MANTA

Here's a zippy 49¾ in. span aerobatic model for .40 motors

BY PAT INGROUILLE

THIS design was born out of a desire to replace my tired old .40-powered 'plank' (which was getting rather soggy and threatening to fall apart at any moment), with something a little more sophisticated.

I'd long had the yen to try some of those more advanced design features that are normally found on the larger .60-powered aerobatic machines, but on a smaller, more economical model. What would happen, I wondered, if one incorporated a proper airfoil section built-up tailplane, and a thick streamlined section fin instead of the more usual flat plate devices that are found on this class of model; and would a slightly greater percentage thickness toward the wing tips help to avoid any tip-stall tendencies? There was only one way to find out, so I started to scribble on bits of paper and hack at bits of balsa until I finally came up with this little model.

I was pleasantly surprised to find that the formula seems to work. The change in wing section, as it progresses outwards, does seem to give the model good low-speed characteristics – it's certainly very easy to land! Also, the fact that the response of the whole model is so smooth does indicate that the thick tailplane and fin are doing their jobs well, with the added bonus that the model's speed alters quite quickly in response to throttle changes. All this – and it's good looking too! (Well, I think so anyway).

Two prototypes have been built, the second incorporated slightly larger ailerons, top instead of centre hinged. This is the version

shown on the plan. The model is very uncomplicated to build, despite those built-up tail surfaces and if you follow the building procedure I've shown, you'll be surprised how quickly it goes together. Pretty well any motor in the .35-.40 class will haul it around quite happily, but for precise aerobatics, good vertical performance is important, so a high-performance .40 motor does help. (The prototypes have both used HP 40F motors.) Also very important is the fact that, the lighter the model is built, the better its capabilities in the aerobatic manoeuvres will be.

Wing

This is built in one piece, flat on the building board, upside-down so that the only dihedral is on the lower surface.

Start by laying down the upper spar – this is made up by scarf – joining two short pieces to each end of a standard 36 in. length, which means that the spars run unbroken right through the centre section. This does away with the need for dihedral braces. Next, add the ribs, jigging them up so that the centre lines are parallel to the board. Don't forget to add the 1/16 in. ply doublers to W2 and W5, to take the undercarriage plate. The false leading edge and the trailing edge are now added; also the lower spar which is prepared in a similar way to the upper one. The basic framework may now be lifted from the board, so that you may add such things as the ply plate for the wing bolts, the aileron linkage and the undercarriage plate, etc. You will note that the latter runs right across from one side to the other – don't worry, it will negotiate the very slight lower surface dihedral quite easily, as did the lower spar. After all has been safely gathered in, so to

speak and you are quite sure that there are no more bits to go inside, you may sheet the wing with medium soft 1/16 in. sheet. I used contact adhesive here. (I hate having hundreds of pins stuck into the wing while slower PVA glue dries). But whichever glue you use, do make sure that the structure is securely jigged up so that all rib centres are parallel – this is where warps are made and on a fully sheeted wing they are almost impossible to remove! All that remains now to complete the wing is to add the leading edge pieces at the centre. A narrow strip of glass fibre tape is placed over the centre joint in the sheeting, with resin and also serves to strengthen the leading edge where the dowel protrudes.

The ailerons are made from medium 1/2 in. straight-grained sheet, carefully matched for weight – a razor plane is invaluable here. If you make them the full length of the trailing edge, you can cut off the surplus at each end and glue it to the root and tip trailing edge of the wing. The ailerons are top-hinged in preference to centre hinging as this adds to the differential effect, which I feel is particularly important with strip-type ailerons. I've shown the bellcrank linkage method (you can use tube and cable if you wish), because with the more usual bent-wire type of connection system, you can run into problems with foul-ups between the fuselage-mounted servos above and the upright wing-mounted servo below. With the aileron servo flat in the wing, it's plain sailing.

Tailplane

Choose your wood very carefully here to ensure that the tail end is built as lightly as possible. The method recommended here may seem a little odd, but it really is very straightforward. The ribs, each in two parts i.e. ahead and behind the spar, are cut in half along their centre lines. You can now build each half of the tailplane, top and bottom, flat on the board. They can even be sheeted before you lift them! Then all you have to do is glue them together and 'Voila', one warp-free, tapered section, built-up tailplane, built without a single jigging block.

