

Electronic Flight Bags: Part II, An Emerging Market Heats Up July 2002

An FAA advisory circular will accelerate the development of a large number of electronic flight bag options, some to be fully certified and integrated with the aircraft's avionics.

By David Jensen

Like an alignment of the planets, events and activities surrounding the development of electronic flight bags (EFBs) have been coming together to form what would appear to be a large new market in avionics. As we stated in our last issue (June 2002, page 32), the "airlines appear highly motivated to swap their bulky flight bags for a digital reference." The same can be said for corporate aircraft operators. EFBs—with digital maps, charts and checklists—will not only relieve the pilot from lugging a leather bag full of paper manuals and charts, but also may save a tree or two. Chart producer Jeppesen Sanderson claims that more than a billion pieces of paper are delivered from its Denver facility each year.

An Imminent AC?

Pressured by aircraft operators and EFB manufacturers, the Federal Aviation Administration (FAA) was working at an unusually fast pace in May to finalize Advisory Circular (AC) 120-175. The AC's stated purpose is to provide "an acceptable method of compliance for the certification, airworthiness and operational approval of both portable and installed EFB aircraft computing devices."

Initially released in January 2002 and then pulled back for apparent further review, AC 120-175 was re-released on May 6 for industry comment. The agency subsequently issued several drafts; many in the industry hope to see the final draft this summer. As this is written, the FAA is reviewing industry comments, many of which came from the airlines.

The AC has been subject to considerable modification since its first release. One obvious change was to narrow the number of EFB levels, or "classes," from five to three (see sidebar on page 38).

Meanwhile, like horses at a starting gate, manufacturers have been anxiously awaiting AC 120-175's guidance to pursue the development of certifiable EFBs. Their new products are varied, ranging from small, portable laptops to large, installed displays that would incorporate flight bag material along with electronic flight instrumentation and navigational data.

Most of these new systems will be more capable than the portable electronic devices (PEDs)—largely laptop computers or Palm Pilots—that some aircraft operators have begun using to initiate EFB utilization. Self-contained PEDs do not require a type certificate (TC) or supplemental type certificate (STC) "because there are not specific airworthiness requirements that apply to carrying portable EFBs on aircraft," according to the FAA.

A large number of new EFBs will be able to serve as monitors for cabin surveillance systems, which have gained strong airline interest since the Sept. 11 terrorist attack. Further fueling EFB development is the creation of high-definition taxiway charts of key airports by both the Boeing subsidiary, Jeppesen Sanderson, and the National Aeronautical Charting Office (NACO). These charts, which will improve taxi operations and further prevent runway incursions, will provide high resolution, "which will be needed" to accompany the accuracy of local and wide area augmentation systems (LAAS and WAAS), says an FAA official.

NACO is surveying 76 major airports across the United States. For Jeppesen's new charts, satellite photography is being converted to a digital database. Called the "Accurate Taxi Program," Jeppesen's high-definition charts will facilitate aircraft taxiing during low-visibility conditions, says Ron Bauer, Jeppesen's business development executive.

Boeing and Jeppesen

Boeing offers its customers an EFB option supplied by Jeppesen Sanderson, which the airframe manufacturer acquired some two years ago. Jeppesen is providing the EFB's "applications and data, including electronic charts," says Bauer, "while the aircraft manufacturer supplies the aircraft data, EFB integration, hardware selection and program management."

The Jeppesen EFB will meet the requirements outlined in the FAA's AC, including those for certified and non-certified systems under RTCA DO-178B, which covers airborne systems software. It is scheduled to be available in the second quarter of 2003. Boeing reportedly is about to announce its first EFB customer.

For the system's performance data, Jeppesen is working closely with Boeing's Crew Information Services. (It intends to collect performance data from all aircraft manufacturers for its new product.)

Jeppesen's initial chart products for EFBs are JeppView and JeppView Flite Deck. Object-oriented, or database-rendered, charts are being developed as future products. In addition, Jeppesen plans by the third quarter of 2003 to supply its bi-weekly JeppView updates via the Internet. (Database updates currently are accomplished with a CD-ROM.)

