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The Amazing Headwind

MOHAWK AIRLINES COPILOT Don Stewart, jetting down the beautiful Mohawk Valley in upstate New York a few years ago, gazed down on the breathtaking expanse of cornfields and apple orchards from 25,000 feet, admiring the world basking under a warm summer sun.

"Man," he yelled, "what a day to be out flying!"

It did not occur to him until later that his comment neatly spelled out the vast difference between commercial jet age aviation and sports plane flying, an exhilarating form of sky travel unique for several reasons.

First, in cavorting through the low sky in a sports plane one feels a part of the world below him, senses the smells of new mown hay, of burning leaves, of the moist earth strong in the nostrils.

Second, in flying a homebuilt aircraft one has the joy and satisfaction of creativity at work, for while sports plane flying today is recognized as a spectator sport, it gives fullest measure of enjoyment to the pilot, who has given wings to his imagination by creating a wonderful flying machine of wood and wire and fabric and taking it aloft to soar free as a bird over hill and dale and river.

Thus was born the **Headwind**, a rara avis whose virtue is not high speed nor altitude performance but utter simplicity of design and construction and ease of handling. It is the brainchild of Don Stewart, a 43-year-old father of four active children whose understanding wife, Elizabeth, encourages him in his hobby. Stewart lives, breathes and loves flying, and to really understand what makes the Headwind exceptional, one must understand the man who created it.

Stewart is deadly serious about one thing — living life fully by throwing all his energies into whatever he undertakes. Tempering his concentration is a rare sense of humor that appears in sudden laughter when he and a neighbor, Mohawk Copilot Tom Raybourn, are at work in their homebuilt "factory" — behind the Stewarts' lovely rural home, near Salem, Ohio.

"Don't think we're crazy," Stewart grinned when I visited him one day. "We always act this way!"

Liz Stewart came out of the farm-style kitchen carrying a tray of sandwiches and beer and milk and set it on a table in the backyard, a sloping green leading down to a crystal stream and a New England stone fence, shaded by towering maples. It was a typical "homebuilt haven," a bit of backyard America where for two centuries Yankee ingenuity has flourished and mechanically minded dreamers have designed and built everything from guns and butter churns to perpetual motion and flying machines.

In the tradition of the Wright Brothers, homebuilt enthusiasts today frequently construct their own wind tunnels, strain gauges and other paraphenalia with which to fashion dream ships often incorporating new and untried aerodynamic principles. More often, however, builders like Stewart and Raybourn adapt proven ideas, combining known elements to fashion their machines from tried and true designs.

Like many of his contemporary enthusiasts, Stewart was bitten by the flying bug in boyhood, which he spent in the pleasant Green Bay region of northern Michigan. "I always tried to simplify my model airplane designs," he recalls. "I found that if I figured long and hard enough I could usually find a way to make one part serve for two."

