A Buyer's Guide:
Multi-Function Displays

MFDs: The World on a Screen

BY DAVE HIGDON

Many a skeptic has expressed his doubts by uttering one succinct phrase: "Seeing is believing."

The comment leaves room for him to be convinced — if he is shown.

Here, in the 21st century, seeing continues to help pilots both believe and act on what they see — whether the sight lays out their route or reveals a hazard to avoid: weather, traffic or approaching terrain.

But seeing generally works only as far out as you can, well, see on any given day.

Today's pilots increasingly benefit from a window that only opened around the dawn of the new century — about the time the color multi-function display, or MFD, started becoming widely available.

In the last century, such displays were found mostly in more sophisticated, more expensive business-turbine aircraft, and largely included moving-map displays, dedicated hazard-awareness displays or representation of flight instruments.

But as technology began to offer liquid-crystal displays as an alternative to monochromatic cathode-ray tubes, and digital circuitry supplanted analog electronics, displays began to rapidly take on multiple roles, even as they grew in size and shrank in weight.

What once served as a navigation tool quickly took on additional roles. They also started becoming available at price levels affordable for a larger number of aircraft, right down to the most modest piston-single aircraft.

In almost no time, it seems, the color LCD evolved from serving merely as a moving-map display to a true multi-function device capable of displaying graphics from a variety of sensors: traffic for anti-collision protection; lightning and radar for weather avoidance; terrain and obstacles to help pilots avoid inadvertent contact with the ground and tall structures.

Going even further, MFDs today also can serve to display engine-operation information and Doppler weather radar images without onboard weather radar thanks to high-resolution graphics processed from ground-based radar and relayed via a data-link network — terrestrial-based or satellite-based.

To believe these MFD screens have become valued assets, one only need glimpse at the panel of most new factory-built aircraft, thousands of older retrofitted airplanes and thousands of home-built experimental aircraft.

Even before the advent of fully integrated avionics suites for the piston and light-turbine markets, back when the standard six-pack panel still reigned, planemakers offered MFDs as either optional or standard equipment in their products.

And the choices continue to expand, offering aircraft owners options for upgrading their panels

Aspen Avionics' EFD1000 multi-function display

with all the functionality available from these electronic windows on the world.

Today's dominant screen technology appears to be the active matrix liquid crystal display, or AMLCD. The "active" part of the name comes from switching technology for each pixel that complements each pixel's capability to briefly hold the charge used to activate that pixel. In this way, the pixel remains brighter longer until recharged by the next refresh cycle.

Passive matrix LCDs employ no such switching, so each pixel lacks some of the sharpness and brightness of the active matrix screen.

Resolution as stated by most MFD manufacturers is actually a description of the pixel dimensions, expressed in pixels wide by pixels high.

As with computer and television screens, the higher the numbers, the sharper the image.

For example, the 800 x 600 pixels of a SVGA display is somewhat crisper than the VGA screen with only 640 x 480 pixels.

Finally, a screen's ability to display different colors is governed by the depth of memory — or bit depth — available to devote to each pixel. Therefore, an 8-bit image can simultaneously display no more than 256 discernable colors; a 24-bit image offers the ability to show millions of different colors.

Today's best MFDs boast higher resolution and greater bit depths to provide screens capable of greater sharpness and a wider array of colors to better show the graphics and symbols called for by their various inputs. The ability to show those differently sourced graphics is the reason pilots find the MFD a better window on the world.

When you put an MFD together with an electronic primary flight display (PFD), you have a full glass panel. Combine an MFD, PFD and controls for radios and transponders, and the package is an integrated panel.

This Buyer's Guide focuses on stand-alone MFDs used as both original equipment and as retrofit gear — some of which also form part of a full glass panel as well

as being available as a stand-alone device.

In addition to the product descriptions that follow, you will find a chart providing a brief description of each model and a suggested base price for each unit — a price exclusive of installation or any optional items to accommodate different inputs.

ASPEN AVIONICS
EFD1000 MFD & EFD500 MFD

Arguably one of the most anticipated new products in several years, Aspen's EFD1000 is the common backbone hardware for a line of products that includes three PFDs and two MFDs. Undisputedly, the EFD1000 MFD offers depth in features and value.

Aspen touts the EFD1000 MFD as a perfect complement to any of its three EFD1000 PFDs — and for some logical reasons. All of Aspen's EFD1000 line employs a TFT AMLCD screen measuring 6 inches diagonally with the pixel dimensions of 400 wide by 760 tall and high-intensity white LED backlighting for