The elevators and rudder are built separately and have sections arranged so that they may be built flat on the board. Simply cut out the basic full outline from soft 1/16 in. sheet and glue the leading edge onto it, followed by the ribs and pieces of scrap block to take the horns. Then plane down the leading edge to follow the section shown and cover with 1/16 in. sheet.

Fuselage

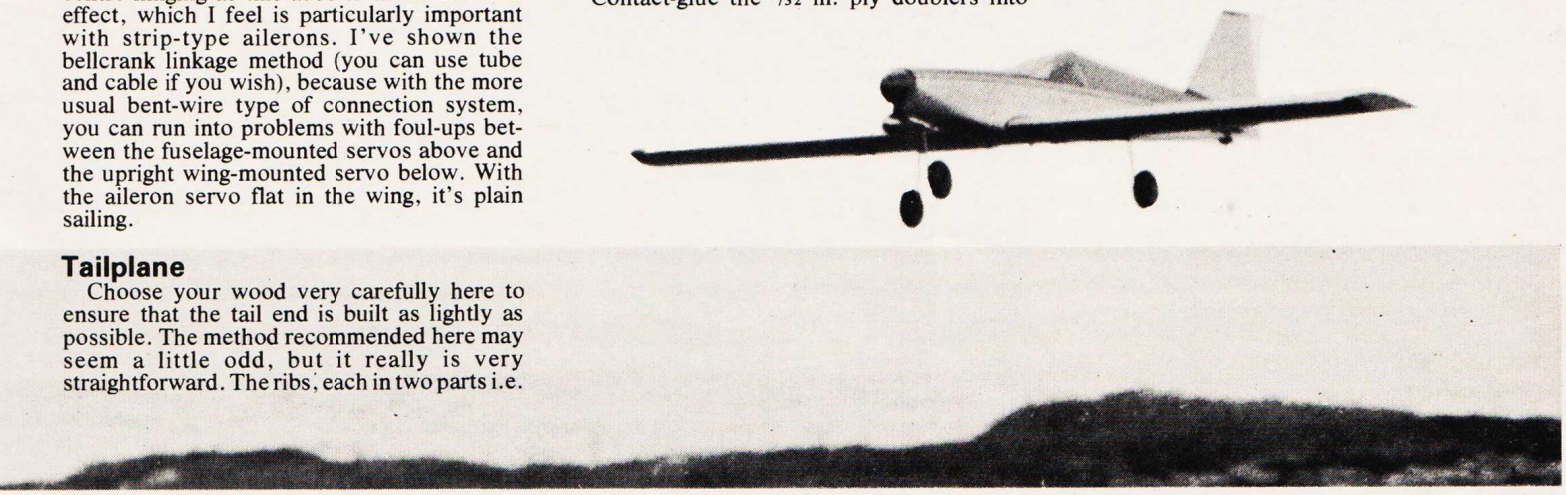
Select two well matched pieces of medium/soft 1/8 in. balsa for the fuselage sides. Then, having cut one to shape, use it to mark out and cut the other; check before proceeding any further that they are identical.

Contact-glue the 1/32 in. ply doublers into place at front and rear and glue on the rear longerons, relieving them slightly where they pass onto the doublers. Do not fit the triangular 1/2 in. strips at the front end yet – they are best left until a little later on.

The fuselage sides are joined using F3 and F4. Make absolutely sure at this stage that everything is lined up correctly – a twist in there now will be impossible to remove later on.

F4 is a little unusual in that it is a laminated former. It's dead easy to make – just cut out the balsa core, contact-glue it on to a piece of 1/32 in. ply and then run a sharp knife around it. Repeat for the other side, it's quicker than fretting the former from 1/8 in. ply; it's just as strong for the purpose and it's lighter.

