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Electronic Flight Bag (EFB): 2005 Industry Review

Michelle Yeh
Divya C. Chandra

U.S. Department of Transportation

Research and Innovative Technology Administration

John A. Volpe National
Transportation Systems Center

Cambridge, MA 02142

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For:
Dr. Tom McCloy
Federal Aviation Administration (FAA)
Air Traffic Organization Operations Planning
Human Factors Research and Engineering
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The Electronic Flight Bag (EFB) market has accelerated rapidly in the past few years. The purpose of this industry review is to provide a primer on who is involved in the industry and what their efforts are. This informal summary of EFB technology provides a picture of the current state of EFB development as of February, 2005. This document is an update to a 2003 EFB industry review (see Appendix A of Chandra, Yeh, Riley, and Mangold (2003)). This review provides information about EFB systems, software/content, and hardware that are currently on the market or in active development. This material was gathered through industry contacts, demonstrations, websites, brochures, and trade journal reports. For each product, the manufacturer's website is provided where more recent information can be found.

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	1 kilometer (km) = 0.6 mile (mi)
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1 square mile (sq mi, mi^2) = 2.6 square kilometers (km^2)	10,000 square meters (m^2) = 1 hectare (ha) = 2.5 acres
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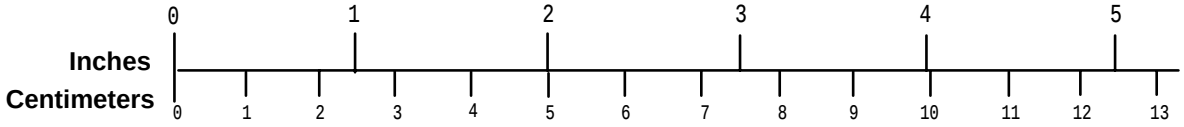

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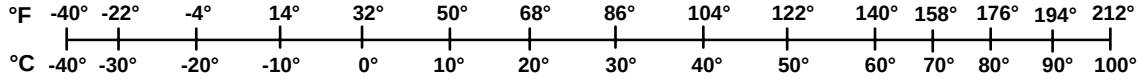

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Preface

This report was prepared by the Operator Performance and Safety Analysis Division of the Office of Safety and Security at the Volpe National Transportation Systems Center. It was completed under the Division's Flight Deck Technologies program under the sponsorship of the Federal Aviation Administration's (FAA) Human Factors Research and Engineering Division. Dr. Tom McCloy served as the FAA program manager. We would like to thank Tom McCloy and Bill Kaliardos for providing feedback on this document. Many thanks also to the many manufacturers who generously provided information for the industry review.

The views expressed herein are those of the authors and do not necessarily reflect the views of the Volpe National Transportation Systems Center, the Research and Innovative Technologies Administration, or the United States Department of Transportation.

Feedback on this document can be sent to Michelle Yeh (Yeh@volpe.dot.gov) or Divya Chandra (Chandra@volpe.dot.gov). Further information on this research effort can be found at www.volpe.dot.gov/opsad/efb.

Table of Contents

Executive Summary

Development of Electronic Flight Bags (EFBs) has accelerated rapidly in the past few years. EFBs are in use during revenue operations at many airlines both in the United States and in Europe. The base system of an EFB is a computer such as a laptop, tablet personal computer, or customized computer. Software can support a variety of applications, such as electronic documents, electronic checklists, flight performance calculations, electronic charts, display of weather, cabin video surveillance, surface moving maps, and flight planning information.

The purpose of this industry review is to provide a primer on who is involved in the EFB industry and what their efforts are. This informal summary of EFB technology provides a picture of the current state of EFB development as of February, 2005. This document is an update to a 2003 EFB industry review (see Appendix A of Chandra, Yeh, Riley, and Mangold (2003)).

This review provides information about EFB systems, software/content, and hardware that are currently on the market or in active development. This material was gathered through industry contacts, demonstrations, websites, brochures, and trade journal reports. Attempts were made to verify all information with a company representative, but this was not always possible. As with any system development cycle, changes in the design occur frequently; as a result, accuracy of the information cannot be guaranteed.

The industry review consists of three sections. Section A contains information regarding EFB systems providers, i.e., those manufacturers offering a combined EFB hardware and software package. Section B presents a table of software and content providers and applications. Finally, Section C reviews hardware providers, i.e., display companies that are developing portable computing devices that have been used as EFB platforms. For each product, the manufacturer's website is provided where more recent information can be found.

Acronyms

ACARS	Airborne Communications Addressing and Reporting System
ADS-B	Automatic Dependent Surveillance-Broadcast
AEG	FAA Flight Standards Aircraft Evaluation Group
AIR	FAA Office of Aircraft Certification
AMLCD	Active Matrix Liquid Crystal Display
AWIN	Aviation Weather Information
BBJ	Boeing Business Jet
BSMI	Bureau of Standards, Metrology, and Inspection
CB	Certification Body
CDL	Configuration Deviation Lists
CDTI	Cockpit Display of Traffic Information
CE	Conformité Européene (European Compliance)
COTS	Commercial-off-the-shelf
CPDLC	Controller Pilot Data Link Communications
CUL	Certified to CSA Standards by Underwriters Laboratories
ECL	Electronic Checklists
EFB	Electronic Flight Bag
EMI	Electromagnetic Interference
EVS	Enhanced Vision System
eTAWS	Early Terrain Awareness Warning System
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FOM	Flight Operations Manual
GA	General Aviation
GPRS	General Packet Radio Services
GSM	Global Systems Mobile
GUI	Graphical User Interface
IEEE	Institute of Electrical and Electronics Engineers
LCD	Liquid Crystal Display
MEL	Minimum Equipment List
OEM	Original Equipment Manufacturer
OS	Operating System
PED	Portable Electronic Device
PID	Pilot Information Display
PDA	Personal Digital Assistant
QVGA	Quarter Video Graphics Array (240x320 resolution)
SATCOM	Satellite Communications
SOP	Standard Operating Procedure
STC	Supplemental Type Certificate

SVGA	Super Video Graphics Array (800x600 resolution)
TCAS	Traffic Alert Collision Avoidance System
TFT	Thin-Film Transistor (screens)
TITAN	Totally Integrated Technical Aircraft Network
TUV	TUV Rheinland of N.A., Inc
UCD	Universal Cockpit Display
UCDT	Universal Cockpit Display Terminal
USAF	United States Air Force
USB	Universal Serial Bus
USMC	United States Marine Corps
UXGA	Ultra Extended Graphics Array (1200x1600 resolution)
VCCI	Voluntary Control Council for Interference
VDL	VHF Data Link
WiFi	Wireless Fidelity
WLAN	Wireless Local Area Network
XGA	Extended Graphics Array (1024x768 resolution)

Introduction

Electronic Flight Bags (EFBs) are electronic information management devices for use by pilots in performing flight tasks. Today, EFBs are in use during revenue operations at many airlines both in the United States and in Europe (e.g., Continental Airlines, Southwest Airlines, JetBlue Airways, FedEx, Finnair, and Lufthansa). The business case for deploying EFBs considers many types of benefits to airlines. 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-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. 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 (PC), 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. 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 1, 2, and 3) 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.

