From MFD to PFD—Displays for Your Cockpit

BY GEORGE WILHELMSEN

The options to install a display in your cockpit have literally exploded in recent years. Text and monochrome moving maps have given way to equipment that can display position and its relation to various features and hazards in living color. Multi-function and primary flight displays have been developed to help pilots improve situation awareness, avoid hazards, to provide primary flight guidance, and reduce cockpit workload.

With so many display options, aircraft owners face the problem of choosing and understanding what's available and will meet their needs. To help sort through the dizzying array of available equipment, the Aircraft Electronics Association has put together this guide to the various cockpit displays available. It is our hope that with these facts, you will be able to choose the right display for your cockpit.

PRIMARY FLIGHT DISPLAYS

PFDs, or Primary Flight Displays, are relatively new to the industry. Currently being actively marketed by Avidyne and Chelton for the retrofit and OEM market, and Garmin and Honeywell for the OEM market, the PFD is designed to replace your existing cockpit instruments with an electronic, big-screen EFIS display. The advantages of this approach are simple: all your mechanical "steam gauges" but three emergency backups are removed from the cockpit, and replaced with high tech glass. With the right combination of backups, you can eliminate the vacuum pump from your airplane, and will add a redundant electrical system to provide sufficient backup power.

Avidyne

Avidyne's Entegra PFD is a well constructed unit that capitalizes on all of the company's previous experience with their FlightMax MFDs. As a result, you get a PFD with a lot of flexibility, as well as a sunlight readable LCD display. Adding on the FlightMax EX5000, you get the same high resolution screen that has integrated terrain and a water base map with man-made obstacles, as well as other interfaces. Featuring two 10.4 inch AMLCD color screens, the system can be configured in Portrait or Landscape modes for maximum installation utility. The system is available in a variety of new production aircraft, as well as for the retrofit market.

Other features of the Entegra include a built-in Air Data and Attitude Heading Reference System (ADAHRS), as well as

Avidyne's Entegra PFD and MFD

datalink capability. The system has numerous interfaces to other avionics. For traffic, there are interfaces to the L-3 Skywatch and Skywatch HP and Ryan TCAD 9900B/BX. Weather support is available through Avidyne's datalink product, and through an interface to the L-3 WX 500 Stormscope. The Entegra will work with the S-Tec System 55 and Bendix/King KAP 140 autopilot systems.

When connected to Garmin 400 and 500 series GPS systems, the Entegra can display curved flight paths. Avidyne offers an optional EMax engine management module, which includes a fuel totalizer, automatic leaning, percent horsepower indication, full engine monitoring of CHT and EGT parameters, engine RPM, manifold pressure, oil temperature and pressure, fuel flow, outside air temperature and electrical bus voltages.

For more information visit www.avidyne.com or call 800-AVIDYNE.

Bendix/King

Entering the market with an Integrated Avionics System is Bendix/King with their Apex System. The new Apex System uses solid state sensors, dual processors, and a pilot-friendly design to make this a system worth looking at. With one or two Primary Flight Displays and one MFD, the Apex offers high resolution color AMLCD displays which have almost unlimited dimming and cutting edge resolution. The system is connected to a high speed, bi-directional data bus means that the system can be easily expanded in the future as new features are made available.

Bendix/King's APEX PFD and MFD

The APEX System regularly takes the information available from the GPS sensor, as well as traffic, weather, and terrain displays, and prioritizes the safety information to allow the pilot to maximize situational awareness while flying. The cockpit display is described as an "advanced T," to assure that pilots will find it easy to fly, since it is adapted off of the popular "T" style analog panel. The system also offers VC2, or Visual Cueing and Control, which is designed to make even the most challenging IFR flight as easy as one that was VFR.

For more information visit www.bendixking.com or call 877-712-2386 or 913-712-2613.

Chelton

Chelton started with the Sierra line of cockpit displays, which were the forerunner of the current FlightLogic Synthetic Vision EFIS Systems. With two sunlight readable 6.5 inch color TFT LCD displays that are also glare resistant, the new Chelton display systems work well in the cockpit. The FlightLogic System features inertial non-tumbling, non-precessing Attitude Heading Reference System, equipped with three solid-state angular sensors, three solid-state accelerometers and three magnetometers.

