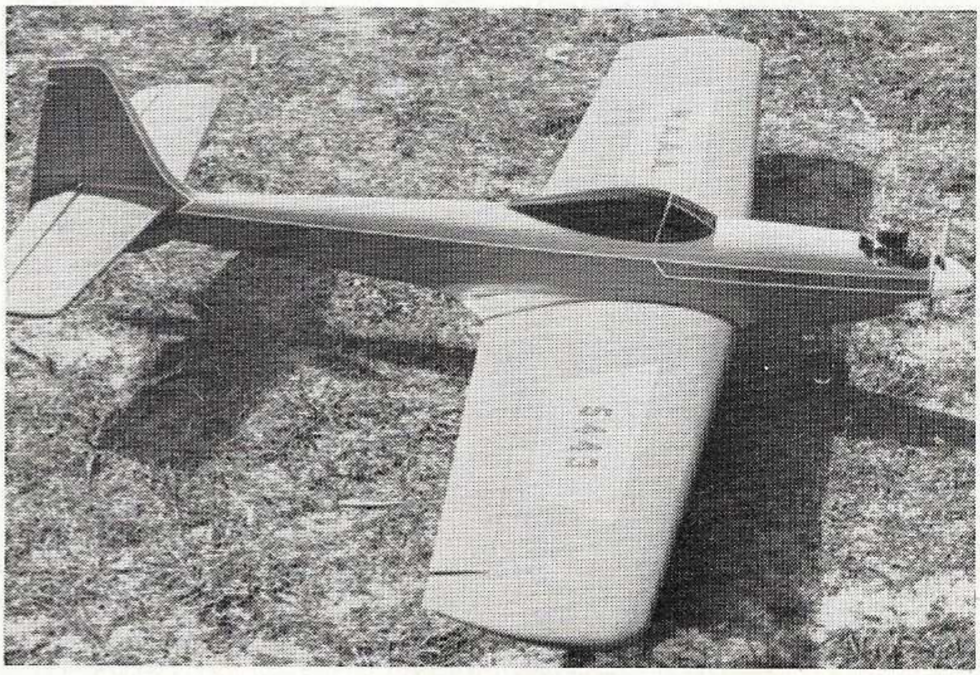
CRESCENDO

Tom Prosser's top winning aerobatic design

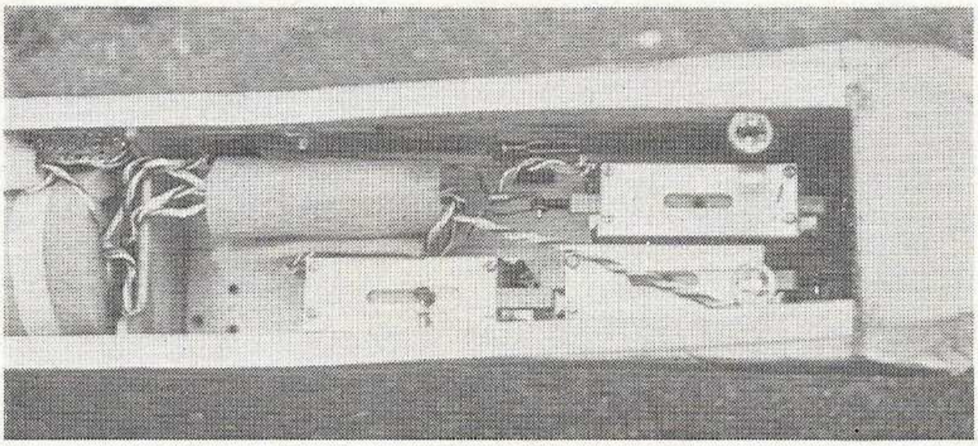
THE CRESCENDO series began as an extension of an earlier series of modified *Sultans,* the Mk. I having 6 sq. ft. of wing, strip ailerons, and weighing 6lbs. Though it was good enough to win the 1965/66 Australian Nationals, I soon realised that it was too big and too light for precise flying.

Shortly after those far-off Nats, this model met its doom (spelt "g-r-o-u-n-d") and the need arose for a new model for the Easter N.S.W. state Championship. The wing from the Mk. I was repaired and a new fuselage built, incorporating some changes in moment arm, tailplane position and structure. This Mk. II version proved better, but was still too lightly loaded for really first class results, I felt.



Following a winter's thinking, the Mk. III was drawn up. The fuselage was similar to that of the Mk. II except that, following persistent vibration problems, a much heavier engine mount (designed to anchor very firmly the "vibration factory") was incorporated. The flat-plate tailplane was changed to a fully sectioned type, and the fin thickened up to preclude warping.

It was the wing which received most changes, however, and it is from here that much of the impeccable handling of the Mk. III model is derived. First, the area was reduced to 795 sq. in. and a tapered planform adopted, but the main feature is the use of a change in section from 17 per cent semi-symmetrical at the centre, to 17 per cent fully symmetrical at the tip. In practice, this produces a wing which simply *will not* tip-stall or snap-roll, no matter what you do to provoke it. This is because the centre section stalls first; the tips continue flying and thus provide lateral stability, while the



nose drops and flying speed is regained.

