



The one-piece wing has been turned lengthwise on its central pivot point to allow for easy storage—in this configuration, the legal Part 103 ultralight measures 25 feet long, 72 inches tall, and 83 inches wide.



The Back Yard Flyer UL

Sparky Barnes Sargent, EAA 499838

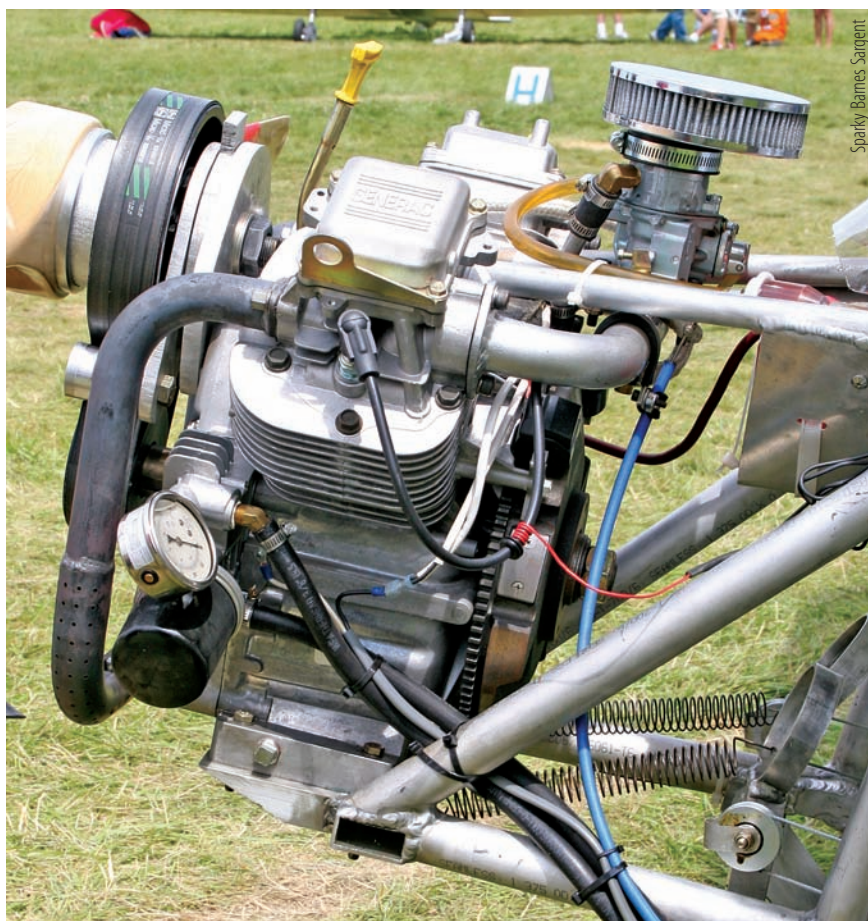
That thick, tapered wing will grab your attention right away.

Take a closer look at the Back Yard Flyer UL (ultralight) and you'll likely be struck by its clever design, which includes four features not usually found in a single-seat ultralight vehicle. Those features—the four-cycle engine, electric start with alternator and battery, differential braking with the rudder pedals, and a BRS ballistic parachute—were chosen to enhance the ultralight's performance and ground handling and to add an extra margin of safety for the pilot. There's more—Junkers-style ailerons, a custom Culver prop, a prop speed reduction unit (PSRU), and a one-piece, cantilever wing that can easily be stowed in a streamlined position to facilitate storage. →

A father and son team—otherwise known as Valley Engineering LLC—from Rolla, Missouri, designed and brought the Back Yard Flyer UL to life. Gene Smith is an easy-going, affable southern gentleman. Paired with his quick-witted and good-natured son, Larry, the duo has created a niche in the ultralight world. They’ve developed their own airframe and engine, and their own propeller business, too. Obviously, that’s more work than two people can handle, so Gene’s wife, Juanita, along with Larry’s daughter, Alaina, and son, Grant, all participate in airplane building and propeller making. With this trio of family-run cottage industries, they have everything they need to produce a legal Part 103 ultralight. When asked how long it took to design the Part 103 Back Yard Flyer UL, Gene laughed softly and speculated, “Several sleepless nights.”

