DER VOLKSPLANE

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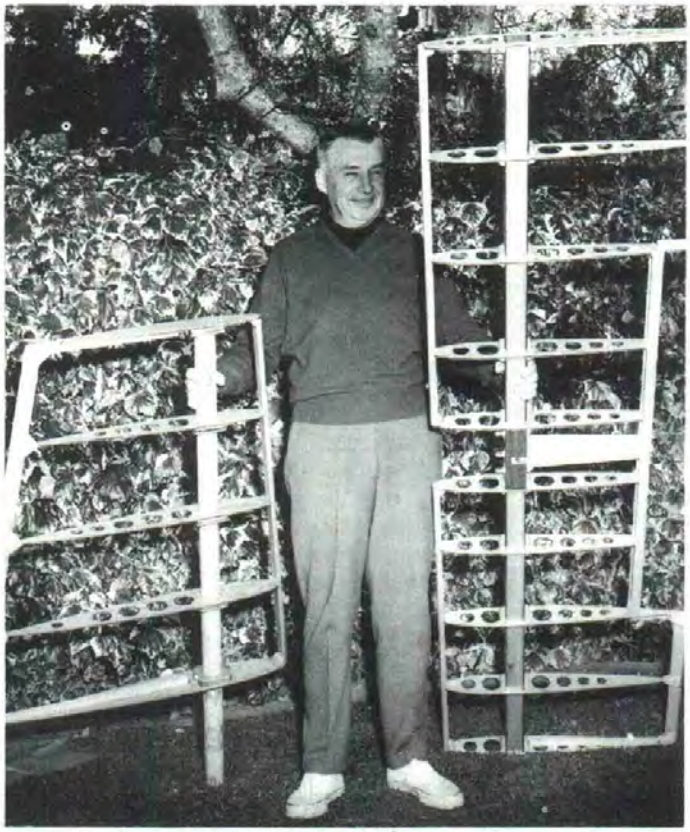
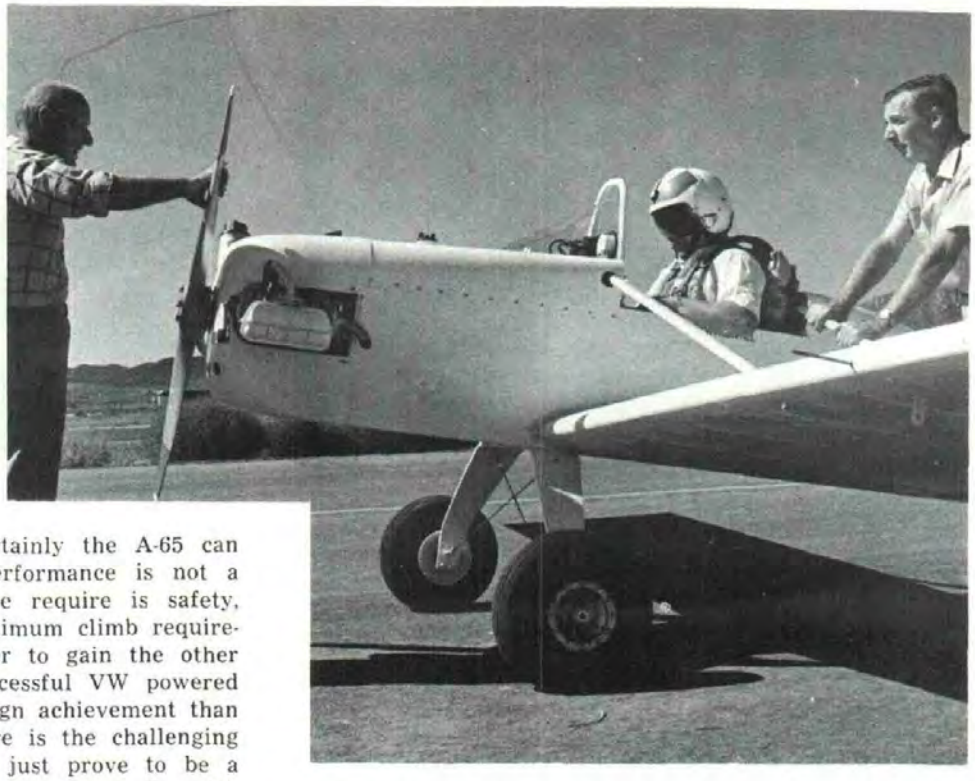


W. S. Evans beams pride with the simple stabilator and rudder for the "Volksplane."

AFTER TWO years of spare time designing, and one year of spare time building, the Volksplane has become a real live flying machine and the source of a very satisfying sense of fulfillment which those of you who have built aircraft can understand.

