

# AVRO 560



**Build Dave Chinery's electric ultralight for up to 540 motors and get thermalling!**

I have long admired the clean, efficient looking lines of the Avro 560 – ever since I found a plan of it during the 1960s and made a free-flight model that flew very well. After my son Mark had learned to fly, using my Heinrich (Argus plan), he decided he wanted a scale model and the idea of a new electric model of the 560 fitted the bill perfectly.

My original plan having been lost in the mists of time, we found another one in the pages of the excellent book, *Ultralights* by Richard Riding, published by Patrick Stephens Ltd. This gave ample detail to draw up a plan, so we started to consider the design. Although a basically simple shape, the layout of the subject required a little care to model in a practical manner.

The wing position meant that there was a choice between having them plug on glider-style or having them strap on with a fairing over the top. Since the latter would be more forgiving in the event of an untidy landing, and would



*...and is a fine performer, as Dave's son Mark would agree.*

give better access to the inside of the fuselage, we chose that method.

The short nose gave us little option on possible positions for the main nicad pack, so we chose to feed it in under the motor as shown on the plan, in line with my preference to have the battery sitting on top of the landing gear! The latter was initially bolted to the ply

*Avro displays simple lines...*

bottom of the nicad compartment. Experience showed that it was not sufficiently resilient in this form, tearing the bolts out of the thin ply, so the arrangement was changed to that shown on the plan, which is a good deal more robust and springy.

### **Simple but effective!**

As intended, the model was mostly constructed by Mark, who was only ten at the time! Although very simple to do, we omitted the fine details like the false wing ribs and the pitot head, however these are shown on the plan. After covering with silver Solarfilm an Astro .035 Cobalt motor was installed together with standard (not lightweight) radio gear including a servo driving a motor switch. All-up weight was just under three pounds (1.3 kg) with a five-cell pack of Sanyo reds.

The model flew very well from the start, doing eleven minutes on its second flight, although seriously under pitched with a 6x3 prop. The sparless blue-foam wing was easily man enough for the job, even though flown by Mark at very unscale high speeds on occasions, and even looped! Although

the area of the tail surfaces is quite small, no problems were found with stability, although the model would drop a wing if provoked. Extra washout has been added to the plan to help avoid this.

Mark flew the model quite a lot, even winning a 'pot' at one of the Old Warden Golden Era days, and eventually he moved on to faster and more aerobatic models.

Although we used more a expensive Cobalt motor, the model will fly happily on a reasonable buggy motor. This will have similar power, although it will be bigger, heavier, and less efficient. The weight will come in handy in the short nose, and the efficiency of the model itself will still turn in a reasonable flight performance.

### To construct one Avro...

As stated above, the model was designed to be built (with a little help) by a ten-year-old, so it is quite simple. The original model was controlled by rudder/elevator/switch, but it would be possible to fit operating ailerons if you wish. This would allow the dihedral to be reduced to a scale amount. Due to the high aspect ratio you will still need rudder control to coordinate turns, so you will need at least 4-channel radio.

The wings are made by my usual blue-foam method, although an alternative built-up construction is suggested on the plan. The foam method is simplicity itself, and was described in considerable detail in a series of RCM+E articles during 1988.

the rectangular tabs on the ends of the templates protrude past the edges of the blank to lead in the cutting wire. The templates should have their datum lines parallel to the flat top and bottom of the foam slab to give the correct washout.

Rest the blank on a firm, dead flat surface (chipboard will do) and weigh down evenly across the top. I use metal plates, but books are OK. Cut the foam blank in the usual way, being careful to move the wire across each end in proportion to the chord, so that each end finishes simultaneously. I usually start at the TE, as any wire drag will be less important at the thicker LE. Add the templates to the other blank and cut the other wing, making sure its the opposite hand to the first one!