Boeing customers will have the option of a portable or hard-mounted EFB. The company selected Astronautics Corp. of America to make the hard-mounted version and is "considering various options" for the portable version, according to a Boeing spokesman.

The portable version must be stowed during critical phases of flight, he adds, while the hard-mounted EFB will be certifiable for all phases of flight.

For the hard-mounted display, Boeing considered various configurations but settled on a "split box" system, in which the processing is remote from the display. The company also chose to offer two processors and two hard drives per installation, one to support the certified Linux software and one for non-certified Windows software. This will serve the airlines that already use Windows-based software in EFB applications, and it will assure that the non-certified software will not interfere with certified software. The system also will include a remote battery for up to 3.5 hours of power backup.

Both the portable and hard-mounted EFBs will grant the pilot "single click" access to documents, which "are fully integrated and intuitively accessible to the flight crew," says the Boeing spokesman. To further reduce pilot workload, the hard-mounted variant will be able to interface with, and thus access digital airport charts from the flight management system (FMS). This means the pilot will need to input his departure and destination airports just once. An FMS interface is planned for Boeing's portable EFB, as well.

The hard-mounted Astronautics display includes a moving map application that integrates Jepp charts, which are geographically-referenced from a GPS input to show the aircraft's position on an airport's taxiways. This function gives pilots the option of a heading-up mode for tactical use and a north-up mode for strategic awareness of the aircraft's position on the taxiways.

Even greater situational awareness could be achieved during surface movements in low-visibility conditions, the Boeing spokesman theorizes, if the EFB is "coupled with a data link from the ground controllers' ASDE [airport surface detection equipment] or from a 'fully used' ADS-B [automatic dependent surveillance-broadcast] input." The caveat to this technology, he adds, is that "every vehicle must be displayed as a potential target [and] the airport geo-position data must be current."

Pick and Choose

Boeing customers will be able to "pick and choose" the applications for their EFBs. The options on the hard-mounted version will include checklists, manuals, aircraft performance data, an integrated document browser, en-route moving map displays, crew scheduling and cabin display video.

The system can include an electronic logbook, Bauer adds, "with a fault isolation and reporting system that will identify faults and get [the information] down to the ground, prior to the aircraft's arrival." Such data, adds the Boeing spokesman, "would go to the appropriate maintenance entities for planning purposes."

A function Jeppesen plans for future EFBs is Controller-Pilot Data Link Communications (CPDLC) for air traffic control (ATC) message transmission and retrieval. It would

provide ATC message displays in priority order and log a list of received ATC messages, according to Bauer.

"Ultimately, we hope to uplink things like real-time graphical weather and NOTAMS [notices to airmen]," says Ed Schuster, Jeppesen's senior manager of advanced business development.

The Astronautics' Pilot Information Display (PID) Boeing selected for its hard-mounted version is ruggedized and contains an embedded Pentium processor with a 20-gigabyte hard drive and programmable keys. Various PID configurations are being designed for Boeing customers. "The trick is to cleverly establish real estate in cockpits that often are already compact and filled with avionics," says Dan Wade, Astronautics' manager of business development. The Boeing 777 "is easy," he adds, "because it already has a display slot to the side of the cockpit panel. Boeing has selected us to install and certify the PID in its B777ER [extended range], which goes into flight test in the spring of 2003 for delivery in the fall of 2003."

"For the B737, we were working on a retractable arm, like the video display in the first-class section in the cabin," says Wade. However, a panel-mounted EFB may become the option, as "Boeing is working on moving the instruments in the B737 and B747-400 into the side console," he adds. "Then the electronic flight bag would be beside the EFIS [electronic flight instrument system] and canted a little." As for the B757 and B767, the positioning of the EFB display probably will be determined as a result of a project that is part of NASA's Aviation Safety Program, he adds.

Astronautics isn't ignoring Airbus and is considering an EFB that would rest on the pilot's pull-out table and include an "umbilical cord" for power and integration into the aircraft, says Wade. Airbus aircraft have sidesticks, which frees the area in front of the pilot but precludes an EFB's position off to the pilot's side.

