

Avionics for your Homebuilt and Sport Aircraft

BY JAMES WYNBRANDT

Building or buying a high performance kit aircraft? If so, you're probably planning on installing an equally sophisticated panel to match. Avionics professionals say most of the homebuilt panels they're helping fashion today feature gear like MFDs (multi-function displays), IFR-certified GPS units, real-time weather display capability and more.

"Everybody wants all the whistles and bells," says Martin Elshire, who teaches EAA workshops on panel construction, and owns the Billings, Mont.-based Aerotronics Inc., an avionics shop with expertise in homebuilt panels.

"They're going straight to the good stuff," agrees Don Dominguez, general manager and part owner of San Luis Avionics, at California's San Luis Obispo Airport, another shop noted for its homebuilt panel work.

In fact, the allure of glass and gizmos on the flight deck is helping fuel the experimental market, according to the EAA.

"The desire to have cutting edge technology in the panel is a driver to get a homebuilt," says Charlie Becker, the EAA's director of Aviation Services. "If you want the latest whiz bang panel, amateur built is the way to go."

But building a panel like this

is more involved than putting a new electrical circuit in the basement. Most builders don't have the required skills to do it on their own, and many learn that the hard and costly way.

"We have had a number of people who start the instrument panel project, only to give up after spending hours and hours. They find its best left to a professional," says Jim Kantor, president of Eastern Avionics, the avionics shop and dealer noted for its catalog-cum-avionics primer, based at Florida's Charlotte County Airport. "If they get it all done and things do not work, there's a lot of rework to make things functional, and that's going to run the cost up twice as much."

"I would say 10 percent successfully complete their mission," Dominguez opines.

Can You Handle It?

How much assistance do you need? That depends on your capabilities. Dominguez suggests builders ask themselves a few questions to help decide: Can you use hand crimpers? Do you know how to splice wire? How is your soldering skill? Do



you have experience working with BNC connectors? Can you read schematic diagrams of electronic equipment, and determine what gauge wire and hardware an installation calls for? Do you know about antenna placement and issues of electronic “noise?” If the answer to any of these questions is “no,” you’re going to need help.

Fortunately, amateur builders can get all the help they want. Panels and wiring aren’t subject to the 51 percent rule that mandates builders of record construct the majority of the aircraft themselves. So the entire job or any portion of it can be farmed out. And getting help from an avionics professional at an FAA certified repair station can save not only time, but money. As Kantor notes, installation mistakes that require professional help to troubleshoot and fix or redo can quickly nullify any cost savings a do-it-yourselfer anticipates.

Selecting Help

Choosing a shop you’re comfortable with is critical. You’re going to be working closely with this shop for probably longer than you think as you fine-tune your instrumentation and panel layout and proceed with construction and installation.

“Try to get a shop that is enthusiastic,” advises Kantor. “If they’re not enthusiastic, find another shop, because kitplanes require a commitment on the part of the avionics shop, and on the part of the builder of the kitplane, and unless the customer can develop a good relationship, they need to go elsewhere.”

As Kantor implies, a shop’s

experience working with home-built panels is important to consider. Given the different rules governing allowable and mandated equipment (as covered in FAR 91.205), the need to be familiar with the world of non FAA-approved parts, and the demands of creating a customized electrical system from scratch, professionals who only work on certificated aircraft are at a disadvantage.

As Elshire bluntly says, “Just because they’re a reputable general aviation shop doesn’t make them a reputable experimental shop. We did two Lancair 4Ps, one after the other,” Elshire continues by way of illustration. “I’ve got 27 people, and it still cratered us for awhile. So many things (in the installation) are not what they seem.”

In the Beginning

Whoever you work with, involve them from the beginning as you formulate your ideas for the panel. Not all of today’s avionics systems interface with one another, and there’s no sense spending hours planning out your dream panel only to learn that’s the only place such a set-up can ever exist. Your panel partner can offer invaluable advice on such issues.

But there’s something of a chicken-and-egg dilemma here. You’ll want to get price quotes on the panel work before choosing a shop, and you have to have a rough idea of your panel plans before you can get the estimates. A shop you’ll be comfortable with should be able to provide numbers based on your basic layout, and may provide price quotes

that include several instrumentation options.

