The 18-day Sportsman

What does it take to build an airplane in less than a month?

BY MARC E. COOK

PHOTOS BY RICHARD VANDERMEULEN, MARC COOK, AND COURTESY BARRETT PRECISION ENGINES

I suppose it had to happen. Again. More than a decade ago, I started to build and then, some three years later, completed a simple, elegant, lightweight kit airplane called a Pulsar. It was a transformational process in my life as many of you read in the series I wrote when I was a senior editor for this magazine ("Parenting a Pulsar," 1995 *Pilot*).

I learned, perhaps for the first time, patience and perseverance. I gained new skills and learned, sometimes the hard way, which skills I would never fully master. Call it fulfilling and exasperating all at once—an experience shared by most of the hardy souls who have, collectively, constructed some of the 25,000 Experimental airplanes extant.

But soon, with the birth of my daughter, I had a two-place airplane and a three-person family. Next thing I knew, I had a factory-built airplane that someone else had to work on—sometimes, at great expense—and I found myself missing the freedoms of an Experimental/Amateur-Built airplane.

Then I became editor of *Kitplanes* magazine and I knew my days as the pilot of a production-line airplane were numbered. The only problem was time—somehow, back in the mid-1990s, I had a lot more of it. As a result, I became a member of perhaps one of the fastest-growing segments in Experimental aviation: The pilot who wants a homebuilt less for the building experience and more for the freedom to use new technology—glass cockpits are the norm these days—as well as freedom from spiraling replacement-parts prices, onerous regulations, and, perhaps, the drudgery of having an airplane that looks and flies just like the next guy's. (Then again, this could be hubris. The most common homebuilt is the Van's RV. There are so many of them flying now that to arrive at an airshow in one is to risk having an airplane that looks and flies just like the next guy's.)

At least my timing was good. Just as I began checking out the new Experimental scene, sniffing around for a new, rapid-build process, I stumbled upon something called the Customer Assembly

The author (right, on left) works alongside Brandon Rodstol, one of the Glasair Aviation Customer Assembly Center employees, installing systems inside one of the wings. Thanks to the quickbuild options, the wing arrives nearly structurally complete. The "finished" airplane (above) flies with a fresh paint job earlier this year. By the end of August, the Sportsman 2+2 had amassed 150 hours.

Traditionalists tend to think you're not a real builder unless you've made every part from scratch.

Center (CAC), a program set up by Glasair Aviation (née Stoddard-Hamilton) for its Sportsman 2+2 utility airplane. Put simply, the company's plan was to offer in-house building assistance in two segments, one a two-week course to assemble the basic airframe and a single week's course to hang the engine and prepare the airframe for the final, say, 200 man-hours of labor necessary before first flight.

It was, at the time, an ambitious program perched upon an audacious theory—that you could legally build with factory assistance and benefit from the company's expertise and, in this case, specialized tools and fixtures. Such a program had never been tried, at least on this scale. But what I didn't know as I toured the CAC and began thinking about building under this system was that we would turn even this aggressively scheduled program on its ear.

By the end of January 2006, prototyping a new program for Glasair Aviation, I had become part of a somewhat controversial and very public demonstration that it was indeed possible to build an airplane in 18 working days. You read that right: 18 long, arduous days during the darkest, wettest season in upstate Washington, at the end of which this airplane, N30KP, surged from a massive collection of parts to a bona-fide airplane.

Hold on a minute, you're saying: How could this possibly be legal? It's a good question, one that deserves an explanation. The rules governing Experimental/Amateur-Built aircraft are at once fairly clear-cut and frustratingly vague. At the core of the freedom is the understanding that this is not a commercial venture, that the aircraft are to be constructed by individuals for their "education and recreation" and that they are to participate in the "majority" of the work involved.

