Simple Towline Glider — Aegeus, 42″ span

As we have seen in the design chapters we can bring about a reduction in the drag of a slabsider fuselage by making the top slightly wider than the bottom. This makes construction a little harder, since all the horizontal cross members now have to be cut with their ends at an angle, but a little patience should soon obviate this difficulty.

Sheet covering is used on the fuselage forward of the wings and this is strength and weight in the right place. The two $\frac{1}{16}$″ birch 3 ply formers make the fuselage particularly strong and, besides anchoring the wing fixings, makes for greater accuracy when joining the fuselage halves together.

Correct bracing of towing hook is important, as there is a considerable tension on this unit during launch, tending to tear it out of the fuselage.

Whilst correct trim may be obtained by shifting the wing forwards or backwards on the mountings our adjustable balance weight is included in the fuselage. To some this may appear redundant, but it serves as excellent practice for more advanced types where the wing position is usually fixed. In any case by moving the wings we are upsetting our side-area balance slightly and it is as well to get used to the fixed wing-position idea.

Construction — Fuselage.

Two sides are first built and, to commence, two pairs of fairly hard $\frac{1}{8}$″ square balsa should be selected and one pair steamed to the curve of the top longeron, the other pair to the bottom longeron. These are then held in position on the plan by means of pins and the vertical spacers, also of $\frac{1}{8}$ square hard balsa, cut to the correct length and firmly cemented in position. The two halves are built together, one on top of the other, so that one is an exact duplicate of the other.

When the cement is set these halves may be removed from the plan and separated. Two formers, Nos. 4 and 6, are then cut out of $\frac{1}{16}$″ birch 3 ply to the shape shown on the plan. Before fitting to the fuselage it is best to attach the wire wing mounts to these as the binding job is then much easier. The wire wing mounts are bent from 18 s.w.g. wire to

the shape shown on the plan. At the top end the wire is bent over and doubled back on itself to form a binding surface for attachment to the wing mounts. Bind each mount to its respective former making sure that the rear one is $\frac{1}{4}$" lower than the front.

The formers may then be fitted into each fuselage half and cemented, making sure that the "set-up" is quite square. The fuselage is left to dry in this position.

The next stage is to pull in the tail ends of the fuselage sides and cement together and also cement the nose cross piece in place. Unless care is taken at this stage the fuselage will probably not be true, but reference to the plan will indicate any errors.

Note that the cross section is not square and so each horizontal spacer must be cut at a slight angle to get a good butt joint with the longerons. Having got the nose spacers secured, and also the tail end, the remaining spacers may be fitted.

The last bay of the fuselage is filled in with $\frac{1}{16}$" light sheet balsa, except on top. The top longeron is then filed or sandpapered away until it is sufficiently hollowed to allow the tailplane to "sit" at 0° without further packing. If a template of the tailplane centre section rib is used to check this work the result should be accurate.

The $\frac{1}{8}$" square birch skid is then taken and steamed to the shape of the front underside of the fuselage. It should have its lower edges slightly bevelled by sandpaper. Then fill in the underside of the first two bays of the fuselage with $\frac{1}{16}$" sheet and cement the birch skid in place.

When dry, bind the tow hook, of 18 s.w.g. wire, to the skid in the position shown on the drawing. A block of $\frac{1}{8}$" balsa is then cemented over the skid and binding at this point and $\frac{1}{8}$" square balsa struts run upwards to the top longerons. The bottom of the third bay should then be filled in with $\frac{1}{16}$" sheet balsa and also the remainder of the first two bays as soon as the special $\frac{1}{16}$" ply fitting is secured to the second former.

Trim up the fuselage with fine sandpaper and, fitting the 1 mm. 3 ply former No. 1 in place, smooth into the front of the fuselage.

The wing "runners" are $6\frac{1}{2}" \times \frac{3}{32}" \times \frac{1}{16}"$ bamboo and are secured to the wire mounts by binding with thread and cementing.

The underfin outline is of $\frac{3}{32}$" balsa and the mainspar is a paper tube extending to the top of the fuselage, which also serves to take the fin spar when the latter is mounted in position. It has two ribs of $\frac{1}{8}" \times \frac{1}{16}"$ balsa, of symmetrical section, one against the fuselage itself to act as a point of attachment for the tissue covering.

The fuselage is covered with a fairly heavy grade of tissue, water sprayed to tighten and given three coats of dope, allowing several hours to dry between each coat. Lighter tissue may be used for the underfin in order to avoid distortion by excessive tautening. One coat of dope only is applied for the same reason.

