SAM-5

This contest winning A/2 is the current peak result of a long line of development aircraft. The brief outline of the experiments involved is worth the time to read even if you don't intend to build the model.

By Ron Evans

Author-designer Ron Evans (left) and Bob Lipori preparing SAM for a test flight. Glued on thread turbulators were used here but were not as effective as outrigger type shown on plans.

● The SAM 5 as presented here is a development of the "SAM" series which started it's life in 1969. Since that time there have been 11 "SAMS" built by this writer, and 4 or 5 others by local flyers. The number of changes is hard to pin down, since components have been switched, separate wings built for the same fuselage, different rudder locations and sizes on the same boom, and so on. The greatest number of changes have been to the wing and stabilizer airfoils.

I was fortunate enough to have received a great deal of help in regard to new theories, airfoils, and trimming suggestions from several sources, notably Vic Nippert and Hugh Langevin. The primary aim throughout all the changes was to evolve a stable, strong, consistant airplane. "Dead Air" time was not given too high a priority, although a lower limit of 2:30 was considered minimum. All the airfoils to date have reached or exceeded the minimum limit (some just barely) except the Ritz 6407D, at 2:25. The main considerations were; good tow stability and thermalling ability. Ease of construction has not been of any great concern. My feeling is that anyone who desires an easy-to-construct glider ought to fly Hand Launch Glider. Nordic Glider is one of the 3 World Championship events, and as with anything of "Olympic" caliber, "You get what you pay for."

It probably would take up more space than it is worth to detail *all* the changes, trials, and tests here. I will simply explain briefly *why* I have presented this particular model to represent the best of the series. The rear fin was tested against both front fins (4 of them) and T-tails (2), and shows the best tow control, and no discernable advantage *or* disadvantage in the glide. A good towing model is hard to argue with. The GF 6 wing section has the best non-thermal duration of all the sections to date, excells in light lift (the B 6456 F is the only other section to consider for light thermals of the airfoils tested), and can be flown in very windy weather with good results. The Ritz 6407 D can handle bumpy or turbulent weather a bit better than the GF 6, but loses points in both light lift and no lift conditions. The CH 407 has not been tested well enough to recommend it, but early tests indicate it may give the GF 6 a run for the money, in any weather, provided it is matched with the proper stab section. It was not responsive with a flat bottom stab, but now is flying well with the "Osprey" stab shown on the plans. The Osprey stab section, incidentally, was the best match for the GF 6, from a sampling of 5 different stab airfoils. The pylon/shoulder wing mounting question has not been answered to my satisfaction; they certainly do not have a significent effect on either the tow or glide, so I have presented the nose that is more within the reach of the average modeler. The aluminum nose/pylon requires access to a machine shop to duplicate, and has no real drag reduction, all things considered.

Construction: The place to start is by obtaining all the balsa wood, hardwoods and miscellaneous small items like autorudder stops, towhook, tubing, etc. By doing this and also prefabricating the laminated parts (Wing L.E. & T.E., planking, etc.) you will save a great deal of time. Cut *all* wing ribs to shape, making only the normal spar notches . . . leave the doubler notches for later. Tack cement 8 ply blanks together with a non-penetrating glue such as Testors, saw to shape (again, no doubler notches) and drill 5/32 inch holes for tubes. Split them apart with an X-acto blade.

The tip ribs are formed by the stack method . . . that is by pinning together 13 pieces of 3/32 x 5 x 3/4 inch balsa, with the root template at one end and the tip template at the other. Carve to the shape indicated by laying a straight edge across both templates. Repeat for opposite wing. When this is done, separate and number each rib with felt tip pen. Carve the (prelaminated, I hope) trailing edges to shape, and attach to plan, shimming to undercamber. Also pin (over, not through) the leading edges to board.

Epoxy all wing ribs into place, including dihedral break ribs. Add upper spars and T.E. gussetts.

When this is dry, lay wings across the board in the assembled (flight) position, and epoxy the 1/8 inch I.D. wing wire tubes in place. Use the utmost care in aligning the wings, so that there is no warp, sweep, or dihedral. About half way through the opoxy hardening process, rotate the tubes 180 degrees to distrute the adhesive evenly. When *completely* cured, insert pin retainers through tubes, and bend to lock into place.