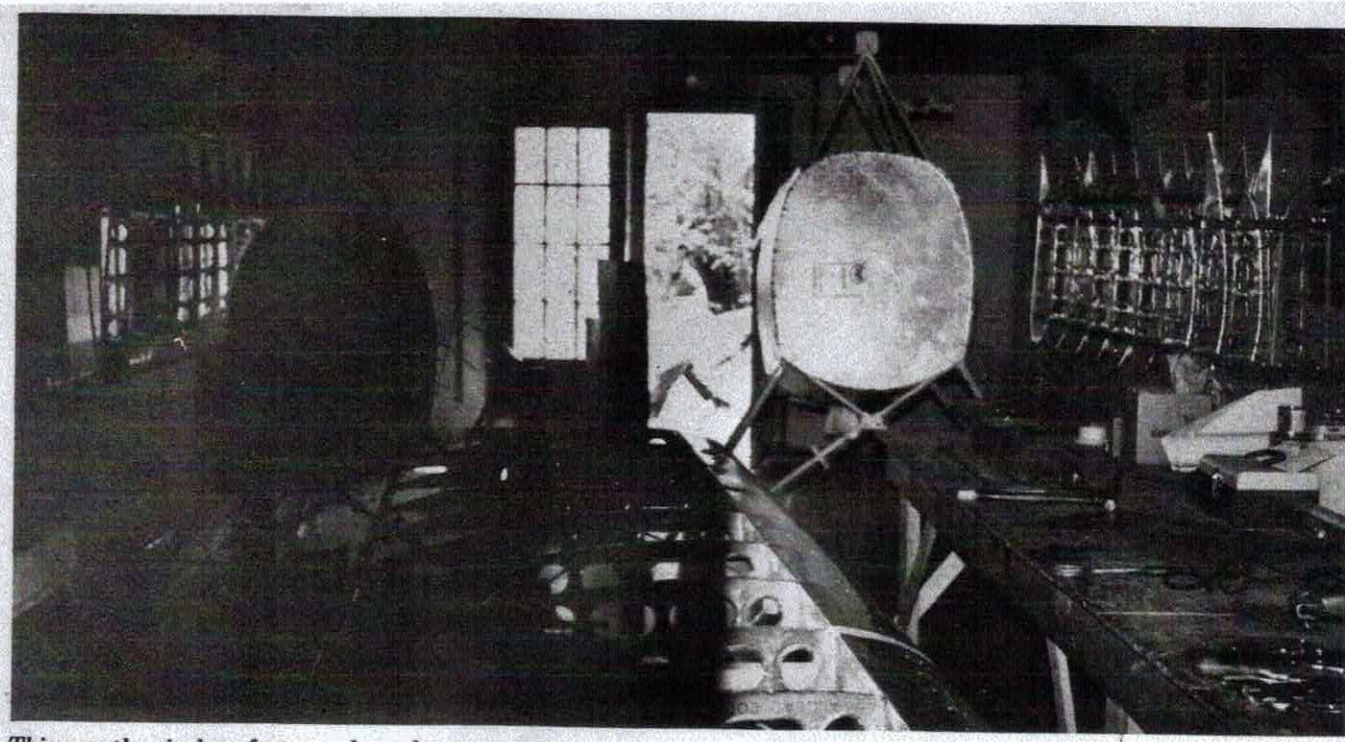
Stewart finally took up man-size aviation in 1945, paying for flying lessons by pumping gas at Menominee Airport. His enthusiasm for designing planes persisted, and for some time he experimented with a variety of combinations of low, mid and high-wing types while in high school. His only formal engineering education, however, was an I.C.S. correspondence course in aeronautical engineering. "I learned to read blueprints and airfoil charts," he says. "It was enough to get started."

All this time Stewart carried his dream of the perfect simple homebuilt airplane, and while its shape grew in his head and on paper, a search went on for a "decent engine." He finally settled on a 36-hp Volkswagen powerplant.

After 10 years of planning, construction on the Headwind began in October, 1961, and on March 28, some five months later, he finally got it off the ground. "It was Liz's birthday," he remembers. "We had a double celebration!"

The first flight was something, he recollects. "I taxied up and down the runway and found the engine would turn up about 2,700 rpms under static thrust. But when I took off and got out of ground effect the rpms stayed right there! I staggered around a silo and got back to the field at Menominee. I knew right away what was wrong. I needed a bigger prop, and a reduction jack shaft so the little engine could swing it."

Stewart discussed the problem with a friend, Bob Huggins, in Tulsa, Okla., who has designed a reduction gear with



This was the airplane factory where the Stewart Headwind was initially assembled.

a rotating shift. Stewart decided on a different approach and used a fixed shaft with a belt drive to give a reduction ratio of 1.6 to 1. With this, Stewart figured he could develop 36 horsepower at 3,600 rpms at the engine and 32 horsepower at 2,200 rpms at the prop, where before he could get only 18 working horsepower. Presently he is designing a new propeller of 62 inches diameter and a Clark Y airfoil.

"With the first installation it was a wonder the Headwind flew at all," he laughs. "I guess there's where I got the idea for the name!"

Discussing the prop speed reducer, Stewart said: "It's a different concept I worked out so there is positive lubrication of the unit regardless of the attitude of the airplane. This is accomplished with no pumps or other devices. It is basically a belted arrangement and the belt tension and alignment can be adjusted at one point without disassembling the unit."

The positive lubrication feature is achieved by a series of internal agitators that splash oil over the moving parts automatically whenever the unit is turning. It, too, exemplifies Stewart's philosophy of simplicity of design.

The Headwind is described by Stewart as an "extremely simple airplane of steel tubing construction for the fuselage and tail. The wings are two wood spars with either sawed plywood or formed aluminum ribs. All the fittings are flat and only two of them require any preassembly. The engine

Don Stewart poses with VW engine, showing propeller reduction gear he designed.