That's not to say that I, or any other builder utilizing so-called "quick-build processes," have to drive every rivet or construct from scratch every component of the airplane. In fact, the norm in the industry has long since moved on from what are called "scratch builders," those who purchase plans for aircraft, seek out the raw materials, and then construct pretty much every part on their own. Such an endeavor requires myriad skills—welding, riveting, engine building, sewing, wiring...the whole deal. By the late 1970s and early 1980s, as homebuilt designs became ever more complex (and further away from the Cub-like origins of the sport), kit manufacturers began shouldering ever more of the load, providing, for example, composite-aircraft kits with big parts of the project seemingly done. You might get a big box with the fuselage in two halves or a wing with most of its structural contents already glued in place.

Today, the process is underpinned by what's erroneously called the "51-percent rule"—there's no such title to the directive, which says only that a builder must construct a "majority" of the airplane, and there are exceptions to that. (The guidance says nothing about building your own engine, creating your own instrument panel, painting or upholstering the interior, all of which can be and very often are farmed out to professionals.) Modern interpretation has allowed more of the work to be done by the factory, legally, leaving less for the builder to do. For example, the guidelines say that a builder must fabricate and assemble certain components of the airplane. But what does it mean to fabricate? Hew an aileron from raw ore? Or does it mean something less onerous, such as to trim a piece to size?

There continues to be a struggle in the Experimental community between the traditionalists and the newcomers, who almost without exception opt for every quick-build option on the menu and often sign on for something called "builder assist," which can be as informal as an independent shop where you can store your project, use professional tools, and avail yourself of the advice and occasional help of experienced

The Lycoming kit engine resides in a thousand parts at Barrett Precision Engines (opposite page, left). The Customer Assembly Center at Glasair Aviation (opposite page, right) is equipped with special tools and fixtures that would cost thousands of dollars for a homebuilder to reproduce. The “yellow monster” is a new fixture that helps locate the steel-tube cage inside the composite fuselage shell with great accuracy (left). Monty Barrett, at home in the engine test cell control room (above).

craftsmen to highly structured programs like the Glasair Aviation CAC.

There is actually a third segment involving what are known as “hired guns.” You buy the kit, have it delivered to the shop, and then show up when the airplane is done. It happens more often than the industry would like to admit and although the airplanes that come from these establishments are often better and safer than if built by a true amateur, they skirt both the letter and the intent of the law. The risk is that you might get caught with a massive investment in an airplane that can be registered only as an Experimental/Exhibition, which so dramatically reduces the utility of the airplane as to make it near worthless for the average pilot.

Traditionalists tend to think you’re not a real builder unless you’ve made every part from scratch. Newcomers are goal oriented: They want to use every legitimate tool to arrive at a safe, functional airplane. It’s the difference between savoring the journey or the destination.

My destination for the first month of 2006 was, instead, Arlington, Washington, home of Glasair Aviation. I had seen the original three-week CAC in action early in 2005 and had been impressed with the amount of work completed from my Monday afternoon visit to my Friday visit on the way back from Canada.

I didn’t care to admit it at the time, but the hook had been set. Although I considered building other airplanes, the CAC program made the decision for me as it was married with an excellent airplane. The Sportsman 2+2 (see “Kit-built-Bush Fun, “ June 2004 *Pilot*) is an outgrowth of the popular Glastar two-seater, but it has a lot of new parts and benefits from the early portions of the certification cycle that resulted in the SAI Symphony. The wing is stronger, the steel-tube frame that makes up the “safety cage” is more robust to carry the higher maximum gross weight; for the 2+2 it’s 2,350 pounds on wheels, 2,500 on floats. This high-wing design is intended to be a utility player in the outback—claimed runway performance has it landing or taking off in less than 400 feet—but with good speed: The 180-horsepower version cruises at 135 knots true; my 210-plus-horsepower version will do 150 KTAS.