Now is the time to enlarge the notches for the tapered doublers, first with a Zona saw, then with an emery board glued to a scrap piece of spar stock. Where the doublers are a snug fit, epoxy all four into place. Bevel the 1/4 inch dihedral break wing ribs, and add dihedral, using HobbyPoxy Quick-Fix. Lower sheet planking is next (the 1/16 x 1/4 inch spruce spar should be glued to the planking first) using masking tape, hair clips, and as few pins as possible. Now all the details, such as vertical webbs, center-section fill-in, wingtips, and so on. The wings should weigh between 58 and 65 grams each at this point. For final sanding, you will find a contoured sanding block easier and more accurate than any other method.

It need only be a few scrap blocks (3) of balsa sawed to the lower camber shape with sandpaper tacked or glued on. Blocks for rib stations 2, 10, and 17 (tip) will be sufficient for a neat job. Sand wing to a smooth finish and predope all contact surfaces with 2 coats of 50/50 dope/thinner (skip this portion if using MonoKote or Solarfilm) and sand again.

If using tissue, may I suggest the following procedure: Cover all surfaces with a layer of tissue, water shrink, and apply two coats of 50/50 dope. Sand surface lightly, then apply a second layer of tissue, cross-grain, over the open structure only. This will go on quite easily (no wrinkles) if you apply it as if there were no previous cover, that is by sticking it to each rib on the lower surface, *not* doping through to the first layer on open areas, and then water-shrinking the second layer. Put two more coats of dope over everything, add AMA numbers, decals, etc, one last coat of dope, and sand lightly. A final waterproofer of 50/50 HobbyPoxy clear paint/thinner over entire wing will assure you of a stable surface in any weather. Rub down with Dupont Polishing Compound when thoroughly cured. Scrape away tissue at locations marked, and glue turbulator supports in place with a fast drying cement such as Testors. If a support breaks off at a contest (likely), use the wing wires to align it back in place, the thread should bisect a line that touches the lowest point of both the L.E. and T.E. The thread itself is elastic thread (Sewing department of any department store) knotted at both ends of a 30 inch (no stretch) piece. Make up several sets and replace about every 2 - 3 weeks, *on both sides*, if one gets ravelled. Never replace or tighten only one.

Obtain a fibreglass boom for the fuselage that is as light as the one indicated, or sand a heavier one to weight. Carve a 1/2 inch diameter hardwood dowel to a slight taper and epoxy into the front of the boom as shown. Cut the nose core from 1/2 inch ply or basswood, making all cutouts indicated. Do the same with the 3/32 inch ply sides. Laminate the core, using masking tape, C-clamps, and a flat surface. When dry, pour about 3-1/2 ounces of Cerrobend or solder into the ballast compartment, but do not glue the access hatch in place yet. Add fibreglass boom, using tape to hold it *straight* while drying. Fill in areas around boom with balsa as indicated. The FAI Supply towhook must be screwed in place at this time, but just insert the carraige bar, leaving the actual towhook off for the time being. Again, fill in with scrap. Epoxy shoulder ribs, using slow-drying epoxy, and drill tube holes before it hardens. Check alignment with wing attached. When everything is dry, rough sand to contour shown, using power sander. Apply two coats of Hobbypoxy "Stuff" mixed 50/50 with HP thinner, using a brush. Sand between coats, which will be every 24 hours. Either color dope or cover with tissue to suit your taste.

Laminate the stabilizer L.E. right over plans. Plane T.E. to shape, and pin (over, not through) to board, shimming as noted. Cut ribs from very light 4 - 6 pound C-grain, 1/32 inch balsa, and epoxy in place. Add false ribs next. Epoxy upper spars in place, and when dry, remove from board and add lower spar. Return to board. Glue in tips, gussetts, and other details. When dry, sand, apply two coats of 50/50 dope thinner, sand again, and cover with Jap tissue. These coats of 50/50 dope will be sufficient for finishing, or one coat of dope and one coat of 50/50 HobbyPoxy clear paint/thinner. Add D.T. hooks. Final weight should be 7 - 8 grams.

Cut out three rudder laminations shown. Remove striker disc material (if you don't have X-acto disc cutter shown, these can be made square) and replace with 1/32 inch ply. Laminate and clamp to a flat surface. Slit 3/32 inch balsa fin to accept hinges (Sig nylon hinge material, .010) roughen hinges, and epoxy in place. Attach rudder and sand everything to an airfoil shape.

Slot boom to accept rudder and glue in place.

Tap FAI Supply Auto Rudder stops, cut in half, and epoxy in place. Cover rudder with Japanese tissue, add hooks, and finish per stab. Epoxy stab rest on boom, and bind with thread.