A 12-channel parallel tracking Freeflight GPS WAAS receiver is part of the package for maximum GPS capability, which also includes predictive RAIM and FDE. The FlightLogic System provides digital flight performance recordings for last 21 flights, which makes it easy to look back on past flights. The onboard database includes terrain, towers and obstructions, and the system has an integrated voice warning feature.

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Chelton's FlightLogic EFIS System

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One of the unique features of the FlightLogic System is the deadstick glide area, which is shown on the display. This area, which is compensated for wind, terrain and turns, makes it easy to see what is within your glide distance, or whether an off-field landing is warranted. With STCs for over 400 Part 23 aircraft pending, this system is poised and ready to enter the cockpit. The Chelton FlightLogic System has interfaces that can provide full weather and traffic capability, as well as Class A, B and C TAWS and Class A and B Helicopter TAWS.

For more information visit www.cheltonflightsystems.com or call 208-389-9959.

Garmin

With the release of their G1000 Integrated Avionics Suite, Garmin joined the PFD market. Garmin's edge comes from the fact that their products include the nav and com functions as well as GPS and AHRS, which sets them apart from their competition. Garmin is currently selling to the production aircraft market, but it is only a matter of time before this popular display migrates into the retrofit market.

The G1000 features two 10.4 inch diagonal XGA AMLCD screens, with an optional 15 inch MFD screen available. The system features flight instrumentation, all engine operational parameters for piston, turboprop and turbofan engines; engine trend data; exceedance monitoring, detailed topographic mapping, and TIS data using Garmin's Mode S technology. Available interfaces include Garmin weather radar (in development), satellite weather data link (via Weather Works and XM Radio), lightning-detection interfaces, and Class-B TAWS, Traffic Avoidance System (TAS) interfaces; with future expansion to accommodate emerging traffic-awareness technologies.

Garmin's G1000 PFD and MFD

For more information visit www.garmin.com or call 913-397-8200.

S-Tec / Meggitt Avionics

The MAGIC suite is a set of LCD displays and solid state sensors that provides a cockpit design to smaller aircraft that previously was only seen in the executive jet or airline crowd. Featuring a Primary Flight Display and Navigation Display, this two tube system shows all the information that is needed to fly the aircraft. The PFD shows a standard horizon with Flight Director bars, flanked by tapes of airspeed, altitude, course and vertical speed. The ND or Navigation Display can show a compass rose HSI, Map and ARC view, with data taken from systems such as the GPS, nav and com system. Autopilot outputs are provided.

The MAGIC system has redundant engine display units available to display engine information for the safe operation of turbine engines, as well as a selected reversionary mode where the data from both screens is compressed and displayed on one of the screens. The entire system includes the PFD, ND, ADAHRS, and data acquisition unit.

For more information, visit www.meggitt.com, or call 800-872-7832 / 940-325-9406.

Meggitt's MAGIC Suite

MULTI-FUNCTION DISPLAYS

The area of MFDs is wide and varied. In the interest of fairness, we are including units that are stand-alone MFDs, as well as MFDs that feature nav and com functions and extra interfaces. Our intent is to provide you with the most information on the subject, so that you can make the right decision as to which MFD might be right for your airplane and flying needs. MFDs have evolved over the last several

years to offer the budget and safety conscious the most situational awareness for their avionics dollar. With screen sizes to fit virtually any panel, MFDs have become the hottest retrofit seller for two simple reasons—they help you fly safer and more accurately. The units detailed here take you beyond the moving map to a world of new features in traffic, terrain and weather.

Avidyne

Avidyne is one of the leaders in MFD displays, originally starting with their FlightMax line. The line has since matured into the FlightMax EX500, which has the impressive ability to access the Avidyne Satellite Weather System, as well as with the right options, a variety of other aircraft weather systems. In doing so, the EX500, or its bigger brother, the EX5000 (See the PFD section for details) are interesting products for your cockpit needs. The EX500 is the MFD that we'll focus on here, and it features a 5.4 inch diagonal, color AMLCD screen in landscape format.

