Electronic Flight Bag (EFB): 2010 Industry Survey

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Air Traffic Organization Operations Planning

Human Factors Research and Engineering Group

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13. ABSTRACT (Maximum 200 words)

This document provides an overview of Electronic Flight Bag (EFB) systems and capabilities, as of June 2010. This document updates and replaces the April 2007 EFB Industry Review (Yeh and Chandra, 2007). As with the previous industry survey, the focus is on the human systems interface. The information for this report was gathered through industry contacts, demonstrations, websites, brochures, and trade journal reports. This report was conducted in support of the Federal Aviation Administration (FAA), but the information is intended to be of use to anyone interested in EFBs.

The report contains four sections. The first provides an overview of the effort. The second contains tables summarizing the information collected from those manufacturers who provide an integrated EFB system solution. The third provides details for products and services offered by EFB *systems manufacturers*, i.e., those who develop physical EFB hardware and provide EFB software. The fourth contains detailed information for products offered by EFB *software manufacturers* who do not develop EFB hardware. *Software manufacturer*s were classified into two categories: those who offer an *integrated and customizable software* package that integrates several functions/applications and those who provide *commercial off-the-shelf software* that has not been integrated, customized, or tailored for a particular EFB. References to FAA EFB regulatory and guidance material and links to Flight Standardization Board (FSB) reports, which provide information regarding the operational suitability for particular EFB models, are also included.

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ENGLISH TO METRIC	METRIC TO ENGLISH
LENGTH (APPROXIMATE)	**LENGTH (APPROXIMATE)**
1 inch (in) = 2.5 centimeters (cm)	1 millimeter (mm) = 0.04 inch (in)
1 foot (ft) = 30 centimeters (cm)	1 centimeter (cm) = 0.4 inch (in)
1 yard (yd) = 0.9 meter (m)	1 meter (m) = 3.3 feet (ft)
1 mile (mi) = 1.6 kilometers (km)	1 meter (m) = 1.1 yards (yd)
	1 kilometer (km) = 0.6 mile (mi)
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1 square foot (sq ft, ft^2) = 0.09 square meter (m^2)	1 square meter (m^2) = 1.2 square yards (sq yd, yd^2)
1 square yard (sq yd, yd^2) = 0.8 square meter (m^2)	1 square kilometer (km^2) = 0.4 square mile (sq mi, mi^2)
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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1 short ton = 2,000 pounds (lb) = 0.9 tonne (t)	1 tonne (t) = 1,000 kilograms (kg) = 1.1 short tons
VOLUME (APPROXIMATE)	**VOLUME (APPROXIMATE)**
1 teaspoon (tsp) = 5 milliliters (ml)	1 milliliter (ml) = 0.03 fluid ounce (fl oz)
1 tablespoon (tbsp) = 15 milliliters (ml)	1 liter (l) = 2.1 pints (pt)
1 fluid ounce (fl oz) = 30 milliliters (ml)	1 liter (l) = 1.06 quarts (qt)
1 cup (c) = 0.24 liter (l)	1 liter (l) = 0.26 gallon (gal)
1 pint (pt) = 0.47 liter (l)	
1 quart (qt) = 0.96 liter (l)	
1 gallon (gal) = 3.8 liters (l)	
1 cubic foot (cu ft, ft^3) = 0.03 cubic meter (m^3)	1 cubic meter (m^3) = 36 cubic feet (cu ft, ft^3)
1 cubic yard (cu yd, yd^3) = 0.76 cubic meter (m^3)	1 cubic meter (m^3) = 1.3 cubic yards (cu yd, yd^3)
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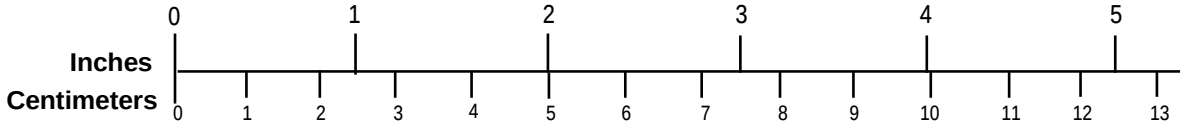
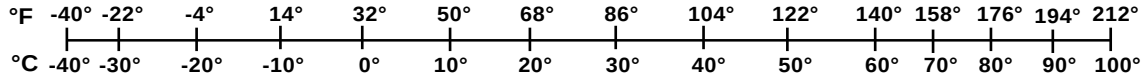


QUICK FAHRENHEIT - CELSIUS TEMPERATURE CONVERSIO



For more exact and or other conversion factors, see NIST Miscellaneous Publication 286, Units of Weights and Measures. Price $2.50 SD Catalog No. C13 10286 **Updated 6/17/98**

Preface

This paper was prepared by the Behavioral Safety Research and Demonstration Division of the Human Factors Research and System Applications Center of Innovation at the Volpe National Transportation Systems Center. It was completed with funding from the Federal Aviation Administration (FAA) Human Factors Research and Engineering Group (AJP-61) in support of the Aircraft Certification Service Avionic Systems Branch (AIR-130) and the Technical Programs and Continued Airworthiness Branch (AIR-120). We would like to thank our FAA program manager, Dr. Tom McCloy, as well as our technical sponsor Colleen Donovan for providing suggestions and feedback. We would also like to thank Caroline Donohoe for her help in developing the manufacturer tables. Many thanks to the many manufacturers who generously provided information for the industry survey. As with any system development, changes in the design occur frequently; as a result, this information is only accurate for a short period of time. For each product, the manufacturer's website is provided where more up to date information may be found.

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 Technology Administration, or the United States Department of Transportation.

Feedback on this document may be sent to Michelle Yeh (Michelle.Yeh@dot.gov). Further information on this research effort can be found at http://www.volpe.dot.gov/hf/aviation/efb/.

Table of Contents

Executive Summary

This report provides an overview of Electronic Flight Bag (EFB) systems and capabilities, capturing the state of the EFB industry as of June 2010. The industry review highlights aspects of the EFB user interface (e.g., display size, types of controls available, etc.). It is intended to be useful to anyone interested in the EFB market, including the Federal Aviation Administration (FAA), customers, operators, manufacturers, and researchers. This document updates and replaces the April 2007 Volpe Center EFB Industry Review (Yeh and Chandra, 2007).

The information for this report was gathered through industry contacts, demonstrations, websites, brochures, and trade journal reports. Manufacturers were classified into the following categories:

- *Systems manufacturers (EFB software and hardware)* were considered to be those manufacturers who develop physical EFB hardware and provide EFB software.
- *Software manufacturers (EFB software without hardware)* are those who focus on EFB software and do not develop EFB hardware. The software manufacturers were classified into two categories:
    1. Software manufacturers who provide an *integrated and customizable software* package provide a software package that integrates and manages functions or software from one or more software providers onto any EFB hardware.
    2. Software manufacturers who provide *commercial off-the-shelf software* only; that is, they provide isolated functions or applications that have not been integrated, customized, or tailored for a particular hardware platform.

This document contains four sections. Section 1 provides an overview of the survey effort. Section 2 contains tables summarizing the information collected from those involved with developing an integrated EFB systems solution (i.e., *systems manufacturers* and software manufacturers who provide an *integrated and customizable software* solution). Section 3 provides detailed information tables with descriptions of products offered by EFB *systems manufacturers*. For each manufacturer, a general picture of their product line is provided. Information on FAA approvals that have already been received or are in progress is also indicated. Section 4 provides information for products offered by *software manufacturers* who develop EFB software only but do not develop hardware. The fourth section is divided into two subsections. Section 4.1 provides information about manufacturers of *integrated and customizable software*. Section 4.2 lists manufacturers of *commercial off-the-shelf software*; details for individual commercial off-the-shelf software applications can be found on the manufacturers' website.

References to FAA regulatory and guidance material, EFB research documents, and Flight Standardization Board (FSB) reports, which provide information regarding the operational suitability of particular EFB models, are included at the end of this report. A full list of Volpe Center research reports and conference papers related to EFBs is also provided.

Acronyms

AC	Advisory Circular
ACARS	Airborne Communications Addressing and Reporting System
ACO	Aircraft Certification Office
ADIRU	Air Data Inertial Reference Unit
ADS-B	Automatic Dependent Surveillance-Broadcast
AEG	FAA Flight Standards Aircraft Evaluation Group
AMLCD	Active Matrix Liquid Crystal Display
CCD	Cursor Control Device
CCFL	Cold Cathode Fluorescent Lamp
CD	Compact Disk
CDL	Configuration Deviation Lists
CDTI	Cockpit Display of Traffic Information
CDMA	Code Division Multiple Access
CE	Conformité Européene (European Compliance)
COTS	Commercial off-the-shelf
CPDLC	Controller Pilot Data Link Communications
CPU	Central Processing Unit
CRJ	Canadair Regional Jet
DoD	Department of Defense
DVD	Digital Versatile Disk
DVI	Digital Visual Interface
EASA	European Aviation Safety Agency
EE	Electrical and Electronics
EFB	Electronic Flight Bag
EMI	Electromagnetic Interference
EVDO	Evolution-Data Optimized
EVS	Enhanced Vision System
eTAWS	Early Terrain Awareness Warning System
FAA	Federal Aviation Administration
FMS	Flight Management System
FSB	Flight Standardization Board
FSDO	Flight Standards District Office
GNSS	Global Navigation Satellite Systems
GPRS	General Packet Radio Services
GPS	Global Positioning System

GSM	Global Systems Mobile
GUI	Graphical User Interface
HD	High Definition
HITS	Highway-in-the-sky
HSDPA	High-Speed Downlink Packet Access
HTML	HyperText Markup Language
IFR	Instrument Flight Rules
IP	Internet Protocol
IR	Infrared
LAN	Local Area Network
LCD	Liquid Crystal Display
LED	Light-Emitting Diode
LRU	Line Replaceable Unit
LVDS	Low Voltage Differential Signaling
MEL	Minimum Equipment List
METAR	Aviation Routine Weather Report
MTBF	Mean Time Between Failures
NACO	National Aeronautical Charting Office
NEXRAD	Next Generation Radar
NOTAM	Notices to Airmen
NTSC	National Television System(s) Committee
OEM	Original Equipment Manufacturer
OIS	Onboard Information System
OS	Operating System
PAN	Personal Area Network
PC	Personal Computer
PCMCIA	Personal Computer Memory Card International Association
PDF	Portable Digital Format
QAR	Quick Access Recorder
RAM	Random Access Memory
RPU	Remote Processor Unit
SATCOM	Satellite Communications
SDK	Software Development Kit
SOP	Standard Operating Procedure
STC	Supplemental Type Certificate
SVGA	Super Video Graphics Adapter/Array
TAF	Terminal Aerodrome Forecast

TAWS	Terrain Awareness System
TC	Type Certificate
TCP/IP	Transmission Control Protocol Internet Protocol
TFR	Temporary Flight Restriction
TFT	Thin-Film Transistor (screens)
TPC	Topographic Production Capability
TSO	Technical Standard Order
TWLU	Terminal Wireless LAN Unit
UMTS	Universal Mobile Telecommunications System
US	United States
USB	Universal Serial Bus
VGA	Video Graphics Array
WAAS	Wide Area Augmentation System
WAC	World Aeronautical Chart
WiFi	Wireless Fidelity
WLAN	Wireless Local Area Network
WSVGA	Wide Super Video Graphics Adapter/Array
WWAN	Wireless Wide Area Network
WXGA	Wide Extended Graphics Adapter/Array
XGA	Extended Graphics Adapter/Array (1024x768 resolution)
XML	Extensible Markup Language

1 INTRODUCTION

Electronic Flight Bag (EFB) systems are offered for a wide range of operations to support many different capabilities. The Federal Aviation Administration (FAA) provides regulatory and guidance material for EFBs in two documents:

- Advisory Circular (AC) 120-76A, *Guidelines for the Certification, Airworthiness, and Operational Approval of Electronic Flight Bag Computing Devices,* and
- Order 8900.1, *Flight Standards Information Management System,* Electronic Flight Bag Operational Authorization Process (Volume 4, Chapter 15).

Additional guidance to streamline the approval process for using a surface moving map application on an EFB is provided in:

- Advisory Circular (AC) 20-159, *Obtaining Design and Production Approval of Airport Moving Map Display Applications Intended for Electronic Flight Bag Systems*;
- Technical Standard Order (TSO)-C165, *Electronic Map Display Equipment for Graphical Depiction of Aircraft Position*; and
- RTCA DO-257A, *Minimum Operational Performance Standards for the Depiction of Navigational Information on Electronic Maps*.

General display guidance is provided in AC 25-11A, *Electronic Flight Deck Displays*.

The Volpe Center has supported the FAA to understand the human factors issues in the design and evaluation of EFBs for almost a decade. As part of this support, the Volpe Center informs the FAA of industry trends through periodic industry surveys. This EFB industry survey provides an overview of current EFB systems, capturing the state of the EFB industry as of June 2010. This review is an update to three previous reviews (see Appendix A of Chandra, Yeh, Riley, and Mangold (2003), Yeh and Chandra (2005), Yeh and Chandra (2007)). This report is provided in support of the FAA, but the information in this report is intended to be of use to anyone interested in the EFB market.

Although all efforts were made to provide as comprehensive a survey as possible, there are other ongoing efforts that are not included. Some manufacturers declined to participate or did not respond to the invitation.

Manufacturers were classified into the following categories based on their offerings:

- *Systems manufacturers (EFB software and hardware)*, which are considered here to refer to those manufacturers who develop physical EFB hardware in addition to providing EFB software (18 manufacturers).
- *Software manufacturers (EFB software without hardware)* are those who focus on EFB software and do not develop EFB hardware. The software manufacturers were classified into two categories:
    1. *Software manufacturers: integrated and customizable software*. This group includes software manufacturers who provide an integrated and customizable software package. These manufacturers provide a custom software package that integrates and manages the various functions or applications from one or more software providers onto any EFB hardware. These manufacturers may not produce an EFB hardware device, but they can obtain one from a third party hardware provider, and customize the EFB device with a user interface that manages and integrates software from one or many manufacturers on the EFB (5 manufacturers).

2. *Software manufacturers: commercial off-the-shelf software*. This group includes software manufacturers who provide commercial off-the-shelf software only; that is, they provide isolated functions or applications that have not been integrated, customized, or tailored for a particular hardware platform.

A general picture of the product line offered by each participating *systems manufacturer* and software manufacturer with an *integrated and customizable EFB software* solution is provided. Particular focus is given to the EFB interface (e.g., display size, number and types of controls, available applications, etc.). Common software applications that may be hosted on the EFBs described are indicated. The software can either be created in house by the specific manufacturer or provided by a third party (or multiple third parties). Information on FAA approvals received or in progress is also included (e.g., TSOs). Detailed information is not available on the *commercial off-the-shelf software* manufacturers because that information was not readily available for those products due to the nature of the installations and approvals. That is, many of these products are not approved by the FAA because the FAA does not typically approve software-only systems. Instead, this report simply lists information regarding the types of commercial off-the-shelf software offered and compatibility with other operating systems.

Section 2 provides summary tables describing the findings for those involved with developing an EFB hardware product. Section 3 contains detailed information tables for EFB *systems manufacturers*. Section 4 provides a picture of EFB *software manufacturers*; Section 4.1 contains detailed information tables for software manufacturers with *integrated and customizable software* packages, and Section 4.2 provides a list of EFB software manufacturers who provide *commercial off-the-shelf software* products. Section 5 contains related references, including regulatory and guidance material, Flight Standardization Board (FSB) reports, and research documents. The regulatory and guidance material from the FAA are available under the Regulations and Policies section at www.faa.gov. A full list of FSB reports, which provide information regarding the operational suitability for particular EFB models, is available publicly at www.opspecs.com.

The Volpe Center website has a subsection dedicated to EFB research which can be found at www.volpe.dot.gov/hf/aviation/efb. The site contains research reports by the Volpe Center as well as a list of regulatory and guidance material and recent news articles relating to EFBs. Most notably, comprehensive human factors guidance for EFBs is provided in a Volpe Center report titled, *Human Factors Considerations in the Design and Evaluation of Electronic Flight Bags (EFBs), Version 2*, by Chandra, Yeh, Riley, and Mangold (2003). (An earlier version of this document was referenced in FAA AC 120-76A.) The report provides information on general EFB human factors considerations, with detailed information for four applications: Electronic Documents, Electronic Checklists, Flight Performance Calculations, and Electronic Charts. Also available are a set of tools developed by the Volpe Center to aid the FAA or industry evaluators to identify human factors issues with EFBs. Chandra and Yeh (2006) provide an overview of the tools and information on when and how each tool may be used. Abstracts for Volpe Center reports and conference papers are provided in Appendix A of this document.

2 EFB OVERVIEW

The Volpe Center worked with EFB *systems manufacturers* and EFB software manufacturers who provide an *integrated and customizable software* solution to collect detailed information about the integrated EFB solutions offered. The information consisted of a product overview, FAA approvals received or in progress, and a description of the hardware and/or software user interface. (As noted in the previous section, this detailed information was not collected for *commercial off-the-shelf EFB software*.)

The detailed information collected is summarized in the five tables listed below. Please note that these tables present only an overview of the systems' characteristics; detailed tables and images of the EFB hardware and/or software follow in Sections 3 (*systems manufacturers*) and 4.1 (*software manufacturers: integrated and customizable software*).

- Table 1 lists the EFB *systems manufacturers* who participated in this industry survey, their product(s), and a website where more information can be found.
- Table 2 lists EFB software manufacturers with an *integrated and customizable software* solution, their product(s), and website.
- Table 3 summarizes the approval(s) sought or compliance demonstrated by these manufacturers.
- Table 4 describes the hardware user interface offered.
- Table 5 provides a list of the software applications supported by each EFB *systems manufacturer* and EFB software manufacturer with an *integrated and customizable software* solution.

Table 1. Participating Systems Manufacturers (EFB Software and Hardware).

Manufacturer	Product(s)	Website
1. ADRF – Advanced Data Research Florida, Inc.	FG-1630, FG-7100, FG-7150, FG-8000	www.adrsoft.com
2. Airbus	FlySmart with Airbus EFB Class 2 and Class 3 for Type A/B applications	www.airbus.com/en
3. AirGator, Inc.	NAVPad 8X, NAVPad 10X, NAVPad 7X, NAVPad 5X and Fujitsu P1630 Convertible notebook/tablet	www.airgator.com
4. Astronautics	Single and Dual Processor Electronic Flight Display systems	www.astronautics.com
5. The Boeing Company	The Boeing EFB solution (Class 1, Class 2, and Class 3)	www.boeing.com
6. CMC Electronics	PilotView CMA-1100 MkII, PilotView CMA-1100 MkIIE, PilotView CMA-1100, PilotView CMA-1410	www.cmcelectronics.ca
7. DAC International	Class 3 GEN-X EFB	www.dacint.com
8. FlightPrep, Stenbock and Everson, Inc.	ChartBook™, ChartKey™ USB EFB, ChartCase Professional™ Software	www.flightprep.com
9. Goodrich Sensors and Integrated Systems	Traditional Electronic Flight Bag, Laptop Docking Station Electronic Flight Bag, SmartDisplay™ Electronic Flight Bag	www.goodrich.com
10. IMS Flight Deck (IMS)	SkyTab 1100, SkyTab 1500, SkyTab 1350, SkyTab 2350, SkyTab 3200C, SkyTab 3200, SkyTab 4200	www.imsco-us.com
11. Innovative Solutions & Support (IS&S)	IS&S CockpitIP™ Glass Cockpit Display Systems with Integrated Class 3 EFB Options	www.innovative-ss.com

Table 1. Participating Systems Manufacturers (EFB Software and Hardware). (continued)

Manufacturer	Product(s)	Website
12. L-3 Communications	CrewMate™ 104, CrewMate™ 840	www.l-3com.com
13. navAero, Inc.	t•Pad™ 1500, t•Pad™ 2000, t•Pad™ 800, 3G UMTS/HSDPA Communications Module, and Aircraft Interface Device	www.navaero.com
14. SAT-WAY sa	EFB Class 1 – EFB Class 2, CSU (router), and CCU (airborne server)	www.sat-way.com
15. TECNOLOGIA GPS	4PilotPro® Class 2 EFB	www.4pilotpro.com
16. Teledyne Controls	Class 3 EFB, Airbus Class 3 Onboard Information Terminal (OIT), Teledyne EFB Software Suite	www.teledyne-controls.com
17. Universal Avionics	Application Server Unit (ASU) / Displays on Universal Cockpit Display Terminal (UCDT-III) or EFI-890R	www.uasc.com
18. Virtual Papyrus[1]	ANKH main computing platform with multiple CPUs, RAH T1X, and RAH T3X	www.virtualpapyrus.com

Table 2. Participating Software Manufacturers (EFB Software without Hardware): Integrated and Customizable Software.

Manufacturer	Product(s)	Website
1. Aircraft Management Technologies	Flightman ™	www.flightman.com
2. ARINC	AeroConnx EFB Solutions, ARINC EFB Content Delivery Management System, AeroSync Communication Services, ARINC GateFusion Gatelink Services	www.arinc.com
3. Jeppesen	Jeppesen FLITEDECK Pro, Jeppesen Applications for Boeing EFB, Jeppesen Applications for Airbus EFB	www.jeppesen.com
4. Lufthansa Systems	Lido/Flight Bag, Lido/eRouteManual, Lido/Performance Tools, eLoadsheet	www.lhsystems.com
5. OBDS.com (On-Board Data Systems)	MFB™ (Multi-Function Flight-Deck Browser), Electronic Checklists (ECL), Fleet and Aircraft Content Management and Distribution Systems	www.obds.com

[1] Input provided is current as of March 2007.

Table 3. Summary of approval/compliance for manufacturers.

This table summarizes the approval sought or compliance demonstrated for each EFB *systems manufacturer* and EFB software manufacturer with *integrated and customizable* s*oftware*. The table highlights the following:

- *Manufacturer*
- *EFB*: Class 1, 2, or 3
- *Authority* providing the approval: FAA, EASA, Other
- *Approval/compliance*, e.g., ACs, TC, STC. If the approval/compliance is a TC or STC, then the aircraft for which the approval/compliance was obtained is listed. Eight documents related to the EFB hardware or software are specifically listed in the table.
  - TSO-C113, *Airborne Multipurpose Electronic Displays*, issued on October 27, 1986.
  - TSO-C165, *Electronic Map Display Equipment for Graphical Depiction of Aircraft Position*, issued on September 30, 2003.
  - AC 20-159, *Obtaining Design and Production Approval of Airport Moving Map Display Applications Intended for Electronic Flight Bag Systems*, issued on April 30, 2007.
  - AC 120-76A, *Guidelines for the Certification, Airworthiness, and Operational Approval of Electronic Flight Bag Computing Devices*, issued on March 17, 2003.
  - Order 8900.1, *Flight Standards Information Management System*, Electronic Flight Bag Operational Authorization Process (Volume 4, Chapter 15).
  - RTCA DO-160, *Environmental Conditions and Test Procedures for Airborne Equipment*. The version number is listed in the cell. RTCA DO-160F is the most recent update to this environmental qualifications document. Class 1 and 2 systems do not require compliance with RTCA DO-160E according to FAA Advisory Circular (AC) 120-76A.
  - RTCA DO-178B, *Software Considerations in Airborne Systems and Equipment Certification*. The software level(s) is listed in the cell.
  - RTCA DO-254, *Design Assurance Guidance for Airborne Electronic Hardware*.

  The status of the approval or compliance is indicated using two symbols: a filled circle (●) indicates that the approval or compliance has been received, whereas an open circle (○) indicates that the manufacturer is in the process of seeking approval or demonstrating compliance. Empty cells indicate no approval or compliance.

	Manufacturer	EFB			Authority			Approval/Compliance											
								TSO											
		Class 1	Class 2	Class 3	FAA	EASA	Other	C113	C165	AC 20-159	AC 120-76A	TC	STC	Aircraft	Order 8900.1	RTCA DO-160 (Version)	RTCA DO-178B (Software Level(s))	RCTA DO-254	Other
Systems Manufacturers	ADRF - Advanced Data Research Florida, Inc.												●	Boeing 747-400, Embraer ERJ-135, and Challenger 601/604; STC Effort on Citation 550/560					
	FG-1630	●			●						●		●						
	FG-7100	●	●		●						●		○						
	FG-7150	●	●		●						●		○						
	FG-8000			●	●						●		○	Pending for various Bombardier aircraft		E			

	Manufacturer	EFB			Authority			Approval/Compliance										
		Class 1	Class 2	Class 3	FAA	EASA	Other	TSO C113	TSO C165	AC 20-159	AC 120-76A	TC	STC	Aircraft	Order 8900.1	RTCA DO-160 (Version)	RTCA DO-178B (Software Level(s))	RCTA DO-254	Other
Systems Manufacturers	Airbus																		
	FlySmart with Airbus Class 2 for Type A/B Applications		●		○	●						●		A318, A319, A320, A321		E			
	FlySmart with Airbus Class 3 for Type A/B Applications			●	○	●						●		A330, A340		E			
	AirGator, Inc. NAVPad X family	●	●		●						●					F			Some NAVPad units have undergone DoD testing and certification
	Astronautics													Boeing commercial and military aircraft					
	Single Processor Electronic Flight Display System		●	●	●	●			●	●	●	●	●	747-400 (certified); 737 and A320 (in process)	●	F	C, D, E - Depends on OS; Linux is level C	C, D - Latest version of both systems is Level C	
	Dual Processor Electronic Flight Display System			●	●	●			●	●	●	●	●	Production aircrafts 777/767/757/737/747-400/747-8/BBJ. Standard on B787; B767	●	D			

	Manufacturer	EFB			Authority			Approval/Compliance										
		Class 1	Class 2	Class 3	FAA	EASA	Other	TSO C113	TSO C165	AC 20-159	AC 120-76A	TC	STC	Aircraft	Order 8900.1	RTCA DO-160 (Version)	RTCA DO-178B (Software Level(s))	RCTA DO-254	Other
Systems Manufacturers	The Boeing Company																		
	Boeing Class 1 EFB	●			●	●					●								
	Boeing Class 2 EFB		●		●	●					●	●	●	737NG (1Q2011)					
	Boeing Class 3 EFB			●	●	●	●				●	●	●	777, 787, 747-8, 737NG, 747-400, 757, 767			C		
	CMC Electronics PilotView series		●	●	●	●			●	●	●	●	●	Over 25 STCs on aircraft (Gulfstream GV, GIV, Bombardier Global Express/XRS, and others). PilotView is standard OEM Class 2 EFB at Dassault and ATR; selected for the Bombardier Global platform, E-170/190, CRJ700/900/1000, Next-Generation B737, and BBJ. See CMC entry for more details.		E		●		
	DAC International Class 3 GEN-X EFB		●	●	●					●	●		●	CRJ – 200, 700, 900 (all types); DC-8 (in progress); B727 (in progress); B757/767; L328; EMB-170 (Class 2 STC)	○	E	C		

	Manufacturer	EFB			Authority			Approval/Compliance										
		Class 1	Class 2	Class 3	FAA	EASA	Other	TSO C113	TSO C165	AC 20-159	AC 120-76A	TC	STC	Aircraft	Order 8900.1	RTCA DO-160 (Version)	RTCA DO-178B (Software Level(s))	RCTA DO-254	Other
Systems Manufacturers	FlightPrep, Stenbock and Everson, Inc. ChartBook™ ChartKey™ USB EFB ChartCase Professional™ Software	●	●		●						●				●				
	Goodrich Sensors and Integrated Systems																		
	Traditional Electronic Flight Bag		●		●	●	GCAA - Dubai	●			●	●	●	Boeing 737NG; Bombardier Global Express, Global 5000, Global XRS; Bombardier Challenger 605 (in progress); Sukhoi Superjet (OEM Option)		E			TSO – C179, *Rechargeable Lithium Cells and Lithium Batteries,* Approved for Lithium Ion Battery
	Laptop Docking Station Electronic Flight Bag		●		●	●	GCAA - Dubai	●			●	●	●	Airbus A320, A330, A340; Boeing 737CL, 747-400, 777; Bombardier CRJ 700/900; MD-11; Embraer 190 (via SB and OEM option)		E			TSO – C179, *Rechargeable Lithium Cells and Lithium Batteries,* Approved for Lithium Ion Battery
	SmartDisplay™ Electronic Flight Bag		●	●	●	●	GCAA - Dubai	●			●	●	●	Airbus A320, A330 w/ADS-B (in progress); Boeing 737-NG (in progress) Bombardier Dash8 (in progress)		E			TSO – C179, *Rechargeable Lithium Cells and Lithium Batteries,* Approved for Lithium Ion Battery

	Manufacturer	EFB			Authority			Approval/Compliance										
		Class 1	Class 2	Class 3	FAA	EASA	Other	TSO C113	TSO C165	AC 20-159	AC 120-76A	TC	STC	Aircraft	Order 8900.1	RTCA DO-160 (Version)	RTCA DO-178B (Software Level(s))	RCTA DO-254	Other
Systems Manufacturers	IMS Flight Deck (IMS) SkyTab series (Information provided for Class 2 installations)	●	●	○	●	●					●		●	Dash-8 Q400, CRJ 700, B767, B747,B737, MD11, DC10, AVRO RJ(EASA)		D			
	Innovative Solutions and Support (IS&S) IS&S CockpitIP™ Glass Cockpit Display Systems with Integrated Class 3 EFB Options			●	●			●	●		●		●	Pilatus PC-12, Cessna Citation, Eclipse 500		E	C	A	
	L-3 Communications																		
	CrewMate™104		●		●	○		○	○		●		●	Various Large Transports (planned)		F (In progress)	E		
	CrewMate™ 840		●		●	○		○	○		●		●	Various Business Jets (In progress)		F (In progress)	E		

	Manufacturer	EFB			Authority			Approval/Compliance										
		Class 1	Class 2	Class 3	FAA	EASA	Other	TSO C113	TSO C165	AC 20-159	AC 120-76A	TC	STC	Aircraft	Order 8900.1	RTCA DO-160 (Version)	RTCA DO-178B (Software Level(s))	RCTA DO-254	Other
Systems Manufacturers	navAero, Inc. t•Pad™ 1500, t•Pad™ 2000, t•Pad™ 800, and Aircraft Interface Device		●		●	●	ANAC			●	●		●	FAA Issued: B727-100/100C/200/200F; B737-600/700/800/900; B747-100/200/300/400; B757-200/300; B767-200/400; MD-10/MD-11; MD -80 Series; A319/320/321/200/300/600 EASA Issued: B737-NG; MD-80 Series; A319/320/321; B757-200/300	●	D, E			
	SAT-WAY sa EFB Class 1, EFB Class 2, CSU (router), CCU (airborne server)	●	●		●	●							○	Cessna fleet Citation and Mustang, Bombardier Global Express, Embraer Phenon, Airbus A319 to A340, B737, Fokker 50 and 100		F			
	TECNOLOGIA GPS 4PilotPro® Class 2 EFB		●				Approval in process by Brazilian Aviation National Agency												

	Manufacturer	EFB			Authority			Approval/Compliance										
		Class 1	Class 2	Class 3	FAA	EASA	Other	TSO C113	TSO C165	AC 20-159	AC 120-76A	TC	STC	Aircraft	Order 8900.1	RTCA DO-160 (Version)	RTCA DO-178B (Software Level(s))	RCTA DO-254	Other
Systems Manufacturers	Teledyne Controls Class 3 EFB, Airbus Class 3 OIT			●	●	●						●	●	TC: A330/ A340 (Class 3 OIT) STC: Class 3 currently on B737NG aircraft in progress		E			
	Universal Avionics ASU/Displays on UCDT-III or EFI-890R			●	●	●		●	●				●	Falcon 10, 20, and 50, King Air 200/300350, Pilatus PC-12, Boeing Business Jet and 737-300/400, Bombardier's Lear 25, Challenger and Global Express, Dassault Falcon 2000, Gulfstream G500, and Cessna Citation Bravo		D, E	C		TSO-C113 and TSO-C165 for internally-developed electronic approach charts.
	Virtual Papyrus ANKH main computing platform		●		●						●					E (in progress)			

	Manufacturer	EFB			Authority			Approval/Compliance											
		Class 1	Class 2	Class 3	FAA	EASA	Other	TSO C113	TSO C165	AC 20-159	AC 120-76A	TC	STC	Aircraft	Order 8900.1	RTCA DO-160 (Version)	RTCA DO-178B (Software Level(s))	RCTA DO-254	Other
Software Manufacturers: Integrated and Customizable Software	Aircraft Management Technologies Flightman™	●	●	●	●	●					●						D		Other applicable regulations and industry standards (e.g., AC 120-78, SAE AS9100)
	ARINC AeroConnx EFB Solutions	●	●	●	●		●				●		●	B727, A320, B777		○			
	Jeppesen Jeppesen FLITEDECK Pro	●	●	●	●	●	●		●	●	●	●	●	Currently in operation on a number of aircraft models	●		D		
	Lufthansa Systems Lido/FlightBag	●	●	●	●														eRouteManual ops approved by FAA for some US operations
	OBDS.com (On-Board Data Systems) MFB™, ECL, and Fleet and Aircraft Content Management and Distribution Systems	●	●																Checklist application features "tagged" procedures and revision management per AC120-64.

