# AVRO CLUB CADET

By
Ray Booth



THE "638" was one of several versions of the *Cadet* designed and produced by A. V. Roe & Co. Ltd., Manchester, during 1932.

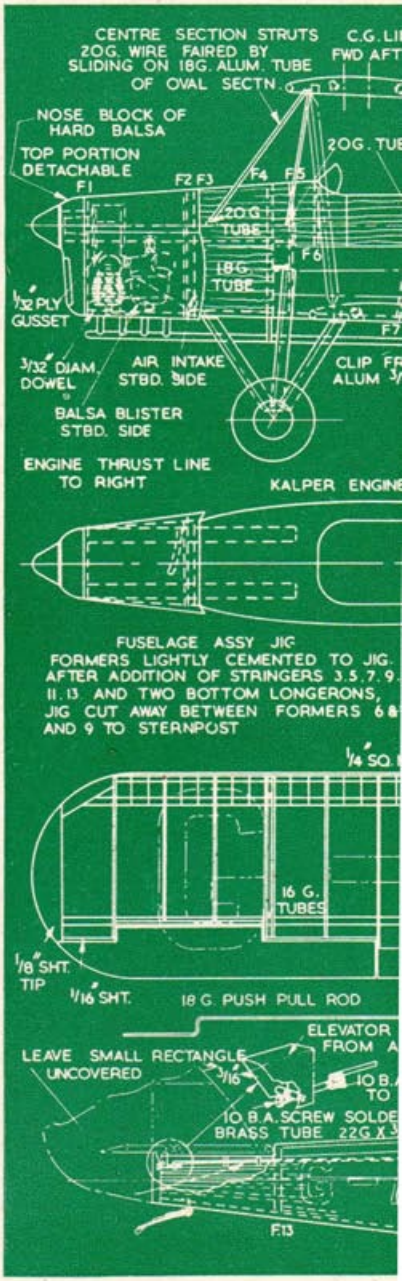
The prototype *Cadet*—type "631"—was a heavily staggered two-seat biplane fitted with a 7-cylinder Armstrong-Siddeley "Genet Major" 135 h.p. engine, and was very similar in appearance to the standard R.A.F. Trainer of that period, the Avro *Tutor* ("621"), although the "631" had a much lighter airframe than the *Tutor*.

*Fuselage*

Build up the fork-shaped fuselage jig from $\frac{1}{2}$ in. × $\frac{1}{4}$ in. balsa, $\frac{1}{4}$ in., square hardwood and 3/32 in. × $\frac{1}{4}$ in. balsa as shown on the plan. Carefully trace the various former shapes on to thin tracing paper and cement these tracings on to the appropriate material specified on the plans. Cut and slot as indicated.

Lightly cement the formers to the jig and when dry add two bottom longerons and stringers Nos. 3, 5, 7, 9, 11 and 13 (all $\frac{1}{8}$ in. × $\frac{1}{16}$ in.). Ensure that former No. 7 is inclined at the correct angle before commencing attachment of stringers and longerons. When dry cut away jig between formers Nos. 6 and 7, and No. 9 to stern post. Add nose block and 1/32nd sheet ply gusset under engine bearers.

At this stage it is necessary to construct and fit the pendulum. Commence by cementing the two $\frac{1}{4}$ in. × $\frac{1}{8}$ in. members between formers Nos. 11 and 12. Be particularly careful that the balsa used for these two members is really hard. The actual pendulum is extremely simple to assemble. First cut two lengths of $\frac{1}{16}$ in. sheet ply $\frac{1}{4}$ in. wide × $1\frac{3}{8}$ in. long, radiused at one end. A $\frac{1}{4}$ in. cube of hard balsa is used as a distance piece, and a suitable weight (approximately 1/5 oz.) is securely bound and cemented between the two lengths of ply. The pivot point of the pendulum is bushed with 22-g. brass tube $\frac{3}{8}$ in. long. A straight pin 1 in. long locates the pendulum between the two balsa side members, and to maintain free movement fore and aft two glass beads are placed either side of the pendulum. The importance of ensuring that the pendulum is mounted so as to be freely-swinging cannot be over emphasised. The push-pull rod is formed to the shape given on the drawings from 18-g. steel piano wire, a 10-B.A. brass nut is soldered



