAC International Inc

DAC International is based in Austin, Texas. The company offers avionics equipment solutions, including the Gen-X EFB which can operate as a Class 2 or 3 EFB. It consists of an installed computer processor and a mounted, interactive touchscreen display.

Gen-X uses the Windows 7 operating system and can accommodate any third-party Windows 7-based EFB applications. It could also come with a Linux operating system. Gen-X can be hardwired to an ARINC 429 databus for uploading and downloading data to and from approved avionics systems. It is equipped with Wi-Fi, cellular, USB and Ethernet connectivity interfaces. It can tie into any communication system available on the aircraft including ACARS and Satcom.

Currently there are STCs pending for Gen-X for the 777, A330-300, A340-300, A320 and 747-400/-800. DAC International has two existing airline customers for Gen-X, which can be installed in line fit or by retrofit.

DAC International also offers its GDC 64 product, an AID that provides approved power and connectivity to aircraft systems for COTS-based tablets. The company has five airline clients for the GDC 64.

Esterline CMC Electronics

Based in Montreal, Canada, CMC Electronics (CMC) is part of the Esterline Technologies Corporation. It provides the PilotView® product line of EFB hardware.

The first airline customer was established in 2007 and there are now 29 operators using PilotView® hardware. This includes the CMA-1612, CMA-1410 and CMA-1100 range of avionics-grade electronic display units (EDUs) with built-in processors. These units can be portable or installed, and are normally configured as fully compliant Class 2 systems. They are installed with an expansion module unit (EMU) that offers a certified interface to aircraft data and power. The three PilotView® EDUs can support Windows XP/7 and Linux operating systems. They have a number of potential communication interfaces including WiFi, cellular, Ethernet, ACARS and Satcom.

CMC also offers integration solutions for PEDs such as the iPad through its aircraft information server (AIS) architecture. This connects the PED to an AID, allowing data connectivity with the aircraft and Class 2 functionality. The AIS also operates with the PilotView® EDUs via Ethernet connectivity.

PilotView® EDUs are offered as optional, line-fit, Class 2 EFB solutions by a number of aircraft manufacturers, including Boeing, Embraer, ATR and Bombardier.

PilotView® EDUs are certified for use on 737, 747, 757, 767, A320-family, A330, A340, ATR 42/72, E-175/-190, and CRJ-700/-900/-1000 aircraft.

navAero AB

navAero AB is a Swedish company with extensive experience in developing and commercialising Class 2 EFB computer and display hardware and STCs.

The company's core product is the flightdeck-tailored t•Bag™C2² Class 2 EFB system. This avionic-grade, retrofit solution can be portable or installed, and consists of a remote-mounted docking station with a central processing unit (CPU) and a choice of several different touch screen t•Pad™ displays. The t•Bag™C2² offers built-in USB and Ethernet connectivity as standard. It also provides WiFi and cellular connectivity options. The t•Bag™C2² system can be hardwired to an ARINC 429/717 databus, as well as aircraft discretes via the navAero universal aircraft interface device (UAID) to provide access to aircraft data. When connected to the UAID Satcom or ACARS, connectivity can be realised.

navAero currently has STCs covering the installation of the t•Bag™C2² on a wide range of commercial aircraft, including most Boeing and Airbus models. It is currently contracted with 41 airlines for the t•Bag™C2² system. The t•Bag™C2² hardware is delivered with the Windows 7 operating system and can run any compatible third-party software. It also has the capability to host Windows XP or a Linux operating system.

navAero also offers a Class 2 COTS iPad/tablet EFB installation solution. This includes a mounting solution for the selected device and the ability to provide certified connectivity to aircraft power for device charging. By incorporating the navAero UAID into the COTS tablet system architecture, data connectivity to an aircraft can be achieved.

NVable's Appixo ETL is available for EFBs operating with Windows 7 and 8. BA Cityflyer uses it in combination with Panasonic's Toughbook mobile computers.

In addition, navAero markets video camera surveillance hardware and recording software, as well as dedicated aircraft file servers. navAero also provides customised middleware to facilitate functionality of third-party software with the navAero EFB system.

UTC Aerospace Systems

UTC Aerospace Systems (UTAS) was formed in 2012 following the merging of Hamilton Sundstrand and Goodrich. Its SmartDisplay® EFB range offers Class 2 or 3 hardware solutions.

The SmartDisplay G500 and G700 series combine the EFB display and computer into one unit. Both can be connected to avionics systems to permit the exchange of data between the aircraft and EFB. They can be hardwired to ARINC 429, ARINC 717 and discretes via an AID. The SmartDisplay units are an avionics-quality solution and have a Windows-based operating system. They can run any Windows compatible software. UTAS has also developed a certified version of the G500 using DEOS.

Communication interfaces on the G500 and G700 include WiFi and cellular. On the G700 these interfaces are built in, while for the G500, WiFi and cellular capability can be added via a USB port.

The G500 and G700 can tap into aircraft communication systems to send data via ACARS and Satcom. They both have ADS-B IN capability for future ATC requirements.

For the G500, UTAS currently has STCs for the A320-family, A330, 737NG-family, and the 747-400. For the G700 there are STCs pending for the 737NG-family, A320-family, A330 and A340.

UTAS also offers a tablet-compatible system. This includes a tablet interface module (TIM), Federal Aviation Administration (FAA)-certified AID and an installation kit, and permits COTS tablet devices to act as a Class 2 EFB with the ability to access avionics data. UTAS now has STCs pending for the A320-family and 737NG-family for its TIM product.

UTAS currently has seven airline customers for the G500, two for the G700 and a launch customer for the TIM.

VT Miltope

VT Miltope is based in Alabama, USA. It is a leading manufacturer of rugged computer hardware for the military, and industrial and commercial aviation applications.

It is developing a ruggedised tablet platform called ODEM (On-Demand Extreme Modularity). Unlike COTS-based devices, ODEM is designed for functionality and capability expansion and evolution.

The ODEM tablet will be available from the first quarter of 2014 and could be used as a Class 1 or 2 EFB device. It will be able to host Windows, Android or Linux operating systems.

COTS Hardware Vendors

Apple

The iPad has proven popular as a COTS EFB device. Legacy carriers, including American Airlines and Qantas, have implemented iPad-based EFBs. The iPad can be used as part of a Class 1 or 2 EFB system.

Microsoft

Founded in 1975, Microsoft is a worldwide leader in software, services and solutions. Microsoft announced its entry into the hardware devices business in 2012, and Delta Air Lines recently chose the Surface 2 tablet for its EFB hardware solution.

Classified as a portable Class 1 solution, the Surface 2 will run on the Windows RT 8.1 platform and provide flight crews with real-time access to essential tools and the most up-to-date flight-related resources, including key charts, reference documents and checklists.

Mounting devices for the Surface 2 are available from third-party providers.