Table 4. Summary of EFB systems characteristics.

This table summarizes some key characteristics of EFBs for each *systems manufacturer* and software manufacturer with an *integrated and customizable software* solution who participated in this review. The columns provide the following:

- *Manufacturer*
- *EFB type*, i.e., whether the EFB is portable or installed
- *Mounting Device*, which describes the different mounting/installation options
- *Aircraft Connectivity*, i.e., whether and/or how the EFB communicates with the aircraft (e.g., ACARS, FMS, etc.)
- the *Power Source* for the EFB
- the *Battery Type*, if there is a battery

In the table, a checkmark (✓) indicates that the manufacturer provides an EFB with that option and an open circle (○) indicates that the manufacturer is in the process of developing this capability. Empty cells indicate that the manufacturer does not provide this capability. Rows for software manufacturers with an *integrated and customizable software* solution were included, although some of the categories were not applicable to these manufacturers; in these cases, "N/A" is used.

	Manufacturer	EFB Type		Mounting Device						Aircraft Connectivity				Power Source				Battery Type					
		Portable	Installed	Articulating Arm	Yoke	Cradle	Kneeboard	Not Attached	Other	Transmit and Receive	Receive Only	Transmit Only	Other	Aircraft Power Only	Internal Battery Only	Aircraft Power and Internal Battery	Other	Lithium Ion	Lithium Polymer	Lithium Metal	Nickel Metal	Other	N/A
Systems Manufacturers	ADRF - Advanced Data Research Florida, Inc.	✓	✓	✓	✓	✓	✓	✓			✓					✓		✓					
	Airbus	✓	✓						✓		✓		✓	✓			✓					✓	✓
	AirGator, Inc.	✓		✓	✓	✓	✓		✓		✓	✓			✓	✓	✓	✓					
	Astronautics		✓	✓					✓	✓				✓									✓
	The Boeing Company	✓	✓			✓		✓	✓	✓	✓	✓		✓	✓	✓		✓					✓
	CMC Electronics	✓	✓	✓	✓				✓	✓	✓	✓		✓	✓	✓		✓					
	DAC International		✓	✓					✓	○	✓					✓					✓		
	FlightPrep, Stenbock and Everson, Inc.	✓			✓	✓	✓		✓							✓		✓					
	Goodrich Sensors and Integrated Systems	✓	✓	✓							✓			✓				✓					
	IMS Flight Deck (IMS)	✓	✓	✓	✓		✓	✓			✓					✓		✓				✓	
	Innovative Solutions and Support (IS&S)		✓						✓		✓			✓									✓
	L-3 Communications	✓		✓		✓					✓					✓			✓				
	navAero, Inc.		✓	✓		✓	✓		✓	✓	✓	✓				✓		✓			✓		

	Manufacturer	EFB Type		Mounting Device						Aircraft Connectivity				Power Source				Battery Type					
		Portable	Installed	Articulating Arm	Yoke	Cradle	Kneeboard	Not Attached	Other	Transmit and Receive	Receive Only	Transmit Only	Other	Aircraft Power Only	Internal Battery Only	Aircraft Power and Internal Battery	Other	Lithium Ion	Lithium Polymer	Lithium Metal	Nickel Metal	Other	N/A
Systems Manufacturers	SAT-WAY sa	✓	✓	✓		✓					✓					✓		✓		✓			
	TECNOLOGIA GPS	✓					✓				✓			✓									✓
	Teledyne Controls		✓	✓					✓		✓			✓					✓				
	Universal Avionics		✓		✓				✓		✓		✓	✓									✓
	Virtual Papyrus				✓				✓	Not provided				Not provided				Not provided					
Software Manufacturers: Integrated and Customizable Software	Aircraft Management Technologies	✓	✓	N/A							✓			N/A				N/A					
	ARINC	✓	✓	N/A						✓	✓			N/A				N/A					
	Jeppesen	✓	✓	N/A							✓			N/A				N/A					
	Lufthansa Systems	✓	✓	N/A							✓			N/A				N/A					
	OBDS.com (On-Board Data Systems)	✓		N/A										N/A				N/A					

Table 5. Software overview.

Table 5 provides an overview of the operating systems (OS) used and the types of applications offered and supported by each *systems manufacturer* and EFB software manufacturer with an *integrated and customizable software* solution. Note that some of these manufacturers may develop their own custom applications whereas others may offer third-party software. Software manufacturers who develop only *commercial off-the-shelf software* are listed in Section 4.2. In the table, a checkmark (✓) is used to indicate that a manufacturer supports the use of the application, whereas empty cells indicate that the manufacturer does not support the application.

	Manufacturer	Operating System			Applications Supported																	
		Microsoft Windows	Linux	Custom	Data Link	Electronic Charts	Electronic Checklists	Electronic Documents	Enhanced Vision	Flight Performance Calculations	Flight Planning	GPS/Navigation Display	Logbook	Moving Map	Surface Moving Map	Synthetic Vision	Terrain Display	Traffic Surveillance	Video Surveillance	Voice Data Communications	Weather	Other
Systems Manufacturers	ADRF - Advanced Data Research Florida, Inc.	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓
	Airbus	✓		✓		✓	✓	✓		✓	✓		✓	✓	✓				✓		✓	✓
	AirGator, Inc.	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓
	Astronautics	✓	✓		✓	✓	✓	✓		✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
	The Boeing Company	✓	✓		✓	✓		✓		✓	✓		✓	✓	✓				✓			
	CMC Electronics	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
	DAC International	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓		✓				✓		✓	✓
	FlightPrep, Stenbock and Everson, Inc.	✓				✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓			✓	✓
	Goodrich Sensors and Integrated Systems	✓		✓		✓	✓	✓	✓	✓	✓		✓	✓	✓			✓	✓		✓	
	IMS Flight Deck (IMS)	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
	Innovative Solutions and Support (IS&S)			✓		✓	✓		✓	✓		✓		✓	✓		✓	✓	✓		✓	
	L-3 Communications	✓			✓	✓	✓	✓		✓	✓	✓	✓	✓	✓				✓		✓	
	navAero, Inc.	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	

	Manufacturer	Operating System			Applications Supported																	
		Microsoft Windows	Linux	Custom	Data Link	Electronic Charts	Electronic Checklists	Electronic Documents	Enhanced Vision	Flight Performance Calculations	Flight Planning	GPS/Navigation Display	Logbook	Moving Map	Surface Moving Map	Synthetic Vision	Terrain Display	Traffic Surveillance	Video Surveillance	Voice Data Communications	Weather	Other
Systems Manufacturers	SAT-WAY sa	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	
	TECNOLOGIA GPS	✓				✓	✓			✓	✓	✓		✓	✓	✓	✓				✓	✓
	Teledyne Controls	✓				✓		✓		✓										✓	✓	✓
	Universal Avionics	✓				✓	✓	✓	✓					✓	✓				✓		✓	✓
	Virtual Papyrus	✓				✓	✓	✓		✓	✓		✓						✓		✓	
Software Manufacturers: Integrated and Customizable Software	Aircraft Management Technologies	✓	✓			✓	✓	✓		✓	✓		✓						✓		✓	✓
	ARINC	✓	✓		✓	✓	✓	✓		✓			✓	✓	✓					✓	✓	✓
	Jeppesen	✓	✓			✓	✓	✓		✓	✓			✓	✓				✓		✓	✓
	Lufthansa Systems	✓	✓	✓	✓	✓		✓		✓	✓		✓	✓	✓				✓		✓	✓
	OBDS.com (On-Board Data Systems)	✓				✓	✓	✓		✓	✓								✓		✓	✓

3 SYSTEMS MANUFACTURERS (EFB SOFTWARE AND HARDWARE)

Eighteen *systems manufacturers* participated in this industry survey. The following information was gathered:

- Product(s)
- Website(s) where more information can be found
- A brief overview of the product(s), with images
- A list of approvals received or in progress. The authority issuing the approval (i.e., FAA, EASA, or other) and the type of approval/compliance received (e.g., AC, TC, STC) are noted. Two Technical Standard Orders (TSO) are listed:
  - TSO-C113, *Airborne Multipurpose Electronic Displays*, issued on October 27, 1986.
  - TSO-C165, *Electronic Map Display Equipment for Graphical Depiction of Aircraft Position*, issued on September 30, 2003.

  Three FAA guidance documents are specifically identified:
  - AC 20-159, *Obtaining Design and Production Approval of Airport Moving Map Display Applications Intended for Electronic Flight Bag Systems*, issued on April 30, 2007
  - AC 120-76A, *Guidelines for the Certification, Airworthiness, and Operational Approval of Electronic Flight Bag Computing Devices*, issued on March 17, 2003
  - Order 8900.1, *Flight Standards Information Management System*, Electronic Flight Bag Operational Authorization Process (Volume 4, Chapter 15)

  Additionally, compliance with the following industry documents is also indicated:
  - RTCA DO-160, *Environmental Conditions and Test Procedures for Airborne Equipment*. The version number is listed.
  - RTCA DO-178B, *Software Considerations in Airborne Systems and Equipment Certification*. The software level(s) is listed in the cell.
  - RTCA DO-254, *Design Assurance Guidance for Airborne Electronic Hardware*
- The intended hardware class (i.e., Class 1, 2 or 3 system)
- Description of the hardware user interface. Specifically, the type of EFB system (i.e., portable or installed), the mounting and/or stowage options, hardware style, display size, any special brightness characteristics of the display, communications capabilities, and type of controls. Specific control types are identified, e.g., touch screen, stylus, buttons, mouse/cursor control, and/or keyboard. For EFBs with touch screens, the technology used is also noted because it affects the type of interaction. A *resistive* display is composed of several layers of electrically conductive material, and an "input" occurs when enough pressure is applied so that the layers connect with each other to complete a circuit. A *conductive* display is coated using transparent conductive material, and an "input" requires a measurable change in capacitance (e.g., skin contact). An *infrared* display has beams that run across the active surface of the display, so an input is registered when an input device disrupts the beams.
- Whether the EFB talks to other EFBs or aircraft system and how (e.g., push/pull functionality, data bus, aircraft connectivity, etc.)
- The power source for the EFB and battery type
- Accessories that could facilitate use of the EFB
- Applications supported. *Systems manufacturers* were asked to indicate the operating system and identify which software applications were supported. For each software application, *systems manufacturers* noted whether the software is developed in-house or is a third-party application.

ADRF – Advanced Data Research Florida, Inc.	**Location**: Rochester Hills, MI & Boynton Beach, FL
Product(s)	Electronic Flight Bags FG-1630, FG-7100, FG-7150, FG-8000
Website(s)	• www.adrsoft.com • Product Information: FG-1630, FG-7100, FG-7150, FG-8000
Product Overview	
The FG-Series EFB systems are comprised of commercial-off-the-shelf (Fujitsu) touch-screen computers, customized for use in unique aviation environmental conditions. In particular, most displays have been specially enhanced to improve screen readability in sunlight, and most all of our EFBs offer a "night flight" dimming feature that allows the brightness of the screen to be adjusted to levels that will not compromise night vision. The FG-8000 remote screen is a custom designed product with extensive RTCA DO-160E testing used as both a Class 2 and 3 device. The FG-Series EFB systems are compatible with Jeppesen's family of products.	
 FG-7100  FG-7150  FG-8000 *Photos courtesy of Advanced Data Research Florida, Inc.*	
Approvals/Compliance	
Authority	☒ FAA ☐ EASA ☐ Other
TC/STC	☐ TC ☒ STC
Aircraft	• FG-3600: STC for Boeing 747-400 (Los Angeles ACO) • FG-5000 and FG-6000: STC's for Embraer ERJ-135(Airplane Certification Office (Ft. Worth)), Challenger 601/604 (Chicago ACO) • FG-7000T: STC Effort on Citation 550/560, Project Number ST-85895SC-T (Airplane Certification Office (Ft. Worth)) • FG-8000: STC Pending for various Bombardier aircraft (Chicago ACO) • FG-7100: STC's Pending • FG-7150: STC's Intended
TSO	☐ C113 ☐ C165
FAA Regulatory and Guidance Material	☐ AC 20-159 ☒ AC120-76A ☐ Order 8900.1
Industry Documents	☒ RTCA DO-160 (Version E for FG-8000) ☐ RTCA DO-178B (Software Level ____) ☐ RTCA DO-254 (Level ____)

ADRF – Advanced Data Research Florida, Inc.	**Location**: Rochester Hills, MI & Boynton Beach, FL
Other Notes	• FG-6000: Decompression • FG-7000: EMI, Decompression (STC Effort on Citation 550/560, Project Number ST-85895SC-T) • FG-7100: EMI, Decompression • FG-7150: EMI, Decompression Pending
Hardware	
Hardware Class(es)	☒ 1 (FG-1630, FG-7100, FG-7150) ☒ 2 (FG-7100, FG-7150) ☒ 3 (FG-8000)
Type of EFB system	☒ Portable (FG-1630, FG-7100, FG-7150) ☒ Installed (FG-8000)
Mounting Device	☒ Articulating Arm (FG-1630, FG-7100, FG-7150, FG-8000) ☒ Yoke (FG-8000) ☒ Cradle (FG-1630, FG-7100, FG-7150) ☒ Kneeboard (FG-1630, FG-7100, FG-7150) ☒ Not Attached ☐ Other *Other Notes:* The FG-1630, FG-7100 and FG-7150 can all be used as Portable Electronic Devices (PEDs). Both certified and non-certified mounting options are available.
Stowage	Operator defined
Hardware Style	• FG-1630: Convertible Laptop computer (Fujitsu) • FG-7100: Custom Convertible Laptop computer (Fujitsu) with Enhanced Screen Dimming and ADRF Flight Command Software. • FG-7150: Custom Convertible Laptop computer (Fujitsu) with LED Enhanced High Bright Screen, Enhanced Screen Dimming and ADRF Flight Command Software. • FG-8000: Custom designed Remote Display, RTCA DO-160 (Version E) tested units for Class 2 and 3 systems
Display Size	• FG-1630: 8.9”, 1280 x 768 WXGA LED backlit LCD display • FG-7100: 8.9”, 1280 x 768 WXGA LED backlit LCD display • FG-7150: Custom High Bright 8.9” , 1280 x 768 WXGA LED backlit LCD display • FG-8000: 8.4” , 800 x 600 SVGA, High Bright backlit and polarized active matrix
Brightness	• FG-1630: Base commercial off the shelf computer • FG-7100: Day or night readability; greater variation in dimming for easier transition from twilight to night flying • FG-7150: Greater than 800 nit screen enhancement for daylight readability; greater variation in dimming for easier transition from twilight to night flying • FG-8000: Day or night readability; greater than 500 nit screen enhancement, full brightness to approx. 1 nit fully dimmed; greater variation in dimming for easier transition from twilight to night flying

ADRF – Advanced Data Research Florida, Inc.	**Location**: Rochester Hills, MI & Boynton Beach, FL
Communications	☐ None ☒ Wired (USB, PCMCIA serial) ☒ Wireless (BT, 802.11) ☐ Other *Other Notes:* • FG-1630: V.90 phone modem and 10/100 Base-T/TX Ethernet; 802.11 A/B/G/Draft-N and Bluetooth, 2 USB 2.0, 1 PCMCIA • FG-7100: V.90 phone modem and 10/100 Base-T/TX Ethernet; 802.11 A/B/G/Draft-N and Bluetooth, 2 USB 2.0, 1 PCMCIA • FG-7150: V.90 phone modem and 10/100 Base-T/TX Ethernet; 802.11 A/B/G/Draft-N and Bluetooth, 2 USB 2.0, 1 PCMCIA • FG-8000: Remote Display only, processor driven
Controls	☒ Touch Screen ☒ Resistive ☐ Conductive ☐ Infrared ☒ Stylus (Passive or inactive – Stowed inside computer or in case, can be tethered) ☒ Buttons (Vary by system. Some have membrane buttons for numeric keypad, zoom functionality, and 4-button cursor control. FG-8000 accepts input from membrane input keys. Software switches only on Fujitsu-based products. FCS shell provides ability to program buttons on main menu.) ☒ Mouse/cursor control ☒ Keyboard (On laptop/slate tablet systems) ☐ Other
Push/Pull Functionality	COTS Device with Windows XP Tablet PC capability
Data Bus	☒ ARINC 429 ☐ ARINC 828 ☒ USB ☒ LAN ☒ Other (Serial via PCMCIA, USB)
Aircraft Connectivity	☐ Transmit and Receive: Aircraft to EFB and EFB to aircraft ☒ Receive: Aircraft to EFB only (FMS to EFB via 429 to RS-232 Converter) ☐ Transmit: EFB to aircraft only ☐ Other
Power Source	☐ Aircraft power (no battery) ☐ Internal battery only (self-powered) ☒ Aircraft power and internal battery
Battery Type	☒ Lithium ion (FG-1630; FG-7100, FG-7150) ☐ Lithium polymer ☐ Lithium metal (non-rechargeable) ☐ Nickel metal ☐ Other ☐ N/A
Accessories	Weather Hardware/Software solutions (both certified and portable non-certified); mounting solutions (both certified and non-certified); power solutions (both certified and non-certified); wireless solution; USB & Bluetooth GPS receivers; carrying cases including kneeboard version; docking station; dual serial PCMCIA card; USB keyboards; serial adapter; 429 to serial (RS-232) converter; USB composite video adapter; power adapter; battery/battery charger; extra stylus; screen protectors

ADRF – Advanced Data Research Florida, Inc.	**Location**: Rochester Hills, MI & Boynton Beach, FL
Operating System	☒ Microsoft Windows (Version: 2000 or XP Tablet PC) ☐ Linux ☒ Custom (Flight Command System (FCS) Software Interface) *Other Notes:* • FG-1630: Windows XP® Tablet PC edition operating system (867 MHz Intel Pentium III processor (256 MB memory w/512 MB optional and 80GB RAM) • FG-7100: Windows XP® Tablet PC edition operating system [Fujitsu LifeBook® w/1.2GHz Core Duo ULV processor (1GB memory w/2Gb optional) and 80 GB hard drive (120GB and 64GB solid-state drive optional)] • FG-7150: Windows XP® Tablet PC edition operating system [Fujitsu LifeBook® w/1.2GHz Core Duo ULV processor (1GB memory w/2Gb optional) and 80 GB hard drive (120GB and 64GB solid-state drive optional)] • FG-8000: Windows 2000® operating system

Applications Supported

All FG-Series Electronic Flight bags support Windows-based third party applications. ADR's specialty is integrating our aviation grade hardware with multiple applications ensuring reliable communication and functionality between each application.

☒ **Data Link** – ADRF WxLink powered by Avidyne for World Wide Datalink Weather

☒ **Electronic Charts** – ☐ Raster or ☐ Vector-based
Compatible with all Electronic Chart providers including Jeppesen

☒ **Electronic Checklists** – ☐ Viewer only, ☒ Error checking, ☐ Automated error-checking, ☐ Active checklist
ADRF Electronic Checklist included on FG-7100, FG-7150. Includes Checklist Editor allowing custom checklist creation. Compatible with most Electronic Checklist providers.

☒ **Electronic Documents** – ☒ Viewer only, ☐ Viewer with additional features, ☐ Mark-up language
ADRF Electronic Document Viewer included on FG-7100, FG-7150

☒ **Enhanced Vision** – Greater than 800 NITs Available on the FG-7150

☒ **Flight Performance Calculations** – ☐ Weight & Balance, ☐ Takeoff/Landing Performance, ☐ Other
Compatible with most Flight Performance Calculation providers.

☒ **Flight Planning** – Available via Windows-based third party applications

☒ **GPS/Navigation Display** – GPS capable for Charts and Weather via USB, BT or serial via PCMCIA

☒ **Logbook** – ADRF Pilot Log application included on FG-7100, FG-7150

☒ **Moving Map** – Available via Jeppesen software and other Windows-based 3d party applications

☒ **Surface Moving Map** – Available via Windows-based third party applications

☒ **Synthetic Vision** – Available via Windows-based third party applications

☒ **Terrain Display** – Available via Windows-based third party applications

☐ **Traffic Surveillance** – ☐ Merging/Spacing

☐ **Video Surveillance**

☒ **Voice Data Communications** – Available via ADR WxLink Avidyne World Wide Datalink Weather

☒ **Weather** – Compatible with certified weather – ADR WxLink Avidyne World Wide Datalink Weather, WSI, XM and also compatible with XM's portable non-certified weather

☒ **Other** – Notetaker (Application for taking notes), Checklist Editor, Start Menu Editor (allows custom button assignment on start menu), Utilities Button, Electronic Help Files

Airbus	**Location:** Toulouse, France
Product(s)	FlySmart with Airbus EFB Class 2 for Type A/B applications FlySmart with Airbus EFB Class 3 for Type A/B applications
Website(s)	• http://www.airbus.com/en

Product Overview

The Airbus EFB Class 2 solution is based on two displays located on the sliding window and linked to two docking stations installed next to the lateral stowage behind the First Officer seat. The two Docking Stations are connected together via Ethernet link (network exchange) and video link (video exchange). The airline can select off-the-shelf processing unit (laptop) complying with Docking Stations requirement (e.g., size).

The Airbus Class 3 EFB solution is based on two displays, which are called the Onboard Information Terminal (OIT) displays. Each is located on a sliding tablet and linked to two computer processing units (CPUs) installed on the aircraft floor. The two CPUs are connected together via Ethernet link (network exchange) and video link (video exchange). The CPUs are avionics certified computers that can be connected to Airbus Aircraft Network and communications devices.

Several functions, such as video exchanges and cross check, are included to allow airlines to go up to no-paper operations. The Airbus EFB supports both Airbus Type A and B applications as well as third party (Type A) applications. Airline-specific Type A applications can be integrated into the main menu.

FlySmart with Airbus Class 2 EFB

FlySmart with Airbus Class 3 EFB

Photos courtesy of Airbus

Airbus	**Location:** Toulouse, France
Approvals/Compliance	
Authority	☒ FAA (ongoing, 2010) ☒ EASA ☐ Other
TC/STC	☒ TC ☐ STC
Aircraft	• Class 2: A318, A319, A320, A321 • Class 3: A330, A340
TSO	☐ C113 ☐ C165
FAA Regulatory and Guidance Material	☐ AC 20-159 ☐ AC120-76A ☐ Order 8900.1
Industry Documents	☒ RTCA DO-160 (Version E) ☐ RTCA DO-178B (Software Level ____) ☐ RTCA DO-254 (Level ____)
Other Notes	N/A
Hardware	
Hardware Class(es)	☐ 1 ☒ 2 ☒ 3
Type of EFB	☒ Portable (COTS laptop for Class 2) ☒ Installed (Docking station and display for Class 2 and fully installed Class 3)
Mounting Device	☐ Articulating Arm ☐ Yoke ☐ Cradle ☐ Kneeboard ☐ Not Attached ☒ Other • Class 2: On the sliding window • Class 3: Fully installed
Stowage	Class 2: • EFB displays on Single Aisle family (A318/319/320/321) are installed on sliding window • Docking stations are installed next to lateral stowage behind First Officer seat Class 3: • OIT displays on long range family (A330/340) are installed on the sliding tablet • CPUs are installed on the avionics compartment
Hardware Style	Class 2: • Rockwell Collins provides EFB displays and Docking Stations • EFB Displays and Docking stations are linked with video buses and Ethernet links • Docking Stations and EFB Displays offer USB ports • EFB Displays offers video inputs spare Class 3: • Teledyne provides OIT displays and CPUs. OIT and CPUs are linked with video buses (Ethernet or optical fibers) • CPUs can be connected to four different video inputs • OIT CPUs offer USB and Ethernet ports
Display Size	12” diagonal, 1024 x 768
Brightness	Certified for night conditions (<0.7 nits) as well as in sunny conditions

Airbus	**Location:** Toulouse, France
Communications	☐ None ☒ Wired (See below) ☒ Wireless (See below) ☐ Other *Other Notes:* • Airbus Class 3 EFB is part of the Airbus Aircraft Network. It is linked to the Aircraft Server in order to access: - Communications on ground, thanks to 801.11 b/g and Global Packet Radio Services (GPRS)/Universal Mobile Telecommunications System (UMTS) transmitter - Communications in flight thanks to the High Speed SATCOM • Airbus Class 3 EFB can be connected to other specific communication devices by using USB and/or Ethernet plugs • Airbus Class 2 EFB can be connected to other specific communication devices by using USB port)
Controls	☒ Touch Screen ☒ Resistive ☐ Conductive ☐ Infrared ☐ Stylus ☒ Buttons • Class 2 EFB: 5 hard buttons (Bezel), no interaction with applications • Class 3 EFB: 11 hard buttons (Bezel), no interaction with applications ☐ Mouse/cursor control ☒ Keyboard (USB, COTS, removable) ☒ Other (USB, Ethernet plugs) • OIT displays are controlled with touch-screen and/or removable keyboard (stored in pilot lateral console when not used) • All Airbus applications are designed for touch-screen • OIT hardware interface buttons on display allow: - Mouse/cursor control - Video left/right side exchanges - CPU left/right selection - Brightness manual control - Reset • EFB displays are controlled with touch screen - Video left/right side exchanges - Brightness manual control - Reset • USB ports are available on displays and on right lateral side of the cockpit • Ethernet plugs are available on left/right lateral sides
Push/Pull Functionality	• View of side • Control of side • Electronic Flight Folder's data synchronization
Data Bus	☒ ARINC 429 ☐ ARINC 828 ☒ USB ☒ LAN ☐ Other

Airbus	**Location:** Toulouse, France
Aircraft Connectivity	☐ Transmit and Receive: Aircraft to EFB and EFB to aircraft ☒ Receive only: Aircraft to EFB only ☐ Transmit only: EFB to aircraft only ☒ Other (Two way connection with communication means)
Power Source	☒ Aircraft power (no battery) ☐ Internal battery only (self-powered) ☐ Aircraft power and internal battery ☒ Other (Laptop battery for Class 2)
Battery Type	☐ Lithium ion ☐ Lithium polymer ☐ Lithium metal (non-rechargeable) ☐ Nickel metal ☒ Other (Class 2 battery type will depend on laptop specifications) ☒ N/A
Accessories	All software can be installed on laptop for Class1 use
Operating System	☒ Microsoft Windows (Version: XP) ☐ Linux ☒ Custom (Class 2 may depend on laptop specifications)

Applications Supported

☐ **Data Link**

☒ **Electronic Charts** – ☐ Raster or ☒ Vector-based

Application provided by 3rd party partners and integrated by Airbus.

☒ **Electronic Checklists** – ☐ Viewer only, ☐ Error checking, ☐ Automated error-checking, ☐ Active checklist

Provided by Airbus flight deck displays (not needed)

☒ **Electronic Documents** – ☐ Viewer only, ☒ Viewer with additional features, ☒ Mark-up language

Supported in HTML and XML format. Flight briefing document allow pilots to load free format text or pictures, update these documents during flight, and download after flight using a USB key.

Airbus XML browser allows hyperlinks between Airbus Flight Operations documentation, and data sharing with Airbus performance's applications.

This applications is also available for Class 1

☐ **Enhanced Vision**

☒ **Flight Performance Calculations** – ☒ Weight & Balance, ☒ Takeoff/Landing Performance, ☒ Other

These applications can be used on all Fly-by-Wire aircraft families (A320 family & A340 family).

Additionally, Airbus provides an "In Flight" performance applications allowing various flight phases calculations (e.g., planning, fuel, time, etc.). Those applications are also available for Class 1 and for all Airbus fleet.

