A large number of airlines are now implementing EFBs & ETLs, with the aim of assisting pilots and generating savings in flight operations. The implementation process of EFB & ETL programmes of several airlines, and the subsequent results and benefits, is examined here.

Airline case studies - the implementation & operation of EFBs & ETLs

The options for electronic flight bag (EFB) solutions offer increased potential to provide cost and efficiency savings for airlines. There have been substantial developments in EFB technology in recent years, driven by the growth of commercial tablet devices. EFBs have moved on from their initial function of displaying read-only manuals, to hosting interactive software applications, such as performance calculation tools.

Airlines cite different reasons for adopting EFB solutions. This article will look at a number of airline case studies to determine how and why these carriers have implemented and operated EFBs. It will look at the initial business case, the hardware and software selected, the benefits of the chosen system and the challenges and costs of implementation.

EFB definitions

An EFB is generally used on the flightdeck (see *The latest developments in EFBs & selection of the right solution, Aircraft Commerce, December 2012/January 2013, page 26*). The combination of electronic visual display hardware with software enables the user to perform operational functions previously carried out using paper. Examples include manuals and charts.

EFB hardware and software have been classified by class and type respectively. There are three hardware classes and three software classes.

EFB hardware classes

Class 1 EFBs are often consumer-off-the-shelf (COTS) -based portable electronic devices (PEDs). These might include laptop computers, or tablets such as the iPad. They are not fixed to the aircraft and have no data connectivity to aircraft systems. Class 1 hardware does not need airworthiness approval and can support Type A and/or Type B software.

At one time Class 1 devices were not authorised for use in critical phases of flight. Recent developments in securing COTS equipment have led some authorities to allow their use in all phases of flight, provided that the Class 1 devices are properly secured and viewable.

Class 2 hardware can also consist of COTS devices. Class 2 devices can be attached to a mounting on the flightdeck that permits their use in all phases of flight, but they are often portable and can be easily removed from the flightdeck. With Class 2 EFBs it is possible to receive data from an aircraft's systems via a certified interface. Airworthiness approval is only required for the hardware mounting, and Type A and/or Type B software can be supported.

Class 3 hardware can host Type A, B and C software. Two-way data connectivity with aircraft systems is possible for Type C applications, while data download from the aircraft is allowed for Types A and B. Class 3 EFBs require airworthiness approval, since they are installed avionics equipment.

EFB software types

Type A software applications tend to be categorised by regulators as pre-composed and non-interactive. Examples include browsers displaying information that used to be in paper form, like maintenance manuals, the air operator certificate (AOC), service bulletins (SBs) and airworthiness directives (ADs).

The Federal Aviation Administration (FAA) and the European Aviation Safety Agency (EASA) consider Type B software to be dynamic and interactive applications, capable of using data for operational requirements. Examples include the electronic technical log (ETL), electronic aeronautical charts, flight operations manuals and performance calculation tools.

Type C software applications are approved avionics functions relating to communications, navigation and surveillance. Examples include those applications that support controller-pilot data link communications (CPDLC).

Airport moving map display (AMMD) applications showing own-ship position on the ground were previously considered a Type C application. Current thinking suggests applications showing own-ship position on the ground will be reclassified as Type B software.

Applications that can be used to check and control the aircraft's position in-flight remain Type C avionics functions. Unlike Type C, Types A and B do not require airworthiness approval.

Confusion & proposed changes

Continued technological advances have led to some confusion about EFB classifications. The distinction between Class 1 and 2 systems has become particularly blurred, with Class 1 systems now being approved for use in all phases of flight. In addition, inconsistencies between national authorities mean that certain EFB solutions might receive approval in one country, but not another.

The FAA and EASA are aware of the need for EFB classifications and supporting regulations to keep pace with developments in technology. As a result, they have decided to move away from the current class-based system. In future, EFBs will be classified according to whether they are portable or installed,

The first main benefit of an EFB project is the ability to automatically and electronically update the content of all EFBs held by all pilots or located on all aircraft. This compares with the laborious task of manually updating and revising paper and hard copy manuals.

and the functions they are performing. Only Type A and B software (including AMMD applications) will be considered as providing an EFB function. Type C applications will be considered as avionics systems. The FAA estimates that it will implement these new classifications by the end of 2014.