Before rounding-off the tips, add the balsa LE and TE strips using PVA, and allow to dry. When dry, round off the foam at the tips, leaving the edge vertical for the moment. Cut a number of 2mm sheet strips about 1cm wide at one end and 6mm at the other, and long enough to go round the foam tip from the LE to the TE. On a firm surface, roll these strips out lengthwise, rolling-pin fashion so that they curl up. This will make the next stage easier!

You are now ready to laminate the tips. Collect a stack of three or four strips and apply PVA fairly generously to the inside curved surface of each. Add the first strip to the wing with the wide end stuck to the chamfered end of the LE strip, and the narrow end stuck to the TE.

Add the other strips over the first,

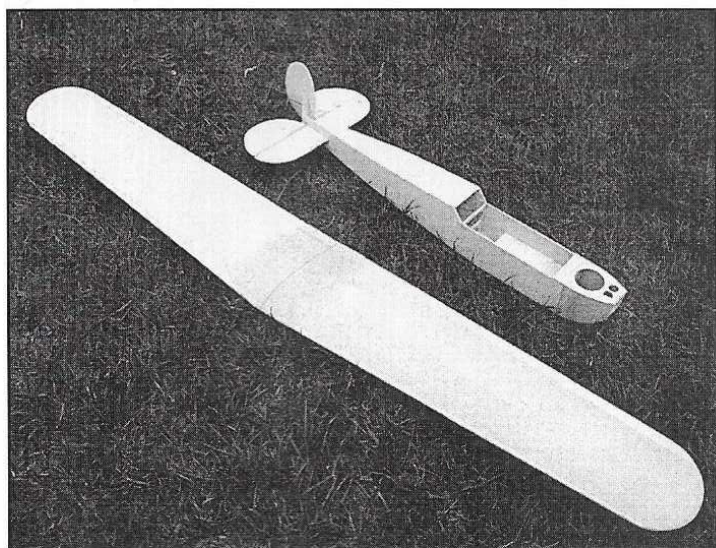
butt joint with 75mm under one tip as shown on the plan, and join using PVA or epoxy. Note that PVA will need at least 24 hours to dry, so epoxy is preferred for this part of the job. When the joint is dry, bandage it in the usual manner, either using glass cloth and epoxy resin (polyester will melt the foam!) or you can use PVA glue or household emulsion paint to stick the glass cloth or heavyweight nylon on. Emulsion really works - one of my models has made over 300 flights with a nylon/emulsion jointed wing!

Apart from covering, that's the wing complete, so let's move on to the fuselage.

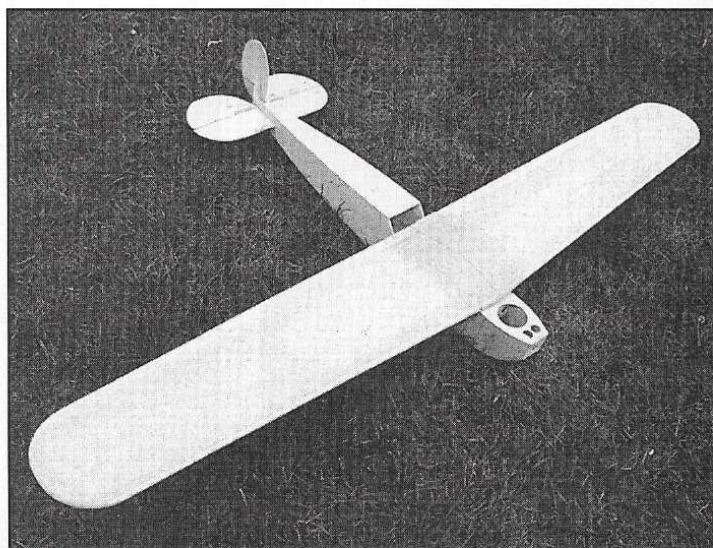
### The bit in the middle

The fuselage is basically a simple box, and is easy to make. First, decide where you need the Rx floor, you can raise or lower it according to how big your intended nicad pack will be. The position shown will allow a pack of standard sub-C cells to be used, but using smaller, 800mAh cells might allow the floor to be lowered for more Rx room. Having cut out the sides from firm 2mm sheet balsa, cut and add the ply doublers as shown, using either PVA or Evostik (quicker). Cut formers F2 and F3 add the hard balsa dowel blocks, and drill the dowel holes.

