

STEPHENS AKRO

By Brad Shepherd ... A real classy scale, sport, or pattern ship, using an economical .35 or .40 engine. Construction is all balsa and ply . . . conventional.

♦ The beginning of this very satisfying project goes back to the May 1968 issue of the then popular "Sport Flying" magazine. Under the heading of "Sport Flying Country Store", there was a short commentary about a new aircraft, written by Gerald T. von Aspe. I quote, "Attention home builders, plans for the STEPHENSAKRO midwing monoplane designed specifically for competition aerobatics will soon be available. Acrobatic aviatrix Margaret Ritchie will enter her STEPHENSAKRO in the 5th Biennial World Acrobatic Championships at Magdeburg, East Germany, this year, and many see success for this fine little airplane."

As you who keep up with full scale flying know, Marge 'Grandma' Ritchie went to her rest while practicing at an airport in Orange, California while preparing for the Championships.

Directly under the commentary by Mr. von Aspe there was a tiny partial 3 view of this airplane. Being a midwing "nut", it struck me as a good project with the exception of the front end: I just couldn't get fired up over it. One of my RC buddies, Leon Folse, and I, did some quick calculations from the tiny drawing and that's as far as the project got for 4 years.

Getting a little "burned out" designing quarter midgets, I looked at the STEPHENSAKRO again and realizing that Sig now had 1/64 inch plywood available, started putting things on paper. It looked good and had the possibility of staying simple in construction. The pictures tell the final story but I would like to say that it is simple to build, has the looks of the full size aircraft, and is about 2 1/8 inch stand-off Scale. It won't quite do a vertical 4 point roll with the .35 in it, so I'm planning to

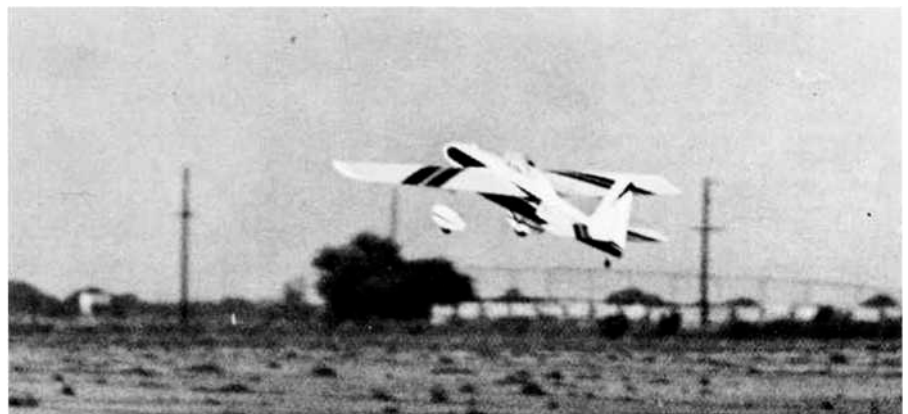
put a .40 under the cowl.

This may sound a little prejudiced, but this project has been a real "pleaser" from the time I drew up the plans 'till it went in the air on the test flight, so if your building appetite is whetted, start fuselage construction by laying out the basic sides on 3/32 inch sheet. Basic outline is all straight lines and can be laid out with a yard stick or straightedge. Draw thrust line first (ball point works good) then measure from this to establish outline. Use the lines inside top and bottom sheeting, also lines inside top and bottom half inch front nose blocks, to give you the basic outline.

Draw a straight line parallel to and 3/16 inch above thrust line for wing cut out, use root rib and draw wing section outline 3/32 inch wider than root rib to allow for 3/32 inch sheeting on wings. Draw a line parallel to and 9/16 inch above thrust line for the stab location and make a 3/16 inch slot for this, or, cut top off (see photo) and use blocks to fair in the fuselage over the stab. Mark angles of front and rear of turtle deck piece.



The author/designer, all decked out in flying togs, taxis the Akro to takeoff position.



"And awaaay we go!" The ship is a great combination for scale, sport, and aerobatic flying.



Ship is balsa and ply construction throughout. Only a few weeks old, and a trophy winner already. Akro placed second in scale at Corpus Christi Even cheek cowls are formed of 1/64 plywood. Internats contest, was judged by well known scaler. Tom Dean.

Cut the side to shape, making wing cut out and angle for turtledeck (save turtle-deck piece.) Use the side just cut out as a pattern for the other side.

The doublers are cut to shape from medium grade 1/8 inch balsa. Making these with the help of a straightedge and square at bulkhead locations insures a straight and square fuselage. Glue the doublers to the fuselage sides, D-3 first, then D-2, using a scrap of 1/8 inch balsa to get a good fit where the B-1 bulkhead will go. If you elect to use a one piece firewall instead of the crutch arrangement, draw a line on the inside of each D-2 doubler, square with the thrust line at the locations shown, to assure 0-0 engine thrust when gluing firewall in place.