Side view of VW engine and reduction gear with belt drive.

bolts directly to the front of the fuselage, saving a separate engine mount. The landing gear is rigid and uses partially deflated J-3 Cub wheels and tires. No brakes are fitted and aren't missed at all. I saved 17 pounds that way. Instead, there is a steerable tailwheel and this combination works beautifully."

The Headwind is quite comfortable for anyone except a very large person, Stewart says. "The cockpit is 24 inches wide and the cockpit sides are placed to act as armrests. Leaning out, you can actually look under the airplane, which may or may not be a first!"

The Headwind's flight characteristics were more than Stewart had hoped for: "It's not quick and skittish like a lot of homebuilts and in fact flies a lot like a J-3 or a Champ, with a very docile stall. The angle at which it stalls is quite high and I can't explain it. It probably stalls at 30-to-35 mph, though the airspeed indicator reads zero because of the relative wind over the pitot tube at that high angle."

Landing is no problem, Stewart confides. "You just watch the wheels and fly the airplane onto the ground. It's fun to watch the wheels touch, although doing this almost always causes a one-wheel landing. It's a very stable airplane on the ground, due to its low CG."

When Stewart designed the Headwind, all he could come up with for cruise speed was about 70 mph, but Headwinds built by other enthusiasts, since the prototype first flew, indicate about 80 mph in cruise mode. One, powered with a 65-horsepower Lycoming, reportedly cruised at 120 mph "and with a climb you wouldn't believe," Stewart heard.

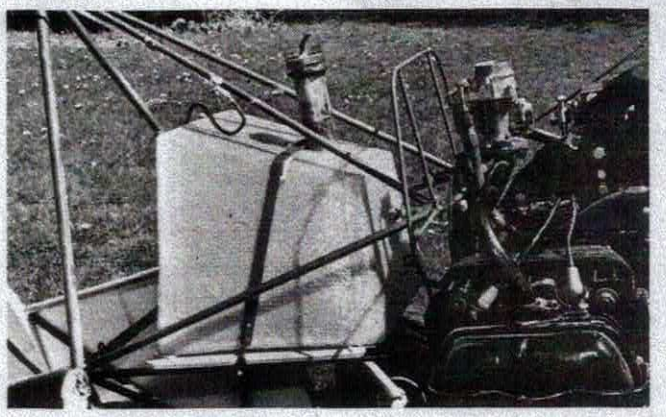
When I visited Stewart at his Salem home, he and Tom Raybourn demonstrated how quickly it could be assembled. From the time they started carrying the fuselage, wings, empennage and engine out of the red barn until it stood as a complete machine took less than 20 minutes.

I noticed several intriguing points emphasizing the simplicity of design which makes the Headwind unique. The triangular cross section of the fuselage, with two longerons at the bottom and one at the top, is a design reductio ad absurdum. Elimination of brakes and a shock system from the landing gear is a good weight-saver, with the fat 800-by-4 Cub tires inflated to six pounds pressure taking the landing load.

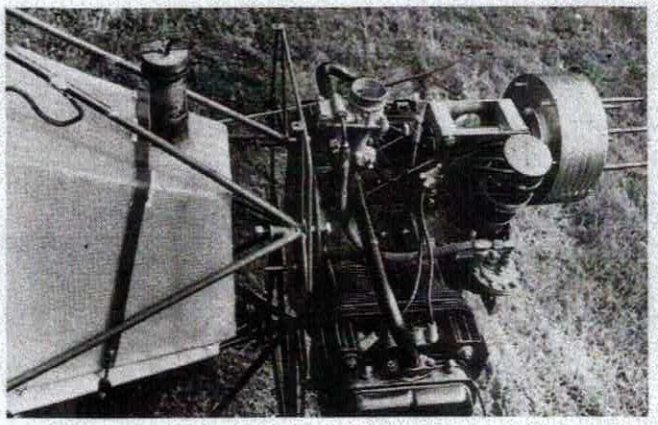
The front wing struts have been modified from an Aeronca Champ, and the flying surfaces are designed to bolt quickly to the fuselage. The pilot seat board is simple 3/8 inch marine plywood which can be upholstered to suit. The back rest is of ¼ inch marine plywood.

Most unusual is the fuel tank, a tapered tetrahedron Stewart built of hardware cloth wire lined and covered with glass cloth and resin, giving a capacity of six gallons. A pitot vent in the gas cap, facing forward, produces two psi pressure which provides fuel flow, even without using the VW engine's fuel pump.