It all began one winter evening when the little woman tired of my sleeping in front of the TV and suggested that I get a project of some sort started. At the moment nothing seemed to fire me up, yet I had always wanted to build an airplane as far back as I can remember, and maybe this was just the time to do it. The thought that if it was not done now it probably never would be was just enough to freeze the decision. So out came the board, books, and slide rule, and almost exactly two years later I returned from the back room with 50 sheets of 11 by 17 in. drawings, a stress report of 50 pages, and a weight report of an equal amount. I might mention that many times that amount of paper was generated through the process of trade-off studies. But don't misunderstand, the whole operation was a labor of love because I happen to be a guy who loves to design airplanes. Actually, I have been in this aircraft design business for over 27 years, so getting started on the Volksplane was only a matter of applying the procedure used in industry which, in a case of this kind, is to determine your objective first of all. For the Volksplane, the objective was the "simplest-to-build basic aircraft for the novice homebuilder." It must fly as safely as a "Cub", but beyond that all other performance and even appearance must give way to simplicity for homebuilding. I always felt that the reason more of our members do not build aircraft is not because of the aircraft's lack of utility but because the job is considered too complex.

So, with "construction simplicity" as the watchword, a family of configurations was made and evaluated. There were high wings, low wings, mid-wings, parasols, biplanes, tractors, pushers, open cockpits, closed cockpits, and even the "Breezy" type. This operation resulted in an open cockpit, strut braced, low-wing monoplane having both a full flying horizontal and vertical tail, a one-piece bent up aluminum landing gear, and a Volkswagen engine. Without going into detail, the one-piece horizontal appeared simpler than stabilizer and elevators, the one-piece vertical simpler than fin and rudder, the one-piece gear simpler than cantilever, etc. The decision to design around the VW engine was not an easy one initially, simply because I had not seen one fly. So, away to Rockford that summer, from where I returned a "convert" after seeing both Beckman's "Monoplane" and Doyle's "Moonmaid" perform. Engine selection at that time was documented as follows: "The choice is between the A-65 and the VW conversion, since these are the only inexpensive light engines readily available in this country. Of the two, only the VW is in production. The A-65 is available only on a rebuilt basis, which makes it a poor choice if by chance the Volksplane becomes popular. Not only is the VW engine available all over the world, but its parts are far less expensive than A-65 parts. There is also every reason to believe that these little engines will become even more abundant in the future. For our purposes, the VW offers other advantages. It is lighter, which allows a smaller ship; it can be bolted directly to the firewall, thus eliminating the engine mount, and it requires minimum maintenance (800 hours between major overhauls is not uncommon). The only place it suffers by



Ackerman props the "Volksplane" for Walt Mooney, as designer Evans works the original brakes.

comparison is in performance. Certainly the A-65 can fly circles around it; however, performance is not a primary consideration here. All we require is safety, and if the VW can supply our minimum climb requirements, we will accept this in order to gain the other features. In summary, a really successful VW powered craft would be a much greater design achievement than just another 65 hp ship. Also, there is the challenging thought that such a design might just prove to be a shot in the arm for the homebuilt movement. For this reason, more than any other, the VW engine is selected." Looking back now, I am satisfied that the selection was right. Finally, wood was selected as the building material simply because more people understand it, have had experience working with it, and have the tools. I definitely believe it is the material for the novice.

At any rate, the design was finished, documented, and frozen (I thought), so material was ordered and construction started. Six months later I stored the fuselage in the neighbor's garage, managed a leave of absence from Convair, and took off for six months in Europe.

I included in the itinerary all of the aeronautical places and people we have all read about. At the Tiger Club at Red Hill I examined a brace of "Turbulents" and discussed the VW installations with the man who keeps them in flying shape—Jim Ellis. Jim assured me that the only trouble they had ever experienced with the VW was overheating initially which was easily corrected by a simple baffle over the cylinders. He will be interested to learn that we have had no heating problems whatsoever on the Volksplane which has no baffles. The answer may be in the half pint of Wynn's we carry in the crankcase. I base this thought on an experience I had some years ago with a missile seeker dish bearing. This was a close tolerance friction type bearing which gave us lubrication problems until we tried Wynn's. Though this bearing would heat and seize in a matter of minutes on all other oils, it would run indefinitely on pure Wynn's.