The EX500 features an integrated datalink transceiver that uses the FlightMax Datalink Weather Service & Orbcomm satellite network to download airborne weather data to the system. A color contour terrain base map is built into the product, and includes the Americas and International terrain, as well as United States obstacle data. The display can show curved flight paths, including DME arcs, with weather overlaid over the course, allowing improved weather tactical avoidance.

The options available on the EX500 include an EGPWS, TCAS I or II Interface, as well as interfaces with the L-3 WX 500 Stormscope, and a variety of EGPWS sensors. For the radar

Avidyne's EX500 MFD

capable version of the EX500, there are 18 different interfaces for Collins and Bendix radar systems, with numerous traffic interfaces available as well. With the right addition of interfaces, the EX500 will become a more powerful MFD, since you can fill in all the tactical positions of traffic, weather, and terrain in one, easy to use unit.

For more information visit www.avidyne.com or call 800-AVIDYNE.

Bendix/King

Bendix/King has focused a significant amount of effort into their IHAS Integrated Hazard Avoidance System product line, with the company sporting a 2000, 5000 and 8000 line, backed by the KMD 250, 550 and 850 MFDs. As a result, the company has a number of MFD options that are able to be custom tailored to just about any cockpit environment.

Their lowest cost GA unit is the KMD 250 / IHAS 2000 combination. Offering a 3.8 inch diagonal, color TFT active matrix display in landscape format, this new unit has the best graphics of the current line. The features include a color moving map display with terrain awareness that includes an extensive database of aeronautical and cartographic information such as land features, reference information on airports, navaids, intersections, special use airspace, rivers, roads, lakes, cities and railroad tracks.

The built-in Quick Tune feature allows pilots to load frequencies directly into a KX 155A or 165A nav/com. New options for the KMD 250 include an internal GPS receiver, and numerous interfaces to datalink weather. Lightning information via the L-3 WX 500 Stormscope, TIS traffic from the KT 73, and higher end traffic and terrain solutions are available as well.

The next step up is the KMD 550 / IHAS 5000 combination. With a larger, 5 inch diagonal high resolution color active matrix LCD display in landscape format, the KMD 550 includes an extensive database of aeronautical and cartographic information, including land features and reference information on airports, navaids, intersections, special use airspace, rivers, roads, lakes, cities and railroad tracks.

Bendix/King's KMD 250

Options: When interfaced with the KLN 94 GPS, the KMD 550 can display holding patterns, procedure turns and DME arcs. A NTSC interface is available to display an external camera or video source.

The IHAS 5000 system is constructed of the KMD 550 which is combined with KMH 880 traffic and terrain processor and KDR 510 datalink receiver, which provides active traffic, terrain and datalink weather. The system has numerous interface capabilities, including the KDR 510 datalink transponder, L-3 WX

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500 Stormscope, with traffic and terrain from numerous sources. GPS inputs can be accepted from most GPS receivers, including the Bendix/King KLN89B, KLN 90B, KLN 900 and KLN 94.

Bendix/King's KMD 550

The KMD 880 / IHAS 8000 system is basically the same display and capabilities as the KMD 550, with the addition of radar. With the ability to accept signals from nine different radar systems, the KMD 880 / IHAS 8000 is one way that existing radar-equipped aircraft operators can upgrade their radar display and get traffic and weather in the same bargain. For those owners looking for a clean start, the IHAS 8000 system is comprised of the KMD 850 display, along with the KMH 880 traffic and terrain processor, and the ART 2000 radar sensor.

For more information visit www.bendixking.com or call 877-712-2386 or 913-712-2613.

Garmin

Garmin changed the world of avionics when it released the GNS 430 some years back. The company's 400 Series, which is comprised of the GPS 400, GNC 420 GPS/com and GNS 430 GPS/nav/com, set new standards at the time of their release. The 400 series has a 3.75 inch diagonal color LCD display, with the 500 series offering a larger 5 inch diagonal color

Garmin's GNS 430

LCD screen. Better yet, these units are approved for IFR GPS approaches.

Both systems feature customizable map displays, along with the ability to show cartographic details such as borders, major highways and cities, along with a full array of aviation data. The units can be interfaced with the L-3 WX 500 Stormscope, as well as receive weather information from Garmin's GDL 49 Orbcomm weather sensor and TIS traffic information from the GTX 330 Mode S Datalink Transponder.

