

# Casper

**A classic 76" span sports beauty by Adrian and Hugh Kingsford**

**M**y Dad and I have always enjoyed designing, building and flying model aircraft – not only sports types but more notably aerial photographic models. When it came to 'Casper' the objective was to come up with something that not only performed well, had pleasing lines but was also fairly straightforward to construct! We began preparatory sketches for this high wing strut layout in 1985 and, along with a couple of other models, finished the layout in 1987! Designing other models helped us to come to a much clearer understanding of the



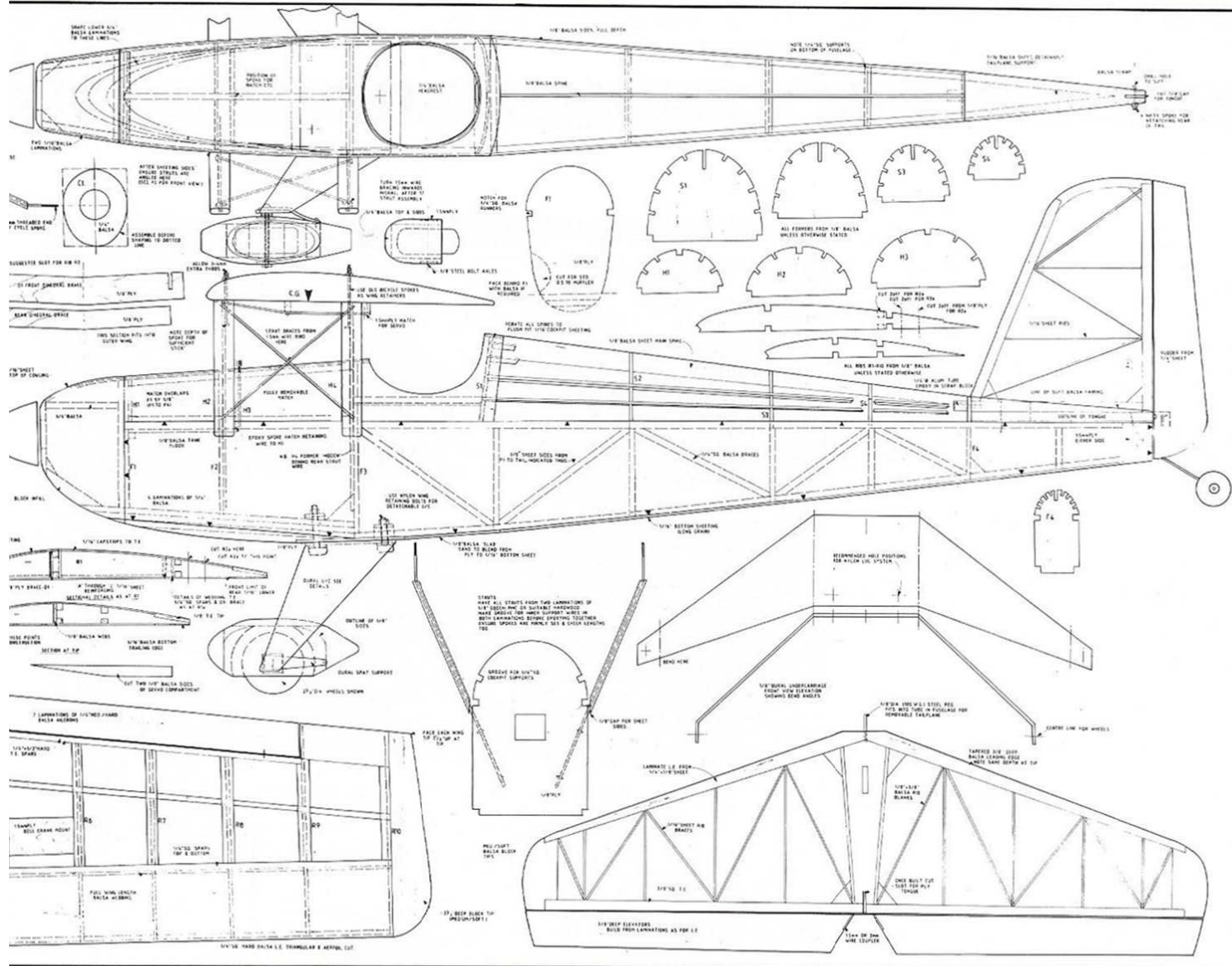
constructional requirements and materials needed for this modest sized sports model. 'Casper' has been put together with a degree of portability in mind, therefore a detachable tail, undercarriage and a simple one-piece wing have been incorporated.