The engine, bolted to the fuselage frame with only four bolts, is unmodified except for the propeller reduction gear and a reversed intake manifold. Stewart prefers to stay with the VW's single ignition system: "Drilling extra holes for another set of plugs would only cut down the reliability," he points out.

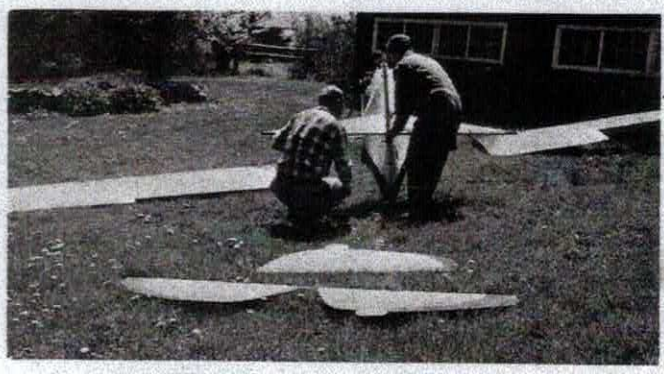


Novel fuel tank for Headwind is built up from hardware cloth wire covered with glass cloth inside and out, plus resin.

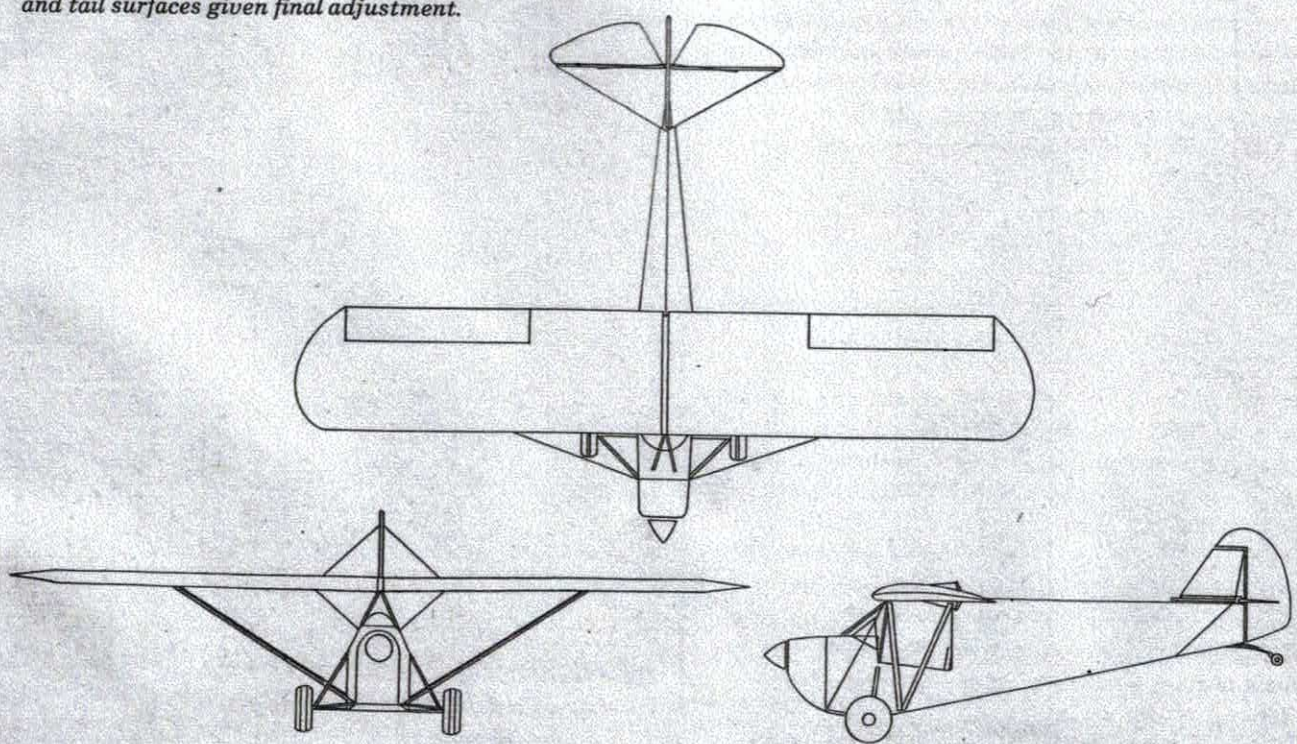


Note that VW engine bolts directly onto fuselage, eliminating need for motor mount. Fuel tank is at left.