Meanwhile, back in England, I also visited Rollason where Frank Hanslow showed me through their operation. He showed me their approved VW conversion which must be assembled from new parts selected to match the tolerances of the components in the engine used to pass the certifying tests. In other words, they are not permitted to simply convert new engines. An interesting feature of their conversion was the straight press fit of propeller hub to the crankshaft which is not tapered. To accomplish this, they use a hub which is heat treated to 110,000 psi and the standard Woodruff key. Since Rollason builds aircraft of wood, I also inquired about their glue experience and found that they use Aerolite. Frank said that of course they had made many tests and found that Aerolite was as good as any of the others and easier to use.

Two months after returning, I finally overcame that old inertia and picked up where I left off on the Volksplane. Another six months brought roll-out day at the Ramona, Calif. airport, and we have been flying it ever since with one lay-up to add brakes and a steerable tail wheel. County airports frown on skids. How does it fly? About like a "Cub" except for a higher power-off sink rate common to all small span aircraft. Hands-off stability has been achieved with a good long tail arm and large tail surfaces. Turns can be made with ailerons alone due to the large vertical tail. Landings are normally made carrying some power. With an average breeze, it will touch down and stop within 200 feet and take off in about 450 feet. How's that for STOL performance! Full throttle level flight indicates 85 mph. It lands at 45 and climbs out at 400 fpm. Stall is with a gentle break and straight ahead. Though the Volksplane has a very open cockpit, we have experienced absolutely no tail buffeting.

Since the watchword in this design was construction simplicity, it may be of interest to review some of the

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C. A. Ackerman and Evans check the engine of "Volksplane" preparatory to a flight.

Instrumentation is sparse, with an electric marine tachometer at the upper left. Turnover structure is immediately aft of the windshield but not attached to it.

DER VOLKSPLANE . . .

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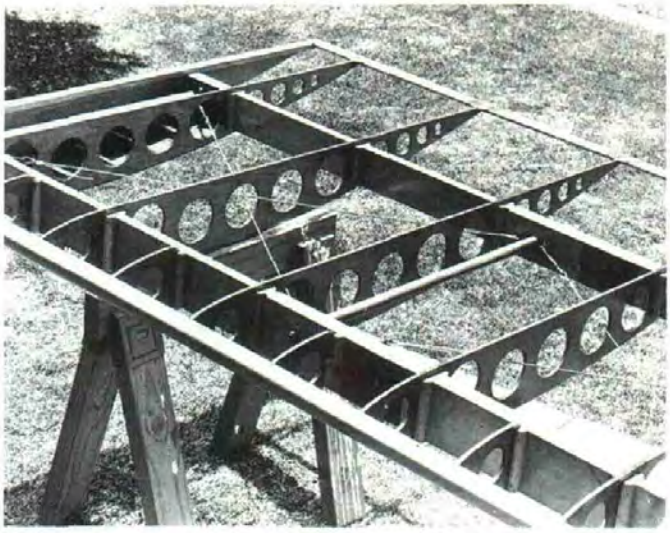
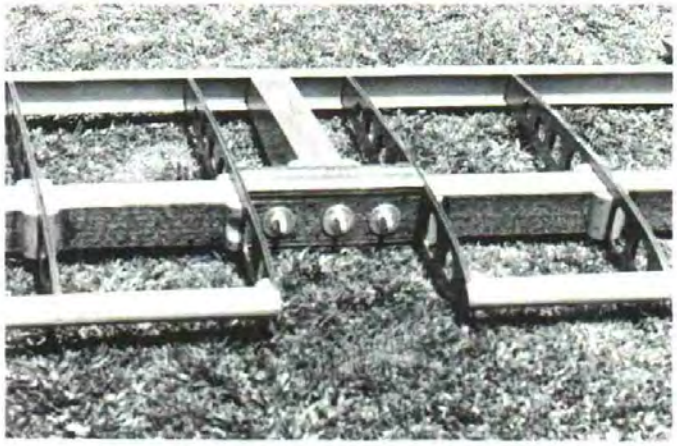
design features. The vertical tail is a one-piece full flying surface having a simple quarter inch plywood anti-servo tab for centering purposes. The surface consists of quarter inch plywood ribs bolted, through blocks to a two inch aluminum tube spar which rotates in two nylon bushings in the top and bottom of the aft fuselage. An extension of the tube below the fuselage provides for mounting of a steerable tail wheel bellcrank. The horizontal tail is a one-piece full flying surface having an anti-servo tab both for centering and feel. The surface consists of quarter inch plywood ribs blocked and glued to a simple constant section box spar. The surface hinge consists of a 3/8 in. bolt passing through six aircraft eyebolts. While the eyebolts are a bit expensive, they do elminate all labor—just drill and install. while at the stern post, we can cover the skid which is simply a 1/4 by 1 1/2 in. piece of spring steel bent to shape and tempered. It passes through a slot in the fir and plywood sandwich stern post and fastens in place with one bolt. There are no fittings involved unless one goes to a steerable tail wheel.