Potential benefits of EFBs

A potential benefit of EFBs is the removal of paper from the flightdeck. Replacing paper forms, manuals and charts with electronic versions can reduce weight, potentially leading to lower fuel burn, or an increase in payload.

Another potential benefit comes from integrating the flightdeck into the airline's central IT system and data flow. Sending forms and data electronically can lead to cost savings and improved efficiencies.

EFB-based performance calculation applications can also be beneficial. They offer optimised calculations for various stages of flight including take-off and cruise, and can suggest the most efficient thrust settings, and potentially lead to reduced engine wear and, subsequently, maintenance costs. Coupled with other strategically chosen applications, they can lead to more efficient fuel burn in flight.

The maintenance department can also realise cost and time savings by adopting an EFB solution. An ETL application can reduce human error in fault code reporting, and instantly send fault data to an airline's maintenance & engineering (M&E) IT system. This could result in engineers having replacement parts ready for an aircraft when it reaches the gate.

To fully enjoy the potential benefits of EFBs, airlines need to communicate data to back-office systems on the ground and in the air. Airborne connectivity is possible via SATCOM, but can be expensive if it is not carefully implemented. To manage costs there are ways to segment and prioritise data using different communications channels. Airlines reduce the cost of SATCOM, by using wi-fi and cellular methods at the gate before take-off and after landing.

Costs and considerations

The cost of EFB hardware rises with the capability of the system. A basic Class 1 COTS-based tablet may only cost $500. For a Class 2 system the cost of the device and, most significantly, the supplementary type certificate (STC) needed for the flightdeck mounting, could be $10,000–40,000. Class 3 hardware is the most expensive at $100,000–200,000.

Choosing an EFB solution does not guarantee cost and efficiency savings. EFB hardware and software suppliers and industry consultants all say that an EFB programme should start by identifying a strong business case for implementation. Airlines need to decide on structured and achieveable goals before choosing the most appropriate hardware and software to help achieve these aims.

Case Studies

A number of airline case studies have been included to identify how and why different carriers have implemented EFB solutions. These case studies cover scheduled, charter and full-service airlines and low-cost carriers (LCCs) operating widebody, narrowbody and regional aircraft.

Denim

Denim is a Netherlands-based operator that specialises in aircraft, crew maintenance and insurance (ACMI) services for regional airlines. Its fleet consists of four Fokker 50s and an E-190, which it operates on behalf of new start-up carrier FlyNonstop. Two more E-190s will be added to the fleet in August 2013 for operations on behalf of another customer.

Denim has been operating an EFB solution on its Fokker 50 fleet for about six months. "Our main business case for deploying an EFB solution was the need to ease paperwork distribution," explains Maarten Temminck, project manager at Denim. "Our aircraft have no fixed home base. They are either with a customer or flying charters. This can make updating paper documents and sending them back to head office a logistical challenge. EFBs' ability to send these documents electronically adds flexibility to our operation."

Once it had decided on a business case for implementation, Denim looked at the most suitable hardware and software solutions to meet its needs. "For the Fokker 50s we decided to go with a Class 2, iPad-based system," says Temminck. Among other reasons, iPads were chosen because they were already certified for use on aircraft and had electronic charting software available. "The iPads were sourced directly from Apple, while Fokker Services provided the mounting and STC necessary to install them, along with the required electromagnetic interference (EMI) and decompression tests," explains Temminck. The iPads are attached to a moveable bracket, which is installed on the side-panel of the flight deck and permits EFB use in all phases of flight.

"We have two software suppliers for the Fokker 50 EFB system," says Temminck. "These are Jeppesen for electronic charts and IFS with its Paperless Flight Bag (PFB). We currently use the flight plan, flight reporting and document library modules of the IFS software platform. The IFS solution is flexible and can be integrated with other software. The PFB platform allows for future growth as extra functionality can be added."