Panasonic

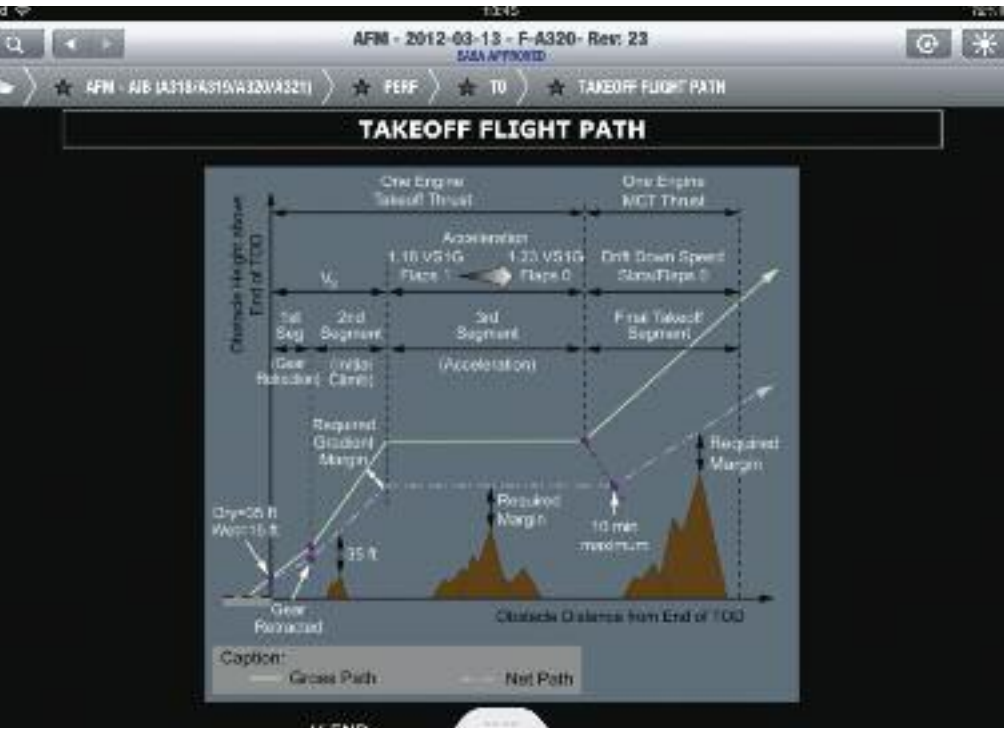
Panasonic Corporation is based in Japan and is one of the world's largest manufacturers of electronic products.

Panasonic's Toughbook® range of mobile computers can be used as EFB hardware solutions. They are designed for use in harsh environments with a focus on ruggedness, durability and mobility.

The FZ-G1 and JT-B1 are Toughpad tablet devices. The FZ-G1 uses Windows 7 or 8, while the JT-B1's operating system is Android 4. Both Toughpad devices can connect to certified, powered docking stations for Class 2 status. They can also operate as Class 1 devices. The FZ-G1 and JT-B1 can connect to back office systems via Wi-Fi, 3G or 4G cellular networks and USB methods. Both Toughpad devices come with D0160G certification.

Panasonic also offers the Toughbook CF-19, a PC which converts from a laptop to a tablet. The Toughbook CF-19 operates as a Class 1 device and supports Windows 7 compatible software. It offers the same back-office connectivity options as the FZ-G1 and JT-B1.

There are currently 15-20 airlines using Toughbook hardware as part of their EFB solutions.



Most commercial aircraft manufacturers provide EFB software. This normally includes performance calculation tools. Airbus provides the FlySmart with Airbus EFB software platform. It includes the Ops Library Browser for viewing documents and manuals.

Scandinavian Avionics A/S

Scandinavian Avionics A/S is part of the SA Group. The Denmark-based company has been providing avionics maintenance, sales, certification and installation services for more than 35 years.

Scandinavian Avionics currently offers a proprietary, Class 2, tablet-based EFB hardware solution. This solution hosts Windows-based software and consists of the Panasonic FZ-G1 Toughpad in combination with Scandinavian Avionics' Data Integration Center (DIC-600) and Ethernet Radio Controller (ERC-400).

This concept is designed to be 'future-proof' by moving the focus from the EFB display to the flightdeck infrastructure. Airlines can then regularly upgrade their COTS tablet devices, while incurring lower certification costs than would be necessary with traditional avionics-grade EFB hardware.

The DIC-600 can provide bi-directional connectivity to aircraft systems. The communications module (ERC-400) offers a number of potential wireless communication interfaces, including cellular or WiFi.

STCs have so far been granted for 737s and are under approval for the ATR 42/72, A320 and Q400.

There are currently four airlines using Scandinavian Avionics' EFB hardware. Two of these have the full solution. The other two use the basic version consisting of the tablet and power supply only. Scandinavian Avionics also provides European Aviation Safety Agency (EASA) certification services and installation support based on its own in-house EASA Part 21J, 21G, 145 design, production and maintenance organisations.

EFB Software

EFB software is classified as Type A, Type B or Type C.

Type A applications are generally pre-composed and non-interactive. Examples might include document readers.

Type B software can be dynamic and interactive and use data for operational requirements. Examples include electronic aeronautical charts, performance calculation tools, the electronic technical log (ETL) and flight operations manuals.

Type C software provides avionics functions for communication, navigation and surveillance, such as ADS-B.

Type A and B software does not need avionics approval, but Type C does.

Type A and B applications will form the main focus of this feature.

There is an ever-growing list of EFB software vendors. Some are focused on providing individual applications in specialised areas, such as aeronautical charts. Others offer multiple software modules within an integrated platform with a general user interface (GUI). These can also incorporate other third-party software applications.

It is possible for EFB software to integrate with other software, but there are different levels of capability. Integration may refer to the ability for different software modules within a platform or application to exchange data. On the other hand it may only refer to the ability to launch a third-party application from within another vendor's platform or GUI. Integration could also mean the ability for software applications to exchange data with third-party back-office systems. The level of potential integration needs may also depend on the operating system being used. For confirmation of current integration capabilities, airlines should contact the appropriate software vendors directly.

Most EFB software is provided as native applications. This means it is physically downloaded on the hardware device so that the application can function off-line. When a connectivity solution is available or within range, such as gate-based WiFi, the software can synchronise updates or exchange data with ground-based servers.

EFB software vendors

ACFT PERFO

ACFT PERFO was formed in 1999 and is based in Luxembourg. It is experienced in implementing and managing EFB software solutions and airport data. It offers the ACFT EFB software applications suite for Windows, iOS, Linux and Android operating systems.

ACFT EFB includes take-off, landing and weight-and-balance calculation tools. These are interfaced from ACFT software applications. The suite also includes LIB, a flight operations library where documents, manuals and forms can be consulted in electronic format. Other applications include forms, briefing and crew flight reports.

ACFT LINK provides the interface between the EFB and different applications, and allows synchronisation and communication with ground server applications. ACFT ground applications provide a content management and EFB administration function.

