

EFB & ETL APPLICATIONS & SOFTWARE SURVEY



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Sweden

The EFB and ETL market was summarised in 2013. While many providers remain, some new software has also emerged, and other legacy software has either been acquired or consolidated. Charlotte Daniels updates the key service providers' EFB and ETL applications & solutions.

EFB & ETL applications & solutions

An increasing number of airlines has implemented electronic flight bags (EFB) and electronic technical logbooks (ETL) into their operations, thereby replacing legacy, paper-based processes and optimising and increasing efficiency. In addition, some weight saving can be achieved by storing the content of paper manuals, logs and charts on a portable electronic device (PED) via software solutions.

A summary of key EFB and ETL providers was last undertaken in 2013 (see *Survey of EFB & ETL hardware & software vendors, Aircraft Commerce, October/November 2013, page 24*). The survey explored both hardware and software providers. This analysis will focus on the software options available to operators, thanks to the flexibility and options presented by modular software applications (apps). The use of apps is becoming increasingly popular, with the rise of toughpads, tablets and iPads among flightcrew.

The shift from the use of software to the concept of 'apps', 'platforms' and 'modules' has resulted from PED usage. With the rising popularity of laptops and PEDs by flight crew and line mechanics, the incorporation of apps has enabled greater flexibility for airlines.

The market and concept of an EFB and ETL has, therefore, now shifted towards solutions in the form of apps, which can be customised according to individual operator requirements. The class definitions that describe the level of integration these applications have with the aircraft, alongside the types of documentation they process, have also been revised. The EFB and ETL have also consolidated in some areas, thereby combining vendor solutions and forming software suites built on the technology between companies. Such examples include Airbus acquiring Navtech, to create NAVBLUE, and the acquisition of AvioVision by Thales.

Flight data assessing the performance

of aircraft, as processed by EFB and ETLs, has also undergone a radical review in recent years. The introduction of Big Data, and the capability to analyse it, has led to operators wanting more from their products. Hence, apps have increased further in sophistication, with some focusing on the processing of flight data so that airlines can further optimise fuel uplifts, climb profiles and flight plans (FPLs).

To truly benefit from the information processed by these solutions, adequate interfaces also need to be established between the EFB and ETL applications, and third-party systems such as operational, flight planning, and maintenance & engineering (M&E) systems. These interfaces can allow high-speed data flow between the systems, allowing paperless processes from the flightdeck to line station, base maintenance hangar, and the administrative areas of an airline. These allow carriers to use aircraft performance and defects to establish best practice going forward.

In summary, this survey aims to update the information provided in 2013, taking into account the changes that have occurred in the operational environment over the past four years: the benefits of EFB and ETL software have now been proven, so the market has expanded into various adaptable solutions. The demand from airlines has increased, and the capabilities of these applications have become more sophisticated.

Definitions and differences

Key differences between the concept of the EFB and ETL are established, although the terms are often considered in similar contexts. An EFB provides an e-enabled solution that meets the needs of a flight crew before, during and after a flight. The complete EFB solution therefore typically replaces traditional methods such as paper charts, printed

flight plans, and notices to airmen (NOTAMS) listed on paper. An all-encompassing EFB solution should therefore provide pilots with the ability to access flight and operating manuals, standard operating procedure (SOP) documentation, FPLs, climb profiles, performance calculations, weather and/or navigational charts such as Jeppesen.

EFB applications allow operators to pick solutions that best match their flight bag requirements. Of course, an EFB might not be accessed via a separate tablet or PED in today's landscape; on new generation aircraft the EFB is increasingly integrated into aircraft systems.

The ETL is a standalone minimum equipment list (MEL) item that can also form an integral aspect of an EFB solution. Pilots use the ETL to ascertain the technical and service status of an aircraft before flight. It needs to be able to display up-to-date defect information, for example, in addition to capturing technical and flight performance data. An ETL also needs to be accessed by many different parties including line mechanics, operation controllers, and airline administrators. Cabin crew may also need access to a 'Cabin ETL' to record defects observed in the cabin.

All the information recorded by the ETL has to be passed and processed by an M&E system. With the onset of Big Data Analytics, performance and fuel efficiency monitoring is an increasing demand of the ETL (see *Exploring the benefits of big data analytics in airline operations, Aircraft Commerce, December 2016/January 2017, page 35*).

Reclassification & Approvals

Since the 2013 survey, the classes and types of EFB and ETL have been redefined, to better describe the main characteristics displayed by the evolving software (see *EFB regulation & classification update, Aircraft Commerce,*

The shift from the use of 'software' to the concept of 'apps', 'platforms' and 'modules' has resulted from PED usage. Given the rising popularity of PEDs by flightcrew and line mechanics, the incorporation of apps has allowed greater adaptability for airlines.

October/November 2015, page 33).

EFB software used to have three types of classification: Type A, B and C. These have now been condensed into Type A and B, and refer to the types of documentation accessed using the application. Type A refers to ground operation-based, static (non-dynamic) documentation that is non-critical to flight operations if access to the document malfunctions. Examples of Type A EFB software documentation include weight and balance (W&B) forms, airworthiness directives (ADs), and the aircraft maintenance manual (AMM).

Type B EFBs provide access to dynamic or interactive documentation that need to be accessed during stages of a flight. Type B EFB software therefore includes performance calculation modules, climb profile software, and weather applications. These can adapt with changes of circumstances and scenarios such as real-time weather updates. Type B EFB applications include charts, operational manuals and NOTAMs. An ETL is regarded as a Type B EFB.

Connectivity – navAero

navAero Avionics AB, a Global Eagle company, is located in Sweden. navAero provides tablet-based and aircraft-dedicated EFB hardware systems to airlines, in addition to ground-to-air data connectivity solutions. navAero EFB systems can include integrated navAero developed technology, called the UAID, which provides secure and protected access to aircraft data that can be used to populate ETL applications. These can reside on an EFB hardware platform, as well as in an appropriate file repository service embedded into the UAID.

The role of the UAID is to provide a secure means to access and pass aircraft data to an EFB platform. The UAID is an essential part of many avionics upgrades, such as EFB, where it accesses specific avionics data that is required to populate specific software applications, while protecting aircraft control domains from interference and corruption.

More than 60 airlines are flying with navAero's systems. These airlines are using a wide variety of EFB-hosted software applications, some of which are also ETL-capable.



In terms of industry take-up of the EFB, navAero states that interest in the technology varies by region. "Within the Americas the percentage of commercial airline operators using some type of EFB device (connected/non-connected/installed/portable) is greater than 90%, while in the European Union (EU) it is 50-60% and in Asia it is probably 20-30%," says Simone Giordano, president of Global Eagle's navAero division. Giordano estimates that 40% of EFB users are opting for type B applications. "We see growth in the use of Type B and estimate that it will be close to 70% in the next three years," he adds. "There is a slow, but gradual migration to connected platforms, where more Type B applications are added to the EFB platform to maximise operational efficiency."

It is the ability to transfer data in real-time that is key to maximising this efficiency. "Accessing real-time data from the aircraft and collating it with big data analysis tools can bring a fresh new way of benchmarking airline operations, while streamlining a number of functions that make the airline more efficient, save money and react more quickly to changes, internal and external," continues Giordano. "The aircraft communications addressing and reporting system (ACARS) connection is just another way to exploit existing old fashioned technology for 21st century revolution, by bringing into the cockpit real-time weather information for example, or automated airline operational control (AOC) messaging to facilitate pilots' decisions and workflow."

navAero also explains that aircraft data exists in two main sets, based on A429 or A717 stream format. "A429 are

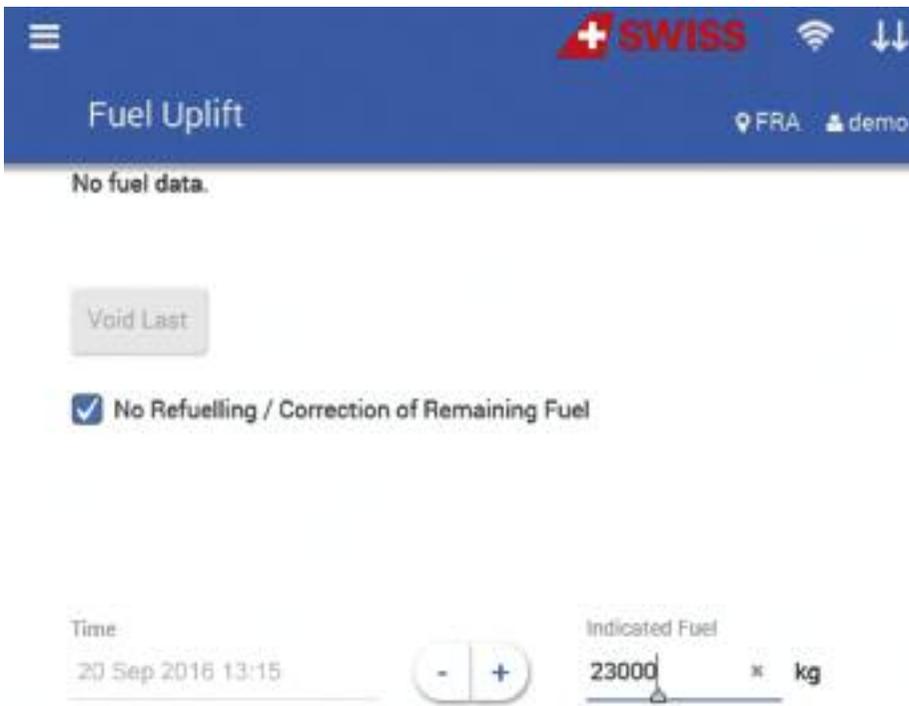
punctual aircraft parameters like GPS position, fuel consumption and wind direction," says Giordano. "A717 is a collection of multiple data and sensors recorded then as quick access recorder (QAR) data.