FINAL ASSEMBLY: Hook up A/R line (.008 *braided* U-control cable), D.T. line (12 lb. monofilament, timer/start bushing, and install Seelig timer. The 80 lb. Mono "pin" should shut off the timer cleanly, and hold A/R in neutral position. Check C.G. and ballast accordingly. At this point model should weigh between 13 - 14 ozs. Add ballast to the C.G. to bring the total weight to 14.46 ozs.

The method of trimming a model with this section is slightly different than that usually used. One of the reasons for this is the outrigger turbulator, which has a profound effect upon the model's handling, if used correctly. The model will not tolerate having the incidence "stretched" (stab raised higher than optimum) as will other sections, notably the B7457D/2 and B 6456 F. When you have reached glide trim, you will know it, as the model will stall out of the sky with only a slight increase in incidence from the optimum. Hand glide to obtain a *very* slow glide, with the model making 1/16 - 1/8 turn before landing. It may take 20 hand glides to get this, but it's worth it in terms of time saved by line trimming.

Place towhook in location shown for trimming in normal weather (5-10 MPH winds) and start tow trim using a full length line and no anti-fall off. If the wings warped to provide any wash-in, make the model turn in the direction of the wash-in, provided it is present in the inner panel only (outer panels will probably wash out slightly by themselves) and it does not exceed 1/16 inch at the dihedral break. If more than this is present, remove to 1/16 inch.

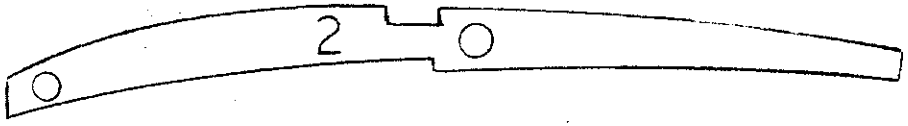
A/R should be set slightly against the glide turn (actually countering the wash-in). The tow should be straight for the first 50 degrees or so, after which the plane will probably weave somewhat to the top of the line. Release the model and watch the glide. Make adjustments to obtain a circle of about 100 - 125 foot diameter, correct the tow as needed, but leave the hook where it is if the model behaves as described. It is supposed to weave slightly, but only at the top of the line. If it veers more to one side than the other, use tow rudder adjustment. If it still won't return to neutral, move the hook forward.

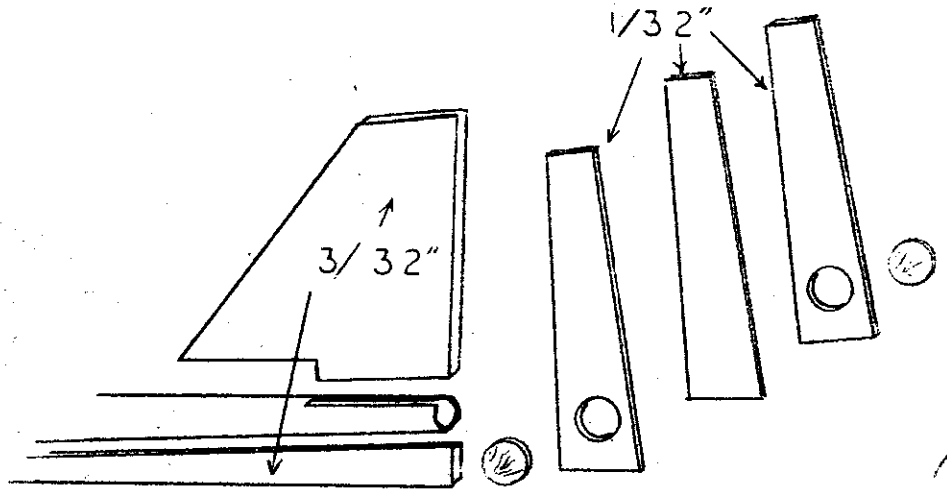
You will find the model rises quite quickly on the line, and in winds in excess of 15 MPH it will not be necessary to move at all after getting the model up, it can be "kited" from a fixed position. When kiting, you will find it handy to hold a short length of line in your free hand, to pay out and take in slack as the model adjusts itself to varing wind speeds. In lift, the model will shoot from it's 60 degree kit position to the top of the line, and veer slightly towards the glide side (this is thanks to the stab tilt). Let the slack out, pull the winch down to waist height, and whip it up and away (downwind) from you to clear the line in strong lift. This motion looks like you are throwing your reel at your retreiver . . . warn him.