Fuselage of Headwind is simple triangular shape.



Quick assembly: stabilizer is bolted on, vertical fin, rudder added, and tail surfaces given final adjustment.



A typical Headwind can be built for less than $625, though some of those 10 already flying have cost more. With the new propeller reduction gear installed, Stewart computes his prototype's performance at:

Vmo at 36 hp: 75 mph
Vne at 36 hp: 100 mph
Vso at 36 hp/650 lbs.: 36/38 mph
Vmo at 65 hp: 85 mph
Vne at 65 hp: 100 mph
Vso at 65 hp/700 lbs.: 38/42 mph
Vno/both versions: 70/75 mph
ROC 1st min/36 hp: 350 fpm
ROC 1st min/65 hp: 650/700 fpm
Takeoff, zero wind: 300 ft. at 36 hp
Takeoff, over 50 ft.: 1,200 ft.
Landing run: 400 ft.
Landing run/over 50 ft.: 1,600 ft.
Fuel/reg. auto: 6 gals.
Endurance: 2:25 hrs. at 36 hp
Oil cap: 5 U.S. pints

Other Headwind Specifications:

Wingspan: 24 ft. 2 ins.
Length: 17 ft. 9 ins.
Height: 5 ft.
Stabilizer span: 7 ft.
Wheel track: 5 ft.
Wheel base: 13 ft. 6 ins.
Wing area: 94.5 sq.ft.
Ailerons (two): 14.4 sq.ft.
Fin: 2.17 sq.ft.
Rudder: 4.77 sq.ft.
Stabilizer: 7 sq.ft.
Elevators: 9.54 sq.ft.
Empty weight: 426 lbs.
Gross weight at 36 hp:650 lbs.
Gross weight at 65 hp: 700 lbs.

Headwind Rigging & Settings:

Wings

Incidence/root: plus 2 degrees
Incidence/tip: plus 30 minutes
Dihedral/front spar: plus 2 degrees

Stabilizer

Incidence/(nominal): minus 1 degree 30 minutes
Dihedral/rear spar: zero degrees

Fin

Incidence/right plus (nominal): 20 ft. at 36 hp
Incidence/left minus (nominal): 20 ft. at 36 hp
Incidence/right plus (nominal): 30 ft. at 65 hp
Incidence/left minus (nominal): 30 ft. at 65 hp
Dihedral/rear spar — ref. stab.: 90 degrees

Engine

Thrust: zero degrees, all axis, VW install.
For installation details contact:
R.G. Huggins
4915 South Detroit
Tulsa, Okla.

Propeller

R. Hegy
Marfa, Tex.

Ailerons

Up: plus 15 degrees
Down: plus 15 degrees

Elevators

Up: plus 35 degrees at 36 hp
Up: plus 40 degrees at 65 hp
Down: minus 25 degrees, both

Rudder

Right and Left: 30 degrees

Tires

800 x 4 (nominal): 6-12 psi

Control Cables

Aileron tension plus/minus 5 lbs.: 20 lbs.
Elevator tension Plus/minus 5 lbs.: 30 lbs.
Rudder: spring loaded

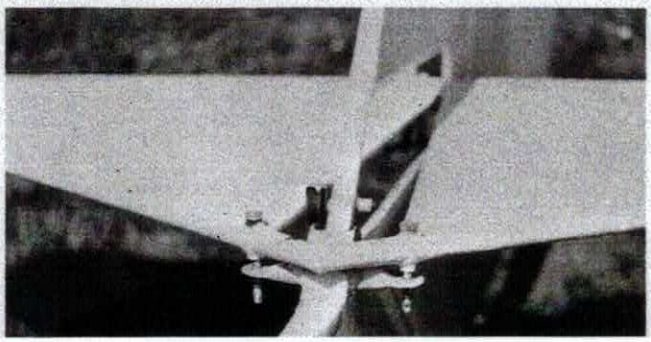
Weight & Balance

Datum: L.E. wing
Forward limit: 8.6 ins. aft datum
Rear limit: 14.4 ins. aft datum