☒ **Flight Planning** – Flight briefing documents folder (free text /picture format) and communication manager

☐ **GPS/Navigation Display**

☒ **Logbook** – Available from Q2 2011

☒ **Moving Map** – En Route charting applications from 3rd party partners and integrated by Airbus are available

☒ **Surface Moving Map** – Third party airport moving maps can be hosted

☐ **Synthetic Vision**

☐ **Terrain Display**

☐ **Traffic Surveillance** – ☐ Merging/Spacing

☒ **Video Surveillance** – Optional

☐ **Voice Data Communications**

☒ **Weather** – Under study

Airbus	**Location:** Toulouse, France

☒ **Other**

- Technical and Cabin Logbook, with Connection to Airbus Aircraft Network for electronic maintenance operations are under development
- Electronic Flight Folder application
- Maintenance and Cabin applications are also available through the Airbus airborne platform
- Dedicated Airbus ground tools are provided to ensure a proper management of EFB data and software applications update
- Integration by Airbus of 3rd party applications

AirGator, Inc.	**Location**: Mount Kisco, NY
Product(s)	NAVPad 8X EFB NAVPad 10X EFB NAVPad7X EFB NAVPad 5X EFB Fujitsu P1630 Convertible notebook/tablet
Website(s)	• www.airgator.com • Product Information: Solid State EFBs, Hard Drive EFBs
Product Overview	
AirGator's NAVPad X are purpose-built fully integrated Electronic Flight Bags designed for aviation use. NAVPads use high capacity industrial-grade Solid-State-Disk storage or optional G-Shock-protected HDs. Touch screen, sunlight-visible displays can be adjusted from high-brightness to full night-mode dimming through bezel buttons. NAVPads work with some Night-Vision-Goggles. With full DO-160F Decompression and other testing, numerous NAVPads are used as Class 1 & 2 EFBs and for varied military mission-specific requirements. The NAVPad X EFB family runs standard Windows and Linux software including Jeppesen FliteDeck, AirGator's NAVAirEFB and Approaches3D, flight & mission planning, performance & W&B calculators, logbooks, Safety Management Systems, special mission applications, FalconView and similar software.	
  *Photos courtesy of AirGator*	
Approvals/Compliance	
Authority	☒ FAA ☐ EASA ☐ Other
TC/STC	☐ TC ☐ STC
Aircraft	N/A
TSO	☐ C113 ☐ C165
FAA Regulatory and Guidance Material	☐ AC 20-159 ☒ AC120-76A ☐ Order 8900.1
Industry Documents	☒ RTCA DO-160 (Version F) ☐ RTCA DO-178B (Software Level ____) ☐ RTCA DO-254 (Level ____)
Other Notes	Some NAVPad units have undergone DoD testing and certification

AirGator, Inc.	**Location**: Mount Kisco, NY
Hardware	
Hardware Class(es)	☒ 1 ☒ 2 ☐ 3
Type of EFB system	☒ Portable ☐ Installed
Mounting Device	☒ Articulating Arm ☒ Yoke ☒ Cradle ☒ Kneeboard ☐ Not Attached ☒ Other *Other Notes:* Can be mounted on side or center console
Stowage	Units can be stowed in flight bags, seat pockets or custom carriers at operator's discretion
Hardware Style	Solid-state disk Tablet PC
Display Size	• NAVPad 8X: 8.4" Hi-Brite Thin Film Transistor (TFT) LCD; 800x600 (SVGA) • NAVPad 10X: 10.4" TFT LCD; 1024x768 (XGA) • NAVPad 5X: 4.8" TFT LCD; 1024 x 600 (WSVGA) • NAVPad7X: 7" 800 x 480 or 1024 x 600 (WSVGA) • Fujitsu FG1630: 8.4" TFT; 1280x768 (WXGA)
Brightness	All units feature daylight readable touch screens, dimmable for night flying • NAVPad: Outdoor sunlight readable dimmable to 0 nits in 3% steps. Low-gloss, low-glare enhanced visibility display. • NAVPad X Family: Brightness range 500 – 0 nits
Communications	☐ None ☒ Wired (Ethernet) ☒ Wireless (IEEE 802.11 WLAN, Bluetooth 2.0, Mini card WLAN (802.11 b/g), Wireless Wide Area Network (WWAN) available) ☒ Other (Available without any wireless radios for military and classified applications)
Controls	☒ Touch Screen (Lightweight finger – under 2lbs) ☒ Resistive ☐ Conductive ☐ Infrared ☒ Stylus (Tethered stylus stowed in the EFB body) ☒ Buttons (Systems generally have 4 - 7 hard keys, 5-way navigation button and power button. Also hardware buttons for brightness/dimming, screen rotation and onscreen keyboard control.) ☐ Mouse/cursor control ☒ Keyboard (Wireless or USB, available as accessory) ☐ Other
Push/Pull Functionality	All NAVPad X EFBs are capable of bi-directional information exchange over wired, wireless, terrestrial and satellite data links
Data Bus	☒ ARINC 429 (Optional adapter) ☐ ARINC 828 ☒ USB ☒ LAN ☒ Other (Bluetooth)
Aircraft Connectivity	☐ Transmit and Receive: Aircraft to EFB and EFB to aircraft ☒ Receive only: Aircraft to EFB only (Via any RS232 & ARINC 429) ☒ Transmit only: EFB to aircraft only (For special mission aircraft only) ☐ Other

AirGator, Inc.	**Location**: Mount Kisco, NY
Power Source	☐ Aircraft power (no battery) ☒ Internal battery only (self-powered) ☒ Aircraft power and internal battery ☒ Other (Extended capacity and hot-swap batteries) *Other Notes:* Native 12V DC (direct current) power input with 28V DC and AC (alternating current) options.
Battery Type	☒ Lithium ion ☐ Lithium polymer ☐ Lithium metal (non-rechargeable) ☐ Nickel metal ☐ Other ☐ N/A
Accessories	GPS units, satellite weather receivers, memory upgrades, antennas, USB CD/DVD drive, weather receivers, power supplies, extra stylus, screen protectors. Various interfaces to onboard and offboard devices such as Enhanced Visual System (EVS) or Infrared (IR) video, radar, avionics and engine monitoring, satellite data link, etc.
Operating System	☒ Microsoft Windows (Version: XP Tablet, Professional, Embedded Editions) ☒ Linux ☐ Custom

Applications Supported

☒ **Data Link** – Various data link sources. Customized solutions per requirements.

☒ **Electronic Charts** – ☒ Raster or ☒ Vector-based

FAA, Jeppesen, customer-supplied, other

☒ **Electronic Checklists** – ☒ Viewer only, ☒ Error checking, ☐ Automated error-checking, ☒ Active checklist

Standard off-the-shelf or custom-requirement solutions

☒ **Electronic Documents** – ☐ Viewer only, ☒ Viewer with additional features, ☒ Mark-up language

Document viewer and note taking capability including onscreen clearance writer and scratchpad. Ability to mark and electronically sign forms, charts, reports, manifests, etc.

☒ **Enhanced Vision** – Standard video input.

☒ **Flight Performance Calculations** – ☒ Weight & Balance, ☒ Takeoff/Landing Performance, ☒ Other

Standard off-the-shelf or custom-requirement solutions

☒ **Flight Planning** – Integrates with or directly runs most flight planning packages as well as run military and special mission-planning packages

☒ **GPS/Navigation Display –** Utilizing FAA, Jeppesen and/or customer provided data sets

☒ **Logbook** – Standard off-the-shelf or custom-requirement solutions

☒ **Moving Map** – NAVAirEFB works with FAA, Digital Aeronautical Flight Information File (DAFIF), and customer supplied aeronautical and terrestrial data sets. Jeppesen FliteDeck and other commercial, special-mission and customer-specific compatible packages are available

☒ **Surface Moving Map** – Geo-referenced raster or vector Airport Moving Map Display.

☐ **Synthetic Vision** – Planned first quarter 2010

☒ **Terrain Display** – Terrain depiction and terrain warning with commercial or proprietary data sets

☐ **Traffic Surveillance** – ☐ Merging/Spacing

☒ **Video Surveillance** – Standard video input, full onscreen/touchscreen camera control

☒ **Voice Data Communications** – Integrates with various SATPHONE and land-base solutions

☒ **Weather** – NAVAirEFB XM WX and WSI/Sirius viewer with moving map. Support for customer-specified weather data. Compatible with other viewers.

☒ **Other** – Standard Operating Procedures (SOPs), squawk lists, communications and dispatch, email, other

Astronautics	**Location:** Milwaukee, WI
Product(s)	Single and Dual Processor Electronic Flight Display systems
Website(s)	• www.astronautics.com • Product Information: Single and Dual Processor Electronic Flight Bag Displays
Product Overview	
The Astronautics Flight Displays are avionic quality displays with adaptable hardware and software configuration. These systems consist of two displays, installed on either side of each pilot's seat. Single- or dual-processor options are available. In the dual-processor design, one processor is configured to run the Linux operating system and the other Microsoft Windows, allowing certified and non-certified applications to be isolated. The single-processor design can be configured to support either a combination of certified and uncertified applications (simultaneously) or uncertified applications only. The hardware is compliant with RTCA DO-160 for use in all phases of flight, and is backed by Astronautics worldwide support organization.	
 *Photo courtesy of Astronautics.*	
Approvals/Compliance	
Authority	☒ FAA ☒ EASA ☐ Other
TC/STC	☒ TC ☒ STC
Aircraft	Boeing commercial and military aircraft: • Dual processor system - Fully certified by Boeing for production aircrafts 777/767/757/737/747-400/747-8/BBJ. Standard on Boeing 787 - Certified by Astronautics on Boeing 767 aircraft • The Single processor system is certified on the 747-400 and is in the process of certifying the system for the 737 and A320 aircraft
TSO	☐ C113 ☒ C165
FAA Regulatory and Guidance Material	☒ AC 20-159 ☒ AC120-76A ☒ Order 8900.1
Industry Documents	☒ RTCA DO-160 (Version D for Dual processor and Version F for Single processor) ☒ RTCA DO-178B (Software Levels C,D,E) – Depends on OS; Linux is level C ☒ RTCA DO-254 (Level C/D) – Latest version of both system is Level C

Astronautics	**Location:** Milwaukee, WI
Other Notes	• Certified (Linux) or Uncertified (Windows) operating systems can be hosted on the Single processor system (Class 2/3 EFB) • Astronautics has obtained TSO-C165 in accordance with AC 20-159 for Astronautics' Universal Cockpit Display of Traffic Information (airport surface surveillance Application). The application can be hosted on any manufacturer's Class 2/3 EFBs.
Hardware	
Hardware Class(es)	☐ 1 ☒ 2 (Single processor system) ☒ 3 (Dual and single processor systems)
Type of EFB system	☐ Portable ☒ Installed
Mounting Device	☒ Articulating Arm (Single processor system) ☐ Yoke ☐ Cradle ☐ Kneeboard ☐ Not Attached ☒ Other (Dual and single processor systems can be installed in a fixed side panel)
Stowage	N/A
Hardware Style	Two avionic quality display units and dual electronic units with single or dual processors, solid state memory or dual hard drives (Pentium and I7 processor). • The dual processor units are connected by a fiber optic cable, and can be 100 feet apart. The Electronic Units are installed in the Electronics and Equipment (EE) bay. • The single processor Electronic Unit can be installed in any area within 15 to 50 feet of the Display Unit.
Display Size	• Length of display diagonal: 10.4" or 12.1" • Resolution: 1024 x 768 (XGA)
Brightness	High-contrast display with LED backlighting with a wide range of brightness from sunlight readable to dark flight deck operations. Further, the luminescence is compatible with other equipment in the flight deck.
Communications	☐ None ☒ Wired • Dual processor supports Ethernet 10/100Base-T, ARINC-429, video, ground/open outputs/inputs, PS/2 connection (for keyboard and CCD), USB connection for maintenance • Single Processor supports 4 Ethernet 10/100 Base-T, 8 ARINC 429 receive and 4 ARINC 429 transmit, ARINC 717 receive channel, video, ground/open outputs/inputs, RS 422, external keyboard, 3 USB connections with one USB port available on the display, and the option of supporting MIL-STD-1553 ☒ Wireless (Prefer connecting to external wireless unit) ☐ Other *Other Notes:* Astronautics Class 3 systems can support two way communications with on-board sensors

Astronautics	**Location:** Milwaukee, WI
Controls	☒ Touch Screen ☒ Resistive ☐ Conductive ☐ Infrared ☐ Stylus ☒ Buttons (16 programmable bezel soft keys, 12 dedicated function keys, brightness increase/decrease key, and power control) ☒ Mouse/cursor control (CCD on Dual Processor) ☒ Keyboard (Virtual keyboard and on-display cursor capability; Can support an external keyboard.) ☐ Other
Push/Pull Functionality	Systems operate independently but provide cross talk capability enabling each crewmember to view the others data and to support the cross loading of databases and information
Data Bus	☒ ARINC 429 ☒ ARINC 828 (Flight systems do not require an ARINC 828 AID box) ☒ USB ☒ LAN ☐ Other
Aircraft Connectivity	☒ Transmit and Receive: Aircraft to EFB and EFB to aircraft – Connectivity is not restricted; systems can interface to any on-board sensor, e.g., ACARS, GPS, FMS, Printer, ADS-B, Terminal Wireless LAN Unit (TWLU), etc. when installed as a Class 3. ☐ Receive only: Aircraft to EFB only ☐ Transmit only: EFB to aircraft only ☐ Other *Other Notes:* The systems utilize the interfaces described in communication section to interface with the on-board sensors, and TWLU.
Power Source	☒ Aircraft power (no battery) – Dual/single processor system ☐ Internal battery only (self-powered) ☐ Aircraft power and internal battery
Battery Type	☐ Lithium ion ☐ Lithium polymer ☐ Lithium metal (non-rechargeable) ☐ Nickel metal ☐ Other ☒ N/A (no battery)
Accessories	None
Operating System	☒ Microsoft Windows (Version: XPe) ☒ Linux ☐ Custom *Other Notes:* • Astronautics offers an open architecture certified Linux Operating System, and a Windows Operating System on the Dual Processor system. The Single Processor system has either an open architecture certified Linux Operating System, or an open architecture Windows Operating System. • Dual processor has two independent processor/ hard drives. One hosts Linux for certified (Type C) applications, second hosts Windows XP for uncertified applications. Dual hard drives provide 160 GB of mass storage. • Single processor has a single I7 processor with 4GB of RAM and 1066 MHz front side bus/ 64 GB solid state memory hosting the certified Linux operating system (OS) and has the option of a Windows OS. • The Single processor system is an open architecture systems that can host any application selected by the operator, and supports the customer developing/customizing their own applications.

Astronautics	**Location:** Milwaukee, WI

Applications Supported

Astronautics single processor being an open architecture system can support any 3rd party application.

☒ **Data Link** – CPDLC, SATCOM, GateLink, Link 16, etc

☒ **Electronic Charts** – ☐ Raster or ☐ Vector-based

Provided by 3rd party

☒ **Electronic Checklists** – ☐ Viewer only, ☐ Error checking, ☐ Automated error-checking, ☐ Active checklist

Provided by 3rd party

☒ **Electronic Documents** – ☐ Viewer only, ☐ Viewer with additional features, ☐ Mark-up language

Provided by 3rd party

☐ **Enhanced Vision**

☒ **Flight Performance Calculations** – ☒ Weight & Balance, ☒ Takeoff/Landing Performance, ☒ Other

Provided by 3rd party

☐ **Flight Planning**

☒ **GPS/Navigation Display** – With certified software only

☒ **Logbook** – Provided by 3rd party

☒ **Moving Map** – Provided by 3rd party

☒ **Surface Moving Map** – Have CDTI and UCDTI application that are described above

Astronautics developed the Universal Cockpit Display of Traffic Information application that is compliant with TSO C-165 and in accordance with AC 20-159. It is hosted on a Windows operating system in any Class 2 or 3 system.

☐ **Synthetic Vision**

☒ **Terrain Display** – Terrain avoidance, early Terrain Awareness Warning System (eTAWS)

☒ **Traffic Surveillance** – ☒ Merging/Spacing

Astronautics developed the Linux DO-178 Level C Cockpit Display of Traffic Information application that is certified on UPS 757/767 aircraft supporting merging and spacing, constant decent approach, and displaying own ship position on the airport surface and other traffic that is equipped with ADS-B.

Astronautics provides Type C certified application for ADS-B as well as the ACSS SafeRoute program that provides sequence & merging of traffic, in-trail procedures, and surface surveillance.

☒ **Video Surveillance** – Provided by 3rd party

☒ **Voice Data Communications** – Single processor qualified by to support ACARS

☒ **Weather** – Provided by 3rd party

☒ **Other** – Runway incursion prevention, countermeasure display, FLIP charts, Falcon View, maintenance, Combat Track II, and others.

The Boeing Company	**Location:** Chicago, IL
Product(s)	Boeing Class 1 EFB, Class 2 EFB and Class 3 EFB
Website(s)	• www.boeing.com • Product Information: www.boeing.com/commercial/flightops/efb.html

Product Overview

Boeing is leveraging its Class 3 EFB experience to provide airlines with a Class 2 EFB with functionality similar to the fully integrated Class 3 and which can be installed in production or retrofit. Boeing's Class 1 and 2 EFBs provide a common look and feel to the Class 3 EFB. All use the same application software packages, common ground support and administration software. This commonality allows customers to utilize the same EFB infrastructure and processes when deploying mixed-class EFBs across the fleet. The Boeing EFB system creates a link between the airplane and the airline enterprise which is intended to allow airlines to realize cost savings.

Installed Class 3 EFB

Class 1 EFB

Installed Class 2 EFB

Photos courtesy of The Boeing Company

Approvals/Compliance

Authority	☒ FAA ☒ EASA ☒ Other • The Boeing Class 3 EFB has been evaluated by the FAA and EASA and they have approved the system for operations. The Class 3 EFB has also been approved by the following authorities: • Civil Aviation Administration of China • Civil Aviation Authority of New Zealand • Civil Aviation Authority (Qatar) • Civil Aviation Authority of Singapore • Directorate General Civil Aviation (India) • General Civil Aviation Authority of the United Arab Emirates • Japanese Civil Aviation Bureau • Pakistan Civil Aviation Authority • Secretaría de Comunicaciones y Transportes (SCT) - Mexico • Taiwan Civil Aeronautics Administration • Transport Canada

The Boeing Company	**Location:** Chicago, IL
TC/STC	☒ TC ☒ STC
Aircraft	• Class 2 (STC): 737NG (1Q2011) • Class 3 (TC): 777, 787, 747-8, 737NG, 747-400, 757, 767
TSO	☐ C113 ☐ C165
FAA Regulatory and Guidance Material	☐ AC 20-159 ☒ AC120-76A ☐ Order 8900.1
Industry Documents	☐ RTCA DO-160 (Version ____) ☒ RTCA DO-178B (Software Level C – Class 3 only) ☐ RTCA DO-254 (Level ____)
Other Notes	N/A
Hardware	
Hardware Class(es)	☒ 1 ☒ 2 ☒ 3
Type of EFB	☒ Portable ☒ Installed
Mounting Device	☐ Articulating Arm ☐ Yoke ☒ Cradle (Class 2) ☐ Kneeboard ☒ Not Attached (Class 1 is not attached) ☒ Other (Class 3 is installed into sidewall)
Stowage	Boeing does not provide a dedicated area to stow the Class 1 device. The operator is responsible for finding a suitable place for stowing the device during critical phases of flight and while not in use.
Hardware Style	• Class 1 – Can be any laptop or tablet PC running the Windows OS and meeting Boeing minimum hardware and software requirements • Class 2 – Modified COTS hardware • Class 3 – Custom built hardware
Display Size	Class 1, 2, and 3 – 10.4 inch diagonal display. Our software requires a minimum resolution of 728x1024 pixels.
Brightness	• Class 1 – This is dependent on the hardware the operator chooses • Class 2 and Class 3 – Dedicated bezel keys to dim and brighten the display. The Boeing Class 3 EFB is integrated with the master dim dial in the flight deck.
Communications	☐ None ☒ Wired ☒ Wireless (Wireless LAN (TWLU), SATCOM) ☒ Other (ACARS) *Other Notes:* • Class 1 – An operator can download EFB data using a wireless and wired connection. • Class 2 – Cellular wireless technology and ACARS. In the future Boeing will support 802.11x protocols and other in air broadband (IP) capabilities. • Class 3 – Boeing supports 802.11 (TWLU), ACARS and High speed SATCOM.
Controls	☒ Touch Screen ☒ Resistive ☐ Conductive ☐ Infrared ☐ Stylus ☒ Buttons ☒ Mouse/cursor control

The Boeing Company	**Location:** Chicago, IL
	☒ Keyboard ☐ Other *Other Notes:* • Boeing Class 2 and Class 3 solutions feature resistive touchscreens that do not require the use of an active stylus. • The Class 2 has 9 hard keys and 6 soft keys available for the pilot to use. The applications accept input from both hard keys and soft keys consistently. • The Class 3 has 28 hard keys that outline the display the unit. The vertically aligned buttons provide an alternative method for selecting buttons displayed. The horizontal aligned buttons allow pilots to interact with the applications (i.e., zoom in and out, page up and down and back).
Push/Pull Functionality	• The Boeing Class 2 and 3 solutions have the capability for the user of the EFB to view the other EFB's screen. • Additionally, the EFB's are networked, enabling applications to share data.
Data Bus	☒ ARINC 429 ☐ ARINC 828 ☒ USB ☒ LAN ☐ Other *Other Notes:* The Boeing Class 2 and Class 3 solutions interface with the ARINC 429 buses on the airplane. Also, the Class 2 and Class 3s are networked together via a LAN. Specific to Boeing Class 2, the electronic display unit interfaces with the aircraft interface unit through a USB cable. Additionally on the Class 2 there are two USB ports for plugging in peripheral devices like keyboards and mice.
Aircraft Connectivity	☒ Transmit and Receive: Aircraft to EFB and EFB to aircraft (On the 787 the Class 3 EFB can send data to the FMC) ☒ Receive only: Aircraft to EFB only (Boeing Class 2 and Class 3 solutions can receive data from ADIRU-ADR, ADIRU-IR, Multi-mode Receivers (MMR)/GPS Sensor Unit, FMC and Common Display System (CDS)-Display Electronic Units (DEU)) ☒ Transmit only: EFB to aircraft only (The Class 2 and Class 3 solutions can transmit data to an ACARS unit.) ☐ Other
Power Source	☒ Aircraft power (no battery) – Class 3 solution is powered by aircraft power and does not contain an internal battery. ☒ Internal battery only (self-powered) – Class 1 EFB ☒ Aircraft power and internal battery – Boeing Class 2 solution contains a battery but is also powered by non-shedable aircraft power. ☐ Other
Battery Type	☒ Lithium ion (Class 2 only) Please note: The Class 2 contains a lithium ion battery; however it is not essential to its operation. The battery has been tested in accordance with the latest FAA Lithium Ion Battery guidance ☐ Lithium polymer ☐ Lithium metal (non-rechargeable) ☐ Nickel metal ☐ Other ☒ N/A (Class 3 does not contain an internal battery)
Accessories	• The Boeing solution includes operational approval support, training materials and maintenance documentation to help the operator incorporate EFBs into their operations. • Additional items Boeing sells include training tools that help pilots and maintenance crew learn the EFB.

The Boeing Company	**Location:** Chicago, IL
Operating System	☒ Microsoft Windows (Version: 2000, XP, XPe) ☒ Linux ☐ Custom
Applications Supported	
☒ **Data Link** ☒ **Electronic Charts** – ☒ Raster or ☐ Vector-based ☐ **Electronic Checklists** – ☐ Viewer only, ☐ Error checking, ☐ Automated error-checking, ☐ Active checklist ☒ **Electronic Documents** – ☐ Viewer only, ☒ Viewer with additional features, ☒ Mark-up language Support pdf, html and xml documents, search, bookmark, content filtering ☐ **Enhanced Vision** ☒ **Flight Performance Calculations** – ☒ Weight & Balance, ☒ Takeoff/Landing Performance, ☐ Other Includes accountability for MEL/CDL, NOTAM, airline policies such as V1, engine thrust, etc. ☒ **Flight Planning** – Includes Flight Plan, Weather, Fuel & Weights, NOTAMS, etc. automated collection of waypoint data. Consumes ARINC 633 Supplement 1 formatted data. Customer can tailor interface. ☐ **GPS/Navigation Display** ☒ **Logbook** – Can be integrated with an airline's Maintenance Resource Planning system ☒ **Moving Map** ☒ **Surface Moving Map** ☐ **Synthetic Vision** ☐ **Terrain Display** ☐ **Traffic Surveillance** – ☐ Merging/Spacing ☒ **Video Surveillance** ☐ **Voice Data Communications** ☐ **Weather** ☐ **Other**	

CMC Electronics, Inc.	**Location:** Montreal, Quebec
Product(s)	PilotView CMA-1100 MkII PilotView CMA-1100 MkIIE PilotView CMA-1100 PilotView CMA-1410
Website(s)	• www.cmcelectronics.ca • Product Information: PilotView
Product Overview	
The PilotView® EFB is an avionics grade Class 2 Commercial-Off-The-Shelf (COTS) EFB system specifically designed for flight deck environments to bring up-to-date Information Technology-related advantages to the pilot. The PilotView® system consists of two (2) Line Replaceable Units (LRUs): a lightweight, compact and self-contained Electronic Display Unit (EDU), and an Enhanced Expansion Module Unit (EEMU). With the PilotView CMA-1100 and CMA-1410 EFBs, CMC provides features such as high-resolution, fully dimmable display, integrated communication capabilities and RTCA DO-160E qualification. CMC's PilotView EFB is intended to improve productivity by enabling pre-flight planning and efficient access to up-to-date aircraft documentation, checklists and flight planning information. PilotView is intended to increase situational awareness in-flight with en-route, approach charts, moving map display and graphical real time weather information.	
 PilotView CMA-1100 (8.4")and CMA-1410 (10.4") Products *Photos courtesy of CMC Electronics, Inc.*	
Approvals/Compliance	
Authority	☒ FAA ☒ EASA ☐ Other
TC/STC	☒ TC ☒ STC
Aircraft	Over 25 STCs are available for the PilotView EFB on aircraft ranging from the Gulfstream GV and GIV to the Bombardier Global Express/XRS. PilotView is the standard OEM Class 2 EFB option at Dassault and ATR, and has been selected by Rockwell Collins for the Bombardier Global platform, by Embraer for the E-170/190 program, by Bombardier for the CRJ700/900/1000 and by Boeing for the Next-Generation B737 and BBJ aircraft.
TSO	☐ C113 ☒ C165
FAA Regulatory and Guidance Material	☒ AC 20-159 ☒ AC120-76A ☐ Order 8900.1

CMC Electronics, Inc.	**Location:** Montreal, Quebec
Industry Documents	☒ RTCA DO-160 (Version E) ☐ RTCA DO-178B (Software Level ____) ☒ RTCA DO-254 (Level ____)
Other Notes	N/A
Hardware	
Hardware Class(es)	☐ 1 ☒ 2 ☒ 3 (Both options supported)
Type of EFB System	☒ Portable ☒ Installed (Both options supported)
Mounting Device	☒ Articulating Arm (Including Custom Arm designs) ☒ Yoke ☐ Cradle ☐ Kneeboard ☐ Not Attached ☒ Other (Side-mounted)
Stowage	The PilotView EDU (display-processor) is placed in its normal cockpit position via a docking mount. It can be removed during flight and on the ground if desired.
Hardware Style	Custom built integrated displays w/1.1 Ghz Intel® Centrino Mobile processor; 1MB Integrated Level 2 Cache (CMA-1100) or 1.4 Ghz Intel® Centrino Mobile processor; 2MB Integrated Level 2 Cache (CMA-1100 MkII/CMA-1410)
Display Size	• Length of display diagonal: 8.4" (CMA-1100/CMA-1100 MkII) or 10.4" (CMA-1410) • Resolution: 1024 x 768 CCFL Backlit (CMA-1100/CMA-1100 MkII) 1024 x 768 LED Backlit (CMA-1410)
Brightness	• CMA-1100 MkII: Brightest screen - true 0.5 to 800 nits luminosity range • CMA-1100 MkIIE: Enhanced for sunlight readability. 0.5nits to 800 nits. • CMA-1410: Brightest screen - true 0.5 to 800 nits luminosity range
Communications	☐ None ☒ Wired (Ethernet 10/100 Base-T RJ-45; ARINC 429 Tx, TxRx) ☒ Wireless (IEEE 802.11 a/b/g Wireless LAN and GPRS/3G capability) ☒ Other (Tested with most iridium communication systems and ACARS CMUs)
Controls	☒ Touch Screen (Film on glass resistive type touch screen) ☒ Resistive ☐ Conductive ☐ Infrared ☐ Stylus ☒ Buttons • PilotView CMA 1100 (8.4"): 15 FMS-style line select keys; dedicated keys for zooming, dim, bright, video and application control; 4-button joystick, page up, page down • PilotView CMA-1410 (10.4"): 9 buttons including power and brightness control) ☒ Mouse/cursor control ☒ Keyboard (CMA-1100 offers integrated mechanical keyboard) ☐ Other
Push/Pull Functionality	EFBs can be configured to communicate via an Ethernet cross wire (via EEMU/AIDs) or via a WiFi connection. This can support application to application collaborative features such as sharing flight plans, forms or simply the copy of the current selected screen.

CMC Electronics, Inc.	**Location:** Montreal, Quebec
Data Bus	☒ ARINC 429 (CMA-1100 MkIIE – via EEMU/AID) ☒ ARINC 828 – via EEMU/AID ☒ USB (Dual – all models – via EEMU and EDU (dual USB 2.0, powered interfaces)) ☒ LAN (CMA-1100, CMA-1100 MkII, CMA-1410) ☒ Other (Discrete)
Aircraft Connectivity	☒ Transmit and Receive: (ACARS MU, CMC FMS, Iridium and SATCOM units) ☒ Receive only: Aircraft to EFB only (FMS, GPS, ADIRUs) ☒ Receive only: (Video Systems, Weather Receivers) ☐ Other
Power Source	☒ Aircraft power (no battery) ☒ Internal battery only (self-powered) ☒ Aircraft power and internal battery ☐ Other
Battery Type	☒ Lithium ion ☐ Lithium polymer ☐ Lithium metal (non-rechargeable) ☐ Nickel metal ☐ Other ☐ N/A
Accessories	The PilotView® EFB provides the following options and accessories: • EDU options (Solid state disks capacity from 16Gbytes to 64Gbytes) • EEMU options (ARINC 429, RS232/422, Ethernet, Video, HD) Accessories include: • Power brick (for use on ground) • carrying case
Operating System	☒ Microsoft Windows (Version: XP Pro) ☐ Linux ☐ Custom

Applications Supported

☒ **Data Link** – Via SATCOM or ACARS CMU.
☒ **Electronic Charts** – ☒ Raster or ☒ Vector-based
☒ **Electronic Checklists** – ☐ Viewer only, ☒ Error checking, ☒ Automated error-checking, ☒ Active checklist
☒ **Electronic Documents** – ☐ Viewer only, ☒ Viewer with additional features, ☒ Mark-up language
☒ **Enhanced Vision** – Operates as head down repeater for Enhanced Visual System (EVS) via video input.
☒ **Flight Performance Calculations** – ☒ Weight & Balance, ☒ Takeoff/Landing Performance, ☐ Other
☒ **Flight Planning** – Via application partner software offering
☒ **GPS/Navigation Display** – Via Jeppesen, ACSS, LH Systems, EAG charting and moving maps products.
☒ **Logbook** – Via application partner software offering
☒ **Moving Map** – Via Jeppesen, LH Systems, EAG charting and moving maps products.
☒ **Surface Moving Map** – Supports ACSS, Jeppesen Surface moving map.
☐ **Synthetic Vision**
☒ **Terrain Display** – Via Jeppesen, LH Systems, EAG charting and moving maps products
☒ **Traffic Surveillance** – ☒ Merging/Spacing – Via partnership with ACSS. TSOA received for airport CDTI.
☒ **Video Surveillance** – Via RS170/NTSC/Phase Alternating Line (PAL) and Ethernet based EEMU/AID system options.
☒ **Voice Data Communications** – Via Iridium unit integration option.

