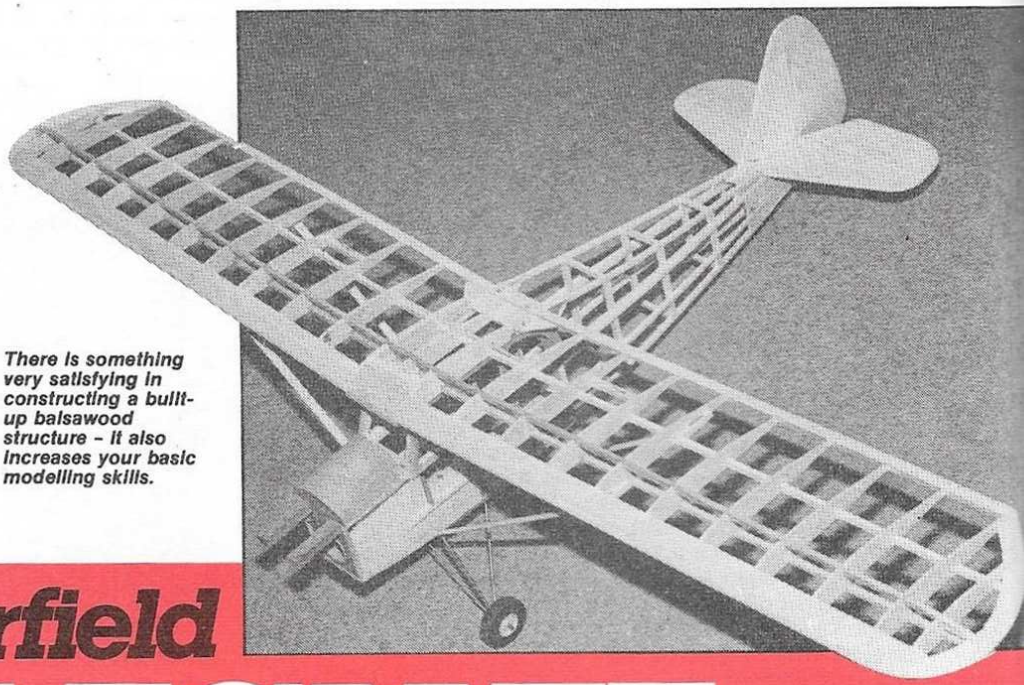
RM Porterfield COLLEGIATE

A 48 inch wing span sports scale model for .15-.19 cu. ins engines and three function radio

CONTINUATION OF THE RM FLIGHT TRAINING COURSE now involves the building and flying of the Porterfield 'Collegiate', a scale model of a high wing monoplane. Why a scale model? The majority of R/C modellers will, at some time during their modelling activities, want to build a scale or semi-scale R/C model. Indeed, one of the ever present problems is that newcomers to aeromodelling want to build a scale type as their first model — and it can take a lot of effort to dissuade them. But building a scale model, such as the 'Collegiate' is not an end in itself. Constructing the model and learning to fly it will, incidentally, introduce you to some new building techniques, increase your building skills and improve your flying ability. It is a natural progression from the 'Trainer' and the 'Aerobat' to taking you towards becoming the 'complete aeromodeller' — if it is possible to reach that exalted status!

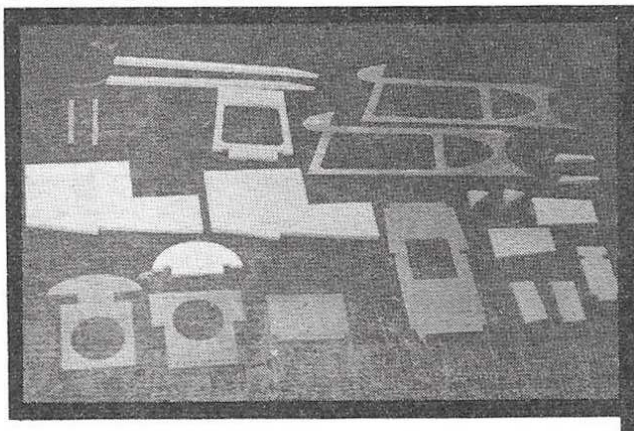
Scale models normally involve more complex airframe structures and the 'Collegiate' is no exception. Being relatively small and utilitising an 'open' structure i.e. not fully sheeted surfaces or G.R.P. and veneered foam materials, there is a fair amount of intricate work to carry out. Precision is important in the cutting of the wood parts, the bending of the pianowire components and the assembly of the airframe components. Whereas you could get away with parts not fitting absolutely right with the 'Trainer' and 'Aerobat', this one calls for a high degree of accuracy if you are to have a sound airframe and model with good flying qualities. For instance, there are quite a number of butt joints between longerons, uprights and crosspieces on the fuselage and if we are to end up with a structurally sound fuselage these joints must be well prepared. Gaps between the mating surfaces will inevitably lead to weakness — even when adhesives with gap filling qualities are used.