By the middle of 2005, the operation was in motion, but with a twist I could not have predicted. Mikael Via, Glasair president, was concocting a scheme to further reduce the after-CAC build time and he needed, for lack of a better term, a guinea pig. Originally, he proposed having me prototype the new program and I figured that if all went well we’d have the airplane flying in 60 to 90 days, an astonishingly short period of time, to my thinking. But as he developed the infrastructure around his ultimate goal, which he had yet to share with me, the timeframe condensed even further. Until, at a late-summer meeting, he said, “I think we can do this in 30 days.” I openly guffawed at his suggestion, but after looking at a comprehensively marked-up set of steps right out of the builder’s manual it became clear that the amount of work he was proposing to bring into the three-week CAC would leave comparatively little to do afterward.

What I could not appreciate at the time was that Via’s ultimate goal was the program we ultimately prototyped and that his company launched this summer, called Two Weeks to Taxi (TWT). Not only has the company endeavored to reduce build time, but also it has packaged the program in such a way as to avoid many traditional pitfalls, among them, budget creep. You can estimate the completed cost of a homebuilt as three times the base kit cost, but there are too many variables even with that.

How much assistance do you want or need? What, exactly, comes with the kit? How carried away will you get with the avionics? Instead, for the TWT system, Glasair has created a basic airplane using an all-electronic glass panel and a carbureted Lycoming O-360 with a fixed-pitch prop for an all-inclusive price of $128,900. That includes everything in the program including a basic interior but no paint; plan to add $6,000 to $8,000 for that. Options packages are available to add more avionics, autopilots, larger engines, and different props. A fully loaded airplane with the top engine choice comes out near $170,000.

Sitting down with a calculator and imagining this project are very much different from actually doing it, of course. I traveled to Arlington and began work on January 9. During our prototype program, we worked Monday through Friday from 7:30 a.m. to approximately 4 p.m. (For the new two-week program, it's six days a week, 10 hours a day; the goal was to fit the process into a commonly available two-week vacation.) Every session started with a 15-minute briefing on what was to be accomplished during that day coupled to a look forward to any outstanding items that might pop up later in the week. Like a good fighter pilot, the CAC's focus is not just on the job at hand but also the jobs that will take place a day or three down the road. When you're moving at this pace, you simply cannot afford to be held up waiting for parts. In fact, the CAC's relationship with the factory—it is a wholly owned subsidiary—ensures that the basic airframe components will all be there on time. (I also came to depend on Aircraft Spruce & Specialty having a massive stock of parts as we came to the true prototyping part of the project. Thanks to them and FedEx is all I can say.)

Crucial to the success of our mission was starting with as many quick-build components as possible. For the old CAC and the new TWT, you're obligated to plump for every quick-build (QB) option in the catalog, but I think they're an incredible deal. The wings, for example, come from the Philippines—the same shop Van's Aircraft uses for its quickbuild pieces—with all the major components prefabricated. Both spars, all but the end ribs, leading edge, and top skins are all in place. The top is off so you can run controls, electrics, and the fuel system, but the wing starts out looking amazingly complete. It's the same deal with the fuselage: The QB option starts with the 4130 cro-moly steel cage already mounted to the two-piece composite fuselage shell—a process done by hand with my airplane but that will be semi-automated by what Glasair calls the "yellow monster," a fixture that sets all the critical cage and shell dimensions before they're mated.

If you think a quickbuild program means standing around and watching others work, guess again. There's plenty of hands-on and plain old fabrication involved; the author is checking the innermost rib on the wing (left).

The question often comes to this: Am I just watching my airplane taking shape or am I actively participating?

Another fixture captures your attention on the first day of work. The fuselage shell and cage are mounted to a sturdy fixture bolted to the floor; the fuselage is then leveled and waterlined so that every measurement taken from it will be repeatable. There's almost no way an amateur builder could come up with such a device at home.

So I arrived every morning at 7:30, with a reasonably high caffeine level, expecting to savor every moment of the build. I was there to learn and to improve my skills. That expectation—the part about savoring—was snuffed out by the end of day one. Why? The CAC is a lot more like a production line than a traditional homebuilding program. You don't get to deviate from the plans and instructions often, if at all.

