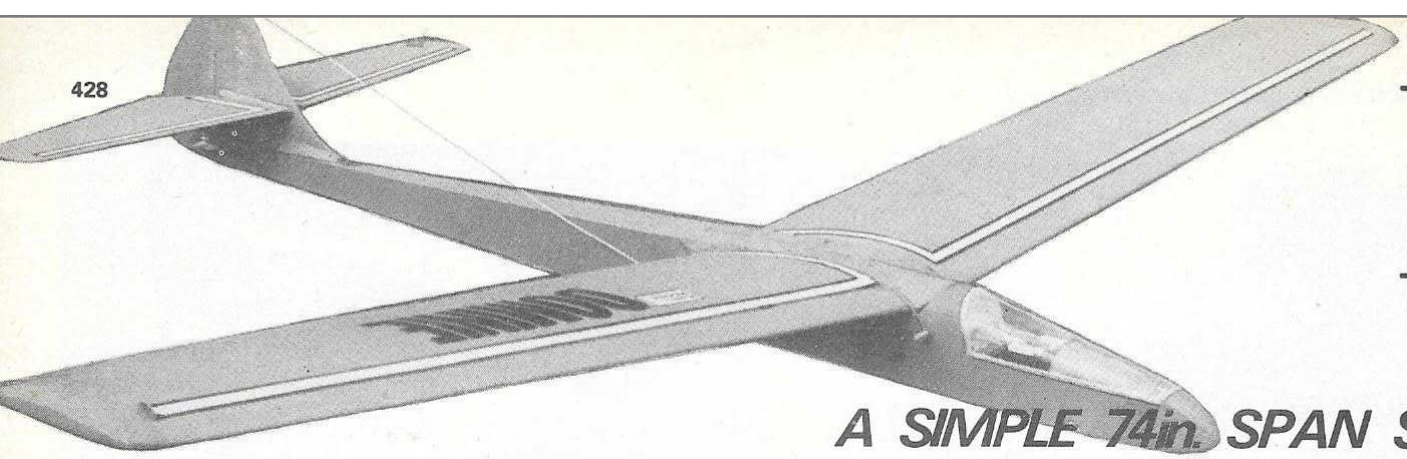

DOMINIE



A SIMPLE 74in. SPAN SLOPE TRAINER FOR 2 FUNCTION R/C

RUMOURS spread very rapidly in our Editorial offices and news of the advent of project *Dominie* was no exception. Every experienced R/C modeller has his or her own ideas on the desirable features that a trainer should incorporate and MAP's modellers are no exception. Advice poured in from every quarter – including visitors to the offices who cast their critical eyes over the outlines that slowly evolved on the office drawing board. A brief resume of the design parameters that *Dominie* had to fulfil are outlined below.

1. *'Forgiving' flight characteristics*. A trainer must possess a large degree of inherent stability with no unpredictable tendencies.
2. *Easy construction*. It is assumed that the builder of the model might well be a novice builder as well as a novice flyer.
3. *High strength-to-weight ratio*. It is to be expected that the novice will have several heavy landings, even out-and-out crashes, before he learns to fly well. A trainer must survive these.
4. *Readily available parts and materials*. It should not be necessary to purchase non-standard items or items only available from a single source.
5. *Attractive appearance*. Many novices are instantly attracted to unsuitable models by virtue of their appearance. A trainer should be as attractive as the demands of simplicity and ruggedness allow.

With the above points in mind – design commenced with the wings. Whilst parallel chord wings seemed at first to offer the simplest solution, memories of the excellent 'Equi-angular' wing sections designed by Bob Annenberg prompted the consideration of a tapered wing. Using only one such template it is simplicity itself to cut out an accurate set of ribs for a tapered wing. For speed of construction an all sheeted wing was decided upon. At this point, cost of construction was queried but a quick estimate indicated that an all sheet balsa wing could be built for about £3.00 (uncovered) so design of the wings proceeded. With a wing span of 74ins. (2 panels from 36in. sheet balsa, plus 1in. tip blocks) and an average chord of 8in. results in a wing area of almost precisely 600sq. ins. A rapid calculation revealed that if a complete sheet of 3in. wide 36in. length balsa was used to shape the tailplane, an 18% tail area would result. This coupled with a moment of just over twice the wing chord, would provide more than adequate stability.