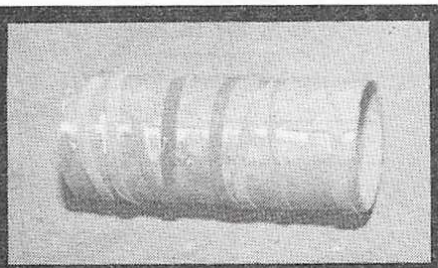
You may find some of the areas of construction rather 'fiddly' and they may try your patience more than somewhat. This is all part of the excercise of improving you basic modelling skills. When it comes to fitting the radio equipment you will again find that it is not 100% straightforward; the installation must be fully planned (although details are included on the drawings) as there is little spare space available in the narrow 'Collegiate' fuselage. Part of the general Training Scheme the model may be, but it is also an attractive and pleasant to fly model in its own right and well worth the effort of building. For the naturally interested builder the construction and finishing of the 'Collegiate' will be a rewarding experience. For those of you who have

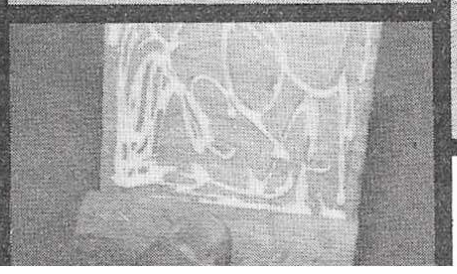


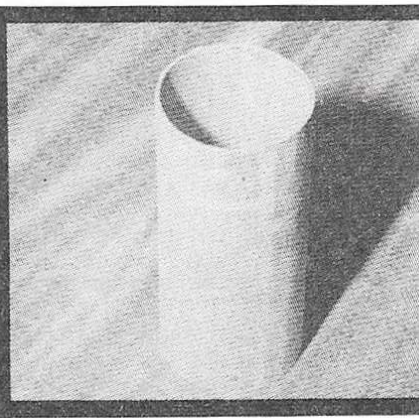
There is something very satisfying in constructing a built-up balsawood structure - it also increases your basic modelling skills.

Cut out the basic parts before commencing construction - it saves time and frustration in the long run. Illustrations below show the construction of the fuel tank housing. Thin plywood is wrapped around the bottle, glued and held with rubber bands.









found the building of the other two models something of a chore, or you found them to be on the limits of your manual skills, perhaps it would be as well to give this one a miss. We are not all blessed with great manual dexterity skills and there is no point in starting a project that will not be completed because of lack of ability, or because it provides little satisfaction.

Prototype history

Ed Porferfield was typical of the enterprising American individuals. His interest in flying led him to found the American Eagle Aircraft Corp in 1926, watched it grow to a major manufacturer of light aircraft, only to see it fail in 1932. Although he resolved to keep clear of the aircraft market in future a chance meeting with Noel Hockaday, the previous Eagle designer, in 1934, changed all that. Noel's 'Pup', as the prototype for the Porterfield Model 35 was originally known, was constructed by the Aviation club of Wyandotte High School — hence the eventual name 'Collegiate'. Porterfield was sufficiently impressed to purchase the aircraft, and the rights to manufacture, the first time he saw it perform.

In 1937, with the advent of four cylinder, flat opposed — reliable — engines, the CP65 Porterfield 'Collegiate' was developed. The C denoted a Continental engine, versions were also produced with the Lycoming and Franklin 65 hp. engines. These aircraft — the subject of our plan — were produced until 1941 together with a de-luxe CP75 version. This highly successful light monoplane rivalled the more illustrious Piper 'Cub' in popularity as a trainer and private owner's aeroplane.

Cut here

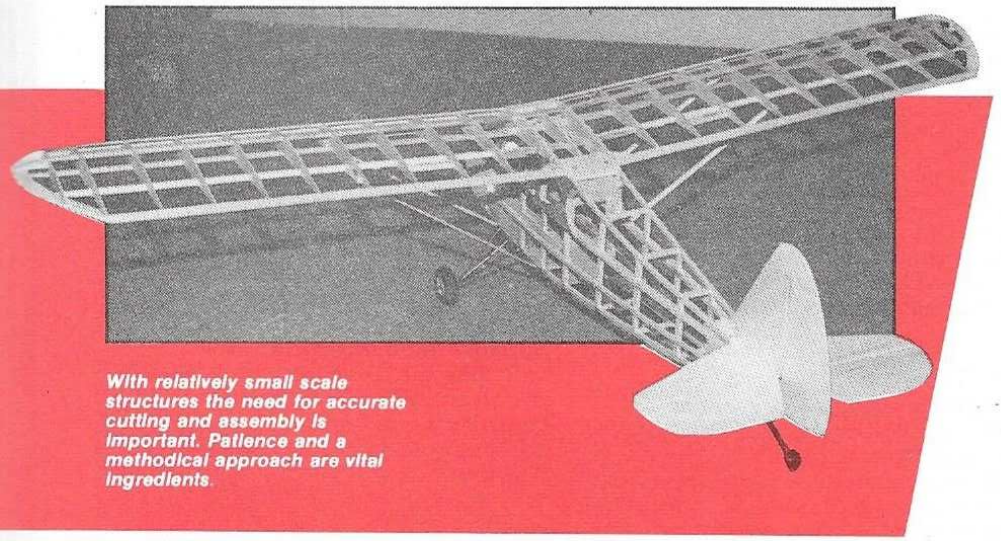
Our Radio Modeller version of the 'Collegiate' is designed to be powered by the same type of engine as the 'Trainer' and 'Aerobat'. Be warned however, you will not require the maximum output of a '19' or '21' engine to fly this model — if you happen to have a spare '15' sized engine this would be quite adequate for the 'Collegiate'.