But it's efficient work, and that counts for a lot during the short, dark days of January. Each task is defined by its place in the overall scheme with a critical eye toward minimizing the inevitable put-it-together-now-take-it-apart process of homebuilding. But it goes a lot deeper than that. The CAC is organized around maximizing the builder's time on the project. For any task you would perform on your own airplane project, you have to first read up on it, find the parts, assemble the tools, create a clean working space, read up on it some more, commit the actual work, then put the subassembly, tools, and supplies away before you can move to the next task. What would happen if someone was there to work ahead, set up subassemblies before you begin, and clean up after you? For that matter, how valuable is the expertise of someone who has completed the same airplane you're building? What if that person has done, say, 20 of them?

These are the underlying concepts, and they're executed to near perfection in the CAC. For my project, we had three of us working full time—Brandon Rodstol, Seth Town, and myself—plus Ted Setzer hovering over the project, working through the prototyping of the TWT program as well as for the IO-390 installation. (Mine would be the first to fly with this new variant of the familiar angle-valve Lycoming. More on that later.) The breakdown of labor—who does what—is highly variable, but reduces to something like this: One helper normally works directly with you while the other is busy setting up for or cleaning up after a specific task. During my build, Town was responsible for the wings (generally) and Rodstol concentrated on the fuselage and tail section.

One of the prime benefits of a program like the CAC's is that you're working alongside guys who really know their stuff. Let's take riveting the wing. I worked with Town on it and quickly exposed my lack of riveting acumen. I'd done a little but hardly anything on the scale of a wing. During my program, the first rivets I drove were in my actual wing. After confessing my concern about my own skills here, the company elected to create a short course on riveting using a salvaged Sportsman wing. This program went into place for the next Sportsman CAC after mine, and provided a couple hours' banging rivets into unimportant metal to get the hang of it.

Progress came rapidly through the first week. By the end of day two, the wings were nearly done. By the end of day five, the engine was on the airframe and many of the big control-system components were done, rigged, and placed back on a huge set of shelves for safekeeping. Part of the speed comes from the myriad special tools and fixtures developed by the CAC, some of which an enterprising builder might make for himself but others, such as the massive steel jig for holding the wing perfectly square while you're riveting, are just out of the scope of a homebuilder.

The question often comes to this: Am I just watching my airplane taking shape or am I actively participating? My answer is that this is building, absolutely and positively, just not in the form we have come to expect. During the build, I worked on every system and worked with every material to be found on a Sportsman. I pounded rivets. I worked with fiberglass lay-ups—there aren't many of them in the QB version, but it was a nice way to remember my Pulsar—and I worked on the electrical and hydraulic systems. I assembled minor components like the wheels and brakes, and did the big things like hanging the wings and control surfaces. Recreation is harder to underscore than education, but there's no denying the sense of accomplishment as you ease into the shower after a long day, more items checked off the build list during one shift than you could manage, alone, in a month or more. Education comes from actually working the materials, learning the ropes. And, very important, from modules built into the program, which discuss ongoing maintenance items for the airframe. By the end of the fifteenth day, we were ready to roll the airplane outside into the Washington rain—imagine that—and start the engine. A few days later, after a thorough inspection by Designated Airworthiness Representative (a civilian given authority by the FAA to sign off on Experimental/Amateur-Built aircraft) Charlie Cotton, the expected pitot-static sign-off, and a thorough inspection by the three of us, separately, working from an excellent pre-first-flight checklist, N30KP completed a surprisingly uneventful first flight. The date was January 31.

That's not, of course, the end of the story; nor have you heard the true beginning. Indeed, any big project like this requires hours of preparation, organization, and coordination. In fact, not long after the decision was made to start the N30KP project, I was on the phone to various subcontractors for big, expensive pieces such as an engine, avionics suite, interior, and paint. For this airplane to be done rapidly, and to make the major airshows in 2006, it would have to be utterly fast tracked.

