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Taking your airline to new heights

A man in a dark pinstriped suit and tie is smiling and holding a small white model airplane. He is standing in front of window blinds. The background is a light blue sky.

World's Happiest Airline

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The Glass Cockpit

From cutting costs and improving revenues to boosting productivity and improving the quality of life for airline employees, electronic flight bag technology provides substantial benefits for airlines and their crewmembers. EFB, part of but not exclusive to the next-generation “glass cockpit,” has eliminated the need for weighty, paper-filled flight bags once carried onboard by pilots and cabin crewmembers.

■ By Dave Roberts | *Ascend* Contributor



Technology has overtaken the cockpit and the manner in which pilots operate and monitor their aircraft and flight. In today's new aircraft, every component of the plane's operation is now tracked through technological advances and displayed on monitors on the instrument panel to make the flight safer and more efficient.

What about the paper in today's aircraft? Fortunately, technology is helping with that as well.

Airlines are beginning to use electronic versions of the paperwork required for a flight, some of which goes back to when the Wright brothers noted the weather on paper before the launch at Kitty Hawk. Paper in the cockpit was a part of virtually every cockpit function.

Pre-taxi and takeoff — paper checklists. En route weather — paper charts. Flight plan and load manifest — paper forms. Engine performance numbers — hardcopy aircraft manual. Warning light in cockpit — hardcopy printed aircraft minimum equipment list (MEL) chart. Airport approach procedures — printed airport charts.

It requires a tremendous amount of data, such as manuals, charts and checklists — printed on many different pieces of paper — to operate a single flight. All of this paper must be carried on each flight for safety and operational efficiency. Each flight crewmember must have a copy of all of this paper, and the data must be current.

Pilots traditionally carried all of this paper in a personal bag much like that utilized by doctors. This personal bag, or flight bag, became a mainstay for pilots everywhere — private, commercial and military. As air travel and aircraft increased in complexity with larger and faster aircraft designed to fly farther, higher and quicker, the amount of paper necessary for operations increased.

The flight bag has presented many obstacles over time. To maintain the current data requires separate staff in each airline to print and distribute new charts and manuals. Each pilot then must remove old data pages and insert new ones. Obviously, this can lead to human error and potentially effect flight safety or operational efficiency.

Then there is the weight of each of these bags that is carried on each flight. Flight bags can weigh up to 40 pounds when filled. This is for each crewmember and can mean an additional 80 pounds to 120 pounds on the aircraft — weight that increases fuel burn and expense.

Evolving technology provides an alternative, called "electronic flight bag" (see related article on page 74), to the physical bag that eliminates the additional weight and the printing and distribution of new data via paper. It also affords a more efficient means of retrieving dynamic as well as static data. Electronic flight bag is an electronic management information storage

unit much like a laptop computer that can be affixed to the aircraft or built into the avionics system onboard the aircraft.

This new computing capability in the cockpit replaces paper reference material as well as opens the door for more automated calculations normally accomplished manually. In addition, new software applications can be made available to flight crews to improve the efficiency of flight operations en route and on the ground. In many other ways, airlines and crewmembers have adapted to the electronic age through the use of personal computers for other aspects of their jobs that go beyond actual flying. For example, crew scheduling to include crew bidding and crew swaps are just two of the items that can be introduced into the cockpit rather than having to wait until the crew is on the ground.

EFB Benefits

The benefits of adding EFB capability to an aircraft for the flight crew varies depending on the size of the operation, the type of applications deployed and the method selected to manage the EFB data and the distribution of this data. Cost-saving benefits include fuel savings associated with the reduction in weight of the onboard flight bags, printing and manual distribution costs of required operational manuals and charts and, in some cases, reduced medical costs associated with handling the physical flight bags.

Efficiency benefits are realized through provision of increased amount and accuracy of data available to the flight crew in preparing and conducting operations.

Reducing delays and the impact down line is another major EFB benefit. Naturally, an aircraft on the ground does not produce revenue whereas aircraft time in the air is key to an airline's productivity and bottom-line success. One of the primary ways EFBs help reduce delays is the enhanced communication of data between the flight crew and the airline's maintenance group. An electronic communication of mechanical issues detected while in flight from the aircraft to maintenance provides mechanics advanced time to determine what is required to correct a problem and locate necessary parts to be changed if warranted.

In essence, EFBs now provide an electronic version of the paper-based maintenance techlog. The electronic version accommodates any aircraft type, providing capability to identify and find the mechanical problem and enabling a better picture of the situation to include MEL expiration dates for faster clearance.

The results are faster flight turn times by utilizing an electronic techlog to identify problems as well as quicker log corrective actions. There is a significant reduction in time when comparing the EFB approach to the normal manual maintenance procedures used today. Dispatch reliability, aircraft turn time and reduced expense

are direct benefits of communication via EFB between flight crew and maintenance. Several airlines have confirmed that this difference alone in time and procedures has justified the deployment of EFB.

Off The Paper Trail

The technology evolution leading to EFB onboard aircraft included the introduction of GPS, weather displays, and electronic approach plates and airfield diagrams. The evolution continued with new ruggedized computers and docking or mounting stations affixed to aircraft. Along with these new computers was the development of viewers for crewmembers to see and read digitized manuals and charts. Eventually, all flight bag documents found an electronic home and can be viewed via EFB.

"There is currently great interest and activity toward developing small electronic information management devices for use by flight crew in performing flight-related tasks," according to a report prepared by the Operator Performance and Safety Analysis Division of the Office of Research and Analysis at the Volpe Center. "These devices aid pilots and aircraft operators in conducting flights more efficiently and safely.

