

Am I

URST'S A/1 glider
sports flying



THE FIRST A/1 GLIDER in this series had a wing similar to AmI, but had a balsa 'box' fuselage and 'T' tail. After one or two instances of tail flutter this was altered to a semi-high tail with dihedral... a layout which the designer still thinks has advantages for 'still' air. However, this arrangement gave poor towing characteristics although the glide was good, in fact, the model was eventually lost.

The second model was experimental (see *Aero Modeller* April 1970, Page 201, 8) having a glass fibre pod with alloy tube boom - the wing had a sunken 'box' spar. Again a good glide performance resulted but the use of a constant diameter tube caused the weight to be in the region of 7 or 8 ozs. This model was broken before it was fully trimmed.

Soon after, the present wing was started, the sunken spars being retained to try and maintain a laminar flow over the upper surface of the wing, and to avoid sudden changes in curvature usually present due to surface spars and tissue sag, which may cause early breakaway of air flow. This wing was then put away for some time while the fuselage was thought out.

When shown an AI size glass fibre blank, it was realised that this was the answer and a couple of days later the fuselage and tail were completed!

Trim flights in initially calm, but later gusty conditions, showed that the model design was sound. It was trimmed using Alan's own technique of hand launching to determine the direction of the natural turn, then making the auto rudder force the model to glide in the opposite way. Therefore, natural warps tend to stop the model spiralling in and give a tighter, more controllable turn.

No mention has been made on the plan about the use of a tubulator (sometimes required on a smooth wing) as a means of boundary-layer control. The wing is intended to be a laminar flow section (at a Reynolds Number* of 36,000 the airflow should tend to be

laminar) and as such should be better than a turbulent section provided the boundary layer does not separate before reaching the front edge of the T.E. However, in gusty conditions, random disturbances may cause the airflow to separate with a delay before reattachment.

The whole subject of boundary-layer theory is very complex and Alan does not intend to make any definite statement on this until he has a greater knowledge than at present, not wishing to influence people into sticking tubulators all over the place and possibly causing the flow to separate rather than causing the boundary-layer to re-energise.

As it stands, the model flies well without a tubulator although it is possible that there may be some advantage in using one, *IF* this is done correctly. However, it is suspected that the vortex street pattern may not form over a tubulator at such a low Reynolds number, and therefore a tubulator wrongly placed may itself promote early separation of the boundary layer.

Construction is best started with the wing, as this allows the dope to 'set' whilst the tail and fuselage are built. First make the tips from 7 laminations of $\frac{1}{32}'' \times \frac{1}{2}''$ balsa strip. This is most easily done by cutting out the tip shape from a piece of $\frac{1}{2}''$ plywood, as shown in figure 1. The strips should then be soaked in water to make them pliable, and are then bent round the male half of the former, each being glued with P.V.A. Now push the female mould in place and clamp in position, taking care not to glue the laminations to the plywood! The outline is roughly sanded to shape when set, final sanding being done on completion of the tip.

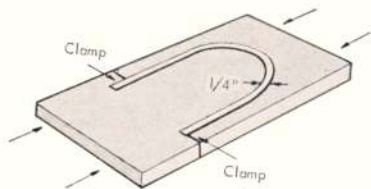


Figure 1. The clamp is made of $\frac{1}{2}''$ plywood, the wing tip laminations are then bent around the male portion, glued, and held in position by pushing the female portion in place.

Select the wood for the wings, so that each half will have equal strength and weight, using softer wood for the tips. Shape the leading and trailing edges with a 'razor plane' then finally sand smooth, before notching the T.E. for the ribs.

Build each panel in turn, starting with the centre section as described. Begin by pinning down the L.E. and T.E. - packing up the latter to suit the rib camber. Carefully cut out the ply ribs and templates, sandwich together and sand to shape. Drill the holes for the 14 s.w.g. tubing (No. 32 drill) in the centre ribs, then drill two $\frac{1}{16}''$ diameter holes in the rib templates at the upper spar positions.

Now strip a sheet of $\frac{1}{16}''$ balsa into $\frac{3}{4}''$ wide strips,

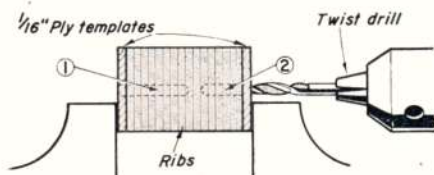


Figure 2. Clamp the rib blanks between the ply templates, sand to shape, then drill the upper spar holes from each side for accuracy.