Denim's Class 2 EFB solution does not interface with aircraft systems for

Despite being equipped with installed Class 3 EFBs, Qantas chose to add a Class 1 iPad-based EFB system. The on-board Class 3 EFBs are used for performance calculations and some manuals. The iPads are used for carrying manuals and charts, and also have performance tools.

uploading or downloading data. Nor does the airline have in-flight connectivity for its EFBs. "We use 3G cellular and wi-fi methods of connectivity before departure and after landing to send information from EFBs to back-office systems," says Temminck.

Denim believes its EFB solution is helping to meet the goals set in the initial business case. "By sending information electronically from the aircraft to other airline systems we have increased our flexibility and reduced the back-office workload in terms of printing and distributing paperwork," says Temminck. "Some benefits of the EFB system were not included with the first business case, but were added when we realised the potential." This included improved data workflows within the organisation. "Information from EFBs can be sent to back-office planning and reporting systems as soon as the aircraft reaches its destination," explains Temminck. "For example, our IFS PFB software is integrated with the airline's scheduling system, which sends data to the EFB before departure to pre-populate certain fields. After arrival, the pilot signs for the flight and data such as block times, fuel and time checks delay codes and ground service usage, are sent automatically to the airline's operations system."

Denim is also planning to implement a Class 1 EFB solution for its E-190 aircraft. The business case for this differs from that for the Fokker 50. "Since there is currently only one E-190 in the fleet, and it operates quite a fixed route schedule, there is not the same need for electronic charts," says Temminck. "The main focus for the E-190 Class 1 solution is the EFB performance calculations. The E-190 EFBs will have the same IFS PFB software as the Fokker 50 Class 2 system, with the addition of a performance module. There are two main advantages to these performance tools. First, they save time. The EFB software calculates the optimum speed settings for take-off and avoids the need for pilots to look through books or charts. This could help on-time performance. The other benefit comes from potential maintenance savings. Optimised power settings provided by EFBs could allow engines to be de-rated during take-off. This might reduce engine wear, and therefore, maintenance costs."

The Class 1 EFB solution for the E-190 will not be approved for all phases of flight. "It will be used during pre-flight and during cruise above 10,000 feet," says Temminck. "During critical phases of flight the iPads will be stowed in the pilot's flight bags."

For Temminck the main challenges involved in implementing an EFB programme were choosing the right platform to suit the operation and knowing how to get it certified. "Regulations in this field are relatively new and the authorities have struggled to keep up with technical developments," he explains. "When we started looking into our EFB programme there was little guidance material available on how to get it certified. Our local authority has been very co-operative throughout the implementation process."

Qantas

Qantas is one of the longest established and best known global airline brands. It is the biggest international and domestic carrier in Australia. There are more than 130 aircraft in the airline's active mainline fleet. About half of these are 737s and the rest are widebodies. The widebody fleet consists of 767-300s, 747-400s, A330s and A380s.

In late 2012 Qantas began the roll-out of an iPad-based, secured, Class 1 EFB system, permitted for use in all phases of flight. This replaced an existing Class 1 solution that had been in use since 2009. Qantas followed structured research and planning processes before deciding to upgrade its EFB system. "We started with discussions between key departments to identify any needs the new EFB programme could meet," explains Captain Alex Passerini, technical pilot, technology development, at Qantas flight operations. "From there we decided that the programme would involve a simple, building-block approach to avoid overburdening it with too many objectives from the outset." It was decided that the early phases of the new EFB solution would be driven by operational requirements. The initial business case was built on operational savings related to performance calculation software and weight savings by reducing paper on the flightdeck. Extra functionality including an ETL application could be added later.

The ability to replace paper charts with an EFB application was a crucial factor in Qantas' decision to upgrade its solution. The previous Class 1 system was not approved for use in all phases of flight. The new secured solution would have no such restrictions, so it would allow more paper to be removed from the flightdeck, including aeronautical charts.

Having established its initial business case, Qantas decided it wanted a COTS-based hardware solution to deliver the required benefits. "Our A380 aircraft are delivered with installed Class 3 systems," says Passerini. "We only use these for performance calculations and a limited set of manuals. The future does not lie with Class 3 systems. Operators want the flexibility of COTS tablets, which can be replaced every few years with upgraded models more cheaply than modifying aircraft-installed systems.