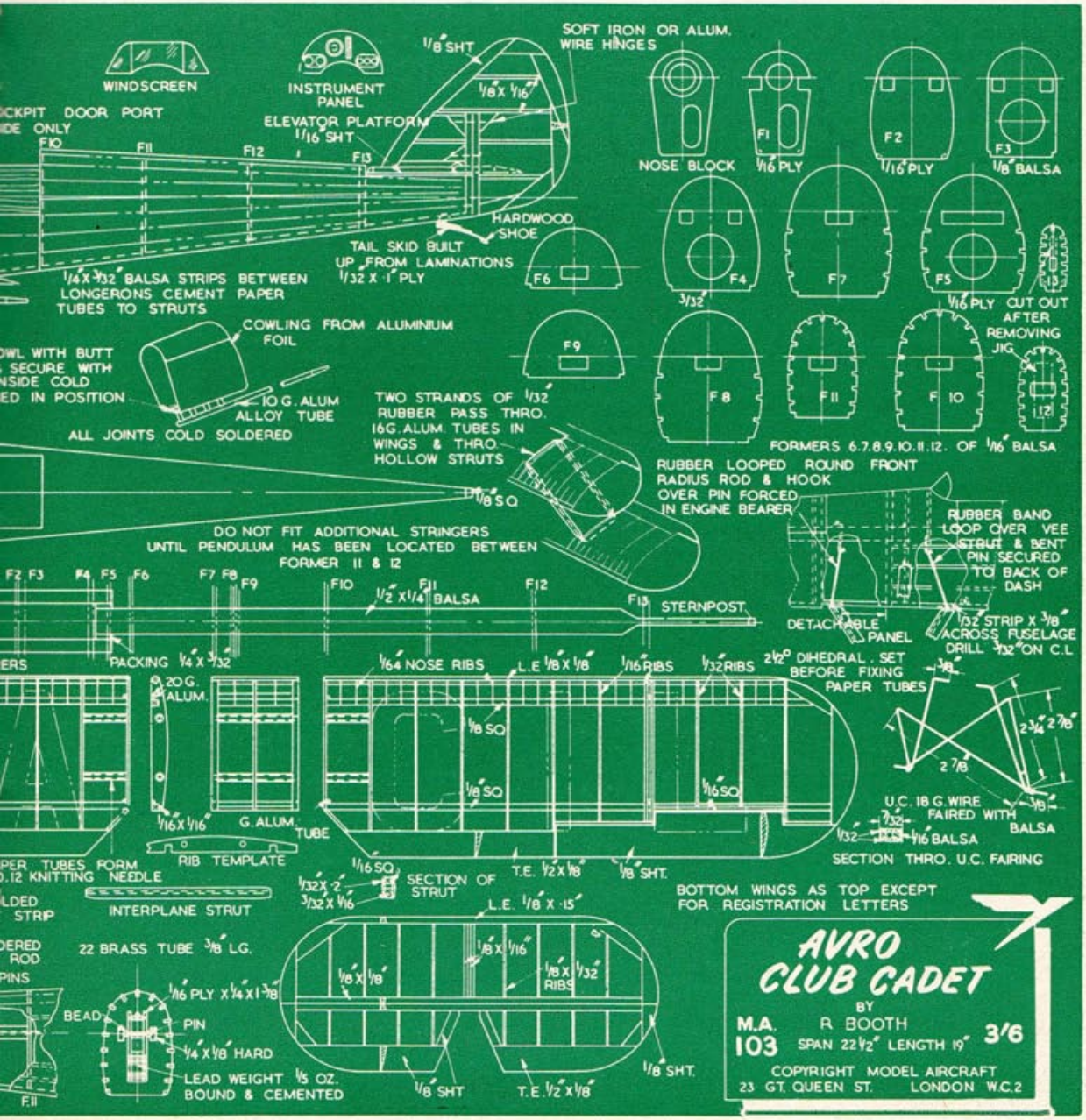

FULL SIZE DRAWINGS ARE OBTAINABLE FROM YOUR LOCAL DEALER, OR BY POST FROM THE "MODEL AIRCRAFT" PLANS DEPARTMENT, 23, GREAT QUEEN ST., LONDON, W.C.2. 3s. 6d., POST FREE.

to the end of the short leg and a $\frac{3}{16}$ in. length of 22-g. brass tubing to the long (forward) leg. Assemble rod to pendulum before adding remaining stringers (*all* $\frac{1}{8}$ in. $\times$ $\frac{1}{16}$ in.). Bend pins to hook form and fit inside fuselage as shown. Two short lengths of 3/32 in. dia. round dowel are cemented at the bottom of the fuselage between formers Nos. 1 and 2. Cut elevator platform from $\frac{1}{16}$ in. sheet and cement in position, taking care that it is located at the same angle as that shown on the drawing.

The swivelling tail skid is constructed from strips of 1/32 in. ply 0.1 in. wide, laminated and bound together.

Two hard balsa strips $\frac{1}{4}$ in. $\times$ 3/32 in. are cemented across the fuselage between the bottom longerons. Paper tubes—formed around a No. 12 knitting needle—are securely bound and cemented to these strips for attachment of lower wings.

20-g. aluminium tubes are fitted for attachment of centre-sections struts, prior to covering fuselage



completely between formers Nos. 3 & 4 with 1/32 in. sheet balsa. The upper portion is also sheeted between formers Nos. 4 to 10 inclusive.