The ACFT EFB modules can exchange data between them. The suite can host third-party applications.

ACFT EFB applications are currently being used by eight airlines.

Airbus

Airbus is a leading commercial aircraft manufacturer headquartered in Toulouse, France. It provides the FlySmart with Airbus EFB software platform for operators of its aircraft.

The FlySmart platform includes a number of modules: Ops Library Browser, which allows users to view

documents and manuals; Performance, which contains take-off, landing, in-flight and weight-and-balance calculation tools; Electronic Flight Folder; and CrossLogbook, which functions as an ETL.

The CrossLogbook is a mixed-fleet, standalone application that replaces the paper logbook. It allows operators to standardise logbook data and is inter-operable with the Airbus EFB applications and airline IT systems.

The FlySmart software modules are native applications and can exchange data. Airlines can select individual applications or a group of modules. It is also possible for third-party software to be integrated into the FlySmart platform.

There is a ground server for synchronising and sending data to and from the EFB modules. FlySmart can run on the Windows 7/8 Pro and iOS 7 operating systems and is used by 170 airlines.

Aircore Systems GmbH

Aircore Systems was formed in 2007 and is based in Germany. It has five airline customers for its AS-FlightBag 3.0 EFB software solution.

AS-FlightBag 3.0 has a number of core software modules: CrewBriefing, JourneyLog, TechLog, LeastCostRouting, Library and PostFlightAnalysis.

Functions include document viewing and content management, and an ETL. The JourneyLog includes an Operational Flight Plan (OFP) tool. The TechLog is a front-end module for communication with maintenance control systems. It includes: an electronic minimum equipment list (eMEL); eSignature capability; the ability to review the last aircraft status page issued by maintenance control; work order capture and communication; and aircraft status review after work order capture.

The AS-FlightBag 3.0 software modules can run on EFB hardware that supports Windows 7/8, and iOS 6/7. All modules are available as native applications and can exchange data.

Airlines are free to select the software modules they require. Full integration of third-party software is possible on Windows devices. The AS-FlightBag 3.0 ground server manages communications for synchronisation and content management. It can be connected to other airline software systems.

Arconics

Arconics is based in Dublin, and was formed in 2001 with a focus on providing content management and distribution services to airlines.

Its AeroDocs EFB product consists of four main software modules: Notices, Manuals, Forms and Electronic Flight Folder. The Electronic Flight Folder module includes Flight Plan, Flight Log, Weather, notices to airmen (NOTAM) and Voyage report.

Arconics provides the capability to create, update, distribute and view notices, manuals, forms and the electronic flight folder. The software is currently available on any Windows 7, iOS 6 or Android-based EFB hardware.

The software can be selected as individual applications, or as part of an integrated platform. Other third-party applications such as performance and charting can also be incorporated. AeroDocs is also available via web-based portals so that flight crews can access notices, manuals and forms using desktop computers and other PEDs.

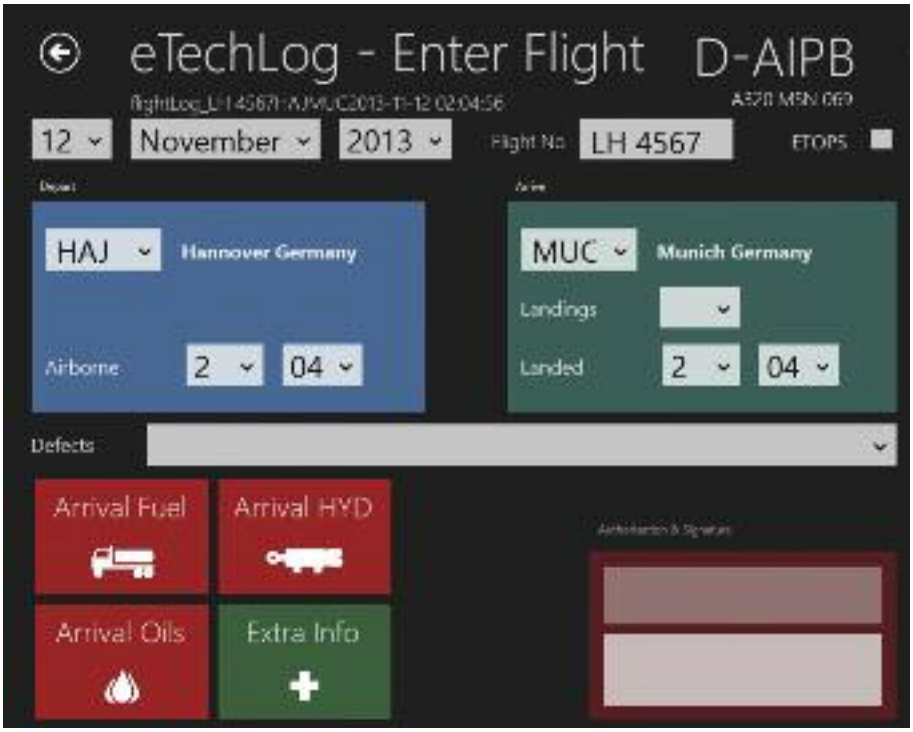
Arconics currently has a number of airline customers for its AeroDocs product, including: Ryanair, Aer Lingus, Thomson Airways and Philippine Airlines.

Astronautics Corporation of America

Astronautics also provides an EFB software platform, which can host third-party software applications that run on the Windows 7/XPE or Linux operating