Northstar

Other avionics manufacturers have been developing and/or producing EFBs, as well. Northstar Technologies, for example, introduced its CT-1000 EFB some three years ago. In March, it received an STC for the installation of a CT-1000 variant in Gulfstream IV and IVSP business jets. Certification of the CT-1000G is in process for the GV, GII and GIII models.

The use of EFBs in bizjets is no surprise to Jeppesen's Bauer. "The cutting edge is in the corporate market," he states. The corporate aircraft operators "are the early adopters, in part, because the nature of corporate travel is quite demanding."

For Gulfstream, Northstar modified its CT-1000A model. "The requirement was to seek an STC and to make some changes, including a battery backup," says Tom Milanette, Northstar's product manager.

"We provided a power interface unit [PIU] that provides more than a backup," he adds. "It also provides voltage conditioning. If incoming power diminishes to 25 volts or spikes upward, the PIU automatically provides a steady voltage stream."

To obtain an STC, Northstar had to test its EFB for electromagnetic interference (EMI), as well as to assure it would perform in various temperatures, altitudes and humidity levels. The CT-1000G was certified to DO-160D requirements, for environmental conditions and test procedures.

The Gulfstream system was made smaller than the CT-1000A, which sits in a "cradle," to fit into a wedge-mount receptacle fastened to the aircraft's yoke. Otherwise, says Milanette, the 1000G includes the same functions as the 1000A. The Windows 98-based CT-1000 can accommodate uplinked weather and moving map displays. For the CT-1000G, the airplane symbol can appear on Jepp charts used for ground referencing, but not on charts for airborne positioning.

Spirent Systems

At the 2001 Paris Air Show, Wichita, Kan.-based Spirent Systems introduced its AvVantage electronic flight bag, a ruggedized PC that, instead of a keyboard, has a touchscreen to accompany the integrated software.

Kenneth Hurley, Spirent's director of flight operations development, says his company has an airline customer for its "single-box" version of AvVantage. Embraer recently evaluated the system. However, like Boeing, Spirent is developing a "dual-box" system that has remote processing.

The company offers various EFB solutions, including the test and integration of off-the-shelf computers. In developing battery-rechargeable docking stations for these processors, Spirent says it has "encountered snags" in securing STCs. Apparently facing similar difficulty, other EFB manufacturers, like Spirent, claim the FAA is uncomfortable with the issue of onboard batteries, which can overheat and emit noxious fumes. "We're close to resolving the issue," says Hurley. Meanwhile, adding that the AvVantage system also will have a battery-rechargeable docking station.

Spirent's AvVantage system is distinctive because it is a dedicated EFB and not an off-the-shelf laptop used as an EFB. It comes with an 8.4-by-10.4-inch (21-by-26.4-cm) active matrix, liquid crystal display (AMLCD) that is sunlight readable.

AvVantage has a PCMCIA interface and offers five zoom levels. It can interface with an onboard file server and display cabin video, using a wireless local area network (LAN).

Spirent continues to develop the AvVantage system. It is "looking at two processing speeds" for its Pentium III processor, to account for different heat dissipation levels, says Hurley. The company also is negotiating with an en-route chart provider for software to add to the system's terminal charts, manuals, minimum equipment lists (MELs), flight

plans, pilot fault reporting, checklists, document browser and performance calculations capability.

Universal Avionics

Meanwhile, Universal Avionics Systems Corp. has been working for two years on its Universal Cockpit Display (UCD), designed to integrate with flight instruments. Its UCDDT-II (T for terminal) contains DO-178B software certified to the same level as an FMS. Its 8.4-inch (21.3-cm) display can be permanently mounted or positioned on the yoke with an umbilical cord-like connection to the aircraft. "We're differentiating ourselves from the portable models," says Stephen Scolnik, Universal's manager of marketing communications.

