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DYNON CERTIFIED REVISITED

It's been quite a while since we talked about Dynon. In February 2018, I wrote an article about Electronic Flight Instrument Systems (EFIS) called "EFIS Options for 2018," in which I featured the two contenders at the time: The Dynon SkyView HDX Certified and the Garmin G3X.

That three-year interval does not mean that I have not been talking about Dynon — a lot. It seems these days, the majority of my clients want to have what I call "the EFIS discussion." I think I have made my position clear. Equip for the mission! EFIS is a great tool for pilots who spend time in true Instrument Flight Rules (IFR). Simply stated, light IFR pilots don't *need* EFIS technology, but many want it.

Light IFR, as I define it, is using your instrument ticket to avoid conditions that would otherwise ground you. Light IFR pilots have no desire to spend a flight in the clouds. They'll use their IFR ticket to get above it and *plan* for minimum clouds or higher ceilings at their destination.

True IFR pilots don't have a problem with this. Light IFR pilots have personal minimums in the range of 500 to 1,000 feet above ground level (AGL). Frankly, most of my clients have personal minimums closer to 1,000 feet AGL. They have no desire to go anywhere near approaches to minimums, where experienced true IFR pilots are more comfortable (and better equipped for it).

In short, you can safely fly light IFR as long as you have a healthy vacuum pump and mechanical gyros. The risk of vacuum failure is there, but the risk in light IFR is reduced compared to true IFR. My concern is a pilot who chooses EFIS over something else in their panel that *needs* attention, like a back-up nav/comm that (if the primary nav source fails) can't be trusted.

On the other hand, I don't discourage light IFR clients who have already checked all the boxes in their panel and (with a long-term plan of ownership) want to add EFIS to their upgrade plan. More often than not, that's a discussion about solid-state gyros (like the Garmin G5 and GI 275, and uAvionix AV-30-C) that can replace the mechanical vacuum gyros and allow the removal of the vacuum pump. This, of course, expands the budget beyond what might be considered reasonable for the aircraft. With a long-term plan, safety, comfort, and ease of flight take priority over resale value, and EFIS contributes.

Big-screen EFIS, like the Dynon HDX, fills another role in true IFR. Large displays for mapping, approach plates, weather (WX), traffic, and synthetic vision are a plus in true IFR. Where your average light IFR guy is using his iPad to provide this, large-format navigators and multi-function displays (MFDs) have filled that role in the past. MFDs are gone. EFIS systems with large primary flight displays (PFDs)/MFDs, like the Dynon Skyview HDX, are filling the void.

EFIS Dynon D10-A

Dynon Avionics

Dynon is 21 years old. It got its start in January 2000 with the development of the EFIS-D10. Originally a product for the experimental market, it went on (in 2016) to be the EFIS-D10A as the first EFIS 10-in-1, a certified replacement for a vacuum AI in a certified aircraft, along with the larger format D100.

Spaceship One, the Burt Rutan design that made it to the edge of space in 2004, used the D10 as its back-up navigation tool, and it was used solely for the return to Earth. Still a primary source for experimental builders, Dynon introduced an autopilot in 2008.

Then Dynon announced the large-format Skyview system in 2009 for its experimental customers, and it became the SkyView HDX in 2016. Two years later (March 2018) it was certified for the Cessna 172. Today, the HDX is certified for installation in almost 600 aircraft.

Dynon Skyview HDX

Dynon SkyView HDX Certified

The SkyView HDX system is made up of displays, Air Data and Attitude Heading Reference System (ADAHRS), and a set of peripherals (some optional) that add capability or aid in ease of operation. Synthetic vision is standard. We will look at each of these and put a value on these as they relate to the functionality of the system.

In addition, the SkyView offers an engine monitoring and autopilot option that, when combined, is a very good value by comparison. If you're a candidate for big-screen EFIS (refer to paragraph two!), are ready to upgrade a legacy autopilot, and need enhanced engine instrumentation, you'll want to pay attention.

