

Your Glass Panel Future:

Strategies for Selecting a Glass-Panel Retrofit

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In this information age, we have been led to believe more data is good, but this is not necessarily the case. Often more is not better; it's just more. Bits and pieces of data are meaningless unless the data is integrated into information.

Modern avionics, as capable as they are, do not guarantee your situational awareness is improved; they could lead to an information overload situation. To benefit from their advanced design and increased situational awareness, two things must take place: the myriad of data must be integrated into true information, and you must be proficient enough to know exactly where to look for the information.

With this in mind, you might be at the point of seriously considering how to best equip your panel. Complex avionics have undoubtedly increased the capability of our aircraft, but much time is spent looking down at the avionics systems, either learning their operation or manipulating their controls to finally get what you want. This reduces heads-up time looking for other aircraft or absorbing the entire flight situation. In other words, it's all about situational awareness. Selecting the right avionics is not an easy task, especially when trying to add capability in increments to an older panel with original equipment.

Instrument panels have changed dramatically in the past few years. Glass displays are the norm now, rather than a high-priced option. Can you even recall a new aircraft that doesn't have a glass panel? And now, the legacy fleet is able to finally pitch those mechanical flight instruments and join the glass-panel revolution.

Display and database technology has spurred all-in-one units for the general aviation market, while corporate and airline pilots have enjoyed glass for a long time. In case you haven't noticed, it's been more than 20 years since the first glass panels appeared in the Boeing 757/767 and Beechcraft Starship — although glass was appearing in NASA simulators a good decade before.

During the beginning stages of the integrated glass system upgrades for general aviation, the FAA was reluctant to allow a full electronic panel to be installed in place of the originally type-certificated mechanical flight instruments. Their primary concern was the high power requirements and resiliency these large displays demanded of the aircraft's electrical

system. There needed to be assurances the electrical generating and distribution system was robust enough to keep the lights on. The FAA began requiring a separate redundant electrical buss with the capability to supply power to the electronic displays after a major electrical system malfunction.

With the efforts of aircraft OEMs and avionics manufacturers, the FAA now is allowing installations of fully integrated glass-panel systems into legacy aircraft, as long as certain safety measures are properly implemented. Additionally, a fully reliable set of back-up instruments is required to be within the pilot's primary field-of-view, just in case the lights do go out unexpectedly or the pilot needs a crosscheck reference.

Technically, a glass retrofit could entail replacing just an old mechanical HSI with an electronic display showing the identical information with a few enhancements. Or you might decide to take the plunge and replace the entire set of flight instruments with a glass panel completely filling the primary field-of-view for the pilot, or both pilots.

The choice to go glass is easy — deciding which capabilities or manufacturers are best for your needs and best fit your budget are matters better discussed with your local avionics shop. The following provides a quick rundown of some current offerings.

ASPEN AVIONICS

Aspen Avionics is a newcomer to the avionics scene, but it already has revolutionized the glass retrofit market with a modular panel package that allows replacement of two instruments at a time.

Aspen's innovative Evolution flight displays are modular, allowing the option of replacing two vertically placed instruments at a time. Each display unit is specifically designed to slide into an existing three-inch instrument hole, eliminating the need for extensive instrument panel modifications. A universal bracket provides easy surface mounting using the existing instrument cutouts, or the unit can be optionally flush-mounted for a cleaner look. Replacing only the center flight instruments with a single Evolution display unit increases the capability and reliability of the traditional instrument six-pack, while replacing the entire six-pack with three Evolution displays transforms any aircraft into the next level of performance and safety.

Aspen's EFD1000 Pilot primary flight display is designed to replace the center of the six-pack cluster. The full-functioning, PFD/MFD combo unit replaces the previous AH/DG or ADI/HSI instrument pairs. Aspen offers three levels of PFDs, allowing full customization of a glass cockpit upgrade to meet both capability and budget requirements. The PFD is upgraded with minimal downtime through simple software updates.

The Evolution PFD delivers an integrated, solid-state, air-data, attitude, heading reference system (ADAHRS), combined with advanced



The Aspen Avionics Evolution flight displays installed in a Beechcraft Bonanza. One, two or three individual EFD1000s replace the six-pack flight instruments.

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navigation, moving map and hazard awareness capabilities.

The EFD1000's built-in air-data computer shows wind speed and direction at all times, in addition to the indicated airspeed, altitude and outside air temperature and true airspeed. The built-in altitude alerter provides altitude awareness during climbs and descents, or if the altitude drifts from the selected target. A built-in battery back-up keeps all the flight critical information intact, even in the event of a vacuum pump or total electrical system failure.

Adding a second or third EFD500 or EFD1000 multi-function display adds moving maps, data-link weather and traffic interfaces, a built-in terrain awareness database, flight-information pages and more. Built using the same hardware as the EFD1000 PFD, the EFD1000 MFD provides a duplication of air-data and attitude sensors. Working to continually monitor the health of flight data from each other, the MFD automatically can become a backup PFD if the primary should deteriorate or fail.