Development of EFBs has accelerated rapidly in the past few years. The purpose of this industry review is to provide a primer on who is involved in the industry and what their efforts are. This informal summary of EFB technology provides a picture of the current state of EFB development as of February, 2005. This document is an update to a 2003 EFB industry review (see Appendix A of Chandra, Yeh, Riley, and Mangold (2003)).

The EFB market is diverging into specialties (e.g., hardware, software, integrated solutions, content). This review provides information about EFB systems, software/content, and hardware that are currently on the market or in active development. This material was gathered through industry contacts, demonstrations, websites, brochures, and trade journal reports. Attempts were made to verify the information with a company representative, but this was not always possible. As with any system development cycle, changes in the design occur frequently; as a result, accuracy of the information cannot be guaranteed. For each product, the manufacturer's website is provided where more recent information can be found.

The industry review consists of three sections.

A. EFB Systems Providers. For each system, the review describes the display characteristics, controls, mounting style, applications supported, approvals obtained, potential customers, websites where more information can be found, and an image of the product. Some airlines are working with system integrators on higher end functionality (e.g., communicating electronic information on/off the aircraft, allowing the integration of aircraft operations with existing legacy systems for maintenance, operations, planning, etc.). This functionality is described in AC 120-76A; it is not covered here.

B. Software and Content Providers. For some of the systems described in Section A, additional applications can be purchased separately from software and content providers. The software options available are presented in Section B. A table listing the software and content applications available for use on EFB platforms is provided. The table lists information on the application type, hardware and software compatibility, and potential customers.

C. Hardware Providers. There are several display companies who have developed portable computing devices that have been used as EFB platforms. The software described in Section B may be installed on these devices in order to develop a complete EFB system. These hardware options are described in Section C. Information provided for each display includes display characteristic, user interface options, mounting style, approval (if any), potential customers, websites where more information can be found, and an image of the product.

The review begins with three tables that provide an overview of the manufacturers included in the industry review. Table A lists EFB system providers, Table B lists software and content providers, and Table C lists hardware manufacturers. In each table, the products developed are classified as a function of their target market: air transport,

business jet, high end general aviation (GA), low end GA, or military. Numbers are linked to the corresponding section where more information can be found about the system. Manufacturer names are linked to the corresponding websites.

Table A. Overview of EFB Systems Providers.

Products for each EFB system provider are listed and classified as a function of their target market: air transport, business jet, high end GA, low end GA, or military. Numbers are linked to the corresponding section where more information can be found about the system. Manufacturer names are linked to the corresponding websites.

MANUFACTURER	Location	MARKET				
		Air Transport	Business Jet	General Aviation		Military
				High End	Low End	
[1] Advanced Data Research (ADR)	Rochester Hills, MI & West Palm Beach, FL					
• FlightGuide(FG)-4000			✓	✓	✓	✓
• FG-5000		✓	✓	✓	✓	✓
• FG-8000		✓	✓	✓	✓	✓
[2] ApproachView TD-840			✓	✓	✓	✓
[3] ARINC	Annapolis, MD	✓	✓			✓
[4] Astronautics Pilot Information Display (PID)	Milwaukee, WI	✓	✓			✓
[5] Avrotec EFB in development	Hillsboro, OR					
[6] Boeing / Jeppesen / Astronautics Pilot Information Display	Seattle, WA	✓				✓
[7] CMC Electronics	Montreal, Quebec	✓	✓	✓		✓
• PilotView						
• CT-1000						
[8] Control Vision	Pittsburg, KS		✓	✓	✓	
• Anywhere EFB						
• Raven						
[9] eflightsystems, LLC e**flight**pad nxt	Mansfield, TX			✓	✓	
[10] Flight Deck Resources	Irvine, CA					
• SkyTab 770HB		✓	✓	✓	✓	✓
• SkyTab 800			✓	✓	✓	
• SkyTab 900R		✓	✓	✓	✓	✓
• SkyTab 1000NG		✓	✓	✓		✓
[11] GSCS	McLean, VA	✓	✓		✓	✓
• SAMM						
[12] NavAero	Chicago, IL	✓	✓	✓	✓	✓
• tBag C2						
• tPad 800						

Table A (continued). Overview of EFB Systems Providers.

MANUFACTURER	Location	MARKET				
		Air Transport	Business Jet	General Aviation		Military
				High End	Low End	
[13] Paperless Cockpit • E-Board Plus • E-Board C3 • FliteServEFB (FliteServ C2, FliteServ LE, FliteServ C3)	Memphis, TN	✓	✓	✓	✓	✓
[14] Teledyne Controls AvVantage	Los Angeles, CA	✓	✓	✓		✓
[15] Universal Avionics • Universal Cockpit Display	Tucson, AZ	✓	✓	✓	✓	✓

Table B. Overview of Software and Content Providers

Products for each software and content provider are listed and classified as a function of their target market: air transport, business jet, high end GA, low end GA, or military. Numbers are linked to the corresponding section where more information can be found. Manufacturer names are linked to the corresponding websites.