My standard demonstration of this feature is to bring the throttle back to idle, then gradually increase up-elevator as the speed dies, until the model is mushing along, nose-high, full up-elevator applied and held—hand off the aileron stick and in my pocket! Try this with your present model. (On second thoughts, maybe you had better not). Then, to emphasise the lateral stability, I do some steep aileron turns, still with no power and full up-elevator held on.

A change to large outboard ailerons was made on the Mk. III wing. These are set in four inches from the tip, again to avoid tip-stalling during low-speed turns and so on.

Crescendo III has proved to be a delightful model to fly—smooth and easy, very stable and very predictable but, before going on to some notes on the construction, a word about the spin. There is only one way in which the model can be made to spin. Procedure is to kill all power and immediately bring the nose right up to about 45 degrees. Wait for the speed to die, then as the model stops, hit full up-elevator, wait for the stall to occur and, as it does, hit full left rudder *and aileron*. This will give an absolutely classic spin entry, with the model stalling and then dropping instantly into a very safe, positive spin, with the nose well down. Recovery takes half a turn on neutralising controls.

R/C needle valve

This was the first model in which I used a radio operated needle valve on the engine, and I will never build another one without this feature. What a joy it is never to have a bad engine run! With it I use full lean for take-off, then a fairly rich mixture through the looping manoeuvres in the early part of the pattern, full lean to really blast through the rolls, then richer for the eights. Finally, fairly lean for the circuit to give good throttle response, then to full rich for a very low idle, so that the model will stop at the end of its landing roll (I don't use brakes).

Mixture control is effected with one of the auxiliary channels of my old KP-6. The travel is arranged to provide about three-quarters of a turn of the needle, which is set for a safe full-lean setting before take-off, thus preventing cutting of the motor in the air through over-leaning.

CONSTRUCTION

Tailplane

I usually build the tailplane first, to get my hand in, then the wing, so that both will be ready to mate to the fuselage, when that is finally built. So that's how I will describe it. . .

The l.e., t.e. and spar are cut to shape from sheet, jigged up on the building board and the root and tip ribs added. The intermediate ribs are simply rectangular blanks cut from strips. These should be a little wider than necessary—and of uniform width, as their bottom surfaces will be your gauge for accurate jigging later on.

When dry, the tops of the ribs are trimmed with a razor plane, then finished to shape by sanding, using the root and tip ribs as a guide. The technique here is to take a strip of hardwood about $\frac{3}{4}$ x $1\frac{1}{2}$ x 16in., facing one side with 180 wet-and-dry abrasive paper (dry please!). Put a single wrap of Sellotape where this runs on the root and tip ribs, and sand until all the ribs are perfectly true. This side is now sheeted with $\frac{1}{16}$in. soft sheet, joined and sanded *before* application. Lift the structure from the board, turn it over and block it up so that the flat bottoms, now upward, are all an equal height from the board, then trim, sand and skin as for the first side. Now the elevators are shaped from sheet with a razor blade, and hinged. (*Note: keep all control-surface hinge gaps as small as possible, in order to attain the best control response. This is absolutely essential.*) The $\frac{1}{2}$ x $\frac{1}{4}$in. spruce joiner should be glued in place before shaping commences.

Wing

The wing ribs may be shaped by the block method, or by using a similar system to that described for the tailplane. (Actually, I cheat a bit here, as I have a homebuilt, and quite simple, machine which shapes the ribs from blanks after they are pinned to the board and the leading edge). Or you could use a foam wing. But whichever way you do it, make sure that the wing is jigged true as, due to the change in section, it is quite impossible to *see* whether it is warped or not.

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Do not omit the spar webs, as they are the thing which contribute about 90 per cent of the torsional rigidity to the wing, and a good measure of bending strength as well. Built as shown, the use of fibreglass around the centre section is a complete waste of time and only creates more weight—and a stress-point at its edge where the wing can conveniently break.

Fuselage

The sides are cut out, doublers added with contact cement, longerons glued on, and Cam-loc fittings put in place. Yes, that's right, fit them in *now*—they will all line up later. Now join the fuselage sides at the rear and add bulkheads and cross-pieces, working forward. The engine mount should be drilled, the nut plates mounted and the filler block below the motor glued to it. Then glue it between the sides, pulling them in with clamps.

Now add the bottom, nose-gear mount, nose-leg, lower nose block —in that order. Then the triangular blocks above the motor mounts, the firewall and the tank.

This is the time to make sure the wing seats properly—before the fuselage top goes on. Sand the fuselage cut-away to match the wing, fit the l.e. wing dowels and then simply shove a scriber, or kitchen skewer or whatever, down through the female Cam-loc fitting and right through the wing. Open up these holes with a drill, recess a couple of 1in. circles of $\frac{1}{16}$in. ply into the bottom of the wing and you will have perfectly fitted Cam-locs. Now add the fuselage top, fin, wing fillets, a fairing at the fuselage/l.e. junction, a bit of sanding and it's ready for painting or MonoKote.

My *Crescendo III* has a Merco 61 and Kraft KP-6 with five servos, and weighs 7lb. I hope you enjoy your model as much as I have mine. (Finally, I would like to acknowledge the efforts of a good friend, David Whitehead, of Eltham, New Zealand, who wrestled my drawings into shape for presentation in R.M.).