The fuselage structure is comprised essentially of three bulkheads, a stern post, four longerons, and a skin of plywood. Since this is a stressed skin design, there are no diagonals anywhere. Instead, vertical stiffeners are used between longerons about every 25 in. to size the shear carrying panels. Incidentally, while the longerons are of certified aircraft spruce, the vertical stiffeners are just plain straight grained Douglas fir. This is because the longerons are subjected to tension loads, while the stiffeners only serve as compression members (Ref. 1). Since the aft fuselage is a plywood box, there are also no diagonal members from upper to lower longeron opposite; torsion is carried through differential bending in the sides, top and bottom. Of the three bulkheads, one (the firewall) is cut from 3/4 in. exterior plywood. The other two, which pick up the wing loads and form the cockpit, are built up of spruce, fir, and plywood. On the prototype, no fabric covering is used on the fuselage.



Wing construction is neat and simple, with cable tie-rods and dowel compression members.



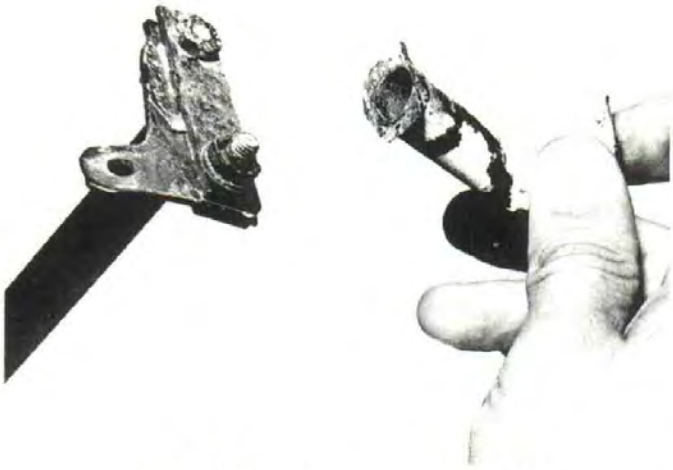
The stabilator mounts to the sternpost with three eyebolts shown on the spar.

Instead, epoxy paint was used directly over the plywood except where varnished for esthetic purposes. No motor mount is used, but the engine is mounted directly to the 3/4 in. firewall. The fuel tank, of fiberglas, is built integral with the forward fuselage cowling as is the windshield. The engine cowl is a two-piece fiberglas lay-up mounted over right angle hooks screwed into the firewall and secured by the time honored aircraft safety pins.

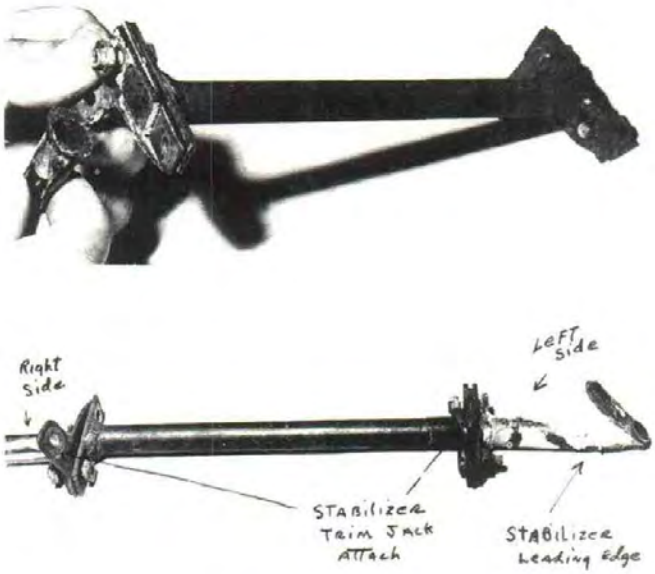
The wings are strictly conventional externally braced panel, fabric covered. Ribs are cut from quarter inch marine plywood with hole-sawn lightening holes. Spars are conventional rectangular beams of certified aircraft spruce (Ref. 1). Leading and trailing edges are of clear white pine as is the aileron spar. Internal drag wire bracing is of 3/32 in. aircraft cable, and all compression struts are made from 7/8 in. standard birch dowel counterbored at each end to fit snugly over a quarter inch fiber lock nut.