"We chose the iPad for our current EFB project because, along with the IOS operating system, it is a very stable platform with millions of users,"

continues Passerini. "The Apple environment is also relatively virus-free, while the user experience is simple and intuitive. Each pilot is issued with their own iPad, and we allow a certain level of personalisation, including their use for personal email. We would look to refresh the tablets every two-and-a-half years."

The iPad mounting device in the flightdeck is fixed to the aircraft with high-strength bonding tape, so it does not need an STC. "It was developed in-house and is easy to install," says Passerini. The mounts cost less than $1,000 per shipset."

Qantas uses performance calculation software supplied by Boeing and Airbus, electronic charts, provided by Jeppesen and the Qpilot application designed by Tata Consulting Company (TCS) on its iPad EFBs. "Qpilot performs three functions in one app," says Passerini. "These are a library for manuals, electronic flight plans and electronic forms." The Airbus performance software resides on the integrated Class 3 system on the airline's A380s. Most other functions are performed on the iPads.

The airline's iPad EFB solution has several main benefits. "The performance tools allow pilots to quickly calculate optimum thrust settings for different stages of flight, including take-off and landing," explains Passerini. "This can reduce engine wear and maintenance costs. By replacing the majority of paper, including manuals, navigation charts and forms, we save about 20kg in weight on each aircraft. This can reduce fuel burn, leading to lower carbon emissions. We have a carbon tax in Australia, so there is a saving there. Having electronic manuals and forms is also useful in that it saves back-office printing and distribution costs. Manuals and charts can now be updated across the whole fleet in a matter of hours or minutes. With paper-based systems this can sometimes take weeks."

Qantas uses cellular or wi-fi methods to send information from EFBs to back-office systems when on the ground. It does not provide connectivity for EFBs while airborne. The current system does not involve any data integration with aircraft systems. This is being evaluated for the next phase of its EFB programme, along with implementation of an ETL.

For Passerini there are a number of challenges when implementing an EFB solution. "Qantas first got involved with EFBs in the early 2000s with an attempt to introduce a Class 2 system on its A330s. This was unsuccessful, possibly because it tried to do too much at once. The road is littered with failed attempts at deploying EFBs. In the early days of EFBs, there were few regulations in place for their implementation. Requirements creep is also a big issue, where project leaders allow more and more capabilities and requirements to be added as the project evolves. This will most likely result in failure as costs escalate and complexity increases. It is also important that the project remains focused on the user. This is why our current project was run by operational staff rather than IT."

easyJet

easyJet is the UK's largest airline in terms of passenger numbers. It is one of the largest LCCs in the world, operating more than 600 routes in over 30 countries. Its fleet of 212 aircraft comprises 153 A319s and 59 A320s.

easyJet has been operating EFBs since the introduction of Airbus aircraft to its fleet in 2003. "We currently operate a fleet-wide Class 1 EFB solution," explains Taylor Bradbury, flight operations support manager, for easyJet.

"We started in 2003 with one application, in the form of an Airbus performance tool," says Bradbury. "The justification was the ability to optimise performance and reduce airport costs. We have since added extra functionality with electronic operations manuals that can be accessed using a document reader, and have allowed for the removal of paper operations manuals from the flightdeck. This reduces weight on the aircraft, as well as logistics and distribution costs."

easyJet uses Panasonic CF19 Toughbooks as its EFB hardware. "The Toughbooks were chosen because they are a robust solution with a proven track

Despite not being connected to aircraft systems, a lot of airlines have considered and implemented iPads. Some airlines have received approval to use these in all phases of flight.

record in challenging environments," adds Bradbury. The EFBs are not permitted for use in the take-off and landing stages. During these critical phases of flight they are kept in document stowage on the sidewall of the flightdeck. There is no data interface with aircraft systems, and the Toughbooks are not connected to back-office systems. Software is updated by engineers when necessary. easyJet issues two Toughbooks to every aircraft.

easyJet uses the Airbus Flysmart solution, which provides performance calculation tools, including weight and balance and take-off calculation applications. It also uses a document reader designed by Vistair.