Select your balsawood with care, the fuselage longerons and crosspieces should be from a flexible medium weight stock i.e. pliable but not too soft. Wing spars are from hard, straight grained, stock, spruce is recommended for the two main spars, but if this is not easily obtainable you could use very hard balsawood. Wing tailing edges are from 3/16in x 1/2in., either preformed trailing edge stock or you can plane and sand your own (prepare the chamfer before you cut the section away from the sheet). Tail surfaces are from a light medium grade of 3/16in. sheet - the slightly 'orangey' coloured balsawood is often good for these items. You will notice that fuselage former F3 is laminated, using a 3/32in. balsawood core and, ideally, .4mm plywood faces. Scrap obechi veneer can be used in place of the plywood, it isn't quite as strong but it is still a lot better than plain balsawood. Do, as normal, cut out *all* the parts before you commence building.

Side frames

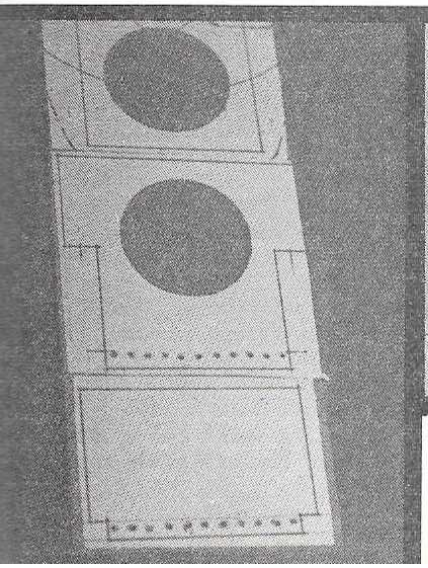
Start the fuselage construction by building the side frames from 3/16in. sq., 3/16in. x 1/4in. and 3/16in. sheet parts etc. Build the first frame directly over the plan — protecting the drawing with soap or candle wax — and then build the second frame directly on top of the first, placing a layer of cling film or thin polythene between the two frames. Remember that the 1/8in insets at the rear of the fuselage must be handed to finish flush with the outside surface. You can use cyano adhesive for the building but PVA white glue is equally as good — providing you have the patience to wait for it to dry. Mark on the plan the position of your engine and, therefore, the engine mounting bolt spacings on the bearers. Cut and drill the bearers and glue to the fuselage sides. Fit formers F1, 4, 5 and 6 to one fuselage side and leave to set.

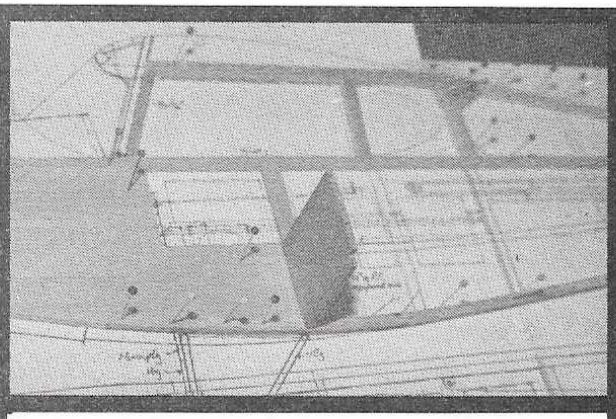
Before continuing any further we must consider the radio installation (it's no good completing the model and then finding that the radio will not fit into the fuselage). Because the space available for the radio is narrow and deep it would be rather difficult to mount the equipment in a conventional manner i.e. with servos fixed to bearers and the receiver and battery seperate. To ease the problem the radio equipment is all mounted on a plywood plate (1.5mm or, preferably, two laminations of .8mm plywood) so that it can be located and removed in toto. Normal sizes servos are a tight fit on the plate but can be used, and the receiver area is sufficient for most modern units. Do not use a larger Ni-