The landing gear, as mentioned before, is a one-piece bent-up bar of 3/8 in. thick 24ST3 fastened to the fuselage bottom structure with four bolts. It looks like a Cessna gear, but it isn't. The diagonal cables make the difference. All shock attenuation is handled by the rather large 6:00x6 tires inflated to 12 psi. Trade-off studies showed this to be the lightest and simplest gear for *this* aircraft. Incidentally, this gear has been designed to FAR Part 23 requirements as has the rest of the aircraft where practicable.

The last item to cover is the flight control system which is entirely cable, but has only one pulley in the



The stabilizer-trim jack assembly shows the weld failures at both sides.



fuselage. The wing has three pulleys in each panel, but no metal pulley bracket fittings are used anywhere.

SUMMARY

I'm satisfied that wood is the material for the novice. Volksplane welding is limited to control stick assembly, stabilator horn, and flying strut ends. I would hope in the future to eliminate welding altogether. I'm satisfied with Aerolite glue—it is much simpler to use and less sensitive to temperature, pressure, etc. (Ref. 2). I'm satisfied that the Volkswagen engine is the smoothest thing in the air, and predict a great future for it in the homebuilt field. Conversion requires essentially the addition of a propeller and magneto which, if a Vertex, slips into the distributor hole with no rework. Use of a marine electric tachometer also eliminates making provisions for a tachometer drive. A stress analysis of the entire structure was run and static tests were made on the horizontal tail and the wing aft spar which looked so good at limit load that it was taken all the way up to ultimate with no problem. A flutter analysis was also made on the horizontal tail. The Volksplane is designed to the Normal category of 6.6 Gs ultimate.

Now that the task is completed, what next? Well, I plan not to follow the usual procedure of adding refinements until the simplicity is gone, but rather to continue the search for further construction simplicity. To me, progress will be any reduction in building time, for it is in this direction that I see a chance for increased building activity among the rank and file.

It is standard practice to close an article of this kind by thanking the friends and family who contributed help in the venture. At the risk of sounding trite, I doubt very much whether or not we really accomplish anything of significance entirely on our own. If your wife is tolerant, that's a big thing; but if you are fortunate enough to have a spouse who encourages you, that is a big plus. In this regard, I haven't forgotten that it was she who booted me out of the chair in front of the TV and started me on an adventure that has been the most rewarding of my entire life from a standpoint of sense of accomplishment. Then there are two others. C. A. Ackerman, Project Engineer for Solar, my great and good friend, made the engine conversion and installation an apparently flawless bit of work. Perhaps even more important was his talent for making anything seem possible which really helps when annoying problems arise and enthusiasm recedes. The other is Walt Mooney, the test pilot in this venture, who is perhaps the most air minded enthusiast in the business. I could not have been more fortunate in an engineering test pilot because here is a very clever predesign engineer as well as pilot with over 1,500 hours which includes the coveted Golden C sailplane rating. His test flight reports on the Volksplane have been nothing less than professional documents.