The engine decision was easy: There is, in my view, no such thing as too much power, so when Glasair said it was considering fitting one of the new Experimental-only IO-390s, I jumped on board. And although the company will be offering only factory Lycoming engines for the TWT program, I decided to trace a different path, one that led me to Tulsa and Barrett Precision Engines.

If you're a hot rodder or any kind of gearhead, you'll instantly take to Monty Barrett. A no-nonsense-kinda guy with an impeccable reputation in the industry, his operation was largely responsible for developing the 390 in the first place. By increasing bore marginally (5.319 inches vs. 5.125 in the IO-360) and performing a few subtle tweaks, this four-cylinder engine is rated at 210 horsepower on a modest 8.9-to-1 compression ratio. That's a useful jump from the 180 horsepower normally fitted to the

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Front and center in the Sportsman's panel is a Dynon EFIS D-100, which combines the functions of 10 instruments into one—and weighs just three pounds. A backup display in front of the copilot houses the engine monitor; the two displays can show any combination of engine and air data. The Garmin GPSMap 396 is nestled above the PS Engineering PMA8000B audio panel and the Garmin SL30 nav/com. A TruTrak attitude direction indicator shows attitude, vertical speed, and ground track. The TruTrak autopilot (left of the altimeter) provides most of the features of conventional autopilots, at a fraction of the cost.

The airplane looks whole, but it is still a day or two away from starting up, and a week away from flying.

Sportsman. Barrett's shop has that well-worn feeling and his builders—nobody goes around saying things like "technician"—are extremely well experienced; his decades of playing with aircraft engines inform every step of the process.

Indeed, I got more than I bargained for, literally. Although the 390 is rated for 210, Barrett's load-cell dynamometer (a device to measure engine power) showed mine to turn out an easy 215—in fact, I saw 219 at times on the horsepower readout—in the first hour of its life. Combined with the four-into-one exhaust we fitted on the Sportsman and the benefit of a good break-in period, it might do even better. Whatever, after watching this engine come together, and seeing firsthand how many small, intricate steps there are between a table full of parts and an assembled engine, I had slightly less angst about writing a $30,000-plus check for the engine alone.

More money would head toward the state of Oregon as Pacific Coast Avionics constructed a panel for the project. This was a fairly easy choice, as I'd worked with the firm before; its relative proximity to Glasair helped because we'd be prototyping a uniform panel to be used in the TWT program. For that reason, I made a few compromises on the choice and placement of components in the panel; to be a useful prototype, it would have to reasonably resemble the "production" panel currently offered.

I knew early on that I'd be busting the budget on the engine, so the panel would be a bit more subdued. There was never any question about using an electronic flight information system (EFIS). Current technology in homebuilts is practically centered on new "glass," with several companies vying for a piece of this lucrative market. Particularly at the low end, the capabilities and value are tremendous. When I started, the hot ticket was the Dynon product line—it remains the value leader in the class. The company had just introduced its D-100 EFIS, using a 7-inch-diagonal screen. It also was about to introduce a similarly sized engine monitor, now called the D-120. (In the meantime, it has brought to market something called a D-180, a combined EFIS/engine monitor in a single 7-inch screen.)

The extraordinary thing about this Dynon package—and this applies to many of the modern, mid-priced EFISes for Experimentals—is the cost-benefit ratio. For example, the D-100 has an internal attitude reference system, all the pitot-static instruments, an electronic compass/DG, plus an angle-of-attack indicator (when used with a special pitot head). There are the 10 most useful instruments in one package, which weighs 3 pounds with the optional internal battery that's good for more than two hours. Moreover, when you sit down and figure out how much a standard vacuum gyro system costs—money and weight—you'll be astonished to find the electronics are both lighter and cheaper. It was a no-brainer for me. Moreover, the Dynon suite is configured for expansion and communication between the units. In new firmware just introduced, I can display all the engine-monitoring functions on the main EFIS screen as well as port the EFIS air-data information to the identical screen in front of the copilot. Amazingly, the EFIS D-100 costs $2,400, the engine monitor D-120 costs $2,000 plus approximately $800 in probes (including a fuel-flow sender). Better yet, through a serial connection, I can upload product updates, which are guaranteed to be free for the life of the instrument, that improve functionality and add features.