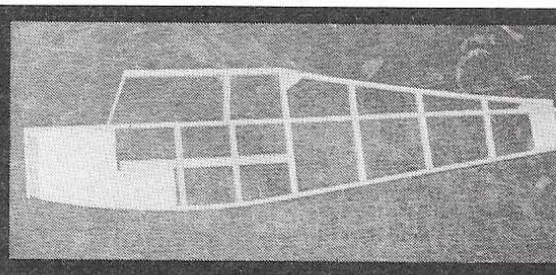


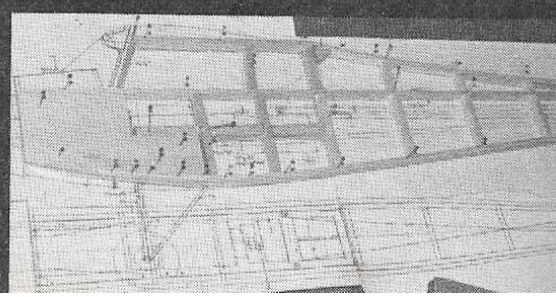
With relatively small scale structures the need for accurate cutting and assembly is important. Patience and a methodical approach are vital ingredients.

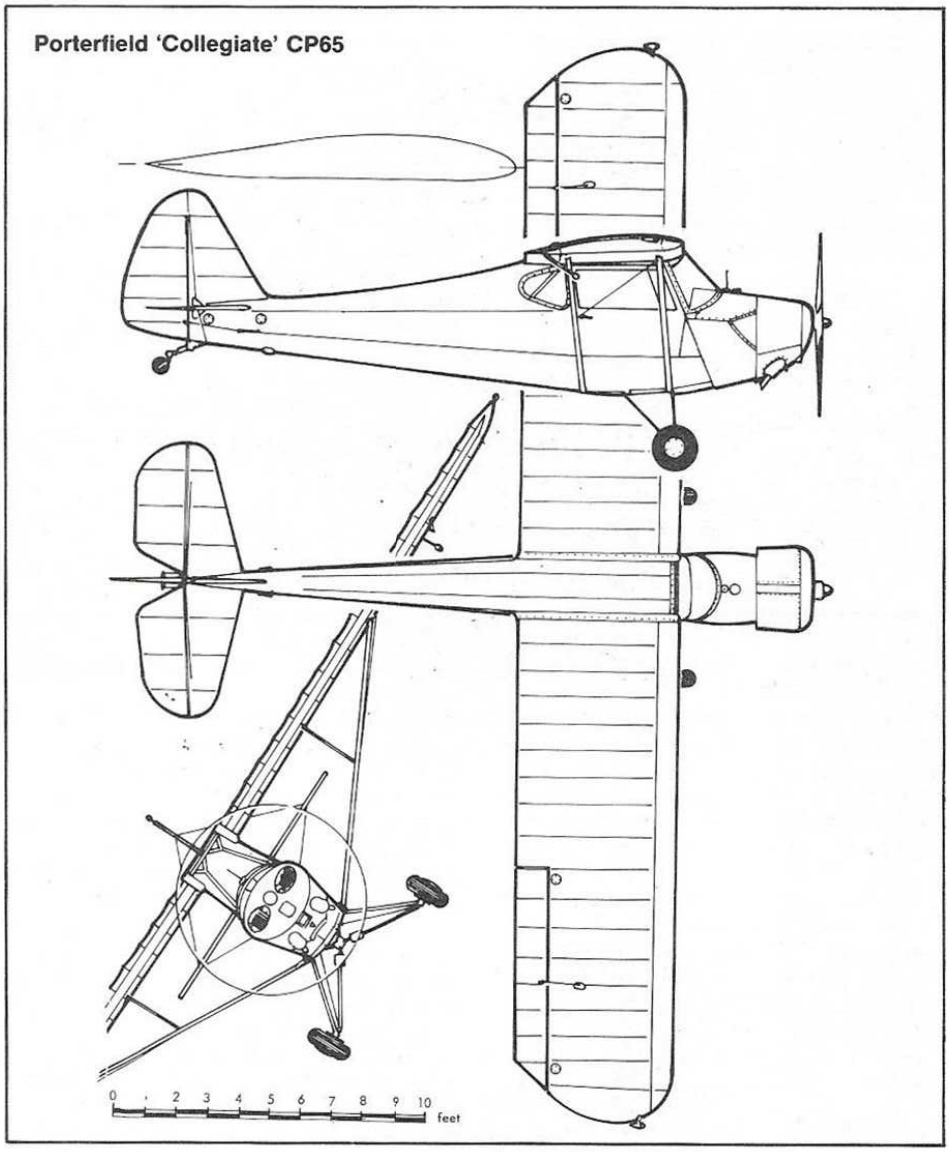
Plywood formers are cut out by taking photo copies and gluing them to the wood with Cow Gum. Use the formers to position the fuselage uprights. Basic fuselage frames are built one over the other, when separated the triangular fillets are added.











