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Revisiting Don Stewart's Headwind

An LSA for the ages?

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Stewart Headwind

An LSA for the ages

By Budd Davisson

Builder Jack Roberson flew his VW/Maximizer powered "A" model Headwind to Oshkosh from Phoenix, Arizona in the '80s. Note his self-designed spring gear. The aircraft is currently owned by Timothy Stover of Apple Valley, California

Everyone has a list of favorite airplanes. Sometimes it's loaded with high-performance barn burners (Mustangs, Pitts Specials, Harmon Rockets, etc.). Other times the list is dominated by summer-afternoon-sunset flyers (Cubs, Pietenpols, Fly Babys). As a general rule, the lists are fairly parochial, with no crossover. However, one little homebuilt flying flivver, the Stewart Headwind, sometimes shows up where it doesn't belong: on a high-speed list. It makes that list because it is the quintessential summer-afternoon cruiser with very cute retro looks (like a 1930s free-flight model). It's also one of aviation's best-kept secrets—something we'd like to rectify with this article because the Headwind is the absolutely perfect, low-dollar, low-tech, light-sport aircraft (LSA) compliant, good-flying airplane anyone can build. And we mean anyone. And it will cruise at 90 mph!

Photography courtesy EAA Archives

Don Stewart, who designed the Headwind in 1961 and flew the prototype in 1962, said, "At the time, everyone else was trying to go fast, but I was trying to go slow and spend as little as possible to do it. That's why I named it the Headwind, in counterpoint to the Wittman Tailwind. I saw the Headwind then, and I see it now, as an 'everyman's airplane,' an airplane that can be built by anyone who knows which end of a screwdriver to hang on to. Plus, I wanted it to be super easy to fly while at the same time having plenty of performance."

Don has been a serious free-flight modeler his entire life and a longtime, hardcore student of aircraft design and engineering. (He has designed and built a number of aircraft after the Headwind and does engineering consulting.) So, when he laid a clean sheet of paper on his drafting table (that was the early '60s—he uses CAD now), all of his background and tastes helped shape what eventually took place in the drawings. He knew from his free-flight experience that low wing loadings and low span loadings gave the most performance for the least amount of power. That meant light structure and long wings. He also liked a specific look that was often embodied in many traditional free-flight model designs: high wing: low-slung, minimal fuselage; and a high thrust line as epitomized in Alberto Santos-Dumont's Demoiselle of 1908, one of Stewart's favorite airplanes. So, there's little surprise that Don mixed all of those ideas together and came up with what is one of the most practical homebuilt, light airframes sport aviation has seen. The primary reason the Headwind is not better known is because it's not the kind of airplane someone builds to go to fly-ins. They build it to have a good time in their local area, so even after half a century, the Headwind hasn't developed a profile on a national level.

"I used the triangular fuselage cross section, as used on the Demoiselle, Champ, Aeronca C-2 for the same reason those designers did," said Don. "It's quite strong and light. Better yet, it has far fewer pieces of tubing in it than a rectangular layout would have. I designed it specifically for the amateur, so it is much simpler and easier to build. This goes for every aspect of the airframe. I wanted a guy who is building his first airplane to have no doubts that he can do it."

Bill Budgell of Wasaga Beach, Ontario, Canada, one of the latest Headwind builders, addressed the construction difficulty of the airframe by saying, "I tell everyone that there is nothing hard about building this aircraft. If I were to rate the difficulty of building on a scale of 1 to 10, with 10 being the hardest, the average

Bill Budgell of Wasaga Beach, Ontario, Canada, flies behind a Continental A-75 engine, which is heavier than a VW, but it gives phenomenal performance to his Headwind, which he completed in 2011.

builder should see this as a 3 to 4.5 scale of difficulty. I can't think of an easier first-airplane project. Or a less expensive one."

A casual perusal of the plans shows that Don also drew up the plans with the first-timer in mind because no interpretation is needed to figure out how everything goes together. Plus, an outstanding cutaway is available that shows the relationship of all the parts to one another.

"The plans are well drawn and very self-explanatory," Bill said. "A little studying and there would be no reason to contact the designer. They are that understandable. This really is an airplane anyone at any skill level can build. Same thing with flying it: It's very docile and Champ-like, so piloting skill required is also minimal."

Bill thinks so much of the airplane that he makes himself available to answer building questions and will custom-build components, if needed (capaviation1@rogers.com).