ONE THING LED TO ANOTHER

In 1994, Gene flew his first custom-built ultralight from his home in Missouri to EAA AirVenture Oshkosh. While flying from the ultralight field there, he heard complaints that some



The Back Yard Flyer UL sports a Valley Engineering “Big Twin” two cylinder, four-stroke engine with a prop speed reduction unit and a Culver wooden propeller.



The simple instrument panel and flight controls.

folks were climbing out too steeply on takeoff. Concerned, he inquired if he was one of them. “No, you’ll never get a Volkswagen engine to climb out too steep,” he heard.

That did it—the challenge was on. “When somebody pokes your pride a little bit, it spurs you to do something,” chuckled Larry. “That’s actually how we got into the prop speed reduction unit.”

At home after the show, they devised a bolt-on, belt-driven reduction unit for Type 1 VW engines. [See “The Quest for Affordable Power,” *EAA Sport Pilot & Light Sport Aircraft*, April 2008.] In 1997, Gene flew to AirVenture in his Volkswagen-powered, tricycle-gear ultralight and was rather pleased when he heard the sharp admonishment, “That’s too steep a climb-out!”

Three years ago, the Smiths brought another new single-seat,

high-performance Volkswagen-powered ultralight to AirVenture. It had an 8-foot propeller on a 100-hp engine, with super Junkers-flaps that had 40 degrees of flap deflection with the ailerons. Its takeoff run was only 62 feet. They didn’t even have a name for it, but that didn’t deter the customer who purchased it. Larry asked where he intended to fly it, and the fellow told him, “I’m going to fly it out of my backyard!” The Back Yard Flyer UL had a name.

Gene had been a basic flight instructor (BFI) for years, so for a while he and Larry focused their efforts on a two-place Back Yard Flyer, demonstrating the prototype at AirVenture 2005. With the advent of the FAA’s light-sport aircraft (LSA) rule, they contemplated going the LSA route, but ultimately decided to build an ultralight. “We thought the experimental LSA would be great, but



Close-up view inside the wing shows the spar and rib construction.

[Inset] Another peek inside the wing reveals the ballistic chute and fuel tank.

brakes, electric start, and if possible, carry its own battery and alternator, with a four-stroke engine,” Gene said. “We said, ‘Can we do that and still meet 103?’ We worked on it pretty hard, and we succeeded. The first one came in well under the weight. On the second one we added just a little bit of wingspan, and it still came out to 249 pounds dry—no oil, no fuel, no parachute. With the 24-pound allowance for the parachute, it all weighs out with 5 pounds to spare.”

we got into the details of the first one having to be a special LSA,” Gene said. “The paperwork required for manufacturing and selling the LSA is beyond our capability, so we’re limited to building amateur-built.”

The Smiths devised their own two-cylinder, four-cycle engine by modifying an engine that was built for airboats. Their Big Twin has a peak horsepower of 40 at 3600 rpm and a continuous horsepower of 32. Weighing only 120 pounds dry—including the prop and PSRU—it burns 5 quarts of gas per hour at normal cruise (per Valley Engineering’s brochure). The debut of this V-twin engine was in their low-wing, single-place Back Yard Flyer at AirVenture 2006 [“Animal Attraction! The Backyard Flyer,” *EAA Sport Pilot*, December 2006]. Ultralight enthusiasts took note of the new light airplane engine, as did the judges, who gave it the Ultralight Innovation Award for its custom powerplant. The engine and PSRU required special propellers, and there was only one source for them.