CMC Electronics, Inc.	**Location:** Montreal, Quebec

☒ **Weather** – Via Sirius, XM, Satellite integration option.

☒ **Other** – CMC delivers Main Menu, Tools, SideView, CMCView, ECM (EFB Content Manager) as optional application on PilotView® EFB system.

DAC International	**Location**: Austin, TX
Product(s)	Class 3 GEN-X EFB
Website(s)	• www.dacint.com • Product Information: GEN-X EFB
Product Overview	
DAC's GENESYS solution including the GEN-X EFB provides airlines a complete and total system solution for the paperless flight deck. The system includes EFB hardware, EFB software, electronic chart data, Gatelink, server software, and a cabin surveillance system. Each component of the system is designed to get the most from the rest of the interconnected components.	

Photo courtesy of DAC.

Approvals/Compliance	
Authority	☒ FAA ☐ EASA ☐ Other
TC/STC	☐ TC ☒ STC
Aircraft	• CRJ – 200, 700, 900 (all types; Los Angeles ACO) • DC-8 (in progress, Airplane Certification Office (Ft. Worth)) • B727 (in progress, Airplane Certification Office (Ft. Worth)) • B757/767 (Chicago ACO) • L328 (Atlanta ACO) • EMB-170 (Class 2 STC, Chicago ACO)
TSO	☐ C113 ☐ C165
FAA Regulatory and Guidance Material	☒ AC 20-159 ☒ AC120-76A ☐ Order 8900.1 (Under evaluation with Shuttle America)
Industry Documents	☒ RTCA DO-160 (Version E) ☒ RTCA DO-178B (Software Level C) ☐ RTCA DO-254 (Level ____)
Other Notes	N/A

DAC International	**Location**: Austin, TX
Hardware	
Hardware Class(es)	☐ 1 ☒ 2 ☒ 3
Type of EFB	☐ Portable ☒ Installed
Mounting Device	☒ Articulating Arm ☐ Yoke ☐ Cradle ☐ Kneeboard ☐ Not Attached ☒ Other (Installed system, RPU (Remote Processor Unit) can be installed in the flight deck (Class 2) or in the Electronics and Equipment bay (Class 3). Display has mounting holes tapped for direct mount attachment in the rear.)
Stowage	N/A
Hardware Style	Two separate units: Display Unit and RPU. Single cable connection from the display to a rugged, quick release, removable RPU.
Display Size	• Length of display diagonal: 12.1", 10.4" or 8.4" Active Matrix Thin Film Transistor (TFT) LCD • Resolution: XGA (1024x768) or SVGA (800x600 standard)
Brightness	900 nits fully dimmable down to < 1 nit transflective screen for viewing in bright sunlight
Communications	☐ None ☒ Wired (16-bit Ethernet Integrated On-Board, USB, RS-232 up to 115,000 Kbaud, ARINC 429) ☐ Wireless ☐ Other
Controls	☒ Touch Screen ☒ Resistive ☐ Conductive ☐ Infrared ☐ Stylus ☒ Buttons (Display On/Off button and dimmer controls) ☐ Mouse/cursor control ☒ Keyboard (Virtual keyboard) ☐ Other
Push/Pull Functionality	Limited to image of the screen. Data sharing is also provided so that data loaded to one EFB can update the other.
Data Bus	☒ ARINC 429 ☐ ARINC 828 ☒ USB ☒ LAN ☐ Other
Aircraft Connectivity	☒ Transmit and Receive: Aircraft to EFB and EFB to aircraft (ACARS – in progress) ☒ Receive only: Aircraft to EFB only (FMS) ☐ Transmit only: EFB to aircraft only ☐ Other
Power Source	☐ Aircraft power (no battery) ☐ Internal battery only (self-powered) ☒ Aircraft power and internal battery – The internal battery is used only if the normal bus for aircraft power is off and the battery bus is on. No power is drawn from the aircraft back-up battery. ☐ Other

DAC International	**Location**: Austin, TX
Battery Type	☐ Lithium ion ☐ Lithium polymer ☐ Lithium metal (non-rechargeable) ☒ Nickel metal hydride (90 minutes) ☐ Other ☐ N/A
Accessories	Pre built umbilical cable for display to RPU interface (30' maximum length restriction).
Operating System	☒ Microsoft Windows (Version: XP Professional) ☐ Linux ☒ Custom (GENESYS Application Manager/Shell software) *Other Notes:* GENESYS Application Manager/Shell software prohibits operators (other than Administrator) from seeing windows. All functions are controlled through the shell which also supports a means to automatically update company data, chart data, and software.

Applications Supported

Compatible with and supports applications designed to run under the Microsoft Windows operating system, including the following:

☒ **Data Link**

☒ **Electronic Charts** – ☒ Raster or ☒ Vector-based

Choice of MapTech, Jeppesen, or Lido. Unique Clipboard user interface for origin, destination, en route, and alternate.

☒ **Electronic Checklists** – ☒ Viewer only, ☐ Error checking, ☐ Automated error-checking, ☐ Active checklist

☒ **Electronic Documents** – ☐ Viewer only, ☒ Viewer with additional features, ☐ Mark-up language

The look of the paper document is preserved. In addition, hyperlinks are used throughout, and keyword search is supported as well as go to page number.

☒ **Enhanced Vision**

☒ **Flight Performance Calculations** – ☒ Weight & Balance, ☒ Takeoff/Landing Performance, ☐ Other

3rd party applications

☒ **Flight Planning** – 3rd party application

☐ **GPS/Navigation Display**

☒ **Logbook** – 3rd party application

☐ **Moving Map**

☒ **Surface Moving Map**

☐ **Synthetic Vision**

☐ **Terrain Display**

☐ **Traffic Surveillance** – ☐ Merging/Spacing

☒ **Video Surveillance** – Supported with video server

☐ **Voice Data Communications**

☒ **Weather** – XMWX WxWorx supported

☒ **Other** – Calculator

FlightPrep, Stenbock and Everson, Inc.	**Location**: Aurora, OR
Product(s)	ChartBook™ ChartKey™ USB EFB ChartCase Professional™ Software
Website(s)	• www.flightprep.com • Product Information: ChartBook™, Fujitsu® 1630, Motion Computing J3400, TabletPC and Lenovo X200 Convertible Notebook PC, ChartKey™, Software
Product Overview	
ChartCase Professional provides electronic charting, XM Weather, flight planning, Traffic Detection functions, delivering paperless flight deck capabilities for most Windows-based computers. All Sectional Charts, WAC Charts, High/Low Enroute Charts, Instrument Procedures, Airport Diagrams, and vector charts for the U.S. are provided. Additionally, weather capability in the flight deck is supported using the WxWorx receiver so that NEXRAD, METARs, TAFs, TFRs, and more can be overlaid for the route and flight path. A Synthetic Vision (Highway in the Sky (HITS)) feature displays flight information in 3D format and can show supplemental GPS based flight telemetry. A Terrain Awareness Function (TAWS) is also supported.	
 *Photos courtesy of FlightPrep, Stenbock and Everson, Inc.*	
Approvals/Compliance	
Authority	☒ FAA ☐ EASA ☐ Other
TC/STC	☐ TC ☐ STC
Aircraft	N/A
TSO	☐ C113 ☐ C165
FAA Regulatory and Guidance Material	☐ AC 20-159 ☒ AC120-76A ☒ Order 8900.1
Industry Documents	☐ RTCA DO-160 (Version ____) ☐ RTCA DO-178B (Software Level ____) ☐ RTCA DO-254 (Level ____)
Other Notes	N/A

FlightPrep, Stenbock and Everson, Inc.	**Location**: Aurora, OR
Hardware	
Hardware Class(es)	☒ 1 (ChartBook™, Fujitsu® 1630, Motion Computing J3400 Tablet PC, Lenovo X200 Convertible Notebook PC) ☒ 2 (ChartBook™, Fujitsu® 1630) ☐ 3
Type of EFB	☒ Portable ☐ Installed
Mounting Device	☐ Articulating Arm ☒ Yoke (ChartBook™) ☒ Cradle ☒ Kneeboard (ChartBook™) ☐ Not Attached ☒ Other (ChartBook™ - "Side Mount" on the seat rail; Motion J3400 - Work Anywhere Kit, FlexDock) *Other Notes*: All mounting options consist of a cradle and a fixture that is attached to the aircraft
Stowage	N/A (At operator's discretion)
Hardware Style	Tablet computer, Slate Computers, Laptops, Desktops
Display Size	• ChartBook™: 8.9" wide Thin Film Transistor (TFT) LCD; 1024x600 • Fujitsu® 1630: 8.9" wide; 1024 x 600 • Motion J3400: 12.1" wide screen with active digitizer • Lenovo X200: 12.1"; 1024 x 600
Brightness	• ChartBook™: Approx. 300 nits, Flight Definition Outdoor Viewable Display • Fujitsu® 1630: 300 nits • Motion J3400: 300 nits • Lenovo X200: Sunlight readable 12.1"
Communications	☐ None ☒ Wired (Fujitsu® 1630: Multinational3 56K4 V.92 modem; 10/100/1000 Gigabit Ethernet LAN) ☒ Wireless • ChartBook™: WLAN 802.11 b/g/n + USB Bluetooth Adapter • Fujitsu® 1630: Intel® Wireless Wi-Fi Link 5300AGN (802.11a/b/g/draft-n), Bluetooth 2.1 • Motion J3400: Wi-Fi, Bluetooth® wireless connectivity and optional mobile broadband (Wireless Wide Area Network (WWAN)) • Lenovo X200: Integrated Bluetooth PAN, Intel WiFi Link 5100 (AGN) with My WiFi Technology, Integrated Mobile Broadband upgradable ☐ Other
Controls	☒ Touch Screen (ChartBook™, Fujitsu® 1630 and Lenovo X200) ☒ Resistive ☐ Conductive ☐ Infrared ☒ Stylus (Active on Motion® or inactive on others. Tetherable Stylus, Stowage location available in casing of EFB) ☒ Buttons (Minimum of 5 hard keys to perform Tablet PC functions) ☒ Mouse/cursor control (ChartBook™, Lenovo X200) ☒ Keyboard (Physical keyboard on ChartBook™, Fujitsu® 1630 and Lenovo X200; virtual keyboard available on all) ☐ Other
Push/Pull Functionality	N/A

FlightPrep, Stenbock and Everson, Inc.	**Location**: Aurora, OR
Data Bus	☐ ARINC 429 ☐ ARINC 828 ☒ USB (ChartBook™, Fujitsu® 1630) ☒ LAN (ChartBook™ and Fujitsu® 1630: RJ-45) ☐ Other
Aircraft Connectivity	☐ Transmit and Receive: Aircraft to EFB and EFB to aircraft ☐ Receive: Aircraft to EFB only ☐ Transmit: EFB to aircraft only ☒ None ☐ Other
Power Source	☐ Aircraft power (no battery) ☐ Internal battery only (self-powered) ☒ Aircraft power and internal battery ☐ Other
Battery Type	☒ Lithium ion ☐ Lithium polymer ☐ Lithium metal (non-rechargeable) ☐ Nickel metal ☐ Other ☐ N/A
Accessories	Bluetooth GPS receiver, weather receiver, power adapters, weather antennas, optional traffic receiver
Operating System	☒ Microsoft Windows (Version: XP, Vista and 7) ☐ Linux ☐ Custom

Applications Supported

FlightPrep, Stenbock and Everson, Inc. provides custom software that works on most Windows™ based PC's, Data Updates Available in annual or 1 time downloads from FlightPrep:

- Annual Subscriptions – updated every 28 days (IFR Current Update)
- 1 Time data updates (also available in the form of 4 week subscriptions)

EFBs are also compatible with and support applications designed to run under the Microsoft Windows operating system.

☐ **Data Link**

☒ **Electronic Charts** – ☒ Raster or ☒ Vector-based

☒ **Electronic Checklists** – ☐ Viewer only, ☐ Error checking, ☐ Automated error-checking, ☒ Active checklist
Integrated checklist functionality with completion status buttons for each item available

☒ **Electronic Documents** – ☐ Viewer only, ☐ Viewer with additional features, ☒ Mark-up language
Provides creating, viewing, printing, PDF functionality

☐ **Enhanced Vision**

☒ **Flight Performance Calculations** – ☒ Weight & Balance, ☒ Takeoff/Landing Performance, ☒ Other
Calculations are based on data for that specific individual aircraft. User may input performance data for numerous aircraft. Program comes with generic data for over 20 aircraft that is modifiable by user

Functions supported: Weight & Balance, Climb/Descent Performance, Fuel Planning, Altitude Analysis tool for selecting efficient cruising altitude based upon forecasted winds

☒ **Flight Planning** – Full suite of tools for routing, filing, and weather provided for off-line or on-line use

☒ **GPS/Navigation Display**

☐ **Logbook**

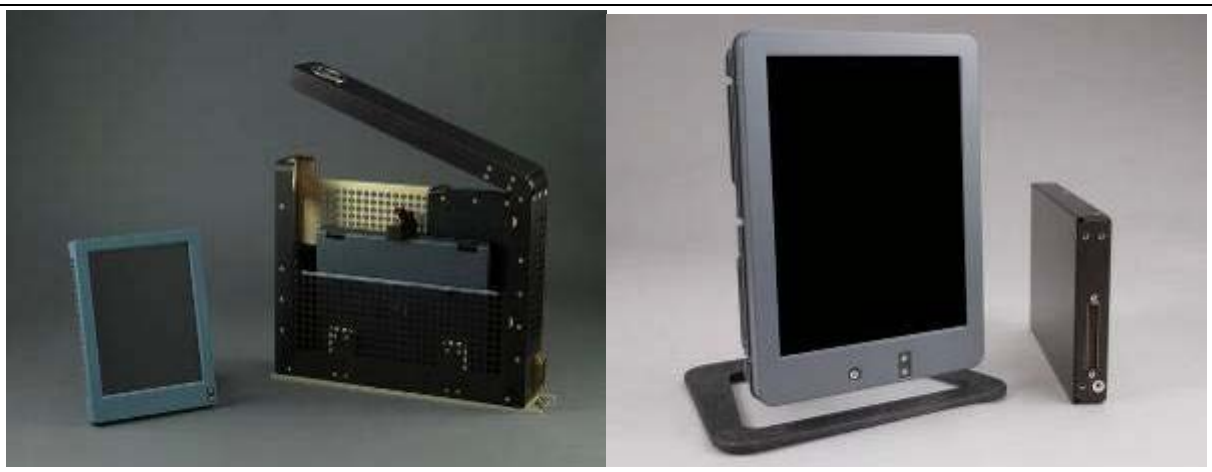
FlightPrep, Stenbock and Everson, Inc.	**Location**: Aurora, OR

- ☒ **Moving Map**
- ☒ **Surface Moving Map**
- ☒ **Synthetic Vision**
- ☒ **Terrain Display** – 3-D and 2-D overhead, and profile terrain display.
- ☒ **Traffic Surveillance** – ☐ Merging/Spacing
  Traffic Avoidance
- ☐ **Video Surveillance**
- ☐ **Voice Data Communications**
- ☒ **Weather** – XM Weather support when used with Bluetooth or USB XM Radio Receiver
- ☒ **Other** – Track building capabilities to store information about flight paths

Goodrich Sensors and Integrated Systems	**Location:** Burnsville, MN
Product(s)	Traditional Electronic Flight Bag Laptop Docking Station Electronic Flight Bag SmartDisplay™ Electronic Flight Bag
Website(s)	• Goodrich: www.goodrich.com • Sensors and Integrated Systems: SIS • Product Information: SmartDisplay™ EFB Product Brochure

Product Overview

Goodrich Sensors and Integrated Systems offer three EFB hardware solutions. The Traditional EFB is the baseline system that consists of two adjustable display modules and two computer modules with a video surveillance option. The Laptop Docking Station EFB was developed for operators that prefer pilot-issued or aircraft-issued laptops as the computer for their EFBs, so it consists only of two laptop docking stations, two display modules, and interconnect cables for connections to commercial off-the-shelf (COTS) laptops. The SmartDisplay™ EFB is a modification of the traditional Class 2 EFB system, integrating essential equipment from the EFB computer module into the existing avionics-grade display shell. SmartDisplay™ can be installed as either a Class 2 or 3 system and supports Type A and B software with the capability for upgrade to a certified Type C operating system. Goodrich Sensors and Integrated Systems also offers a turn-key, fully-integrated hardware and software solution; the Cockpit Data Management Solutions™ Portfolio is intended to allow flightcrews, maintenance and flight operations groups to perform critical tasks electronically.



Photos courtesy of Goodrich Sensors and Integrated Systems

Approvals/Compliance

Authority	☒ FAA ☒ EASA ☒ Other (GCAA – Dubai)
TC/STC	☒ TC ☒ STC
Aircraft	• Traditional EFB (Chicago ACO) – Boeing 737NG (complete); Bombardier Global Express, Global 5000, Global XRS (complete); Bombardier Challenger 605 (in progress); Sukhoi Superjet (OEM Option) • Laptop Docking Station (Chicago ACO) – Airbus A320, A330, A340 (complete); Boeing 737CL, 747-400, 777 (complete); Bombardier CRJ 700/900 (complete); MD-11 (complete); Embraer 190 (via SB and OEM option) • SmartDisplay™ (Chicago ACO) – Airbus A320, A330 w/ADS-B (complete); Boeing 737NG (in progress); Bombardier Dash8 (in progress)
TSO	☒ C113 ☐ C165
FAA Regulatory and Guidance Material	☐ AC 20-159 ☒ AC120-76 ☐ Order 8900.1

Goodrich Sensors and Integrated Systems	**Location:** Burnsville, MN
Industry Documents	☒ RTCA DO-160 (Version E) ☐ RTCA DO-178B (Software Level ____) ☐ RTCA DO-254 (Level ____)
Other Notes	TSO-C179, *Rechargeable Lithium Cells and Lithium Batteries*, approved for Lithium Ion Battery
Hardware	
Hardware Class(es)	☐ 1 ☒ 2 ☒ 3
Type of EFB system	☒ Portable ☒ Installed
Mounting Device	☒ Articulating Arm ☐ Yoke ☐ Cradle ☐ Kneeboard ☐ Not Attached ☐ Other
Stowage	N/A
Hardware Style	• Traditional EFB: Two adjustable display modules located on either side of each pilot and two computer modules designed for installation in a variety of locations. • Laptop Docking Station EFB: Two laptop docking stations, two display modules and interconnect cables for connection to laptop computers selected by the airline or operator. • SmartDisplay™ EFB: Essential equipment from the computer module is integrated into the display to reduce the total number of Line Replaceable Units (LRUs) required. This design also eliminates the need for a docking station adapter, which traditionally connected the display to the computer, thereby reducing the overall mounting stack-up, while still allowing for a progressive installation plan over multiple scheduled maintenance dates, increasing the speed of implementation through an entire fleet.
Display Size	• Length of display diagonal: 8.4” or 10.4” • Resolution: 1024 x 768
Brightness	Enhanced for readability in all lighting conditions; brightness/contrast control plus day/night mode; 170° viewing angle; luminance levels to 750 nits for the 10.4” display and 550 nits for the 8.4” display
Communications	☐ None ☒ Wired (ARINC 429, Ethernet, RS422, MIL-1553) ☒ Wireless (ACARS, 802.11 a/b/g wireless, Global System for Mobile communications (GSM)) ☒ Other (SATCOM) *Other Notes:* Capabilities vary depending on the system
Controls	☒ Touch Screen ☒ Resistive ☐ Conductive ☐ Infrared ☐ Stylus ☒ Buttons (Programmable buttons. Traditional EFB also has 22 assignable bezel keys, 4-button joystick with center, navigation and zoom buttons, brightness contrast, video transfer, and real time screen rotation key.) ☐ Mouse/cursor control ☒ Keyboard (Soft keyboard) ☐ Other *Other Notes:* Controls vary depending on the system

Goodrich Sensors and Integrated Systems	**Location:** Burnsville, MN
Push/Pull Functionality	One-touch "pull" feature to allow the flightcrew to share information quickly and easily.
Data Bus	☒ ARINC 429 ☒ ARINC 828 ☒ USB ☐ LAN ☐ Other (ARINC 717, 834)
Aircraft Connectivity	☐ Transmit and Receive: Aircraft to EFB and EFB to aircraft ☒ Receive: Aircraft to EFB only (FMS, GPS, Air Data Inertial Reference Unit (ADIRU)) ☐ Transmit: EFB to aircraft only ☐ Read only ☐ Other
Power Source	☒ Aircraft power (no battery) ☐ Internal battery only (self-powered) ☐ Aircraft power and internal battery
Battery Type	☒ Lithium ion (Optional, TSO'd) ☐ Lithium polymer ☐ Lithium metal (non-rechargeable) ☐ Nickel metal ☐ Other ☐ N/A
Accessories	The Goodrich EFB has backup battery and wireless options available. The battery is a separate LRU; the wireless connectivity is accomplished within the computer module. In addition, video capability is included within the computer module which can accept up to 8 cameras.
Operating System	☒ Microsoft Windows (Version: XP) ☐ Linux ☒ Custom (Any certified real-time operating system (RTOS), Design Assurance Level (DAL) C)) *Other Notes:* • Traditional EFB – Computer module features a Pentium® M 1.8 GHz Centrino processor and hard drive or optional flash-based mass storage capability (1GB Memory and 16GB Flash drive) • SmartDisplay™ EFB – Computer module features an Intel Core Duo 1.6 GHz processor and optional flash-based mass storage capability (16GB Removable Compact Flash)
Applications Supported	
Compatible with and supports applications designed to run under the Microsoft Windows operating system, including the following: ☐ **Data Link** ☒ **Electronic Charts** – ☐ Raster or ☐ Vector-based Jeppesen, Lufthansa Systems, EAG ☒ **Electronic Checklists –** ☐ Viewer only, ☐ Error checking, ☐ Automated error-checking, ☐ Active checklist COTS application ☒ **Electronic Documents –** ☐ Viewer only, ☐ Viewer with additional features, ☐ Mark-up language COTS application ☒ **Enhanced Vision**	

Goodrich Sensors and Integrated Systems	**Location:** Burnsville, MN

☒ **Flight Performance Calculations** – ☐ Weight & Balance, ☐ Takeoff/Landing Performance, ☐ Other COTS application

☒ **Flight Planning** – COTS application

☐ **GPS/Navigation Display**

☒ **Logbook**

☒ **Moving Map**

☒ **Surface Moving Map**

☐ **Synthetic Vision**

☐ **Terrain Display**

☒ **Traffic Surveillance** – ☒ Merging/Spacing

☒ **Video Surveillance** – Goodrich Proprietary Video Application: add cameras to existing hardware, cameras available directly from Goodrich Sensor Systems

☐ **Voice Data Communications**

☒ **Weather** – COTS application

☐ **Other**

IMS Flight Deck (IMS)	**Location:** Brea, CA
Product(s)	SkyTab 1100, SkyTab 1500, SkyTab 1350, SkyTab 2350, SkyTab 3200C, SkyTab 3200, SkyTab 4200
Website(s)	• www.imsco-us.com • Product Information: www.flightdeck.aero/
Product Overview	
IMS Flight Deck provides integrated hardware and software for Class 1 and 2 EFB systems with Class 3 under development. The SkyTab product line consists of ruggedized touch-screen, avionic grade, self contained Single Line Replaceable Unit (LRU) devices with LED backlit sunlight-readable displays. Applications supported include IMS Flight Deck custom software as well as COTS software (e.g., JeppView, WxWorx, WSI InFlight). Integrates with ARINC 429, weather, Iridium Satellite, etc.	
  *Photos courtesy of IMS Flight Deck (IMS)*	
Approvals/Compliance	
Authority	☒ FAA ☒ EASA ☐ Other
TC/STC	☐ TC ☒ STC
Aircraft	Dash-8 Q400, CRJ 700, B767, B747, B737, MD11, DC10, AVRO RJ (EASA)
TSO	☐ C113 ☐ C165
FAA Regulatory and Guidance Material	☐ AC 20-159 ☒ AC120-76A ☐ Order 8900.1
Industry Documents	☒ RTCA DO-160 (Version D) ☐ RTCA DO-178B (Software Level ____) ☐ RTCA DO-254 (Level ____)
Other Notes	All Class 2 installations
Hardware	
Hardware Class(es)	☒ 1 ☒ 2 ☒ 3 (Class 3 product currently under development)
Type of EFB system	☒ Portable ☒ Installed

IMS Flight Deck (IMS)	**Location:** Brea, CA
Mounting Device	☒ Articulating Arm ☒ Yoke ☐ Cradle ☒ Kneeboard ☒ Not Attached ☐ Other
Stowage	Stowed according to operators requirements.
Hardware Style	Single piece display units.
Display Size	8.4” SVGA (800x600), or 10.4” XGA (1024 x 768)
Brightness	All systems allow for both hardware and software based dimming from 1 to 800 nits
Communications	☐ None ☒ Wired (Ethernet, RS232, RS-422, ARINC 429) ☒ Wireless (Wireless 802.11, Bluetooth) ☒ Other (3G under development)
Controls	☒ Touch Screen ☒ Resistive ☐ Conductive ☐ Infrared ☒ Stylus (Class 1 units have a tethered stylus stowed in the unit) ☒ Buttons (Screen on/off, brightness/dimming control, rotate screen and unit power) ☒ Mouse/cursor control (Can be added with USB accessories) ☒ Keyboard (On screen or keyboard based) ☐ Other
Data Bus	☒ ARINC 429 (SkyTab 1100, SkyTab 3200 and 4200) ☐ ARINC 828 ☒ USB ☒ LAN ☐ Other
Aircraft Connectivity	☐ Transmit and Receive: Aircraft to EFB and EFB to aircraft ☒ Receive only: Aircraft to EFB only ☐ Transmit only: EFB to aircraft only ☐ Other
Power Source	☐ Aircraft power (no battery) ☐ Internal battery only (self-powered) ☒ Aircraft power and internal battery ☐ Other
Battery Type	☒ Lithium ion ☐ Lithium polymer ☐ Lithium metal (non-rechargeable) ☐ Nickel metal ☒ Other (Certified battery under development) ☐ N/A
Accessories	SkyTab 1100 powers off ship power (24V DC (direct current))
Operating System	☒ Microsoft Windows (Version: XP Professional) ☒ Linux ☐ Custom

IMS Flight Deck (IMS)	**Location:** Brea, CA

***Applications Supported*:**

IMS Flight Deck EFBs run their own custom software and are also compatible with and support applications designed to run under the Microsoft Windows and Linux operating systems.

☒ **Data Link** – In-house Iridium solution to be used for ACARS type functionality.

☒ **Electronic Charts** – ☐ Raster or ☒ Vector-based
3rd party windows-based applications (e.g., Jeppesen, NavTech EAG/eRM, Lido)

☒ **Electronic Checklists** – ☐ Viewer only, ☒ Error checking, ☐ Automated error-checking, ☒ Active checklist
Error checking (FliPrep™); Can also host 3rd party application

☒ **Electronic Documents** – ☐ Viewer only, ☒ Viewer with additional features, ☒ Mark-up language
Markup Language (FliView™)

☐ **Enhanced Vision**

☒ **Flight Performance Calculations** – ☐ Weight & Balance, ☐ Takeoff/Landing Performance, ☒ Other
3rd party application

☒ **Flight Planning** – 3rd party application

☒ **GPS/Navigation Display**

☒ **Logbook** – 3rd party application

☒ **Moving Map** – 3rd party application

☒ **Surface Moving Map** – 3rd party application

☒ **Synthetic Vision** – 3rd party application

☒ **Terrain Display** – 3rd party application

☐ **Traffic Surveillance** – ☐ Merging/Spacing

☒ **Video Surveillance** – EFB can accept and display video

☒ **Voice Data Communications** – IMS software which supports voice and data communications.

☒ **Weather** – COTS party application

☒ **Other** – FliControl – user interface that serves as a “control panel” for other application

Innovative Solutions and Support (IS&S)	**Location:** Exton, PA
Product(s)	IS&S CockpitIP™ Glass Cockpit Display Systems with Integrated Class 3 EFB Options
Website(s)	www.innovative-ss.com

Product Overview

IS&S Class 3 EFB system is integrated as an option in the IS&S CockpitIP™ Glass Cockpit Display Systems for both forward-fit and retrofit solutions. The EFB functionality is integrated into the Navigation Display (ND)/Multi-Function Display (MFD) displays as a Class 3 forward field of view implementation. The EFB products include Jeppesen's terminal, approach, departure, airport diagram, RNAV, and more charts, moving map display with satellite weather (XM) overlay capability, optional checklist and video input functions. Own aircraft is overlaid on all geo-referenced Jeppesen™ charts including airport diagrams/taxiways. The EFB integrates with existing or new WAAS capable Flight Management/Navigator systems. Interactive Checklist functionality uses XML based files that can be generated by the aircraft operator. Video input capability allows for the addition of composite, DVI or RGB type video feeds enabling forward field of view EVS, tail cameras, gear cameras, cabin surveillance or mission specific computers to interface with the Class 3 display(s). IS&S plans to provide this EFB/satellite weather option in the 757/767 FPDS airline Cockpit Display Systems shortly.