### Fuselage

Construction is mostly straightforward, however, the strut assembly and wing alignment will require careful attention. Start by making the two rear sides from 1/4in sq. hard balsa spars, from F3 to the tail – don't attach these to F3 yet. Make sure that the top 1/4in sq. balsa longerons continue forward far enough and allow a little extra for the curve. Leave these unglued to F1 and F2 at this stage.

Next mark out and drill holes in F3 for the supporting struts, the two rear sides can now be assembled to F3 using the top plan view as a guide. The rear cockpit former S1 is next followed by all bottom 1/4in sq. spar supports, S2, S3, S4 and F4. Keep a close

*Engine in the prototype is an O.S. 30.*



*All set to go; model should weigh around 5lbs dry with motor installed.*

first, the front fuselage sides must be pulled in gradually for best results. Five minute glue is an advantage here, the only other possibly 'tricky' bit is gluing in of the front bottom balsa laminations. After installing F1 and F2 fit the bottom four laminations and leave final shaping until the fuselage is nearly finished. Be sure to leave the laminations protruding forward under F1, these are later utilised when constructing the cowling.

After sheeting the fuselage with 1/8in balsa, fit the two 1.5mm ply inserts at the extreme end of the fuselage. These will be used later for helping to retain the tail unit in place.

### Hatch and engine cowling

The forward fuselage hatch is made pinned to the upper fuselage, with a layer of wax paper between the two! Pin the two lower outer runners first then H1, 2 and 4 onto the hatch runners. A top 1/4in sq. spar 'spine' is next, followed by four 1/4in by 1/8in supports. Cover the hatch framework with two laminations of 1/16in balsa; these should protrude over F1 by 1/8in (the thickness of this former). For retaining the hatch a threaded cycle spoke rod and end is utilised, glue the rod to H3 and make sure the correct length of thread is exposed

eye on the alignment of all the formers for the final strut positions (and therefore wing setting) depend on your building expertise! The top rear spine is next, followed by the wedge shaped scrap block at the extreme rear of the fuselage. Do not saw cut the block until the tail assembly is completed. **NOTE:** you may prefer to leave fitting of the top stringers, together with the two 1/16in cockpit surrounding laminations until later - this will allow easy access to the elevator and rudder servos, etc.

Make the slots in all the top rear formers a little oversize - it pays to leave enough space for a good bond! The cockpit balsa supports can now be glued into place and at this stage (only if you prefer) the top stringers and two laminations of 1/16in balsa

around the cockpit. The top area between F4 and the very end of the fuselage should be covered with hard 1/16in cross grained balsa. If you don't wish to utilise the 'removeable tail concept' this can be omitted.

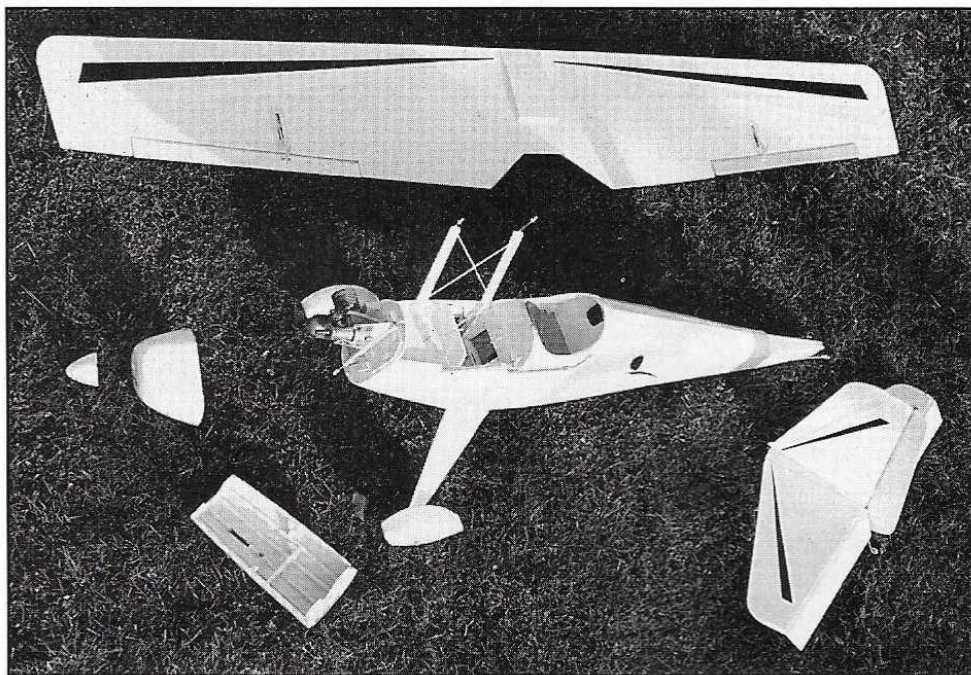
If you wish to mount the engine on its side, with the exhaust venting at the bottom of the fuselage, F1 will need to have the appropriate cut out made. A small soft balsa block can be fitted against the back of F1 and shaped after sheeting the fuselage sides. If, however, you prefer installing the engine in an upright position then the cut out in F1 can be omitted. F1 and F2 go into place on the two front 1/4in sq. longerons; mark the positions of the front struts and drill holes for these before attaching F2 to the longerons! F2 should be glued into place