System Requirements. The SkyView HDX system STC requires the following equipment be installed:

- HDX1100 (11.3-inch diagonal) or HDX800 (8.7-inch diagonal) display (at least one)
- EFIS-D10A standby display
- SV-ADAHRS-200 ADAHRS (shared if multiple displays are present)
- SV-OAT-340 Outside Air Temperature (OAT) sensor
- SV-GPS-2020 GPS antenna/receiver
- SV-MAG-236 Remote Magnetometer
- SV-BAT-320 Back-up Battery (up to one hour)

NOTE: There are a number of optional features that are available through the supplemental type certificate (STC) for a certified aircraft. We will discuss these.

HDX1100_Combo

SkyView Displays. The original HDX STC for certified aircraft was limited to a single display. The updated STC allows for up to three displays in the panel. If that is not enough, note that the Garmin G3X allows for four. We may refer to the G3X for comparison from time to time here.

Speaking of panels, that's phase one in any large-format EFIS installation. You'll need to have a new panel designed and created, especially if you plan to go with the engine monitoring option. Once all the original engine gauges are removed, you'll need one.

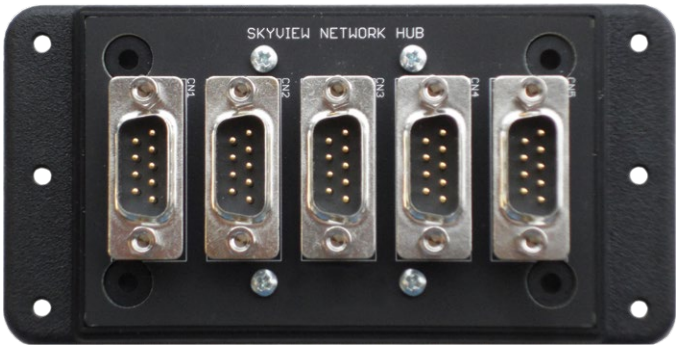
Look at this as an opportunity to arrange the panel (within FAA and Dynon guidelines) in a way that maximizes functionality! We just discussed this in the August 2021 issues.

Certainly, the number of displays is a budgetary issue. If you have the budget, you may choose a separate display for engine monitoring or as a separate MFD, but a single 10-inch display can provide a primary flight display, MFD, and engine data on the side quite well. The Dynon display resolution is 1,280 x 800 pixels, and this is similar in the Garmin G3X, however, unlike the Garmin, the Dynon 8-inch (HDX800) display is meant to be installed in the landscape (horizontal) position, where the G3X 7-inch display is mounted in the portrait (vertical) position. The displays can be mounted with or without the optional mounting trays, but these trays also provide provisions for mounting related peripherals (like the ADAHRS, backup battery, etc.), and that makes sense to me.

EFIS D10A Standby Display. Like most other EFIS options, back-up altimeter, airspeed, and attitude are required, and per the STC, the Dynon D10A electronic flight instrument fills that role. Garmin allows the use of mechanicals (or the G5) for this, but Dynon specifies the D10A here. Frankly, the electronic instrument is the more desirable and reliable option and simplifies the new panel design.

SV-ADAHRS-200 ADAHRS. The heart of any EFIS system is the AHRS, or in this case ADAHRS, which also includes heading. The HDX ADAHRS is remote-mounted, typically attached to the displays mounting tray.

OAT, GPS, Magnetometer and Back-Up Battery. The remote mounted OAT probe allows for temperature-corrected airspeed calculations. The system uses GPS as a back-up to ADAHRS when the pitot/static system is interrupted and is a requirement of the FAA. It is also used for Wide Area Augmentation System (WAAS) position if you choose the optional Dynon Mode S ES ADS-B Out solution. The remote magnetometer measures the flux of the earth and is mounted away from equipment and cables that can affect it. The backup battery is a requirement in all primary EFIS systems.



SV-NET-HUB

SkyView Network. The HDX system is connected through what Dynon calls the SkyView Network which is a serial bus system using central hubs. Note that Dynon offers custom, prefabricated harnesses included with the system and this is a real win-win because it saves on time and installation costs vs. the time and added expense of having to create them or have a shop create them.

SkyView HDX System Options. The following equipment may also be available for your airplane, but Dynon recommends that you check the current AML to confirm whether these options apply to your aircraft.