With one side lying flat on the board, doubler up, add F2 and F3, the 3mm square fillet for the Rx floor, and the vertical parts of the 'box frame' stiffeners in the tail section. Add the balsa doubler to the tail end, and the



*Fuselage is a straightforward box with nose from block...*



*...and wings may be foam, or built-up construction.*

For the benefit of those unable to read these, the method is as follows:-

Trace out the templates shown onto a piece of scrap Formica or other heat-resisting material and cut them out. (Ply will do, but make sure the edges are really smooth). Mark the datum lines clearly as shown to get the right washout - this is important - see above! If you are using the built-up construction option, you can use the templates to make the ribs using the sandwich method.

Cut the Styrofoam blanks to the exact planform required (without rounding off the tips) with the right taper at the LE and TE. Pin the templates to the correct ends of the blanks; you should find that

and pin into place every couple of centimetres or so to make sure that the laminations fit snugly to the LE, TE, the foam, and each other. When dry, the squared-off end of the foam can be sanded down to a nice curved shape viewed from front or rear, and the tip laminations and LE strip can be sanded to the correct curved profile.

After sanding the entire wing smooth, the dummy ribs may be added if desired by sticking strips of 1mm balsa on top of the foam in the correct places, sanding the ends down to nothing to be level with the LE and TE. This will give a very realistic finish when covered, at very little effort.

Sand the wing roots to give a good

spruce or ply landing gear mounts to the ply doubler. With the exception of the formers, which are sticking to the first side, repeat the addition of all the bits to the other side, making sure that the holes for the landing gear wires are staggered 3mm to each other.

When dry, glue the second side on the upper sides of F2 and F3, ensuring they are parallel and the tailplane slots are vertically opposed. This can be checked by putting a piece of 3mm sheet through the slots and checking it is vertical with a square.

The next stage is to add the ply Rx floor, the ply nicad bay floor, and the 6mm balsa end across the nicad bay. When dry, draw the tail ends of the

sides together, ensuring the fuselage is straight in plan view, and add the horizontal box frame spacers, and, eventually, top and bottom sheeting.

That completes the basic fuselage, so the next bit is to add the nose. Because of the sharp curves, and the strength required, the method shown was the only way to go. Cut the two side blocks from 12mm hard balsa and glue firmly to the front of the fuselage box. You can use a temporary brace in the motor location to hold them in the right position. Cut out F1 from a good piece of 1.5mm ply or glass/epoxy PC board material, and drill fixing and cooling holes to suit your motor.

When the 12mm balsa blocks are firmly stuck to the fuselage, sand the front faces so that F1 sits at the correct

five degree side and down thrust angles. Fit the motor to F1, and try it for fit in the nose, removing any temporary braces you added previously. Since standard 540 motors are larger in diameter than my Astro 035, you may have to remove some of the balsa at the extreme nose, where the side blocks come closely together. When satisfied, epoxy F1 firmly to the balsa blocks, keeping the glue off the motor, or it will be in there permanently!

The landing gear is made as shown using 1/8in (10swg) piano wire for the legs and 12 swg for the axle. After binding the two leg sections together (I use steel wire as sold for flower arranging) push them into their holes in the fuselage before soldering the bindings and the axle joint. Note that

each binding is soldered to only one of the leg wires to allow the torsion bar action to work unimpeded. Small, rectangular fairings can be added to the vertical sections of the legs as per the full-size if required.

After completing the bulk of the fuselage, there are a few bits and pieces. Add the four short dowels for the wing bands and strap the wing on with a reasonable number (say, 6) suitable bands. Using offcuts from the fuselage side sheets, make up the fairing over the wing, covering the top with 1.5mm sheet. If you have difficulty bending the front ends of the sides round to match the curvature of the nose, try rolling them as for the wing tip material. I cut out the shape of the cockpit opening from the top sheet of the fairing, and

edged it with a strip of grommet material after covering. The pilot was fixed to the top of the wing (with Velcro), and protruded through the cockpit hole in a realistic manner.

