Electronic Flight Bags: A World of Their Own

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If you work with aircraft, you have heard of Electronic Flight Bags (EFBs) and every pilot's desire to have one installed in his or her aircraft. For the avionics technician, this is an extremely complicated proposition if you intend on doing it by the book. How many times have you heard, "It's a COTS (Commercial-off-the-Shelf) item, why do I need approval?" Or, "No problem, I'll just carry it on my lap." To make matters worse, you need to be a certified Microsoft Technician to troubleshoot what is nothing more than a tablet PC (Personal Computer) with specialized software. Software application programs are not usually DO-178B compliant, but some EFBs have been tested to pertinent Radio Technical Commission for Aeronautics (RTCA) DO-160D standards.

So, what is the purpose of this technology? EFBs are electronic information management devices for use by pilots in performing flight tasks. EFBs are attractive because, relative to traditional avionics, they come at a low initial cost, can be customized, and are easily upgraded, making them an open-

HP iPAQ configured as an EFB

ended computing platform rather than a packaged system. Some EFB benefits include reduction in costs associated with data management and distribution, potential reduction in training costs, and even the avoidance of medical costs associated with pilot injuries from carrying heavy flight bags filled with paper. The airlines, in particular are attracted to EFBs because they make a great business case and some airlines are even working directly with vendors to architect EFB solutions for their specific needs.

The base system of an EFB is a computer such as a laptop, tablet personal computer, or user-customized computer. Software on an EFB can support a variety of tasks, including electronic documents, electronic checklists, flight performance calculations, electronic charts, and even display of weather, traffic, cabin video surveillance, surface moving maps or flight planning information.

CMC Electronics CT-1000 mounted in a Gulfstream

There are numerous EFB manufacturers with multiple levels of integration. Some may not seem like EFBs at all as they have been molded into the instrument panel right next to Electronic Flight Displays (EFDs). The Rockwell Collins Integrated Flight Information System (IFIS) is a perfect example of an EFB being injected into the instrument panel as part of a seamless platform. To list all of the EFB manufacturers is difficult because there are so many, but according to the Electronic Flight Bag (EFB): 2005 Industry Review, Document Number DOT-VNTSC-FAA-05-06 Dated April 2005, Table 1 (page 55) lists the current manufacturers and their market and combined hardware and software.

OK, so how do you legally install EFBs? The Federal Aviation Administration (FAA) set forth a streamlined approval process on EFBs in Advisory Circular (AC) 120-76A, which defines three classes of EFBs (Class I, II and III) reflecting the level of integration of the EFB within the aircraft and three types of software (Type A, B and C) reflecting the capabilities of the device. EFBs may be totally portable or mounted in the aircraft in some fashion, e.g., "cradled." They may be battery-powered or may obtain power from the aircraft directly. Or, they may have access to various sources of data such as GPS and aircraft data busses. Most EFBs also contain USB ports, integrated IEEE 802.11 a/b/g wireless LAN, and a single channel PCMCIA Type II Card Bus interface for more connectivity options.

Portable Electronic Devices (PEDs) have been approved to replace some of the hard copy material that pilots carry in their flight bags. Thus the term "Electronic Flight Bag" entered the aviation lexicon. EFBs were originally approved for use prior to pushback, but now operators are seeking approval to use EFBs during all flight phases.

The EFB AC defines 3 hardware classes for EFB Systems. Class I & II are portable EFB systems. Portable definition is flexible and allows for ship's power and data link connectivity with certified protection mechanisms. Class I & II EFB computer platforms require an operational approval but do not require aircraft certification design approval. Class III are installed EFB systems which require an aircraft certification design approval and ops approval.