easyJet is now considering upgrading its EFB solution to a Class 2 system so that it can add an electronic chart application to its existing functionality. "We have a very robust business case process," says Bradbury. "If the EFB solution does not provide savings we will not introduce it. An electronic chart application can provide substantial cost savings by allowing the weight of paper charts to be removed from the aircraft, and reduced printing and distribution costs. This is especially important when operating over 200 aircraft across 22 bases around Europe."

easyJet has been carrying out a proof-of-concept trial to identify the Class 2 solution most suited to providing its electronic chart function. Like other carriers, easyJet sees the benefit of a staged increase in EFB capabilities. "We have been careful to limit the scope of the current EFB work to delivering electronic charts and not getting distracted by other potential functions," says Bradbury.

Bradbury sees regulatory issues and internal transition requirements as two of the challenges involved with implementing an EFB system. "EFB guidelines and regulations continue to evolve, as does the technology, but we have worked very closely with our local authorities in the UK and Switzerland throughout the deployment of our EFB solutions," says Bradbury. "When a new Class 2 system is eventually deployed we have 22 bases over which we need to consider the training of crew and configuration of aircraft. It is not an easy process, but there is a huge potential benefit at the end of it."

American Airlines

American Airlines is one of the largest carriers in the world with a mainline fleet of more than 600 aircraft. Its narrowbody fleet comprises MD-80s 737s and 757s. The widebody fleet consists of 767s and 777s.

In December 2011 American became the first commercial US carrier to receive FAA approval to use an iPad EFB solution in all phases of flight for its 777s. The airline now has approval to use its iPad-based EFBs across its entire fleet.

American had to come up with different solutions for securing its iPads in the flightdeck to permit their use in all phases of flight. "On the 777 fleet we use Velcro," explains David Clark, senior manager of flight operations efficiency and quality assurance at American Airlines. "This is an inexpensive solution for securing the tablets, and was actually used for securing objects on the Space Shuttle. Due to variable flightdeck design, Velcro was not suitable for the rest of the fleet, so for the other aircraft we use mounts that attach to the side window with suction cups." There is no STC requirement for the Velcro or suction mounts, because they are considered minor modifications and are not part of the certified aircraft systems. This means that American's EFB solution is considered Class 1. It is one of the first airlines to receive approval for use of a Class 1 system in all phases of flight.

American's EFBs currently host Jeppesen electronic chart software and an application called GoodReader. This is a PDF reader that allows flightcrew to display manuals and documents on their iPads. The GoodReader software has a built-in browser that allows pilots to download documents from American's flight department website. There is no data interfacing with aircraft systems.

American started to look into the possibilities of a tablet-based EFB solution in 2010. "Our initial aim was to remove paper from the flightdeck," says Clark. "A pilot's kit bag contains paper manuals, documents and charts and can weigh more than 40-50lbs. They have been a source of pilot injuries for us, so replacing the kit bag with a lightweight iPad reduces the chance of injury. It also reduces printing and distribution costs. Updates to manuals and charts can be carried out electronically, rather than requiring paper revisions. This takes minutes instead of hours. Removing 40-50lbs in weight per pilot from the aircraft can also result in tremendous fuel savings over a year for an airline of our size."

American estimates that replacing the kit bag with a 1.3lb iPad saves the airline at least 400,000 gallons of fuel each year. This is equivalent to an annual saving of $1.2 million based on current fuel prices.

The initial decision to adopt its particular EFB solution was driven partly by price. "We liked the simplicity and price point of the iPad," says Clark. "We soon realised how well-suited it was for document viewing." American began with a focus on electronic charts. "Additionally Jeppesen was proactive in designing an application for commercial aviation," adds Clark. The document reader application followed and now American is planning to add further functions. "We are finding ways to make the EFBs useful that we had not originally thought of," admits Clark. "The next phase will involve rolling out electronic

American Airlines was the first US carrier to receive approval to use iPads in all phases of flight on its 777s. The airline uses velcro to secure it on its viewing platform on the flightdeck.

flight plans. Currently, printing out a flight plan and weather information can involve taking as much as 30 feet of paper from a dot-matrix printer on every flight. An electronic solution will save miles of paper a year."