"EFBs were originally seen as a repository for electronic documents such as checklists, operating manuals and navigation publications, but now they are seen as multi-function devices that can support an array of applications beyond those of a traditional flight bag, including cabin surveillance, surface moving map, electronic

messaging and display of live weather. Some EFBs will even be fully installed systems with multiple functions."

According to the U.S. Federal Aviation Administration, the scope of EFB functionality is broad. "EFBs may be portable electronic devices or installed systems. The physical EFB display may use various technologies, formats and forms of communication."

The FAA's entire definition of EFB not only included installed devices that could be sophisticated and complex, but it also introduced data link connectivity, a feature of EFBs that has significantly broadened the capability of what can be included in information available to the flight crew. Complex functions require communication with external sources that can provide real-time weather displays, updated NOTAMS, ground mapping and specific aircraft operational systems.

The Human Factor

While the technology is rapidly changing the scope and boundaries of the EFB, there is still the human factor that must be considered. Ease of use for pilots using the EFB will enable airlines to recognize operational benefits and enhanced situational awareness and safety. The FAA and other government agencies around the world have addressed the human factors issues and issued guidelines for the safe use of EFB applications and functions. (The EFB presentation must not conflict with the crew's ability to concentrate on other instruments in the cockpit or on flying the aircraft. The ability to read the



A key way EFBs help reduce delays is the improved communication of information between the flight crew and the maintenance organization. Electronically informing mechanics of issues detected during flight gives them an opportunity to determine the problem and locate necessary parts prior to the aircraft arriving.



Cost-saving benefits of an electronic flight bag include fuel savings associated with the reduction of weight of the onboard flight bags as well as printing and manual distribution costs.

screen and easily use the touch screen, colors and night-time operation all must be considered when designing and installing an EFB device.) There is sufficient data indicating that the EFB will become an invaluable tool for all aviation and will provide a more-effective management tool and improved safety of flight.

EFB — Hardware Or Software?

Regulatory authorities have tried to define EFB in terms that include the hardware components as they apply to aircraft equipment lists and as software applications that support EFB systems. EFB systems are divided into three hardware classes and three software types.

EFB Hardware Classes

- Class 1 — Primarily commercial-off-the-shelf equipment that includes laptops and handheld electronic devices. These devices are not attached to the aircraft and may be stowed during segments of a flight. A Class 1 EFB may connect to aircraft power and interface with other systems through a certified interface.
- Class 2 — This hardware may also be off the shelf or specially developed computer systems designed for cockpit and in-flight usage. They are normally affixed to the aircraft via a mounting device or docking station, and the EFB display can be seen by flight crewmembers throughout the flight. These systems connect to aircraft power and data sources using interfaces such as ARINC 429. A major advantage of Class 2 is that it may have multi-directional communication capability to send and receive data between the air and ground.

- Class 3 — This is an onboard hardware system that is developed as part of the avionics system with components in the avionics bay. It is subject to airworthiness directives just like other onboard systems. It is part of the “glass cockpit” concept and can provide more approved software components.

EFB Software Types

- Type A
 - May be hosted on any of the hardware classes;
 - Supports static applications such as document viewer (PDF, HTML, XML formats);
 - Offers electronic checklists;
 - Eliminates the need for flight crew operating manuals and other printed documents such as airport NOTAM.
- Type B
 - May be hosted on any of the hardware classes;
 - Provides takeoff, en route, approach and landing as well as missed-approach performance calculations;
 - Equipped with power settings for reduced thrust (major source of reduced wear of the engines);
 - Provides weight and balance calculations;
 - Produces weather and aeronautical data.
- Type C
 - Subject to airworthiness requirements, such as software certification;
 - Must run on Class 3 EFB hardware.

EFB Of The Future

Electronic flight bags are no longer a thought of the future ... they are on the flight deck today, and their scope and capabilities are expanding daily. The provision of regulatory guidelines for EFB is a clear indication of the acceptance by the aviation community and those governing it. Aircraft manufacturers are closely involved with new aircraft equipped with hardware and connectivity capabilities. Government-subsidized organizations continue to analyze the impact of the EFB on human factors and are searching for guidelines to improve safety and efficiency of crewmembers.

The original goal of EFB was to replace the large quantity of paper with electronic versions of the same information. However, today, it is apparent that the complexity and features employed by EFB are limited only by imagination and budget.

Improved efficiency of flight operations can be demonstrated now with the advent of EFB in the cockpit. However, efficiency alone will not generate the return on investment airlines require for the initial capital outlay for EFB systems. The reduction in delays that contribute to decreased expense and a potential increase in revenue will help. The creation of new systems that turn the cockpit into the crew’s office can also help decrease costs while improving the efficiency and quality of life for crewmembers. For example, the time to complete a pre-flight check can be reduced by 50 percent in some cases with the proper use of EFB.

EFB solutions designed to drive improved customer service and increase revenue are now being developed and implemented. Providing links to the ground data for passenger information that is readily accessible by the cabin crew leads to more personalized service and return customers. The various reports required by airlines for cabin crews to complete after the flight can be submitted via EFB with improved accuracy and submission timing. The cabin crew can also have access to their personal scheduling information while on the aircraft and complete bids, swaps or any activities within their crew management system.

Like the evolution of the passenger ticket system from paper to card to e-ticket, the EFB will continue to evolve and move airline flight operations forward and continue to gain greater capabilities, improve safety, increase revenue and decrease expenses. Sounds too good to be true, but the results during the past decade are beginning to pay significant rewards. **F**

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