A note should be made here concerning the use of the term "simple." There is a definite difference between "simple" and "crude." Simple means a lack of complexity. It means designing and engineering something so the job gets done with the smallest number of parts possible and making certain that each of those parts is, itself, easy to make. And that is the design philosophy behind the Headwind: Every single part of the airplane could be made with a hacksaw and files, if need be (except the axles). In theory, the entire airplane could be made with hand tools. In fact, it could be done without power tools, if you don't mind drilling a few holes in metal by hand. Now there is a worthwhile challenge: Prove that you can build an airplane without power tools! Of course, there's no reason to.

Don said he built the prototype in five months using nothing but a hacksaw and a powered hand drill. He continued, "You start the fuselage by laying out the bottom truss, which forms the bottom of the triangle. You bolt that to a firm table and lift the tail end of it up to the right height, as indicated on the plans, bending the longerons in the process. Then you build some simple wooden jigging that locates the tail post and top longeron. Everything sort of 'hangs' from that.

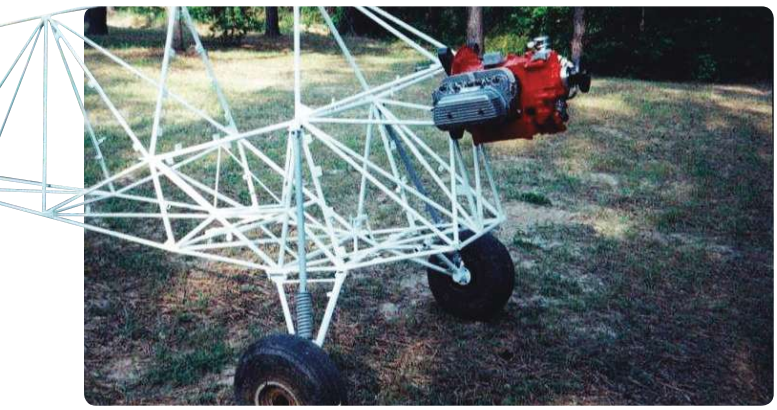
"One approach is to make three plywood patterns and stand them up on the worktable. The first establishes the firewall station, and you build the forward fuselage station and motor mount, which is part of the fuselage, to that. The second locates the front end of the top longeron and the main wing and landing gear fittings, and the third plywood station establishes the back of the

Landing shocks are absorbed by stacks of rubber wafers or Chevy motor mounts.

The cockpit can be built to fit almost any size pilot. The door can be eliminated.

Headwind builders consider simplicity to be more important than streamlining.

cockpit including the rear wing fittings and seat position. Spend a little time studying the drawings, and most people can build the jig and start cutting tubing the first weekend. Progress is very quick. If someone is afraid of welding, they can always have Bill weld up a fuselage for them, which I think they can do and still stay within the 51-percent requirement. However, the nature of the structure is such that only a few welds are critical, and those have enough weld length involved that they have a large safety margin included."