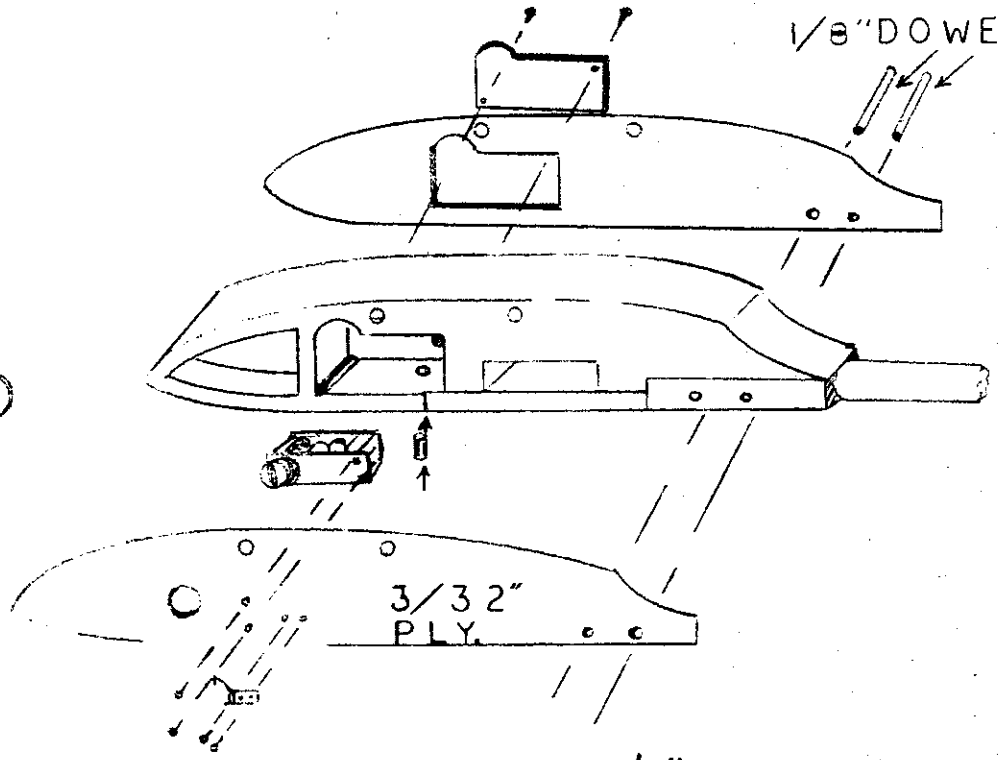
Once the trim is set properly, install the antifall-off wire, and get acquainted with the model: Tow for as long as you can, as often as you can. ●

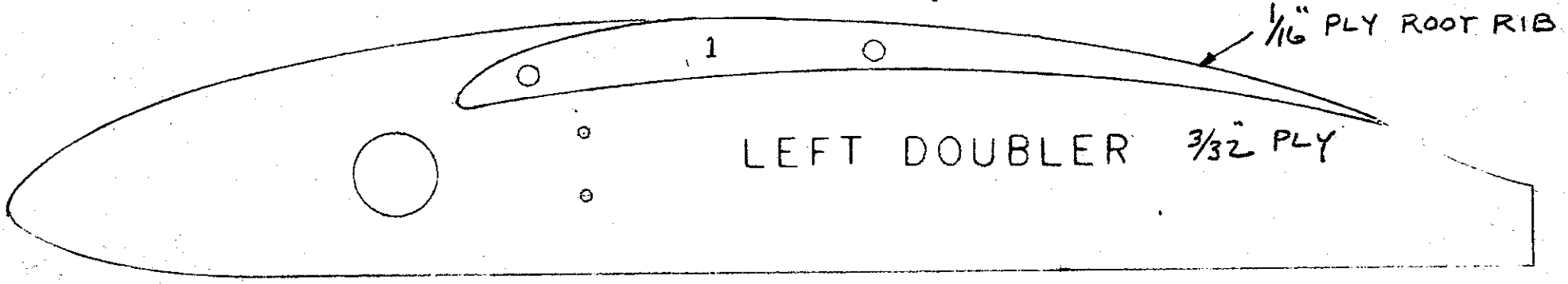
FIND THERMALS!!

Note: Full size drawings include an 8-1/2 x 11 plate showing fuselage and rudder details.









MODEL BUILDER DRWG 772-A