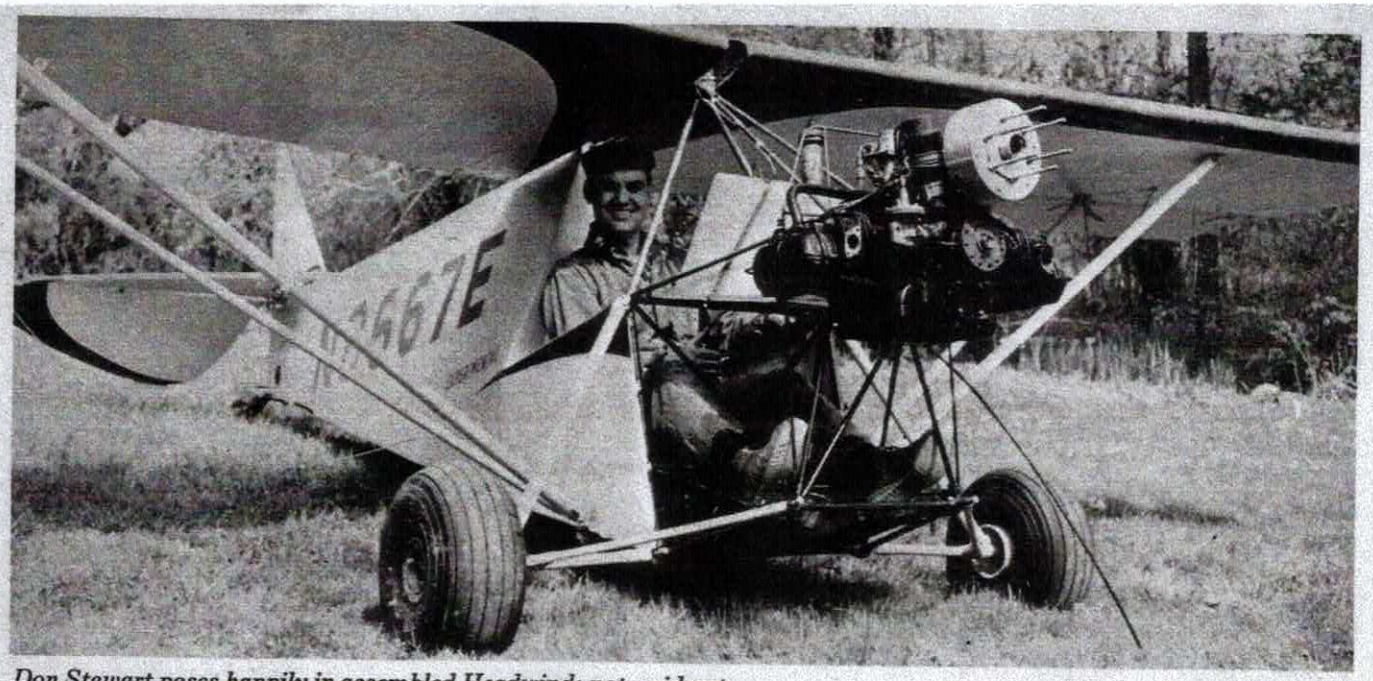
Limit Loading

Positive factor: 6.0
Negative factor: 3.9

For material and supply sources contact:
Experimental Aircraft Association
Hales Corners, Wisc.



Details for final assembly of Headwind.



Don Stewart poses happily in assembled Headwind; note wideset landing gear that makes for good stability on ground.

Stewart and Raybourn were once members of the Experimental Aircraft Association, Chapter 294, whose members already have under construction or flying a total of 15 aircraft, including two Midget Mustangs, three Pitts Specials, a Tailwind, a Baby Ace, a Teal Amphibian and two Foo Fighters.

The latter also are products of the genius of Stewart and Raybourn. One has now taken shape in Stewart's red barn "homebuilt factory." They enthusiastically put the framework of one of them together, propped on chairs and poles, to show me what it will look like when finished.

"We got the idea by going through a book of World War I fighters," Stewart says. "I styled it to sort of look like a World War I fighter, using the Alcock as a basis for the whole airplane. People who first look at it think they recognize it and sometimes say, 'Oh, I know what kind of an airplane that is, but I can't remember the name of it now!'"

In naming the odd craft Foo Fighter, Stewart explained that "the names for my airplanes are consistent with my philosophy that sports planes are intended for fun, and what better place to start than the name?"