“We had to have a wide prop blade, with lots of diameter, for the reduction drives. David Miller of Culver Props had several patterns he built for us, but then he went out of business. So we ended up buying his business sight unseen,” said Gene, adding, “he loaded it all up

in a tractor trailer and sent it down to us. Then he and Bill Powers came down and spent a week with us, and we learned how to build props. It’s a great thing for us, because we have the need for so many prop variations,

“We put everything on and flight test it, to where we know it’s performing perfectly.”

and we can easily customize these hand-carved, wooden Culver props.”

Continually contemplating improvements for their ultralight designs, they wanted to build a new Back Yard Flyer that would “have

WING AND AILERON DESIGN

The Back Yard Flyer UL has a deeply cambered and tapered cantilever wing that is bolted to the fuselage with five half-inch bolts. The overall shape of the wing is somewhat

reminiscent of Ford Tri-Motor’s wing. The wing chord (not counting the ailerons) measures 60 inches in the middle, tapering to 44 inches at the wingtips, and the wing has a thickness of 10 inches in the middle,



[left] Close-up view of the tail. [right] Note the trailing edge Junkers-style displaced aileron (flaperon).

From Crop Dusting to Ultralights

tapering down to 7 inches at the tip. Gene designed the wing and explained that the depth in the middle is for strength and that the taper is to concentrate less lift at the tip and more lift toward the middle, so that the spar, a triangular truss, will be strong and light.

Other notable features about the wing include its one-piece design, trailing-edge ailerons, and unusual method of “folding.” While working on the wing one day, which was originally designed as a three-piece wing, Larry mentioned to his father that he wished they didn’t have to take the wing apart. Couldn’t they just make it one piece? “I wanted a 25-foot, one-piece wing. Dad started scratching his chin, and pretty soon, here he comes back with two propeller scraps. He’s got a bolt going through them on two angles, and he says, ‘Look! I can make it rotate and level at the same time.’ I couldn’t get hold of the concept for a week,” said Larry, adding, “We had to get it built on the plane before I could figure it out!”

Elaborating on the concept, Gene explained, “Of course, the wing is on the airplane with an angle of incidence now, and if you’re going to rotate it, then that angle has to come back to horizontal, or else it’s going to hit the tail. So I had to make the pivot and keep the wing level with the horizon as it swings around over the fuselage. All it takes is a compound angle on the pivot point. I just kept messing around, drilling holes in those scrap boards until I finally got it working. The swing wing rotates 90 degrees, and it takes about two minutes to transfer it from one position to the other.”

Junkers-style ailerons (or flaperons) are mounted externally on the trailing edge, adding about 10 inches of chord to the wing. “As the stick comes back for landing, the ailerons droop about 15 degrees,” said Gene, “and that limited amount makes for an easy landing. In a normal airplane, when you make corrections for a little balloon on landing,

YOU MIGHT be wondering just how this father and son became involved in aviation in the first place. As for Gene, he enrolled in mechanical engineering at the Missouri School of Mines and Metallurgy after high school, and the dean of the engineering department happened to be a flight instructor and had his own airplane. “I started taking lessons with him in his Piper Tri-Pacer, but I didn’t have enough money to get my license before I got out of school—I had four kids. Then I went to Memphis and started working, and I finished my private license there in 1965. I came back to Missouri to the farm; I didn’t like to work in engineering at all, being at the desk all day,” reminisced Gene, adding, “I guess I’ve always been running from the paperwork! But the farm didn’t support us well, and I loved to fly, so I decided to crop dust—there was a need for that. I bought an old Super Cub in 1970, built the ag system and put it on, and started crop dusting. I crop dusted for 21 years, and after that I had bypass surgery—you know what that means. I found out there was a lot of paperwork to try and get my medical back, so that’s when I started looking at ultralights and became a BFI.”

Son Larry grew up helping his mother be the pit crew for his crop duster. “I flew our Super Cub, and when we got into the higher-performance planes, I just couldn’t handle them on our small grass strip, so I kind of dropped out of flying. But when we built our own plane in 1993, Dad gave me five hours of dual in it, and I was gone. And now when we build a new ultralight, I just get in it and go—I just love it!”