Wing design and tailplane size and position thus decided their positions were drawn onto the paper and a fuselage outline to couple the whole together sketched in. Tailplane position caused much heart searching, the final high tail layout decided upon provides adequate ground clearance on landing plus the solid fixing needed to avoid constant changes of trim caused by poorly located rubber banded attachment. Some would query the all moving tail layout but an examination of this design will reveal the absolute simplicity of operation. No horns, no bellcranks, just simple direct linkage.

Plywood 0.8mm thick, was selected for the fuselage sides. The veneers that make up plywood are bonded together so that their grains lie at 90° to one another. This makes the ply very resistant to splitting, a major failure of natural timbers such as balsa. Whilst it is possible to reinforce balsa sheet fuselage sides with doublers and cross-braces the plywood sides have simplicity, if not weight, in their favour. A 3/16in. sheet balsa top and bottom is used for the fuselage and a ply/balsa composite crutch is used at the nose to carry the servos as well as form the nose taper. All parts that would often be plywood of over 1.5mm in other designs, are of a ply/balsa laminate. There are none of the difficulties associated with cutting out complicated thick plywood shapes, all plywood parts can be easily cut with a sharp modelling knife.

Wing Construction

Mark two 4in. × 1/16in. sheets of balsa to the angled cut lines indicated on the plan. Cut these using a straight edge and sharp knife. Sellotape together four sets of wing skins each comprising two sheets of 3 × 36 × 1/16in. balsa and one of the tapered pieces. Sellotape should only be applied to one side of the joint at this stage. Using the Sellotape as a hinge, bend back each joint, apply PVA glue then close and Sellotape the joint. Lay the four completed skins to one side on a flat surface to dry. It may be necessary to trim the long edges of the 36in. sheets with the aid of a straight edge to achieve a close joint.

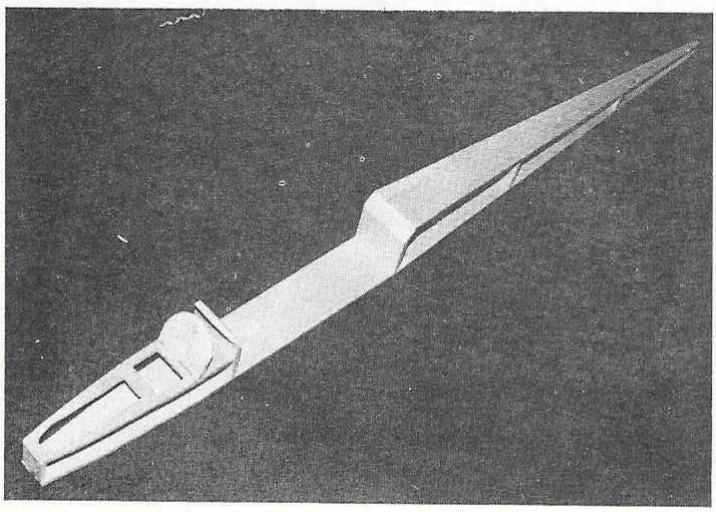
Transfer the wing rib template shape to either thick card or scrap plywood by pricking through the plan with a pin, or using carbon paper. Cut out a complete set of ribs including the 0.8mm ply doubler ribs. Mark the spar position on each rib from the plan then using an engineer's square and a knife cut each rib into two pieces. Bond the doublers to the root ribs and drill holes for the rear 10 swg dowel tubes. Cut out the two main spars and 0.8mm ply doublers. Epoxy the brass dowel-tube and doublers into place on the main spar.