above the hatch.

The engine cowling is built utilising the bottom balsa laminations on the fuselage that protrude forward of F1. Make another 'blank' from F1 from 1/4in balsa and cut out C1 together with several scrap balsa 'supports'. Pin the F1 blank to F1 and place a layer of wax paper between these. This is then followed by the scrap 1/4in cowl supports (the more the merrier!) and C1. The scrap supports and the F1 blank can always be trimmed to give a good fit around the engine later. A .30 engine gives a realistic flight, but for those wanting a more sprightly performance we suggest .35 to .40s. The cowling is held in place with a threaded rod which passes through a short aluminium tube, glued to the engine mount (see photo). When fitting the cowling the rod first passes through a scrap block, glued into the inside top of the cowling, the tube, then the bottom of the cowling. This makes for a first class fit as long as you get the holes lined up in the right place. After the frame is made, sheet the cowl with laminations of 1/16in balsa on the top and sides. When dry, sand/match to the engine and finally give the cowling several filler coats of paint before a coat of gloss, etc.

## The struts

These are made from two laminations of hardwood (we used obechi). Needless to say, the correct positioning of all four struts is ESSENTIAL, therefore a simple cardboard template (taken from the plans centre wing section) could prove useful. Punch correct



surface (when fitted) a minimum of 1.5cm and if necessary can be trimmed later on. It pays also to bend each rod end to the correct angle before actually gluing into place...

Wiring and gluing of the struts to F2 and F3 can be left until the wing is built. However, if you prefer to, go ahead with the struts at this stage – whatever your choice make sure all wire areas to be bonded are

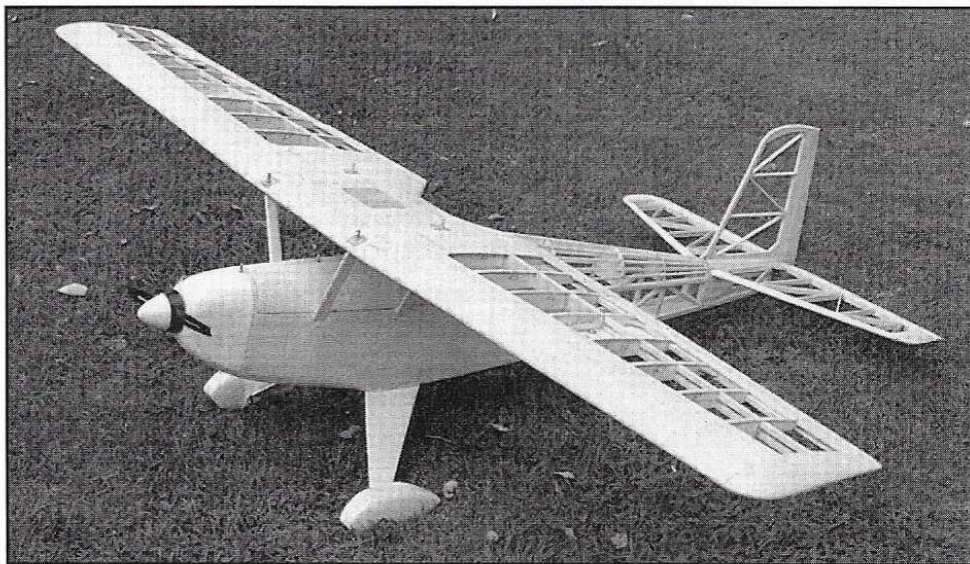
*Model breaks down into manageable bits; small plastic pieces glued in place around aileron pushrod exits prevent covering film from tearing and make for a very neat finish.*