Eclipse EFB

Cessna AdViz EFB

Pilatus PC-12 EFB

Photos courtesy of Innovative Solutions and Support (IS&S)

Approvals/Compliance

Authority	☒ FAA ☐ EASA ☐ Other
TC/STC	☐ TC ☒ STC
Aircraft	Pilatus PC-12, Cessna Citation, Eclipse 500
TSO	☒ C113 ☒ C165

Innovative Solutions and Support (IS&S)	**Location:** Exton, PA
FAA Regulatory and Guidance Material	☐ AC 20-159 ☒ AC120-76A ☐ Order 8900.1
Industry Documents	☒ RTCA DO-160 (Version E) ☒ RTCA DO-178B (Software Level C) ☒ RTCA DO-254 (Level A)
Other Notes	N/A
Hardware	
Hardware Class(es)	☐ 1 ☐ 2 ☒ 3
Type of EFB	☐ Portable ☒ Installed
Mounting Device	☐ Articulating Arm ☐ Yoke ☐ Cradle ☐ Kneeboard ☐ Not Attached ☒ Other (Class 3 – Integrated into the glass panel mounted in forward field of view)
Stowage	N/A
Hardware Style	Custom built display systems. The EFB processing unit interfaces with the display through Ethernet.
Display Size	IS&S CockpitIP™ Display systems are available as 10.4”, 15” and 15.4” displays
Brightness	Depending on cockpit configuration up to 200 fL
Communications	☐ None ☒ Wired (ARINC 429, Ethernet, USB, RS-422) ☐ Wireless ☐ Other
Controls	☐ Touch Screen ☐ Resistive ☐ Conductive ☐ Infrared ☐ Stylus ☒ Buttons (Customized interface solutions through bezel buttons or control panels) ☐ Mouse/cursor control ☒ Keyboard ☐ Other
Push/Pull Functionality	N/A
Data Bus	☒ ARINC 429 ☐ ARINC 828 ☒ USB ☒ LAN ☐ Other
Aircraft Connectivity	☐ Transmit and Receive: Aircraft to EFB and EFB to aircraft ☒ Receive only: Aircraft to EFB only (FMS, air data, AHRS) ☐ Transmit only: EFB to aircraft only ☐ Other

Innovative Solutions and Support (IS&S)	**Location:** Exton, PA
Power Source	☒ Aircraft power (no battery) ☐ Internal battery only (self-powered) ☐ Aircraft power and internal battery ☐ Other
Battery Type	☐ Lithium ion ☐ Lithium polymer ☐ Lithium metal (non-rechargeable) ☐ Nickel metal ☐ Other ☒ N/A
Accessories	XM Satellite receiver unit, Enhanced Visual System (EVS) camera
Operating System	☐ Microsoft Windows ☐ Linux ☒ Custom (Certified IS&S proprietary OS)

Applications Supported

☐ **Data Link**

☒ **Electronic Charts** – ☐ Raster or ☒ Vector-based
Jeppesen™ JDS/JIT E-Chart integration

☒ **Electronic Checklists** – ☐ Viewer only, ☐ Error checking, ☐ Automated error-checking, ☒ Active checklist
XML based checklist, customizable

☐ **Electronic Documents** – ☐ Viewer only, ☐ Viewer with additional features, ☐ Mark-up language

☒ **Enhanced Vision** – Requires external camera

☒ **Flight Performance Calculations** – ☒ Weight & Balance, ☐ Takeoff/Landing Performance, ☐ Other
Available on Eclipse 500 platform

☐ **Flight Planning**

☒ **GPS/Navigation Display** – Integrated into primary ND/MFD

☐ **Logbook**

☒ **Moving Map** – Integrates with existing FMS/Navigator

☒ **Surface Moving Map** – Jeppesen™ airport maps

☐ **Synthetic Vision**

☒ **Terrain Display** – Class A or B TAWS terrain is depicted on both the ND and PFD.

☒ **Traffic Surveillance** – ☐ Merging/Spacing
TCAS I/II, or TIS traffic is displayed on both the ND and PFD displays, Provisions are made to allow for ADS-B traffic and Merging/spacing.

☒ **Video Surveillance** – Requires external camera

☐ **Voice Data Communications**

☒ **Weather** – Active weather feed from onboard weather radar unit and XM Satellite Weather receiver.

☐ **Other**

L-3 Communications	**Location:** Alpharetta, GA
Product(s)	CrewMate™ 104 CrewMate™ 840
Website(s)	• www.l-3com.com • Product Information: www.l-3com.com/Displays/products/crewmate.htm
Product Overview	
CrewMate™ EFBs are Class 2 devices that incorporate a high-resolution LCD display that is thin and lightweight. The EFBs support permanent or off-aircraft operation. CrewMate™ EFBs can have either an 8.4" or 10.4" high-resolution Active-Matrix LCD (AMLCD) enhanced for sunlight readability, a wide viewing angle (portrait and landscape), an infrared touch screen that works with gloved hands, and extremely low reflection/glare. CrewMate™ EFBs also allow for crosstalk functionality with dual EFBs.	

Photos courtesy of L-3 Communications

Approvals/Compliance	
Authority	☒ FAA ☒ EASA (in progress) ☐ Other
TC/STC	☐ TC ☒ STC
Aircraft	• CrewMate™ 104 – Various Large Transports (planned) • CrewMate™ 840 – Various Business Jets (in progress)
TSO	☒ C113 (planned) ☒ C165 (planned)
FAA Regulatory and Guidance Material	☐ AC 20-159 ☒ AC120-76A ☐ Order 8900.1
Industry Documents	☒ RTCA DO-160 (Version F) ☒ RTCA DO-178B (Software Level E) ☐ RTCA DO-254 (Level ____)

L-3 Communications	**Location:** Alpharetta, GA
Other Notes	DO-160 testing scheduled to be performed in Summer 2010
Hardware	
Hardware Class(es)	☐ 1 ☒ 2 ☐ 3
Type of EFB	☒ Portable ☐ Installed
Mounting Device	☒ Articulating Arm ☐ Yoke ☒ Cradle ☐ Kneeboard ☐ Not Attached ☐ Other
Stowage	Crewmate 840 stores in the pilot's armrest. Storage for Crewmate 104 is TBD.
Hardware Style	• The CrewMate™ 104 connects directly to the aircraft power and interfaces. • The CrewMate™ 840 connects to the aircraft via an Aircraft Interface Unit that provides an electrical interface between the display and the aircraft.
Display Size	• CrewMate™ 104 – 10.4" Active-Matrix LCD (AMLCD) (1024 x 768 XGA) • CrewMate™ 840 – 8.4" AMLCD (1024 x 768 XGA), 160° viewing angle
Brightness	1,000 nits dimmable to <1 nit
Communications	☐ None ☒ Wired (USB 2.0, Ethernet, RS-232, RS-422) ☒ Wireless (WiFi, Bluetooth) ☒ Other (ARINC 429)
Controls	☒ Touch Screen ☐ Resistive ☐ Conductive ☒ Infrared ☐ Stylus ☒ Buttons (CrewMate™ 104 has five buttons including power on/off, brightness (up/down); CrewMate™ 840 has 10 buttons including power on/off, brightness, night mode, zoom in/out) ☐ Mouse/cursor control ☐ Keyboard ☐ Other
Push/Pull Functionality	N/A
Data Bus	☒ ARINC 429 ☐ ARINC 828 ☒ USB ☒ LAN ☒ Other (WSI Weather via external antenna/receiver)
Aircraft Connectivity	☐ Transmit and Receive: Aircraft to EFB and EFB to aircraft ☒ Receive only: Aircraft to EFB only (ARINC 429) ☐ Transmit only: EFB to aircraft only ☐ Other
Power Source	☐ Aircraft power (no battery) ☐ Internal battery only (self-powered) ☒ Aircraft power and internal battery ☐ Other

L-3 Communications	**Location:** Alpharetta, GA
Battery Type	☐ Lithium ion ☒ Lithium polymer ☐ Lithium metal (non-rechargeable) ☐ Nickel metal ☐ Other ☐ N/A
Accessories	Hotel kit includes such accessories as keyboard, mouse, A/C charger packaged in a flight bag
Operating System	☒ Microsoft Windows (Version: Windows 7 Professional) ☐ Linux ☐ Custom

Applications Supported

☒ **Data Link**
☒ **Electronic Charts** – ☐ Raster or ☐ Vector-based
☒ **Electronic Checklists** – ☐ Viewer only, ☐ Error checking, ☐ Automated error-checking, ☐ Active checklist
☒ **Electronic Documents** – ☒ Viewer only, ☐ Viewer with additional features, ☐ Mark-up language
☐ **Enhanced Vision**
☒ **Flight Performance Calculations** – ☐ Weight & Balance, ☐ Takeoff/Landing Performance, ☐ Other
☒ **Flight Planning**
☒ **GPS/Navigation Display**
☒ **Logbook**
☒ **Moving Map**
☒ **Surface Moving Map**
☐ **Synthetic Vision**
☐ **Terrain Display**
☐ **Traffic Surveillance** – ☐ Merging/Spacing
☒ **Video Surveillance**
☐ **Voice Data Communications**
☒ **Weather** – Internal WSI weather receiver with CrewMate™ 840
☐ **Other**

navAero, Inc.	**Location**: Chicago, IL
Product(s)	• t•Bag™ C2[2] EFB Computer System to be connected to: – t•Pad™ 1500 Touch Screen Display (10.4" diagonal screen dimension) – t•Pad™ 2000 Touch Screen Display with optional bezel keys (10.4" diagonal screen dimension) – t•Pad™ 800 Touch Screen Display (8.4" diagonal screen dimension) • Aircraft Interface Device (AID) – A secure link to connect to aircraft systems. Hosts physical protection and isolation to ensure non-interference of attached data buses and discrete. It hosts internal QAR functionality with 8GB of built-in memory and communicates to the EFB via an Ethernet connection and supports ARINC 828/834. • 3G UMTS/HSDPA Communications Module – Worldwide coverage and support; certified on the AT&T Network • t•Pad™ 800 System – Combined with the navAero 12-28 volt-powered VGA Interface Unit, it provides for the use of the t•Pad 800 as a daylight readable external display when connected to any laptop computer
Website(s)	• www.navaero.com • Product Information: http://www.navaero.com/support/brochure.php
Product Overview	
The t•Bag C2[2] is a modular EFB system that consists of a touch screen display, a remote-mounted CPU module with integrated backup battery, a docking station, and an Interface Unit that functions as an interconnect point between the CPU/Docking Station assembly and the display. The Interface Unit also contains the on/off power switch for the system, a back-up battery "in-use" indicator lamp and two USB 2.0 ports. navAero maintains strategic relationships with application providers and systems integrators such as Jeppesen, LIDO, EAG, Avionica, Sabre Airline Solutions, Rockwell Collins and others in order to provide customers with a complete hardware and software solution.	
 *Photos courtesy of navAero*	
Approvals/Compliance	
Authority	☒ FAA ☒ EASA ☒ Other (ANAC - Brazil)
TC/STC	☐ TC ☒ STC

navAero, Inc.	**Location**: Chicago, IL
Aircraft	FAA Issued STC: • B727-100/100C/200/200F (Chicago ACO, Memphis FSDO) • B737-600/700/800 (Atlanta ACO, Miami FSDO) • B737-600/700/800/900 (NY ACO, FSDO) • B747-100/200/300/400 (Chicago ACO, Detroit FSDO) • B757-200/300 (Los Angeles ACO, Houston FSDO) • B767-200/400 (Los Angeles ACO, Houston FSDO) • MD-10/MD-11 (Atlanta ACO, Memphis FSDO) • MD-82/83/87 (Landmark Aviation DAS, Los Angeles FSDO) • A319/320/321 (Atlanta ACO, San Francisco FSDO) • A300-300/600 (Chicago ACO, Memphis FSDO) • A310-200/300 (Chicago ACO, Memphis FSDO) EASA Issued STC: • B737-300/400/500/600/700/800/900 • MD-80 Series • A318/319/320/321 • B757-200/300
TSO	☐ C113 ☐ C165
FAA Regulatory and Guidance Material	☒ AC 20-159 ☒ AC120-76A ☒ Order 8900.1
Industry Documents	☒ RTCA DO-160 (Version D and Version E) ☐ RTCA DO-178B (Software Level ____) ☐ RTCA DO-254 (Level ____)
Other Notes	The following related FSB reports have been posted at www.opspecs.com: navAero t Bag(EFB) C2, Jeppesen EFB FSB
Hardware	
Hardware Class(es)	☐ 1 ☒ 2 ☐ 3
Type of EFB	☐ Portable ☒ Installed
Mounting Device	The t•Pad 1500, t•Pad 2000, and t•Pad 800 displays are designed to be secured and held-in-place by means of an STC'd mounting cradle. This mounting cradle is then attached to the aircraft structure (side-wall or window frame peripheral mounting solution) by means of several different types of fixtures, including the following: ☒ Articulating Arm ☐ Yoke ☒ Cradle ☒ Kneeboard – The t•Pad 800 display can be used as a kneeboard and attaches to the pilot's leg by means of an elastic strap that is secured by means of Velcro closures. ☐ Not Attached ☒ Other – Other STC'd sliding mounting fixtures or tilt mounting fixtures
Stowage	N/A

navAero, Inc.	**Location**: Chicago, IL
Hardware Style	The navAero t•Bag C2^2 Computer and Display System is a COTS-based, purposefully built EFB that features a removable and independent CPU module. The CPU module connects to docking station and the two components are held in-place with a mounting plate. The docking station provides a connection point for hardwire connectivity to the aircraft for data and power. The CPU/Docking Station assembly also connects to an Interface Unit by means of a multi-cable wiring harness kit. This Interface Unit provides a port for the t•Pad display to connect to the system. The Interface Unit can be located up to 5 meters from the CPU/Docking Station assembly. Display choices: t•Pad 1500, t•Pad 2000, t•Pad 800
Display Size	All displays are active-matrix liquid crystal display color screen (color Thin Film Transistor (TFT) LCD) film-on-glass resistive touch screen. • t•Pad 1500 – 11.7"(h) x 7.44"(w) x .94"(d), 10.4" diagonal screen dimension, XGA 1024x768 resolution, 262K colors. Viewing angle L/R 160^o, U/D 160^o. • t•Pad 2000 – 11.4"(h) x 7.5"(w) x .88"(d), 10.4" diagonal screen dimension, XGA 1024x768 resolution. 262K colors. Viewing angle L/R 160^o, U/D 160^o. • t•Pad 800 – 9.4"(h) x 6.2"(w) x .94"(d), 8.4" diagonal screen dimension, VGA 800x600 resolution. 262K colors. Viewing angle L/R 120o, U/D 120o.
Brightness	All displays have contrast ratio 450:1. • t•Pad 1500 – LED backlighting brightness is manually controlled by hard buttons allowing for controlled illumination levels from 1000 nits to 0 nits. • t•Pad 2000 – LED backlighting brightness is 1000 nits (1000cd/m^2 progressively dimmable to 0cd/m^2) Illumination is automatically controlled by a light sensor that automatically adjusts to ambient conditions and can be manually adjusted to a user defined level. • t•Pad 800 – Fully dimmable with hard button brightness controls allowing for 3 NITS to 750 NITS of brightness in direct sunlight with enhanced readability.
Communications	☐ None ☒ Wired (Ethernet, USB 2.0; RS 232/422) ☒ Wireless (WLAN 802.11b/g, CDMA, UMTS/HSDPA (3G) or GPRS/EDGE) ☐ Other
Controls	☒ Touch Screen ☒ Resistive ☐ Conductive ☐ Infrared Response time: 34 msec; Operating temperatures: -30^o C to +50^o C ☐ Stylus ☒ Buttons • t•Pad 1500 and t•Pad 800 feature 3 hard buttons that control illumination on/off, illumination increase and illumination decrease. • t•Pad 2000 feature optional bezel keys: 22 user-assignable and 12 pre-assigned ☐ Mouse/cursor control ☒ Keyboard (Onscreen keyboard; optional portable USB keyboard) ☐ Other
Push/Pull Functionality	The four-port Ethernet switch that is standard equipment on every t•Bag C2^2 computer and display system allows for Ethernet cross-connectivity between the t•Bag C2^2 CPU modules. This cross connectivity can facilitate the push/pull functionality that is resident in some software applications for data sharing between CPU units.

navAero, Inc.	**Location**: Chicago, IL
Data Bus	☒ ARINC 429 ☒ ARINC 828 ☒ USB ☒ LAN ☐ Other
Aircraft Connectivity	☒ Transmit and Receive: Aircraft to EFB and EFB to aircraft SATCOM ☒ Receive: Aircraft to EFB only (ARINC 429) ☒ Transmit: EFB to aircraft only (Printer) ☐ Other
Power Source	☐ Aircraft power (no battery) ☐ Internal battery only (self-powered) ☒ Aircraft power and internal battery ☐ Other
Battery Type	☒ Lithium ion ☐ Lithium polymer ☐ Lithium metal (non-rechargeable) ☒ Nickel metal ☐ Other ☐ N/A
Accessories	ARINC 429 4-channel receiver; UMTS/HSDPA (3G) module; GPRS/EDGE module; CDMA module; WiFi 802.11b/g module
Operating System	☒ Microsoft Windows (Version: XP Professional or Windows 7) ☒ Linux ☐ Custom *Other Notes:* Standard CPU module processor: Core2 Duo 1.5GHz with 2GB RAM

Applications Supported

Compatible with and supports applications designed to run under the Microsoft Windows operating system, including the following:

☐ **Data Link**

☒ **Electronic Charts** – ☐ Raster or ☐ Vector-based

Compatible and supports applications from Jeppesen, LIDO, EAG and other charting applications designed to run under the Microsoft Windows operating system

☒ **Electronic Checklists** – ☐ Viewer only, ☐ Error checking, ☐ Automated error-checking, ☐ Active checklist

☒ **Electronic Documents** – ☐ Viewer only, ☐ Viewer with additional features, ☐ Mark-up language

Compatible and supports Electronic Document viewer applications from Jeppesen, LIDO, EAG, InfoTrust and others

☒ **Enhanced Vision**

☒ **Flight Performance Calculations** – ☐ Weight & Balance, ☐ Takeoff/Landing Performance, ☐ Other

Compatible with Flight Performance Calculation applications from Boeing, Airbus, Embraer as well as third party providers who applications are designed to run under the Microsoft Windows operating system

☒ **Flight Planning**

☒ **GPS/Navigation Display**

☒ **Logbook** – Compatible with Electronic Logbook applications from numerous third party providers like Ultramain and others whose applications are designed to run under the Microsoft Windows operating system

☒ **Moving Map** – navAero t•BagC2^2 EFB system is the first Class 2 EFB system to be STC'd and deployed with the Jeppesen AMM application and currently flying on a Part 121 airline

☒ **Surface Moving Map** – navAero t•BagC2^2 EFB system is the first Class 2 EFB system to be STC'd and deployed with the Jeppesen AMM application and currently flying on a Part 121 airline

navAero, Inc.	**Location**: Chicago, IL

☒ **Synthetic Vision**

☒ **Terrain Display**

☒ **Traffic Surveillance** – ☒ Merging/Spacing

The navAero t•BagC2^2 EFB system is currently deployed in the FAA New Technology full motion flight simulators (B737NG; A330/340) located in OKC for testing the ACSS CDTI applications

☒ **Video Surveillance** – navAero has developed a proprietary video surveillance system (t•Cam) which features Ethernet cameras and a viewing/recording/playback software application

☒ **Voice Data Communications** – navAero t•BagC2^2 EFB system is currently flying on Part 121 commercial airliners as a data communications display device (ACARS alternative) that is using the Iridium SATCOM as the communications pipeline

☒ **Weather** – navAero t•BagC2^2 EFB system is compatible with and supports applications designed to run under the Microsoft Windows operating system – WSI, WxWorx, Honeywell WINN and others

☐ **Other**

SAT-WAY sa	**Location:** Luxembourg
Product(s)	EFB Class 1 – EFB Class 2 CSU (router) CCU (airborne server)
Website(s)	• www.sat-way.com
Product Overview	
SAT-WAY sa has a background in all land mobile telecommunications and adapts products for use in aircraft, using and upgrading existing industrial equipment. SAT-WAY sa provides solutions for EFB, Quick Access Recorder (QAR), remote communication, monitoring, email, or data links on ground and airborne.	

Photo courtesy of SAT-WAY sa.

Approvals/Compliance	
Authority	☒ FAA ☒ EASA ☐ Other
TC/STC	☐ TC ☒ STC (in progress)
Aircraft	Cessna fleet Citation and Mustang, Bombardier Global Express, Embraer Phenon, Airbus A319 to A340, B737, Fokker 50 and 100
TSO	☐ C113 ☐ C165
FAA Regulatory and Guidance Material	☐ AC 20-159 ☐ AC120-76A ☐ Order 8900.1
Industry Documents	☒ RTCA DO-160 (Version F) ☐ RTCA DO-178B (Software Level ____) ☐ RTCA DO-254 (Level ____)
Other Notes	N/A

SAT-WAY sa	**Location:** Luxembourg
Hardware	
Hardware Class(es)	☒ 1 ☒ 2 ☐ 3
Type of EFB	☒ Portable ☒ Installed
Mounting Device	☒ Articulating Arm ☐ Yoke ☒ Cradle ☐ Kneeboard ☐ Not Attached ☐ Other
Stowage	Cradle stored
Hardware Style	Based on COTS program, EFB's made of modified tablet PC's of various types, they have the newest CPU's and available functions
Display Size	8.9 to 12 inch screen with highest resolutions available
Brightness	300 to 500 nits with night mode dimming.
Communications	☐ None ☒ Wired (Ethernet, USB, Serial) ☒ Wireless (3G, UMTS, GPRS, WiFi, Bluetooth) ☐ Other
Controls	☒ Touch Screen ☒ Resistive ☒ Conductive ☒ Infrared ☒ Stylus ☐ Buttons ☒ Mouse/cursor control ☒ Keyboard ☐ Other *Other Notes:* SAT-WAY sa modifies industrial computers for aviation standards. Features and types change as progress comes. STC's are adapted.
Push/Pull Functionality	Push/pull functionality is available, but will depend on the software construction in use.
Data Bus	☒ ARINC 429 ☐ ARINC 828 ☒ USB ☒ LAN ☐ Other
Aircraft Connectivity	☐ Transmit and Receive: Aircraft to EFB and EFB to aircraft ☒ Receive only: Aircraft to EFB only (FMS/GPS/FDR) ☐ Transmit only: EFB to aircraft only ☐ Other
Power Source	☐ Aircraft power (no battery) ☐ Internal battery only (self-powered) ☒ Aircraft power and internal battery ☐ Other

SAT-WAY sa	**Location:** Luxembourg
Battery Type	☒ Lithium ion ☐ Lithium polymer ☒ Lithium metal (non-rechargeable) ☐ Nickel metal ☐ Other ☐ N/A All batteries used are UL 1642 compliant
Accessories	CSU (router) and CCU (airborne server)
Operating System	☒ Microsoft Windows (Version: XP) ☒ Linux ☐ Custom

Applications Supported

☒ **Data Link** – Mobile internet on ground and in flight.

☒ **Electronic Charts** – ☐ Raster or ☐ Vector-based
Jeppesen - Lido

☒ **Electronic Checklists** – ☐ Viewer only, ☐ Error checking, ☐ Automated error-checking, ☐ Active checklist
Support integration of customer's products and practices.

☒ **Electronic Documents** – ☐ Viewer only, ☐ Viewer with additional features, ☐ Mark-up language
Support integration of customer's products and practices.

☐ **Enhanced Vision**

☒ **Flight Performance Calculations** – ☐ Weight & Balance, ☐ Takeoff/Landing Performance, ☐ Other
Support integration of customer's products and practices.

☒ **Flight Planning** – Support integration of customer's products and practices

☒ **GPS/Navigation Display** – Support integration of customer's products and practices

☒ **Logbook** – Support integration of customer's products and practices

☒ **Moving Map** – Support integration of customer's products and practices

☒ **Surface Moving Map** – Support integration of customer's products and practices

☐ **Synthetic Vision**

☒ **Terrain Display** – Support integration of customer's products and practices

☐ **Traffic Surveillance** – ☐ Merging/Spacing

☒ **Video Surveillance** – Support integration of customer's products and practices

☒ **Voice Data Communications** – Support integration of customer's products and practices

☒ **Weather** – Support integration of customer's products and practices

☐ **Other**

TECNOLOGIA GPS	**Location:** Sao Paulo, Brazil
Product	4PilotPro® Class 2 EFB
Website	• www.4pilotpro.com
Product Overview	
The 4PilotPro® is a stand-alone Class 2 kneeboard EFB, customizable to the operator's needs. 4PilotPro is based on a rugged 10.4" sunlight readable touch screen LCD and an Intel Core 2 Duo® CPU. Flight calculations, electronic checklists, manuals, real time GNSS navigation, TAWS and weather information applications are supported.	

Photos courtesy of TECNOLOGIA GPS

Approvals/Compliance	
Authority	☐ FAA ☐ EASA ☒ Other (ANAC - Brazil)
TC/STC	☐ TC ☐ STC
Aircraft	N/A
TSO	☐ C113 ☐ C165
FAA Regulatory and Guidance Material	☐ AC 20-159 ☐ AC120-76A ☐ Order 8900.1
Industry Documents	☐ RTCA DO-160 (Version ____) ☐ RTCA DO-178B (Software Level ____) ☐ RTCA DO-254 (Level ____)
Other Notes	The unit is in approval process by the Brazilian Aviation National Agency (ANAC – www.anac.gov.br)
Hardware	
Hardware Class(es)	☐ 1 ☒ 2 ☐ 3
Type of EFB	☒ Portable ☐ Installed

TECNOLOGIA GPS	**Location:** Sao Paulo, Brazil
Mounting Device	☐ Articulating Arm ☐ Yoke ☐ Cradle ☒ Kneeboard ☐ Not Attached ☐ Other
Stowage	Double Elastomer Velcro Strap
Hardware Style	4PilotPro® is a custom built all-in-one single unit hardware, specially designed to be carried as a kneeboard, on the pilot's leg. The only external connection necessary is the power cable (3 meters length), that may be plugged in any aircraft power outlet service jack.
Display Size	Rugged 10.4" LCD, resolution 1024x768
Brightness	1.000 nit LED Backlight, sun readable, anti-glare and hard coating 3H surface treatment
Communications	☐ None ☒ Wired (2 USB ports, 1 VGA port, 1 serial (RS-232) port, 1 PS/2 port, 1 Gigabit LAN port) ☒ Wireless (802.11b/g/n wireless connectivity and Bluetooth 2.0 connectivity) ☐ Other
Controls	☒ Touch Screen (5 wire, can be used with gloves) ☒ Resistive ☐ Conductive ☐ Infrared ☒ Stylus (Inactive, stowed inside the unit) ☒ Buttons (Reset and power buttons) ☒ Mouse/cursor control (External mouse supported) ☒ Keyboard (Virtual keyboard included and external keyboard supported) ☒ Other (Dimmer potentiometer)
Push/Pull Functionality	N/A
Data Bus	☐ ARINC 429 ☐ ARINC 828 ☒ USB ☒ LAN ☒ Other (RS-232 Serial)
Aircraft Connectivity	☐ Transmit and Receive: Aircraft to EFB and EFB to aircraft ☒ Receive only: Aircraft to EFB only ☐ Transmit only: EFB to aircraft only ☐ Other
Power Source	☒ Aircraft power (no battery) – The device can be used with any aircraft's CC outlet power source between 9 and 32 Volts ☐ Internal battery only (self-powered) ☐ Aircraft power and internal battery ☐ Other
Battery Type	☐ Lithium ion ☐ Lithium polymer ☐ Lithium metal (non-rechargeable) ☐ Nickel metal ☐ Other ☒ N/A
Accessories	Optional Night Vision Goggle (NVG) Class A or B screen filter – maintains the touch screen functionality

TECNOLOGIA GPS	**Location:** Sao Paulo, Brazil
Operating System	☒ Microsoft Windows (Version: XP Professional Edition Service Pack 3 Customized) ☐ Linux ☐ Custom

Applications Supported

Compatible with and supports applications designed to run under the Microsoft Windows or Linux operating systems, including the following:

☐ **Data Link**

☒ **Electronic Charts** – ☐ Raster or ☒ Vector-based

Jeppesen FliteDeck® Vector based charts

☒ **Electronic Checklists** – ☒ Viewer only, ☐ Error checking, ☐ Automated error-checking, ☐ Active checklist

Touch-and-Go® Electronic Checklist customized by the customer's needs. The pilot uses the fingers or the stylus to check the task and view the next one.

☐ **Electronic Documents** – ☒ Viewer only, ☐ Viewer with additional features, ☐ Mark-up language

Flight Manuals, Route Manuals, any documents provided by the customer can be added.

☐ **Enhanced Vision**

☒ **Flight Performance Calculations** – ☒ Weight & Balance, ☒ Takeoff/Landing Performance, ☐ Other

Developed specifically for each customer.

☒ **Flight Planning** – Jeppesen FliteDeck® Suite

☒ **GPS/Navigation Display** – Raster charts real-time navigation by CompeGPS Air® and Street level navigation by Mapfactor PCNavigator®

☐ **Logbook**

☒ **Moving Map** – Jeppesen FliteDeck® and PCNavigator®

☒ **Surface Moving Map** – CompeGPS Air® raster surface charts.

☒ **Synthetic Vision** – MountainScope® HITS (Highway-in-the-Sky), 3D synthetic vision and terrain proximity warning.

☒ **Terrain Display** – Jeppesen FliteDeck® terrain profile view and MountainScope®

☐ **Traffic Surveillance** – ☐ Merging/Spacing

☐ **Video Surveillance**

☐ **Voice Data Communications**

☒ **Weather** – WX Worx bundle or any other weather application preferred.

☒ **Other** – The 4PilotPro EFB can be totally customizable. The pilot can choose which software and document to include or exclude. There is a base pack and the customer can order useful add-ons.