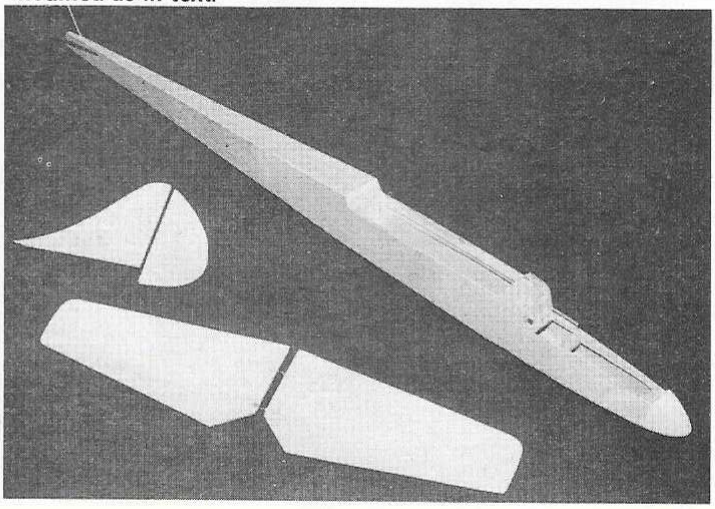
Mark the positions of the ribs and main spar onto the lower wing skins then pin down onto a flat building board. Pin and glue the main spar into position followed by the front and rear wing rib halves ensuring that the root rib W1 is angled as shown on the plan. Glue the 3/8in. shaped leading edge into position. Epoxy the rear brass wing dowel-tube into position. Insert a length of 10 swg wire into each tube and sight across both to ensure that these are level. Fill in above and below the rear tube with scrap balsa. Apply PVA glue to the entire top surface of the ribs, spar, etc., and glue the top skin into place. Repeat the procedure for the second wing but use the completed wing as an alignment jig for the wing dowel tubes. You will have to prop up the tip of the completed wing in order to do this. When both wing halves are completed sand down the entire wing, glue block balsa for the tips in place then carve and sand to shape. The fairing blocks on the centre section are added at a later stage.

Fuselage

Cut out all the formers, the laminated ply/balsa crutch for the fuselage nose, and the fuselage top and bottom from 3/16in. sheet balsa. You will need to splice 2 pieces for the fuselage bottom. Mark the positions of the

Below left: the basic fuselage assembly prior to the addition of the 0.8mm plywood sides. Below right: with control tubes installed and plywood sides in place the fuselage is nearly complete. Note that the fin shown is from first prototype – fixed to fuselage top, now modified as in text.





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THE MODEL ON THE COVER – AN RCM&E STAFF DESIGN

formers on the fuselage bottom then glue them into place at right angles. Add the crutch and the angled formers F2A and F4A. (Chamfers are required top and bottom of both these formers.) Lay a straight edge along the rear fuselage formers to check that the tops are level. Correct if necessary then add the rear fuselage top sheet.