## Tail and fin

The tail section has been designed to be detachable, this means that if you own a small car the risk of damaging it (not the car!) will be less. If you find no need to go this way then leave out the locating tube, steel peg in the leading edge, rear ply tongue and the two rear fuselage ply inlays. Construction of the tail is straightforward; begin by cutting out all the necessary parts (i.e. leading and trailing edges, all rib blanks and the central balsa block, etc.) For maximum strength the fin is rebated into two slots in the central block – so be sure to cut out the two holes in this.

With the flat tail, start by rebating the tapering l.e.s and t.e.s into the tips, 1/4in gussets should be glued against the two centre ribs for further reinforcing. If going 'detachable' instal the short steel 1/8in peg into the front of the two l.e.s and at the same time instal the second tube-balsa retaining block to the fuselage (former F4). After gluing in place all the rib blanks, make the elevators from two laminations of balsa, 3.5mm and 6mm. When dry, plane to shape. Both elevators need to be joined by a 1.5 or 2mm connecting wire. Roughen up the areas to be glued.

The vertical stabiliser – for us laymen, the fin – is equally easy to build! Cut out the l.e. and top balsa curves and, together with the t.e. and bottom fins, support pin these to the wax covered plan. Three 1/4in balsa gussets are used for bracing strength; glue the two ribs that bond onto the corner gussets then the remaining blanks. Cover all gussets with an extra coat of glue, there is no 1/16in balsa sheeting employed on either tail surface. The fin slots into the flat tail using two tongues, the front one from 1/4in ply and two outer laminations of 1/16in balsa – the rear one is 1/8in ply. Before joining



hole positions in the template and then fit this over the top of the struts/threaded rods during final wiring and bonding etc.

A groove will need to be routed lengthwise in each 3mm strut lamination so that when both pieces are joined, encasing the central 3mm wire, a neat fit is obtained. The central wire must protrude the correct distance below each hardwood lamination for fitting into F2 and F3. Once again use five minute glue or any good epoxy, a strong bond is desired! The top threaded rods used for actually attaching the wing are glued, into place next to each main strut wire. These should project above the wing's upper

*'Casper' in her underwear; straightforward structure was covered in white Solarfilm.*

well roughened up. Strut bracing is 1.5mm wire, the end of each brace should be bent to a right angle and small holes drilled in each strut to allow recessing of each 'hooked' brace end.

An 1/8in plywood undercarriage platform is needed below F3 and requires careful fitting. Trim both lower 1/4in longerons together with the two lower front balsa laminations: the undercarriage itself is made to be detachable if so desired and therefore three nylon threaded bolts are shown on the

the fin to the tail you may wish to cover each unit, trimming off excess film to allow adequate gluing area. Two side tail fairing blocks are required; cut these to shape then cover, trim away excess film before gluing into place, etc.

The rudder is shaped from 1/4in sheet balsa. Sand the extreme trailing edge of the fin to match with the leading edge of the rudder. A small notch should be cut in the l.e. of the rudder to allow full free elevator movement (the wire connecting each half) The 1.1/2in tail wheel is glued to the rudder and sandwiched into place between two