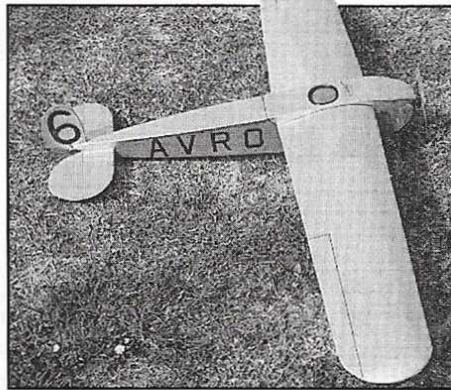
If you bothered to add the dummy ribs to the wing, you also need to add a strip of 1.5mm square balsa along the middle of each side of the fuselage, level with the datum line. After choosing a location for the Rx switch and making the relevant hole(s), the fuselage is ready for covering.

### Tail feathers

The tail is made from light quarter grain balsa to the outlines shown. The sheet is reinforced by 1mm ply patches at various points, such as horn locations and the bottom of the fin. To minimise weight, the use of closed loop control linkages is recommended, you can either bolt a small commercial horn each side of the surface, or make horns from glass/epoxy PC board.

The tail assembly is designed to be covered before assembling to the fuselage. I hinged the rudder and elevators with the covering material, which was silver dope Solarfilm as mentioned before. Leave the parts uncovered where they have to stick to the fuselage, even epoxy doesn't fix to Solarfilm very well!

After covering the tail surfaces and fuselage, slide the tail into its slot with plenty of glue and pin to dry. Trim the bottom part of the fin to fit into the triangular space between the ends of the fuselage sides, and glue in place, packing any spaces with scrap balsa.



**Decoration is simple. Anyone can paint that name and figure '6'!**

Ensure the fin is vertical and dead straight looking from the nose end.

### And to finish

Since there were only two prototypes made, your choice of decoration is somewhat limited. Our model was decorated with a large AVRO on each side of the fuselage, and large figure "6"s on each side of the fin/rudder and under each tip. Alternatively, period RAF livery can be applied, as the aircraft was painted that way and had a serial number of J7322 for testing at Martlesham Heath. The book, *Ultralights*, mentioned above, has full details. After installing the gear and assembling the model, check it for balance *with a nicad pack installed*. Slide the pack into its bay underneath the motor, and move it backwards and forwards to get the model to balance on, or just in front of, the balance point shown on the plan. If

there is space behind the pack when it is in the correct position, remove the pack and fill the space with a piece of blue-foam to permanently position the pack. The pack is retained at the front by a rubber band, stretched round the motor and the landing gear.

### Testing time

After checking the controls, about 30 degrees each way for the rudder, and about 1cm each way for elevator, you are ready for the big moment. As usual, it is best to test glide over long grass, if you can find any! Test glides are usually fairly short, and if you launch the model yourself you don't have too much time to assess stability and correct the controls. It is, therefore, advisable to keep them to the minimum necessary to ensure a reasonable trim, and then go for a powered flight at a reasonable altitude so that you can let the model fly itself and show up any trim deficiencies.



**You needn't look so worried, Mark! Completed Avro flew sufficiently well to be awarded a cup at Old Warden last season.**



*Lining-out and small details add character. How about a pilot for that final touch?*

The model should be fairly docile to fly, but there are a couple of points to watch. The extra washout should minimise tip-stalling problems, but handle with care at low speeds and altitudes until you have found out what the limits are! Because it is quite clean the model will soon pick up speed in a dive and can be flown quite fast, but this is definitely unscale and may overstress the wing if taken to excess! At lower speeds it really looks the part, and will even thermal happily with the motor off.

Well, that's about it - here's wishing you lots of flying fun with your Avroplane.