MANUFACTURER	MARKET				
	Air Transport	Business Jet	General Aviation		Military
			High End	Low End	
[1] Adobe	✓	✓	✓	✓	✓
[2] Advanced Data Research (ADR)	✓	✓	✓	✓	✓
[3] Airbus	✓				
[4] Aero Data Solutions	✓				
[5] Aircraft Data Fusion	✓				
[6] Aircraft Management Technologies (AMT)	✓	✓	✓		✓
[7] Astoria Software	✓	✓			✓
[8] Astronautics	✓	✓			✓
[9] CMC Electronics					
[10] Control Vision		✓	✓	✓	
[11] Echo Flight		✓	✓	✓	
[12] Flight Deck Resources	✓	✓	✓	✓	✓
[13] Flight Explorer			✓	✓	
[14] Hangar B-17				✓	
[15] Honeywell	✓	✓			✓
[16] ION Systems	✓	✓	✓	✓	✓
[17] Jeppesen	✓	✓	✓	✓	✓
[18] LIDO	✓				
[19] Maestro Aviation Limited	✓	✓			
[20] On Board Data Systems	✓	✓	✓	✓	

Table B (continued). Overview of Software and Content Providers

MANUFACTURER	MARKET				
	Air Transport	Business Jet	General Aviation		Military
			High End	Low End	
[21] RMS Technology		✓	✓	✓	
[22] Rockwell Collins		✓			
[23] Sporty's Pilot Shop			✓	✓	
[24] Stenbock & Everson				✓	
[25] Teledyne Controls	✓	✓			✓
[26] Ultra-Nav					
[27] WSI			✓	✓	
[28] WxWorx			✓	✓	

Table C. Overview of Hardware Providers

Products for each hardware provider are listed and classified as a function of their target market: air transport, business jet, high end GA, low end GA, or military. Numbers are linked to the corresponding section where more information can be found. Manufacturer names are linked to the corresponding websites.

MANUFACTURER	Partners	MARKET				
		Air Transport	Business Jet	General Aviation		Military
				High End	Low End	
[1] Astronautics	Boeing, Jeppesen	✓	✓			✓
[2] CMC Electronics			✓	✓		✓
[3] Hewlett-Packard	Anywhere Map, Echo Flight	✓	✓	✓	✓	
[4] NavAero	ARINC		✓	✓		
[5] Panasonic	Jeppesen	✓	✓	✓	✓	✓
[6] Paperless Cockpit	Various OEM Providers	✓	✓	✓		✓
[7] Teledyne Controls	WalkAbout Computers	✓	✓			✓

A. EFB Systems Providers

For each system, the review describes the following:

- Product name
- Website(s) where more information can be found. The text in the following table is hyperlinked to the manufacturer's site. A list of URLs is included at the end of this appendix.
- Location
- System size and weight
- Display
- Brightness
- Controls, i.e., how the user interacts with the device
- Mounting style
- Form Factor
- Operating System
- Applications supported
- Approvals
- Potential customer(s)

1. Advanced Data Research (ADR)

FlightGuide-5000

FlightGuide-8000

Photos courtesy of ADR.

Product Name(s)	FlightGuide (FG)-4000, FG-5000, FG-8000
Website(s)	• ADR • FG-4000 • FG-5000 • FG-8000
Location	Rochester Hills, MI & West Palm Beach, FL
System Size & Weight	FG-4000: 9.6" x 6.3" x 1.1", 2.65 lbs FG-5000: 9.6" x 6.3" x 1.51", 3.33 lbs FG-8000: 8.25" x 6.3" x 1.5", 1.55 lbs
Display	8.4", 800x600 SVGA brightness and polarized active matrix
Brightness	315 nit FG-4000; 700 nit FG-5000/8000
Controls	Vertical touch screen; FG-8000 also has mouse control
Mounting Style	Cockpit-mountable; FG-8000 also yoke-mountable
Form Factor	Fujitsu COTS pen tablet computers
Operating System	Windows OS
Applications Supported	Open architecture – all Windows-compatible software
Electronic Charts	✓ (JeppView FliteDeck)
Electronic Checklists	✓
Electronic Documents	✓
Flight Performance Calculations	✓
Flight Planning	✓ (JeppView FliteStar and FliteMap)
Surface Moving Map	
Video Surveillance	✓ (AD Aerospace)
Weather	✓ (WSI real-time satellite weather)
Other	terrain avoidance, Internet and satcom communications, scheduling programs
Approvals	Hardware Class 1 or 2 EFB STC for Challenger 604 Certified mounting systems and power supplies available. See www.adrsoft.com/Aviation/Aviation_Cert.htm for the latest information.
Potential Customer(s)	Air transport, business jet, high-end GA. ADR EFBs are in use by: • Jet Aviation (Boeing Business Jets) • Alcoa (Bombardier Global Express, Gulfstream IV and GV) • Raytheon Flight Options • Citation Shares • NetJets • FAA • Boeing

2. ApproachView

Photo courtesy of ApproachView.

Product Name	ApproachView TD-840
Website(s)	• ApproachView
Location	
System Size & Weight	8.5” x 6.25” x 2.07”
Display	8.4”; 800x600
Brightness	1400 nits
Controls	Touch screen
Mounting Style	R-A-M ball. See www.ram-mount.com for options.
Form Factor	Remote touchscreen display
Operating System	
Applications Supported	
Electronic Charts	✓ (Jeppesen FliteDeck)
Electronic Checklists	
Electronic Documents	
Flight Performance Calculations	
Flight Planning	✓ (Jeppesen, JeppView, FliteMap)
Surface Moving Map	
Video Surveillance	
Weather	✓ (WxWorx)
Other	
Approvals	
Potential Customer(s)	Business jet, high- and low-end GA, military

3. ARINC

Photo courtesy of ARINC.

Product Name	eFlightDeck
Website(s)	• ARINC • eFlightDeck
Location	Annapolis, MD
System Size & Weight	9.4" x 6.2" x 0.6"
Display	8.4" color TFT LCD, 600 x 800 (standard) 10.4" color TFT LCD, 768 x 1024 (optional)
Brightness	Range 3-750 nits
Controls	Touch screen
Mounting Style	Dependent on the cockpit configuration and customer preference
Form Factor	
Operating System	Windows XP OS
Applications Supported	
Electronic Charts	✓
Electronic Checklists	✓
Electronic Documents	✓
Flight Performance Calculations	✓ (3rd-party applications)
Flight Planning	✓ (3rd-party applications)
Surface Moving Map	✓ (3rd-party applications within guidelines of Class2/Type B EFB)
Video Surveillance	✓ (3rd-party applications)
Weather	Graphical weather with updates provided in-flight over VDLMode 2 datalink; 3rd-party applications also supported
Other	• Connectivity to ACARS and other air/ground data link technologies (such as 802.11 Gatelink) • Connectivity to aircraft data- bus (such as ARINC 429) for engine parameter monitoring and connecting to other on-board systems
Approvals	Class II EFB (per FAA AC120-76A) STC for eFlightDeck on Boeing 727 obtained January, 2005
Potential Customer(s)	• ASTAR Air Cargo installed eFlightDeck on their Boeing 727s with DC8 and A300 fleet to follow • System installed on Air Force Flight Standards Agency C-21 aircraft; additional USAF installations scheduled 2005

4. Astronautics

Photo courtesy of Astronautics.

