



A Whole Lot of Helping Hands

Inside the Glasair Aviation Sportsman Customer Assembly Center.

BY MARC COOK



We begin at the end (top), with the Sportsman as it looks after 15 days at the Customer Assembly Center. Back on Day 1, however, (middle) Randi Ernst (right side of photo) begins laying the systems into one of the Sportsman's aluminum wings. The Prebuilt kit includes wings that arrive in nearly complete form, with all the major structural members in place. Also on Day 1 (above), the wings are hung on the airplane to set the strut fittings and check general alignment. It's starting to look like a real airplane already.

On Day 2 (top), Randi has begun work closing the wing. The Sportsman uses conventional aluminum construction in the wings but, to save time, uses prepunched skins so that the drilling required is only to make the holes to size. On Day 3 (middle), Barbara (Randi's wife) gets her shot at riveting. CAC personnel are there the whole time to help the learning process and, mercifully, to hold the bucking bar. On Day 5 (above), Randi installs the aft supports between the fuselage shell and the steel-tube cage surrounding the cockpit.

When you boil it right down, the big difference between regular humans like us building airplanes and big companies like Cessna and Cirrus doing the same—aside from the fact that we have cooler designs—is in the construction methodology. Big manufacturers have assembly lines with every task neatly laid out and ordered to maximize efficiency. They have trained personnel and precisely the right tools at hand. Everyone working on the airplane has done it at least once, and there is, even if it's not obvious, a plan and schedule to be met.

For the rest of us, it's different—a lot different. We need to learn which tools to buy and how to use them.

We don't have the luxury of an assembly line, so parts must be constructed and assembled as space, time, patience and knowledge allow. All of that takes time, and that time is normally not counted as part of the "build time" you see listed for kits. If anything, the time spent "head scratching" by first time builders is a sizeable proportion of the whole.

Wouldn't it be great to have what amounts to an assembly line—complete with trained employees—helping you build your airplane?

That's just the premise behind the growing number of "builder assist" programs. In the coming months, we'll be looking at several of these programs, starting here with Glasair Aviation's Customer Assembly Center. The CAC is currently set up to build the company's Sportsman 2+2 in a facility adjacent to the Arlington, Washington, factory. Under the program, builders can start on a Monday morning with the airplane in pieces and be approximately 150 to 200 hours from first flight by the end of the fifteenth working day. Yep, three weeks. At press time, some 15 kit sets had been through the program and, as of early summer, the shop was booked through the first quarter of 2006.

"We've been in the business long enough to understand what builders struggle with," says



On Day 5 (top), the stainless-steel firewall is placed against the steel-tube frame and sealed with fireproof caulking. On Day 6 (middle), Randi can test-fit the engine mount to the firewall. What you can't see is that the airplane has long been resting on its main gear. On Day 7 (above), Randi connects the wiring for the fuel transfer pumps. The Sportsman uses outboard auxiliary tanks whose contents are pumped into the main tanks.

Mikael Via, Glasair Aviation president. "And we know how to build this airplane." In essence, the CAC connects the dots, allowing builders to make use of the factory's tools and experience and personnel to construct their own airplanes according to a detailed and carefully conceived process.

Via is careful to point out that the CAC is not a completion center where the builder drops off parts, writes a check and waits for the telephone call that the airplane is ready for flight. "In our program, the builder is there eight hours every day, for every operation. It's the only way we can truthfully say that he's done the majority of the work and learned the construction methods well enough to be safe working on the airplane once it is finished." Via says the program meets the guidelines set out in FAA Advisory Circular 20-139, which discusses the use of builder-assist centers and provides the outline of what a builder is expected to do in order to meet the "Amateur-Built" portion of the certification.

What's the Process?

For the Sportsman CAC program, the process starts with the Prebuilt version of the kit, which includes a fully powder-coated fuselage cage that has been mated to the preassembled fiberglass fuselage shells—they are three separate pieces in the standard kit. The aluminum wings that have had their spars, ribs and lower skin riveted into place. (The top skin is open to install systems.) It is not possible to run the CAC program with a standard kit.

In the accompanying photos of Randi and Barbara Ernst's Sportsman, it's possible to follow the general progression of the airplane but be warned that we had some 50 images to choose from—meaning there's a lot more to it than meets the eye. (Check out the company's web site for images of this project from start to finish.)

The key to making the schedule—which is actually in two parts, a 10-day airframe section and a five-day firewall-forward program—is a detailed outline of every step required to build the Sportsman. Every line in the builder's manual is pulled out and marked as

either completed by dint of having the Prebuilt kit, signaled as a task

the builder will complete at the CAC, and what would be left when you get home. Again, the trick to getting the process down to three weeks is an aggressive compression of the workflow; there's no time for dallying.