Teledyne Controls	**Location:** Los Angeles, CA
Product(s)	Class 3 EFB, Airbus Class 3 Onboard Information Terminal (OIT), Teledyne EFB Software Suite
Website(s)	• www.teledyne-controls.com • Product information: Aircraft Information Solutions, EFB, hardware options, software applications, Onboard Information Terminal (OIT)
Product Overview	
Teledyne's EFB III provides operators with avionics-quality equipment. This Class 3 EFB system utilizes the same components as those used to design and manufacture the Airbus Onboard Information Terminal (OIT), which is a factory-installed option on the Airbus A330 and A340 airplanes. As such, it had to meet Airbus' requirements in terms of design, construction, human factors, reliability, safety and maintainability, as well as physical, functional, and environmental characteristics.	
 *Photo courtesy of Teledyne Controls*	
Approvals/Compliance	
Authority	☒ FAA ☒ EASA ☐ Other
TC/STC	☒ TC ☒ STC
Aircraft	• TC for A330/A340 (Class 3 Onboard Information Terminal) • STC for Class 3 currently on B737NG aircraft in progress (Chicago ACO)
TSO	☐ C113 ☐ C165
FAA Regulatory and Guidance Material	☐ AC 20-159 ☐ AC120-76A ☐ Order 8900.1
Industry Documents	☒ RTCA DO-160 (Version E) ☐ RTCA DO-178B (Software Level ____) ☐ RTCA DO-254 (Level ____)
Other Notes	Operational Suitability Report for Teledyne's Performance and Weight&Balance applications (also available at www.opspecs.com)

Teledyne Controls	**Location:** Los Angeles, CA
Hardware	
Hardware Class(es)	☐ 1 ☐ 2 ☒ 3
Type of EFB	☐ Portable ☒ Installed
Mounting Device	☒ Articulating Arm (Class 3 EFB) ☐ Yoke ☐ Cradle ☐ Kneeboard ☐ Not Attached ☒ Other (Sliding tray for Airbus Class 3 Onboard Information Terminal) *Other Notes:* • Class 3 EFB – OIT: 12.1" Display mounted in retractable sliding center tray. The general display unit (DU) location is near the Captain/First Officer side window. It is mounted on an adjustable attachment system to allow various users to adjust DU viewing angles. The processor unit (PU) is located in the avionics bay. • Certified mount/dock provided for Class 3 installations. Service Bulletin provided by Airbus for Class 3 Onboard Information Terminal.
Stowage	Detachable Onboard Information Terminal keyboards mount into sliding arm when in use / detached & stowed when not in use. Processor units located in the forward lower bay.
Hardware Style	Class 3 EFB and Airbus Class 3 Onboard Information Terminal are custom-built computers that meet Airbus specifications. For both systems, the processing unit is separate from the display unit. Total distance 6.5 meters from Processor Unit to Display (12.1" or 10.4").
Display Size	10.4" or 12.1" XGA (1024 x 768)
Brightness	• Sunlight-readable mode annunciators, wide dimming control range of 0.3 – 500 cd/m^2, and low reflectivity (<2%) • Class 3 12.1" and 10.4": 1 to 500 nits, auto-adjusted with manual override
Communications	☐ None ☒ Wired (Ethernet) ☒ Wireless (802.11 or cellular through Teledyne AirLAN unit) ☐ Other
Controls	☒ Touch Screen ☒ Resistive ☐ Conductive ☐ Infrared ☐ Stylus ☒ Buttons [Display Select (Captain video, First Officer video, LRU1 video & control, LRU2 video & control), CPU Select (Captain CPU, First Officer CPU); Cross view; Reset; BRT; DIM)] ☒ Mouse/cursor control ☒ Keyboard (optional USB keyboard with touchpad that connects to the display unit integrated via a USB connection available.) ☐ Other
Push/Pull Functionality	Cross-talk functionality is supported through the hardware and software. With respect to the hardware, one EFB can be viewed or controlled from the other EFB by pressing either the "View Offside" or "Control Offside" buttons located on the bezel. This is intended to provide continued EFB functionality if one of the processing units fails. With respect to the software, cross-talk capability allows the view from one EFB to be shared or sent to the other EFB.

Teledyne Controls	**Location:** Los Angeles, CA
Data Bus	☒ ARINC 429 ☐ ARINC 828 ☒ USB ☒ LAN ☐ Other
Aircraft Connectivity	☐ Transmit and Receive: Aircraft to EFB and EFB to aircraft ☒ Receive only: Aircraft to EFB only (ARINC 429 data bus) ☐ Transmit only: EFB to aircraft only ☐ Other
Power Source	☒ Aircraft power (no battery) ☐ Internal battery only (self-powered) ☐ Aircraft power and internal battery ☐ Other
Battery Type	☐ Lithium ion ☒ Lithium polymer (Note: for shutdown and interrupts only) ☐ Lithium metal (non-rechargeable) ☐ Nickel metal ☐ Other ☐ N/A
Accessories	Optional keyboard for Onboard Information Terminal Class 3 EFB on Airbus installations. Airborne Server Unit, Aircraft Wireless LAN Unit for 802.11 and cellular file transfers, installation kits, mounts and antennas.
Operating System	☒ Microsoft Windows (Version: XP) ☐ Linux ☐ Custom *Other Notes:* Windows O/S with Flight Manager (Customized application management system; open-systems design providing an integrated operating environment for data sharing between hosted EFB applications, and a suite of administrative utilities pertaining to device configuration (e.g., screen orientation), and content management (e.g., software/data revisions))

Applications Supported

The cornerstone of Teledyne's EFB software suite is Flight Manager, which is based on an open-systems design and provides the following:

- EFB "home page"
- Login for multiple user domains
- Multiple application management (EFB Task Bar)
- Inter-application communication
- Inter-EFB communication
- Revision status
- Load/Close Flight function
- Flight information entry (manual or automatic)
- User preferences: e.g., screen orientation, workspace orientation, keypad style, day/night mode
- Library and Open Documents management
- Calculator function
- Offline Airport entry (manual or automatic for performance tool)
- Diversion airport selection
- MEL/CDL Status entry (manual or automatic)
- Scratch pad function
- Units Conversion application
- TOLD (Take Off and Landing Data output management)
- EFB Administration: return-to service, set Windows shell, set date/time

Teledyne Controls **Location:** Los Angeles, CA

Teledyne Class 3 is also compatible with and supports applications designed to run under the Microsoft Windows operating systems, including the following:

☐ **Data Link**

☒ **Electronic Charts** – ☐ Raster or ☒ Vector-based

Charting application displays most vendors' navigation charts. Chart Viewer uses an access methodology so pilots can organize and view pdf-based charts from National Aeronautical Charting Office (NACO) and the European Aeronautical Group (EAG). Charts in proprietary formats (e.g., Jeppesen charts) require the chart vendor's application for viewing.

☐ **Electronic Checklists** – ☐ Viewer only, ☐ Error checking, ☐ Automated error-checking, ☐ Active checklist

☒ **Electronic Documents** – ☐ Viewer only, ☒ Viewer with additional features, ☒ Mark-up language

Teledyne's Library application includes a document viewer, movie viewer, forms manager and scratch-pad. The Document Viewer supports various formats, adapting to the documentation technology used by the operator. A robust Search function is included.

☐ **Enhanced Vision**

☒ **Flight Performance Calculations** –

☒ Weight & Balance, ☒ Takeoff/Landing Performance, ☒ Other (en route)

Computations based on real-time airport weather, aircraft-specific data, and MEL/CDL conditions. Compatible with digital AFM from aircraft OEMs. AEG approved. Several aircraft types already in service.

☐ **Flight Planning**

☐ **GPS/Navigation Display**

☐ **Logbook**

☐ **Moving Map**

☐ **Surface Moving Map**

☐ **Synthetic Vision**

☐ **Terrain Display**

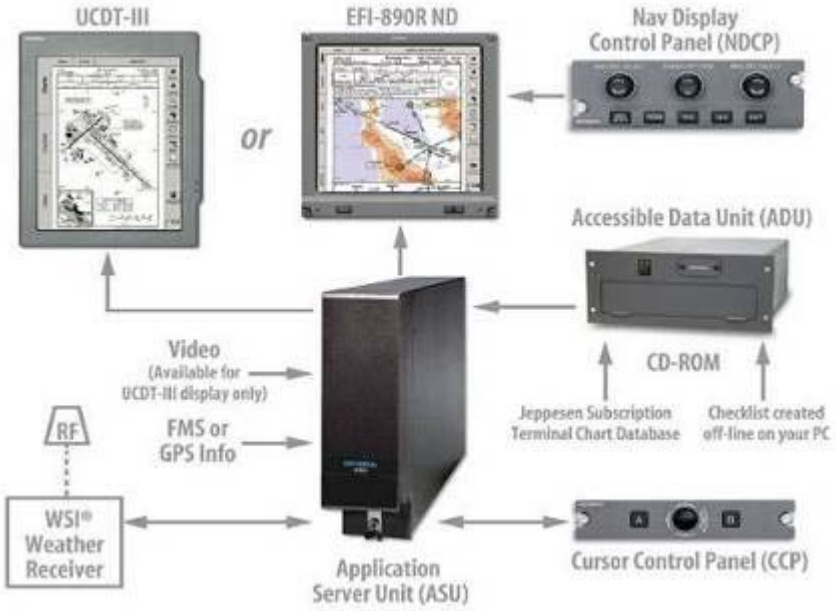
☐ **Traffic Surveillance** – ☐ Merging/Spacing

☐ **Video Surveillance**

☒ **Voice Data Communications** – The Communications application works in conjunction with the AeroMechanical Services Automated Flight Information Reporting System (AFIRS) system or the Wingspeed XL Link Flight Information Architecture (XFIA) system. These are both Iridium-based communications solutions.

☒ **Weather** – Teledyne provides an application to select, view and manipulate the weather products provided by WSI Corporation. This application utilizes the Windows® Dynamic Linked Library (DLL) supplied by WSI. Weather information is broadcast to the airplane via Sirius® satellite radio. Presently, this application is limited to use within the 48 contiguous United States.

☒ **Other** – SmartForms that allow flightcrews to complete forms using the EFB touch-screen interface, and ground based content and configuration management workstation software

Universal Avionics	**Location:** Tucson, AZ
Product(s)	Application Server Unit (ASU) / Displays on Universal Cockpit Display Terminal (UCDT-III) or EFI-890R
Website(s)	• www.uasc.com • Product Information: Application Server Unit, Universal Cockpit Display
Product Overview	
The ASU provides a supplemental electronic display system that can be integrated with flight deck instruments. The remote ASU computer supports up to two display terminals (UCDT-III) or can be displayed on the EFI-890R Navigation Display (ND). Pilots can access electronic charts, checklists, electronic documents, WSI satellite weather and video sources. The ASU electronic chart database is provided by Jeppesen's JeppView product; appropriate charts can be sorted automatically based on departure and arrival airport information supplied by the Flight Management System (FMS). Aircraft present position can be displayed on the electronic charts or WSI broadcast weather products for all phases of flight. Aircraft-specific procedural checklists can be created by pilots for normal, abnormal, and emergency situations. Documents such as Flight Manuals can be digitized and stored for convenient in-flight access.	
 *Copyright 2010 Universal® Avionics Systems Corporation. All rights reserved.*	
Approvals/Compliance	
Authority	☒ FAA ☒ EASA ☐ Other
TC/STC	☐ TC ☒ STC
Aircraft	Falcon 10, 20, and 50; King Air 200/300350; Pilatus PC-12; Boeing Business Jet and 737-300/400; Bombardier's Lear 25; Challenger and Global Express; Dassault Falcon 2000; Gulfstream G500; Cessna Citation Bravo
TSO	☒ C113 ☒ C165
FAA Regulatory and Guidance Material	☐ AC 20-159 ☐ AC120-76A ☐ Order 8900.1
Industry Documents	☒ RTCA DO-160 (Version D and Version E) ☒ RTCA DO-178B (Software Level C) ☐ RTCA DO-254 (Level ____)

Universal Avionics	**Location:** Tucson, AZ
Other Notes	• TSO-C113 and TSO-C165 for internally-developed electronic approach charts • All product approvals (TSO) and those installation approvals (STC) obtained by Universal Avionics are issued from the Los Angeles ACO
Hardware	
Hardware Class(es)	☐ 1 ☐ 2 ☒ 3
Type of EFB system	☐ Portable ☒ Installed
Mounting Device	☐ Articulating Arm ☒ Yoke ☐ Cradle ☐ Kneeboard ☐ Not Attached ☒ Other (flight deck mountable) *Other Notes*: There are two installation options: (1) if integrated with the instrument panel, then all components are DO-160E qualified; (2) if the display unit is separate (e.g., UCDT-III + ASU), then the components are a mix of RTCA DO-160D and RTCA DO-160E qualified.
Stowage	N/A
Hardware Style	Custom built hardware, with separate display and processor units.
Display Size	• EFI 890R – 8.9", 780x780 pixel, Active Matrix Color LCD; 6.3 in (H) x 6.3 in (W) • UCD Terminal (UCDT-III) – 8.4", 1024 x 768-pixel; 5.1 in x 6.8 in
Brightness	Low reflectance, fully dimmable for nighttime viewing
Communications	☐ None ☒ Wired (Ethernet, RS-232, RS-422, and ARINC 429, analog inputs/outputs, VGA input ports, discrete inputs) ☐ Wireless ☐ Other
Controls	☒ Touch Screen ☒ Resistive ☐ Conductive ☐ Infrared ☐ Stylus ☐ Buttons ☐ Mouse/cursor control ☐ Keyboard ☒ Other (Cursor Control Panel (CCP) for EFI-890R)
Push/Pull Functionality	One ASU LRU installed with two UCDT displays are able to share the same information and control can be transferred between the two displays
Data Bus	☒ ARINC 429 ☐ ARINC 828 ☐ USB ☐ LAN ☒ Other (CSDB input/output ports, ARINC 407, ARINC 708, Manchester bus ports, RS-232, RS 422, Ethernet)
Aircraft Connectivity	☐ Transmit and Receive: Aircraft to EFB and EFB to aircraft ☒ Receive only: Aircraft to EFB only (UASC FMS, Generic FMS, generic GPS) ☐ Transmit only: EFB to aircraft only ☒ Other (RS-232 I/O to WSI, Ethernet I/O to Data loader and printer)

Universal Avionics	**Location:** Tucson, AZ
Power Source	☒ Aircraft power (no battery) ☐ Internal battery only (self-powered) ☐ Aircraft power and internal battery ☐ Other
Battery Type	☐ Lithium ion ☐ Lithium polymer ☐ Lithium metal (non-rechargeable) ☐ Nickel metal ☐ Other ☒ N/A
Accessories	Solid-State Data Transfer Unit (SSDTU); Air Data Converter Unit (ACU); Flight Management System Trainer; COTS HP (Hewlett-Packard) printer for onboard chart, and electronic document printing.
Operating System	☒ Microsoft Windows (Version: XP) ☐ Linux ☐ Custom

Applications Supported

The UASC EFB will run DO-178B level C windows applications.

☐ **Data Link**

☒ **Electronic Charts** – ☐ Raster or ☒ Vector-based

Jeppesen electronic charts with world-wide coverage and printing

☒ **Electronic Checklists** – ☒ Viewer only, ☐ Error checking, ☐ Automated error-checking, ☐ Active checklist

Checklists are interactive and interface to yoke switches. Aircraft specific checklists are supported. Offline program to create aircraft unique checklist is provided.

☒ **Electronic Documents** – ☒ Viewer only, ☐ Viewer with additional features, ☐ Mark-up language

PDF files can be loaded, viewed, deleted, printed, and managed within the viewer application.

☒ **Enhanced Vision** – Support display of Enhanced Visual System (EVS) camera input in landscape or portrait mode in UCDT III display.

☐ **Flight Performance Calculations** – ☐ Weight & Balance, ☐ Takeoff/Landing Performance, ☐ Other

☐ **Flight Planning**

☐ **GPS/Navigation Display**

☐ **Logbook**

☒ **Moving Map** – Show Present Position (PPOS) in flight on Jeppesen electronic charts and WSI weather depictions.

☒ **Surface Moving Map** – Show PPOS on airport chart diagrams.

☐ **Synthetic Vision**

☐ **Terrain Display**

☐ **Traffic Surveillance** – ☐ Merging/Spacing

☒ **Video Surveillance** – Support for RS-170 (e.g., EVS camera) and NTSC (e.g., standard camera) video inputs

☐ **Voice Data Communications**

☒ **Weather** – WSI Embedded application viewer

☒ **Other** – Printer support

Virtual Papyrus *The information provided is current as of March 2007.*	**Location:** Sun Valley, CA
Product(s)	MCP System (Mobile Computing Platform) as part of the Class II Plus Offering consisting of: • ANKH (Aircraft Network Konnectivity Hardware) main computing platform with multiple CPUs • RAH T1X (Remote Access Hardware) series designed for Boeing, Bombardier, Embraer, ATR, and similar space restricted flight decks • RAH T3X (Remote Access Hardware) series designed specifically for Airbus Flight Decks • Support Accessories (e.g., additional displays, battery packs, etc.)
Website(s)	• www.virtualpapyrus.com
Product Overview	
The Virtual Papyrus MCP system is designed by airline professionals to meet airline operational requirements. Its main strengths are: • Communication through multiple paths to meet an airlines logistic issues • Computing power to drive the flight deck and the passenger cabin • Flexibility to adapt to the ever changing PC hardware upgrade path by simple sub-component swap capability • Flexibility to run any Windows based application the airline requires • And the grace of integral flight deck design for ergonomic compliance	
Approvals/Compliance	
Authority	☒ FAA ☐ EASA ☐ Other
TC/STC	☐ TC ☐ STC
Aircraft	N/A
TSO	☐ C113 ☐ C165
FAA Regulatory and Guidance Material	☐ AC 20-159 ☒ AC120-76A ☐ Order 8900.1
Industry Documents	☒ RTCA DO-160 (Version E in process) ☐ RTCA DO-178B (Software Level ____) ☐ RTCA DO-254 (Level ____)
Other Notes	N/A
Hardware	
Hardware Class(es)	☐ 1 ☒ 2 ☐ 3
Type of EFB system	☐ Portable ☐ Installed
Mounting Device	☐ Articulating Arm ☒ Yoke (table design for the Remote Access Hardware Airbus system) ☐ Cradle ☐ Kneeboard ☐ Not Attached ☒ Other (side window mount design for the Remote Access Hardware space restricted flight deck system) *Other Notes:* • The Remote Access Hardware units are mounted with quick change capabilities for a modular design. The Remote Access Hardware units have different mount locations (e.g., the sliding window, the built in chair table) and custom installations as per individual requests. • The Aircraft Network Konnectivity Hardware is a mounted housing for the industrial COTS laptop, CPU boards, and power supplies.

Virtual Papyrus *The information provided is current as of March 2007.*	**Location:** Sun Valley, CA
Stowage	Not provided
Hardware Style	• The Remote Access Hardware series of screens/keyboards are COTS units, repackaged by Virtual Papyrus as part of the mounting solution. The Remote Access Hardware contains only the screen, keyboard, USB, and brightness controls. • The Aircraft Network Konnectivity Hardware houses the CPU boards, communications and power supplies. The CPU boards are COTS Intel based dual-core mobile processor units repackaged by Virtual Papyrus. Each board is individually changeable like a laptop computer. • There is no distance restriction between the Aircraft Network Konnectivity Hardware and the Remote Access Hardware as this connection is achieved by fiber optics. The placement of the Aircraft Network Konnectivity Hardware within the fuselage is usually more the consideration of maintenance personnel for convenient access. This design ensures the flight deck remains intact as designed by the OEM, with no additional components to take up existing allocated space.
Display Size	Remote Access Hardware units are based on COTS LCD Technology. • Remote Access Hardware T1X Series: 9" - 16x9 widescreen format @ WVGA • Remote Access Hardware T3X Series: 12.1" - 16x9 widescreen format @ WXGA
Brightness	Remote Access Hardware (both systems): Dimmable to zero for all flight deck lighting conditions. All the Remote Access Hardware series use Superbright LCD technology for daylight readability and are all incrementally step dimmable to zero for display control at night. They also support a 160 degree viewing angle.
Communications	☐ None ☒ Wired ☒ Wireless ☐ Other *Other Notes:* Communications is the strength of the MCP System providing connectivity via: telephony (GPRS,GSM,1X,EVDO,EDGE, HSDPA covering both world present standards and the new HSUPA worldwide high speed network technology), 802.11 WIFI (A,B,G), 8 port Ethernet Hub, 5 USB interfaces, ARINC 429, RS 232 & RS 422 & RS 485
Controls	☒ Touch Screen (Self calibrating throughout operating temperature range. Separate toggle control provided to adjust screen brightness (full bright to 0)) ☐ Stylus ☐ Buttons ☐ Mouse/cursor control ☒ Keyboard (Integrated indestructible keyboard, spill proof, chemical resistant, and sealed with 5 stages of integral back lighting (0 to high) for night or day use. 10,000,000 keystrokes Mean Time Between Failures (MTBF)) ☐ Other *Other Notes:* The Aircraft Network Konnectivity Hardware component is self monitoring with individual CPU health status displays. It implements auto update and auto backup capabilities.
Push/Pull Functionality	Not provided
Data Bus	☐ ARINC 429 ☐ ARINC 828 ☒ USB ☐ LAN ☐ Other
Aircraft Connectivity	Not provided

Virtual Papyrus *The information provided is current as of March 2007.*	**Location:** Sun Valley, CA
Power Source	Not provided
Battery Type	Not provided
Accessories	Depending on the level of software applications the MCP is hosting, the Airline may elect to procure the optional battery pack. Virtual Papyrus offers super low light IP cameras for cabin surveillance.
Operating System	☒ Microsoft Windows (Version: XP) ☐ Linux ☐ Custom *Other Notes:* Linux will be considered for future installation upgrades.

Applications Supported

☐ **Data Link**

☒ **Electronic Charts** – ☒ Raster or ☒ Vector-based

3rd party raster and vector-based charting applications (e.g., Blueskydox, FlightPrep, Jeppesen, Lido, Maptech, EAG NAVTECH)

☒ **Electronic Checklists** – ☐ Viewer only, ☐ Error checking, ☐ Automated error-checking, ☐ Active checklist

☒ **Electronic Documents** – ☐ Viewer only, ☒ Viewer with additional features, ☒ Mark-up language

☐ **Enhanced Vision**

☒ **Flight Performance Calculations** – ☐ Weight & Balance, ☐ Takeoff/Landing Performance, ☐ Other

The Virtual Papyrus MCP can support both Type A and Type B Software Flight Performance applications

☒ **Flight Planning** – Can host flight deck centric flight planning systems like FlightPrep, etc

☐ **GPS/Navigation Display**

☒ **Logbook**

☐ **Moving Map**

☐ **Surface Moving Map**

☐ **Synthetic Vision**

☐ **Terrain Display**

☐ **Traffic Surveillance** – ☐ Merging/Spacing

☒ **Video Surveillance** – The MCP supports IP cameras via the 8 port Ethernet hub. These can be daisy-chained in multiple of eights to a max of 256. Most installations require 2-4 cameras. The MCP can interface with analog cameras; however an additional analog/digital conversion hardware piece is required.

☐ **Voice Data Communications**

☒ **Weather** – MCP was demonstrated using the WINN weather application but can also host WxWorx, Rockwell, WSI, and Jeppesen products

☐ **Other**

4 SOFTWARE MANUFACTURERS (EFB SOFTWARE WITHOUT HARDWARE)

EFB software manufacturers vary in the level of integration offered. Some manufacturers offer an *integrated and customizable EFB software* package that integrates several functions and/or software applications. This integration offers a comprehensive solution by allowing software from one or more manufacturers to be accessed through a single user interface. In some cases, the applications may have a similar look and feel. For example, Jeppesen has developed an integrated software system that contains a charting application/function, an electronic documents function, and an airport surface moving map. The integrated software system can be customized for a particular airline customer and tailored to work on specific hardware platforms.

In contrast, *commercial off-the-shelf software* manufacturers provide isolated functions or applications that have not been integrated, customized, or tailored for a particular hardware platform. In this case, the user (pilot or airline) must integrate (i.e., install and configure) the software with third-party hardware.

Often the integrated software systems are more expensive, but the benefit is that the user (pilot) can be assured that the functions/applications will work on the specified hardware platform.

Examples for each of these manufacturers are described in the two sections below. Section 4.1 contains detailed tables describing the products offered by software manufacturers who provide *integrated and customizable software* packages. Section 4.2 lists manufacturers of EFB *commercial off-the-shelf software*.

4.1 INTEGRATED AND CUSTOMIZABLE SOFTWARE

Five software manufacturers that *integrate and customize software* for any EFB, but do not provide hardware contributed to this industry survey. These manufacturers work with the airline or pilot to integrate and organize the various software applications on an EFB through a common user interface. These manufacturers may also develop custom software or offer third-party software that can be integrated onto any EFB hardware system.

The information gathered from these manufacturers focused primarily on the capabilities offered by their software products. Information specifically pertinent to the EFB hardware itself (e.g., display size, brightness, etc.) were less important for describing the role filled by these manufacturers who provide software only, because these manufacturers work with different EFB devices. However, hardware information was included if it pertained to how the pilot interacted with the software, as described in the list below.

- Product(s)
- Website(s) where more information can be found
- A brief overview of the product(s), with images
- A list of approvals received or in progress. The authority issuing the approval (i.e., FAA, EASA, or other) and the type of approval/compliance received (e.g., AC, TC, STC) is noted. Three FAA guidance documents are specifically identified:
  - AC 20-159, *Obtaining Design and Production Approval of Airport Moving Map Display Applications Intended for Electronic Flight Bag Systems*, issued on April 30, 2007
  - AC 120-76A, *Guidelines for the Certification, Airworthiness, and Operational Approval of Electronic Flight Bag Computing Devices*, issued on March 17, 2003
  - Order 8900.1, *Flight Standards Information Management System*, Electronic Flight Bag Operational Authorization Process (Volume 4, Chapter 15)
- The EFB hardware classes supported (i.e., Class 1, 2 or 3 system)
- Description of the hardware types supported. Specifically, the type of EFB system (i.e., portable or installed), the controls with which the user would interact with the software, and the communication capabilities offered or required by the software (e.g., push/pull functionality, data bus, and aircraft connectivity).
- Operating system
- Applications supported. For each software application, these manufacturers noted whether the software is developed in-house or is a third-party application.

Aircraft Management Technologies	**Location:** Co. Dublin, Ireland
Product(s)	Flightman™
Website(s)	• www.flightman.com

Product Overview

Aircraft Management Technologies (AMT) is a specialized provider of technology to enable the "Connected Aircraft." AMT's Flightman™ product is intended to be a complete Electronic Flight Bag (EFB) software solution for the aviation industry. Flightman™ is designed to enable airlines to be compliant in all aspects of onboard flight operations in a cost effective manner and to provide a platform for future revenue generation applications in the cabin.

Our airline customers can benefit from a single fleet-wide EFB solution that:

- Runs on all classes of hardware (FAA EFB Class 1, 2, or 3)
- Is independent of hardware vendor
- Supports all aircraft types
- Is able to host third-party applications e.g. 3rd Party Chart Provider
- Is independent of Operating System (OS)
- Integrates with airlines' Flight Planning, MRO, Financial and other systems to deliver data to aircraft

Flightman™ eJourney Log

Flightman™ Business Intelligence

Flightman™ Electronic Flight Folder

Flightman™ eTechlog

Flightman™ Perf. Calcs & WAB

Flightman™ Large Content Manager

Flightman™ Cabin Surveillance

Flightman™ Forms Designer

Flightman™ PRM

Photos courtesy of AMT

Approvals/Compliance	
Authority	☒ FAA ☒ EASA ☐ Other
TC/STC	☐ TC ☐ STC
Aircraft	N/A
TSO	☐ C113 ☐ C165
FAA Regulatory and Guidance Material	☐ AC 20-159 ☒ AC120-76A ☐ Order 8900.1
Industry Documents	☒ RTCA DO-178B (Software Level D)

Aircraft Management Technologies	**Location:** Co. Dublin, Ireland
Other Notes	AMT also takes into consideration other industry standards and regulations such as SAE AS9100 and FAA AC 120-78
Hardware	
Hardware Class(es)	☒ 1 ☒ 2 ☒ 3
Type of EFB	☒ Portable ☒ Installed
Communications	☐ None ☒ Wired (Ethernet) ☒ Wireless (WiFi 801.11, 3G, Satellite, GSM/GPRS) ☐ Other
Control Requirements	☒ Touch Screen ☒ Stylus ☒ Buttons ☒ Mouse/cursor control ☒ Keyboard ☐ Other
Push/Pull Functionality	Based on defined communications policies, the onboard Flightman™ Client establishes a connection to the Flightman™ Ground Server and transfers data on and off the aircraft. This data transfer can happen over various communications media. Flightman™ manages these various channels and the data sent over them. All data exchanged between the aircraft and the ground is transferred in accordance with the AEEC ARINC 633 standard. A full audit trail is maintained of all data updates to the system. The Flightman™ synchronization protocol deployed between the aircraft and the Flightman™ Server ensures that the aircraft always operates off the latest data published for the particular aircraft tail number.
Data Bus	☒ ARINC 429 ☒ ARINC 828 ☒ USB ☒ LAN ☐ Other
Aircraft Connectivity	☐ Transmit and Receive: Aircraft to EFB and EFB to aircraft ☒ Receive only: Aircraft to EFB only (ARINC 429 aircraft data bus) ☐ Transmit only: EFB to aircraft only ☐ Other
Operating System	☒ Microsoft Windows (Version: XP Professional Service Pack 2) ☒ Linux ☐ Custom
Applications Supported	
☐ **Data Link** ☒ **Electronic Charts** – ☐ Raster or ☒ Vector-based Capable of integrating with any 3rd party charting system that provides maps or charts in electronic format ☒ **Electronic Checklists** – ☒ Viewer only, ☒ Error checking, ☒ Automated error-checking, ☒ Active checklist Flightman's business rules, automated error-checking and active checklist is intended to assist the pilot in completing all the pre-flight and post-flight documentation.	

Aircraft Management Technologies **Location:** Co. Dublin, Ireland

☒ **Electronic Documents** – ☐ Viewer only, ☒ Viewer with additional features, ☒ Mark-up language

The Flightman™ document/content management system enables the remote distribution and management of content to the EFB devices. In addition the system provides for the support of the configuration management of the EFB's data and software revisions.

The content managed by Flightman™ can include, for example:

- Aircraft Manuals
- Charts
- Company Documents and Circulars
- Databases
- Anti-Virus Updates

Features of the Large Content Manager include:

- Remote content distribution and installation support
- Full audit trail
- Optimized content delivery for unreliable and low bandwidth networks
- Support for USB, WiFi, Cellular or Satellite communications networks
- XML messaging to automatically update relevant ground systems
- Support for manual and automated installations
- Custom installers based on content type
- Ground based reporting of the EFB Content Manifest

☐ **Enhanced Vision**

☒ **Flight Performance Calculations** – ☒ Weight & Balance, ☒ Takeoff/Landing Performance, ☐ Other

Flightman™ allows the onboard calculation from first principles of aircraft Weight and Balance and Performance Calculations. The current paper process requires interpolation which provides a conservative result and reduces benefits. Flightman™ is designed to give accurate calculations and exact results, which improves the calculated Maximum Take-Off Weight (MTOW). Additionally, the flightcrew can pre-calculate for all desired runways and intersections at a specific airport. In the case of a runway change, there is no need for re-calculation, ensuring a more timely departure. Flightman™ also enables entry and management of NOTAM and MEL restrictions. (The screen shot provided is of the performance calculations entry data entry screen.)

☒ **Flight Planning** – The EFF is a set of flight briefing applications (including Flight Plans) which allow pilots to access their flight plans and other briefing information onboard the aircraft, and also from home/hotel/crew room, via a secure internet connection. In addition, the EFF also offers the possibility to create annotations in the flight plans. The applications in the EFF are not stand alone point applications and may be tailored to meet specific customer requirements. The features of EFF include real-time availability of flight briefing data e.g. Flight Plan, the elimination of manual routing and filing of paper documents, and compliance with regulatory requirements.