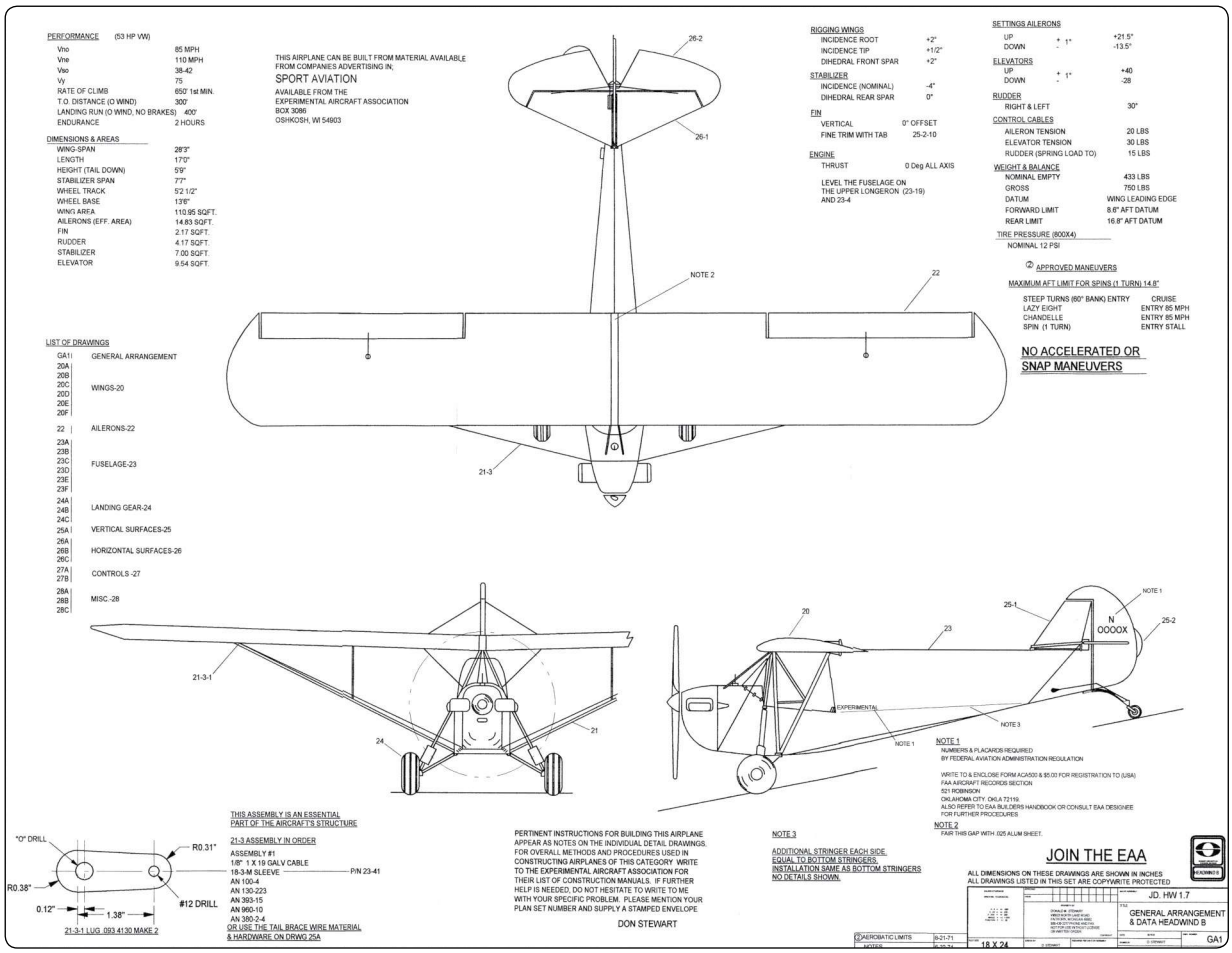
The fuselage structure features a triangular cross section with the top longeron running from the main wing fittings to the rudder post. The motor mount is integral to the fuselage.

The landing gear is another area where low cost and simplicity is involved.

"I made the gear sort of an outrigger arrangement so the shock struts would be super simple to build and gear alignment would be easy," he said. "The shock absorption system is a stack of wafers that are cut from a sheet of one-inch, 50 durometer rubber sheet with a hole saw—it cuts easier and cleaner if you freeze it first—or a stack of Chevy motor mounts. The part number is in the plans."

Don built the prototype to be light and simple, which included no brakes on the former 800 x 4 Cub wheels, but few builders have gone that route.

"Builders have used every size of wheel and brake available with 600 x 6 being the most popular," he said.



"Some have even gone down to 500 x 5, but I think the airplane retains more of its retro look with bigger tires. Sort of like an old 1930s free-flight model. Because it's so light, it doesn't need very much in the way of tires or brakes, so lots of used ones could be sourced cheaply."

The plans clearly show a door on the right side, which Don said is just there as an option and not really needed. "The door can be on either side of the cockpit or it can be eliminated completely. Crawling in the window is no problem. But the door makes it much easier, and it can be flown with the door left off and the side open, like a Cub."

The wings are classic fabric wing construction identical to any number of wings, except the ribs are made from ¼-inch Marine plywood. They can easily be band sawed and sanded in stacks and the internal cuts made with a jigsaw. However, they absolutely scream to be made on a homemade router table after making up a master pattern out of hardwood or ¼-inch Masonite. (Birch or oak from Home Depot would work, too).

Bill said, "You can jigsaw them out and do them all in a long weekend. However, Don's son, Bill, and a friend have set up a CNC router to make them for a good price. Their e-mail is pwr985@hotmail.com."