"While A429 data has an added value into EFB for real-time usage and analysis, QAR data has a major value for post-flight analysis." Giordano explains that while most airlines push QAR data manually every day or even weekly, the implementation of EFB systems can streamline the process by introducing 4G transmissions. To stream data in-flight, only satellite-equipped planes can be used. In this case the data speed is similar to the one provided to passengers for in-flight WiFi usage. In essence the UAID is a full avionics grade device that interconnects and speaks the avionics language over the A429 and A717 formats, and translates such data into a non-certified language such as the one provided by Windows-based or iOS-based tablet. The UAID collects and aggregates aircraft data, and sends it to the EFB (or directly to ground via wireless).

The installation of navAero's 'Smart' Mount Tablet EFB system for PEDs requires an FAA or EASA supplemental type certificate (STC). The smart mount is an aircraft-grade provision normally installed in a non-disruptive way on the cockpit sliding window for pilots' best usability and experience.

Survey of providers

The information established by each vendor within the survey includes: whether the solution is EFB- or ETL-orientated, key configuration



requirements, the information captured by the application, compatibility requirements, and the interface capabilities of each application.

A table of contact information is given (see table, page 40).

Air Support

Air Support A/S is located in Billund, Denmark. Its application offering, CrewBriefing, is a flight briefing package that contains the flight summary, pilot-log (plog), METAR/TAF and SWX charts, NOTAMS, and cross-sectional charts. More than 450 operators use the pilot brief software.

CrewBriefing operates on iOS, Windows and Android platforms, so the application can be accessed on all compatible tablets and other PEDs. CrewBriefing works offline, meaning that flightcrews can access briefing packages in flight as long as these have been synchronised before departure.

CrewBriefing can also be accessed via a web portal at www.crewbriefing.com. The application and web-based platform both interface with the PPS Flight Planning System, which is Air Support's flight planning solution. The backend of CrewBriefing is also available to interface to other EFB solutions, making the data from PPS Flight Planning available for other EFB providers. Air Support and PPS Flight Planning software interface with 100 different providers of aviation software.

While CrewBriefing is a free application, access to flight data is via a monthly software licence subscription on the PPS Flight Planning System. New CrewBriefing customers can use the software once credentials are confirmed.

Aircore_systems GmbH

Aircore_systems GmbH is headquartered in Germany. It provides an EFB software application called AS-FlightBag, which can form a Type A or B solution, depending on the customer's needs.

AS-FlightBag consists of these basic standalone modules: AS-Library, AS-JourneyLog, AS-CrewBriefing, and a new product: AS Airbus® FlightSmart (LPCNG) Plug-ins, the AS LPCNG updater, AS LPCNG LibraryViewer and AS LPCNG EFF. These plug-ins provide the missing features for the Airbus LPCNG EFB system. Shipped as Airbus-Loads, installation is as simple as deploying any new load to LPCNG. Self-contained, no system changes whatsoever required.

Aircore's EFB solutions are platform-independent and run on Windows, MacOS X and Linux, and can be accessed in-flight using ACARS and SatCom connectivity. Naturally, the software runs on all portable devices running any operating system except iOS. It is managed via a web portal. The software interfaces easily with a carrier's crew planning systems, library backends via FTP, SFTP, SSH and JEE.

New customers of the AS-FlightBag pay a one-off licence fee followed by a monthly subscription. Operational, rather than regulatory, approval is needed when integrating Aircore's EFB into a new fleet.

Astronautics Corporation

Astronautics Corporation of America provides various EFB hardware and software solutions for operators around the world, including the standard-fit EFB

Via CROSSMOS, developed by CrossConsense, flightcrew can assess flight details, aircraft status, cabin status, complaint details, fuel tracking, preflight check, and service fluids status for oil and hydraulics.

hardware on the 787. Additionally, several customers utilise various combinations of Astronautics' EFB-related applications in their avionics suites.

Astronautics' suite of NextGen-capable applications includes an Enroute Moving Map (EMM), and a Cockpit Display of Traffic Information (CDTI) suite which contains Surface Area Moving Map (SAMM), Merging and Spacing (M&S), and In-Trail Procedures (ITP) modules displaying ADS-B traffic and situational awareness information which provide significant fuel-saving potential.

Additional Astronautics applications include a Chart Viewer, PDF Document Reader, SafeBrowser™ (for white-listed internet access), on-board aircraft data loading, and a Quick Access Recorder (QAR) Visualiser to support paperless operations and automated data collection. These applications all run on avionics equipment installed on customer aircraft, rather than on PEDs, though Astronautics also provides Aircraft Interface Device (AID) equipment and services to support aircraft data parameters provided securely to PED-based applications.

Astronautics' applications are written in a custom Linux environment, which also comes with a Software Developers Kit (SDK) for customers to write additional applications. Data collected by Astronautics' software can therefore be provided to airline systems and third-party applications (through cellular connection for example) via the SDK.

In-flight, ARINC 717 input is used for the QAR storage and Visualiser to process data in real-time. All of Astronautics' EFB applications are type A and B, other than the EMM and CDTI. These require inclusion in an STC for installation on customer hardware.

Comply365

Comply365 is based in Wisconsin, United States. It provides both EFB and ETL solutions via its respective solutions - Comply365Mobile and eLogbook. About 75% of airlines in North America are using one or more of Comply365 solutions today. Designed for mobile use, Comply365's enterprise software platform leverages products and capabilities of a cloud-based solution



designed to work with Apple, Android, and Windows mobile devices in addition to a web browser.

“Both our EFB and ETL solutions are Class 1, although we do have carriers which use Comply365 solutions as backups for their charts, thereby requiring a Type B solution,” explains Troy Salwei, vice president of business development at Comply365.

Comply365’s EFB contains the Document & Communication Manager module (DCM), which is a content management solution that allows one to upload, distribute and view documents and content (any file type). This solution ensures the right people have the latest relevant information at their fingertips. Pilots and cabin crew, for example, can access their manuals, policies and procedures, and must-reads on any device. The solution is role-based and distributes relevant content to various individuals, groups or departments or even based on certain criteria such as fleet type or location. DCM manages and tracks user compliance, has automatic revision control. It also provides real time notifications, tracking, trending and reporting.

Documents or content can be organised by collection. DCM also gives users a way to send real-time alerts and notifications to a user, group of users or to people, location or objects based on certain attributes as well. “In addition, our EFB solution has user management and is a one-stop shop for other or third-party applications, such as charting, weather and weight & balance,” adds Salwei.

In addition, Comply365’s eLogbook solution includes the DCM module in addition to Digital Briefing, ProChat and

Forms365; which can be used to access and capture flight performance information provided via third party systems. “Flightcrew have access to digital briefings and releases, their manuals, chief pilot memos, must read/read and sign documents, the ETL for the aircraft, aircraft registration documents including insurance, required documents for international operation, and some airlines also distribute charts and maps for departure and arrival airports,” adds Salwei.

Given that both Comply365’s solutions are compatible with Apple iOS, Windows and Android systems, their applications can be used on any mobile device. While each platform may offer varying levels of functionality to run the applications, Comply365 anticipates that the user experience will be the same across all platforms by Q2 2017.

Comply365Mobile and eLogbook both have offline functionality; users can access and view documents as well as submit forms. Meanwhile compliance and action items are recorded and are automatically synced when in connectivity. The solution syncs automatically when in connectivity or one can leverage in-flight WiFi to provide on-line functionality during flight.

Conduce Group

Conduce Group is located in the United Kingdom (UK). The software specialist has developed an ETL, called eTechLog8, which offers a range of different solutions to customers interested in installing an ETL within their operations.

“eTechLog8 is a total solution for operators, and includes software, hosting,

With ULTRAMAIN® ELB, flightcrew can access the logbook status, logbook historical data, and defect reporting function. On suitably connected and equipped aircraft, the application also integrates with the CMCF (Central Maintenance Computing Function) and offers aircraft-detected faults for one-touch entry.

device management, communications support and client services in one package,” explains Paul Saunders, operations director at Conduce Group.