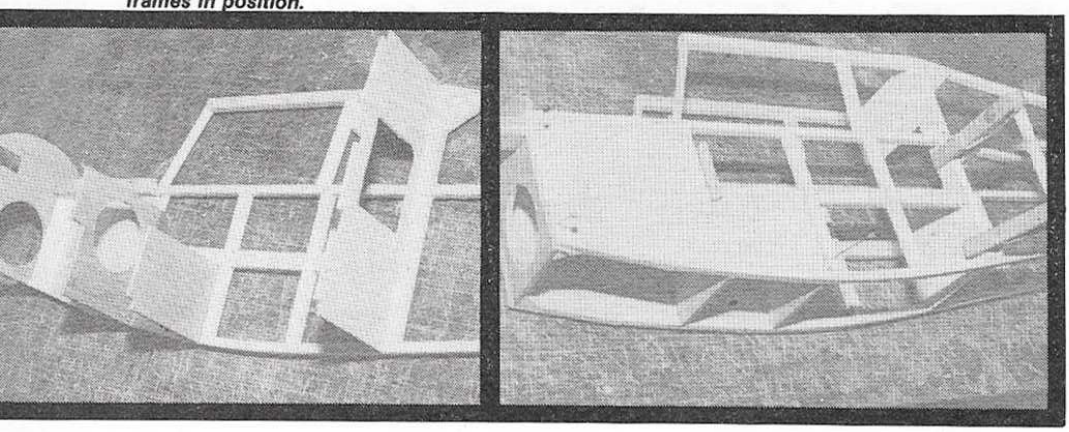
Cad battery than 225mAh size and this is fixed to the underside of the plate. 1/4in. sq. or 3/16in. x 1/4in. mounting rails are fitted to the sides of the fuselage and have captive nuts (insert nuts are the best) for fixing the installation plate. Use rubber grommets on the plate to give a little extra resilience to the mounting. When the complete plate is lowered in position the elevator, rudder and throttle pushrods must be moved to their rearmost positions to clear the plate. The switch is remotely operated by having a length of pianowire attached to the switch dolly and extending through the fuselage side.

No bananas!

Back to the fuselage construction. Glue the R/C equipment mounting rails to the 3/16in. x 3/8in. horizontal crosspieces and then fit the second side to the formers. Make a quick check that the stern posts align correctly when the sides are drawn together but do not glue the posts until the front fuselage assembly is complete. The fuel tank is housed in a tube fitted between formers F1 and F4, it can be made by rolling .4mm. plywood, or card, around the fuel tank and glued with PVA glue. If card is used give the tube a couple of coats of dope to strengthen it — the installation of the tube considerably strengthens the whole of the fuselage assembly. Fit formers F2 and F3 and, when the assembly is dry, bring together the rear ends of the side frames, install former F7, and glue the stern posts together. The remainder of the fuselage cross pieces can now be added — check, by looking down the fuselage, that there is an equal curvature on both side frames. Providing that the wood for the side frames has been carefully selected, and the formers have been fitted truly square, the fuselage should not finish up banana shaped!

To give the correct fuselage cross section 3/16in. sq. side stringers must be fitted, one over the intermediate longeron and one lower down, as shown on the drawing. The 1/4in. side cowls can also be glued in position now. Strenthen the cabin side areas by gluing .4mm plywood (or .8mm. ply) side frames to the structure. Wedge shaped pieces of 3/16in. balsa should be fitted to the top uprights to support the frames. Fix the 1in. soft block to the front of the cabin area and sand to the correct shape. Add the cowl top decking (from .4mm ply or card).

Formers F1, 4, 5 and 6 are glued to the right hand fuselage frame (check for squareness) allowed to dry, and the left hand frame added. Use pins, pegs, clamps - or any suitable item - to hold frames in position.



Wire bending

Bend the pianowire undercarriage parts accurately — don't be satisfied unless they are the correct lengths, angles and are really symmetrical, otherwise they will be difficult to join. Fit the front and rear under carriage legs to some scrap board, at the correct spacings, bind the axle areas — including the crosspiece — and solder (see illustrations). Bind the legs to formers F4 and F5 with strong terylene thread and coat liberally with epoxy. The tailwheel legs should also be bent to shape, bound to the 3mm. (1/8in.) plywood insert and glued to the rear end of the fuselage; the recess where the leg is fixed can be filled with light-weight Bondafilla.

Glue the 1/4in. sheet and 3/16in. sheet to the underside of the fuselage, note that the 3/16in. sheet chamfers to the sides (as if there were two underside stringers) these should be shaped before gluing. Sand the front side and bottom sheets to the rounded contours indicated, the 1/4in. sides fair in with the top decking and are thinned towards the rear to blend in with the side stringers.

That about completes the basic fuselage structure, next month we will continue with the wing and tail construction, struts, linkages and all the interesting finishing parts.

NOW THAT THE HARD PART of the 'Collegiate' is completed - the fuselage construction - we can concentrate on the wings, tail surfaces and the fun part, covering and decorating.

To dispose of the easy items; the fin, rudder, tailplane and elevators are all from sheet and only require the leading edges rounding and the trailing edges tapering and sanding. Don't taper the rudder and elevators too finely, leave an edge of about 1/16in. or the surfaces may warp when they are covered. The fin and tailplane tips have the grain of balsawood running clockwise to help prevent warping.