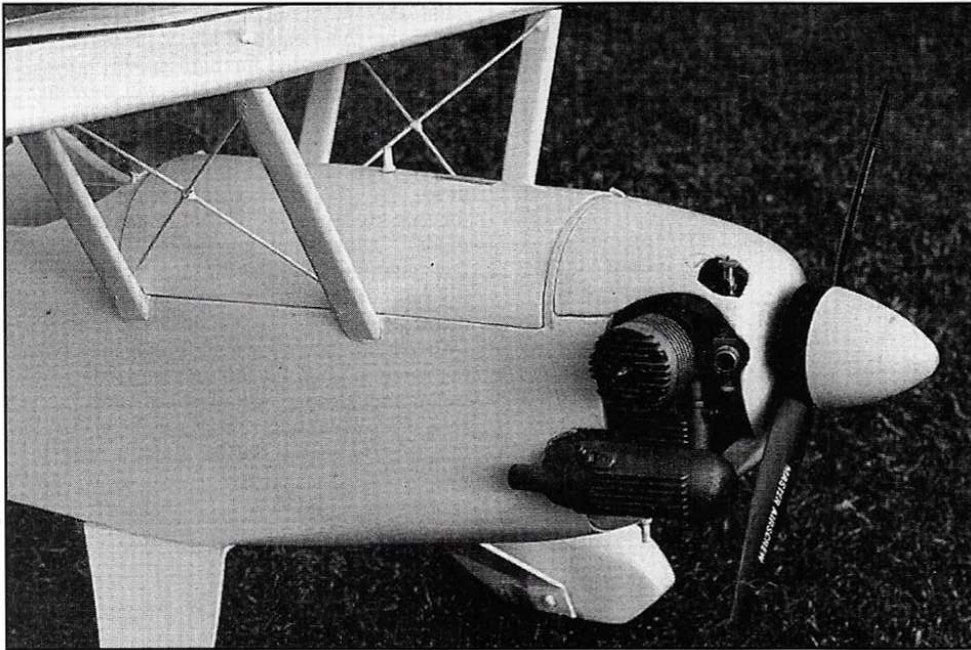
over the wax paper where the 1/4in bottom spars and ribs will go. More scraps of wax paper are needed, put these over the scrap packing before pinning bottom spars, ribs, l.e. and top spars, etc. Note that ribs R1A, R2A and R3A protrude behind the rear spars and are different lengths. Instal the block trailing edge sections before removing the inner wing panel from the board. When dry sheet the bottom of the wing with 1/16in balsa (firm). This precedes more 1/16in balsa reinforcing at E, F, G and H – glue these in place from the top. For those pilots who are thinking of throwing this model

scrap 1/16in packing to the board (don't forget that wax paper!) pin both bottom 1/4in spars, followed by the inner and outer bottom 1/16in balsa t.e.s. Fit ribs R2 through to R10, cut R5 to R8 to length then fit the aileron facing spar – make sure this is also packed up 1/16in off the board. The facing spar will later be capstripped top and bottom for extra strength.

The two 1/4in sq. hard top spars and l.e. are next, followed by the two top t.e. pieces from 1/8in balsa. Next fit the wing tip; this can be from either balsa block or built up using several laminations of medium soft balsa sheet (1/4in). Glue in place flat to the board and allow a minimum of 1/16in to protrude above R10 – there are capstrips and sheeting later on. Shape the wing tips after the wing sections have been joined if you prefer.

When dry remove the outer wing from the board, elevate the wing tip 2.1/2in and use a right angle from the board to instal rib R1. When dry, cut slots in R1 and R2 to allow the dihedral braces to fit neatly into place – fill the small gap between the rear brace and 1/4in spars with scrap balsa block. Roughen the ply surfaces where the braces are to be glued – this helps to give greater adhesion.

One eighth vertical grained balsa webbing is required on the front of the 1/4in spars from R1 to R10, and also on the back of the front spars from R1 to R4. More 1/8in webbing goes from R2 to R5 along the front of the rear spars; all webbing can be fitted before or after joining the wings. Next instal the aileron platforms and bellcranks. Holes for the cables-connecting wires can now be drilled through all three wing panels; a



outer laminations of 1.5mm ply... a 'hook' end at the very top of the tail wire will add more strength. A secure fit is desirable when fitting the tail unit to the fuselage, take care when fitting all the relevant tail locating parts – a crooked tail isn't on the agenda!

## Wings

There are 26 ribs all told, 10 to each outer panel and six for the inner wing section. The final joining of the three wing sections will give a strong one piece wing, not too cumbersome to carry about. All three wing panels can be built on the building board.

Begin by cutting out all the wing ribs; we suggest you use the ever popular 'sandwich' method for obtaining the outer wing ribs. This will mean ply template ribs at R1 and R10 – place eight balsa blanks between the two ply ribs, pin into place and shape away...oh, you'll need two sets of ribs! After this use the ply R10 rib to get two more R10 ribs, both from 1/8in balsa. For the inner wing section again use two ply template ribs, R1, with six blanks placed between these. Both R1A ribs and R3A ribs are from 1/8in balsa, both R2A ribs from ply. **DON'T CUT THE REAR 1/4in spar grooves out yet**, these are in different positions to the outer wing grooves (R1). Also, delete the top t.e. rebate for all centre section ribs.