Version 3.3 of eTechLog8 was released in March 2017. The software comprises four core modules that allow operators to manage their technical documentation, in addition to interfacing with other in-house systems.

- eCentral8 is the ETL’s web-based management application;
- eGIS is the integration package provided within the eTechLog8s suite of applications;
- eDoc8 allows company manuals and technical publications to be managed and distributed to the ETL devices; and;
- eForm8 permits company forms to be configured, distributed and associated data acquired through the ETL.

In addition, Conduce’s ETL includes modules for the journey log, defect log, cabin log, servicing (for fuel & fluids status), ice protection and planned maintenance. As is necessary for an ETL, all modules are available offline during flight.

There are three operators currently live with eTechLog8, with more in the process of conducting flight trials and undertaking initial implementation of the software. According to Saunders, a total of 11 AOCs are committed to the Conduce product at this current point in time.

eTechLog8 is primarily Windows 10-based, so it will work on any Windows 10-based tablet or laptop. Furthermore, the software has been highly optimised for Panasonic FZ-G1 Toughpads, which are a popular ETL device. “Given that the ETL is such a mission-critical application with a very specific use case, there are limited hardware options available,” adds Saunders. “As an example, MS Surface does not allow a SIM card or SD card for data backup and quick-exchange. We have therefore found Panasonic devices to be the most dependable for ETL use.”

CrossConsense GmbH & Co

CrossConsense offers an ETL solution called CROSSMOS. The ETL comprises three modules: the pilot module, maintenance module, and a cabin module. Via CROSSMOS, flightcrew can assess Flight details, aircraft status, cabin

status, complaint details, fuel tracking, preflight check, and service fluids status for oil and hydraulics, for example.

The pilot module contains Aircraft Status, Complaint History, Complaint Entry, Pre Flight Check, Fuel Tracking, Deicing and autoland forms.

Maintenance comprises Maintenance Overview, Complaint Detail View, Entry of Action/Deferral/Closure, Inspection/Independent Inspection, Repetitive Inspection and CRS (Certificate of Release to Service).

Last, the Cabin module includes a Cabin Status and Cabin Complaint Entry modules.

CROSSMOS also includes a PDF viewer for supporting documents to be viewed. CrossConsense's ETL can be used offline by flightcrew, and can also be interfaced with MRO and operations systems.

Today, two airlines are using CROSSMOS, while another four carriers are implementing the software solution. While version 1 is in effect, version 2 will be live by Summer 2017. CROSSMOS is Windows compatible, operating on all PEDs on Windows 7 or higher. CrossConsense is planning to release platform-independent versions of the modules in the near future. For example, the cabin module will become platform independent later in 2017.

EmpowerMX

EmpowerMX provides an ETL solution as part of its FleetCycle® software suite. Its latest version is 5.0. The ETL contains several sub-modules within FleetCycle®, including a FlightLog, FuelLog, ServiceLog, APULog, CertificationLog, DefectLog, DeiceLog, Document reader and Forms repository. Via these sub-modules, all data that is entered either electronically from another system or manually by line mechanics, can be extracted and used by the crew during flight.

FleetCycle® works across all mobile platforms, with equal functionality for each meaning that the ETL module looks the same regardless of Windows, Apple or Android users.

EmpowerMX's ETL can operate offline as well as online. The functionality is the same irrespective of this status. Once connectivity resumes, all data is synchronised and the ground system reflects the on-board system, according to Hugh Revie, vice president regional sales EMEA at EmpowerMX.

Customers interested in utilising the ETL can interface data elements into their existing systems via an integration service bus (ISB) provided by EmpowerMX. Naturally, as the software is an ETL it requires regulatory approval, although

this is more to approve the transition from paper to electronic processes for the operator. "The FleetCycle® ELB is fully and easily configurable by customers helping them to manage future changes by themselves without requiring expensive software changes," adds Revie. "Initially, we would set up the solution using a mixture of best practice and current customer process (such as their current paper log sheet). We would also train an administrator on how to set the solution up to reflect their required procedures."

Evoke Systems

Evoke Systems Limited is based in Norfolk, United Kingdom. It offers an EFB software called EFOS, which is a type A EFB. The latest version of EFOS came out in April 2017, which is being used by 15 carriers today. The software comprises several key modules. These are:

- A document storage and auditing module for library, crew notices and other reference material.
- Reports/Alerts module for user notification of specific events or actions.
- Training Forms for the tracking of all training-related sessions and qualification expiry dates including task analysis to support an Alternative Training Qualification Programme



CROSSMOS® Electronic Technical Logbook (ETLB)



Pilot Client

Shows all the information the pilot needs during the flight.



Cabin Client

Guided cabin complaint entry: Easily select the item with a defect.



Maintenance Client

Perform all the work necessary, including entering actions, deferrals, closure and CRS data.

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www.crossmos.de

TABLE OF CONTACTS - ETL AND EFB APPLICATIONS PROVIDERS

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(ATQP) and Evidence Based Training (EBT)

- Safety forms for tracking all safety-related cabin, ground, engineering and flight information and incidents; supported by workflows and assessments.

- Company Forms for tracking miscellaneous office or administrative user data.

- A Journey Log for tracking on-time performance, delay reasons, fuel data (including planned and actuals plus uplifts), passenger numbers, cargo/weight and associated validation and airline specific data such as de-icing.

- Flight Briefing Packages including weather plans, flight plans and NOTAMs in addition to a PDF viewer.

- Pilot Log Book summarising flight times and duties for individual pilots.

- A FIDS Board, which provides real-time information on flight status for

management users of the software.

Aside from the FIDS Board, all modules can be used offline and synchronised before departure to ensure all flight and aircraft data is current for flightcrew, although the application can connect in flight if WiFi is available.

The EFOS app can be used on Apple products such as the iPad. The software can be accessed, however, via any device and platform via a web portal rather than the app. New customers opting for EFOS will receive the application via a mobile device management (MDM) application with an enterprise licence. As described by Evoke Systems, all modules, settings and permissions are subsequently managed by their web-based administration site.

Flightman

Flightman is a Dublin-based software company that was founded in 2000. It provides EFB and ETL solutions for customers via a range of type A and B applications. 15 customers use the Flightman software suite, which includes:

- eTechLog, Flightman's ETL solution;

- Cabin Defect Log, to record observed cabin defects and cosmetic issues;

- eJourneyLog;

- Electronic Flight Folder (EFF), which is the flight briefing module of Flightman's EFB solution. This module contains OFP data recording;

- Large Content Management, which enables the management of charts and manuals;



- Weight and Balance, facilitating the generation of the loadsheet within the EFB;

- Performance Calculations, which allows the generation of aircraft performance data and airport obstacles. Via the Performance module, crew can pre-calculate for all desired runways and intersections for the airport. In the event of a runway change, there is no need for a recalculation to be carried out, thereby ensuring a more timely departure.

Flightman also allows entry and management of NOTAM and MEL restrictions. Via the Flightman Ground Server, airport obstacle databases can be updated and published over-the-air directly to the EFB. The Ground Server displays all calculations carried out on the EFB, including the corresponding input and output parameters.

- Business Intelligence, which is a ground-based module that extracts and presents business intelligence data developed from the EFB and ETL applications;

- eForms Designer, for form generation and distribution; and;

- Passenger Relationship Management, which allows passenger-related data to be viewed and recorded.

“Through utilising the above modules, customers can achieve streamlined operational processes together with real-time visibility into the performance of their airline,” explains Joe McGoldrick, chief executive officer at Flightman. “The Flightman connected EFB/ETL technology enables the realisation of the paperless cockpit and the closing of the loop between the aircraft and the airline’s back-office systems.”

Flightman is available for tablets, ruggedised pads, Class 2 EFBs and smartphone-based platforms. The software supports both in-flight and ground-based communications. For in-flight the applications run over the available communications channels. In a Class 2 environment, support for communications over ACARS is available.

Flygprestanda AB

Headquartered in Sweden, Flygprestanda AB provides an EFB solution for airlines called Guru. Guru2, the latest version of the software, is an application designed to calculate and analyse aircraft performance using aircraft and weather information. The software is configured specifically to meet individual customer requirements, ensuring a unique user experience.

Guru2 comprises three core elements: a performance module (takeoff and landing data), an optional weight and balance (W&B) module, and the BackOffice administrative software. According to Flygprestanda, Guru2 is primarily a tool for pilots to extract information about: take-off and landing performance (such as v-speeds, weights and gradients); seating/cargo and centre-of-gravity (CG) envelopes; obstacle clearances; and engine failure procedures. The software can also be used by operation and dispatch staff.

About 30 airlines use the Guru suite operationally as a subscription SaaS, where price is based on fleet size and composition. Guru2 is compatible with both iOS and Windows, meaning that it can be used on both iPads and Windows tablets as well as on Windows and Mac

To truly benefit from the information processed by electronic solutions and provide a flow of information across departments, adequate interfaces need to be established between the EFB and ETL applications, and third-party systems; such as operational, flight planning, and maintenance & engineering (M&E) systems.

computers.