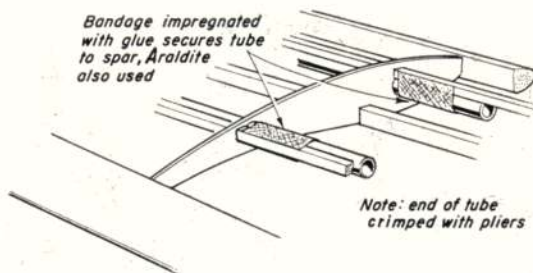
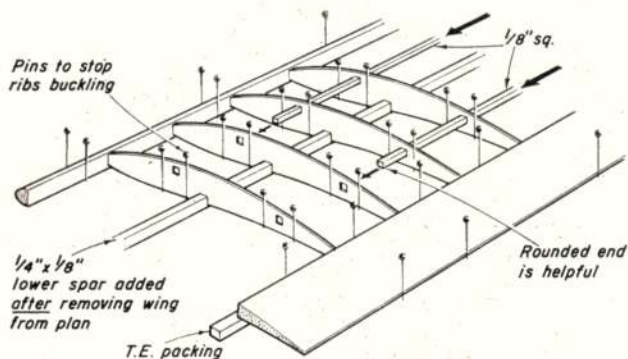


Figure 3 (left). Slot the upper spars through the holes in the ribs, which have been trimmed square. Take care to avoid splitting the ribs. Figure 4 (above). Use an epoxy adhesive and bandage to secure the wing joining tubes to the spars.

cutting them to $3\frac{1}{4}$ " lengths. Taking about ten at a time, sandwich them between the ply templates, and clamp in position. Carve and sand to shape then drill the $\frac{1}{8}$ " holes – drilling first from each side, and then straight through (see figure 2) for the spars. Also file out a slot for the lower spar ($\frac{1}{4}$ " x $\frac{1}{8}$ "). Repeat until all ribs are made – remembering to use lighter wood for the tips. When separated, trim the holes for the top spars square.

The balsa ribs may now be glued in position. Place pins either side of the ribs to prevent buckling when sliding the spars in position – spot cementing at one or two places to secure them – see figure 3. Remove from board, cement spars properly, add the lower spar and the sheeting near the dihedral break.

Build the opposite panel. Enlarge the holes in the ribs for the brass tube near the centre section. Assemble, and pin down together on a board, the 14 s.w.g. brass tubes, 14 s.w.g. wire joiners and ply centre ribs. Slide onto this assembly the wing centre panels, prop up $\frac{3}{4}$ " at the ends to suit the dihedral, and pin in position. The tubes may now be lightly epoxied to the spars – or alternatively, wrapped with tissue and balsa cemented in position. When dry, remove from board, add more adhesive, followed by reinforcing bandage and balsa cement around the tubes. The centre section may now be sheeted before the whole structure is carefully and thoroughly sanded.

The wing tips are built in an identical fashion, using lighter wood. Now cover each of the four separate panels with lightweight tissue, and apply 3 coats of thin (watery!) clear dope, pinning down between each coat. Make the two shear ribs from soft balsa, angled to give the correct dihedral of $3\frac{1}{2}$ ", when the inboard panel is laid flat. Now make the dihedral joints. Cover this joint with a $\frac{1}{2}$ " wide strip of heavyweight Modelspan. Add any trim, S.M.A.E. numbers etc., from lightweight tissue doped on, keeping them to the minimum to avoid interference with the airflow.

The tail plane is built in exactly the same way as the wing.

The fuselage needs little description. The most important point to note here is the way in which the various 'bits' are secured to the rod. The rod is marked out, then the front and rear are covered in lightweight tissue using balsa cement and dope, the tissue being wound round the rod two or three times. (See September issue).

When dry, the pylon parts, fin and tail platform can be simply glued in place. This method is strongly recommended and has been proved to be entirely satisfactory, being cheaper, quicker, lighter and less messy than using epoxy which is the usual practice. The same technique is used

for attaching the D/T snuffer tube and 'pin' tube. Note that a sound tail seating and wing location is very important, this is achieved by correct positioning of the $\frac{3}{16}$ " wood dowels for bands, and correctly packing the wing platform to account for the wing dihedral.

As for flying, suffice it to say that your chances of hooking a thermal are improved if you know your model well and are practiced at flying it. A trick that the designer finds useful is to use tail tilt to learn the model towards the required direction of turn at the top of the tow.

*FOOTNOTE. The Reynolds Number, Re , is the ratio inertia forces / viscous forces (i.e. $\frac{\rho v c}{\mu}$ where ρ = density, μ = viscosity, c = chord, v = velocity) and this ratio is a dimensionless parameter governing the type of flow. At low Re , therefore, the flow is predominantly viscous in character (laminar). However, other factors such as surface roughness may cause the flow to locally behave otherwise, and hence promote separations.



"Now where did I put my fag....?!"