Wing construction

Construct the wing in three panels (centre and two outer panels) these are joined before covering. Note that the root ribs of the wing centre section only are angled to the template, the outer panels have the root rib vertical.

Spruce is recommended for the main spars but, if this is difficult to obtain, a very hard balsawood strip will suffice.

Build the panels flat over the plan, in a similar manner to the 'RM Trainer', taking care to obtain a good joint between the ends of the ribs and the 3/16in × ½in trailing edge. Although it takes a little more time and effort a stronger joint can be made by notching the trailing edge and extending the ribs to slot into the notches. The ⅛in top leading edge sheet follows the scale position and the upper surface is slightly rounded (together with the ¼in. sq. leading edge) to conform to the aerofoil section. Join the 3/16in sheet tip parts together and glue in position with a shallow camber, as shown on the typical wing section, the rear spar is cut back to support the tip.

Cut slots in the centre section and outer panel root ribs to receive the dihedral braces, these are from ⅛in spruce although plywood is acceptable as an alternative. Prop-up the tips by 1½in when the three panels are joined, the supports can be tapered down by ⅛in towards the front to give washout (trailing edges slightly raised at the tips). When dry, remove the wing from the building board and insert the dihedral braces.

If spruce is used the braces can be inserted in the form of straight pieces of strip and the protruding areas - on the outer panels - planed away afterwards.

Wing fixings and struts

Anchoring the wing to the fuselage is achieved by having a 1.5mm (1/16in) plywood tongue at the front and two 4 b.a. bolts (or 3mm) locating into anchor nuts, at the rear. Rubber band fixings could be used, as with the

Engine Cowl Offer

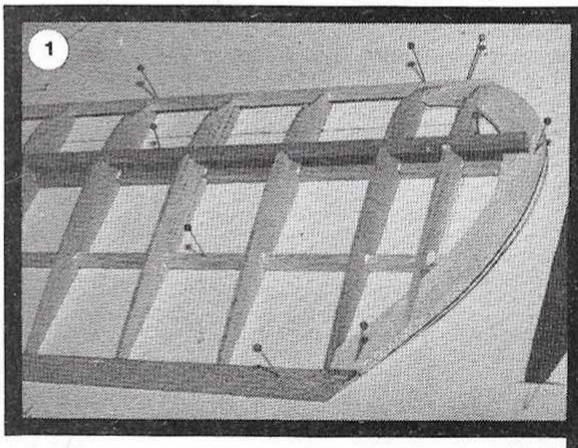
Moulded styrene engine cowls are available from MAP Plans Service, PO Box 35, Wolsey House, Wolsey Road, Hemel Hempstead, Herts. HP2 4SS. Price £1.80 including postage and packing.

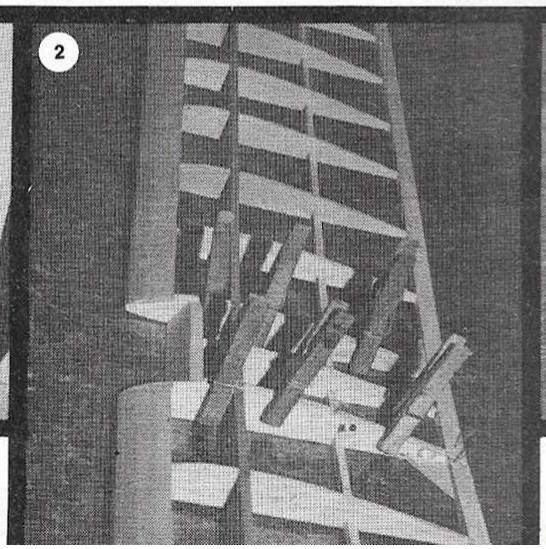
Prototype model of the Porterfield 'Collegiate' was covered in light blue and silver Solarfilm and weighed a touch over 2lbs complete. Thinned matte fuel proofer was brushed over the covering to reduce the high gloss effect, the fuselage stripes were self-adhesive car trim type.

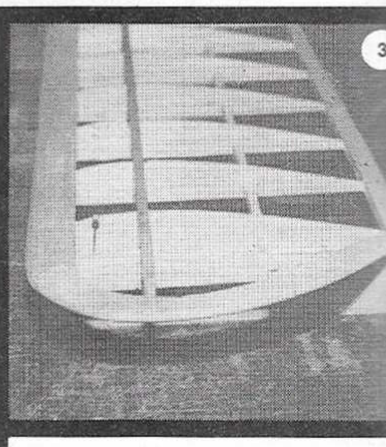
RM Porterfield COLLEGIATE

A 48 inch wing span sports scale model for .15-.19 cu. ins engines and three function radio

Picture 1 shows the starboard wing structure pinned to the building board, note that the wing tip piece is raised off the board. When the three wing panels are constructed they are joined together on the board (2). Supports are fitted under the wing tip ribs to give the correct dihedral (3) - they may be slightly higher at the trailing edge to give the outer panels 'wash-out'. After joining, slots are cut for the dihedral







'Trainer' and 'Aerobat' but this does spoil the scale appearance. Check the fitting of the wing to the fuselage before covering remembering to leave clearance for the covering material where the wing leading edge fits around the fuselage at the centre section - covering materials may be thin but four thicknesses do reduce clearances!