Fin — The fin parts F1, F2 and F3 are cut from $\frac{3}{32}$" medium sheet balsa and built up around a $\frac{3}{32}$" diameter mainspar. $\frac{1}{8}" \times \frac{1}{16}"$ balsa ribs are added, triangulated to the rear of the mainspars and these are sandpapered down to a symmetrical section when securely in position. The whole of the fin is streamlined off and then covered with tissue, water sprayed, and given one coat of dope or banana oil.

Tailplane — On account of the relatively small size of this unit "sparless" construction was used. The ribs are cut to the shape shown from $\frac{1}{32}$" sheet, using templates for greater accuracy. The leading and trailing edges of balsa are shaped to conform to the section and the ribs are slotted into each about $\frac{1}{16}$". It will be necessary to block both leading and trailing edges up slightly when building on the plan due to the undercamber of the ribs.

Tips are of $\frac{1}{16}$" diameter bamboo bent to shape over a candle flame and cemented in position. The centre section is covered, top and bottom, with $\frac{1}{32}$" sheet with the grain running spanwise. A small paper tube is cemented in place to take the fin spar.

Lightweight tissue should be used to cover the tailplane and one coat of dope or banana oil applied after the tissue has been tautened by water. It is advisable to pin out when drying to avoid any warping.

Wings — 34 ribs of $\frac{1}{32}$" sheet balsa are required. These are all the same size and

should be cut with the aid of a template, either altogether or one at a time. Each rib is notched to take the spars.

The leading edge is shaped from $\frac{3}{16}$" square balsa and the trailing edge from $\frac{3}{16}$" × $\frac{3}{32}$" balsa. It is far simpler to do this before joining to the ribs and any final trimming found necessary may be done with the aid of sandpaper later.

The bottom mainspar of $\frac{1}{8}$" square birch is then laid out on the plan and the ribs cemented in place. The top mainspar of $\frac{1}{8}$" square balsa may then be added also the leading and trailing edges, the ribs being notched into these. The trailing edge must have its front propped up with pieces of $\frac{1}{16}$" scrap balsa otherwise the section will not be true Eiffel 400 but will have a reflex trailing edge.

Wing tips are of $\frac{1}{16}$" diameter birch or bamboo. The top mainspar is cracked at the last rib, No. 17, in each wing and bent downwards and faired into the bottom mainspar at each tip. The join is then sandpapered down to the depth of the tip.

The dihedral is formed by cracking the wing at the centre to give 3" dihedral at each tip. The mainspar is then fitted with 1 mm. birch 3 ply "webs" front and back, which holds the dihedral angle in and considerably strengthens the joint. The ribs will have to be cut right through to fit these webs and, when re-cemented, may be additionally strengthened with $\frac{1}{16}$" gussets if desired, although this is not really necessary.

Smooth down with sandpaper before covering. Make sure that the mainspars do not project above the ribs, thus spoiling the section, and remove any blobs of surplus cement. Lightweight tissue is used for covering and, after tautening, is given two coats of dope, allowing one to dry before applying the other. Finally, a coat of gloss dope may be applied if desired.

Noseblock and Trim Weight.

There now remains the noseblock to which is attached the trimming weight. The noseblock itself is of very ordinary construction; just a balsa block faired into the general lines of the fuselage with a plug-in part of $\frac{1}{4}$" balsa which is a push fit in the front former.

Into the noseblock is screwed a length of $\frac{1}{8}$" diameter brass screwed rod about 3" long. The trim weight is of lead, drilled through with a $\frac{7}{64}$" diameter hole so that it can be screwed onto the rod. Two nuts, one each side of the lead, are used to lock the weight in any desired position along the rod. (This type of adjustment does not suffer from the defect that in a heavy landing the weight is shot forwards, and, if not noticed, may cause disaster on the next flight.)

The rear end of the brass rod rests in a hole drilled in the 3 ply cross piece attached to the second "former" and gives a more rigid "rest" for the weight.

Assembling the Model.

The tailplane rests in the specially shaped fuselage top and the fin spar is passed through the tube in the tailplane and into the tube in the underfin. The rear of the fin, and this tailplane, is held down by a band looped over pins, or hooks, attached to fin and underfin. The front of the fin is held down in a similar manner by a band passing around the fuselage and over a pin near the base of the leading edge of the fin.

The wings rest on the bamboo runners and are held in place by bands looped over small birch pegs stuck into the leading and trailing edges and passing around the runner. Make sure that the bands are tight enough and that the wings will not lift off the mounting in a gust of wind.

The model should balance horizontally when supported by the finger tips under the wings at the centre section distance about 3" from the leading edge.