A length of 18-g. brass tubing is fitted to the forward face of former No. 5, and into this tube fits the main undercarriage leg.

Two strips of ply 1/32 in. thick × 3/8 in. wide are fitted to the underside of the fuselage for attachment of front and rear radius rods of the undercarriage

*Upper Centre Section Wing*

Roll two paper tubes (each 1 7/16 in. long) around a No. 12 knitting needle, and leave to dry thoroughly. Carefully trace off the rib shape (including slots for spars) on to thin tracing paper and cement on to thin tin. Allow to dry and cut out with extreme care, afterwards smooth edges with fine emery cloth or glass paper. Drill two 3/32 in. dia. holes in template at the positions shown on drawing. For the centre section two 1/8 in. ribs are required and one 1/16 in. The trailing edge portion aft of the rear spar is cut off from these three ribs, as indicated in Section B-B. 20 g. aluminium tubes are fitted in to the centre section for attachment of struts. These are formed from 20-g. piano wire with the ends bent at right angles for about 1/2 in. When the second bend has been made in the wire, place the strut on a solid surface and flatten the 18-g. tubing on to the 20-g. wire with a pencil.

*Wings*

For each wing four ribs are required from 1/16 in. sheet and eight from 1/32 in. sheet, with twenty riblets from either 1/64 in. or 1/32 in. sheet, depending on individual builders' opinions. The 16-g. aluminium tubes "sandwiched" between the two 1/16 in. sheet ribs are for inter-plane strut attachment. The 16-g. tubing cemented to the outboard face of the root rib is to enable the landing and flying "wires" (1/32 in. sq. rubber) to be threaded through the wings after covering. Before cementing wing paper tubes into position, pin down upper centre section on to flat building board. Push 1/32 in. dia. dowels into C/S and plug on mainplane, raising the tip 15/32 in. so as to give 2½ deg. dihedral. With the tip supported, firmly cement paper tubes in wing roots. Leave to dry thoroughly before removing support.

*Interplane Struts*

Each strut is formed from two pieces of 1/32 in. sheet, 0.2 in. wide by 3 19/32 in. long, one piece of 1/16 in. square × 3 19/32 in. long and one length of 1/16 in. × 3/32 in. × 3 19/32 in. long. Joint as shown on the drawing, leaving hole down centre of strut, and when dry sand to streamlined section.

*Undercarriage*

The wire undercarriage is formed from 18-g. piano wire to the dimensions given on the drawing. After shaping, build up the balsa fairings around the wire from 7/32 in. × 1/32 in. strips (either side of leg), 1/16 in. square (forward) and 1/16 in. × 3/32 in. (aft). Cement up and when hardened sand to the section illustrated.

*Cowl*

Although the prototype model was fitted with a cowl formed from thin (approx. 0.003 in.-0.005 in.) aluminium sheet and an aluminium tube (10-g.) exhaust pipe, a suitable alternative would be thin celluloid with celluloid tubing for the exhaust pipe.

*Covering, Colouring and Assembly*

Cover entire model with lightweight "Modelspan." Water spray undersides of wings and tailplane, and when dry give one coat of clear dope. Pin wings and tailplane down on to a flat board and water upper surfaces. Give one coat of clear dope and do not remove pins until dope is thoroughly dry.

Tailplane and elevator are joined together after doping by means of tissue paper hinges.

The entire machine is finished in silver with the struts, registration letters, and wheel centres coloured red.

The author's machine was powered by the Kalper 0.32 c.c. diesel, and the use of this engine is recommended. However, any of the other small motors up to 0.5 c.c., such as the American K. & B. "Infant," Allbon "Dart," etc., would be a suitable alternative. Irrespective of the type of engine fitted, it is essential that the thrust line is off-set 3 deg. to the right (aircraft viewed from above, looking forward).

Flight tests have shown that the elevator should be set between − 2 to − 4 deg. (i.e., Up) when the aircraft is in normal flying position. The actual angle will depend upon the location of the model's c.g. If, during static tests, the model balances at some point outside the limits shown on the plan, it is necessary to add ballast to suit.

For initial flight trials choose a completely calm day. With the motor running at about half maximum revs., allow the model to attempt a take-off. Carefully watch the direction the machine turns both under power and during the glide, remembering that a *STRAIGHT* flight under power followed by steep turn during the glide, is best corrected by either increasing or reducing the amount of side thrust, as the case may be. After trimming the author's machine climbed gently to the left, i.e., with the torque, under power, and to the right on the glide. Longitudinal trim can be adjusted by varying the angle of incidence of the elevator.

The writer would like to express his appreciation for the valuable assistance given by the Publicity Department of Messrs. A. V. Roe & Co. Ltd., and also by the late Eddie Riding, for information he supplied just before his tragic death.