- HDX1100 or HDX800 Secondary Displays (Maximum of 2 additional)
- SV-XPNDR-261 Transponder Mode S, Class A (ADS-B Out)
- SV-ADSB-472 ADS-B In Receiver
- SV-EMS-220 Engine Monitoring System (and related sensors)
- SV-COM-X83 COM radio
- SV-ARINC-429 Arinc 429 Interface Module (interface to external navs)
- SV-KNOB Panel Knob Control Panel
- Autopilot System:
  - Roll and Pitch Servos are required options
  - Yaw Damper
  - SV-AP-PANEL Autopilot Control Panel
  - SV-BUTTON-APDISC Autopilot Disconnect Button
  - SV-Button-LEVEL Autopilot Level Button

Secondary displays and battery backup are obvious but let's look closer at the other options. We will look at engine monitoring and autopilot with greater detail.

SV-XPNDR-261 Transponder ($2,265 with install kit). This is a remote-mounted Mode S ES ADS-B-compliant transponder that you control through the HDX.

SV-ADSB-472 ADS-B In ($879 with harness and antenna). This is a remote mounted, dual band ADS-B In receiver that sends ADS-B WX and Traffic to the HDX MFD through a wired connection.

SV-COM-X83 Com ($2,195). The X83 com is a split system with the controller on the panel and the transceiver mounted remotely. It is available in horizontal or vertical configuration. Tuning is done through the com panel but info from one com (either this unit or from an external com) can be displayed on the HDX primary display. The Map Menu there allows the HDX to send airports and frequency information to the chosen com.

SV-ARINC-429 Arinc 429 Interface Module ($514 with install kit). The 429 interface allows the HDX to communicate with digital com and nav sources like the Avidyne IFD or Garmin GNS, GTN, or new Garmin GPS models, and digital nav/comms like the legacy SL-30 or Garmin GNC-255. I'm guessing the new Trig TX-56A will also be compatible when it comes to market.

SV-KNOB Panel Knob Control Panel ($250). This is a convenience item that allows you to adjust most-frequently changed in-flight parameters like heading, altitude, and altimeter setting. It's only *recommended* when the autopilot is installed, but I think it is a must-have.

EFIS Installation. I would put installation of a single SkyView HDX at 50 to 60 hours or $5,000 to $6,000. Adding a second screen would be in the 40-hour range ($4,000).

SV-EMS-220

Dynon Engine Monitoring. ($1,749 for four-cylinder, $2,004 for six-cylinder*)

Considering that the engine monitoring system from Dynon is primary and the pricing on the system is consistent with a past-generation JPI EDM-700 that only monitors cylinder head temp (CHT) and exhaust gas temperature (EGT) as advisory, this should start to open your eyes as to the value in the Dynon HDX! Here's what the system monitors (as primary) and what is included in the package (note that the system connects to mags for rpm):

- SV-EMS-220 Module with main harness and CHT/EGT harness
- Oil Temp Sensor
- Oil Pressure Sensor
- Fuel Pressure Sensor
- Fuel Flow Transducer
- Manifold Pressure Sensor
- Amps Shunt
- Carb Temp Sensor
- All CHT and EGT Probes
- Optional mounting bracket to mount engine monitoring system (EMS) module to ADAHRS and mount for shunt are available if required

Installation of the EMS system would be typical of any primary engine management system, and I would estimate that at about 40 hours. This puts the primary EMS system in the Dynon HDX at about $6,000 installed, where most primary engine management systems are in the $10k range (installed).

* Price is for single-engine monitoring. Twin-engine EMS pricing was established for the Piper Seneca at $7,027 for a four-cylinder and $7,537 for the six-cylinder (T) version.

Dynon SkyView HDX Autopilot

Currently, the available STCs for the Dynon HDX autopilot system are limited to the Cessna 172 (models F thru S), the Beechcraft Bonanza (S35, V35, V35A and V35B), and surprisingly the Piper PA-34 Seneca (PA-34-200 and 220T). I am surprised because of the four new autopilots introduced in 2017 (GFC 500, Genesys/S-TEC 3100, Trio Pro Pilot and Bendix King AeroCruze), there is no STC to install these in the Seneca.

STCs are moving slowly at Dynon, and I suspect that COVID-19 and the FAA approval process may be the reason. STC priority is based on "return on investment" so I suspect that Dynon will obtain STCs consistent with aircraft models (and aircraft owners) who are best candidates for large format EFIS with the budgets to match. STCs for expansion of the Bonanza models and the B58 Baron, the Cessna 182, and the Mooney M20 Series are already in the works.