Product Name	Pilot Information Display (PID)
Website(s)	• Astronautics, EFB effort: PID
Location	Milwaukee, WI
System Size & Weight	Class 3 & Class 2 Two Box systems Class 2 Single Box system
Display	10.4", XGA 1024 x 768
Brightness	Sunlight Readable
Controls	16 soft keys, 12 dedicated bezel keys, cursor/mouse control, brightness increase/decrease keys, touch screen, power on/off, virtual keyboard, and external keyboard
Mounting Style	Fixed or adjustable. One display for each pilot; adjustable arm, window mount, or fixed
Operating System	Class 3: two independent processor / hard drives. One hosts Linux for certified applications, second host Windows 2000 for uncertified applications. Hard drives provide 80 GB of mass storage Class 2: single processor / hard drive hosts Windows XP and provides 60 GB of mass storage. Hosting Linux OS is an option
Applications Supported	Open architecture
Electronic Charts	✓ (e.g., Jeppesen EFB)
Electronic Checklists	✓
Electronic Documents	✓ (e.g., Jeppesen EFB)
Flight Performance Calculations	✓ (e.g., Jeppesen EFB)
Flight Planning	✓
Surface Moving Map	✓ (Taxi Position Awareness)
Video Surveillance	✓
Weather	✓
Other	ADS-B/TCAS, runway incursion prevention, terrain avoidance, eTAWS, countermeasure display, FLIP charts, Falcon View, performance weight & balance, maintenance, Boeing Wireless connection, data link (SATCOM, GateLink, Link 16, etc.), CPDLC, CDTI, Combat Track II
Approvals	Available as Class 2 or Class 3 EFB • Certified (Tailored Linux) and Uncertified (Windows) applications for Class 3 PID • Certified (Linux) or Uncertified (Windows) applications for Class 2 PID DO-160D Certified Hardware Level C, D and E software supported (DO-178B). Certification completed.
Potential Customer(s)	Air transport, business jet, and military transport. STCs for B777 and B767; STC for BBJ expected in November. C-17 is being demonstrated to USAF.

5. Avrotec

Photo courtesy of Avrotec.

Product Name	EFB in development
Website(s)	• Avrotec
Location	Hillsboro, OR
Display	10.4”
Brightness	
Controls	
Mounting Style	
Operating System	
Applications Supported	
Electronic Charts	
Electronic Checklists	
Electronic Documents	
Flight Performance Calculations	
Flight Planning	
Surface Moving Map	
Video Surveillance	
Weather	
Other	
Approvals	
Potential Customer(s)	

6. Boeing, Jeppesen, and Astronautics

Boeing, Jeppesen, and Astronautics have cooperatively developed an EFB. In their agreement:

- Boeing will do the aircraft integration
- Jeppesen will implement the software, which may also marketed to other EFB platforms
- Astronautics will implement the hardware

Images are available at www.jeppesen.com.

Product Name	EFB
Website(s)	• Boeing o Information for Boeing customers (password and account required) o Boeing EFB effort • Jeppesen • Astronautics o Astronautics EFB effort
Location	Seattle, WA
System Size & Weight	
Display	10.7” display for a panel mount version in 777, 767, 757, 747, and 737 aircraft
Brightness	
Controls	16 soft keys, 12 dedicated bezel keys, brightness increase/decrease keys, touch screen, and external keyboard
Mounting Style	Installed – one display for each pilot
Operating System	Linux or Windows 2000 OS
Applications Supported	Open architecture
Electronic Charts	✓
Electronic Checklists	✓
Electronic Documents	✓
Flight Performance Calculations	✓
Flight Planning	✓
Surface Moving Map	✓ (Taxi Position Awareness)
Video Surveillance	✓
Weather	
Other	Aviation weather (AWIN), data link (SATCOM, Connexion by Boeing, GateLink etc.), terrain, CDTI, and Logbook Fault Finder
Approvals	Hardware Class 3: Certified (Tailored Linux) and Uncertified (Windows) applications DO-160 tested Level C, D and E software supported (DO-178B). Certification completed
Potential Customer(s)	777 installations for Eva Air, KLM, Malaysia Airlines, MidEast Jet, Pakistan International Airlines Also available for retrofit on BBJ

7. CMC Electronics

PilotView EFB

CT-1000

Photos courtesy of CMC Electronics.

Product Name	CT-1000, PilotView EFB
Website(s)	• CMC Electronics • CT-1000 • PilotView EFB
Location	Montreal, Quebec
System Size & Weight	PilotView™ Display/Processor with integrated IEEE802.11 a/b/g WLAN: 8.5” x 6.5” x 1.5” Power/Interface Unit supporting 10/100BaseT, ARINC429, USB, RS232, RS422, Video: 5.8”x 4.8” x 1.75”
Display	PilotView™ EFB: 8.4” active matrix 1024 x 768 (XGA) display
Brightness	1-800 nits, fully dimmable
Controls	Touch Screen, 12 soft ‘line select’ function keys; dedicated keys allow for zoom, dim, bright, video and application control
Mounting Style	Mounted in aircraft but removable via integrated latching mount
Operating System	Windows XP Pro & Embedded OS
Applications Supported	
Electronic Charts	✓
Electronic Checklists	✓
Electronic Documents	✓
Flight Performance Calculations	✓
Flight Planning	✓
Surface Moving Map	✓
Video Surveillance	✓
Weather	✓
Other	EVS head down display, Note Taker
Approvals	DO-160 tested Gulfstream obtained STC for mounting CT-1000 EFBs on the yoke of GIV and GIV-SP
Potential Customer(s)	Air transport, business jet, helicopters for paramilitary missions

8. Control Vision

Anywhere EFB on RAVEN

Anywhere EFB on PDA

Photos courtesy of Control Vision Corp.