Yet you must participate in every step: You will learn how to rivet, how to work with composites, how to rig control surfaces...the lot. What do the CAC technicians do? They'll lay out the tasks, set up the tools, clean up after you, offer advice and provide another set of skilled hands with the bucking bar, for example.

The Basic Outline

The outline is divided into Wing Days and Fuselage Days, with the steps out of the construction manual placed to maximize efficiency. To look at it on paper makes it seem willy nilly, but to see it in person is to appreciate the organization of the tasks. What's more, Via says that as the CAC completes more airplanes, the system is fine tuned as they go along.



On Day 8 (top), the fiberglass rear door is ready to be test fitted. On Day 9, (above), the final wiring is run through conduit to the wing tips. The inboard fuel tanks, which are separate aluminum vessels, have been plumbed. The Ernsts, intending their Sportsman to be a real utility player, have opted for the direct-reading mechanical fuel gauges.



On Day 9 (top), the control cables have been run and it's time to test fit the seat pans. On Day 10 (top center), the rudder cable pass-throughs can be drilled with the help of a CAC-developed drilling fixture. This is one example of the time-saving tools available in the course. On Day 11 (bottom center), the engine is hung on the mounts and on Day 13 (above), the spinner can be test fit to the already mounted propeller.

Tools, Tools, Tools

One of the prime benefits of using the CAC is that you will have access not just to the shop itself—we're told it's even heated in the winter—but to select tools and, perhaps most important, critical jigs and fixtures used for assembly of the airplane. Anyone who has built an airplane can tell you that a lot of time goes into making fixtures that may be used only once. What's more, many builders spend a great deal of time looking for or creating special tools for certain parts of the build process. The whole of the effort takes tremendous time—recognizing the need for a special tool, the hunt, trial-and-error and finally the solution.

How many of us have spent a full day on an operation that's barely a sentence in the builder's manual? (And that should have taken all of 20 minutes?) To further the point, the CAC's fixtures are durable, not the single-use items that the plans would have you build at home; that means better accuracy.

What's Left?

When you've completed the full 15-day program, there are still significant steps left, including paint, instrument panel, interior, final rigging, safety checks and flight testing. According to CAC documents, there are 20 line items remaining for the builder after the course, with some of them fairly straightforward—installing pitot-static lines in the cockpit, for example—and some a bit more involved—installation of the instrument panel, as mentioned, and installation of the windows and various fairings. When the airplane rolls out of Arlington—and it has to be on time as there will be another project starting



On Day 14, the interior door latch has been installed and aligned.



On Day 15, running a bit ahead of schedule, the instrument panel is mounted. Normally, this step is left to the builder for after the CAC.

on the next Monday—there's a massive amount of work behind you. The first customer to go through the CAC program flew the airplane four months after starting.

What's It Cost?

In truth, you are trading a fair bit of money for the use of CAC's time and tools. Because you must start with a Prebuilt kit, the base airframe will run \$51,535. The cost of the CAC, inclusive of all the steps outlined in the syllabus, is \$21,000. You have the option of buying more shop time to complete optional items, such as the windshield installation and to have help with the interior electrics and avionics; the rate is \$75 an hour. Plus you should budget for the more popular options on the airplane, including electric trim and the aft seats. At press time, Glasair was working on a plug-and-play wiring harness that should cut a lot of post-CAC effort; the price has not yet been decided.

There are more economic factors to consider, too. Because you'll be hanging the engine and prop in the third week, you'll have to pony up for those in advance—a lot of builders like to spread out the big expenditures over months or years. You'll also need to make the time in your life—it's smart to budget a few days on either side of the 15 in the shop—and you'll need to pay for someplace to stay while you're in town.

Glasair has thought of these issues and has a deal with financing company NAFCO to cover the entire kit and CAC costs, plus engine and avionics as a package. NAFCO will finance 90% of the total for up to 20 years.

Put a sharp pencil to the endeavour. Glasair says the basic Sportsman should take around 2000 hours to build, perhaps 40% less with the Prebuilt options. Call it 1200 hours for someone with incredible motivation. Assuming the forecast of remaining work to be done after CAC is accurate—and it's even a bit early to know for sure—the center is absorbing around 1000 man-hours of labor. (You're right that there are not 1000 man-hours available in 15 days unless there are nine guys on the job. The difference comes from the efficiency of the operation.) Plug that into your Casio and you'll see the cost of CAC is, by itself, \$21 an hour.

Is It Worth Doing?

This is a question only you can answer, of course. And it comes down to mainly budget issues, with a few philosophical crumbs on the table. If you're the type who views airplane construction in the long term, as a weekend and evening hobby, then the CAC obviously isn't for you. But for builders who want to fly as quickly as possible—this may be just the ticket. †

For more information on the Glasair Aviation Customer Assembly Center, call Glasair at 360/435-8533 or visit www.glasairaviation.com.