REFERENCES

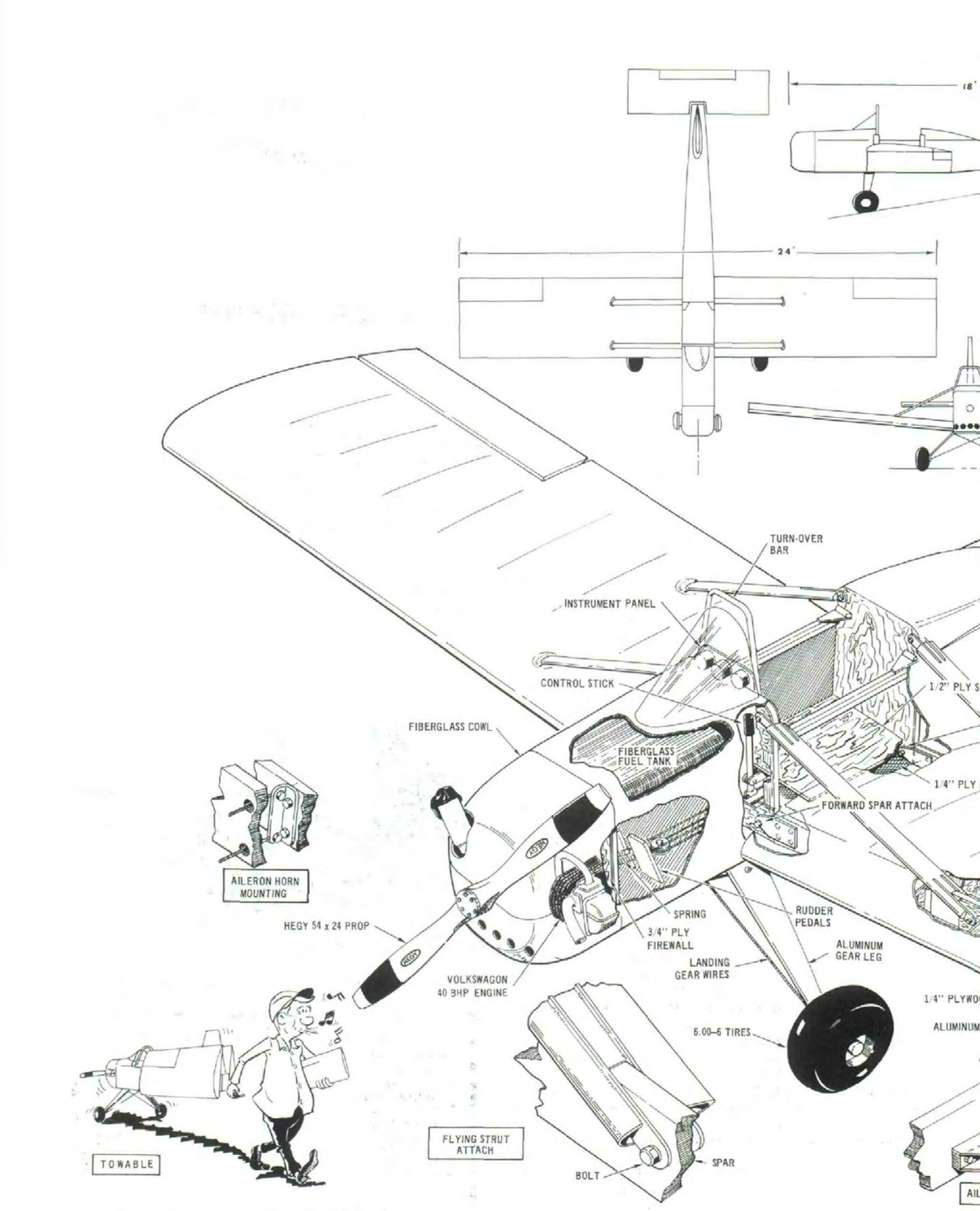
(1) "The Use of Noncertified Wood"; W. S. Evans in *SPORT AVIATION*, January, 1967.