More importantly, the GNS 430 and 530 series are full-featured nav/coms, featuring the ability to support the existing frequency spectrum, and even change over with the touch of a few buttons to the soon to be required 8.33 kHz frequency spacing. The systems feature a 12 channel parallel track GPS engine that is WAAS upgradeable. An "A model" version of the 430 and 530 are now available, with a more powerful 16 watt com transmitter. The company disclosed at the 2003 EAA convention their intent to add terrain advisories and even Class B TAWS to the 400 and 500 series by the end of 2003, with WAAS available by the end of 2004.

Garmin CNX 80 offers a number of advanced features that distinguish it as one of the most advanced products available in avionics. These include a WAAS GPS engine with a high resolution VGA, 256 color AMLCD display with a refresh rate that makes any course changes smooth as glass, built-in airport maps that are so detailed you can taxi by them, and a GPS/nav/com with the ability to remotely control a transponder. The approach certified CNX 80 system also displays flight plans including intersections and airways, making it easier to navigate approaches.

With a 15-channel GPS receiver, the CNX80 is ready to execute these precision approaches, which can now be approved at airports that previously could not afford the expense or upkeep of an Instrument Landing System (ILS). The new approaches support minimums as low as 250 feet, which is well lower than the lowest minimums published for non-precision approaches, which typically start out at around 400 feet AGL or higher.

In terms of map views, there are a total of four available, of which three of the maps are user-configured. The configuration includes the fields on the left side of the display, which in the standard map view are the active and standby com and nav frequencies, the GPS distance from a VHF navigation waypoint, as well as decoding the Morse Code waypoint identifier, the transponder code and status, a small CDI with cross-track error shown below it, and the CDI setting, either OBS for traditional navigation, or GPS for GPS navigation. The system has an approved model list of over 900 aircraft on the STC. This translates to easier and less expensive instal-

Garmin's GNS 530

Garmin's CNX 80 and MX 20 MFD

lations than other models on the market.

As nice as the CNX 80 is, it is hard to forget what the MX 20 brings to the table. Apart from being able to display the information from the CNX 80 on a bigger, 6 inch diagonal color AMLCD display, the MX 20 now has a triple-split screen mode, to allow the pilot to watch the terrain profile, and two other maps side by side at the same time. In addition, there are numerous interfaces for traffic, weather, and position, which make it easy to interface other systems with the MX 20.

A built in terrain and obstruction database is used to provide terrain information right on the MX 20 display, which can also display VFR and IFR charts including approach charts that are easy to read and use. The MX 20 is designed to work with an external GPS receiver, with the company offering an internal GPS as an option. An MX 20 I/O model is available, which has the advantage of being able to display weather radar from the Bendix RDR 2000 system.

For more information visit www.garmin.com or call 913-397-8200.

L-3

L-3's MFD entry is the i-linc, which was designed to allow pilots to put all their systems on a single display. The system can interface with the L-3 WX 500 for lightning information, as well as the Landmark TAWS 8000 System for detailed terrain awareness that meets Class B criteria. It can also interface with the L-3 Skywatch traffic interface, to allow traffic to join the display, as offers an optional interface to the Bendix ART 2000 weather radar system.

L3's i-linc MFD

When you combine these functions with an impressive 6 inch AMLCD screen that can display a sectional chart view and can be interfaced with GPS receivers to provide excellent situational awareness, and you can see why the i-linc is getting attention. An optional Chart View feature is available, which allows the display of Jeppesen approach plates and airport surface charts, as well as SIDs and STARs right on the moving map display. The extensive onboard database contains all the usual must-have information for pilots, including airports, nav aids, non-TAWS terrain, and bodies of water.

For more information visit www.as.l-3com.com or call 800-253-9525 or 616-949-6600.

From multi-function to primary flight, your decision for displays rests on several other key factors including price, aircraft type and available panel space. Your budget, your type of aircraft and your normal flight environment will dictate where you focus when considering a new display. Your avionics shop can further assist with your selection and the unit's ability to integrate with inputs from various navigation, communication, datalink and aircraft system management sources. ■