Guru2 is designed for both offline and online use (via WiFi or 3/4G). Although Flygprestanda anticipates mid-air connectivity to be a standard in next-generation aircraft, offline capabilities are important for redundancy and safety. Guru2 is also being developed for integration with third-party systems.

Flygprestanda explains the process for new customers going live with its software. Airlines provide necessary performance data through AFM or SCAP information, including all supplements and appendices, as well as W&B information on a tail basis. Based on a proprietary Performance Information Form also completed by the customer, each tail is thereby configured in Guru2 for accurate performance. Using the BackOffice, each administrator can then control users, devices and contents as well as updates. Each configuration can be configured on a per-tail basis if needed.

Honeywell International Inc

Honeywell International offers an EFB solution in the form of GoDirect, a Type B suite of applications. The modules in these applications include FlySmart with Airbus Weather on Board, Weather Information Service, Flight Optimisation and Flight Efficiency.

The latest version of Weather Information Service is 1.2.2, while FlySmart is currently on 1.3.1. These two applications provide updated strategic weather information in flight for situational awareness, hazardous weather avoidance and flight efficiency for flight crew. Weather Information Service also contains a PDF document reader so that flightcrew can view pre-flight briefings. Meanwhile, Flight Optimisation provides step climb suggestions for improved fuel efficiency, and Flight Efficiency provides operational flight analysis to further optimise processes. Flight Efficiency can also be interfaced with an airline’s operational IT systems.

All modules within GoDirect operate on Apple and Windows platforms, so applications can function on all supported PEDs. Both Weather Information Service and Flight Efficiency can be accessed via web portals as well as the applications. All three applications

can be used online if cellular, ACARS or IP connections via satellite are available.

International Flight Support

International Flight Support ApS (IFS) is located in Kastrup, Denmark. The company provides EFB and ETL solutions for customers, via the Paperless Flight Bag™ (PFB™) application platform.

PFB is a full EFB software platform solution that comprises multiple modules, including an ETL module solution. Pre- and post-flight data registrations are performed by the crew in the Voyage/Journey Log module of the main system; while electronic MEL & Defect Reporting is entered in the ETL module, which raises faults and feeds back flight-release and corrective action instructions, as released by the line maintenance department.

Airlines can customise the PFB modules by selecting which best suit their operations. IFS provides a customised workflow set-up once the modules are selected, which is included in the standard set-up price. The Paperless Flight Bag™ back-office engine along with the PFB™ CrossFeed function are included for all set-ups. The airline can select one module, a selection of modules

or a full suite of operational modules in any combination.

The Paperless Flight Bag™ modules available are:

- The PFB Back-Office engine, which covers free hosting with data import/export to back-end IT systems, and controls the upload/download to and from EFB units;
- PFB™ Doc Management & Library Module, which interfaces with a customer's CMS system;
- PFB™ Voyage/Journey Log Module, which interfaces with an airline's scheduling and crewing system;
- PFB™ eTechlog Module, which feeds information into an M&E system;
- PFB™ Electronic Flight Planning Module;
- PFB™ Mass & Balance/eLoadsheet Module;
- PFB™ Take-Off & Landing Performance Modules;
- PFB™ Engine Trend Monitoring Module, which interfaces with an M&E system;
- PFB™ eReporting Module;
- PFB™ CrossFeed Module, which facilitates the exchange of flight data between EFB units;
- PFB™ Chart Viewer Interface, which can combine with Lido, Jeppesen, and NavBlue chart applications;

- PFB™ Crew Library and Notification System;
- PFB™ Crew Briefing Portal;
- PFB™ OCC Document Upload Module to EFB;
- PFB™ OCC Flight Overview Portal;
- PFB™ CAA EFB Application Template kit, which helps customers in their EFB approval application.

According to IFS, all imported, keyed-in and calculated data outputs from the pre-flight, in-flight and post-flight phases are automatically recorded by the PFB™ system application, and stored on the PFB Back-Office engine for five years as standard. Stored data can also be exported with real-time updates to the airline's network in parallel.

In-flight data connections can be via WiFi to an on-board installed router in the aircraft, if SATCOM internet and WiFi connection is available for cockpit use. Connectivity can be achieved via IP through a LAN cable connection to the AID unit, although the PFB is designed to be fully offline-capable. Local offline printing is also possible via Bluetooth connection. IFS describes that a pre-flight report including aircraft loadsheet is typically 30 Kb of data, whereas the post-flight report accounts for 30-40 Kb of data. Ground based connectivity is

Bluebox eMan

Mixed fleet?
Engineers in multiple locations?
Frequent updates to manuals?

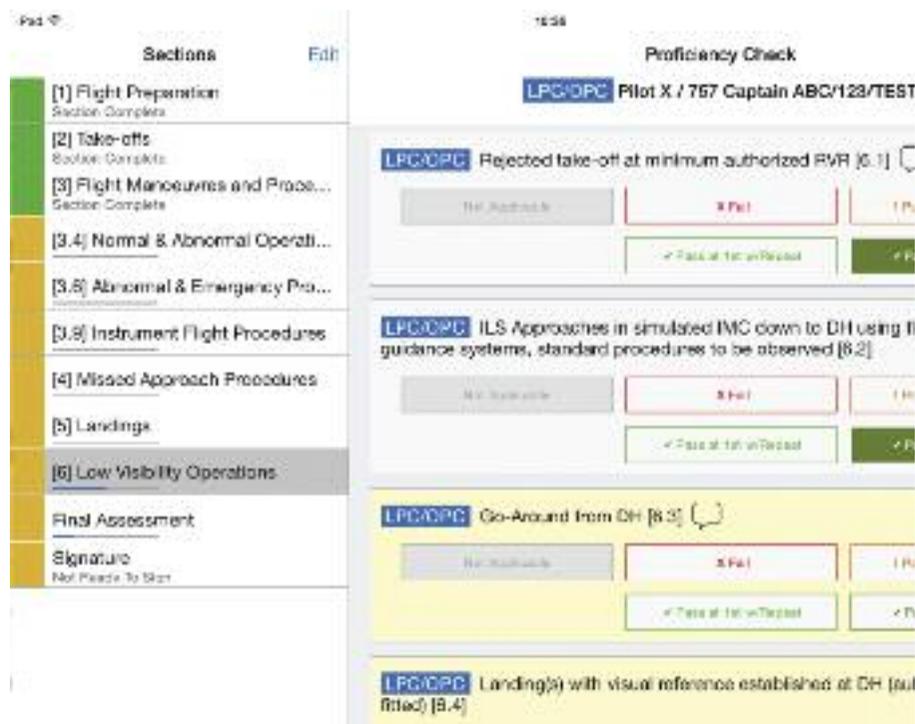


Technical Library Management System

With eMan, library managers and engineering teams have a web-based platform to access all electronic technical documentation from any location, on a wide range of devices, over any network. This eliminates duplicates, reduces demands on IT resources, and enables managers to update manuals instantly for all users. eMan also provides a single view of usage and simplifies tracking and reporting.

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normally achieved through use of WiFi or 3G/4G connection, with the latter working efficiently due to the very small and highly compressed and encrypted data package sizes utilised.

Today, the PFB™ is used by more than 30 operators across 15 countries. The Paperless Flight Bag™ solution is supported for both iOS and Windows units, version 9 and version 8 and higher respectively, meaning that the same functionalities and customised workflow options are available for both operating systems.

For advanced aircraft AID integration projects where the EFB units are connected to the aircraft's Arinc 429/717 databus system, the Windows platform is recommended because iOS units have considerable limitations on data import via cable connection from on-board AID units.

Laminaar Aviation

The parent company of Sheorey Digital Systems, Laminaar Aviation Infotech Pte Ltd is based in Singapore. Aviation Resource Management System (ARMS), Laminaar's software platform, offers both EFB and ETL solutions, called ARMS@ on the TAB™ (AOT). AOT's latest version, 2.0, became effective on 1st March 2017.

With the help of third-party integrations, AOT can become a type A and type B EFB solution, depending on the customer's requirements. AOT is available on Apple iPad and Windows Surface devices. There are two modes of operation within the software: Library Mode where the user navigates in a non-linear interactive way through the content library; and Sequencer Mode, where the

administrator can define a specific workflow process. Users can then navigate in a linear fashion through the sequenced content, and mark completion of a particular step in the sequence, like a checklist.