Product Name	Anywhere EFB
Website(s)	Control Vision: • www.anywheremap.com • www.pocketplates.com
Location	Pittsburg, KS
System Size & Weight	PDA: 5.17" x 3.03" x .59", 6.6 oz Raven: 8.25" x 5.25" x 2", 2 lbs
Display	PDA: 4" RAVEN: 6.5"
Brightness	Up to 700 NIT
Controls	PDA: touch screen, touch pad RAVEN: touch screen, 12 function buttons, trackball input
Mounting Style	Variable, mount included, quick release
Form Factor	Anywhere EFB uses iPAQ 4700 or Raven
Operating System	PDA and Raven: Pocket PC OS XP OS also supported, all applications
Applications Supported	
Electronic Charts	✓ (Pocket Plates)
Electronic Checklists	✓
Electronic Documents	✓ using Acrobat for Pocket PC
Flight Performance Calculations	✓
Flight Planning	✓
Surface Moving Map	✓ (Anywhere Map)
Video Surveillance	
Weather	✓ (Anywhere Wx)
Other	
Approvals	EFB AC pending
Potential Customer(s)	GA, Corporate, Commercial

9. eflightsystems, LLC

Photo courtesy of eflightsystems, LLC,

Product Name	e**flight**pad
Website(s)	• eflightsystems
Location	Mansfield, TX
System Size & Weight	9.29” x 6.89” x 0.98”, 2.6 lbs
Display	8.4” SVGA TFT color LCD, 800x600
Brightness	
Controls	Digitized touch screen, stylus, onscreen keyboard, external keyboard
Mounting Style	legstrap
Operating System	Windows XP Tablet Edition OS
Applications Supported	
Electronic Charts	✓ (Jeppesen FliteDeck)
Electronic Checklists	
Electronic Documents	
Flight Performance Calculations	
Flight Planning	✓ (Jeppesen FliteMap)
Surface Moving Map	✓ (Microsoft Streets & Trips)
Video Surveillance	
Weather	✓ (WSI, FliteMap)
Other	✓ (PCAvionics MountainScope)
Approvals	EMI: CE, FCC, VCCI, BSMI Safety: cUL, TUV, CB, 3C
Potential Customer(s)	High- and low-end GA

10. Flight Deck Resources

SkyTab770HB

SkyTab1000NG

SkyTab 900R

Photos courtesy of Flight Deck Resources.

Product Name	SkyTab 770HB, SkyTab 1000NG, SkyTab 900, SkyTab 800
Website(s)	• Flight Deck Resources • SkyTab 770HB, SkyTab 800, SkyTab 900R, SkyTab 1000NG
Location	Irvine, CA
System Size & Weight	SkyTab 770HB: 7.9" x 9.6" x 0.5", 1.9 lbs SkyTab 800: 8.6" x 11.8" x 0.8", 3.2 lbs SkyTab 900R: 8.5" x 10.7" x 1.9", 4.4 lbs SkyTab 1000NG: 8.5" x 10.5 "x1.6", 4.7 lbs
Display	SkyTab 770HB: 8.4", 800 x 600 SkyTab 800, 900R: 10.4", 1024 x 768 SkyTab 1000NG: 10.4", 1024 x 768
Brightness	SkyTab 770HB: dimmable for night flying SkyTab 1000NG: full dimming functionality, over 850 nits direct sunlight viewable
Controls	Touch screen, keyboard
Mounting Style	Certified mounting solutions
Form Factor	Full screen, tablet-size touch-screen computer
Operating System	Windows OS
Applications Supported	X86 compatible applications
Electronic Charts	✓ (FliNav or JeppView)
Electronic Checklists	✓
Electronic Documents	✓ (FliView)
Flight Performance Calculations	✓
Flight Planning	✓
Surface Moving Map	✓
Video Surveillance	✓
Weather	✓ (WxWorx, WSI InFlight)
Other	✓ (FliControl – FlightLine User Interface)
Approvals	FDR provides Class 1 and Class 2 hardware solutions along with Type A and B software solutions. The SkyTab 1000NG is currently being certified and approved for use on a Boeing 767 aircraft as a Class 2 EFB system. Additional aircraft types will be added in the near future.
Potential Customer(s)	Air transport, business jet, high- and low-end GA, and military

11. GSCS

SAMM

Photos courtesy of GSCS.

Product Name	SAMM FG
Website(s)	• GSCS • SAMM
Location	McLean, VA
System Size & Weight	9.6” x 6.3” x 1.1” / 2.5 lbs
Display	8.4” diagonal display
Brightness	Sunlight readable
Controls	SAMM: touch screen
Mounting Style	
Form Factor	SAMM: 8.4” Tablet PC or kneeboard computer
Operating System	Windows OS
Applications Supported	
Electronic Charts	✓
Electronic Checklists	✓
Electronic Documents	✓
Flight Performance Calculations	✓
Flight Planning	✓
Surface Moving Map	✓
Video Surveillance	✓
Weather	✓
Other	
Approvals	SAMM EFBs have STCs for Part 25 and Part 135. SAMM is approved under class 1 & 2 running Type B software
Potential Customer(s)	Air transport, business jet, low end GA, military

12. navAero

navAero t•Pad 800

navAero t•Bag C2 System

navAero t•Bag C2 CPU Module & Cradle

Photos courtesy of navAero.

Product Name	t•Pad 800, t•Bag C2
Website(s)	• navAero
Location	Chicago, IL
System Size & Weight	t•Pad 800: 9.4" H x 6.2" W x 0.6"/0.9" D, 2.1 lbs. t•Bag C2: 9 3/8" H x 11 3/8" W x 2 3/8" D
Display	t•Pad 800: 8.4", 800 x 600 t•Bag C2: 8.4" diag., 800 x 600 (standard); 10.4", 768 x 1024 (optional)
Brightness	3 - 750 nits
Controls	t•Pad 800: stylus or touch screen, 3 buttons (standby, brightness increase, brightness decrease) t•Bag C2 Class 2 EFB: Power, Emergency battery indicator, USB 2.0 (4x), RS232, Ethernet (100Mb)
Mounting Style	Surface, column/yoke, column/U-bolt, flexarm pedestal, Cessna seat rail mount, and column/V-strap mounts
Form Factor	Kneeboard, laptop
Operating System	Windows XP OS
Applications Supported	Jeppesen General and Business Aviation and Commercial Aviation software, LIDO software, Mountain Scope, WxWorx on Wings, WSI InFlite, True Flight, etc.
Electronic Charts	✓
Electronic Checklists	✓
Electronic Documents	✓
Flight Performance Calculations	✓
Flight Planning	✓
Surface Moving Map	✓
Video Surveillance	✓
Weather	✓
Other	Moving Map
Approvals	Class 2
Potential Customer(s)	Commercial, Business, General and Military aviation Partners with Jeppesen, LIDO, ARINC, Flight Explorer, Avionica, Wingspeed, ICM

13. Paperless Cockpit

FliteServ C2

E-Board Plus

E-Board XP2

E-Board C3

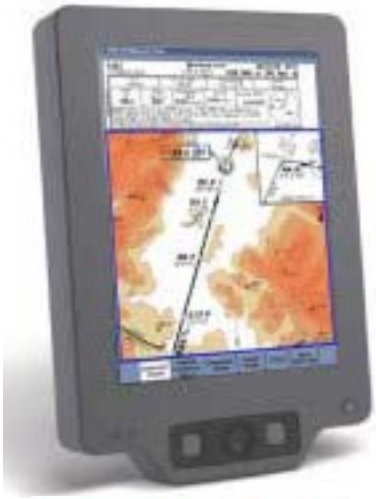
FliteServ C3

FliteServ LE

Photos courtesy of Paperless Cockpit.