EFB HARDWARE, SOFTWARE & SERVICES VENDORS, PRODUCT NAMES & CONTACT INFORMATION

Company	Website	Contact Person	Contact Details	EFB Product
Traditional Hardware				
Astronautics	www.astronautics.com	Brian Keery	b.keery@astronautics.com	Dual/Single Processor & NEXIS™ EFB
DAC International Inc	www.dacint.com	Peter O'Connor	poconnor@dacint.com	Gen-X & GDC64
Esterline CMC Electronics	www.cmcelectronics.ca	Marek Rakowski	marek.rakowski@cmcelectronics.ca	PilotView®
navAero AB	www.navaero.com	Simone Giordano	simone.giordano@navaero.com	t•Bag™C2² EFB System
				iPad/Tablet EFB System
				t.com Communications Module
				t.Server
				t.com Video Surveillance System
UTC Aerospace Systems	www.utcaerospacesystems.com	TJ Horsager	thomas.horsager@utas.utc.com	SmartDisplay®
VT Miltope	www.mymiltope.com	Markus Gilges	MGilges@Miltope.com	ODEM
COTS Hardware				
Apple	www.apple.com	n/a	n/a	iPad
Microsoft	www.microsoft.com	Angela Lean	alean@microsoft.com	Surface 2
Panasonic	www.toughbook.eu	Russell Lane	russell.lane@eu.panasonic.com	Toughbook®
Scandinavian Avionics A/S	www.scanav.com	Hakan Norell	hno@scanav.com	Tablet-based EFB
Software				
ACFT PERFO	www.acftperfo.com	Arno Broes	info@acftperfo.com	ACFT EFB
Airbus	www.airbusworld.com	Jerome Martin	jerome.martin@airbus.com	FlySmart with Airbus
Aircore Systems GmbH	www.aircore.aero	Michael Rosenkranz	michael.rosenkranz@aircore.aero	AS-FlightBag 3.0
Arconics	www.arconics.aero	Niall O'Sullivan	niall.osullivan@arconics.com	AeroDocs
ARINC	www.arinc.com	Mark Taylor	mtaylor@arinc.com	eEnabled Aircraft
Astronautics	www.astronautics.com	Brian Keery	b.keery@astronautics.com	CDTI/Document reader
ATR	www.atraircraft.com	n/a	n/a	SPS
Aviovision N.V.	www.aviovision.com	Knut Aabo	knut.aabo@aviovision.com	AVIOBOOK®
Boeing	www.boeing.com/boeingedge	William Vlases	william.g.vlases@boeing.com	
Comply365	www.comply365.com	n/a	info@comply365.com	myMobile365
Conduce Group	www.conduce.net	Paul Boyd	paul.boyd@conduce.net	Conduce eFB8/ETechlog
EasyBrowse GmbH	www.easybrowse.com	Torsten Machert	torsten.machert@easybrowse.com	EB. Suite
EmpowerMX	www.empowermx.com	Phil Bathurst	phil.bathurst@empowermx.com	FleetCycle Electronic Log Book
Esterline CMC Electronics	www.cmcelectronics.ca	Marek Rakowski	marek.rakowski@cmcelectronics.ca	
Evoke Systems	www.evoke-systems.aero	Martin Smith	martin.smith@evoke-systems.aero	EFOS iPad
Flatirons Solutions Inc	www.techsightx.com	Paul Saunders	paul.saunders@flatironssolutions.com	Techsight/X iPad app for Flight Operations
Flightman	www.flightman.com	Diogo Serradas	diogo.serradas@flightman.com	Flightman™ EFB software
Flygprestanda AB	www.flygp.se	Sales	sales@flygp.se	Performance Guru
International Flight Support	www.ifs.aero	Jens Pisarski	sales@ifs.aero	PFB™ Paperless Flight Bag
Jeppesen	www.jeppesen.com/mobile	Stephanie Masura	stephanie.masura@jeppesen.com	FliteDeck Pro
Lufthansa Systems	www.lhsystems.com	n/a	info@lhsystems.com	Lido/FlightBag, Lido/eRouteManual
				Lido/Performance, Lido/iRoute Manual
				Lido/enRoute, Lido DocView
Navtech	www.navtech.aero	Heath Bowden	hbowden@navtech.aero	Navtech EFB
NVable Ltd	www.nvable.com	Cameron Hood	cameron.hood@nvable.com	Appixo ETL
PACE Aerospace GmbH	www.pace.de	Oliver Spaeth	oliver.spaeth@pace.de	Pacelab CI OPS
				Pacelab Flight Profile Optimiser/
				Pacelab EFB Data recorder
Sabre	www.sabreairlinesolutions.com	Andrew Eastaugh	andrew.eastaugh@sabre.com	Sabre AirCentre eFlight Manager
Sheorey Digital Systems	www.sds.co.in	Prashant Kavi	prashant.kavi@sds.co.in	ARMS on the TAB™
SITA	www.sita.aero	Mario Sabourin	mario.sabourin@sita.aero	e-Aircraft™ Services
Skypaq	www.skypaq.com	Pat Clancy	pat.clancy@skypaq.com	Skypaq eLog/eCabinLog
Smart4Aviation	www.smart4aviation.com	Mike Lewis	mike@s4a.aero	Smart EFB
T&A Systeme GmbH	www.logipad.aero	Alexander Zinn	n/a	Logipad
Ultramain Systems Inc	www.ultramain.com	Melissa Martinez	mmartinez@ultramain.com	efbTechlogs™, eReporting™,
				efbGroundSystem™
UTC Aerospace Systems	www.utcaerospacesystems.com	Bill Baumgarten	bill.baumgarten@utas.utc.com	UTAS EFB Application Suite
Web Manuals AB	www.webmanuals.aero	Martin Lidgard	martin.lidgard@webmanuals.aero	Web Manuals
Other EFB Products/Services				
ASIG	www.asigllc.com/www.flytab.aero	Luke Ribich	lribich@flytab.aero	flyTab®
Closed Loop Consulting	http://loopclosed.com.au	Captain Michael Bryan	michael.bryan@loopclosed.com.au	Your EFB
Teledyne Controls	www.teledyne.com	Murray Skelton	mskelton@teledyne.com	WGL-AID™ and WGL-Fi™
Thales	www.thalesgroup.com/aerospace	Pierre-Yvan Pecunia	topwings@thalesgroup.com	Topwings



Conduce provides EFB software for Windows and iOS devices. This includes eTechLog, the first fully touch-optimised Windows 8.1 ETL.

systems.

Astronautics also offers its own applications for Windows and Linux. These include a document reader, an application manager and a suite of Cockpit Display of Traffic Information (CDTI) applications, designed to support future Air Traffic Control (ATC) SESAR and NextGen technologies. Three airlines have currently been provided with the CDTI application suite. The CDTI application is designed to run on Astronautics' latest EFB hardware platform, the NEXIS™ Flight Intelligence System, and has been adapted to operate on UTC and CMC Electronics EFBs.

Most of the CDTI's functionality depends on it running as a certified, Type C application, so for full functionality it has to be run on the Linux operating system.

AvioVision N.V.

AvioVision N.V. is a Belgium-based company that was established in 2010. It provides a full suite of EFB software functions through its AVIOBOOK® product for which it currently has 11 airline customers. The latest AVIOBOOK® release includes 12 software modules, the Base ground server, and a Pilot Portal.

Among other functionalities, the software modules include a weight-and-balance tool and the ability to create, view and update documents, forms and manuals.

The software modules are hosted in a single suite with a consistent GUI and the ability for data to be shared among them. Airlines have full flexibility to activate the specific software modules they require. The full list of modules is: Main, Operational Flight Plan (OFP), Briefing, Weight and Balance, Library, Tools, Reports, Electronic Check List (ECL) and Globe. A new surveillance camera module has been added in the latest release. Third-party software applications can be integrated within the AVIOBOOK® platform and GUI. The Charts and Performance calculation (Perf) modules are provided by third parties, but fully integrated in the workflow.

The software modules are native applications and can run on EFB hardware that supports iOS 5 onwards and Windows XP/7/8 PRO/8.1 PRO.

The AVIOBOOK® Base is a centralised ground administration tool that can connect the software modules to third-party back-office systems and allow two-way data exchange. The pilot portal provides on-line access to the same software modules when outside of the flightdeck for pre- and post-flight requirements. This is of particular use for airlines operating installed EFB systems, or where data communication relies on portable memory devices.