The 'ARMS@ on the TAB™' comprises the following modules:

- The DOCs (document) Library: this can be organised in sub-sections (such as collections or groups) for ease of access or location. Published Documents (in PDF/HTML format) can be stored in the Library. Searches can be carried out within documents, and documents can also be favourited via Quicklinks. Examples of documents stored within the library are;

- Checklists/ Quick Reference Cards/Quick Reference Handbook (QRH);
- Flight Crew Operating Manual (FCOM);
- Flight Crew Training Manual (FCTM);
- Master Minimum Equipment List (MMEL) and so on;

- NAV CHARTS: Navigation charts/plates and other content from various sources can be organised in this section. The source of charts could be AIPs or third-party vendors. Charts are sorted and filtered as per Airfield. Such content may include AIP Public Notices, Instrument Approach Charts, Departure (SIDs) and Approach (STARs) procedures for airfields, Apron Layout Charts, and en-route Navigation Charts if available in PDF/ PNG or JPG format;

- TRIP KIT: This contains all content needed for Flight Briefing, Flight Planning and Load & Trim. Typical examples of Trip Kit content are Flight Planning and Dispatch Sub-System (FPDS), Crew

The EFOS software, developed by Evoke Systems, comprises several key modules. These include training forms for the tracking of all training-related sessions and qualification expiry dates including task analysis, to support an Alternative Training Qualification Programme (ATQP) and Evidence Based Training (EBT).

Management Sub-System (CMSS), flight briefings, an electronic flight plan (FPL), ETOPS Calculations, weather briefings and forecasts;

- FORMS: This section contains offline electronic forms that can be filled on the PED by crew; completed forms are stored on the device in offline mode and once online, the data is transmitted to the server in XML format. Such forms include the ETL, Cabin Log, Quality Audit Forms, and safety reports.

The AOT offers two applications that can run in offline mode for commercial aircraft: Load & Trim; and RTOW & RLW Calculations and Tables based on Lookup databases.

Six airlines are live on the AOT platform as of May 2017. AOT runs on all Apple, Android and Windows devices. Laminaar Aviation advises that for Class 1 and Type A applications customers need to inform regulatory authorities of their intention to move to paperless processes, whereas type B applications such as performance-based software require certification.

Lufthansa Systems GmbH

Lufthansa Systems is part of the Lufthansa Group. It provides a Type B EFB solution via a range of modules that are included in its 'Lido' software suite. More than 100 airlines are using applications within Lido.

Lido's suite of products operates on a mix of Windows and iOS platforms depending on the application:

- Lido/eRouteManual is a charting application that operates on Windows platforms. Its latest version is 4.3 which became effective November 2016;

- Lido/eRouteManual Mobile Updater is an update function to the previous Lido/eRouteManual application, which operates on Windows platforms;

- Lido/mPilot is a charting application and document viewer with added update functionality. It is available on iOS platforms. Lido/mPilot's latest version is 2.1 which came into effect March 2017;

- Lido/TakeOff is a take-off performance application that functions on Windows operating systems;

- Lido/Landing, Lufthansa System's landing performance application, is available on Windows devices.

According to Lufthansa Systems,

EmpowerMX's ETL contains several sub-modules in its FleetCycle® suite, including a FlightLog, FuelLog, ServiceLog, APULog, CertificationLog, DefectLog, DeiceLog, Document reader and Forms repository.

Lido/TakeOff and Lido/Landing are also available in different customised versions for operators. Via the above applications, flight crew can access terminal and en-route chart information, in addition to operating manual information in-flight. Lido's various applications also offer the possibility to display the aircraft position, for example using the aircraft integrated data systems (AIDs) from other providers. In addition, Lido/TakeOff and Lido/Landing provide take-off weights, speeds, landing weights, runway distances and thrust values in operation.

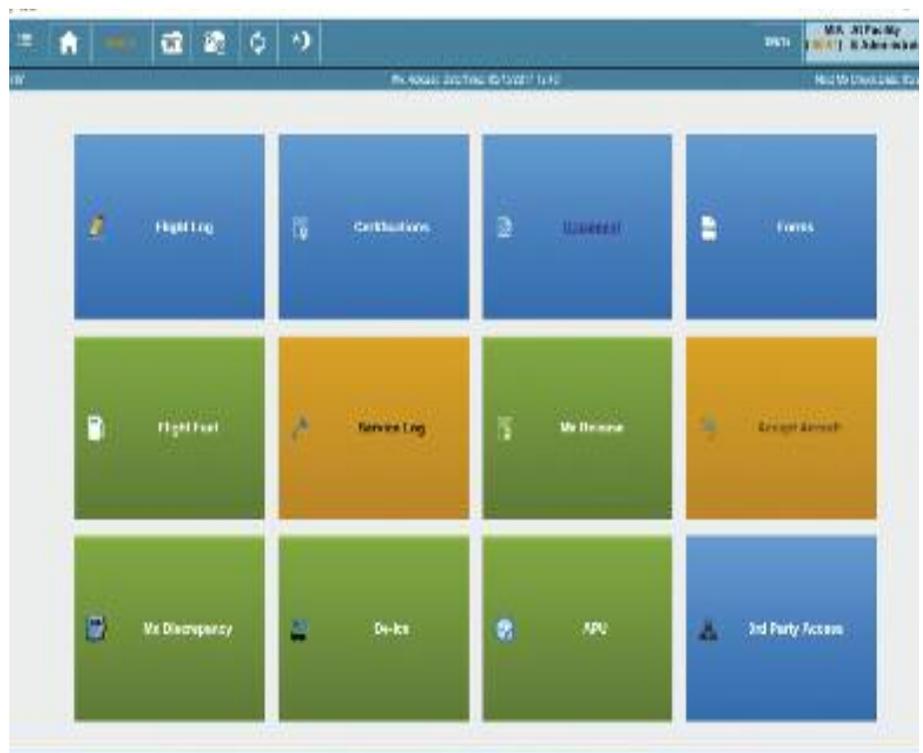
Lufthansa Systems explains that EFB administrators can access the back-end system DVMS (Document Viewer Management System) via a web portal to configure the applications, or manage and upload customer-specific documents to Lido/mPilot. To use the Lido/TakeOff and Lido/Landing applications, the operator must establish data release agreements (DRAs) with the relevant aircraft OEM.

NAVBLUE

NAVBLUE is a wholly owned subsidiary of Services by Airbus. The company is headquartered in the UK, and provides an EFB solution suite called N-Flysmart. This is available across iOS and Windows platforms. A separate ETL application is offered by Airbus in the form of CrossLogBook. While not a NAVBLUE product, CrossLogBook can be integrated into N-Flysmart, although it is currently only Windows-compatible.

Both N-Flysmart and CrossLogBook are type B software applications. The EFB solution comprises five main modules, including the eQRH (electronic quick reference handbook); a performance calculations module for processing LoadSheet, Take-off, Landing and In-Flight data; a documentation consultation segment, including MEL/CDL missing items retrieval; Charts+ for viewing electronic terminal charts, en-route map, route information and customer documents; and an EFF for viewing FPLs, NOTAMS, forms, Weather and so on. The EFF can be tailored to airlines' specific requirements, and contains an automatic pilot synchronization feature.

Meanwhile, the EFF and CrossLogBook main functions allow for mixed fleet capability; Flight Briefing/Flight follow-up/Flight



Reporting; defect logging by pilots, maintenance and cabin crew; and the management of aircraft acceptance and release pre-flight.

N-Flysmart includes a manual reader in the operational library browser module, for viewing operations and company manuals. A dedicated format allows information to be shared with performance applications.

The EFF can store all data recorded in flight, such as loadsheets and performance calculations off-line, to update systems once a connection is re-established post-flight. For the EFB and CrossLogBook to function online in-flight, and therefore transmit data in real time, IP connection is required such as 3G, WiFi or Satcom. 220 airlines are using NAVBLUE's N-Flysmart, while five of these are using the CrossLogBook integration. Both software solutions are available via a yearly subscription fee.

NVABLE Limited

NVABLE is based in the UK. It offers a Type B ETL application via its software suite, Converge Aviation. NVABLE's ETL is on its second version, although Cameron Hood, chief executive officer, explains that the software is configured differently for each customer. "Some customers have significantly different functionality to others," he says. The latest version was introduced in August 2016 as part of Windows 10 compatibility updates. To date, three airlines have adopted Converge Aviation.

Converge Aviation comprises:

The Electronic Techlog App – designed for Windows tablet computers which optionally includes:

- Damage Reporting (Dent and Buckle);
- Line Maintenance Planning;
- Out-of-Phase (OOP) task management;
- Document Scanning (for defect reporting).

Naturally, crew can use all aspects of the ETL in flight. Hood emphasises that the only restriction is that the tablet or PED is put into flight-safe mode. While the ETL app is only supported on Windows platforms, web access allows functionality across all operating systems.

● The Converge Portal, which is a web application for managing the fleet of techlogs, including: users, configuration of stations, OOP tasks, correction management, data analysis and line maintenance planning. "A lot of functionality can be accessed via the web portal," explains Hood. "The Converge Portal is a fundamental part of the solution. All the data transmitted from the Electronic Techlogs is available on the portal, although the Electronic Techlog itself is not completed on the portal because it is physically assigned to the aircraft.

"As part of the service we are able to view, in real-time, the usage of any connected Electronic Techlog in the fleet. We can also provide the same ability to airline staff (such as maintenance/operation control) as required."