Class I & II EFB systems do not require a Supplemental Type Certificate (STC) but do require an operational evaluation. Additional functions for Class I & II EFB systems are limited to a "minor" failure classification. Enablers include Technical Standard Orders (TSO), RTCA Minimum Operational Performance Standards (MOPS) RTCA DO-178B "Level D" software, RTCA DO-160D Environmental con-

Universal Avionics Universal Cockpit Display Approach Chart

Table 1

MANUFACTURER	MARKET				
	Air Transport	Business Jet	General Aviation High End	General Aviation Low End	Military
Adobe	✓	✓	✓	✓	✓
Advanced Data Research (ADR)	✓	✓	✓	✓	✓
Airbus	✓				
Air Data Solutions	✓				
Aircraft Data Fusion	✓				
Aircraft Management Technologies (AMT)	✓	✓	✓		✓
Astoria Software	✓	✓			✓
Approach View		✓	✓	✓	✓
ARINC	✓	✓			✓
Astronautics	✓	✓			✓
Avrotec (In Development)					
Boeing/Jeppesen/Astronautics	✓				✓
CMS Electronics	✓	✓	✓		
Control Vision		✓	✓	✓	
Echo Flight		✓	✓	✓	
Eflightsystems, LLC			✓	✓	
Flight Deck Resources	✓	✓	✓	✓	✓
Flight Explorer			✓	✓	
GSCS	✓	✓		✓	✓
Hangar B-17				✓	
Hewlett-Packard	✓	✓	✓	✓	
Honeywell	✓	✓			✓
ION Systems	✓	✓	✓	✓	✓
Jeppesen	✓	✓	✓	✓	✓
LIDO	✓				
Maestro Aviation Limited	✓				
NavAero	✓	✓	✓	✓	✓
On Board Data Systems	✓	✓	✓	✓	
Panasonic	✓	✓	✓	✓	✓
Paperless Cockpit	✓	✓	✓	✓	✓
RMS Technology		✓	✓	✓	
Rockwell Collins		✓			
Sporty's Pilot Shop			✓	✓	
Stenbock & Everson				✓	
Teledyne Controls	✓	✓	✓		✓
Ultra-Nav					
Universal Avionics	✓	✓	✓	✓	✓
WSI			✓	✓	
WxWorx			✓	✓	

ditions and test procedures for airborne equipment.

As defined in Federal Aviation Regulation (FAR) Part 21, Subpart O, a TSO is a minimum performance standard for specified articles used on civil aircraft. As such, a TSO standard is approved design data, and further FAA involvement with respect to design approval by an applicant who wishes to produce articles under a TSO is not required. Instead, the FAA may accept a statement of conformance from the applicant, certifying that he has met the TSO requirements, and that the article concerned meets the applicable TSO that is effective on the date of application for that article.

Unlike an STC which applies only to products specified in the STC, an article that conforms to a TSO design standard may be used on any aircraft or aircraft product. However, its installation in the product requires separate, appropriate FAA design approval. This installation approval may be an amended Type Certificate (TC), an STC, or a field approval. The steps in such approvals have previously been discussed, and depend on the complexity of the installation. Even though the TSO article itself is already approved, the installation approval may require flight or ground tests of the systems that may be affected by the article's operating characteristics.

For pilots, the beauty in the EFB is the ability to display charts and maps on command without searching through a ton of paper. Most of the EFBs use Jeppesen's JeppView Flite-Deck, so the learning curve between computer generated charts and paper is minimum.

As far as installation, the mounting location should meet the following requirements:

• Be in the pilot's primary field of view.

• Provide the pilot-in-command with an unobstructed view of the primary flight instruments.

• Be as far as possible from sources of severe vibration.

• Allow the unit to be securely fastened to the mounting device.

• Provide unobstructed air flow to the fan in the unit.

If you have any questions about the location, and especially if you have to modify the aircraft for a particular installation, it is recommended that you consult an appropriate FAA Designated Engineering Representative (DER) because there are certain considerations that must be addressed before you install any electronic component in the cockpit area.