Product Name	FliteServ EFB, E-Board Flight Displays
Website(s)	• Paperless Cockpit, E-Board Flight Displays, FliteServ EFBs
Location	Memphis, TN
System Size & Weight	E-Board Displays: *E-Board Plus*, 9.0" L x 6.0" W x 0.67" H, 1.6 lbs; *E-Board XP2*, 6.57" W x 4.25" L x 1.03" H, 1.21 lbs FliteServ EFBs: *FliteServ LE*, 4.7" W x 1.89" H x 8.5" L, 2.8 lbs; *FliteServ C2*, 6.89" W x 2.32 H x 5.44" D, 2.9 lbs; *FliteServ C3*, 8.0" W x 2.45" H x 5.25" D, 3.20 lbs
Display	*E-Board Plus*: 8.4", 600 x 800 SVGA *E-Board XP2*: 5", 800 x 600 SVGA *E-Board C3*: 8.4" or 10.4" 1024 x 768 *FliteServ LE* (maintenance display only, not intended for primary navigation purposes): 6.3" 1024 X 768
Brightness	Readable in direct sunlight and dimmable for night flight E-Board C3: 1,200 nits of brightness
Controls	Touch screen, stylus, on-screen and USB keyboards available
Mounting Style	Various mounting solutions including yoke mounts, articulating armatures and kneeboards
Form Factor	Proprietary hardware design, with some incorporation of existing manufacturers, like Sony
Operating System	Windows OS (XP, Server 2003 Web edition, etc.)
Applications Supported	Any Microsoft Windows compatible application. Software providers include Jeppesen Sanderson, WSI, WxWorx, OBDS, Mountain Scope, Ultra-Nav, AeroPlanner
Electronic Charts	✓
Electronic Checklists	✓
Electronic Documents	✓
Flight Performance Calculations	✓
Flight Planning	✓
Surface Moving Map	✓
Video Surveillance	
Weather	✓
Other	Customized world-wide aeronautical databases and applications for Part 121 and 135 operators; moving map; access to FOM, SOP, MEL, CDL and OEM Tech Pubs; aircraft, flight crew and maintenance logs; custom applications
Approvals	E-Board C3 and FliteServ C3 are built to DO-160D; pursuing STC for E-Board C3 and FliteServ C3
Potential Customer(s)	Class 1, 2, and 3 EFBs for air transport, business jet, high- and low-end GA, military

14. Teledyne Controls



Photos courtesy of Teledyne Controls.

Product Name	AvVantage, Multi-Purpose Aircraft Computer (MPAC), Onboard Information Terminal (OIT)
Website(s)	• Teledyne • Aircraft Information Solutions • AvVantage • Multi-Purpose Aircraft Computer (MPAC) • Onboard Information Terminal (OIT)
Location	Los Angeles, CA
System Size & Weight	
Display	AvVantage: 8.4” or 10.4” displays MPAC: 8.4” or 10.4” displays; can also interfaces to external display systems OIT: 12.1” 1024 x 768 (XGA)
Brightness	
Controls	Five level zoom with touch screen and push button controls MPAC: touch screen OIT: touch screen, keyboard
Mounting Style	Certified mount/dock
Form Factor	Tethered and integrated (one piece) versions Class 1 and 2 systems: based on COTS laptop and pen tablet computers MPAC interfaces with existing displays
Operating System	Windows OS
Applications Supported	Open architecture; able to be networked
Electronic Charts	✓ (Chart Viewer)
Electronic Checklists	✓
Electronic Documents	✓ (Document Viewer)
Flight Performance Calculations	✓ (Onboard Performance System – Take Off, Landing, Weight&Balance)
Flight Planning	
Surface Moving Map	
Video Surveillance	✓ (Cabin Surveillance Viewer)
Weather	✓ (Graphical Weather Viewer)
Other	Fault reporting
Approvals	Class 1, 2, and 3 solutions STC for AvVantage on A330
Potential Customer(s)	• Airbus (OIT) • FedEx [Totally Integrated Technical Aircraft Network (TITAN) System] • In service at 6+ operators on 7+ aircraft models • 100+ units in service

15. Universal Avionics

Photo courtesy of Universal Avionics.

Product Name	Universal Cockpit Display (UCD) / Universal Cockpit Display Terminal (UCDT-II)
Website(s)	• Universal Avionics • UCD product information
Location	Tuscon, AZ
System Size & Weight	UCDT-II (terminal): 7.9" x 6.4" x 1.48 ", 2.7 lbs. UCDC (computer): 2 MCU, 7.5 lbs.
Display	8.4", 800x600 (SVGA)
Brightness	Fully dimmable for nighttime viewing
Controls	Touch-screen
Mounting Style	Tethered; cockpit or yoke-mountable
Operating System	
Applications Supported	All software must be purchased from Universal
Electronic Charts	✓
Electronic Checklists	✓
Electronic Documents	✓
Flight Performance Calculations	
Flight Planning	
Surface Moving Map	
Video Surveillance	✓
Weather	✓ WSI and UniLink 701 data link
Other	
Approvals	• Certified to DO-160 with Level C software (DO-178B) TSO C113, TSO C165 and electronic approach charts (internally developed software, not Jeppesen) • UCDT-II approved for business aircraft, including Falcon 10, 20, and 50, King Air 350, Boeing Business Jet, Bombardier's Challenger and Global Express, Dassault Falcon 2000, Gulfstream G500, and Cessna Citation Bravo. Also certified for U.S. Air Force RC-135
Potential Customer(s)	Air transport and business jet

B. Software and Content Providers

For some of the systems described in Section A above, additional applications can be purchased separately from software and content providers, as listed below. For each software provider, the table indicates the applications available, the application type, operating systems supported, hardware platform supported, and potential customer(s).