Avidyne's EX5000 multi-function display

Garmin's GMX 200 multi-function display

MFD COMPARISONS

MANUFACTURER	MODEL	DESCRIPTION	PRICE
ASPEN AVIONICS	EFD1000 MFD	Vertically oriented color display capable of displaying map and hazard information as well as serving as a back-up primary flight display.	$9,995
	EFD500 MFD	Vertically oriented color display capable of serving as a color moving map as well as a hazard display.	$5,995
AVIDYNE	EX5000 & EX500	Color full-function multi-function displays designed to serve in map, hazard and engine monitoring functions depending on options. EX5000 is 10.4 inches; EX500 is 5.5 inches.	$13,995 $8,995
GARMIN	GMX 200	Full-color multi-function display capable of displaying input from all types of hazard sensors and data-link receivers; 6.5-inch screen.	$8,995
HONEYWELL BENDIX/KING	KMD 150	Color moving-map display for use with an external or internal GPS; hazard input limited to the WX-500 Stormscope.	$4,500
	KMD 250	Full-color multi-function display for use with integral or external GPS; compatible with a wide variety of hazard inputs and compatible data-link receivers.	$5,400
	KMD 550 KMD 850	Full-color multi-function displays for use with external GPS and a variety of hazard sensors and compatible data-link receivers; MMD 850 adds radar-display capability.	$9,100 $15,600
UNIVERSAL AVIONICS	MFD-640	Designed as a radar-display replacement with MFD capabilities; 6.4-inch display.	$40,000

(Prices are base without optional equipment that may be required for some functions. All screen dimensions given are diagonal.
All starting prices are subject to change. Please contact an authorized dealer for current pricing.)

MULTI-FUNCTION DISPLAYS
excellent daylight readability.

Like the company's three EFD1000 PFD models, the EFD1000 MFD can display a GPS flight plan as either a 360-degree view or as an arc. The MFD also displays a base map with curved flight paths, sectional-style maps, and overlays of terrain, traffic and weather with the appropriate inputs.

Among its most distinctive features are the EFD1000 MFD's integral ADAHRS, a GPS engine and backup battery. These pieces of hardware allow what normally serves as an MFD to double as a backup PFD and naviga-tion source to any of the three EFD1000 PFD models the company offers. With a self-contained backup to any of the three Aspen PFDs, the aircraft can lose stand-by mechanical instruments, such as an attitude indicator, altimeter and airspeed indicator.

Another unique feature common to the entire Aspen Avionics EFD1000 and the EFD500 MFD is the form factor of the device. All models measure a compact 3.5 inches wide, 7 inches tall and 4.15 inches deep.

The unit is designed to move into the space of two vertically aligned instruments in a standard six-pack. The relatively shallow 4.15 inch measurement comes from the upper half where a cylinder about 3 inches in diameter contains all the connections, the electronics, ADAHRS, stand-by GPS and backup battery, which is sized to provide at least 30 minutes of operation in the event of a failure of the aircraft's electrical system. The lower half has a shallower protrusion housing a forced-air cooling fan.

The unit weighs about 2.6 pounds — at worst, no more than two air-data instruments, such as an altimeter and vertical-speed indicator.

For pilots on a budget and who don't need a full electronic backup to an EFD1000 PFD, Aspen offers the highly capable EFD500

MFD at a steep discount compared to the EFD1000 MFD.

The EFD500 MFD lacks the integral three backup systems: battery, GPS and ADAHRS. Therefore, it cannot serve in a reversionary mode to one of the PFDs.

Otherwise, it offers all the other features of the EFD1000 MFD in the same compact package — albeit at a somewhat lower weight because of the absence of the backup components.

For more information, visit Aspen Avionics at www.aspenavionics.com.

AVIDYNE
FlightMax EX5000 & FlightMax EX500

An early pioneer in the glass-cockpit movement, Avidyne is one of the major players supplying glass-panel components and integrated packages to the general aviation market.

Among its most popular options is the FlightMax Entegra EX5000 MFD. The EX5000 measures 8.5 inches high, 10.7 inches wide and 4.62 inches deep, and it weighs 6.75 pounds. The EX5000 sports a 10.4-inch AMLCD color screen with 800 x 600 pixels and is sunlight readable.

Avidyne's EX5000 MFD meets TSO requirements for use as a radar display, spherics (lightning) detector, TCAS, TAS and FIS-B, as well as for use as an airborne multi-purpose electronic display. It also can support hazard-awareness sensors for each threat simultaneously.

In addition, it can work with satellite data-link systems to complement its base function as a highly capable moving-map display for a GPS.

For many pilots, the EX5000

has brought a little of the turbine world to their piston-driven cockpit. However, this unit is too large for a number of installations; therefore, Avidyne offers all the same functionality and hazard-sensor inputs in its FlightMax EX500 as an alternative for those with panel-space issues.

The EX500 MFD measures only 4.35 inches high, 6.25 inches wide and 10.75 inches deep, allowing it to accommodate the necessary hardware to support all the same functions as its larger stablemate.

Its 5.5-inch diagonal screen sports 616 x 350 pixels, and it can display more than 65,000 colors, assuring excellent rendition of the different map details and screen functions.

For more information, visit Avidyne Corp. at www.avidyne.com.

GARMIN
GMX 200

One of the trailblazing companies in general aviation, Garmin first helped advance the movement to affordable GPS with a line of compact handheld and feature-rich panel-mounted navigators before taking the community by storm with its two ground-breaking all-in-one boxes for IFR GPS, VHF nav/com and navigation moving map — the GNS 430 and GNS 530.