Back Yard Flyer UL: \$17,500

Back Yard Flyer UL w/Trailer: \$25,500

Prop Speed Reduction Unit: \$1,595

Big Twin: Call for pricing



Gene Smith, left, and his son, Larry.

you have to actuate the elevator, which has to rotate the airplane. In ours, the instant you jerk the stick, the ailerons come down and give you instant lift, so you can get the increase in lift without having to rotate the airplane. It's the easiest landing plane I've ever flown."

Constructed of welded aluminum tubing, with its wing and tail group covered with DuPont Dacron 1.7 ounce fabric, the Back Yard Flyer UL has eye-catching Massey Ferguson red trim—and yes, it is farm implement paint. The ultralight lifts off at 24 mph within 100 feet, climbs out from 35 to 40 mph, and lands around 25 mph. It flies solidly at 30 mph, Gene reported, and cruises comfortably at 50-55 mph.

LANDING GEAR

Another striking feature on this tail-wheel-configured ultralight is the main landing gear design, an aesthetically pleasing combination of form and function. Try to imagine how the Smiths achieved that particular radius while bending the tubing. Gene knew that standard spring gear is far too heavy for an ultralight, so he mulled it over and came up with a solution: "The gear components are just like a J-3 Cub, except for where you'd normally have the bungee cords. I thought, 'Why couldn't you just use a curved piece of metal?' because a curved tube will stretch, and it'll have enough spring in it to bounce back."


Larry added, "A fellow asked me yesterday what kind of special press we had to form those, and I said, 'Oh, it's our secret!' If you don't have a propane tank, you can't make them. It takes two of us, but we bend the tube around the bottom of a propane tank, and when it touches at the top, then the curvature is ideal for the gear leg."

READY TO FLY

The Back Yard Flyer UL is sold as a finished, fly-away legal ultralight. Valley Engineering LLC doesn't even have plans available for it (they just

don't like paperwork!). "So much of it requires aluminum welding, and that's pretty demanding—not everyone can do that," explained Gene. "We put everything on and flight test it, to where we know it's performing perfectly."

The Smiths estimate they can build one every month and a half, so there likely won't be too long a waiting period for those fliers who want to experience the freedom and fun of flying a true ultralight from their back yard. "We don't sell anything

we haven't tested, even in our engine packages," Larry said. "It has to be finished and ready to go before we're happy to let it go. We're proud of our total package: four-stroke, electric start, legal Part 103, spring gear, swing wing—it has so many features, all in one plane." 

For more information, call Gene or Larry Smith at 573-364-6311 or visit www.Valley-EngineeringLLC.com



CTLS

The Flight Design **CTLS** is the new version of the best selling **CT** designed specifically for American pilots. The **CTLS** has more comfort for long flights, a more spacious cabin and is very easy to fly. What Flight Design didn't change is the class leading performance that has made the **CT** famous.

But don't take our word for it, go to FlightDesignUSA.com, find a dealer near you, and arrange a demo flight.



CTLS STANDARD PANEL

Dynon D-100 EFIS (Electronic Flight Information System)
 Dynon D120 EMS (Engine Management System)
 w/back-up primary flight instruments.
 Garmin SL 40 Com, GTX-327 Mode C Transponder,
 Garmin 496 GPS with XM Weather, PS Engineering
 intercom



CTLS ADVANCED PANEL

Dynon D-100 EFIS (Electronic Flight Information System)
 Dynon D120 EMS (Engine Management System)
 w/back-up primary flight instruments.
 Garmin SL 30 Nav-com, GTX-330 Mode S
 Transponder, Dynon HS 34 HSI module, Garmin 496
 GPS with XM Weather, PS Engineering intercom

PO BOX 325 | S.Woodstock, Connecticut 06267

Tel 860-963-7272 | flightdesignusa@rcn.com

Dealerships are available in select areas of the USA.