ARINC

ARINC has been providing communication systems for commercial aviation for more than 80 years. Its e-Enabled Aircraft Solution is a set of integrated services that provide on-board data management via automated communication methods. It includes EFB software and services.

ARINC provides a suite of EFB software applications, including EFB Program Manager, Chart Viewer, DocViewer, TechLog and FOQA Management. Airlines can choose individual or multiple modules.

EFB Program Manager can administer all applications on an EFB and can integrate third-party applications and data. The software applications can run on Windows XP/7 compatible EFB hardware devices.

The Content Delivery Management System can perform automated updates of EFB applications. It can send and receive data between the EFB and back-office systems via an ARINC communications management service.

AeroSync provides a communication management facility that sends data to and from an EFB, while prioritising an airline's preferred method. This might be via ACARS, WiFi, Cellular or Satcom. AeroSync also provides the interface between the EFB and AID for exchanging data to and from aircraft systems.

ATR

ATR is a joint venture between Alenia Aermacchi and EADS, based in Toulouse, France. It is a leading commercial turboprop manufacturer. It supports sales of its ATR 42 and ATR 72 aircraft with an EFB performance application called Single-Point Performance (SPS).

SPS is a native application that includes take-off, landing and weight-and-balance computation modules for ATR aircraft. It can operate on Windows-compatible devices up to and including Windows 7. An iOS-compatible version is currently in development.

There are currently 15 airlines using the SPS application.

ATR also offers a Class 2 EFB solution in co-operation with CMC Electronics and its PilotView® hardware.

Boeing

Based in Seattle, USA, Boeing is one of the world's largest commercial jet manufacturers. It offers a range of EFB software applications to support operators of its aircraft. These can function individually, or as part of an integrated platform. The software applications are the Onboard Performance Tool, Electronic Flight Folder, Electronic Document Browser, Electronic Logbook, Interactive Quick Reference Handbook, and Flight Deck Entry Video Surveillance System.

The On-board Performance Tool includes take-off, approach and landing, and weight-and-balance calculation tools

The Flightman™ EFB software application suite can run on Windows, iOs and Linux operating systems. Airlines can select from a number of software modules including the eJourneyLog.

for Boeing aircraft.

Boeing's software platform allows multiple third-party applications to be incorporated, such as Jeppesen's aeronautical charts. The Electronic Logbook (ETL) software is provided by Ultramain Systems.

Boeing software is, or soon will be, compatible with the latest versions of iOS and Windows.

Boeing's EFB software is used by more than 100 airlines.

Comply 365

Formed in 2007 and based in Wisconsin, USA, Comply365 is a company that offers an EFB software application called myMobile365. The application provides a document management solution and smart forms so that users can access and complete documents and forms on PCs or tablets whether on- or off-line. Flightcrews can view and confirm compliance with any type of document including manuals, checklists and forms. These automatically synchronise with an enterprise content management platform for real-time data visibility and updates.

myMobile365 is a native mobile application that can run on any iOS system from iOS 5 onwards, Windows 8 and any Android system. Third-party software applications can be included in myMobile365's container application. Comply365's solutions integrate with third-party systems and databases. myMobile365 is used by several major US-based carriers.

Conduce Group

Established in 2009, UK-based Conduce Group has focused on combining information management system technology with business strategy.

Conduce has developed an EFB shell that can host third-party applications, such as performance calculation tools and electronic aeronautical charts. It has also developed various EFB applications, including several document viewers, form design and completion tools.

Conduce has also created and brought to market the world's first Windows 8.1, fully touch-optimised eTechLog. This native application works predominantly off-line without an internet connection. The preferred host device is the Panasonic ToughPad. The system is designed as a complete replacement for the aircraft paper technical log.

Functionality includes: full flight sector data management; defect raising; rectification/deferral and closing; out-of-phase (OOP) maintenance management; fuel and oils uplifts; de-icing management; Civil Aviation Authority (CAA) -approved and patented electronic signature sign-off; mobile SIM transmission of bi-directional data between the device and airline Maintrol/Flight Ops; and full integration with airline maintenance and engineering (M&E) systems.

Conduce software is compatible with Windows 7/8.1 and iOS 7 devices. The software applications can be taken individually or together. Conduce provides a ground server for software content management. The software can be integrated into third-party EFB software platforms.

Conduce currently provides software to four airlines.

Easy Browse GmbH/Ovidius GmbH

Easy Browse is a subsidiary of Ovidius and based in Germany. Ovidius provides technical documentation management software through its TCToolbox airline edition. Easy Browse provides its EB.Suite which allows electronic publishing on mobile devices. The publications can also be made available as on-line publications on the internet or intranet.

Airlines can use EB.Suite, in combination with TCToolbox to publish and then manage electronic content on EFBs such as forms, reports, manuals and other documents. EB.Suite can function as a native application on iOS and Windows-based devices.

There are currently two airlines using EB.Suite.

EmpowerMX

EmpowerMX was formed in 1999, and is based in Texas, USA. It offers the FleetCycle® product, a cloud-based maintenance management tool and consultancy service.

EmpowerMX provides an ETL called the FleetCycle® Electronic Log Book. This is designed as a complete replacement for traditional paper tech logs. The FleetCycle® Electronic Log Book can operate on iOS 6 and above, Windows 7 and above, and Android 4 and above. There is a cloud-based, EmpowerMX line maintenance application that interfaces with the logbook in flight. It is possible to connect the ETL to M&E systems.

EmpowerMX recently announced ATSG as its first customer for the FleetCycle® Electronic Log Book.

Esterline CMC Electronics

CMC Electronics provides EFB software with its PilotView® hardware. This includes the Main Menu Suite, eDocView®, sideView®, noteView® and calcView®. These run on a Windows XP, 7 or 8 operating system. The main menu suite can integrate other third-party Windows-based software applications. There is an integration and verification service to support this process.

CMC Electronics also offers other custom-built applications, including CMCView®, En-Route Weather, eFlight Report, FlightView and Tandem™.

IFS has signed up six airline customers for its PFB™ EFB software platform in 2013. The PFB™ platform contains multiple software modules that can exchange data. It can run on iOS and Windows compatible devices.

Evoke Systems

Evoke Systems is a British company that was formed in 2001 with a focus on developing software to improve flight operations efficiency.

Its core product is EFOS, a web-based crew portal and communications management system that is available on the web or as a native application on EFB devices. The EFOS iPad EFB modules include Journey Log, Library, Crew Notices, Safety Forms and Training Forms. Airlines can select the modules they require. Functionality includes the ability to view, update and distribute electronic documents, forms, manuals and notices.

The EFOS EFB software can operate on devices that support iOS 6 and onwards and Windows XP and onwards. It integrates with most airline flight operations software.

Evoke Systems currently has six airline customers using its EFOS iPad EFB software.