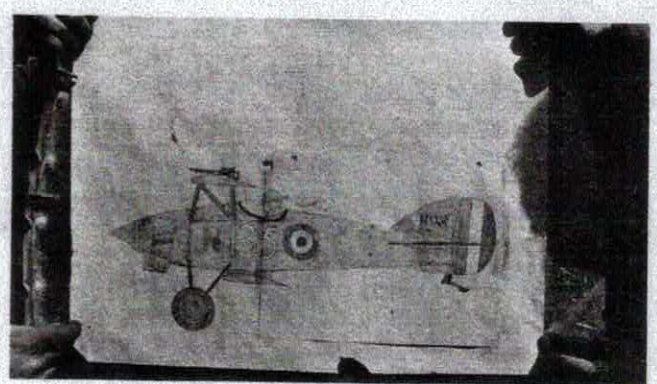
Originally, Stewart wanted to build a faithful replica of a Spad or a D-VII Fokker, powered with an inverted Ranger engine, but decided against it because that way it would not be authentic. "So I decided to build a crazy combination with all the good points of several types."

What evolved from a Snoopy-like drawing Stewart whipped up was a mongrel ship with a Bristol F2B fin and rudder; a Spad fuselage; an Albatros nose, elevator and stabilizer; and wings hung like the Alcock A1, similar to an SE5.

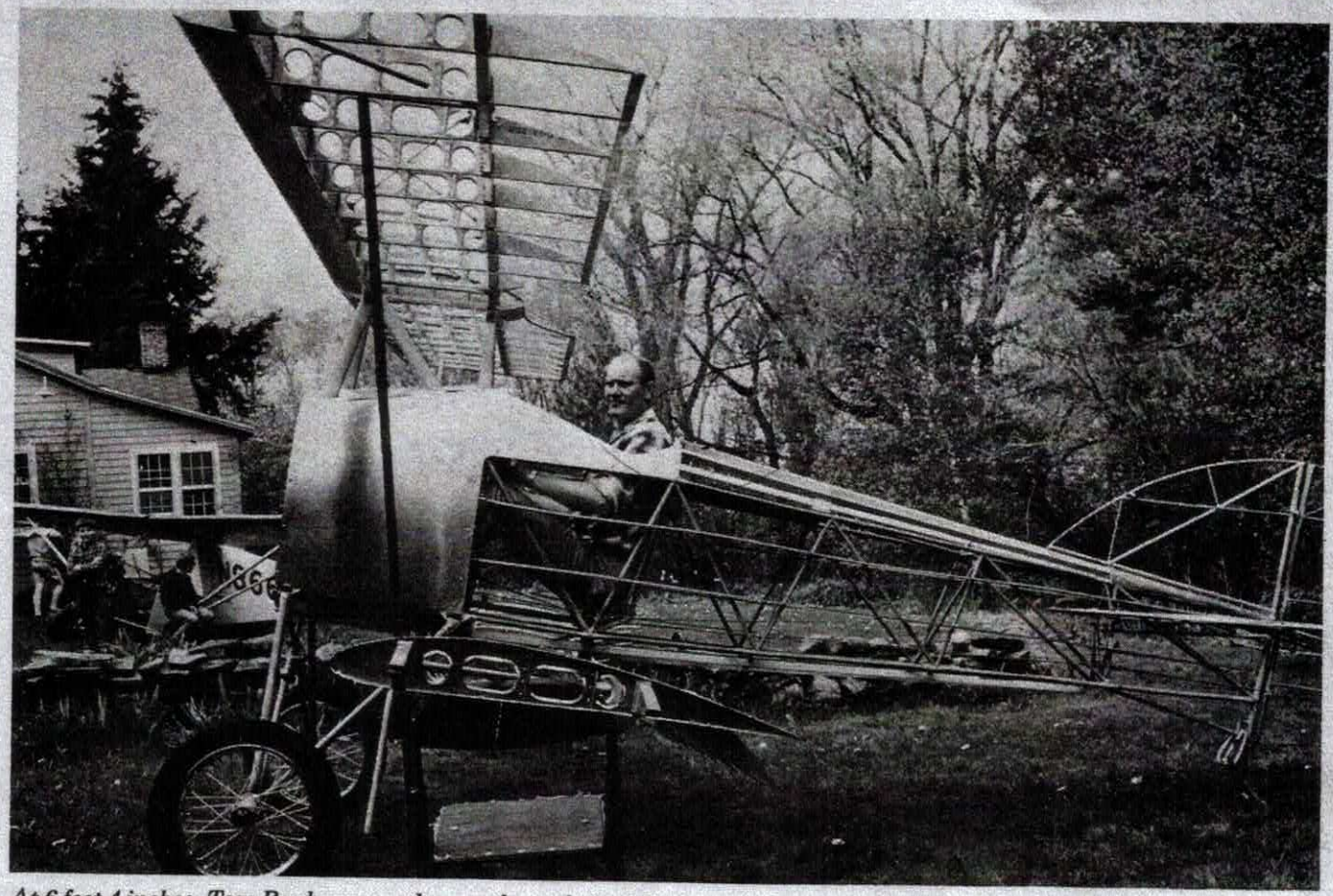
For power Stewart initially used a Ford Falcon engine, which he figured the average poor pilot can afford at around $150. With the exception of a propeller reduction unit the engine is unmodified for top reality. "You just bolt it on and fly, and besides it runs on car gas," he grins.