American has also been investigating the potential of an ETL. "We have been working on an electronic logbook, but have postponed this until after the merger with US Airways so we can fully understand the structure of both maintenance organisations," says Clark.

American issues iPads to every pilot and instructor. Along with the chart and document reader functions, the airline permits their use for personal emailing. Connectivity for sending and receiving data or updates from back-office systems is available using wi-fi or cellular methods at the gate. In the future Clark hopes that in-flight connectivity will be possible. "Connectivity is a key enabler for EFBs and opens up all sorts of functionality. It might be possible to have wi-fi access in the flightdeck during flight."

Like all carriers, American faced challenges during the implementation of its EFB programme. "These depend on the operator and what they want to achieve," says Clark. "One of the main challenges is in the area of guidelines and regulations. EFB technology has been changing so fast that regulatory agencies, which are conservative by nature, have been unable to develop new regulations to keep pace. Relying on consumer devices, such as an iPad, to behave like an aviation-grade device has been a difficult concept to sell. We had a constructive working relationship with the FAA during the project. An airline's working relationship with its local regulatory agency is very important when implementing an EFB programme. The best approach is to involve the local regulatory authority from the start so that you learn, understand and become comfortable with the EFB solution together."

Regulatory issues are not the only implementation consideration. "Internal responsibility is important," says Clark. "There have to be equal working relationships between departments. The IT department will obviously have a significant role but an EFB programme is really an operations-centric project."

Augsburg Airways

Augsburg Airways is a German airline. It has a fleet of 17 aircraft including Q400s, E-190s and E-195s.

The airline first adopted EFBs in 2007 with a Class 1 solution for its turboprop aircraft. In 2011 it introduced a Class 2 system on its E-Jets.

The initial business case for adopting an EFB solution was to improve data transfer processes by cutting out the problems associated with moving large amounts of paper to and from the aircraft. "The objectives identified as key to the business case were affordability, usability, pilot acceptance, stability and flexibility," says Jens Seekamp, a Q400 captain, Augsburg Airways.

"Tablets with an acceptable price and computer power were not available in 2007," explains Seekamp. "We looked at several notebook PCs and decided to go for the Dell D430 which is a good fit, given the limited space in the cockpits of regional aircraft." All of Augsburg Airways's pilots are issued with a Class 1 EFB computer. These can be used on the ground and above a certain safety altitude in flight. During critical phases of flight they are stowed and secured in the cockpit or the pilot's flight case.

These Class 1 devices remain the EFB solution on the Q400 fleet. On the E-Jets there are also Class 2 fixed installation Panasonic Toughbooks secured to the aircraft with Goodrich docking stations.

Augsburg Airways uses a software platform from Aircore Systems. "The modules we were interested in initially were the library and Journey log," says Seekamp. "On both the Class 1 and 2 EFBs the library includes documents, a PDF navigation chart viewer and a runway performance chart viewer. The Journey log includes flight data, rotation data, technical status and fuel data for emission trading. Aircore Systems has an open host platform that allows us to add more applications in the future. On our Class 2 solution on the E-Jets we have already added CiOPS, a fuel-saving tool from PACE. On the E-Jets we are using version 2 of the Aircore Systems software platform. This has been designed to fulfil the needs of a Class 2 environment with touchscreens."

Data are sent from the airline's EFBs using IP connections either via wi-fi or, when outside the flightdeck, available hard-wired connections. There is no data interface between EFBs and aircraft systems.

"We experience a number of benefits in operating our EFB systems," claims Seekamp. "These include: savings in administration costs due to reduced printing requirements; savings in time related to tracking of updates; an increase in pilot documentation quality; and a fast communication process between the cockpit and back office."

"One of the most important considerations for successful EFB implementation is to start by considering the business processes you want to change, and the software that can achieve this," says Seekamp. "Only then should the most appropriate hardware device be selected."

Thomas Cook

Thomas Cook Airlines UK is a charter operator. It has a fleet of 30 aircraft

Thomas Cook first implemented an EFB solution in 2006. The airline has a combined EFB and ETL system.

comprising A320s, A321s, A330s, 757s and 767s.