Flatirons Solutions Inc

In 2013 InfoTrust Group acquired Flatirons Solutions and renamed the combined entity Flatirons Solutions Inc. Based in California, USA, the company's TechSight/X® suite of products provides technical information management for airlines.

The Techsight/X Flight Operations and Manuals edition helps airlines to create and manage the content of their flight operations and company manuals, along with other documentation. Using the TechSight/X application for flight operations, this content can be accessed by flight crews using iPad-based EFBs.

The TechSight/X iPad application for Flight Operations is a native application that operates on iOS 6/7. It manages and updates manuals and documents on iPad EFB solutions.

It is possible for the TechSight/X application to be integrated into a third-party software platform although this is yet to happen.

Flightman™

Dublin-based Flightman™ was founded in 2000. It has EFB software in service with 13 airlines. The Flightman™ EFB software application suite offers multiple software modules in an integrated platform. Functions include document viewer and content management, performance calculations, weight-and-balance and an ETL.

The full suite of available applications comprises: eJourney Log; Electronic Flight Folder; eTechlog; Performance Calculations; Weight and Balance; Large Content Manager; Forms Designer; Business Intelligence Tool; Passenger Relationship Manager; and a Ground Administrative Manager for the central management of the deployed EFBs. The applications can run on iOS 6 and above, Windows XP/7/8, or Linux-based systems in both an aircraft-assigned or crew-assigned deployment.

Airlines can select the Flightman™ modules they require. These modules can exchange data. On Windows devices third-party applications can be launched from the Flightman™ software platform and data can be shared between third-party applications and Flightman™.

Flightman's software modules and platform are marketed individually and also as part of their partners' services offerings.

Flygprestanda AB

Swedish firm Flygprestanda was formed in 1969. It is a leading supplier of aircraft performance software solutions. These include a Flight Planning and Scheduling system and a take-off and landing performance system.

Flygprestanda offers the Performance Guru package of EFB software tools for Windows XP/Vista/7/8, and an iOS application is due for release soon.

Performance Guru consists of mass and balance and take-off and landing performance calculation tools. These can be taken together or as individual modules.

Performance Guru is a native application that can function offline.

International Flight Support - IFS

International Flight Support (IFS) was formed in 2001 and is based in Denmark. It offers its PFB™ (Paperless Flight Bag) solution for Windows XP/7/8 and iOS 6/7 compatible EFB hardware. An Android version can be made available on request. IFS has gained six new airline customers for its PFB™ solution in 2013.

The PFB™ is a fully integrated and interfaced EFB software platform that consists of the PFB™ Back office platform engine (web-based and hosted by IFS) and the PFB™ EFB software suite used in the flightdeck. The available software modules are:

- PFB™ Document Management and Library.
- PFB™ Voyage/Journey Log Reporting (pre- and post-flight reporting).
- PFB™ Electronic Flight Planning integration with eOFP.
- PFB™ Weight and Balance/eLoadsheet.
- PFB™ Take-off Performance (ON-line or OFF-line).
- PFB™ Landing Performance (OFF-line).
- PFB™ Flight Deck and Cabin eReporting.
- PFB™ Duty Time/Roster, a module based on integration to third-party scheduling/crew systems.

In addition to all of these, the PFB™

Lufthansa Systems provides a number of EFB software solutions for Windows and iOS, including electronic aeronautical charts. Lido/Enroute is an en-route charting application for the iPad.

Cross Feed functionality is standard for all delivered PFB™ solutions.

Operators can select individual or multiple software modules as required.

The Voyage/Journey Log modules cover the pre-flight and post-flight ETL items, except Minimum Equipment List (MEL) data. Integration of MEL data import and export requires a subscription to the PFB™ eTechlog module which facilitates handling of MEL and workcard data and defect reporting to and from the airline's maintenance system. All data recordings can be fed into any third-party back-end system, as required.

IFS also offers an integrated web-based PFB™ Crew Portal, which provides web-based access to all documents in the library including notifications.

The PFB™ Back office Portal engine can provide content management for the entire PFB™ platform.

The PFB™ Platform was built using architecture that makes it easy to integrate third-party software applications.

Jeppesen

Jeppesen was acquired by Boeing in 2000. It has been providing aeronautical charts to airlines for many years. It currently offers the Jeppesen FliteDeck Pro software application for Windows XP/7/8 EFB devices and those with iOS 6 or later.

Jeppesen FliteDeck Pro is an interactive application that provides en-route, terminal and airport chart data. Graphical weather is provided as an overlay to the en-route function. Jeppesen FliteDeck Pro can be integrated into third-party Windows-based software platforms. The Windows version of the application has Airport Moving Map (AMM) functionality. AMM on the iOS version will be available in a future release. The windows version can come with a container allowing Jeppesen to host and integrate third-party, Windows-based software applications.

Lufthansa Systems

Lufthansa Systems is a wholly-owned subsidiary of the Lufthansa Group and provides consulting and IT services for selected industries, including aviation. It offers a number of EFB software products and services for Windows 7/8 and iOS 6/7-based hardware devices under its Lido brand. Lufthansa Systems currently has 80 airline customers for its EFB software.

For Windows-based hardware, Lufthansa Systems provides Lido/FlightBag, Lido/eRouteManual, and Lido/Performance. Lido/FlightBag includes an EFB shell and a number of applications providing document administration and management functions. These can share data between themselves and include:

- Lido/FlightBag Library with Document Viewer.
- Lido/FlightBag Electronic Flight Folder.
- Lido/FlightBag Avionics Bridge.
- Lido/FlightBag RevisionService.
- Lido/FlightBag Reporting.
- Lido/FlightBag MultiPurpose Browser.

Lido/FlightBag Ground is a ground server that can integrate various third-party back-end systems to provide data exchange with the on-board software. The Lido/FlightBag shell can host third-party Windows applications.

Lido/eRouteManual and Lido/Performance can be hosted on the Lido/FlightBag shell, or act as standalone applications, which can be integrated into third-party Windows software platforms.

Lido/eRouteManual includes interactive en-route, terminal and airport charts, and an AMM function.

Lido/Performance includes take-off (Lido/TakeOff), en-route (Lido/APM – Aircraft Performance Monitoring) and landing (Lido/Landing) calculation tools.

For iOS-based EFB platforms, Lufthansa Systems provides Lido/iRouteManual, Lido/Enroute and Lido/DocView (with Document Viewer Management System).

Between them the two route applications provide en-route, terminal and airport charts. Lufthansa Systems is planning to incorporate all three of them into a single application with the flexibility to activate the required functionality. These applications can be integrated into a third-party iOS platform application.

All Lido EFB software modules are native applications.

Navtech

Navtech is an international flight operations software provider with offices in Canada, the UK and Sweden. It offers an EFB solution for Windows and iOS-based EFB platforms that can be applied to the Navtech aircraft performance and electronic chart applications.