The biggest contention for most pilots is the desire to display Own Ship Position (OSP), a term used when an aircraft image is displayed on the moving map contained within the EFB that moves as the aircraft transitions during flight which has been ruled a big no-no by the FAA. The reason the FAA has said no to the OSP information being displayed during flight is actually quite reasonable when you consider that the software has not been tested to DO-178 standards and could display inaccurate information. Let's face it, most EFBs are based on the Microsoft Operating System and we all know how reliable that can be. Personally, I don't want a pilot flying at night during low visibility trusting a navigation system that is based on the same system used by my ever frustrating computer.

However, the OSP rule only applies for flight operation and does not apply to ground operations. When you use the OSP during taxi or ground movement, it is a very useful tool. Combine an EFB OSP with RAAS (Honeywell's Runway Awareness and Advisory System) and you have a situational awareness that is unsurpassed. Most installers who add GPS positioning to the EFB "disconnect" the capability utilizing the Weight on Wheels (WOW) switch to prevent the display during flight.

Additional certification guidance can be found in the following documents; FAR 25.1301 "General requirements for intended function;" FAR 25.1309 "Equipment systems & installation;" AC 20-115B invokes RTCA DO-178B "Software Considerations on Airborne Systems and Equipment Certification;" AC 25.1309-1A "Equipment, Systems and Installation in Part 25 aircraft;" and AC 23.1309-1C "Equipment, Systems and Installation in Part 23 Airplanes."

So you got it installed (legally) and you have problems. Now what? As with most electronics today, the trou-

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Definitions and Abbreviations

AC	Advisory Circular
COTS	Commercial-off-the-Shelf
DER	Designated Engineering Representative
EFB	Electronic Flight Bag
EFD	Electronic Flight Displays
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
IFIS	Integrated Flight Information System
MOPS	Minimum Operational Performance Standards
OSP	Own Ship Position
PC	Personal Computer
PED	Portable Electronic Device
POH	Pilot Operating Handbook
RAAS	Runway Awareness and Advisory System
RTCA	Radio Technical Commission for Aeronautics
STC	Supplemental Type Certificate
TC	Type Certificate
TSO	Technical Standard Order
WOW	Weight on Wheels

MESSAGES AND SYSTEM TROUBLESHOOTING		
Problem	**Symptom**	**Possible Solutions/Reasons**
POWER	The unit fails to power up.	Check that the power connections are secure. Verify the circuit breaker. Check that the EDU is connected properly to the I/O connector.
BRIGHTNESS	The display is too dark or too light.	To lighten or darken the display, use the top right Brightness buttons of the EDU.
SOFTWARE	The Jeppesen Jeppview Flitedeck software does not work.	The PilotView EFB comes with a Jeppview/Flitedeck demo CD which is valid for a limited time only. If the demo trial period has expired, contact Jeppesen to order a complete version.
HARDWARE	USB device not working.	Unplug the USB device, wait 10 seconds and then reconnect it.
WINDOWS	Windows shutdown not functioning.	Press the reset button at the top of the EDU unit.
WIRELESS	Wireless communication not working.	Enable wireless functionality and enter parameters via Windows Control Panel (Start/Control Panel/Network Connection).
MASTER MENU - CHANGED SETTING	Changed Master Menu setting via the Setup application and changes are not active.	Prior to exiting Setup, ensure to select Save and Exit. The PilotView EFB will need to be restarted to make the changes active.
PASSWORD	Password invalid when trying to exit Master Menu.	Password is case sensitive. Make sure that Caps Lock is not activated.
PASSWORD	Forgot your password.	Default password is "xxxxxx." If you changed and forgot what it is, contact CMC for help.

bleshooting help you can offer an operator is limited to some basic power and setup settings. For example, the CMC PilotView EFB Pilot Operating Handbook (POH) Document Number 930-600063-000 offers the following troubleshooting guide which is typical of the type of help you can provide to aircrews:

While this may seem limited, you must keep in mind that an EFB is nothing more than a computer with specialized software. Unless you have a background in computer programming and access to the manufacturers proprietary data, it is best to leave the functionality issues to the experts.

Well, that pretty much sums up EFBs. Watch for these computers to become more integrated and gain more functionality in the future. Until then, they definitely are in a world of their own. ❏