AVIDYNE CORP.

With a long-standing relationship with Cirrus for its PFDs and MFDs, Avidyne's success continued as its Entegra displays became standard equipment with many other OEMs. Understanding the market for retrofit installations in legacy aircraft, Avidyne now offers the Entegra PFD/MFD combination as an upgrade replacement for six-pack instruments in the general aviation fleet.

Avidyne's integrated flight deck system, the Envision, is designed with the flexibility to be installed as a retrofit in a number of different aircraft types and configurations. Envision includes a built-in ADAHRS, integrating all of the primary flight instruments into a single display.

The Entegra EXP5000 PFD presents standard flight instrumentation, including an attitude direction indicator (EADI), horizontal situation indicator (EHSI), altitude, airspeed, vertical speed, moving map, weather, terrain and traffic on large 10.4-inch diagonal, high-resolution, sunlight-readable full-color displays. The pilot-selectable moving map also presents flight-plan data and an RMI pointer.

The versatile, large-screen Entegra EX5000 MFD displays navigation data, broadcast data-link weather, lightning, color radar, traffic, obstacles, terrain and CMax approach plates. The EX5000 MFD also presents data-link graphical weather when interfaced with the Avidyne MLB700 or Heads-Up XMD-076/A. When interfaced with a Garmin 400/500 series GPS, curved flight paths are depicted over terrain, weather and traffic information, if the MFD is interfaced with the Avidyne TAS600/610/620, Avidyne TWX670 lightning detection, Ryan 9900B/BX, SkyWatch HP TAS, Garmin GTX330 TIS, or the Bendix/King KTA870 TAS, and a WX-500 Stormscope interface.



The Avidyne Entegra EXP5000 PFD and EX5000 MFD as a retrofit installation in a Cessna T210.

Avidyne continues to expand its Entegra retrofit program to upgrade a standard six-pack panel to glass with its current 10-inch PFD and MFD. Additionally, Avidyne announced a retrofit program featuring an 8-inch PFD will be available in 2010. For those existing OEM Entegra customers, Avidyne introduced its Release 9 retrofit program, which adds higher-resolution glass displays and replaces the dual GNS 430s with its own integral FMS900w/GPS/VHF nav/com radios. Avidyne Entegra owners now can upgrade their existing panels to a highly integrated, WAAS-capable avionics system.

CHELTON FLIGHT SYSTEMS

A division of Cobham, Chelton Flight Systems offers its FlightLogic synthetic vision EFIS, which is a complete flight and navigation instrumentation system replacing the basic six-pack flight instruments with



The Chelton Flight Systems FlightLogic displays are approved for installation in a wide variety of popular aircraft, including many corporate turboprops. The combination PFD/MFD displays also are certified for installation in many helicopter models.

a two-screen display system. The displays use high-brightness LCD screens with bezel-mounted menu buttons and control knobs.

The PFD/MFD combination can be mounted either vertically or horizontally depending on the instrument panel limitations. This provides plenty of flexibility for installations in tight instrument layouts. The panel units are driven by remote-mounted equipment, consisting of an AHRS, air-data computer and GPS/WAAS receiver. The FlightLogic system also integrates a Class C TAWS (terrain awareness and warning system), which is upgradable to Class B or Class A TAWS if necessary.

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One of the first on the market to offer wire-frame synthetic vision, Chelton's forward-looking, 3-D real-time terrain depiction is enhanced with the NASA-developed highway-in-the-sky (HITS) navigation guidance capability.

The PFD is a dedicated display showing flight information in HUD format, and standard EFIS tapes along the periphery of the horizon depiction. The HUD symbology communicates critical flight data, such as airspeed, groundspeed, altitude, vertical speed and heading.

The MFD can be installed alone or with the complementary PFD. The MFD can present up to nine different views — including moving map, traffic and weather — all of which are precisely synchronized with the forward-looking, 3-D Synthetic Vision shown on the PFD. Chelton's FlightLogic displays use Jeppesen NavData and additional databases to show a vector moving map on one or more MFDs.

The FlightLogic displays are approved for installation in a wide variety of popular Part 23, Class I-IV aircraft, including many corporate turboprops. The combination PFD/MFD displays also are certified for installation in many helicopter models.

GARMIN

The industry-changing G1000 from Garmin was first introduced as an option from Cessna in the venerable 172. This stalwart trainer and personal airplane began a new life of sorts, enticing the ever-growing electronic generation into the sky. Other Cessna models followed the 172's lead, with the G1000 becoming standard equipment on the 182 Skylane, 206 Stationair, 208 Caravan and Citation Mustang. The Cessna 162 SkyCatcher light-sport airplane is even equipped with the G1000's baby brother, the G300.