☐ **GPS/Navigation Display**

☒ **Logbook** – The eJourney Logbook is an electronic version of existing paper forms carried on a commercial aircraft. It includes hours and cycles, crew information, fuel management, delays and landing information, and vendor services used. It can be used on any portable computer (tablet, laptop etc) as well as aircraft-mounted computers. Forms include Crew Assignment & Route information, Takeoff and Landing Data, Aircraft Hours and Cycles, Schedule Delays, Vendor Services, Oil and Hydraulic Fluid data, Engine Cruise Log data and De-Icing information.

This application also encompasses Fuel Management. Fuel Management is intended to help the flightcrew plan for their fuel requirements based on the airline's flight plan fuel. It allows flightcrew to calculate fuel requirements and uplifts as well as automatically performing unit conversions. Pilots' compliance with the airline's fuel plan can be measured over time and built-in gross error checking helps eliminate erroneous entries and increase accuracy. All fuel records will be held on the server and populated into relevant airline systems. In addition, records can be sorted by vendor allowing for easy fuel management reconciliation. Fuel consumption can also be reported and analyzed by aircraft, flight number, flightcrew, etc.

☐ **Moving Map**

☐ **Surface Moving Map**

☐ **Synthetic Vision**

☐ **Terrain Display**

Aircraft Management Technologies **Location:** Co. Dublin, Ireland

☐ **Traffic Surveillance** – ☐ Merging/Spacing

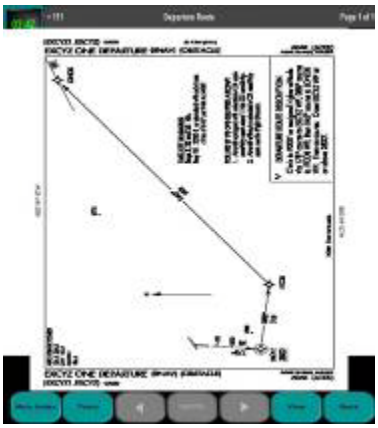
☒ **Video Surveillance** – Flightman™ Cabin Surveillance allows the user to view feeds from one or more cameras installed in the aircraft cabin. The cameras can be either still or video and the images can be viewed in real time by the user or archived for future use.

☐ **Voice Data Communications**

☒ **Weather** – As part of the Flightman™ Electronic Flight Folder module, briefing information such as weather can be made available in the flight deck in real time. Flightman™ can be easily tailored to integrate with any weather provider such as WSI, Meteo Group, etc.

☒ **Other**

- Forms Designer (e.g., ASR, Birdstrike, etc.) – allows users to design and maintain airline-specific Electronic Forms (e.g., ASR, Birdstrike etc.) and distribute the e-Forms to a specified Flightman™ application (onboard the aircraft or the Flightman™ Ground Administrative Manager)
- Business Intelligence – allows airlines to view the high-level critical metrics from the data originating from the onboard EFBs with the added ability of drilling down on any of the selected items to provide detailed information (e.g., Actual Flight Plan Fuel vs Actual Fuel Burn, delays by tail number, load percentage per route, etc.)
- Passenger Relationship Management – allows cabin crew to access all pre-flight information and submit post-flight reports directly from the aircraft to the airline's Flight Operations department. Some cabin crew applications include Cash Reconciliation, Passenger Incident, Crew Health & Safety, Flight Report, Cabin Techlog, Performance Feedback & Duty Free Sales Report
- Electronic Flight Folder – a comprehensive set of flight briefing applications (e.g. Flight Plan, NOTAMs, Waypoints, ETOPs, Alternate Airport Summary, Weather etc) which allow pilots to access their briefing package onboard the aircraft and also from home/hotel/crew room, via a secure internet connection
- Electronic Tech Log (with separate flightcrew and maintenance user versions) – an electronic version of current paper-based techlog held aboard an aircraft that allows an airline to manage defects within its fleet. Flightman™ eTechLog is configurable to any aircraft type and provides a standard user interface across a mixed fleet.

ARINC	**Location:** Annapolis, MD
Product(s)	AeroConnx EFB Solutions; ARINC EFB Content Delivery Management System; AeroSync Communication Services; ARINC GateFusion Gatelink Services
Website(s)	• www.arinc.com
Product Overview	
AeroConnx™ is an integrated suite of applications and services for management of EFB, messaging, and data distribution. Key components are the EFB Content Delivery Management System (CDMS), AeroSync™ Communications Service, ARINC GateFusion℠, and ARINC's EFB Application Suite. The AeroSync Communications Service is an application service that provides applications the transparent ability to interface over multiple communication networks based on a user-definable policy. ARINC GateFusion is a common-use wireless gatelink service for airlines worldwide. The service incorporates ARINC's Data Delivery Service pre-staging data on local servers at airports, where aircraft can exchange data locally over a Wi-Fi connection.	
ARINC ACARS Cockpit Display  **ARINC DocViewer**  **ARINC Graphical/Text Weather**  **ARINC Chart Application Integration**  *Photos courtesy of ARINC*	
Approvals/Compliance	
Authority	☒ FAA ☐ EASA ☒ Other
TC/STC	☐ TC ☒ STC
Aircraft	• B727 (Denver ACO) • A320 (Ft.Worth ACO) • B777 (Ft. Worth & Boston ACO)

ARINC	**Location:** Annapolis, MD
TSO	☐ C113 ☐ C165
FAA Regulatory and Guidance Material	☐ AC 20-159 ☒ AC120-76A ☐ Order 8900.1
Industry Documents	☐ RTCA DO-178B (Software Level ____)
Other Notes	RTCA DO-160 is planned.
Hardware	
Hardware Class(es)	☒ 1 ☒ 2 ☒ 3
Type of EFB system	☒ Portable ☒ Installed
Communications	☐ None ☒ Wired (10/100MB wired LAN) ☒ Wireless (WIFI 802.11g wireless LAN) ☒ Other
Control Requirements	☒ Touch Screen ☒ Stylus ☒ Buttons ☒ Mouse/cursor control ☒ Keyboard ☐ Other
Push/Pull Functionality	ARINC DocViewer provides ARINC's patented push capability allowing the user to select one or more destination EFBs.
Data Bus	☒ ARINC 429 ☐ ARINC 828 ☒ USB ☒ LAN ☐ Other
Aircraft Connectivity	☒ Transmit and Receive: Aircraft to EFB and EFB to aircraft (ACARS, Data Busses) ☒ Receive only: Aircraft to EFB only ☐ Transmit only: EFB to aircraft only ☐ Other
Operating System	☒ Microsoft Windows (Version: XP) ☒ Linux ☐ Custom
Applications Supported	

☒ **Data Link** – ACARS, VDLM2, Iridium, 802.11; in-house

☒ **Electronic Charts** – ☒ Raster or ☒ Vector-based

Zoom and pan functionality provided; 3rd party integration

☒ **Electronic Checklists** – ☐ Viewer only, ☐ Error checking, ☐ Automated error-checking, ☐ Active checklist

Interactive; the pilot can use the stylus to mark whether an item has been completed but does not provide error checking nor is it active. Checklist can be saved for future reference by the pilot or others; in-house

☒ **Electronic Documents** – ☐ Viewer only, ☒ Viewer with additional features, ☐ Mark-up language

Supports PDF, HTML, XML formatted documents and charts. Multi-language support; Patented push functionality; in-house

☐ **Enhanced Vision**

ARINC **Location:** Annapolis, MD

☒ **Flight Performance Calculations** – ☒ Weight & Balance, ☒ Takeoff/Landing Performance, ☐ Other 3rd party integration

☐ **Flight Planning**

☐ **GPS/Navigation Display**

☒ **Logbook** – 3rd party integration

☒ **Moving Map** – 3rd party integration

☒ **Surface Moving Map** – 3rd party integration

☐ **Synthetic Vision**

☐ **Terrain Display**

☐ **Traffic Surveillance** – ☐ Merging/Spacing

☐ **Video Surveillance**

☒ **Voice Data Communications** – ACARS, Iridium, 802.11; in-house

☒ **Weather** – Real-time graphical weather over ACARS/Iridium; in-house

☒ **Other** – ARINC 429/717 data and ACARS messaging service, Iridium communications service, ACARS Cockpit Display application; in-house

Jeppesen	**Location:** Englewood, CO
Product(s)	Jeppesen FLITEDECK Pro Jeppesen Applications for Boeing EFB Jeppesen Applications for Airbus EFB
Website(s)	• www.jeppesen.com • Product Information: Jeppesen EFB solution

Product Overview

Jeppesen's FLITEDECK Pro is an open EFB software solution providing a stable, approved means for hosting applications, data loading, and configuration management for all EFB classes. Jeppesen provides its eCharts, Airway Manual Text, Airport Moving Map, and Enroute applications integrated into this EFB environment. These data driven applications are intended to provide enhanced situational awareness and decision making, while removing paper on the flight deck. In addition, third-parties, such as ARINC, Boeing and others have leveraged the open framework to develop applications that extend capability for operators. Communications functionality is provided through hardware integration (e.g., using ARINC-429, RS-422, Ethernet, fiber optic, SATCOM, GateLink, Cellular data links). Jeppesen has teaming arrangements and successful installations with Astronautics, CMC Electronics, Goodrich, and NavAero for hardware, applications, and system integration.

Jeppesen has integrated its navigational application suite, as well as data and software management tools, with Boeing's EFB system. Jeppesen's data management tools integrate with Boeing's TWLU (Terminal Wireless LAN Unit) and Communication offering to provide wireless updates to EFBs on the flight deck.

Jeppesen has also integrated its navigational application suite for the Airbus FlySmart system and A380 onboard information system (OIS).




Photos courtesy of Jeppesen

Approvals/Compliance	
Authority	☒ FAA ☒ EASA ☒ Other
TC/STC	☒ TC ☒ STC
Aircraft	EFB software currently in operation on a number of aircraft models.

Jeppesen	**Location:** Englewood, CO
TSO	☐ C113 ☒ C165
FAA Regulatory and Guidance Material	☒ AC 20-159 ☒ AC120-76A ☒ Order 8900.1
Industry Documents	☒ RTCA DO-178B (Software Level D)
Other Notes	N/A
Hardware Integration	
Hardware Class(es)	☒ 1 ☒ 2 ☒ 3
Type of EFB	☒ Portable ☒ Installed
Communications	☐ None ☒ Wired (Ethernet, Fiber Optic) ☒ Wireless (Cellular, Satellite, 802.11) ☐ Other
Control Requirements	☒ Touch Screen ☒ Stylus ☐ Buttons ☒ Mouse/cursor control ☒ Keyboard ☐ Other
Push/Pull Functionality	The product supports the sending and receiving content between installed EFBs that are connected via Ethernet
Data Bus	☒ ARINC 429 ☒ ARINC 828 ☒ USB ☒ LAN ☐ Other
Aircraft Connectivity	☐ Transmit and Receive: Aircraft to EFB and EFB to aircraft ☒ Receive only: Aircraft to EFB only (GPS, IRS, FMS) ☐ Transmit only: EFB to aircraft only ☐ Other
Operating System	☒ Microsoft Windows (Version: XP or 2000) ☒ Linux ☐ Custom
Applications Supported	

☐ **Data Link**

☒ **Electronic Charts** – ☐ Raster or ☒ Vector-based

World-wide Terminal charts, Rules-driven Airport maps, and Enroute Application completed.

☒ **Electronic Checklists** – ☐ Viewer only, ☐ Error checking, ☐ Automated error-checking, ☐ Active checklist

Possible using COTS and Jeppesen EFB SDK

☒ **Electronic Documents** – ☐ Viewer only, ☐ Viewer with additional features, ☐ Mark-up language

☐ **Enhanced Vision**

☒ **Flight Performance Calculations** – ☐ Weight & Balance, ☐ Takeoff/Landing Performance, ☐ Other

Third-party Application Integration fully supported through SDK.

☒ **Flight Planning**

☐ **GPS/Navigation Display**

Jeppesen	**Location:** Englewood, CO

☐ **Logbook**
☒ **Moving Map**
☒ **Surface Moving Map**
☐ **Synthetic Vision**
☐ **Terrain Display**
☐ **Traffic Surveillance** – ☐ Merging/Spacing
☒ **Video Surveillance** – Integration with Goodrich and AD Aerospace
☐ **Voice Data Communications**
☒ **Weather** – Worldwide weather available
☒ **Other** – Jeppesen's DDM provides an approved data and software distribution and management solutions, ground tools for configuration management, Complete training solutions including Jeppesen Computer-Based Training, 24/7 support

Lufthansa Systems	**Location:** Kelsterbach, Germany
Product(s)	Lido/Flight Bag (EFB Operating System: Client, Ground Administration, Web Portal; Applications: Doc Viewer, EFF/NavLog, Reporting, Revision Service) Lido/eRouteManual Lido/Performance Tools (TakeOff, InFlight, Landing) eLoadsheet
Website(s)	• www.lhsystems.com

Product Overview

Lufthansa Systems' Lido/FlightBag is the integrated EFB-solution to support the entire flight process. With Lido/FlightBag pilots have a readily available electronic information management system that that is intended to help them to prepare and conduct flights more easily and more efficiently. The solution is independent of the aircraft type and hardware used, and can be installed as a Class 1, 2 or 3 solution.

As Lido/FlightBag is integrated with IT ground systems it offers a seamless and bidirectional flow of information between operational IT systems and the flight deck. This enables the pilot to access e.g. the electronic briefing package from anywhere in the world, prepare the clipboard and set annotations.

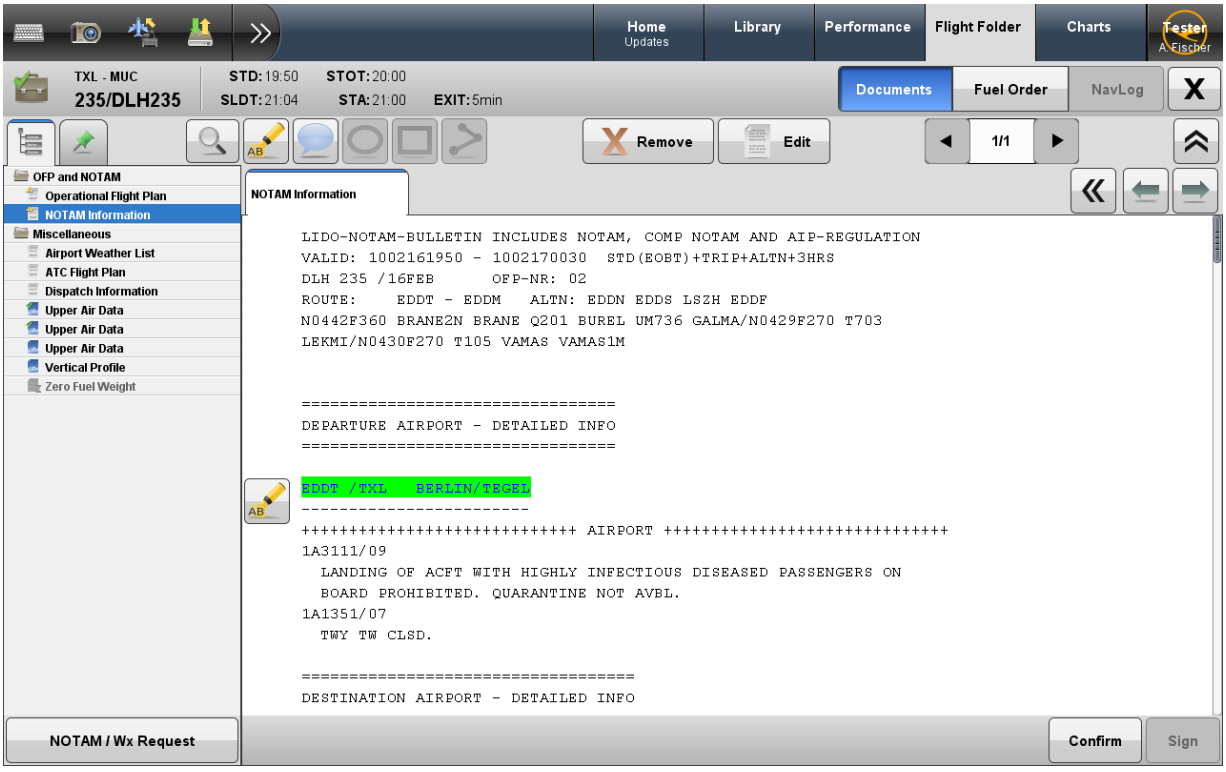


Photo courtesy of Lufthansa Systems

Approvals/Compliance

Authority	☒ FAA ☐ EASA ☐ Other
TC/STC	☐ TC ☐ STC
Aircraft	N/A
TSO	☐ C113 ☐ C165
FAA Regulatory and Guidance Material	☐ AC 20-159 ☐ AC120-76A ☐ Order 8900.1

Lufthansa Systems	**Location:** Kelsterbach, Germany
Industry Documents	☐ RTCA DO-178B (Software Level ____)
Other Notes	Lido/eRouteManual is ops approved by FAA for some US operators
Hardware	
Hardware Class(es)	☒ 1 ☒ 2 ☒ 3
Type of EFB	☒ Portable ☒ Installed
Communications	☐ None ☐ Wired ☐ Wireless ☐ Other
Controls	☒ Touch Screen ☒ Stylus ☒ Buttons ☒ Mouse/cursor control ☒ Keyboard ☐ Other
Push/Pull Functionality	N/A
Data Bus	☒ ARINC 429 ☐ ARINC 828 ☒ USB ☒ LAN ☒ Other (any TCP/IP connection)
Aircraft Connectivity	☐ Transmit and Receive: Aircraft to EFB and EFB to aircraft ☒ Receive only: Aircraft to EFB only ☐ Transmit only: EFB to aircraft only ☐ Other
Operating System	☒ Microsoft Windows (Version: any) ☒ Linux ☒ Custom
Applications Supported	

☒ **Data Link**
☒ **Electronic Charts** – ☐ Raster or ☒ Vector-based
☐ **Electronic Checklists** – ☐ Viewer only, ☐ Error checking, ☐ Automated error-checking, ☐ Active checklist
☒ **Electronic Documents** – ☐ Viewer only, ☒ Viewer with additional features, ☐ Mark-up language
☐ **Enhanced Vision**
☒ **Flight Performance Calculations** – ☒ Weight & Balance, ☒ Takeoff/Landing Performance, ☒ Other
In-Flight (A380 only), Cost Index Calculator as a 3rd party solution
☒ **Flight Planning** – Electronic Flight Folder, NavLog
☐ **GPS/Navigation Display**
☒ **Logbook** – Integrated 3rd party solution
☒ **Moving Map**
☒ **Surface Moving Map**
☐ **Synthetic Vision**
☐ **Terrain Display**
☐ **Traffic Surveillance** – ☐ Merging/Spacing
☒ **Video Surveillance** – Integrated hardware provider solution
☐ **Voice Data Communications**

Lufthansa Systems	**Location:** Kelsterbach, Germany
☒ **Weather** – Integrated 3rd party solution	
☒ **Other** – Electronic Flight Folder, Navigational Logbook, Reporting, Revision Service	

OBDS.com (On-Board Data Systems)	**Location:** Mirabel, Quebec
Product(s)	MFB™ (Multi-Function Flight-Deck Browser), Electronic Checklists (ECL), Fleet and Aircraft Content Management and Distribution Systems.
Website(s)	• www.obds.com

Product Overview

OBDS is an EFB software developer delivering custom Fleet Software and Data Management solutions for Class 1 and Class 2 EFB systems through its MFB™ ("Multi-function Flight Browser and Task Manager") and OBDSsync™ (Web Based Content Management) applications.

MFB™ converts any Windows®-compatible, regulation-compliant tablet PC or laptop into an EFB (Electronic Flight Bag) for use during all phases of flight.

MFB™ offers a standardized pilot interface and document library management platform.

MFB™ software and sub-components have been integrated with many Class 1 devices and a number of Class 2 approved systems including the Esterline CMC CMA-1100, CMA-1410. MFB™ is currently in use by corporate and managed fleets as well as Aircraft Manufacturer flight departments.

MFB™ is intended to allow pilots to:

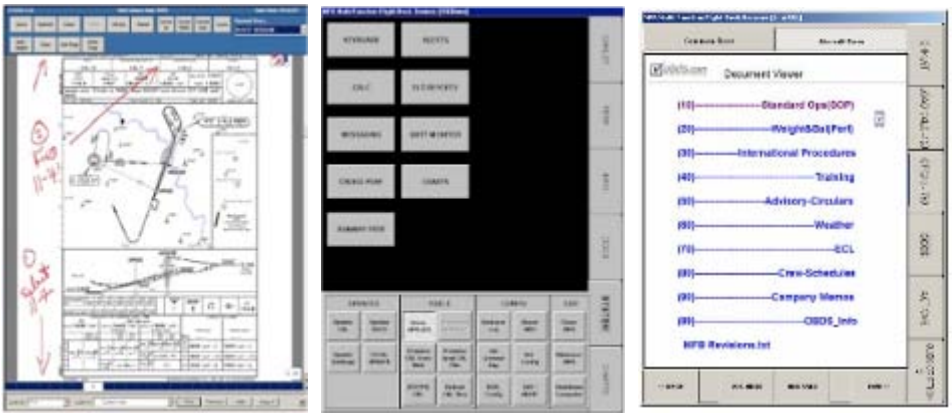
- Replace paper with electronically viewable documents
- Annotate on top of documents and forms
- Launch and navigate to any aviation application.
- Synchronize fleet aircraft and aircraft type libraries with one-button updates.
- Send documents and forms to and from fleet management.
- Limit access to non-EFB programs and Windows®
- Standardize the fleet with one common interface for ALL the aircraft in the fleet.

It is comprised of several core elements:

1. EFB Shell and Application Integration
2. Synchronized Fleet and Aircraft Library Manager and Viewer
3. Notes Manager and Ink Editor
4. Power Management, Timer and Messaging Tool

An array of customization technologies make installation uniquely fit each fleet's requirements.

MFB™ may also be used in a "utility" mode on desktop or laptop PC systems to ensure library synchronization between office, home and EFB.



Photos courtesy of OBDS

Approvals/Compliance

Authority	☐ FAA ☐ EASA ☐ Other
TC/STC	☐ TC ☐ STC
Aircraft	N/A
TSO	☐ C113 ☐ C165

OBDS.com (On-Board Data Systems)	**Location:** Mirabel, Quebec
FAA Regulatory and Guidance Material	☐ AC 20-159 ☐ AC120-76A ☐ Order 8900.1
Industry Documents	☐ RTCA DO-178B (Software Level ____)
Other Notes	The checklist application features “tagged” procedures and revision management per AC120-64.
Hardware	
Hardware Class(es)	☒ 1 ☒ 2 ☐ 3
Type of EFB	☒ Portable ☐ Installed
Communications	☐ None ☒ Wired ☒ Wireless ☐ Other *Other Notes:* Able to customize each installation to fit each fleet’s requirements
Control Requirements	☒ Touch Screen ☒ Stylus ☒ Buttons ☒ Mouse/cursor control ☒ Keyboard ☐ Other
Push/Pull Functionality	N/A
Data Bus Usage	☐ ARINC 429 ☐ ARINC 828 ☐ USB ☐ LAN ☐ Other
Aircraft Connectivity	☐ Transmit and Receive: Aircraft to EFB and EFB to aircraft ☐ Receive only: Aircraft to EFB only ☐ Transmit only: EFB to aircraft only ☐ Other
Operating System	☒ Microsoft Windows (Version: 2000, XP Pro, XP tablet , XP Embedded, Vista and Windows 7) ☐ Linux ☐ Custom

OBDS.com (On-Board Data Systems)	**Location:** Mirabel, Quebec

Applications Supported

☐ **Data Link**

☒ **Electronic Charts** – ☐ Raster or ☐ Vector-based

COTS application. Certain chart systems are made interactive with note-taking capability. Integration for all electronic charting applications. Display and GUI is optimized and customized for controlling third-party charting applications including Jeppesen, NACO, and EAG.

☒ **Electronic Checklists** – ☐ Viewer only, ☒ Error checking, ☒ Automated error-checking, ☐ Active checklist

Class 3 Electronic Checklist (ECL) Systems for Honeywell Data Nav, SPZ, Primus 1000, Primus 2000/ 2000XP, Honeywell Primus EPIC, and Collins E85-86, PL4. Error checking and automated error checking functionality available.

Class 2 ECL Systems (dedicated EFB checklists) offer custom formatting, open and closed loop ECL, active or passive interactivity, and change review feature (with automated review of changes from last revision).

Class 1 ECL systems include an interactive PDF ECL and an ECL Emulator application.

☒ **Electronic Documents** – ☐ Viewer only, ☒ Viewer with additional features, ☐ Mark-up language

MFB™ provides a docs viewer with additional features. Note-taking is supported for all documents. Notes may be typed or handwritten, and pilot notes and signatures may be synchronized with other users. Forwarding of reports, and notes to approved recipient list also provided.

☐ **Enhanced Vision**

☒ **Flight Performance Calculations** – ☐ Weight & Balance, ☐ Takeoff/Landing Performance, ☐ Other

COTS application. Custom integration supported.

☒ **Flight Planning** – Flight Docs may be delivered to EFB by Online Sync or USB update

☐ **GPS/Navigation Display**

☐ **Logbook**

☐ **Moving Map**

☐ **Surface Moving Map**

☐ **Synthetic Vision**

☐ **Terrain Display**

☐ **Traffic Surveillance** – ☐ Merging/Spacing

☒ **Video Surveillance** – COTS application. Custom integration supported.

☐ **Voice Data Communications**

☒ **Weather** – COTS application. Custom integration supported.

☒ **Other** – Integration of other COTS applications is provided

4.2 COMMERICIAL OFF-THE-SHELF SOFTWARE

This section provides a list of software manufacturers that provide *commercial off-the-shelf software* and the product(s) they offer for use on EFBs such as laptops, tablet computers, or installed EFB displays. In contrast to the software manufacturers in Section 4.1 that provide an *integrated and customizable software* solution, manufacturers that produce *commercial off-the-shelf software* provide isolated functions or applications and are not typically involved in the installation of the software on an EFB.

The information in this section was gathered via internet searches, vendor demonstrations, and product literature. This information is intended to provide a snapshot of the available software for EFBs. Neither the Volpe Center nor the FAA endorses any of these products.

Note that software products change frequently; as such, the information in this document may only be accurate for a limited period of time. The information in this review is up to date as of June 2010. Updates can be found at www.volpe.dot.gov/hf/aviation/efb/cots_software.

The following information is provided for each *commercial off-the-shelf software* offering:

- Column 1 contains the name of the manufacturer and their location, if available. Each manufacturer's name is hyperlinked to their website.
- Column 2 contains the specific product name(s). The product names are hyperlinked to a subsite for that specific product, if available.
- Columns 3 - 19 identify different categories of software for EFBs: a filled circle (●) in one or more of those columns indicates that the manufacturer currently offers that software; an open circle (○) indicates that the software is in development. Any additional software that a manufacturer offers beyond those identified in these columns are listed under "Other" (column 20).
- The last four columns of the table describe the operating system (OS) for which each software product is designed, if that information was specified. Three operating systems are specifically identified: Windows, Certified OS (e.g., Linux), and iOS. If the software runs on an operating system other than these three, the “Other OS” column is filled. Please note that in this table, iOS refers only to software designed for use on the iPad and not software designed for use on any other iOS based device (e.g., iPhone).