It has been successfully operating an EFB system for about seven years. The initial implementation was driven by maintenance requirements. "When we first started exploring our electronic paper options nearly 10 years ago the ETL application was the greatest priority," says Rob Woods, general manager of line maintenance at Thomas Cook Aircraft Engineering. "Before the ETL was introduced our data recording accuracy and system update rate was slow and un-transparent," explains Paul Stephenson, project engineer at Thomas Cook Aircraft Engineering. "When aircraft were away from base we relied on paper tech log pages to be faxed or scanned back to the UK. This made it difficult to guarantee the timely and accurate delivery of technical data. Being able to overcome this and improve operational performance using an ETL was part of the initial business case for Thomas Cook's EFB programme."

Thomas Cook uses an ETL software application developed and managed by Conduce. For some years this was the only EFB function it had. "Other EFB applications have been added, since engineering and flight operations worked closely together to realise the potential benefits as new software has become available," says Woods. The airline now also uses performance software tools supplied by Boeing and Airbus, electronic forms designed by Conduce and electronic manuals among others. Vistair provides the manual reader software and updates.

The airline's EFB solution is considered Class 1. "There is no data connectivity to aircraft systems, and the EFBs cannot be used below 10,000 feet," says Stephenson. "We are exploring Class 2 options for our fleet rollover programme allowing data connection from the aircraft."

Thomas Cook selected Panasonic Toughbooks for its EFB hardware. It currently uses the CF19 version in the main and issues two to each aircraft. In critical phases of flight these are securely stowed in purpose-built containers. The airline complied with crucial safety regulations in carrying out modifications that permit the use of aircraft power for battery-charging purposes. "We chose the Toughbooks for the engineering function because they are rugged and reliable and well suited to a maintenance environment when used in the ETL role," explains Woods. "We have been watching developments in laptops and tablets and remain open-minded about their potential, but are not yet fully convinced from an engineering perspective. Improving the speed and the operating system for future-proofing reasons is our current priority, although the cost saving on tablets is undeniably attractive."

Operating an EFB solution provides a number of operational benefits for Thomas Cook, along with reducing paper weight and saving time updating paper revisions of manuals and charts. The maintenance benefits are also significant. "For maintenance control, the ETL application gives them a window onto the aircraft wherever it is," says Stephenson.

"Our ETL application is based, as close as possible, on the layout of a paper tech log," explains Stephenson. "It is divided into a number of tabs including those for out-of-phase maintenance tasks, current sector, deferred defects, fluid/fuel uplifts and icing conditions. When a block of the log is signed off by the crew, the data are automatically transmitted to the airline's M&E system." The airline's EFB solution has no connectivity during flight, but when on the ground it is able to send data via cellular methods. ETL data are automatically transmitted when connectivity is available.

"Receiving live tech log data from the aircraft allows faster troubleshooting and optimisation of maintenance checks," says Woods. "The precise fuel uplift function can also help with emissions regulations. The ETL has also led to more accurate records by eliminating manual adjustment corrections." The way defects are entered into the ETL is an example of how it can reduce errors. "If a defect occurs down-route the captain or engineer types it in under the defect tab," explains Stephenson. "All defects are classified by ATA chapter. To reduce errors the ETL application has drop-down menus and sub-menus to select the appropriate chapter and minimum equipment list (MEL) reference. Exact wording of the defect text is freehand. We believe this allows for a better descriptive explanation than using fault codes alone."

Although the ETL already automatically transmits data to the existing M&E system, a certain amount of manual entry functions still have to be performed. When its new M&E system is introduced, Thomas Cook's ETL data will be automatically input into the system and manual entry will be vastly reduced.

"One of the biggest historic hurdles for implementing the ETL solution was the willingness of aviation authorities to accept this change," says Stephenson. "The best approach is for an airline to work closely in partnership with its local authority. We have worked side-by-side with the UK Civil Aviation Authority (CAA) and come to conclusions together during the continued development of the ETL. Both parties have benefited from the learning curve. Acceptance from pilots and engineers is also an important consideration. We held monthly ETL steering meetings to ensure that all key stakeholders, including pilots and engineers could have their say." AC