Gusset each side of firewall where it meets fuselage side by epoxying 1/2 inch triangle strips to joint. Check notch in the bottom for 1/8 inch ply landing gear plate. Glue top 1/2 inch triangle pieces to side, and bottom 1/4 inch triangles.

Assemble fuselage over top view of plans by inserting bulkheads B-1 and B-2 in place and gluing, pin to keep alignment true while drying (I use 5 minute epoxy for this job.) Glue either the ply crutch assembly, or firewall-only arrangement in place.

Epoxy the 1/8 inch ply landing gear plate in place, then the 1/16 inch ply reinforcing plates to inside of fuselage. Place bent and drilled landing gear over ply plate, position it so it is square, drill holes in ply and install 4-40 blind nuts.

Glue top rear sheeting in place and bottom fuselage sheeting (with landing gear boiled in place), butting the 3/32 inch sheeting against the aluminum LG for a smooth flush fit on the bottom when finished. Engine, (whether using crutch or radial mount system) should be fitted at this time, then the fuel tank.

Use medium to light quarter grain wood sheet for the tail surfaces. For the benefit of those who may not know, the difference in balsa wood grains, "C" or quarter grain (Sig stamps his as such) has a "mottled" effect and is very stiff, and will not bend without splitting the sheet. This keeps the surfaces straight and free from warping when finishing the "tail feathers" on your bird. If your friendly hobby dealer handles Sig balsa you can usually find some light "C" grain in his bin.

Due to the large elevators, I made up a long horn from K&S brass strip and 3/32 inch music wire as a connector between the elevators.

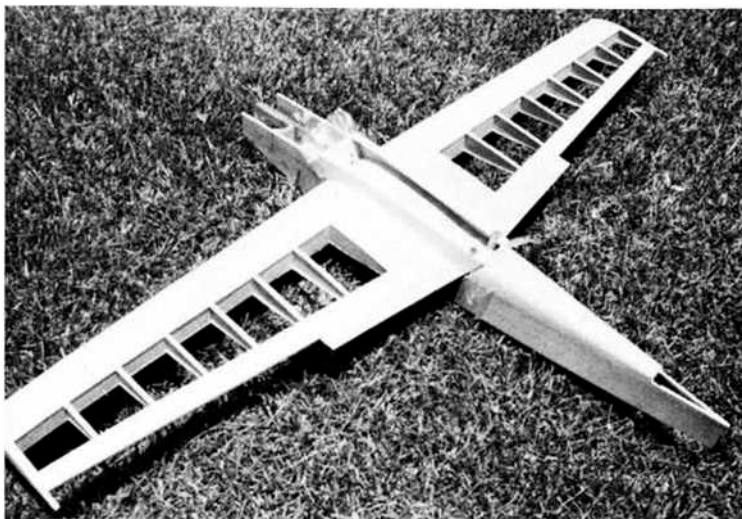
Holes are drilled in the elevators and the

connector/horn is epoxyed in place. The brass strip shown is SILVER soldered to the MW connector. I used low temperature Sta Brite for this job ... it works well.

The tail wheel bracket/rudder drive assembly is made from a Rand/Ace strip aileron fitting. Solder a piece of K&S strip directly below the 90 degree bend for rudder drive, slip a piece of 3/32 inch brass tubing (the length of the Rand/ Ace fitting) over the 1/16 inch collar on the bottom, tightening it so there is no play up or down on the assembly in the aileron fitting, and make a 45 degree bend under the collar. Either make a fork from brass strip, which looks quite realistic when soldered to the wire as shown on the plans, or simply bend the wire to accept the tail wheel.

The wing is built using a 1/8 inch sheet full depth spar with a 1/8 x 1/4 inch cap on top to form an inverted J type spar beam. When combined with the "egg-crate" type panel construction, sheeted at leading edge and trailing edge, the results are a very rigid wing that is difficult to twist even before the covering is applied. It is simple and quick to build, giving a light weight wing when completed.

Cut the two panel spars exactly alike from the same sheet of medium to hard straight



Use of Handi-Wrap permits exact fit and glue-up of turtle deck.



The almost completed bones. Cheek cowls are 1/64 ply wrapped around bulkheads shown here. Canopy is masked for protection.

grained 1/8 inch balsa. Glue the 1/8 x 1/4 inch cap to each of them taking care to end up with a right and left spar.

Pin the spar upside down over the plan. Pin the 1/4 inch square jig strip over the plan at location shown, check each rib to see that it fits before gluing in place to the spar, (use a 90 degree angle when gluing root rib). Pin ribs to spar and the 1/4 inch jig. Glue the 3/8 inch square leading edge in place. Lay the 3/32 inch leading edge sheeting in place and trim off the excess where it overhangs the spar toward the tips. Use this piece, trimmed off from the root rib outward, to finish off the leading edge sheeting.