If money or budgetary limitations are a concern—and when aren’t they—ask yourself how much of the gear you want do you really need. “People way overbuild their panels,” says Elshire. Using non-approved FAA parts can save significant costs. As Kantor points out, some great equipment is available that is smaller, lighter, more sophisticated and cheaper than FAA-approved equipment. But he’s quick to note the downside: Some non-approved equipment is sub-standard, and buyers can’t go by brand name alone, because the quality of various instruments or parts made by a single manufacturer can vary widely. Here again, the counsel of an experienced professional can be invaluable.

Pre-Fab Solutions

Among the most difficult part of any avionics installation is the wiring. The cramped spaces, myriad of wires and the challenge of troubleshooting when things don’t work as they’re supposed to make this a daunting job even for professionals. But just as home-built aircraft have gotten easier to construct, thanks to prefabricated kits, so have the aircrafts’ panels. Off-the-shelf plug-and-play interface boxes are available, making the task of connecting all the components in the panel much easier. Experts say these are typically best for an uncomplicated panel, as the extra connections that make these pre-fab units so adaptable can complicate installation when interface units designed for high-end panels are

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employed.

Custom-designed pre-fabricated harnesses, wiring bundles that connect the panel components, can be made for a similar price. The harnesses have the correct length of wires for a specific panel, and are clearly labeled, making it easy to hook up the panel equipment. Eastern Avionics, for example, with its trademarked Kwikmount system, can completely configure a harness for any homebuilt installation.

Dominguez of San Luis Avionics says his shop rates for labor for building a harness is \$700 per day, and that a harness for a sophisticated, high-end installation generally runs between \$2,500 and \$3,500. Harnesses for less complicated panels may only require two days of labor.

If you want to farm out the entire project, a shop can install everything in the panel, wire it up, and test and calibrate the system to assure it's all working properly, then disassemble it and send it to you. Then it's just a matter of re-assembling the panel and plugging the wires into their connectors. Dominguez estimates a panel wired and installed for a full IFR stack runs about \$4,000 to \$5,000.

Pre-Owned Homebuilts

The EAA's Becker points out that a growing segment of this market is comprised of second owners of homebuilt aircraft. The panel may be poorly laid out, and the new owners often want to upgrade them. That can require a fair amount of troubleshooting, particularly as there may not be

a good schematic of the wiring. Don't underestimate the complexity of such a panel makeover, even if you're farming it out to a seasoned professional.

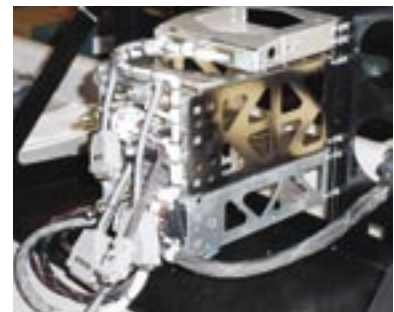
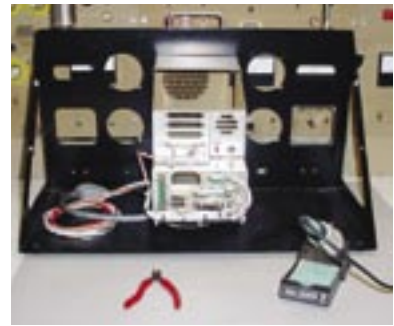
Becker says shops asked to bid on such jobs "have to educate the owner. It could start getting expensive very fast, and managing the expectation of that second owner non-builder is going to be critical. They don't appreciate the amount of time (such work takes), so the first time they hear the price quote it might be much higher than expected."

The shop will have to chase wires down, and may even suggest completely rewiring the panel.

Getting Hands-On Experience

Let's not forget, complex as it is, many homebuilders want the hands-on experience of constructing an aircraft, instrument panel included. This can be both tremendously educational and satisfying, which is, after all, what homebuilding is all about. Even builders without knowledge of electronics can handle some aspects of the job, such as installing rack mounts and running wiring. Experts recommend do-it-yourselfers keep some basics in mind: Use high-quality wire and fasteners. When routing through holes, use chafe guards to keep wiring from rubbing against the airframe. Make sure the wiring has some give, but not too much slack. No tight bends in the wiring, either, and leave a "service loop" in cable so you can add components in the future easily should you want to.

The EAA, in addition to sponsoring workshops on panel construction, provides guidelines



for equipping homebuilt IFR aircraft, and this document can be requested by members at info@eaa.org.

Happy Landings

Thanks to modern avionics and the rules governing amateur-built aircraft, homebuilders can create a panel that's more advanced than that found in any certificated general aviation aircraft. Approach the project carefully, get the help you need, and you'll be able to navigate your way to this panel promised land, no matter what your level of expertise or experience. ■