The Dynon Two-Axis Autopilot includes:

- Straight and level button
- All horizontal functions — roll hold, heading, track, horizontal situation indicators (HSI), general purpose simulation system (GPSS) roll steering)
- Altitude hold and pre-select
- Full vertical navigation (VNAV) with glideslope coupling
- Fully coupled approaches — GPS, VNAV, localizer performance with ver-tical guidance (LPV), localizer (LOC) and instrument landing system (ILS)
- Flight Director
- Manual trim advice (prompting), electric and auto trim coming soon
- Optional yaw damper

Autopilot pricing (to date) with components and harnesses included*

Cessna 172 Models	$ 2,180
Beechcraft Bonanza Models	$ 5,530
Piper Seneca Models	$ 8,330

* Options: The SV-AP-Panel ($550) is highly recommended and there is a dedicated Level button for panel mount for $39 (where the AP-PANEL is not being used) and an autopilot disconnect button (if not currently available) for $49.

Installation of a typical two-access autopilot (with harnesses supplied) is 50 to 60 hours. For example, adding the autopilot to the EFIS system in a Cessna 172 would be about $7,200 to $8,200 additional.

Dynon SkyView HDX Pricing

I've priced up the Dynon SkyView HDX for more than one client, so I find the pricing estimates on the Dynon website to be pretty accurate. They do not estimate labor costs, so with my labor estimates and Dynon's equipment pricing, here's what we come up with. We'll use the three models that Dynon has an autopilot STC for, so we get a complete picture.

This is a single panel Dynon SkyView HDX with ADS-B In and Out, transponder, com radio and IFR connectivity, with EMS and two-axis autopilot installed:

Plane	Cessna 172	Beechcraft Bonanza	Piper Seneca**
Equipment	$21,974	$25,334	$ 37,149
Labor	$16,000 (160 hours)	$ 6,000 (160 hours)	$16,000 (160 hours)
Installed	$37,974	$41,334	$ 53,149

* Adding a second 10-inch display adds about $5,000 plus labor.
** The Seneca installation includes an additional 7-inch display for twin-engine EMS. There is no way you are going to fit twin-engine data on the side of a single 10-inch display.

ACRONYM GUIDE

ADAHRS ..... (air data, attitude and heading reference system)
AGL ..... (Above Ground Level)
AHRS (attitude and heading reference system)
AI ..... (Attitude Indicator)
AML ..... (Approved Model List)
CHT ..... (Cylinder Head Temperature)
EFIS ..... (Electronic Flight Information System)
EGT ..... (Exhaust Gas Temperature)
EMS ..... (Engine Management System)
GPSS ..... (General Purpose Simulation System)
HSI ..... (Horizontal Situation Indicators)
ILS ..... (Instrument Landing System)
MFD ..... (Multi-Function Display)
OAT ..... (Outside Air Temperature)
VNAV ..... (vertical navigation)
WAAS ..... (Wide Area Augmentation System)

Conclusion

Keep in mind that you'll still need a good audio panel, dual coms, and nav sources consistent with the mission, as well as a new panel created. I have no reason to believe that the quality of equipment coming out of Dynon is not consistent with the other manufacturers in our industry, so quality and features being equal (they are), you cannot argue that the value in the Dynon SkyView HDX with EMS and autopilot stands tall.

Let's return to the premise I made at the beginning of the article. I said, *"If you are a candidate for big-screen EFIS, ready to upgrade a legacy autopilot, and in need of enhanced engine instrumentation, you'll want to pay attention!"*

I stand by that statement. Thanks for reading!

Until next time, Safe and Happy Flying!

Bob Hart purchased his first airplane in 1971 at age 21. He's owned five others since. As a Senior Avionics Consultant at Eastern Avionics, Bob has personally sold over $20 million in Avionics. Bob now offers avionics advice through many online forums and consults avionics clients through his website *www.AvionixHelp.com*. He is semi-retired. After living in Colombia, South America, for a few years, he is now back in sunny Florida.

Editor's Note: Bob Hart is a regular participant on the Cessna Owner Organization's forums and is available to answer your avionics-related questions. To contact him, visit *www.CessnaOwner.org*, click the Forums tab, and scroll down to the "Avionics" forum. COO membership is required.