The G1000 now is available for retrofit installations in the Beechcraft King Air 200 and B200 corporate turboprops. First certified for retrofit in the Beech C90, pilots of the bigger King Airs now can replace their old steam gauges with a fully integrated, three-panel, all-glass display system. The King Air installations also benefit from the included reduced vertical separation minimum (RVSM) support. The King Air 200/B200's avionics suite also features the GFC 700 autopilot, an optional synthetic vision upgrade, SafeTaxi, FliteCharts, WAAS and GDL 69A data-link receiver for XM weather.



The Garmin G600 all-glass flight display system replaces the standard six-pack. All of the functions of a PFD and MFD are placed directly in front of the pilot.

For the smaller general aviation fleet, Garmin offers the G600 display system. Designed specifically to replace the six-pack of flight instruments, the G600 combines critical flight data on two, 6.5-inch

diagonal flat-panel LCD screens. These high-resolution screens are mounted side by side in a single bezel, which fits neatly into the six-pack slot. On the left-hand side, the PFD integrates all the information regarding the aircraft position, speed, attitude, vertical rate, altitude, steering and flight progress. On the right side, the MFD provides detailed moving-map graphics of the current aircraft position in relation to ground features, chart data, nav-aids and flight-plan routings.

HONEYWELL'S BENDIX/KING

The Bendix/King division of Honeywell offers a six-pack retrofit display system called the KFD 840 integrated primary flight display. Standing at the forefront of the new Apex Edge Series, its combination of size, advanced technology and affordability allow the traditional steam-gauge six-pack to be replaced with all the latest advancements in electronic display technology.



Honeywell's Bendix/King KMD 840 PFD is available for retrofit in Part 23 piston-engine aircraft. The easy-to-use PFD replaces the instrument panel six-pack.

The KFD 840 presents all the flight information within a large 8.4-inch diagonal LCD display. High-resolution graphics and sunlight-readability complement the package borne from Honeywell's proven corporate aircraft display technology. The full-width horizon and vertical tapes for altitude and airspeed greatly ease the transition for pilots new to the glass revolution. The KFD 840 is fully certified for installation in Part 23 piston-engine aircraft.

It will interface with most existing flight directors, autopilots and navigation systems.

To stay on the leading edge as future standards evolve, the KMD 840 features an SD card slot on the side of the bezel, which also is designed to accept customizable checklists, as well as weight and balance information. The KFD 840 is a self-sufficient unit with an embedded air-data module and ADAHRS. In the event of loss of aircraft electrical power, an optional battery unit keeps power to the ADAHRS for full availability of all attitude, heading and air-data functions. The panel unit is fully self-contained and only requires a remote-mounted magnetic sensor in a wingtip or tail.

SAGEM AVIONICS

Sagem Avionics has carved a niche in the retrofit market by offering glass-panel installations for some of the more popular helicopters and corporate turboprops. Sagem also offers additional aerospace products, including helicopter autopilot systems, flight control components, aircraft condition and monitoring systems and flight operations quality-assurance software.

The Sagem ICDS, or integrated cockpit display system, is avail-

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able in three panel-mounted display sizes: 6.4-inch active matrix liquid crystal color display; 8.4-inch and 10.4-inch. Depending on the configuration, the ICDS displays can function as a PFD, MFD, engine-monitoring system, navigation display, or a combination of these displays



The Sagem ICDS installed in a Bell 206

The ICDS integrates primary flight instruments and other MFD functions, such as moving maps, enhanced vision when linked to a camera, terrain obstacle proximity system, route information and easy interfacing into existing installed avionics. The Sagem displays feature forward-looking terrain awareness, integrated moving map, enhanced cues for caution/exceedance warning, automatic light control and night-vision goggle compatibility. With the ability to mount either vertically or horizontally, the panel displays contain their symbol generator within the display unit, saving weight and easing installation complexity.

UNIVERSAL AVIONICS SYSTEMS CORP.

Designed specifically for the retrofit market, the Universal Avionics EFI-890R high-definition, flight-deck displays replace the ADI, HSI, radar indicator, altimeter, VSI, RMI and airspeed indicators with large, multi-format primary flight display and navigation display, which meet FAR requirements for both Part 23 and 25 aircraft.



The EFI-890R is Universal Avionics' retrofit solution.

With configuration options of 2-, 3- and 4-unit suites, these displays are well-suited for retrofit applications on a range of aircraft, from turboprops and corporate turbine to airliners.

The independently functioning displays incorporate internal signal conversion and data processing, which allows them to accept direct inputs from a multitude of analog and digital aircraft systems. The 8.9-inch diagonal displays accommodate everything from autopilots and flight directors to radars and TAWS, as well as emerging technologies such as the VGA video input currently utilized for Universal's TAWS and Vision-1 synthetic vision products.

With all critical PFD data displayed in the PFD mode, the navigation display is available for map and HSI views, synthetic vision, TAWS, checklists, electronic documents, charts, UniLink data/weather graphics, WSI weather, weather radar and video. □