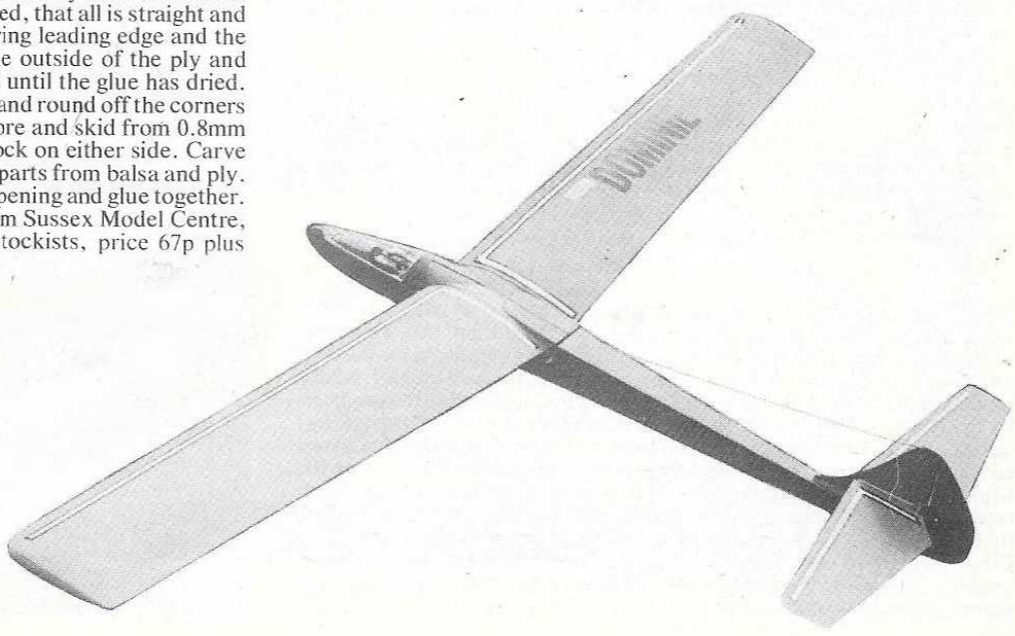
Now install the control snake tubes for rudder and elevator. If necessary immerse the plastic outer tube in very hot water to soften it, then straighten before installation. Use the same technique to permanently curve the rear end of the elevator snake tube which should project ½in. from the fuselage top. Cut out the 0.8mm ply sides and PVA glue to the rear fuselage. Do not attempt to glue the sides in place in one operation as this will probably result in a twisted fuselage. Gradually work from front to back checking carefully as each section is glued, that all is straight and square. The curved top decking between the wing leading edge and the canopy can easily be formed by dampening the outside of the ply and holding into place with a wrapping of Sellotape until the glue has dried.

When all the glue has dried, trim all the edges and round off the corners slightly. Cut out and laminate the nose block core and skid from 0.8mm ply and balsa. Glue into place with the nose block on either side. Carve and sand to shape. Laminate the canopy frame parts from balsa and ply. Sellotape the parts into position in the cockpit opening and glue together. A cockpit canopy moulding can be obtained from Sussex Model Centre, 10 Teville Gate, Worthing, or Micro-Mold stockists, price 67p plus p.&p.

Fin and tailplane

Cut out the ¼in. sheet balsa parts for the fin and rudder. Note that the fin is let through the top of the fuselage and is glued to the fuselage bottom. Drill 2 pieces of 3/16 × 3/16 hardwood for the 16 swg tube which forms a bearing for the all moving tailplane. Epoxy the tube into place with the hardwood strips on either side of the fin. Use a piece of 16 swg piano wire through the tube to help align the tube at 90° to the fin. Glue the completed fin in place then hinge the rudder with mylar strip hinges. Glue and pin the hinges after covering.

Cut a sheet of 3/16 × 3in. balsa as indicated on the plan and reposition the pieces to make the tailplane halves. Cut out the slots for the dowel tubes



and bond tubes into position in both halves simultaneously using the 16 swg dowels to keep the assembly in alignment.

Fairing blocks

Assemble the two wing halves and lightly band into position. Cut scrap soft block to approximately the correct shape for the front and rear fairings. Offer up the rear block for one wing half and trim as necessary to fit the angle of the rear fuselage. Glue in place then sand the top surface to fair in to the top fuselage and wing sheeting. Remove the wing and sand the wing root face of the fairing block smooth. Repeat with the remaining three blocks.

Radio Installation

Install the servos in the already fretted aperture in the nose section. Make up a rudder control cable using stranded wire inner and couple the rudder. Check direction of rudder movement relative to stick movement. Try to obtain a 30° travel either side of neutral. Elevator control is also via stranded wire cable inner. An adjustable clevis should be fitted at the servo end. There is no elevator horn fitted to this model. Connection to the all moving tail is directly to the rear tailplane dowel. Break off the pin side of a metal clevis and drill out the hole in the other side to a clearance fit on the 16 swg tailplane dowel. Solder the modified clevis directly onto the end of the cable. Total movement of the tailplane trailing edge should be 3/4in. maximum. This amount of movement provides adequate control and is easily obtainable with standard servo arms and the tailplane dowel positions shown.

