

# WHAT'S YOUR BACKUP PLAN?

THE LATEST GLASS PANEL UPGRADES STILL REQUIRE A BACKUP FLIGHT INSTRUMENTATION PACKAGE. LET'S REVIEW THE OPTIONS.

BY DARYL MACINTOSH

So, you've decided to upgrade the legacy instrument panel in your aircraft to the latest glass-panel technology, by installing new primary flight displays (PFDs). If you're like many pilots or owners, you didn't spend much time considering what will be used for the backup, or standby, flight instruments. However, all certified aircraft, when retrofitted with electronic PFDs, require standby instruments for attitude, airspeed, altitude and heading. [One exception: aircraft restricted to VFR use by their type certificate generally do not require a standby attitude indicator.]

Many aircraft currently equipped with electronic flight displays use an ordinary spinning mass attitude gyro, together with a standard altimeter and airspeed indicator, as standby instruments. The original wet compass often functions as the required standby heading indicator.

In recent years, the technology behind electronic flight instruments has advanced considerably. They are now

smaller and cheaper, thus enabling several manufacturers to develop new compact, multi-function standby flight instruments. These new systems offer a number of distinct advantages over traditional backup instruments, including: reduced weight, improved reliability, reduced maintenance costs, additional capability, and reduced use of panel real estate. On some aircraft, the entire vacuum system, including pump, filter, regulator and plumbing, can be removed. The weight of the vacuum system parts, plus the combined weight of the uninstalled attitude indicator, altimeter and airspeed indicator, can be considerable.

One fairly compelling reason to consider the installation of an electronic standby instrument system is the sheer challenge of quickly reverting to traditional instruments (steam gauges) after becoming accustomed to flying with an electronic PFD as a primary reference.

If the electronic flight information system (EFIS) PFD should fail, the pilot must immediately revert to the backup instruments, which are typically mounted in the best available, but nonstandard, locations. If the PFD failure occurs in instrument conditions, loss of control is possible as the pilot attempts to revert to traditional instruments.

## DECIDING ON YOUR BACKUP

When planning a new glass panel upgrade, avionics installers and their clients usually go through a standby instrument decision-making process similar to the following:

*Default choice - use the existing instruments:* Typically, the original attitude gyro, airspeed indicator and altimeter are retained and repositioned to be used as standby instruments. For aircraft with ample panel space, this can be a reasonable and cost effective choice.

*Another choice - install new instruments:* Some aircraft are equipped with problematic attitude gyros with high associated maintenance costs; however, these were required as the primary reference for an autopilot. If the new AHRS (attitude heading reference system) is capable of functioning as primary reference for the autopilot, it is a good opportunity to get rid of that old gyro. A new standard vacuum-type gyro, or possibly a new electric gyro with battery backup, can be installed

The Trilogy ESI-1000 by L-3 Avionics.  
L-3 Photo



instead. Likewise, during this process, old encoding altimeters are sometimes replaced with new, more reliable basic altimeters.

*Problem - panel space limitations:* A new Garmin G500/G600 PFD occupies the positions of six standard 3 1/8-inch instruments in the centre of the pilot's panel. Many aircraft panels don't have the additional space to accommodate three standard-sized 3 1/8-inch backup instruments.

*2 1/4-inch instrument option:* If the standard 3 1/8-inch backup instruments won't fit, one or more 2 1/4-inch instruments can be installed to meet the requirement. The disadvantages of 2 1/4-inch instruments include:

- They are fairly expensive – A set of three can easily cost \$12,000 or more.
- They are significantly smaller, and therefore more difficult to see.
- They can be less reliable than standard 3 1/8-inch instruments

*All-glass choice – install an electronic standby instrument:* There are now several types of compact and capable all-electronic backup instruments available from various manufacturers. Specific features and capabilities vary considerably, but each one of them is a true technological marvel in itself.

## SOLID-STATE ELECTRONIC BACKUP INSTRUMENT CHOICES

The newest solid-state electronic standby instrument systems are listed below, together with a brief summary of their key features.

*Trilogy ESI-1000 and ESI-2000*

The L-3 Avionics Trilogy electronic standby instrument was the first solid-state integrated standby system specifically created for general aviation (GA) aircraft. It replaces traditional electro-mechanical standby instruments and presents the information in a compact four-inch by three-inch display. It combines attitude, altitude, airspeed, slip/skid and optional heading data (heading requires a remote magnetometer) into a single digital display. The model ESI-2000 is the same as the ESI-1000, except that it contains an internal lithium-ion battery which will power the instrument for a minimum of 60 minutes. The ESI-1000 weighs 2.22 pounds (1.01 kilograms) and the ESI-2000 weighs 2.56 pounds (1.16 kilograms) and they require a nominal 28 VDC [volts of direct current] for operation. These systems are STC approved as backup instruments on a large number of GA aircraft, and are also vibration qualified for installation in rotorcraft. (List Prices: ESI-1000, US\$14,995; ESI-2000, US\$15,700)

*SAM Two-inch Standby Attitude Module*

The MD302 Standby Attitude Module (SAM) is a new product from Mid-Continent Instruments and Avionics. It is a digital standby instrument that provides attitude, altitude, airspeed and slip information in a compact 2.4 by 5.5-inch package that weighs just 1.6 pounds. Its selectable (horizontal or vertical) orientation enables panel mounting flexibility. It has a self-contained lithium-ion battery that provides a minimum 60 minutes of emergency operation. (List price: US\$10,600)

*GH-3900 ESIS*

The L-3 Avionics GH-3900 electronic standby instrument system (ESIS) provides attitude, altitude, and

airspeed data, presented together with heading and navigation information, in a compact 3-ATI size package using a full-colour, active matrix LCD display. It was designed for Part 25 and Part 23 (Class III & IV) aircraft, as well as Part 27 and Part 29 rotorcraft. It has the capability to interface with a wide variety of FMS, NAV, VOR, ILS and TACAN systems. (List Price: US\$44,200)

*GH-3900RSU ESIS*

L-3 Avionics recently announced a new split version of the GH-3900 standby instrument system, the widescreen GH-3900RSU. It consists of a thin (1.5 inches deep) display that can be installed in a shallow instrument panel and a separate remote sensor unit (RSU) that can be mounted in any convenient location. The 4.2-inch diagonal display is larger than the 3.2-inch diagonal display on the GH-3900. It is expected to be certified in 2013. (List Price: TBA)

*Evolution Backup Display*

Aspen Avionics recently introduced the Evolution backup display, which is a fully digital, independent flight instrument display that replaces traditional mechanical backup instrumentation. Although derived from Aspen's Evolution primary flight display system, it was designed as a backup for all brands of installed glass panels. Its overall dimensions are 3.5 inches wide by 7 inches high by 4.15 inches deep, and it weighs 2.9 pounds. Its selectable orientation enables it to be mounted horizontally or vertically. It is available in two versions: the basic version, which has capabilities similar to other electronic standby systems; and the advanced version, which includes a full-featured EHSI, dual RMI bearing pointers, flight director indicator, autopilot interface, roll steering output, and backup GPS. Each version has batteries capable of operating the system for two hours. (List Price: Basic Version US\$6,995, Advanced Version US\$10,995)

## THE FINAL WORD

We have now reached the stage of aviation evolution where spinning mass gyros are no longer the best technology choice for reliably displaying attitude and heading. Likewise, mechanical altimeters and airspeed indicators, with their inherent inaccuracies, continue to fall short of the performance expected by today's pilots. Over the coming years, I expect we will see a significant proportion of the civil aircraft fleet retrofitted with glass panel technology for both primary and backup flight instruments.

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