The performance applications include take-off, landing, and weight-and-balance calculation tools, branded as Navtech TODC. The chart applications include electronic charts and electronic en-route charts, branded as Navtech eCharts or Navtech iCharts for the iPad. Airlines can choose these applications together or individually. Navtech's performance and chart applications can be integrated with third-party software platforms.

There are currently more than 700 aircraft using Navtech electronic charts.

NVable Ltd

Glasgow-based NVable was founded in 2005 and has begun moving its focus from general IT consultancy to commercial aviation services.

NVable provides the Appixo software

Some EFB software vendors provide individual applications rather than integrated platforms. PACE Aerospace offers the Pacelab CI Ops tool for Windows-based systems. It provides a Cost Index function.

platform for line maintenance activities with the Appixo ETL as the core application. The ETL includes software loaded on an EFB hardware device and a web portal installed in a managed data centre. The ETL is designed to replace paper technical logs and provide data integration with existing maintenance systems. Functions of the ETL application include: recording sector details; managing defects and deferred defects; managing OOP maintenance items; and recording aircraft status and captain's acceptance. The web portal provides user management, data analysis and fleet summary capabilities among others.

The Appixo ETL is a native application that can work off-line. It is currently in use with BA CityFlyer, and is available for EFB hardware operating with Windows 7 and 8. There are plans to develop a version for IOS. Although the Appixo ETL cannot download data from aircraft avionics, this capability is being discussed.

NVable's Appixo platform can manage and support the operating system and applications on remote devices. It can incorporate third-party applications on Windows-based devices. It would also be possible to integrate the Appixo ETL into other third-party software platforms although this has not yet been done.

PACE Aerospace Engineering and Information Technology GmbH

PACE Aerospace is a German software solution provider that was formed in 1995. It produces a number of individual EFB software applications for Windows-based hardware.

There are three main individual EFB software applications. These can be taken individually or as part of a package. Pacelab CI OPS provides a Cost Index function for those aircraft with FMSs that are not already equipped for such operations. Pacelab Flight Profile Optimiser is an advanced tool for generating the most cost-efficient flight profile under given constraints.

The Pacelab EFB Data Recorder provides a cost-efficient alternative to hardware-based data recorders. It collects operational efficiency data that can be used for post-flight analysis.

PACE can also offer additional bespoke software solutions, according to airline requirements, including take-off, and approach and landing performance calculation tools.

The individual software applications that PACE provides can be integrated within a third-party software platform.

PACE currently has eight airline customers for its EFB software, the largest of which is Lufthansa.

Sabre®

Sabre® is a leading global travel technology company based in Texas, USA.

Sabre® is developing an integrated EFB software solution called Sabre®AirCentre ™eFlight Manager (eFlight Manager) that is scheduled for release in the first quarter of 2014.

The foundation of the solution is the eFlight Manager Data Centre. This is a Sabre-hosted ground server that provides centralised data capture for all phases of flight, EFB client population and content management and a choice of several server-client applications. These applications include Flight Briefing, Trip Manager, TechLog, Document Library, Flight Corridor Map and Scratch Pad.

The Flight Briefing application acquires OFP content from flight planning tools to create an electronic briefing that includes airfield status, NOTAMS, weather charts and a searchable PDF copy of the OFP document. Trip Manager is used to record active trip events and includes the triplog, in-flight reports, crew assignments and requested ground services. The Document Library stores, filters and displays flight documents. The TechLog is due for release in late 2014 and will include aircraft acceptance, fuel/oil tracking, and defect-reporting capabilities.

The eFlight Manager software applications can exchange data, and operate on devices compatible with Windows 7/8 and iOS 5/6/7. Third-party data can be shared with the Sabre EFB environment.

Sheorey Digital Systems

Sheorey Digital Systems (SDS) is an Indian company with experience in developing IT systems for aviation. SDS provides an EFB software solution for iOS and Android tablet devices called Aviation Resource Management System (ARMS) on the TAB™.

There are several software modules including DOCs Library, NAV Charts, Trip Kit, and Forms. There are also a number of other applications including load and trim, and take-off and landing calculations.

ARMS on the TAB™ also includes an ETL. This provides instant access to M&E systems, real-time access to technical publications, on-line material requisitioning, electronic work packages, interactive online forms, and the ability to view real-time fleet management data.

The ARMS on the TAB™ software modules can be taken individually or as part of a package. It is possible for the modules to exchange data. Third-party software can be integrated into the ARMS on the TAB™ platform.

SDS's EFB software is currently in use with two airlines.

SITA

SITA is a multi-national company with a long history in air-ground communications services. In a partnership agreement, SITA markets the Flightman™ software platform under its e-Aircraft™ Services offering. In addition to the Flightman™ software, this includes the SITA EFB Integrator and AIRCOM Connect products.

AIRCOM Connect is software that is loaded on the EFB device and/or the AID. AIRCOM Connect is a multi-link messaging application that can send messages over various communications systems, including ACARS, cellular, Gatelink and Satcom.

EFB Integrator is the ground component which receives and distributes the data to and from the EFB. It can support any aircraft type or EFB solution. EFB Integrator manages content distribution, enables end-to-end automation of business processes, and supports Media Independent Aircraft Messaging (MIAM).

EFB Integrator comprises the Flightman Ground Server, EFB Integration Broker, a distributed network of EFB Content Cache Servers, and an AAA server should airlines require WiFi authentication service from SITA. EFB Integrator adapts to airline ground-based IT system proprietary interfaces.

Airlines are free to choose the Flightman™ software modules and SITA connectivity services they need from the e-Aircraft™ Services package. SITA also supports the integration of third-party applications into the EFB software on the device and into the EFB Integrator distribution process.

The combined SITA and Flightman™ product currently has four airline customers. One airline uses the Flightman™ software and the EFB Integrator. The others use a mixture of the Flightman™ software and/or the EFB Integrator. AIRCOM Connect is currently going through customer trials.

Skypaq

Skypaq is headquartered in Ireland and North America. It offers the Skypaq eLog ETL which is in use with two airlines. It also offers the eCabinLog.

The ETL can run on EFB devices using the Windows 7/8 operating systems. It can function as an off-line application. The eLog solution allows data previously entered on an existing paper technical log to be recorded electronically. It allows distribution of defect management data in an electronic format, fleet airworthiness management, block times, fuel data and integration of flight operations and technical services data.

There is a ground server for synchronising and sending data to and from the EFB. The eLog can integrate with ground-based M&E/MRO systems.

It is possible for the Skypaq eLog to be integrated into a third-party EFB software platform and exchange data with other software modules.

Smart4Aviation

Smart4Aviation was formed in 2010 and is based in the Netherlands. Its focus is on the provision of web-based software solutions for the aviation industry. It provides the Smart EFB platform of EFB software modules for use on Windows, iOS and Android compatible devices.

Smart EFB includes performance calculation, and weight-and-balance tools. It also includes document reader and content management functions. Smart4Aviation's EFB applications are an extension of its existing back-end operations software systems and link to these for data exchange.