- Electronic Forms – an iPad application for recording and managing assessments of flight and cabin crew;
- Station Audit – a web application for managing station quality audits;
- Document Management, for managing document versions across internal and external user groups, and;



● Operational Analysis – a web-based application for analysing operational activities.

Converge Aviation can be interfaced with third-party operational and MRO-based systems, so information extracted from the ETL can be fed directly into these systems. “We have live feeds of data from the ETL going into third-party systems. The only restriction is the willingness or ability of those third parties to accept a feed of data,” says Hood.

PACE

PACE Aerospace Engineering and Information Technology GmbH is headquartered in Berlin, Germany. PACE provides type B EFB applications in the form of the Pacelab Flight Profile Optimizer (FPO) and Pacelab CIOPS (Cost Index Operations), which is for use on Regional Jets. Pacelab’s FPO latest version, 2.1, came effective in May 2017; and Pacelab CIOPS 5.3.3 in March 2017. Both products are used by more than 10 airlines.

PACE explains that via Pacelab FPO and CIOPS, flight crew can see and analyse the most efficient flight trajectory from the aircraft’s current position until the end of flight at any time during that flight. Before and during the flight the flight crew can also trigger their own what-if-analysis at any time, and all calculation results profiles and actual data can be recorded and retrieved on the ground for the purposes of post-flight analysis.

In addition, PACE also offers an EFB Library which can be used for the viewing of operational manuals.

Pacelab operates on Windows,

although it will also become iOS-compatible in the near future. Pacelab is not mandated by authorities, so it requires operational, rather than regulatory, approval.

Panasonic Avionics

Panasonic Avionics Corporation has offices in California, Seattle and Denver. Via its 4DAero weather application, it provides EFB services in conjunction with its satcom system solutions.

4DAero provides users with weather forecasts and related weather information in reference to a filed flight plan. This gives flightcrew better weather-related situational awareness, which may influence the flight plan chosen by the pilot. The application can be accessed offline in flight, because the information can be pre-loaded, although it can function online in flight if L-band (Iridium) or Ku-band connectivity is available.

4DAero is being developed and will be available across iOS and Windows platforms, so it will be accessible via most PEDs. Discussions are under way with potential launch airlines to subscribe to the application on its release. Customers subscribing to 4DAero will have access to the software granted via application download, followed by a web-based activation service.

SITAONAIR

SITAONAIR is headquartered in Geneva, with offices in Atlanta, Brussels, Dubai, Geneva, London, Montreal, Paris, Rio de Janeiro and Singapore. The company offers Type B EFB solutions, but an ETL module is under development and

Evoke Systems offers an EFB software called EFOS, which is a type A EFB. The EFOS app can be used on Apple products, such as the iPad. The software can be accessed, however, via any device and platform via a web portal.

expected to launch in 2018.

SITAONAIR provides iOS and Windows-based software from three different vendors: AvioVision, Flightman and GTD’s EFB Weather Awareness Solution (eWAS). SITAONAIR markets, sells and integrates the software into a full cloud-hosted, supported turnkey solution for its clients. 12 airlines are using SITAONAIR’s services.

Within its solution, SITAONAIR can offer clients the following modules:

- A main, core module that manages schedules and notifications;
- A Briefing segment for storing flight Plans, Weather and NOTAMs;
- OFP including acceptance to Fuel and Weights, Navlog, journey log and notes observation during a flight;
- Weight & Balance, showing upload or calculation of weight and balance for all aircraft types;
- Performance module, offering integrated calculations of take-off and landing performance;
- Charts module for electronic charts, and routes and airport data;
- eReports, an electronic template for submitting report contents to ground servers, and integrated with third-party systems as ground to ground;
- Library, a document reader and repository for storing electronic manuals; and;
- eWAS, an EFB Weather Awareness Solution that advises pilot of significant weather en route.

Each module can function offline in flight. Before each flight, updates are completed via a connected ground server so that remaining work can be undertaken minus internet connection, although ACARS can be used to connect the applications inflight alongside TCP/IP which is SITAONAIR’s OnAir Plug.

There are slightly different configuration set-ups, depending on whether the customer requires iOS- or Windows-based platforms. SITAONAIR explains that with iOS, configuration is enabled through settings, and device details are managed via the ground portal. With Windows, a configurator piece of software is supplied along with the main EFB software to allow an airline’s EFB admin team to configure and set up the devices. The modular and level of access permissions are pushed through SITAONAIR’s EFB ground portal. A mobile device management (MDM) solution is also provided to manage the

IOS or Windows devices if required by the customer.

Smart4Aviation Technologies

Smart4Aviation has developed a mobile EFB product called Smart PORTAL Mobile. The software is categorised as Class 1 EFB, PED, that provides Type A and B Information. The latest version, 2.4, was released on March 27th 2017.

The following Smart4Aviation modules form the Smart PORTAL Mobile:

- Smart BRIEF Mobile helps airlines prepare briefing packages. Smart BRIEF gathers all relevant information from available sources to create a fully automated flight briefing package. There are several submodules built into this application:

- NAVLOG functionality allows completion of all waypoint-related data. It recalculates times and fuel values, and inserts and deletes waypoints to customise a route. NAVLOG integrates with the flight planning system, and presents the entire flight from pushback to arrival including all flight-specific waypoints and airways.

- The FUEL ORDER module is developed specifically as a flight crew fuel ordering solution. It is integrated with the flight planning system to present the actual fuel and ZFW values on an interactive GUI, allowing the flightcrew to order ad hoc fuel values, amend alternate selection and challenge ZFW increases. The flight crew can order additional fuel based on airline-specific rules and send this request directly to the fuel supplier and flight dispatch as needed.

- ATC FLIGHT PLAN provides access to the filed ICAO flight plan taken directly from the OFP. It is immediately accessible and can be copied for overlay onto a route chart or map.

- SCRATCH PAD allows amendments to a filed route by ATC. It is designed for crews that are required to manually receive ATIS information.

- ELECTRONIC SIGNATURE for flightcrew acceptance: Smart PORTAL MOBILE provides an easy means for mandatory acceptance of the OFP by the operational flightcrew.

The other modules within Smart PORTAL Mobile include:

- Smart MET Mobile, which groups several weather products into Weather Packages, to provide users with tailored area weather briefings;

- Smart NOTAM MANAGER Mobile provides all necessary flight related NOTAMs in a customised format;

- Smart DOC Mobile synchronises company and personal documents stored on mobile devices with their most recent

versions available in the central database. EFB and mobile interface give users offline access to documents during flight. It can include different airline documents: Flight Briefing Documents and Aircraft Technical Bulletins (ATBs), among others;

- Smart eFORMS Mobile is a fully customisable platform that can easily manage multiple reporting and workflow processes via templates. It can replace or augment an existing Air Safety Reporting system or streamline the gathering and

processing of forms and reports required by an airline, such as Air Safety Reports or Voyage Reports;

- Smart COMM Mobile is the messaging and alerting application within Smart4Aviation's portal. It allows Peer-to-Peer communication, two-way ACARS messaging, automatic ACARS uplink and downlink transactions, and rule-based alerting;

- Smart BRIEF CABIN and Smart CREW INFO Mobile provide cabin



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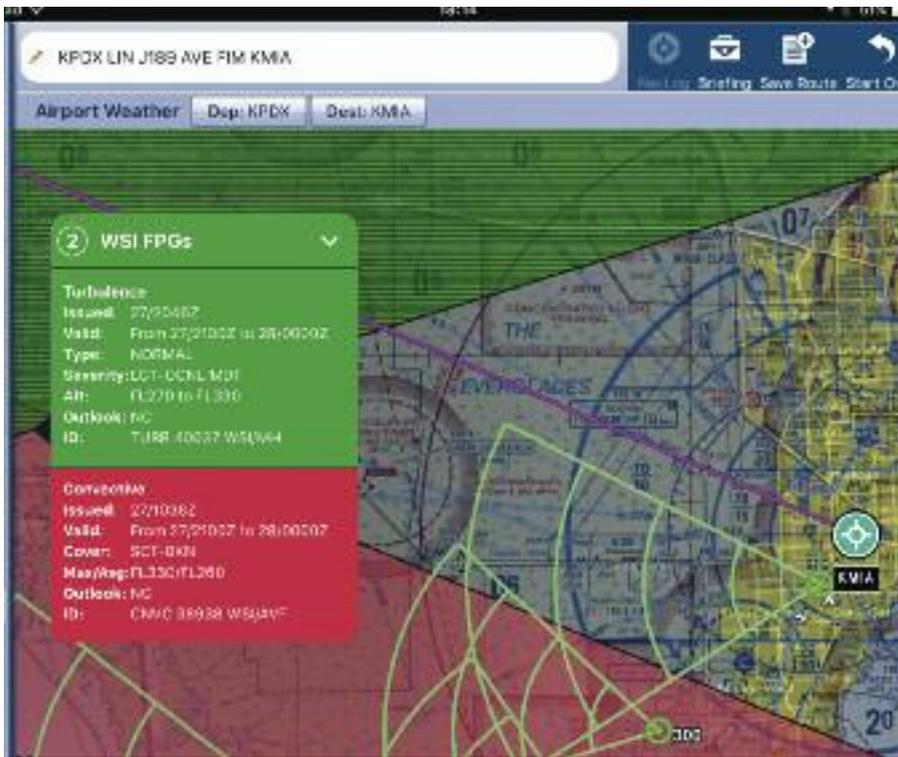
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crews with all flight, service delivery, crew scheduling, roster and pairing information centralised in one easy-to-access, web-based portal, tailored to the schedule of each individual employee.