Manufacturer	Product Name	Software																		Operating System			
		Data Link/Data Comm	Electronic Charts	Electronic Checklists	Electronic Documents	Enhanced Vision	Flight Performance Calculations	Flight Planning	GPS/Nav Display	Logbook	Moving Map (Enroute, Vertical Profile)	Moving Map (Airport Surface)	Synthetic Vision	Terrain Display	Traffic Surveillance	Video Surveillance	Voice Data Communications	Weather	Other Software	Windows	Certified OS	iOS (iPad)	Other OS
1. Adobe San Jose, CA	Acrobat Reader				●															●	●	●	Custom OS
2. Aero Data Solutions San Clemente, CA					●																		
3. AeroCharts			●																			●	
4. Aeroplanner.com St. Louis, MO	Basic Flight Planner							●												●	●		
	Pilot Logbook									●													
	SmartChart		●																				
	Weather Station																	●					
5. Aircore Systems Marsberg, Germany	AS-DORMAS				●					●									Flightcrew Briefing				

Manufacturer	Product Name	Software																	Operating System			
		Data Link/Data Comm	Electronic Charts	Electronic Checklists	Electronic Documents	Enhanced Vision	Flight Performance Calculations	Flight Planning	GPS/Nav Display	Logbook	Moving Map (Enroute, Vertical Profile)	Moving Map (Airport Surface)	Synthetic Vision	Terrain Display	Traffic Surveillance	Video Surveillance	Voice Data Communications	Weather	Other Software	Windows	Certified OS	iOS (iPad)	Other OS
6. Aircraft Data Fusion Farmington, MN	Aircraft Performance Suite						●													●	●		
	E-Maintenance Suite				●														Engine Condition Reporting, ETOPS Checklist, Discrepant Reporting				
	Operations Support Suite																		Crew Management System Interface, Digital Fuel Recording and Management				
7. Aircraft Performance Group Castle Rock, CO							●																
8. Approach Systems Inc. Orem, UT	APIC		●					●			●			●				●		●			
9. Astoria Software San Francisco, CA	Astoria On Demand				●															●	●		

Manufacturer	Product Name	Software																	Operating System			
		Data Link/Data Comm	Electronic Charts	Electronic Checklists	Electronic Documents	Enhanced Vision	Flight Performance Calculations	Flight Planning	GPS/Nav Display	Logbook	Moving Map (Enroute, Vertical Profile)	Moving Map (Airport Surface)	Synthetic Vision	Terrain Display	Traffic Surveillance	Video Surveillance	Voice Data Communications	Weather	Other Software	Windows	Certified OS	iOS (iPad)	Other OS
10. Aviation Communication & Surveillance Systems (ACSS) Phoenix, AZ	SafeRoute™											●			●				Merging and Spacing	●	●		
	TAWS+™													●									
11. Bytron Lincolnshire, UK					●			●	●	●								●	Cabin Crew, Fuel and Emissions Management, Slot Management				
12. Cavu Companies West Winfield, NY	EFB Pro		●		●		●	●										●	Fuel Tankering	●			
13. Control Vision Corp Pittsburg, KS	Anywhere Checklist			●																●			
	Pocket Plates		●				●																
	UltraTAWS										●			●									
14. Coradine Portland, OR	LogTen Pro									○												●	
15. Edgemont Aviation Herndon, VA	Preflight Wx+						●											●	Crosswind Calculator, VOR Viewer, Hold Calculator			●	

Manufacturer	Product Name	Software																	Operating System			
		Data Link/Data Comm	Electronic Charts	Electronic Checklists	Electronic Documents	Enhanced Vision	Flight Performance Calculations	Flight Planning	GPS/Nav Display	Logbook	Moving Map (Enroute, Vertical Profile)	Moving Map (Airport Surface)	Synthetic Vision	Terrain Display	Traffic Surveillance	Video Surveillance	Voice Data Communications	Weather	Other Software	Windows	Certified OS	iOS (iPad)	Other OS
16. eFlight Systems Wedemark, Germany	A.R.C.I.S.																		Revision Cycle Monitoring	●			
	Crew Breifing System																		Crew Briefing Information				
	eFRC Software																		Form Completion				
	eJourney						●	●										●					
	Pilot Briefing System						●											●					
17. Euroscript Bertrange, Luxembourg	Content Management System				●																		
18. Evoke Systems Norfolk, UK	Electronic Flight Operations Systems (EFOS): EFB				●			●		●									Quality Reporting, Training Tools/Forms, Flight Safety and Incident Reporting				
19. Flight Explorer® Bethesda, MD	Flight Explorer Pilot® Edition							●										●		●			

Manufacturer	Product Name	Software																	Operating System			
		Data Link/Data Comm	Electronic Charts	Electronic Checklists	Electronic Documents	Enhanced Vision	Flight Performance Calculations	Flight Planning	GPS/Nav Display	Logbook	Moving Map (Enroute, Vertical Profile)	Moving Map (Airport Surface)	Synthetic Vision	Terrain Display	Traffic Surveillance	Video Surveillance	Voice Data Communications	Weather	Other Software	Windows	Certified OS	iOS (iPad)	Other OS
20. ForeFlight Houston, TX	ForeFlight Charts		●																			
	ForFlight Checklist Pro			●																		●	
	ForeFlight File							●															
	ForeFlight Mobile 3 HD		●		●		●	●	●		●							●					
21. Forward Vision Russell, PA	Forward Vision					●																	
22. FS Kneeboard			●	●														●				●	
23. Global Nav Source Manitowoc, WI			●															●				●	
24. Hangar B-17 Redondo Beach, CA	WinEFIS							●			●			●				●	Flight Director, Windometer, Attitude Indicator	●			
25. Honeywell Morristown, NJ	AV8OR Horizon 3D												●							●			
	WINN™ Graphical Weather																	●					

Manufacturer	Product Name	Software																	Operating System			
		Data Link/Data Comm	Electronic Charts	Electronic Checklists	Electronic Documents	Enhanced Vision	Flight Performance Calculations	Flight Planning	GPS/Nav Display	Logbook	Moving Map (Enroute, Vertical Profile)	Moving Map (Airport Surface)	Synthetic Vision	Terrain Display	Traffic Surveillance	Video Surveillance	Voice Data Communications	Weather	Other Software	Windows	Certified OS	iOS (iPad)	Other OS
26. InfoTrust Group Irvine, CA	TechSight/X				●														Maintenance Management				
27. Jeppesen Englewood, CO	Jeppesen Mobile TC		●																			●	
28. Mikelsoft Abu Dhabi, U.A.E	CrewLog																		Crew Logbook	●			
29. MKS Waterloo, Ontario	MKS Integrity																		Change Management				
30. Moving Terrain Salzberg, Germany	Moving Map Software										●												
	MT BlitzPlan							●															
	MT Camera															●							
	MT Charting		●																				
	MT Satellite Radar																	●					
	MT TAWS													●									
	MT TCAS														●								
31. Myairplane.com Cardington, OH			●																	●			

Manufacturer	Product Name	Software																	Operating System			
		Data Link/Data Comm	Electronic Charts	Electronic Checklists	Electronic Documents	Enhanced Vision	Flight Performance Calculations	Flight Planning	GPS/Nav Display	Logbook	Moving Map (Enroute, Vertical Profile)	Moving Map (Airport Surface)	Synthetic Vision	Terrain Display	Traffic Surveillance	Video Surveillance	Voice Data Communications	Weather	Other Software	Windows	Certified OS	iOS (iPad)	Other OS
32. Navimatics	Aero Charts		●					●														●	
33. Navtech Waterloo, Ontario	Navtech aircraft performance						●																
	Navtech eCharts and Seamless Enroute Navigation Charts (SENC)		●																				
	Navtech flight planning							●															
	Other																		Crew Planning				
34. NC Software Wilmington, DE	LogBook Pro									●												●	
35. PC Avionics Placerville, CA	MountainScope™							●			●			●				●		●			

Manufacturer	Product Name	Software																	Operating System			
		Data Link/Data Comm	Electronic Charts	Electronic Checklists	Electronic Documents	Enhanced Vision	Flight Performance Calculations	Flight Planning	GPS/Nav Display	Logbook	Moving Map (Enroute, Vertical Profile)	Moving Map (Airport Surface)	Synthetic Vision	Terrain Display	Traffic Surveillance	Video Surveillance	Voice Data Communications	Weather	Other Software	Windows	Certified OS	iOS (iPad)	Other OS
36. PDFPlates.com			●																	●		●	OS X, eBook readers
37. PilotLog Littlehampton, West Sussex, UK										●										●			
38. Ramco Lawrenceville, NJ			●		●						●	●											
39. RMS Technology Molalla, OR	FliteSoft						●	●		●								●	Fuel Locator	●			
	Vista		●								●								Clearance Check, Profile View, Virtual Flight, Breadcrumbs, Attitude Display, Rubber Band Routing, Tool Bar, Recording/Playback				

Manufacturer	Product Name	Software																	Operating System			
		Data Link/Data Comm	Electronic Charts	Electronic Checklists	Electronic Documents	Enhanced Vision	Flight Performance Calculations	Flight Planning	GPS/Nav Display	Logbook	Moving Map (Enroute, Vertical Profile)	Moving Map (Airport Surface)	Synthetic Vision	Terrain Display	Traffic Surveillance	Video Surveillance	Voice Data Communications	Weather	Other Software	Windows	Certified OS	iOS (iPad)	Other OS
40. Rockwell Collins Cedar Rapids, IA		●	●															●						
41. Seattle Avionics Woodinville, WA	GlassView										●			●										
	SmartPlan		●					●										●						
	SmartPlates		●																					
42. SITA Geneva, Switzerland	AIRCOM	●																						
43. SkyCharts	SkyCharts Pro		●											●										
44. Skyjob Buckinghamshire, UK							●	●											Framework for hosting EFB applications	●				

Manufacturer	Product Name	Software																	Operating System			
		Data Link/Data Comm	Electronic Charts	Electronic Checklists	Electronic Documents	Enhanced Vision	Flight Performance Calculations	Flight Planning	GPS/Nav Display	Logbook	Moving Map (Enroute, Vertical Profile)	Moving Map (Airport Surface)	Synthetic Vision	Terrain Display	Traffic Surveillance	Video Surveillance	Voice Data Communications	Weather	Other Software	Windows	Certified OS	iOS (iPad)	Other OS
45. Skypaq Westmeath, Ireland	Skypaq eLog "Enterprise"									●									Electronic Technical Logbook, Maintenance Logbook, Fleet Airworthiness Monitoring, Defect Management, Cabin Log and System Integration solutions with partners Finnair	●			
46. SolidFX Foxborough, MA	FX 8 eChart Reader		●																				Custom reader
47. True Flight Boulder, CO			●									●	●	●	●			●	Eagle Eye	●			

Manufacturer	Product Name	Software																	Operating System			
		Data Link/Data Comm	Electronic Charts	Electronic Checklists	Electronic Documents	Enhanced Vision	Flight Performance Calculations	Flight Planning	GPS/Nav Display	Logbook	Moving Map (Enroute, Vertical Profile)	Moving Map (Airport Surface)	Synthetic Vision	Terrain Display	Traffic Surveillance	Video Surveillance	Voice Data Communications	Weather	Other Software	Windows	Certified OS	iOS (iPad)	Other OS
48. Ultramain Albuquerque, NM	eCabin™									○										●			
	efbContent Manager™																		Content/Revision Management (in development)				
	efbCrewComms™																		Chat and email				
	efbFaultFinder™																		Fault Reporting (planned)				
	eReporting™																		In-Flight and Air Safety Reporting				
	efbTechLogs™									●													
49. Ultra-Nav Lubbock, TX							●																
50. Warbred Studios	Flight Scale						●															●	
51. WorldAviationWx																		●				●	
52. WSI Andover, MA	WSI InFlight®																	●					
53. WxWorx Melbourne, FL	WxWorx on Wings																	●					

5 REFERENCES

EFB Regulatory and Guidance Material

Federal Aviation Administration, Advisory Circular (AC) 20-159, *Obtaining Design and Production Approval of Airport Moving Map Display Applications Intended for Electronic Flight Bag Systems*. April 30, 2007.
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Federal Aviation Administration, Advisory Circular AC 120-76A. *Guidelines for the certification, airworthiness, and operational approval of electronic flight bag computing devices.* (17 March 2003)
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Joint Aviation Authorities (JAA). Temporary Guidance Leaflet No. 36. Approval of Electronic Flight Bags (EFBs). (June 2004)
Available at www.jaa.nl/secured/Operations/Public%20Documents/TGLs/TGL%2036.pdf.

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Available at www.tc.gc.ca/civilaviation/commerce/circulars/AC0231.htm.

Federal Aviation Administration, Order 8900.1, *Flight Standards Information Management System*, Electronic Flight Bag Operational Authorization Process (Volume 4, Chapter 15), February 5, 2009.

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Federal Aviation Administration, Advisory Circular (AC) 25-11A, *Electronic Flight Deck Displays*. June 21, 2007.
Available at www.faa.gov, under Regulations and Policies.

Federal Aviation Administration, Advisory Circular (AC) 120-78, *Acceptance and Use of Electronic Signatures, Electronic Recordkeeping Systems, and Electronic Manuals.* October 29, 2002.
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Federal Aviation Administration, Technical Standard Order (TSO)-C113, *Airborne Multipurpose Electronic Displays*, October 27, 1986.

Federal Aviation Administration, Technical Standard Order (TSO)-C165, *Electronic Map Display Equipment for Graphical Depiction of Aircraft Position*, September 30, 2003.

Society of Automotive Engineers (SAE) AS9100: Quality Systems. *Aerospace – Model for Quality Assurance in Design, Development, Production, Installation, and Servicing.* November, 1999.

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RTCA/DO-160E, *Environmental Conditions and Test Procedures for Airborne Equipment*.

RTCA DO-178B, *Software Considerations in Airborne Systems and Equipment Certification*.

RTCA DO-254, *Design Assurance Guidance for Airborne Electronic Hardware*

RTCA DO-257A, *Minimum Operational Performance Standards for the Depiction of Navigational Information on Electronic Maps*.

FSB Reports (as of December 2009)

The following Final FSB reports are available at www.opspecs.com/AFSData/FSBRs/Final/.

Advanced Data Research, FG-3600, FG-5000 Class 2 Electronic Flight Bag (EFB), EMB-135BJ (Legacy); Mounting System: Audio International Articulating Arm.
Available at www.opspecs.com/AFSData/FSBRs/Final/EMB-135%20ADR%203600%20-%205000%20EFB%20FSB%20Report.doc

Advanced Data Research, FG-6000, Class 1 Electronic Flight Bag (EFB), (Viewable Stowage).

Available at www.opspecs.com/AFSData/FSBRs/Final/ADR%20FG-6000%20EFB%20FSB%20final.pdf

ARINC Messenger (NavAero), Class 2 Electronic Flight Bag (EFB), ST3064DE-T.
Available at www.opspecs.com/AFSData/FSBRs/Final/B727%20EFB%20FSB%20Report.doc

Boeing Class 3 Electronic Flight Bag.
Available at www.opspecs.com/AFSData/FSBRs/Final/Boeing%20EFB%20BP4%20FSB.pdf

Collins IFIS-5000 System, CESSNA Model CE-525, Class 3 Electronic Flight Bag, Panel Mounted.
Available at www.opspecs.com/AFSData/FSBRs/Final/Collins%20IFIS%205000%20EFB.doc

Compaq (HP) PC TC1000 Electronic Tablet, Class 1 Electronic Flight Bag (EFB), Type A and B Applications, Kneeboard/Laptop Mounting System.
Available at www.opspecs.com/AFSData/FSBRs/Final/CompaqEFBFSBRptFinal.doc

Fujitsu Lifebook P1610, Class 1 Electronic Flight Bag (EFB), Type A and B Applications, Kneeboard Mounting System.
Available at www.opspecs.com/AFSData/FSBRs/Final/FujitsuLifebookP1610EFBFinalOSR.doc

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Available at www.opspecs.com/AFSData/FSBRs/Final/Fujitsu%20LT%20P-600%20EFB%20FSB.doc

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Jeppesen ™, Electronic Flight Bag (EFB), Application Software Ver 1.0, 1.1, 1.5, and 2.0.
Available at
www.opspecs.com/AFSData/FSBRs/Final/Jeppesen%20EFB%20Application%20Ops%20Suitability%20Report%20R3%2012-8.doc

navAero™ t•Bag™ C22, Class 2 Electronic Flight Bag (EFB), Mounting System: Avionics Support Group (ASG®).
Available at
www.opspecs.com/AFSData/FSBRs/Final/new%20navAero%20t%20Bag%20C2%20Operational%20Suitability%20Report.doc

Teledyne Controls, Onboard Performance System (OPS), Electronic Flight Bag (EFB), Application Software.
Available at www.opspecs.com/AFSData/FSBRs/Final/Teledyne%20OSR%20R1.doc

Xplore Technologies' iX104C2, Class 1 Electronic Flight Bag (EFB).
Available at
www.opspecs.com/AFSData/FSBRs/Final/Xplore%20%20iX104C2%20EFB%20OSR%20R1final.doc

Draft FSB reports are also available at www.opspecs.com/AFSData/FSBRs/Draft/.

Volpe Center EFB Research Reports

The following documents are available at www.volpe.dot.gov/hf/aviation/efb.

Yeh M., Chandra, D. C., (2007) *Electronic Flight Bag (EFB): 2007 Industry Review*. DOT-VNTSC-FAA-07-04, USDOT Volpe Center: Cambridge, MA.

Chandra, D. C. and Yeh, M. (2006). *A Tool Kit for Evaluating Electronic Flight Bags*. DOT/FAA/AR-06/44. DOT-VNTSC-FAA-06-21. Washington, DC. U.S. Department of Transportation, Federal Aviation Administration.

Yeh M. and Chandra, D. C. (2005). *Electronic Flight Bag (EFB): 2005 Industry Review*. DOT-VNTSC-FAA-05-06, USDOT Volpe Center: Cambridge, MA.

Chandra, D. C., Yeh M., & Riley, V. (2004). *Designing a Tool to Assess the Usability of Electronic Flight Bags (EFBs)*. DOT/FAA/AR-04/38, USDOT Volpe Center: Cambridge, MA.

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.

Chandra, D. C. and Mangold S. J. (2000). *Human factors considerations in the design and evaluation of electronic flight bags (EFBs) Version 1: Basic functions*. DOT-VNTSC-FAA-00-22. Cambridge, MA: USDOT Volpe Center.

Volpe Center EFB Conference Papers

The following short research papers, presented at various conferences, are also available at www.volpe.dot.gov/hf/aviation/efb.

Chandra, D.C. and A. Kendra. (2009). Review of Safety Reports Involving Electronic Flight Bags. *Proceedings of the 15th International Symposium on Aviation Psychology*. 27-30 April. Dayton, OH

Chandra, D.C. and Yeh, M. (2006) Evaluating Electronic Flight Bags in the Real World. *Proceedings of the International Conference on Human-Computer Interaction in Aeronautics (HCI–Aero) 2006*. 20–22 September 2006, Seattle, Washington.

Chandra, D.C. and Yeh, M. (2004). Designing and Testing a Tool for Evaluating Electronic Flight Bags. *Proceedings of the International Conference on Human-Computer Interaction in Aeronautics (HCI–Aero) 2004*. 29 September – 1 October 2004, Toulouse, France.

Chandra, D.C. (2003). A tool for structured evaluation of electronic flight bag usability. In *Proceedings of the 22nd Digital Avionics Systems Conference (DASC)*. 12–16 October 2003, Indianapolis, IN.

Chandra, D. C. (2002). *Human Factors Evaluation of Electronic Flight Bags.* Proceedings of HCI-Aero 2002. 23-25 October. Cambridge, MA.

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Other

Flight Safety Foundation Editorial Staff, "Paperless Cockpit Promises Advances in Safety, Efficiency." Flight Safety Digest Volume 24 (June 2005).

APPENDIX A. VOLPE CENTER EFB RESEARCH

This appendix provides abstracts for Volpe Center reports and conference papers related to EFBs. A hyperlink to each report or conference paper is included. The list of documents is also available at www.volpe.dot.gov/hf/aviation/efb.

EFB Volpe Center Reports

Report Title	Abstract
Chandra, D.C. and Kendra, A. (2010). *Review of Safety Reports Involving Electronic Flight Bags.* (DOT/FAA/AR-10/5, DOT-VNTSC-FAA-10-08). Cambridge, MA, US DOT Volpe National Transportation Systems Center Cambridge, MA, US DOT Volpe National Transportation Systems Center. Available at: www.volpe.dot.gov/hf/docs/efb042010.pdf	Safety events in which Electronic Flight Bags (EFBs) were a factor are reviewed. Relevant reports were obtained from the public Aviation Safety Reporting System (ASRS) database and the National Transportation Safety Board (NTSB) accident report database. Of the 67 relevant ASRS reports identified, 32 pertain to use of chart software and 30 pertain to computation of flight performance. Operational outcomes/anomalies and underlying EFB issues are identified. Charts were often in use on the EFB when deviations in heading, altitude, or speed occurred. Zooming and panning the chart display can induce workload and may cause the pilot to miss important information. With flight performance calculations, anomalies included company policy deviations, incorrect computations, and runway incursions. Finally, some pilots who were new to the EFB mentioned that difficulty using the EFB contributed to the event. EFB-related findings from two NTSB accident reports are highlighted. Both of these identified use of an EFB for calculating landing distance as a contributing factor. One issue was that assumptions underlying the performance calculations on an EFB must be presented to the crew as clearly as on paper-based performance tables. A second issue was assessment of the adequacy of training and procedures for using EFB performance calculations functions.
Yeh, M. and Chandra, D.C. (2007). *Electronic Flight Bag (EFB): 2007 Industry Review* (DOT-VNTSC-FAA-07-04). US DOT Volpe Center: Cambridge, MA. Available at: www.volpe.dot.gov/hf/aviation/efb/docs/efb-industry07.pdf	This document, which is based on information from March, 2007, provides an overview of Electronic Flight Bag (EFB) systems and capabilities, with particular focus on the systems' human interface. It updates the April 2005 EFB Industry Review (Yeh and Chandra, 2005). The information in this document will be useful to anyone interested in the EFB market, including the Federal Aviation Administration (FAA), customers, operators, manufacturers, and researchers. The report is divided into three sections. The first section briefly reviews EFB research conducted by the Volpe Center over the past several years and the results of that research. The second section describes products and services offered by several system providers and integrators. The third section is a list of software providers. A list of references, including policy and research documents is provided at the end of this report.

Report Title	Abstract
Chandra, D.C. and Yeh, M. (2006). *A Tool Kit for Evaluating Electronic Flight Bags* (DOT/FAA/AR-06/44 & DOT-VNTSC-FAA-06-21). U.S. DOT Volpe Center, Federal Aviation Administration: Cambridge, MA & Washington, DC. Available at: www.volpe.dot.gov/hf/aviation/efb/docs/toolkit0906.pdf	Over the past few years, the Volpe Center has developed a set of five tools that can be used to evaluate Electronic Flight Bags (EFBs) from a human factors perspective. The goal of these tools is to help streamline and standardize EFB human factors assessments by the Federal Aviation Administration (FAA). This document introduces all of the Volpe EFB assessment tools, which are for use by any FAA or industry evaluator. This report contains descriptions of the tools and practical information on when and how to use each tool. It is not necessary to be a human factors expert to use the tools, and the tools can be incorporated into the evaluation process in different ways depending on the time available. The appendices to this report contain the full version of the tools.
Yeh, M. and Chandra, D.C. (2005). *Electronic Flight Bag (EFB): 2005 Industry Review* (DOT-VNTSC-FAA-05-06). U.S. DOT Volpe Center: Cambridge, MA. Available at: www.volpe.dot.gov/hf/aviation/efb/docs/efb-industry05.pdf	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.
Chandra, D.C., Yeh, M., and Riley, V. (2004). *Designing a Tool to Assess the Usability of Electronic Flight Bags (EFBs)* (DOT/FAA/AR-04/38 & DOT-VNTSC-FAA-04-12). U.S. DOT Volpe Center, Federal Aviation Administration: Cambridge, MA & Washington, DC. Available at: http://www.volpe.dot.gov/hf/aviation/efb/docs/efb-toolreport.pdf	The Federal Aviation Administration (FAA), system designers, and customers all recognize that Electronic Flight Bags (EFBs) are sophisticated devices whose use could affect pilot performance. As a result, human factors issues have received considerable attention from the EFB community. In addition, the FAA's Advisory Circular (AC) on EFBs (AC 120-76A) identifies a need for evaluating EFBs from a human factors perspective, and contains a list of human factors considerations for review. However, the AC does not specify how to perform EFB human factors evaluations. This research was directed at developing a tool that could be used by FAA Aircraft Certification Service specialists in the field to conduct structured and comprehensive, yet practical, EFB usability evaluations. Two tools were developed for initial tests, with the expectation that a single tool would eventually emerge. The tools were refined over the course of several tests with prototype commercial EFB systems. In the end, we found that both tools are valuable, but in different ways. In this report, we describe both tools, our procedures for testing the tools, and our methods of processing the resulting data into feedback for the manufacturer.

Report Title	Abstract
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/FAA/AR-03/67 & DOT-VNTSC-FAA-03-07). U.S. DOT Volpe Center, Federal Aviation Administration: Cambridge, MA & Washington, DC. Available at: www.volpe.dot.gov/hf/aviation/efb/docs/efb_version2.pdf	Electronic Flight Bags (EFBs) are coming into the flight deck, bringing along with them a wide range of human factors considerations. In order to understand and assess the full impact of an EFB, designers and evaluators require an understanding of how the device will function and be used by crews, how the device will interact with other flight deck equipment, and how training and operating procedures will be affected. The purpose of this report is to identify and prioritize guidance on these topics so that designers and evaluators can make informed choices. Much of the guidance in this document is general and applies to any EFB system, regardless of the applications that are supported. Application-specific guidance is also provided for electronic documents, electronic checklists, flight performance calculations, and electronic charts. In addition, information on the rapidly changing and growing market of EFB products is provided in Appendix A, and a summary of high priority guidance for equipment evaluations is included in Appendix B. This document supersedes the earlier Version 1 report (DOT-VNTSC-FAA-00-22), which is referenced in the Federal Aviation Administration Advisory Circular on EFBs, AC 120-76A.

EFB Conference Papers

Conference Paper Title	Abstract
Chandra, D. C. and Yeh, M. (2006). Evaluating Electronic Flight Bags in the Real World. *Proceedings of the International Conference on Human-Computer Interaction in Aeronautics (HCI-Aero 2006).* 20-22 September. Seattle, WA. Available at: www.volpe.dot.gov/hf/aviation/efb/docs/evaluating_efb.pdf	Over the past few years, the Volpe National Transportation Systems Center (Volpe Center) has developed several tools that can be used to evaluate Electronic Flight Bags (EFBs) from a human factors perspective. The tools are needed because EFBs are sophisticated devices that may be approved for use through a relatively abbreviated process, in accordance with the guidance in the 2003 Federal Aviation Administration (FAA) Advisory Circular (AC) on EFBs (AC 120-76A). The newest tools were developed in coordination with the FAA Aircraft Certification Service and Flight Standards Service. They are documented in a draft FAA document known as the "EFB Job Aid." In this paper, the use of all of these different tools is described briefly, and the tools are compared and contrasted.

Conference Paper Title	Abstract
Chandra, D., Yeh, M. and Riley, V. (2004). Designing and Testing a Tool for Evaluating Electronic Flight Bags, *Proceedings of HCI–Aero 2004*, 29 September to 1 October, Toulouse, France.	The Federal Aviation Administration (FAA), system designers, and customers all recognize that Electronic Flight Bags (EFBs) are sophisticated devices whose use could affect pilot performance. As a result, human factors issues have received considerable attention from the EFB community. In addition, the FAA's Advisory Circular (AC) on EFBs (AC 120-76A) identifies a need for evaluating EFBs from a human factors perspective and contains a list of human factors considerations for review. However, the AC does not specify exactly how to do the field human factors evaluation. Our research is directed at developing tools and procedures that could be used by FAA field evaluators in conducting structured and comprehensive, yet practical, EFB usability evaluations. The tools and methods were developed and refined over the course of several tests with real EFB systems. In this paper, we describe the evolution of one promising tool into its latest, relatively mature, format. We also present our test procedure and methods of processing the resulting data into feedback for the manufacturer. Our next step is to expose more potential users, especially those in the FAA, to the tools and methods to determine if these products are useful in practice.
Chandra, D.C. (2003). A tool for structured evaluation of electronic flight bag usability. In *Proceedings of the 22nd Digital Avionics Systems Conference*. 12-16 October 2003, Indianapolis, IN. Available at: www.volpe.dot.gov/hf/aviation/efb/tool.html	Electronic flight bags (EFBs) are coming into the flight deck, bringing with them a host of human factors challenges. The first step in addressing these challenges was to identify and prioritize them. Good progress has been made on that front by Chandra and Mangold, whose comprehensive document is in active use by industry and the FAA today. Unfortunately, using this document is a daunting task because of its breadth and depth. Our next goal is to develop and test a tool based on the full document that can be used for periodic structured assessments of EFB usability. We expect that this assessment tool will benefit designers, operators, and regulators by providing a structure for EFB human-factors evaluations. Both EFB-specific issues and general user interface topics are covered. The purpose of this report is to document the progress to date on constructing this usability-assessment tool for EFBs. We cover how the tool was developed and tested, what it looks like to date, and how it could be used to help assess and track EFB usability. Further testing is planned to ensure that the tool is usable and to ensure that it adds value to the evaluation process.

Conference Paper Title	Abstract
Chandra, D.C. (2002). Human Factors Evaluation of Electronic Flight Bags. *Proceedings of HCI–Aero 2002*. 23-25 October. Cambridge, MA. Available at: www.volpe.dot.gov/hf/aviation/efb/hciaero.html	Electronic Flight Bags (EFBs) are small, customizable information-management devices that aid pilots and aircraft operators in conducting flights more efficiently and safely. While the promise of EFBs is great, government regulators, potential customers, and industry developers all agree that EFBs raise many human factors considerations that must be handled appropriately in order to realize this promise without adverse effects. In order to support the development of an Advisory Circular on EFBs, the Federal Aviation Administration (FAA) tasked the Volpe Center to identify EFB human factors considerations. These were documented and reviewed by both government and industry. The next step is to assist the FAA in creating an evaluation procedure for EFBs that is based on the human factors document. The procedure will be designed for use by inspectors to evaluate EFB human factors considerations in the field.
Chandra, D.C. and Mangold, S. J. (2000). Human factors considerations for the design and evaluation of Electronic Flight Bags. *Proceedings of the 19th Digital Avionics Systems Conference*. 10-12 October 2000, Philadelphia, PA. Available at: www.volpe.dot.gov/hf/aviation/efb/chandrdc.html	There is currently great interest in developing stand-alone electronic devices to support flight deck tasks. These devices, called "Electronic Flight Bags," (EFBs) were originally seen as a repository for electronic documents. Today, some airlines envision EFBs as multi-function devices supporting an array of applications, while others envision a simple low-end device used only for viewing documents, or perhaps for performing flight performance calculations. The Federal Aviation Administration (FAA) is charged with approval of EFBs for installation and use in aircraft. The approval process will be a multi-dimensional effort requiring an understanding of how the device functions and is used by crews, how the device interacts with other cockpit equipment, and training and operating procedures. Volpe Center has been tasked with writing a document on the human factors issues related to EFBs. Our goal is for the document to be of value to both system evaluators in the FAA and system designers in industry. Our challenge was to create a document that addresses the wide range of proposed EFB implementations, suits the needs of the various readers, and provides useful information for designers and evaluators. In this paper we review the design of the document and how it addresses each of these requirements. We also give an overview of the content of the document and provide illustrative extracts from the text.

APPENDIX B. SOFTWARE MANUFACTURERS: COMMERCIAL OFF-THE-SHELF SOFTWARE WEBSITES

Manufacturer	Website
Adobe	www.adobe.com
Aero Data Solutions	www.aerodatasolutions.com
AeroCharts	www.aerocharts.com/a
Aeroplanner.com	www.aeroplanner.com
Aircore Systems	www.aircore-systems.com
Aircraft Data Fusion	www.aircraftdf.com
Aircraft Performance Group	www.apg.aero/mw
Approach Systems Inc	www.approach-systems.com
Astoria Software	www.astoriasoftware.com
Aviation Communication & Surveillance Systems (ACSS)	www.acss.com
Bytron	www.bytron.com
Cavu Companies	www.cavucompanies.com
Control Vision Corp	www.anywheremap.com
Coradine	www.coradine.com
Edgemont Aviation	www.edgemontaviation.com
eFlight Systems	www.eflight-systems.de
Euroscript	www.euroscript.com
Evoke Systems	www.evoke-systems.com
Flight Explorer	www.flightexplorer.com
ForeFlight	www.foreflight.com
Forward Vision	www.forward-vision.net
FS Kneeboard	www.fskneeboard.com
Global Nav Source	www.globalnavsource.com
Hangar B-17	www.hangarb17.com
Honeywell	www.honeywell.com
InfoTrust Group	www.infotrustgroup.com
Jeppesen	www.jeppesen.com
Mikelsoft	www.mikelsoft.com
MKS	www.mks.com
Moving Terrain	www.moving-terrain.de/lang-en
Myairplane.com	www.myairplane.com
Navimatics	www.navimatics.com
Navtech	www.navtech.aero
NC Software	www.nc-software.com
PC Avionics	www.pcavionics.com
PDFPlates.com	www.pdfplates.com
PilotLog	www.pilotlog.co.uk
Ramco	www.ramcoaviation.com
RMS Technology	www.rmstek.com

Manufacturer	Website
Rockwell Collins	www.rockwellcollins.com
Seattle Avionics	www.seattleavionics.com
SITA	www.sita.aero
SkyCharts	www.skycharts.net
Skyjob	www.skyjob.co.uk
Skypaq	www.skypaq.com
SolidFX	www.solidfx.com
True Flight	www.aviationsafety.com
Ultramain	www.ultramain.com
Ultra-Nav	www.ultranav.com
Warbred Studios	www.warbredstudios.com
WorldAviationWx	www.web.me.com/bwalkera300
WSI	www.wsi.com
WxWorx	www.wxworx.com