The GMX 200 builds on other innovations to provide pilots with a powerful MFD capable of delivering color images depicting everything an aviator might want. The basics of the GMX 200 include a sunlight-readable 6.5-inch (diagonal) AMLCD display with the pixel dimensions of 640 x 480.

Depending on the version selected, the GMX 200 offers

interfaces for Garmin's TIS transponders, a variety of TCAS 1 and TAS systems, TAWS and radar.

All variations, however, share in the baseline features that make the GMX 200 a worthwhile cockpit tool. For example, all versions support Garmin's GDL 90 ADS-B transceiver, the Garmin GDL 69 for XM satellite weather and Jeppesen's ChartView function, as well as IFR and VFR charts and plates.

One unusual feature for this type of MFD is the ability of the GMX 200 to function in a split-screen mode, allowing the user to chose two different charting or map functions for each half.

At 6.25 inches wide, 5 inches high and 8 inches deep, the GMX 200 fits nicely in a standard-width stack and is shallow enough for most installations. And the weight — which ranges from 4.3 pounds to 4.6 pounds, depending on interfaces — shouldn't tax most installation.

For more information, visit Garmin at www.garmin.com.

HONEYWELL BENDIX/KING
KMD 150, KMD 250, KMD 550 & KMD 850

At the top of the Honeywell line of MFDs is its aptly named MFRD: multi-function radar display.

As the name states, this full-featured box is designed to provide color support for input not only from airborne weather radar but also from sensors for other needs in one compact package.

Its 6.3-inch (diagonal) screen boasts a high-resolution AMLCD with 1,024 x 768 pixels in a package measuring 6.24 inches wide, 4.8 inches high and 8.378 inches deep. The 7.5-pound weight is in the range with other MFDs of its size and functionality.

MULTI-FUNCTION DISPLAYS

And functionality is the goal. By replacing a one-trick radar display with Honeywell's MFRD in the same space, the aircraft operator also gains the ability to use the MFD as a navigation map, terrain avoidance and traffic display.

A veteran of the Bendix/King product line, the KMD 250 broke new ground with its radio-standard form factor and a higher resolution screen than prior displays. The 3.8-inch AMLCD display comes in a package measuring a mere 3 inches tall, 6.3 inches wide and 7.65 inches deep.

The KMD 250 also took the Bendix/King integrated hazard avoidance system family to a new level by boasting as standard interfaces for a variety of data-link weather sources, lightning detection, several types of traffic input and terrain avoidance.

The KMD 250's built-in terrain database offers pilots two distinct modes of color-coding. In absolute mode, the terrain is color-coded according to its relative height above sea level. In relative mode, the terrain is color-coded according to its proximity relative to the aircraft's altitude and can provide passive terrain-proximity warnings.

Not only does this little package offer big utility, it does so at the svelte weight of only 3.5 pounds. The KMD 250 also is available with an integral GPS engine, so it can serve as a back-up navigator to a panel-mounted GPS that plays on the screen and switches automatically to the internal GPS in the event the other fails, or as a stand-alone VFR navigator.

Honeywell's KMD 550 and KMD 850 are very similar, sharing size, screen type and resolutions

Bendix/King's KMD 550 multi-function display

— differing primarily in the depth of their ability to display different inputs.

They all sport the same 5-inch TFT AMLCD display, control architecture and user interface design — an interface shown to be among the easiest to learn and use.

At the top of the scale are the KMD 850 and the KMD 550 — exact duplicates except in the 850's ability to display radar.

The 550 and 850 both support a variety of traffic, TCAS, terrain and weather interfaces, with each input requiring a matching interface card.

Honeywell also offers a budget solution to pilots who want a basic MFD in their panel: the KMD 150. Similar to its newer sibling, the KMD 150 is available without a GPS to serve solely as the slaved display for a panel-mounted GPS, or with an integral GPS engine so it can function as both a slave and a stand-by unit.

Its ability to display inputs from other sources is more limited — to the lightning-data input of an L-3 Communication's WX-500 Stormscope.

The KMD 150 is a 3.3-pound package measuring 6.2 inches wide, 4 inches high and 6.9 inches deep.

For more information, visit Honeywell at www.honeywell.com.

UNIVERSAL AVIONICS SYSTEMS CORP.
MFD-640

Targeted primarily as a replacement for existing older-technology radar display units in business-turbine and commercial aircraft, the MFD-640 brings to the cockpit the advances of a modern MFD, giving the crew access to information unavailable via those original equipment RDUs.

Weighing 8.5 pounds, the MFD-640 sports a 6.4-inch display in a case measuring 6.675

Universal Avionics Systems' MFD-640

inches wide and 5.175 inches tall at the bezel and 8.7 inches deep. The AMLCD color screen can display up to 256,000 colors.

Capable of supporting navigation functions, moving maps, flight planning, TAWS, EGPWS and TCAS, as well as lightning and weather radar, the MFD-640 also can serve as an annunciator and warning panel when properly equipped.

In addition, the MFD-640 supports onboard video inputs and data-link weather.

For more information, visit Universal Avionics Systems Corp. at www.uasc.com. ■