The rest of the panel follows homebuilder norms. I have a modestly priced TruTrak autopilot with altitude hold, vertical-speed preselect, and GPS nav functions. (I bought the Digiflight II VSGV, which can receive GPS steering and vertical steering commands from a GPS with an ARINC 429 output; the Garmin GPSMap 396 in the airplane now does not provide this output, but there's always the future.) There are traditional pneumatic pitot-static backup instruments as well as a separate electric TruTrak attitude direction indicator, which is a kind of hybrid instrument: Roll is conventionally displayed, but the pitch indication is really gyro-stabilized vertical speed, which takes a bit of getting used to. The direction part of the name comes from the fact that the instrument will display ground track from an external GPS or can be fitted with an optional internal GPS for that purpose. An internal backup battery also is optional.

Befitting the airplane's mission to fly through Southern California IFR, it's otherwise modestly equipped with a Garmin SL30 nav/com—absolutely the best radio I've ever used—a Garmin GTX 327 transponder, the aforementioned 396—whose XM-supplied weather I'm absolutely loathe to fly without—and a PS Engineering PMA8000B audio panel/intercom, whose music and telephone inputs I've used since day one.

In the time since, I've flown the Sportsman an amazing 140 hours, including a marathon trip to Oshkosh this summer and a quick side trip to western Ohio on the way back. (Yes, I know that was going the wrong way.) I've had a chance to fly it in many kinds of weather, and continue to be pleased by the airplane's excellent balance of agility and stability. Hand-flying an instrument approach is no more difficult in the Sportsman than in, say, a Cessna Skylane.

Comparisons with the Cessna are telling: With less horsepower, the Sportsman easily matches and can exceed the 182's cruise and climb performance. At optimum altitude (roughly 8,000 feet), the Sportsman will turn in 150 KTAS on an admittedly thirsty 12.5 gph. More often, I'll choose altitudes

Preparing for first flight, 18 working days after starting the project. This is actually a ground runup test, but the airplane would fly later that day.

and power settings that offer better economy: At 10,000 feet, it'll turn in 145 KTAS on 10 gph. Down low, trying to dodge headwinds, I'll typically run lean-of-peak exhaust gas temperatures and see 142 KTAS on 9.5 gph. One final data point: During the trip to Oshkosh, I cruised at 17,500 feet, truing 138 knots but burning just 8.2 gph; the last bit of climb was somber, at around 300 fpm, but it got there and seemed happy at altitude.

The final comparison with the Skylane comes in useful load. Painted and equipped, my Sportsman weighs around 1,450 pounds empty. Add 293 pounds for full fuel (50 gallons at 5.85 pounds/gallon) and you're left with 607 pounds' payload for the cabin. Given the size of the cabin—the front is definitely roomier than a Skylane's but the rear is definitely smaller, hence the airplane's 2+2 designation—you're more likely to "cube out" before bumping the max gross. My RV-flying friends look on in amazement as I load luggage, tools, pallets of water—whatever I choose to carry on long flights—and the Sportsman seems not to care.

At times it's easy to forget that long, dark month in Washington and fail to realize this airplane is, although rapidly assembled, still a homebuilt, still carrying the freedoms of the category and reaping the benefits of advanced technology at very reasonable prices. For about what I'd spend on a 30-year-old Bonanza, I've got a new, up-to-date airplane that, thanks to the checks and balances of this very specialized build process, is, I'm convinced, as safe and well built as can be. I couldn't ask for more. AOPA

i Links to additional information about kitplanes may be found on AOPA Online (www.aopa.org/pilot/links.shtml).

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