Raybourn, who got involved with the Foo Fighter design at Stewart's invitation, is a big man, six feet and four inches, hence the two EAA members decided to "build the ship around Tom." It came out with a span of 20 feet, four inches,

Here was the way the first Foo Fighter looked in the Stewart backyard factory.



Actual "blueprint" of Foo Fighter was this happy drawing by "grownup kids."



At 6 feet 4 inches, Tom Raybourn made sure the cockpit of Foo Fighter would hold him comfortably when ready to fly.

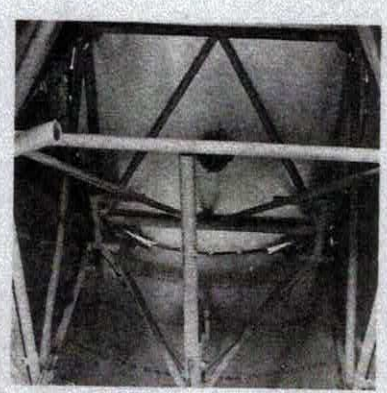
length 18 feet, six inches, height seven feet and a dry weight of 750 pounds.

In the air, they believe the Foo Fighter really flies like something Von Richthofen himself would be proud of, with a 120 mph cruise and 2,500 fpm climb. Its high load factor will make the Foo Fighter a good aerobatic ship, but so far as they are concerned, these two happy backyard homebuilt enthusiasts get just as much fun from flying it straight and level over the pleasant countryside, white scarf flowing in the slipstream and kids waving at them from below.

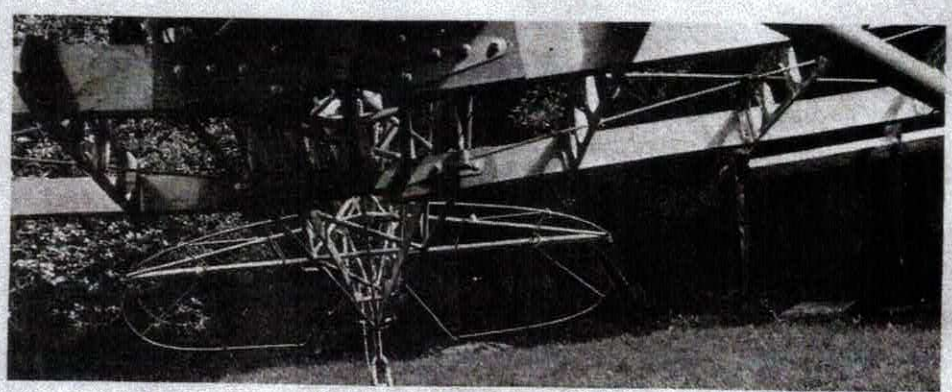
Both men in fact have a fondness for children and the Stewart backyard has become a neighborhood playground where kids gather to make wonderful make-believe flights and plan for the day when they too will find romance in the sky.

Stewart is insistent that both the Headwind and the Foo Fighter designs remain classically amateur productions, available to anyone at no cost except a small fee to cover the cost of blueprints. These are available for $15 a set, by writing to:

Don Stewart
11240 State Route 165
Salem, Ohio 44460



Roomy Foo Fighter cockpit, showing the control linkage.



Low view shows wood spars and metal fittings for the growing Foo Fighter.