The UCDDT-II was to receive STC and technical standard order (TSO) approval in July. "One of the first aircraft to employ the system will be the Boeing Business Jet," Scolnik says. An early version of the UCD already has a TSO, as does Universal's accessible data unit (ADU), which allows data transfer from a PC to the onboard EFB via a CD-ROM.

UCDDT-II software includes airport and approach charts, checklists, standard instrument departures (SIDs) and standard terminal arrival routes (STARs). The system has an FMS interface and two video ports. Pilots access data from drop-down menus using their fingers (not a stylus) on a touchscreen.

IS&S

Perhaps the ultimate in integrating EFB functionality into the cockpit is Innovative Solutions and Support's (IS&S') 15-inch (38-cm) panel-mounted LCD display, designed to replace an aircraft's attitude director indicator (ADI), nav display and electronic instrument indicators. The image on the display can be partitioned, and room can be made for EFB functions, such as approach charts, checklists and uplinked weather. The display has room in one of its partitions for CPDLC message traffic, according to Geoffrey Hedrick, IS&S' chief executive officer. He adds that "a retrofit display implementation for a B767 will replace 23 line replaceable units with only six."

The EFB Class System

The May 16, 2002, draft of Advisory Circular 120-175—for certification, airworthiness and operational approval—divided electronic flight bags (EFBs) into three classes. The FAA describes each class as follows:

Class 1 EFBs "may be used on the ground and during flight as a source of supplemental information." This type of EFB does not connect to the aircraft's power but "may be recharged onboard when not in normal operational use." Class 1 EFBs "do not allow data link connectivity to other aircraft systems." And EFB non-interference compliance should be in accordance with AC 91-21-1 guidelines, as amended, for the use of portable electronic devices.

Class 2 EFBs "are attached to the aircraft either by a structural mounting device or other permanently mounted structure." Such a device "connects to aircraft power during normal operation." A mounting device's location in the cockpit must be evaluated by Flight Standards and Aircraft Certification. Class 2 EFBs "represent a class of off-the-shelf consumer electronics equipment that has been adapted for use in aircraft." This type of EFB "does not require a certification design approval [nor] compliance with RTCA DO-178B software [nor with] RTCA DO-160D guidelines." AC 91-21-1 guidelines must be met and approval from a principal inspector gained for OpSpec A025. "A six-month operational evaluation with both the EFB and paper copies [is] required prior to final approval, allowing the EFB to reduce paper copies in the flight deck." Data link connectivity is allowed.

Class 3 EFBs require an STC or certification design approval, as well as compliance with DO-160D and DO-178B. Connectivity to installed avionics may be wired or wireless, but the data interface requires certification and an evaluation by the Aircraft Evaluation Group.

Honeywell and Collins

The two major avionics manufacturers in the United States, Honeywell and Rockwell Collins, haven't ignored the potentially lucrative electronic flight bag (EFB) market.

Indeed, Honeywell plans to offer "a continuum of solutions, from a fully certified, hard-mounted display to a portable computer," according to Tom Staggs, manager of EFBs. "Our products would be in multiple classes," he adds, referring to the three levels of EFBs described in the FAA AC 120-175.

"But even the hard-mounted displays will have a complementary, portable asset," says Staggs. "Honeywell is focused on portable computer concepts. We've found that carriers favor them. The pilot wants to take his computer off the airplane and, for example, make a note in his ops manual."

Awaiting the final draft of AC 120-175, Honeywell has yet to finalize its EFB designs. It has demonstrated many of the functions that would accompany its systems, however, including the display of cabin video and uplinked weather from Honeywell's Aviation Weather Information (AWIN) program. "We're also looking at wireless connections," says Staggs.

The unveiling of Honeywell EFBs should come soon. Staggs said in May, "Our goal is to demonstrate integrated, non-certificated products in August and introduce products to the commercial market in six to nine months."

Collins is not developing an EFB, although the company did design one for the Boeing 777, primarily for maintenance applications, says Bob Geers, strategic development manager-air transport systems. Rather, Collins has been working on EFB applications, such as a cabin surveillance system. It believes also that its I2S system could be a component of an electronic flight bag installation.