Wing struts on the 'Collegiate' are not strictly functional but securing them soundly may prevent the wings folding during an inadvertent sharp pull-out from a steep dive - it is also good experience for other scale models built at a later date. Struts are retained by the use of small split pins - around 1/32in to 3/64in in diameter - the attachment to the wings being permanent (after covering) and the opposite ends secured to the fuselage by a removable 20g piano wire rod. Lengths of struts are shown on the plan but it is advisable to check the actual lengths with scrap strip balsawood before finalising the length of the struts. The important point is to ensure that the length of the two front, and the two rear, struts are identical.

Strut fitting points (split pins) in the wings are fitted before covering, the small projecting heads do not present any problems during covering. Push the pins through the holes in the strip supports and bend the legs over the top side. Secure the split pins with a dab of cyano or epoxy adhesive. After the airframe is covered the split pins are slipped through the projecting heads of the pins in the wing and then epoxied into the ends of the struts. This retains the struts to the wings but allows them to pivot. Jury struts (the small struts from the main wing struts to the underside of the wing) can be simulated by using hat elastic or small section rubber. This will allow the struts to be folded away on the wing without having to devise intricate separate fittings for the jury struts - they may be omitted entirely if desired.

Covering and finishing

Before the fuselage is covered, or the side window glazing fitted, the interior of the cabin area of the fuselage should be painted. An aerosol spray is the easiest to use for this application; give the interior structure a light spray of a suitable colour (I used an orange which turned out to be too dark, but couldn't wait to get a more agreeable tone!).

For a smallish model such as the 'Collegiate' one of the heat shrink films, e.g. Solarfilm, is quite acceptable for covering. Nylon or heat shrink fabric will give a tougher finish but take care not to allow any warps to develop in the structure. As we are dealing with a scale subject, as opposed to the abstract designs of the trainers, we will want to have a colour scheme representing the prototype aircraft, i.e. the *appearance* of a fully painted aeroplane. Using doped nylon covering will require the model to be painted overall to obtain this effect and the weight increases could be detrimental to the flying performance. Self coloured heat shrink covering materials have the advantage of requiring only a minimum of paint trim or transfers.

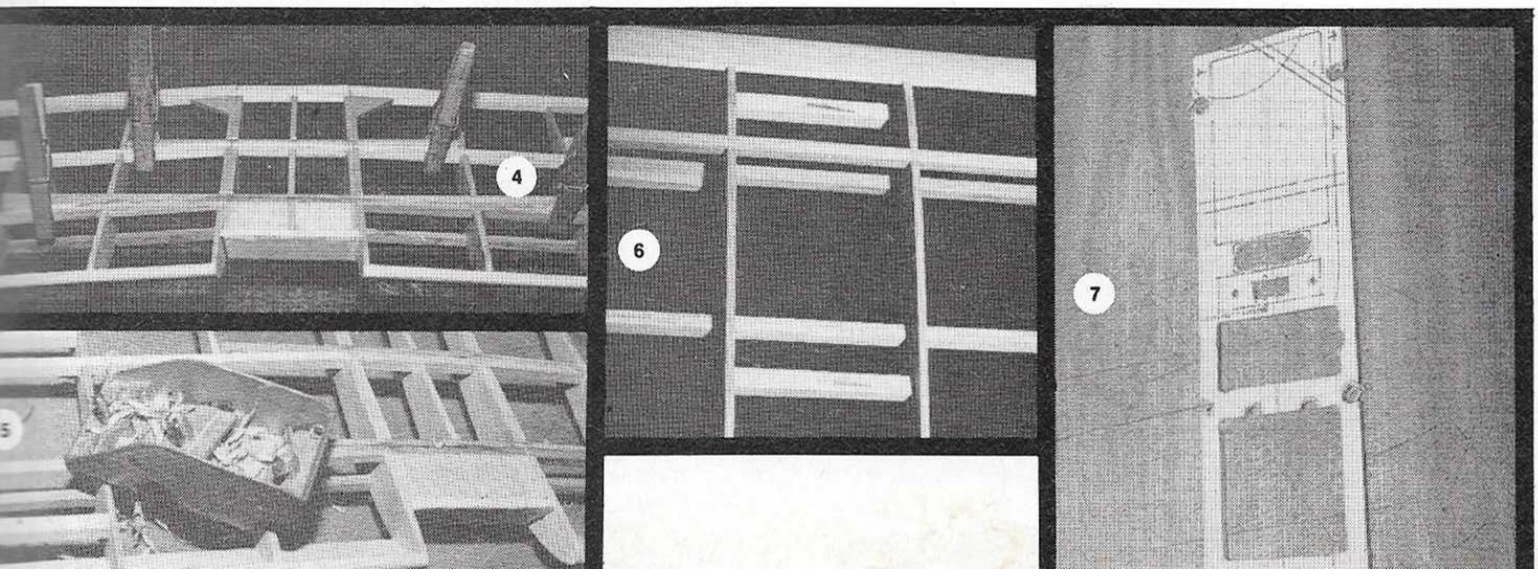
A few general points on finishing may be of assistance. Do check the radio linkage installations before you start to cover and cut the openings in the cowl for the engine. Silencers in small scale models always present a problem (the photographs were taken before I finalised my selection of silencer) and I can only suggest that you hunt around for the least obtrusive type.