Draw in the sides at the front and epoxy F2 into place. Fit F5 and join at the rear with the fin trailing edge. The triangular strips may now be fitted at the front end, followed by the for-



Left: designer Pat Ingrouille and prototype Manta. With a good .40 motor up in front, the aerobatic performance is excellent. Below: clean and simple, the straight lines of the airframe aid speed of construction.

ward fuselage top and cockpit floor. Fit the tailplane at this stage and build the fin into place, with the lower fin rib curved and glued to the top of the tailplane. This forms a step to which the lower edge of the fin sheeting is glued. After the fin has been sheeted, you may proceed to fit the upper rear fuselage sides and 1/4 in. sheet top. Leave the lower sheeting off for the time being until you have installed the pushrods of bowden cables for the control linkage.

Turning to the front end again, you will find it easier if you temporarily fit the motor in its mount in order to build up the soft block nose section around it. Don't forget to include the aluminium plate between the mount and F2 – this has an angled slot cut into it to take the nose-leg. After this, it's just a matter of carving and sanding until you are satisfied with the shape.

Finish

As always, it's up to the individual how he finishes his model, but I will detail briefly my method.

The whole model was given a coat of clear dope to seal the wood and is then covered in heavy-weight coloured tissue, using dope as the adhesive. This was followed by a coat of sanding sealer which was rubbed down with fine Lubrasil paper. After adding a little colour trim with Humbrol enamel, the whole model was given one full coat of Tuf-Coat fuel proofer. The engine bay and tank compartment were fuel-proofed with two coats of glassfibre resin (much to the annoyance of my wife who is allergic to it!!!) This type of finish is quick, light (very important) and, I think, quite attractive.

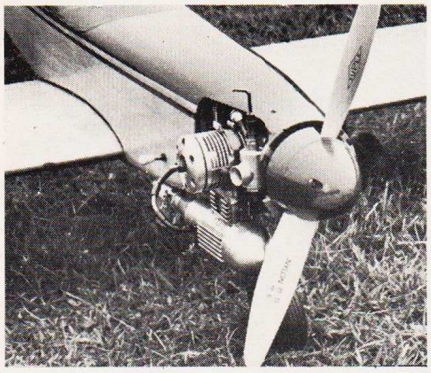
Flying

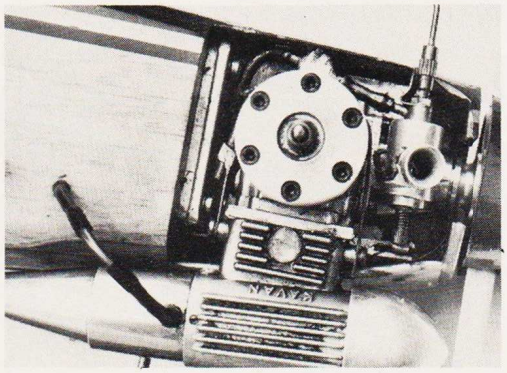
With the model balanced on the C of G shown and with control surface movements at no more than indicated, you should have no problems at all.

Rudder response on the ground is excellent, but it's not there long enough for this to matter much anyway. Once airborne you will find it will do the book with ease. I've used mine in club aerobatic competitions with some success and also found it an excellent model for limbo, touch and go and spins competitions. In a fully stalled condition with full rudder and full up-elevator, the model will drop into a classic spin with quite a slow descent rate. No aileron control is required. If the spin is prolonged as would be the case in spins competitions, allow a turn or so to recover after releasing the sticks; or, if you prefer, about three or four turns before you wish to pull out, apply full aileron in the same direction as rudder. Then, when you return the controls to neutral, she'll pull out immediately.

Landings are a piece of cake – you'll find that your initial approach can be made fairly fast because when you begin your flare-out at about three feet, she will just slow up and sink gently on to her main wheels.

Build your model true and light, balance it correctly and you will get tremendous fun and satisfaction from the Manta – I have!





Left: two views of the nose section, showing the installation of HP-40 motor and nosewheel unit. Note the manifold pressure line to fuel tank in picture near left. Bottom left: aileron servo installation in wing – note the fine wire keeper to retain push rod tin with servo drive arm. Below: fuselage airborne radio pack installation. Receiver and power pack are really well protected.