Cut the trailing sheet pieces from light to medium wood, "C" grain preferred, glue the 1/16 inch square to one edge of one of these, check trailing edge of ribs at this time for alignment to the plans, glue the trailing edge sheet with the 1/16 inch square on the ribs, butting the 1/16 square up against the back end of ribs, and pin firmly in place. Sheet center section of panel, add cap strips to ribs and let panel dry good before removing from bench.

When dry, turn over and pin spar down to plan at location and also to the jig. Glue lop leading edge sheeting, trailing edge sheeting and rib cap strips in place, and let dry.

Draw a straight line on your work bench (or FLAT board) slightly longer than the total span of the wing, lay the panels upside down on this line (wing is flat on top, dihedral is built into bottom), make a mark at No. 10 rib for the jig. Lay a short piece of 1/4 inch square down at the position shown on the plans for the jig at No. 10 rib and pin in place. Make a mark where the jig should be for the root ribs, and lay a scrap of wax paper on the bench where the center section will be to keep the epoxy from slicking to the bench. Position the panels and check the root ribs for alignment with each other, sand if necessary, pin one panel down on the line and to the jig, mix up some 5 minute epoxy, smear on the root rib, join the panels and pin to bench. Cut a slot the full depth of the spar 1/16 inch wide, directly behind the spar at the root ribs, check the 1/16 inch ply joiner for fit, smear with 5 minute epoxy, and slide in place.

OPTION ON BUILDING WING:

If your workbench is long enough to build the wing in one piece, join spar while pinned down straight on the bench with the 1/16 inch ply joiner, place the 2 pieces of 1/8 x 1/4 inch cap spar in position over the plans, glue the 1/8 inch full depth spar to the cap, fit and install the ribs, and glue all the bottom sheeting and caps in place, along with the 3/8 inch square leading edge.

When well dry, remove and pin one panel down over plans with the 1/4 jig in place, apply sheet and cap strips, then pin other panel down, sheet and cap strip, glue center section sheeting in place, and the wing is finished with the exception of the 1/4 inch sheet tips and the 1/4 x 1 inch trailing edge. Install the dowels in the wing with epoxy.

Cut B-1 -P slightly oversize, drill holes for dowels, fit wing in place on fuselage, lining it up for square, trim B-l-P to fit fuselage side, and epoxy in place.

Glue hardwood block inside fuselage back corners, fit wing and check for alignment, pin wing to keep from shifting, drill down through 1/16 ply and through hardwood blocks for nylon screw hold downs. I have never had any trouble using the No. 8 screw (if you feel safer with 1/4 inch, by all means use 'em). Tap the blocks, screw the wing in place, epoxy the paper/epoxy tubes in place, and glue the turtle deck sides on using saran or polyethylene sheet at LE and TE to keep from gluing turtledeck to fuse. After turtledeck is sheeted, fit canopy, doing whatever your "creative bent" causes you to do inside the canopy for realism.

Cowls arc now built using nose ply plate, formers and strips: the picture shows it better than I can explain it. Glue the top of the 1/64 inch ply on first, when dry, wrap and epoxy the ply around the formers (rubber bands help here), checking for a good smooth fit at the bottom of fuselage. Smear the inside of the right cowl with Sig epoxy to fuel proof, this side is function - al, the left one, a dummy.

The exterior finish is up to you!

A few years ago there was a fellow using Mighty Midget motors wired into the relay on a single channel receiver and flying what was then called Galloping Ghost. He had a model called, if memory serves me, "The Square Hare". This fellow was from Delaware (Correct — WCN) or Maryland or someplace where they eat hot steamed crabs and drink beer. He apparently had a window in his shop right over the work bench. Some modelers who design are lucky enough to have a new one fly "right off the board", this fellow's design "flew right out the window!

(Wouldyou believe? There !s a Square Hare out in the garage right now, covered in ten colors of Monokote scraps, powered by an Enya 19, and equipped with a 1970 Micro-Avionics "Proportional Ghost."- WCN)

Remember, this is a "Sport Scale" model of competition aircraft and you will not be limited by an FAI pattern (I respect you guys who spend hours perfecting your routine. No sour grapes, but that's just not my bag). Try a 45 degree ascending, inverted, outside snap (full size ones do it in competition).

The landing pattern and approach is what you would expect of any symmetrical airfoil, high performance model, but it does slow down nicely without "falling apart" for beautiful 3-points (a good one of these is worth the trip to the flying field).

I would not recommend this as a first model, but if you have a couple of experiences in your log book, like the medium range engines, enjoy a realistic looking model, I think you will find a lot of pleasure in building and flying this one. Who knows, the judges might even award you a trophy for your efforts!!

It does fly well and it has been a pleasure developing it.