Cover the fuselage before you fit the cabin glazing, it is much easier to trim around the openings without the glazing in place. There is not over-much area to attach the side panels so cut the clear plastic sheet accurately (place it over the plan and score the sheet). Place the glazing in position and glue by 'wicking' small amounts of cyano adhesive to the inside edges of the panels. Mark centre lines on the front windscreen and check the fit before finally gluing in position.

Plastic film covering has a high gloss finish and, although full size aircraft normally have a glossy surface, this looks wrong on a model. For some obscure reason the smaller the scale of the model the more matte the surface must be to give an authentic appearance. Fortunately, it is not difficult to give the film a matte finish. All you need to do is to brush

Wing lettering for the 'Collegiate' was cut from black self-adhesive Fablon. The method for cutting and fixing these letters will be detailed in a future 'Storyboard' article.

braces and these are glued in position (4). If straight lengths of spruce are used the surplus is planed away (5). Strut retaining split pins are pushed through the ¼in. sq. strips, bent over and epoxied (6). The radio equipment mounting plate is shown in picture 7, ideally this should be constructed from two laminations of .8mm plywood.



on a coat or two of clear polyurethane matte varnish - the 'one part' types are suitable. Thin the varnish about 50/50 with white spirit and brush over the pre-shrunk film. Carrying out this operation in artifical light it is easy to leave gaps in the painting (very noticeable after the varnish has dried) so take the trouble to brush the varnish on in one direction and 'lay-off' in the opposite direction with light brush strokes. If necessary give a second coat of varnish. You will find that the film starts to sag - particularly after a second coat - don't panic, the covering will tighten again as the varnish dries.

One other problem associated with film coverings relates to matching the colours for parts that cannot be covered, e.g. engine cowls and undercarriage struts. I could not obtain a good match to the Solarfilm blue used for the fuselage (the shops were closed at the time) so I opted to paint the cowling silver to match the wings and tail surfaces. The moulded cowling was a pre-production version but the results, after painting with a silver enamel, were quite pleasing - until I tried to fuel proof it with the clear varnish. Unfortunately the varnish reacted with the silver paint and proceeded to lift and dissolve the paint. I left the mess to dry off, rubbed it down with a fine abrasive paper and painted again with the silver enamel. Reactions between the silver and varnish were again obvious but by this time I had had enough! When the production versions of the cowl are ready I shall have another go - this time with a matching blue colour. Silver is a notoriously difficult colour to use so do be warned, check for compatability with fuel proofers before using (I've got a sneaking feeling that this is the second time I have made this mistake).

Flying preparation

As stated in the previous article, the radio equipment is a tight fit in the fuselage when standard servos are used. Be gentle with the installation. Control surface movements of about ½in each way on the rudder and ¼in each way on the elevator should be sufficient for test flights. If you have rate switches on the transmitter you can afford to go for a little more movement on maximum travel and correspondingly less at the lower rate settings.

With the engine in the inverted position you will have to avoid over choking and flooding the motor during starting. Alternatively the model can be held inverted for starting and righted once the engine is running - what's the point in not using a clunk tank when it is fitted! Incidentally, one thing I forgot to mention was the smearing of a fillet of silicone bath sealant at the junction of the fuel tank and the inside of the plywood tube. This will effectively seal any gaps, prevent the tank from rotating but allow the tank to be removed in cases of emergency.

. . . and away

Hand launching is recommended for test flights for the 'Collegiate', unless you have a very smooth take-off area. If you are still a relative novice at R/C flying take the prudent action of getting an experienced and proficient flyer to take the model up for the first flight. Even if you are reasonably competent, the fact that you have spent many hours in completing your scale creation will make you a little nervous about flying the model initially, so stand back and enjoy watching it for the first time around. For a change, I will not give you a whole list of do's and don'ts for flying the 'Collegiate'. It is not all that different to flying the 'Trainer', just a touch more sensitive on the controls and, because of the smaller tailplane area proportion, requiring a little more elevator movement during the landing round-out. What should it weigh? Whatever it finished up at! If you have been sensible with the building and finishing it should not be too far away from the prototype model which weighed-in at just over 2lbs ready to fly - less fuel *and* pilot.