Smart4Aviation's mobile solutions are used by five carriers, including Air Canada, Air New Zealand, easyJet, Emirates and Air Austral. The modules are available on iOS, Windows and Android platforms, and can be used on all compatible PEDs. Off-line functionality includes caching of all uploaded data for viewing and editing Manuals, Documents, BPs, Rosters, NOTAMs, WX and Forms. Any internet access enables the modules to function online during a flight.

Thales AvioVision

AvioVision is a Belgium-based company, fully owned by Thales since the end of 2016. Its software suite, AVIOBOOK, provides both EFB and ETL services within its modules. The latest version of AVIOBOOK for iOS is 16.3.1, whereas the Windows version is on 17.1. Thales AvioVision advises that its software has about three major version releases a year.

The AVIOBOOK EFB software suite is in a set of modules as follows:

- **Main:** provides the administrative functions of the EFB including Leg selection, Updates and notifications;
- **Briefing:** part of the EFF, and includes all pre-flight briefing data legally required to dispatch the flight, such as weather, NOTAMs, ATC information, weather charts and additional documents;
- **Operational Flight Plan:** part of the EFF, which contains the flight planning

system's output (fuel and route calculation), and may be complemented with other flight-related data;

- **Weight & Balance:** is a full automatic weight and balance calculation module based on the aircraft configuration and digital signature. This is available for all aircraft types;
- **Perfo:** a full automatic take-off and landing calculation module, including aircraft configuration, an approved airport database and a calculation engine. It is available for all aircraft types;
- **Charts:** Launches a chart application as selected by the customer and shares the relevant flight data with the chart application;
- **Library:** is a configurable digital library module and document viewer (for PDF or HTML documents) fully connected to the master library;
- **Reports:** is a fully configurable digital reporting module, integrated with the customer's back-office systems;
- **Tools:** provides a set of tools such as MOTNE decoding and de-icing holdover times;
- **Globe:** provides enhanced graphical weather data by showing the flight route and relevant airport on a 2D or 3D map;
- **eTechLog:** is a real-time reporting tool to efficiently manage aircraft defects;
- **eChecklist:** is an electronic checklist currently under development.

AVIOBOOK also provides a Cabin briefing application for cabin crew, with four integrated modules:

- Flight
- Library
- Reports
- Briefing

Via AVIOBOOK, the following information can be extracted and used in

WSI Pilotbrief Optima's mobile application only runs on iOS, while the web-based version is supported on Windows 7, 8.1 and 10. According to The Weather Company, there is feature parity between the mobile and web versions, with the exception of the Navlog, which is only available on PEDs; and text briefings which are only available on the web version.

flight: digital navigation log for in-flight completion; aircraft performance calculations for landing in-flight; charts; manuals; reports; defect information that is entered into the eTechlog module; and up-to-date weather information (provided that the aircraft has in-flight connectivity).

- **Thales AvioVision** has a customer base of 34 airlines, with its solutions being implemented on more than 1,100 aircraft. The software developer advises that when the AVIOBOOK applications cannot connect to the Internet they will continue to work offline. The online mode will be activated once an internet connection is available. The AVIOBOOK EFB can be interfaced with an airline's IT system alongside third-party operation and maintenance systems.

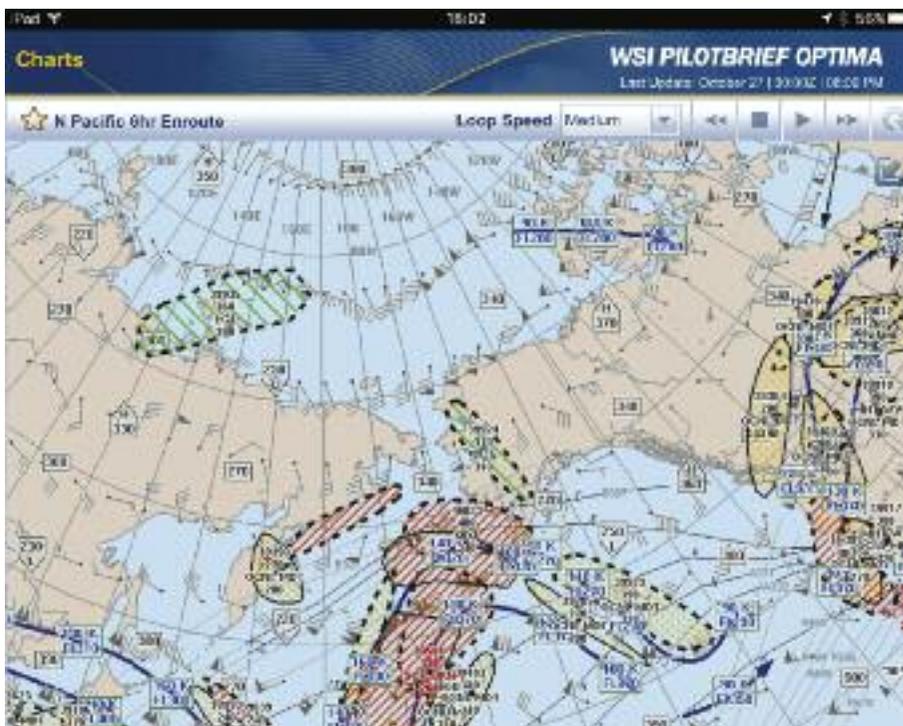
The Weather Company

As the name suggests, The Weather Company provides weather-based EFB solutions for airlines. Based in Massachusetts, USA, the weather application specialist has developed a type A EFB application suite called WSI Pilotbrief Optima.

WSI Pilotbrief Optima comprises six key modules. The first, called Route Briefing, provides pre-flight, weather and airspace briefing packs for specified flight routes. Next, Weather Charts displays radar, satellite, flight planning guidance and other significant weather charts.

The Digital Flight Release (DFR) is a paperless flight release packet for airline crews, while the Interactive Navlog provides in-flight time and fuel tracking. Last, the Offline mode displays pre-downloaded weather, airspace and route briefing information when the EFB device is not connected to the internet. Pilots can manually enter fuel, time, position, wind speed, temperature and flight level into the application during flight. Data connections that allow the WSI Pilotbrief Optima to function in flight include: aircraft WiFi, ADS-B Receiver, and Sirius SXAR-1 connectivities.

WSI Pilotbrief Optima's mobile application only runs on iOS, while the web-based version is supported on Windows 7, 8.1 and 10. According to The Weather Company, there is feature parity between the mobile and web versions, with the exception of the



Navlog, which is only available on the mobile version; and text briefings which are only available on the web version.

No regulatory approval is required to use WSI Pilotbrief Optima on the flightdeck. Airlines typically test the application on live flights before distributing it to crew members and fleets.

Ultramain Systems

Ultramain Systems is based in Albuquerque, USA; with additional offices in Ireland, Hong Kong, Singapore and India. Within its software portfolio, Ultramain has developed an Electronic Technical (and Cabin) Logbook Software called ULTRAMAIN® ELB.

ULTRAMAIN® ELB is Type B EFB software that operates on both installed and mobile devices. ULTRAMAIN® ELB v1 has been live at airlines around the world since 2008 and its new version, v2, which represents a major step forward in ELB software, is set to go live in June 2017. “ULTRAMAIN ELB is the complete replacement of the paper aircraft technical logbook,” says Larry Lenamon, director of flight technologies at Ultramain Systems. “Modules and components include the technical log, cabin log, fuel log, fluid uplifts and servicing, de-icing, aircraft damage log, and journey log. Each of these may be configured for use based on operator requirements and user role.”

With ULTRAMAIN® ELB, flight crew can access the current logbook status, a pre-configured number of flight sectors of logbook historical data, and full defect reporting functionality for the specific aircraft they are flying.

On suitably connected and equipped

aircraft, the application also integrates with the CMCF (Central Maintenance Computing Function) and offers aircraft-detected faults for one-touch entry. In addition, the application’s reporting tree is fully configurable to allow for virtually any flight performance information/profiles to be recorded by the flightcrew. ULTRAMAIN ELB also provides mechanisms to manage electronic signatures and on/off aircraft data movement when disconnected. In addition, data transfer automatically resumes upon the re-establishment of any available communication channel. The module suite also operates with offline Logbook Data Recorders (LDR).