Provider	Product Name	Electronic Charts	Electronic Checklists	Electronic Documents	Flight Perf. Calc.	Flight Planning	Surface Moving Map	Video Surveillance	Weather	Other Applications	Operating Systems Supported	Hardware Platform	Customers
1. Adobe	Acrobat Reader			✓							Windows, Pocket PC, Palm, and Symbian OSs		
2. Advanced Data Research (ADR)	Dual Mode Flight Command System Software	✓	✓	✓	✓	✓		✓	✓	Self-contained in-flight operational shell, checklist editor software, pop-up keyboard, power management tools, Note Taker	Windows OS	Fujitsu tablet computer	
3. Airbus	FCOM/OEB			✓									
	Less Paper Cockpit (LPC)				✓								
4. Aero Data Solutions													
5. Aircraft Data Fusion	ADF Flight Management				✓							PDAs with Microsoft OS	
	xEFB	✓	✓	✓				✓	✓	TCAS, terrain, ACARS, surface management, eLearning		Astronautics PID	
6. Aircraft Management Technologies (AMT)	Flightman	✓	✓	✓	✓	✓		✓		Voyage report, maintenance logs, and on board sales/ cabin management Communications Manager (WiFi, Satcom, ACARS, GSM/GPRS)	Browser-based application. Run on Windows, Linux, or other UNIX OS	Any multi-functional display, portable computer (tablet, laptop, or PDA) Flightman can be configured to any aircraft type or hardware type (Class 1, 2, 3)	Pricing varies based on custom features, from mid-range to high end • Atlas Airways • Futura • DHL • Rockwell Collins
7. Astoria Software	Astoria			✓									

Provider	Product Name	Electronic Charts	Electronic Checklists	Electronic Documents	Flight Perf. Calc.	Flight Planning	Surface Moving Map	Video Surveillance	Weather	Other Applications	Operating Systems Supported	Hardware Platform	Customers
8. Astronautics	Pilot Information Display (PID)	✓		✓	✓	✓	✓	✓		CPDLC, ACARS, data links, runway incursion prevention, terrain Avoidance, eTAWS, Combat Track II, FLIP charts, Falcon View, countermeasure display, network connection, ADS-B/TCAS	Class 3 system: two processors. Linux OS for certified application. Windows 2000 OS for uncertified applications Class 2 system: single processor hosting Windows XP OS	Astronautics PID's	Class 3 systems are in service on KLM and Pakistan B777, VIP B767, and is being demonstrated to USAF on C-17. In addition, Boeing has a number of announced customers
9. CMC Electronics	ECM (EFB Content Manager)		✓	✓						Application and system content management	WinXP OS		
	Customized Checklists (OBDS)		✓										
	eDOCs			✓									
	AeroData				✓	✓							
	MainMenu Browser									Configurable, application shell menu			
	CMCView							✓		EVS head down display			
	Note Taker application									Utility			
10. Control Vision	Anywhere Map	✓	✓	✓	✓	✓	✓				Windows 2000/XP and Pocket PC OSs	Tablet, laptop, or Pocket PC	
	Anywhere EFB	✓	✓	✓	✓	✓	✓		✓	Integrated package consisting of Anywhere Map, Anywhere WX, and Pocket Plates			
	Anywhere Wx	✓	✓	✓	✓	✓	✓		✓				
	Pocket Plates	✓											
11. Echo Flight	EchoChart	✓											
	EchoMap								✓	Moving map with data link weather information	Windows 95/98/NT/ 2000/XP laptop		

Provider	Product Name	Electronic Charts	Electronic Checklists	Electronic Documents	Flight Perf. Calc.	Flight Planning	Surface Moving Map	Video Surveillance	Weather	Other Applications	Operating Systems Supported	Hardware Platform	Customers
12. Flight Deck Resources	FliControl									FlightLine User Interface. Control panel for all applications. Can be used to replace Windows explorer	Windows and Linux OS	x86 compatible systems	
	FliNav	✓											
	FliPrep		✓										
	FliView			✓									
13. Flight Explorer	Flight Explorer Personal Edition					✓					Windows OS	Tablet, laptop, or PC	
14. Hangar B-17	PalmEFIS					✓				Attitude indicator, flight director, moving map, windometer			
	PocketEFIS					✓				Attitude indicator, flight director, moving map, windometer			
15. Honeywell	Interactive Navigation (INAV)	✓										Honeywell Primus Epic systems	Gulfstream V-SP PlaneView cockpit, Dassault Falcon 900EX EASy cockpit
16. ION Systems	eMonocle			✓							Windows OS		

Provider	Product Name	Electronic Charts	Electronic Checklists	Electronic Documents	Flight Perf. Calc.	Flight Planning	Surface Moving Map	Video Surveillance	Weather	Other Applications	Operating Systems Supported	Hardware Platform	Customers
17. Jeppesen	Electronic Charts	✓										Portable computer (tablet/ laptop/PDA)	
	Electronic Documents			✓									
	FliteMap	✓				✓							GA and business jet Universal UCD and Garmin AT use Jeppesen data, but not the Windows software interface
	FliteStar	✓				✓							
	JeppView 3	✓				✓							
	JeppView FlightDeck	✓											
	Onboard Performance Tool				✓								
	Taxi Position Awareness									surface moving map with ownship position			
	Airport Familiarization and Qualification (planned)									Provides photographic and graphical depictions of airport environment			
	Electronic Checklists (planned)		✓										
	Electronic Logbook (planned)									Fault-reporting software			
	Enroute Moving Map (planned)									Moving map			
	Weather and NOTAMS (planned)								✓				

Provider	Product Name	Electronic Charts	Electronic Checklists	Electronic Documents	Flight Perf. Calc.	Flight Planning	Surface Moving Map	Video Surveillance	Weather	Other Applications	Operating Systems Supported	Hardware Platform	Customers
18. Lido	Aircraft Performance Services				✓							PC or notebook	Air transport, business jet, high- and low-end GA
	Briefing												
	RouteManual/ eRouteManual	✓											
	SmartCompan-ion					✓							
	Integrated Take-off Performance (LinTop) Take-off Performance Analysis (TOPAS)			✓									
19. Maestro Aviation Limited	Electronic Flight Manual		✓		✓					Oxygen planning		PCs and hand-helds	
20. On Board Data Systems	Multi-Function Flight Deck Browser (MFB)		✓	✓	✓					Wireless Document Library Synchronization User defined GUI	Windows OS	All Class 2 EFB and Network PC or Wireless Devices	Flight Crews Fleet Management Commuter & Business Aviation
	Electronic checklists for Honeywell, Rockwell Collins, and Universal displays		✓							User-Managed Doc-Library for Fleet Synchronization/ Distribution/ Subscription ECL Specialists	Windows OS Shell User-defined Multitasking GUI	Supports all Class 2 EFB, PCs, & wireless devices	Fleet operations, commuter, and corporate
21. RMS Technology	Flitesoft™ / Flitesoft Express™					✓					Windows OS		
	Vista™									Moving map			
22. Rockwell Collins	Integrated Flight Information System (IFIS)	✓							✓			Interfaces to Pro Line 21 architecture	Falcon, Hawker, Raytheon, Cessna, Gulfstream, Bombardier
	Video Intelligence System (VIS)							✓					UAL
23. Sporty's Pilot Shop	Sporty's Chart Viewer	✓											
24. Stenbock & Everson	ChartCase	✓	✓			✓				Moving map			
	Golden Eagle FlightPrep	✓				✓			✓	Weather		Pocket PC	