The Smart EFB flightdeck applications include: Smart BRIEF; Smart MET; Smart EFF; Smart LOAD; Smart PERFORMANCE; Smart eFORMS; Smart DOC; Smart COMM/ALERT; Smart COMMS MANAGER; and others.

Smart EFB software modules can exchange data. The Smart EFB platform can also host third-party applications.

There are currently three airlines using the Smart EFB software.

T&A Systeme GmbH

T&A SYSTEME is a German company that specialises in aviation IT services and infrastructure projects with a particular focus on network and IT management, communications, security and storage.

It currently has several airline customers for its Logipad EFB product. Logipad consists of an EFB software platform with a GUI that can integrate third-party applications such as electronic aeronautical charts. Logipad also offers its own document reader and form completion software tools.

The Logipad ground system provides content management for the EFB software applications. It synchronises updates, and sends data between the aircraft and back office systems.

Logipad is available for Windows and iOS-based EFB devices.

Ultramain Systems Inc

Ultramain Systems was formed in 1980 and is based in New Mexico, USA. It specialises in providing M&E and MRO software as well as implementation services.

The company's On-board Systems division has developed a range of EFB software modules for flightdeck use. These are efbTechLogs™, eReporting™, and efbGroundSystem™.

efbTechLogs is electronic logbook (ELB) software that operates on fixed EFBs and mobile devices, including the iPad. efbTechLogs fully replaces the aircraft paper-based technical log with a paperless solution. Its functions include: assisted electronic cockpit and cabin fault reporting; electronic sign-offs; immediate maintenance action recording; MEL integration; and searchable up-to-date maintenance history. It can transmit real-time information on technical defects, depending upon the available data communication links. efbTechLogs can integrate with data downloaded from aircraft systems. Data can be stored in, and exchanged with, most M&E systems via Ultramain's efbGroundSystem.

efbGroundSystem is ground-based, and communicates with efbTechLogs. efbGroundSystem is the 'system of record' for ELB data and integrates with M&E systems.

eReporting captures discrete data from the aircraft 429 buses and quickly completes air safety report (ASR) and airline inflight reports (IFR) and transmits them to the ground for handling and processing.

Ultramain also provides consultancy services for assistance with the certification of paperless flightdeck solutions through ULTRAMAIN® efbSolutions™.

UTC Aerospace Systems

In addition to its hardware products, UTAS also offers EFB software and is in the process of providing it to the first two airline customers under the UTAS 'EFB Application Suite' Brand.

The software suite includes Flight Manager, Document Viewer, eChecklist, SmartForm, Performance, Weight & Balance and Configuration Management modules.

Flight Manager is the application manager, while Document Viewer provides a library function for hosting, viewing and searching documents.

eChecklist provides electronic checklists, SmartForm provides electronic form, and Performance includes take-off and landing calculations. Configuration Management is a ground-based suite that manages applications and EFB data content.

The EFB Application Suite is available for Windows operating systems. The modules can exchange data between each other and it is possible to host third-party applications.

ARMS on the TAB™ is an EFB software solution from Sheorey Digital Systems for iOS and Android tablet devices. Like other EFB software platforms it offers its own modules, and the capability to integrate third-party applications, such as electronic aeronautical charts.

UTAS also provides a certified operating system or platform for hosting certified applications like ADS-B IN.

Web Manuals AB

Based in Malmo, Sweden, Web Manuals Sweden AB has created a Web Manuals Reader application for EFBs. It allows pilots to view electronic versions of manuals, documents and forms on their EFB display.

The Web Manuals Reader is a part of the Web Manuals application that has provided content management and distribution functions to aviation clients since 2008. The Compliance Library module within the Web Manuals application allows editors and managers to maintain regulatory compliance by being able to cross-reference individual rules from within their manuals and subscribe to amendments to the EASA regulation as well as a number of aviation standards.

Web Manuals Reader can be incorporated within third-party EFB software platforms.

Web Manuals Reader can run on all major tablet operating systems, including Windows, iOS and Android. There are currently 11 operators using the Web Manuals Reader.

EFB Services

There are a large number of EFB hardware and software options, and the market continues to develop. To help airlines choose the most appropriate solution for their business needs, a number of specialist companies offer integration management and consultancy services.

Others offer communication and connectivity enablers.

There are also firms offering mounting devices for portable EFB hardware, but this is not a focus of this analysis.

Avionics & Systems Integration Group

Avionics & Systems Integration Group (ASIG) is based in the USA. It specialises in analogue-to-digital aircraft avionics upgrades.

ASIG provides its flyTab® product for Class 2 EFB solutions using iPads. flyTab® includes a Software Developers Kit (SDK), mounting device, a power-conditioning module (PCM) and an Aircraft Interface Module (AIM), in addition to custom iOS applications development, and airframe integration services.

The installed equipment and SDK is approved by Apple and permits the development of EFB applications for iOS. The PCM provides an approved and certified solution for the iPad to receive power from the aircraft for either charging or primary operational purposes. The AIM allows data from aircraft systems to be distributed to iPad EFBs though the docking-station-equipped mounts.

FlyTab® is currently approved for use on the CRJ series, Dash 8-100/-200/-300, Q400 and 767-200/-300.

There are currently five commercial airlines using flyTab® EFB solutions.

Closed Loop Consulting

Closed Loop Consulting is a specialist consulting company with offices in the USA, Europe, Asia and Australia. It focuses on assisting airlines with operational domain programmes such as EFB and eEnablement.

Closed Loop has consultants with a wide range of operational experience and provides programme guidance from strategy development to operational implementation and regulatory compliance. Along the way it assists with conceptualisation, and requirement, financial, and business case development. Closed Loop provides independent guidance that aims to ensure the best possible organisational, operational and financial outcomes for EFB and eEnablement programmes.

Teledyne Controls

Teledyne Controls is based in California and is part of Teledyne Technologies Inc. It was formed in 1964 and is a leading provider of solutions designed to increase flight safety and operational efficiency though improved aircraft data information management.

Teledyne Controls produces an avionics unit called the Wireless GroundLink® (WGL Comm+™). This provides a wireless solution to connect aircraft equipment with an operator's back office systems.

Via the WGL Comm+™ and the new WGL-AID™ software system, Teledyne Controls enhances EFB system functionality by adding on-/off-board communication access to aircraft systems and data management capability. In addition, the WGL-Fi™ system extends all WGL-AID™ functions for use with WiFi-enabled EFB devices via a flightdeck wireless network. WGL-AID™ and WGL-FI™ will be installed by airlines with 737 and A320-family fleets by 2014.

Thales

Thales is a French company that has been involved in activities involving aircraft avionics since 1947.

As part of its Top Wings solution, Thales offers management and integration services for EFB programmes. It can provide a complete end-to-end solution for airlines bringing together the most suitable third-party hardware, software and connectivity options. This will be based on the airline's end goals for EFB implementation and an evaluation of its operational procedures.