In keeping with the search for economy in construction, Don said, "Although spruce is best for the spars in terms of weight, you can also use Douglas fir, and in the drawings I clearly say what to look for in terms of grain lines per inch, run-out, etc. A really good source for spar material is 'porch stepping,' the straight grain fir they specify as being good enough to make stair steps out of."

One of Don's professed frustrations is that more people haven't used VW engines using his Maximizer belt-driven reduction system.

Don said, "A lot of Headwinds are flying with stock, or nearly stock, VWs, and they fly really well. However, I originally designed the airplane around a VW with my Maximizer belt reduction system on it. VWs are tiny engines and get their power with rpm, not displacement, so they need to turn up fairly high. They can't do that, of course, with a long propeller, which is much more efficient, so I designed the Maximizer system to let them turn up but swing a bigger prop at a slower rpm. I was really happy with the way it worked, and the airplanes performed great. But I was never able to get the units produced in quantity. Today, someone could take my drawings to one of those online CNC operations and get the drive pulleys turned out relatively inexpensively."

The Headwind in the photo above uses a spring gear and direct drive VW, while the Headwind below uses the rubber wafer damped gear. Its Maximizer-reduced VW has a higher thrust line, which produces the different nose profile.

As it happens, the majority of the Headwinds built use either a direct-drive VW or the old, reliable, and readily available Continental A-65. They are heavier, and a little bit of beefing up is required of the forward fuselage bay; but apparently they really do the job, and midtime engines are generally available for $5,000, give or take.

Bill Budgell has an A-75 (an A-65 turning up another couple hundred rpm) in his airplane, and he said, "I routinely get a solid 900 to 1,000 fpm climb, and the takeoff happens before you're ready for it. Maybe a 200-foot run. I'm cruising at 92 mph at 4 gallons per hour, and the airplane is surprisingly solid in flight. In a lot of ways, it's a Champ. Very easy to fly."

The cost of covering and painting an aircraft has risen to ridiculous levels, but Don has something to say about that. "I like to stay with known fabric, like Poly-Fiber," he said, "but, and I know this sounds crazy because it is so nontraditional, some Headwind builders have been experimenting with household exterior latex paint over normal aircraft Dacron. We have latex-Dacron test panels out in the sun that are more than seven years old, and we see no deterioration at all. To spray it requires thinning it out more than you'd really want; but I just looked at an airplane that the builder painted with a fine-nap roller, and it was amazingly smooth. I asked the manufacturer's rep about it cracking from flexing, and he reminded me, '…It's mostly rubber, remember?' I'd forgotten that."

The Headwind is an airplane that's absolutely made for scroungers and do-it-yourselfers. There are an amazingly small number of parts, and there are alternates for some of them. The lift struts, for instance, don't have to be streamlined tubing. If you want, you can use round tubing (all that will happen is you'll go a little slower) or streamline the tubing using wood, thin aluminum, or available plastic fairing strips. The price of round tubing is less than half that of streamlined.

You can keep your eyes open for someone upgrading a J-3 to a C-85 and pick up an A-65 for a good price. Wheels and brakes, tail wheel, instruments, etc. all could be sourced. This is an airplane that would benefit from you spending a few hours on eBay or cruising swap marts looking for highly airworthy items.

We're not proposing using substandard parts, but we are saying that for a 90-mph airplane, not every part needs to be new. Every part does, however, have to be rebuilt or judged to be airworthy by someone who knows (such as your local A&P).

Bill estimates that with a little creative scrounging and luck, the Headwind can be built for $12,000 to $15,000. With a good find on an engine it could be under $10,000.

The Headwind was born during a period of EAA's growth, when getting into the air as safely and as inexpensively as possible was the standard goal. The concept of $50,000 to $100,000 homebuilts couldn't even be imagined. The Headwind harkens back to the "good old days" and can once again make flying highly affordable. Better yet, you don't need a medical to fly it. So, what's not to like? EAA

Budd Davisson is an aeronautical engineer, has flown more than 300 different types, and has published four books and more than 4,000 articles. He is editor-in-chief of Flight Journal magazine and a flight instructor primarily in Pitts/tailwheel aircraft. Visit him on www.AirBum.com.

Dick Giede, a retired Cessna engineer from Wichita, built this to-the-plans Headwind in the early 1960s. Equipped with a direct-drive VW, at last report he had logged more than 1,000 hours on the airplane.

Photography courtesy EAA Archives