ULTRAMAIN ELB works with the ULTRAMAIN ELB Ground System, which integrates with M&E systems per ATA Spec 2000 Chapter 17. This allows the information provided by the applications to be fed into third-party maintenance systems. The ELB Ground System can be accessed via a web browser.

ULTRAMAIN ELB operates on iOS and Windows, and is complete and fully functional regardless of the operating system. Certain functionalities, however, such as aircraft data access depend on the supporting aircraft’s infrastructure.

UTC Aerospace Systems

While UTC Aerospace Systems is known for its Type B EFB solutions, it has been developing several new applications that are hosted via its Aircraft Interface Device (AID). UTC Aerospace also allows third-party eTechlog applications by hosting them on the hardware it develops, in addition to providing critical data to these applications.

Developed by The Weather Company, WSI Pilotbrief Optima comprises the following key modules: Route Briefing, Weather Charts, The Digital Flight Release (DFR), Interactive Navlog and an Offline mode which displays pre-downloaded weather.

UTC Aerospace offers five applications on its OpsInsight application suite: OpsInsight Electronic Flight Folder; OpsInsight™ vQAR; OpsInsight™ ACMS Lite; OpsInsight™ Data Loader; and the OpsInsight™ Ground Station Portal. This software suite will officially be released this summer, and is undergoing trial evaluations with UTC’s launch customers. Via these applications, flight crew can extract fuel, time, weather and performance data in real time.

Meanwhile, a variety of parameters can be recorded using the application suite. OpsInsight™ EFF can record performance data, such as fuel performance, on-time performance, and any exceedances that occur during flight. Flight performance is also compared against the previous 100 flights flown on the same leg.

UTC Aerospace’s EFF is compatible with iOS and Windows applications, and can also be used on the UTAS G700 SmartDisplay® Electronic Flight Bag. Data can also be interfaced with airline ground systems to efficiently filter flight data throughout the airline.

Last, vQAR is an AID-hosted application that stores and transmits critical flight data such as FOQA data, Prognostic Health Monitoring (PHM) data and Log by accessing the ARINC 717 and ARINC 429 data buses on an aircraft.

OpsInsight™ ACMS Lite is a hosted application that allows users to create custom triggers which will drive defined actions when met. The user creates custom triggers through a simple web interface on the ground or directly through the AID 2.0 on the aircraft. These ‘recipes’ consist of logical combinations of avionics data triggers, which when met will cause user-defined actions to capture data snapshots that can be recorded in a report. The analysis can then be transmitted over a communication link, or stored locally on the AID 2.0.

ViaSat Ireland Ltd

ViaSat is a global communications company, with an airline software development unit in Ireland. ViaSat provides a modular EFB solution called the ViaSat EFB. A Type A software, ViaSat EFB consists of four core modules: the Digital Library, Notices, Forms and

Laminaar's software platform, offers both EFB and ETL solutions, called ARMS® on the TAB™ (AOT). There are two modes of operation in the software: Library Mode where the user navigates through the content library; and Sequencer Mode, where the administrator can define a specific workflow process.

Flight Briefing Pack applications. Other, third-party applications can also be integrated into the ViaSat EFB to offer a fully customised EFB for customers. The software is being used by multiple airlines, with two deployments currently ongoing.

The suite of EFB applications offered by ViaSat allows flight crew to quickly search aircraft manuals, NOTAMs (as part of Flight Briefing Pack) and ECAMs, and enables quick access to Notices, Forms, Read+Signs, and flight briefing packages. In-flight, safety reports can be filled in, while additional data recording depends on integrated third-party applications, and the aircraft AID.

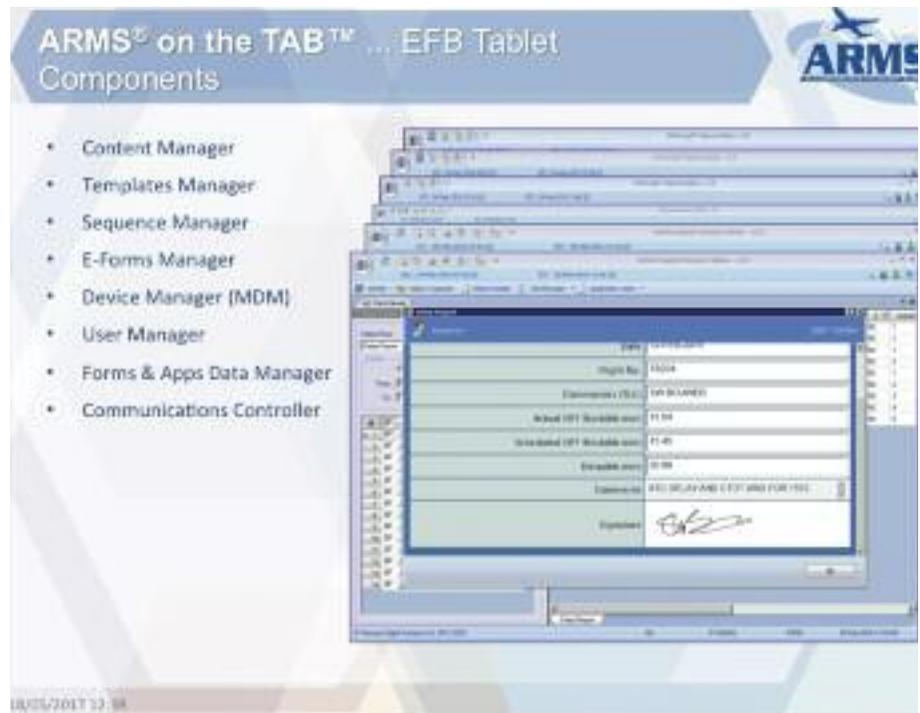
The document reader within the Digital Library allows fast and easy access to aircraft and airline manuals. According to Gary Byrnes, who works in business development at ViaSat Ireland, manuals can easily be bookmarked, annotated and highlighted by flight crew. The document reader also includes a day/night mode, which allows the EFB to be used regardless of the lighting conditions.

ViaSat's EFB is compatible on both Windows and iOS platforms, so it can be deployed on a wide range of PEDs. The application is fully operational offline, although a PED can use an AID equipped with WiFi and/or the aircraft cabin network to establish online connectivity. The ViaSat EFB can also be used via a web portal, which offers almost the same level of functionality as the app, with a responsive display that adapts to any PED screen. Byrnes adds that some of ViaSat's customers allow pilots to access flight briefings via a crew web portal, on personal computers as well as airline-issued PEDs.

Web Manuals Sweden AB

Web Manuals is located in Malmo, Sweden and San Diego, California. It provides an EFB application in the form of Web Manuals, a class 2 EFB that can act as type A or B depending on the type of document in use.

The latest version of Web Manuals, 6.2, known as 'Hyper Gripen', came into effect May 2017. In this version, some revisions to the software have been made, including to the way in which the review and approval process of documentation is performed. "6.2 has streamlined the



process of manual revisions, making it easier for large airlines to carry out," says Martin Lidgard, founder and chief executive officer at Web Manuals. "The document revision process can be complex as multiple departments are involved."

Web Manuals has doubled its client base in the last year. It has therefore focused on upscaling the performance of its application to align with the larger volume of data processed by the software.

The Web Manuals application contains three core modules.

The Production module allows controlled flight documents to be written in an online, cloud-based platform.

The Compliance Libraries function allows aviation companies to remain compliant by connecting each paragraph in the regulations document to the corresponding paragraph in the relevant manual, Lidgard explains.

Meanwhile, the Distribution module passes manuals throughout the organisation, and can track who has been reading what and when. Users also receive email notifications of newly published documents. The document viewer allows flight crew to read manuals, create favourites, and make cross-references between manuals.

Last, the EFB module is an extension to the distribution function. It allows for the same features as the distribution function within Windows and iOS compatible tablets. The EFB works offline, so pilots can read manuals while in the cockpit or on the go.

Today, more than 95 customers are using Web Manuals. The application can be accessed via web portal; the Web Portal Interface and the EFB Interface are

mirrored, and all users have personal accounts. Favourites and other bookmarked links will therefore copy to whichever platform the application is being accessed through.

Conclusion

According to navAero, the lack of adoption of EFBs, ETL and flight data analytics by users, has been primarily due to the perceived cost of deployment and low understanding of their real added value. "While there are a few early adopters and connectivity pioneers which are on the leading edge of using real-time connectivity and big data analytics to maximise operational performance and increase efficiency, most operators have been firmly committed to 'portable', non-connected solutions as a low-cost means of providing a deployed platform for a limited set of Type A applications," summarises Giordano. "Due to the historic high cost and significant involvements (aircraft downtime and installation labour) in providing a hardware data-connected EFB platform on an aircraft, many operators have chosen to keep a non-connected solution.

"However, now that wireless-to-the-cockpit data connectivity has been proven and authorised, we expect that portable solutions will be replaced by connected platforms. These will use aircraft-provisioned power ports or low-cost aftermarket solutions to fulfil power connectivity requirements and support the use of enhanced applications," says Giordano. **AC**

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