Covering and Finishing

Nylon covering is the recommended finishing method. An acceptable alternative would be *Coverite* heat shrink nylon material. Normal heat shrink plastic films do not necessarily provide that 'extra' strength required for a beginner's model. Remove the radio equipment before covering. Sand the entire model and apply one coat of full strength clear dope. Sand again. Cut out a piece of nylon sufficient in size to cover the underside of one wing. Soak the material in water, squeeze out the excess and apply whilst still wet with clear dope. Stretch the material tight holding in place with pins if necessary. Turn over the edges doping them down well.

When the dope has dried, lightly sand the turned over edges smooth and repeat the procedure for the top surface of the wing. Sand lightly all over and apply a sufficient number of additional coats of dope to fill the pores of the nylon. Apply trim colour and transfers as required.

Cover all parts of the model, panel-by-panel in the same way.

Balancing and Test flying

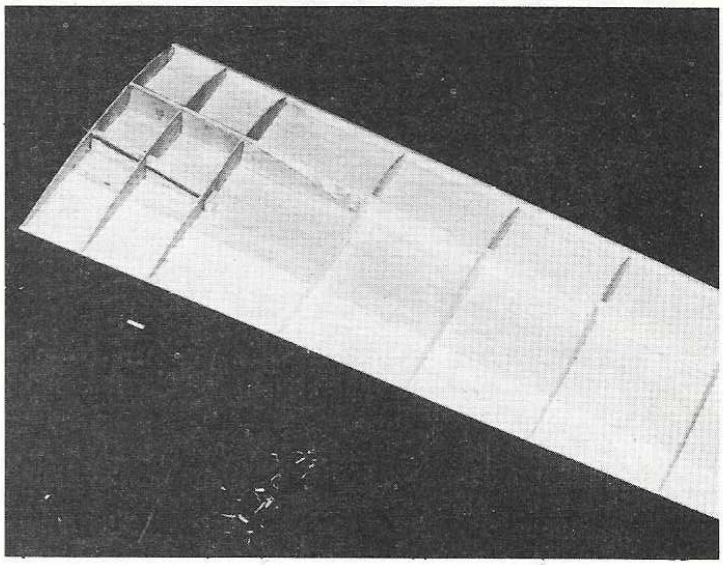
Suspend the completed and assembled model by a stout cord from the front wing joining dowel. Add lead shot to the nose until the model balances in a slightly nose down attitude. Secure the ballast with PVA glue. Check that all controls are free and operating in the correct directions.

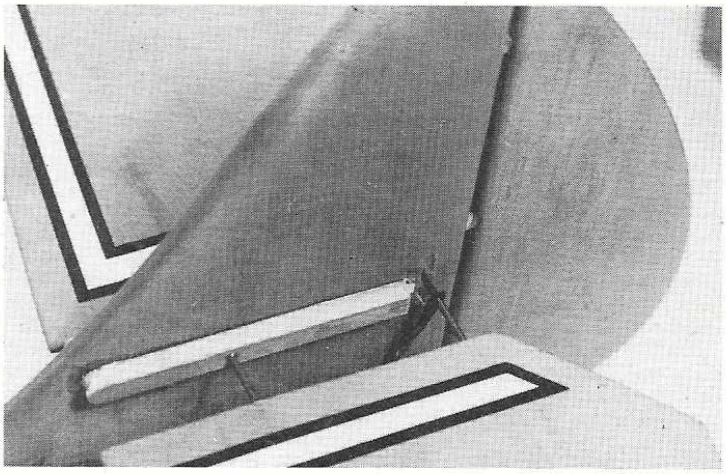
Wait for a day with a 10-15 m.p.h. wind blowing directly onto the slope. Ideally, find an experienced R/C pilot to check out the model for you – that is someone that you have seen yourself flying a model in a competent manner.