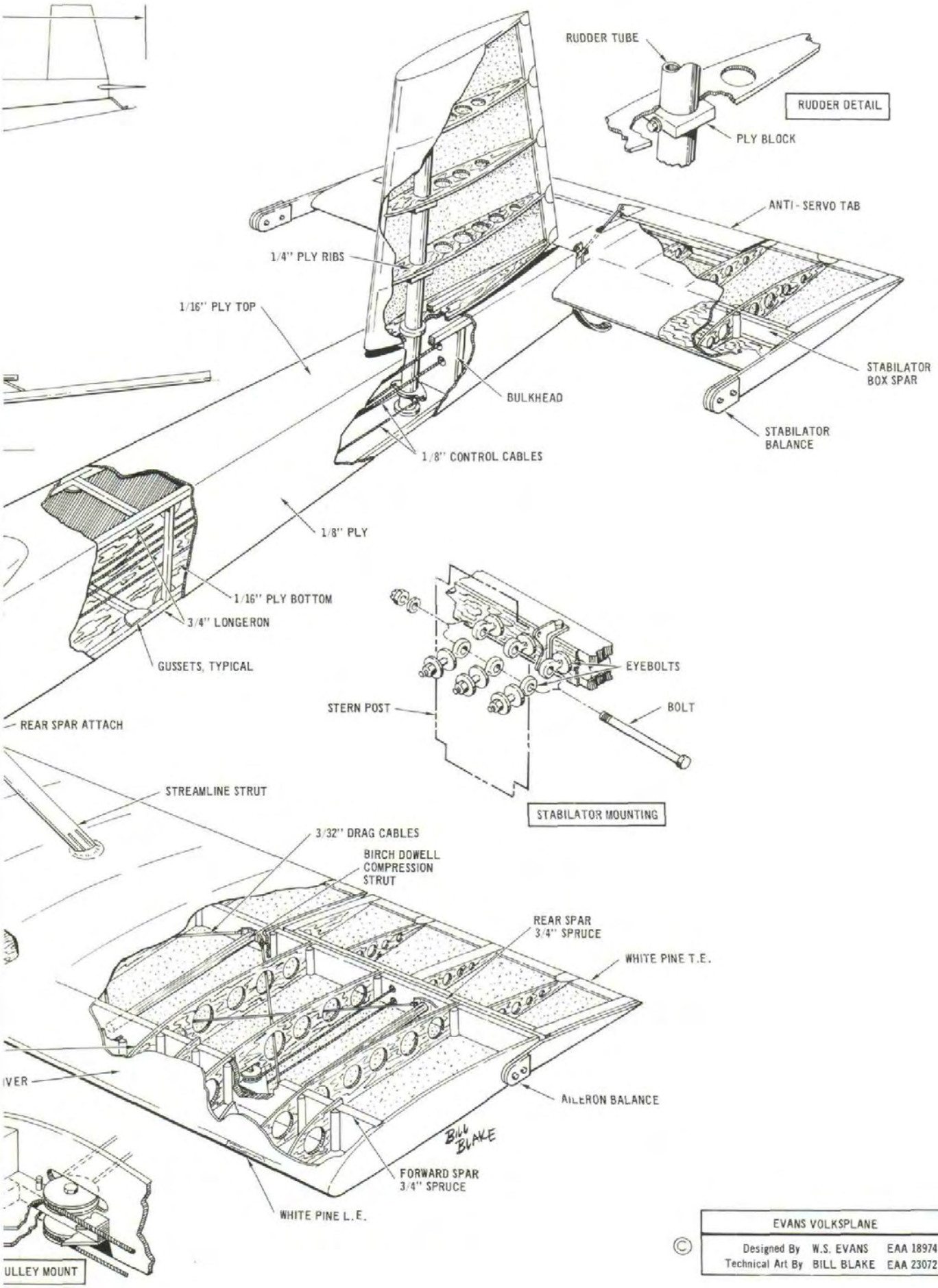
(2) "More about Aerolite"; W. S. Evans in *SPORT AVIATION*, August, 1966.

Walt Mooney, W. S. Evans, and C. A. Ackerman

WE-1 VOLKSPLANE SPECIFICATIONS

Empty weight	440 lbs.
Gross weight	650 lbs.
Wing area	100 sq. ft.
Stabilizer area	15 sq. ft.
Rudder area	7.6 sq. ft.
Fuel capacity	8 gal.
Stall speed	46 mph
Placard dive speed	120 mph
Rate of climb	400 fpm
Propeller	Hegy 54 x 24
Engine	40 bhp VW


18'
24'
TURN-OVER BAR
INSTRUMENT PANEL
CONTROL STICK
1/2" PLY S
FIBERGLASS COWL
FIBERGLASS FUEL TANK
1/4" PLY
FORWARD SPAR ATTACH
AILERON HORN MOUNTING
HEGY 54 x 24 PROP
SPRING
3/4" PLY FIREWALL
RUDDER PEDALS
ALUMINUM GEAR LEG
LANDING GEAR WIRES
VOLKSWAGON 40 BHP ENGINE
6.00–6 TIRES
1/4" PLYWO
ALUMINUM
TOWABLE
FLYING STRUT ATTACH
BOLT
SPAR
AIL



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