AVOIDING THE RETROFIT BLUES

Upgrading your panel with an avionics retrofit can greatly improve the capabilities of your airplane but there is a learning curve involved, for all concerned.

by Fred Simonds

Of the 228,700 aircraft in the general aviation fleet, only about 22,000 are equipped to shoot GPS approaches. Garmin claims about 7,000 G1000 systems in GA service, meaning that about 15,000 IFR GPS-equipped airplanes have been retrofitted one way or another.

This is the story of one such retrofit; the good, bad and ugly, and how to minimize the retrofit blues.

Where's the Documentation?

The tale begins with Henry, a reader who needs an IPC in his 1978 Beechcraft F33 Bonanza newly retrofitted with an Aspen EFD1000 fed by dual Garmin GNS530W navigators, all married somehow to his vintage Century III autopilot.

Henry recognizes straightaway that he needs help. Those who fly by themselves while trying to figure out a convoluted installation risk an airspace bust, midair or CFIT accident.

I will be safety pilot, instructor, and systems analyst.

Henry volunteers forlornly that the avionics shop gave him no documentation.

I am sadly unsurprised. A simple block diagram of what was done in the retrofit is a major first step in learning the capability of your new system as installed. In my view, an essential part of the service provided to you by the avionics shop in installing a retrofit is a diagram that shows how everything is hooked up.

A combination of an Aspen EFD1000 (left) and a pair of Garmin GNS530W navigators (one shown above) creates the basis of nearly a full glass cockpit upgrade. However, it's essential to know how the units integrate with each other and the rest of the avionics in the airplane before you fly IFR.

Lesson 1: If you upgrade your avionics, require a functional block diagram under the contract at delivery time. Don't fall for, "Oh, we'll get you one". Don't make the final payment until the diagram is in your hands.

Reverse Engineer

This oversight is going to cost Henry. We must reverse engineer what the shop did.

No shop person sat with Henry to explain the capabilities he had just bought. Claims that "you can learn it in four hours" are bunk.

Pre- and post-sale, a tech-savvy instructor can protect your interests. In the spirit of *caveat emptor,* you owe yourself due diligence even if you have to pay for it.

Never accept the timeworn copout "It's all in the manual".

That doesn't cut it in general and certainly didn't in the Aspen. As nice as the jewel-like EFD1000 is, the manual is seriously flawed with typos, contradictions, disjointed layout and technobabble.

Unlike many other advanced avionics products, Aspen offers no simulator.

Learn It on the Ground

Rather than take the airplane out and fly it around while we pushed buttons and lacking a simulator, we did the next best thing and arranged for the Bonanza to be connected to a ground power unit through its external power receptacle. (A small power inverter would have worked as well.)

We sat comfortably in the airplane while we worked, manual in hand, through the essentials of the Aspen's many capabilities.

Henry got to push all the buttons and see what happened. He learned what SYNC does, about the HSI, bearing pointers and lots more.

One of the most important things we learned was how the twin GPS units interact with the Aspen and how the Aspen connects to the autopilot.

We formed a hypothesis as to how the autopilot would navigate by VOR and on approach, the essence of which was

that the Aspen sat logically between the autopilot and the VORs as it does with the GPS.

In GPS Steering mode, the Aspen takes GPS guidance and feeds it to the autopilot which we learned needs to be in heading mode. We hoped the VORs would work the same way.

Wrong. The hypothesis proved incorrect as there turned out to be no path between the Aspen and the autopilot that would feed it steering information based on VOR or localizer/glideslope inputs.

We learned in-flight that the autopilot should only be set to heading mode when the Aspen is in GPS Steering or its own heading mode.

For VOR/LOC/GS steering, the NAV, OMNI and LOC NORM/REV must be used, bypassing the Aspen. We could never have discerned this so quickly without having formed the question on the ground.

In this way, we systematically wrote out questions which we subsequently answered in flight. This organized approach greatly accelerated our understanding.

Learn your new avionics system on the ground. Hook up to ground power, fire up the avionics and figure out the buttonology, how the units interact with each other and what you have to do to get the desired information and results before you try doing so in the air. Write down questions and squawks as you go.

Airborne at Last

One test is worth a thousand consultants. We took off and flew a front course ILS localizer backwards at an altitude well above anyone flying it inbound.

We discovered that the Aspen detected a back course all by itself. It did so without help from the GPS database, because there is no back course localizer approach at this airport.

Having learned this, we then discovered that the Century III would track the localizer backwards in LOC REV mode. We were expecting LOC NORMAL because the manual said that the Aspen would correct automatically and a double correction means no correction. But you can't fight facts.

The next day we went to an airport with a real back course localizer. This time the Aspen failed to indicate a back course on the BC LOC 27, a big surprise since it had worked perfectly the previous day.

No amount of knob-twisting or button-pushing got the Bonanza on the localizer such that the autopilot would fly it. Thus our first avionics squawk.

Heading home, I attempted to show Henry how to use the bearing pointers. I could not believe my eyes when pointer 1 aimed right at the station, while pointer 2 aimed away from it.

You can't have it both ways, so bearing 2 was somehow wired backwards. This is just the kind of thing you want to discover in a shakedown, and could be very dangerous. Squawk number two.

The GNS530W can issue instructions to autopilots to fly curved paths such as holds, turn anticipations and DME arcs. Our question was whether the Century III could understand and execute same.

The answer proved a sloppy yes. The autopilot would routinely overshoot in holds turning inbound, during turn anticipation, and on localizers. I noticed that it turned at less than standard rate which certainly did not help. Yet it flew a published DME arc perfectly, because the turn rate was within its ability. Squawk three.

Capture, Capture!

Our major disappointment proved the autopilot's inability to capture ILS glideslopes and APV glidepaths.

On the ILS, the glideslope "needle" would not display until nearly atop the FAF even though the Aspen manual said it would display as soon as a signal was available.

WAAS approach glidepaths presented normally, about two miles outside the FAF. The autopilot never captured any glideslope/glidepath despite being capture-capable.

The AP has a light which predated the upgrade. It comes on at capture but never lit up. Squawk four for the glideslope's tardiness, squawk five for the AP's inability to capture.

Along the way we discovered that the audio for the altitude, airspeed and traffic alerts could be heard only over the speaker. These two squawks brought the grand total to seven.

All told, we spent 7.5 hours airborne and flew 14 varied approaches.

By proceeding in an organized fashion, first working through the system on the ground while keeping notes and writing questions to be resolved in flight then flying in good VFR and progressively answering our questions and recording squawks, we reached our goal of understanding and validating Henry's new gear. And oh, yes, he aced his IPC.

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