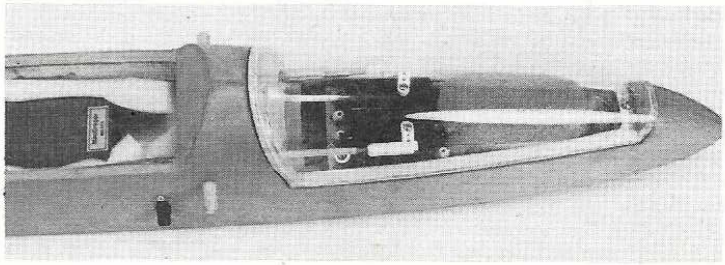
If you are a dedicated loner, launch the model directly into the wind slightly nose down, and endeavour to fly straight out, gaining height steadily. Before attempting to turn, apply a little down elevator to increase speed. Make all turns *away* from the slope, picking up speed before each turn is started.

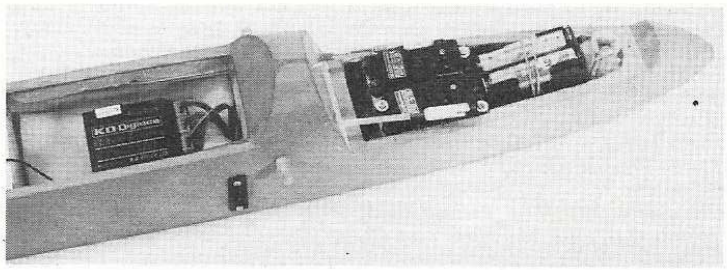
Landing is the most difficult part of the whole operation. Landings should be made directly into wind so that ground speed is at a minimum. Gain height then turn down wind and as soon as the model is over the apex of the ridge start to turn back into wind. This turn may take a little longer as the model is being blown down wind fairly rapidly. When facing into wind hopefully just behind the ridge out of the lift area the model should sink gently down to a landing. Should you be too high, fly out and round again and repeat the operation. Do avoid pulling back the elevator stick too far when travelling fast downwind for although ground speed may be high, airspeed could be dangerously low, and a stall may result.

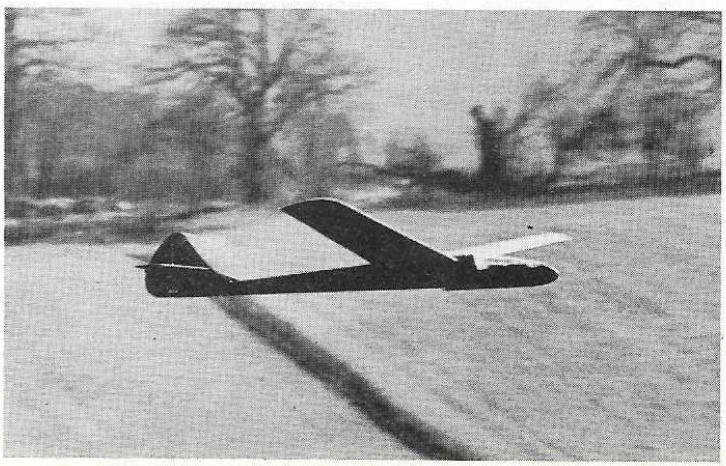
Dominie has no vicious tendencies, stall is gentle and straight ahead with instant self recovery. Loops and stall turns are possible – but allow plenty of height for recovering. *Dominie* is a tough yet elegant trainer with satisfying performance in a wide range of wind conditions. We wish you many hours of happy flying.











Right top to bottom: 1. wing construction is quick and easy. No washout is necessary, assemble the wings flat on the board. 2. Straightforward elevator connection has proved easy to install and positive in operation. 'Knuckle' type hinges were used for the rudder on our prototype. 3. A variety of types of R/C equipment were tried in Dominie – all proved 100% satisfactory. The MacGregor dry-battery 2 function outift is shown here. 4. Flight Link's Digiace fitted easily into the space provided. We used hardwood cross beams for the different servo installations. N.B. These installations were both temporary and the full complement of screws was not used. Do not fly your model unless all the servos are fixed properly. Bottom right: Dominie proved very stable and easy to position for in-flight photography. This shot was taken during one of the many proving sessions the model underwent.