Provider	Product Name	Electronic Charts	Electronic Checklists	Electronic Documents	Flight Perf. Calc.	Flight Planning	Surface Moving Map	Video Surveillance	Weather	Other Applications	Operating Systems Supported	Hardware Platform	Customers
25. Teledyne Controls	Cabin Surveillance Viewer							✓			Windows OS	Fujitsu, Walkabout Computers (Hammer-head model), MPAC	
	Chart Viewer	✓											
	Document Viewer			✓									
	Graphical Weather Viewer								✓				
	Onboard Maintenance System (OMS)			✓									
	Onboard Performance System (OPS)					✓							
	Software Data Distribution System (SDDS)									Manages integration between ground and airborne systems			
26. Ultra-Nav	Ultra-Nav				✓						Windows and Palm OS		
27. WSI	InFlight								✓	Weather		Fujitsu (P-600 or ST-4000)	ADR
	Pilotbrief Pro Pilotbrief Pilotbrief Online Pilotbrief Online International Pilotbrief Dispatch					✓			✓				
	Flight Tracking • Flight Explorer • VectorASD								✓	Flight tracking			
28. WxWorx	WxWorx								✓		Windows 2000, Windows XP OSs	Tablet PC	

C. Hardware Providers

The following is a list of vendors who develop displays for EFB systems. For each display, the website(s) where more information can be found, the display size, controls, mounting style, approval (if any), and potential customers are noted. The website names listed here are hyperlinked. Their URLs are included at the end of this appendix.

1. Astronautics

See information in EFB Systems in Section A (4)

2. CMC Electronics

See information in Section A (7)

3. HP/Compaq

Photos courtesy of Hewlett-Packard website.

Product Name	HP laptops and iPAQ
Website(s)	• HP • Laptops • Handheld devices
Display	Handhelds range in size from 3.5” (240x320) to 3.8” (240x320), tablet PCs are 10.4”; laptops start at 12.1”
Controls	Touch screen display
Operating System	Microsoft Pocket PC OS
Mounting Style	
Potential Customer(s)	Air transport, business jet, high- and low-end GA

4. NavAero

See information in Section A (12)

5. Panasonic

PRDC (12.1” x 1.2”, 1024 x 768)

Toughbook 18

Product Name	Toughbook family
Website(s)	• Panasonic • Toughbook
Display	Depends on the model. Displays range from 3.4” 240x320 (QVGA) to 15” 1600 x 1200 (UXGA).
Controls	Depends on the model
Operating System	Windows OS
Mounting Style	
Potential Customer(s)	• Supplier of rugged mobile computing solutions to the U.S. military. Toughbooks are the defacto standard for USAF, USMC, Navy and most any aviation application for the military and are used in aircraft ranging from B-52's to BlackHawks. • Also interested in air transport, business jet, high-end and low-end GA

6. Paperless Cockpit

See information in EFB systems in Section A (13)

7. Teledyne Controls

See information in EFB Systems in Section A (14).

References

Chandra, D. C., Yeh M., Riley, V., & Mangold, S.J. (2003). Human factors considerations in the design and evaluation of Electronic Flight Bags (EFBs), Version 2. DOT-VNTSC-FAA-03-07. USDOT Volpe Center: Cambridge, MA. Available at www.volpe.dot.gov/opsad/efb.

Federal Aviation Administration, Advisory Circular AC 120-76A, March 17, 2003. Guidelines for the certification, airworthiness, and operational approval of electronic flight bag computing devices.

Websites

The following is a list of websites for EFB system manufacturers, software and content providers, and display providers discussed in the industry review. This list was compiled in January, 2005. Please note that these links may be out of date.

A. EFB Systems

EFB Systems Manufacturer	Website
Advanced Data Research (ADR)	www.adrsoft.com
ApproachView	www.approachview.com
ARINC	www.arinc.com
Astronautics	www.astronautics.com
AvroTec	www.avrotec.com
Boeing	www.boeing.com Information for Boeing customers: www.myboeingfleet.com
CMC Electronics	www.cmcelectronics.ca/
Control Vision	www.anywheremap.com www.pocketplates.com
eflightsystems, LLC	www.eflightpad.com
Flight Deck Resources	www.flightdeckresources.com
GSCS	www.grid.com
JP Instruments	www.jpinstruments.com
NavAero	www.navaero.com
Paperless Cockpit	www.paperlesscockpit.com
Teledyne Controls	www.teledynecontrols.com
Universal Avionics	www.universalavionics.com

B. Software and Content Providers

Software/Content Provider	Website
Adobe	www.adobe.com
Advanced Data Research (ADR)	www.adrsoft.com
Airbus	www.airbus.com
Aero Data Solutions	www.aerodatasolutions.com
Aircraft Data Fusion	www.aircraftdatafusion.com
Aircraft Management Technologies (AMT)	www.airmantech.com
Astoria Software	www.astoriasoftware.com

Software/Content Provider	Website
Astronautics	www.astronautics.com
CMC Electronics	www.cmcelectronics.ca/
Control Vision	www.anywheremap.com www.pocketplates.com
Echo Flight	www.echoflight.com
Flight Explorer	www.flightexplorer.com
Hangar B-17	www.hangarb17.com
Honeywell	www.honeywell.com
ION Systems	www.ionsystems.com
Jeppesen	www.jeppesen.com
Lido	www.lhsystems.com/en/index.htm
Maestro Aviation Limited	www.maestro-aviation.com
On Board Data Systems	www.obds.com
RMS Technology	www.rmstek.com
Rockwell Collins	www.rockwellcollins.com
Sporty's PIlot Shop	www.sportys.com/pilotshop
Stenbock & Everson	www.flightprep.com
Teledyne Controls	www.teledynecontrols.com
Ultra-Nav	www.ultranav.com
WSI	www.wsi.com
WxWorx	www.wxworx.com
XMRadio	www.xmradio.com

C. Display Providers

Hardware Provider	Website
Astronautics	www.astronautics.com
CMC Electronics	www.cmcelectronics.ca
Hewlett-Packard	www.hp.com
navAero	www.navaero.com
Panasonic	www.panasonic.com
Paperless Cockpit	www.paperlesscockpit.com
Teledyne Controls	www.teledynecontrols.com