## Centre section

Start by placing 1/16in scrap packing

*Hatch, cowling and O.S. 30 detail in the prototype; strut bracing is from 1.5mm wire.*

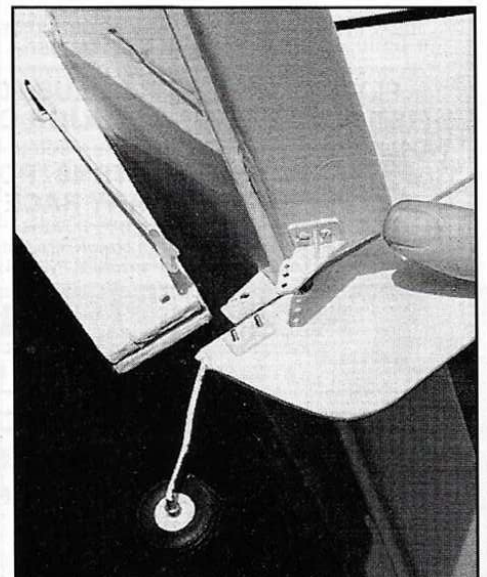
about the sky, extra inlays can be added at A through J...

Next cut and install all four dihedral braces to the front of the centre section spars. Cut the appropriate slots in both R2A ribs to match these. The webbing is from 1/8in balsa (vertical grain) except at the rear of the t.e. 1/4in spars – this should be from 1/16in balsa. Four blocks are needed in the wing to receive the struts; make these from either hardwood or hard balsa with 1.5mm ply 'plates' top and bottom. Do not drill the holes in the blocks at this stage. Note that these are full depth and should be shaped to fit flush with the top of both ribs R2A. If you prefer access to the aileron servo via the top of the wing, instal the four small hatch retaining blocks. Some fliers may prefer a bottom servo access hatch; regardless of your choice cut out the sheeting between both R3A ribs and add the two small bottom side hatch fairings. After gluing these in place below both R3A ribs cover the 'hatch' with 1/16in balsa or thin ply.

The top of the centre section is covered with 1/16in balsa sheeting, give extra attention to the t.e. where the sheeting meets the blocks at the t.e. When dry shape the blocks and sand with fine sand paper.

## Outer wings

Cut all spars to length and after placing



*Tailwheel close-up; whole tail can be detachable if you wish. Text has full details.*

suitable length of sharpened steel wire (held in the drill) works well over the required distance. Assuming that you've got the dihedral braces at the correct angle, joining of each outer wing to the inner wing panel will be straightforward.

Support the outer wing 2.1/2in off the board, using two small clamps to hold the braces firmly in place during gluing. A small

piece of ply scrap behind the webbing (from R1 to R2) will prevent any crushing of the webbing. After each outer wing section has been mated to the centre panel, all the remaining top and bottom 1/16in balsa sheeting and final capstripping is glued into place. When completed the one piece wing is strong and also makes for quick assembly to the fuselage.

## Matching wings to struts

The template used previously for aligning the struts in the fuselage can again be utilised. Lay the template against the bottom of the inner wing and mark through the holes. Sit the wing onto the struts and check visually BEFORE DRILLING HOLES in the wing. If you need to make further adjustments use small hardwood scraps on the relevant strut tops to obtain the right seating of the wing.

## Undercarriage

The main undercarriage is cut from 1/8in dural, drill the holes for both the axles and the three nylon bolts prior to bending the dural. Wheel spats streamline any model, however, it might be worth noting that in long grass some spatted models have an annoying habit of nosing over! If you intend flying this model from a closely cut grass strip or flat runway then by all means fit the spats - if there is any doubt leave them off and/or fit slightly bigger wheels. The parts

are made from a centre lamination of 1.3/8in balsa with each outer wall and top lamination from 1/4in balsa. The 1.5mm ply inserts are recessed into the outer walls; these will stop the axle nuts from crushing into the balsa. Two and a half inch diameter wheels are shown together with a spat retaining bracket; cut this from scrap aluminium and bend to shape. The bracket



is held in place by the axles inner and outer retaining nuts, use a small wood screw to fit the spat to the bracket. The entire undercarriage assembly is fixed to the fuselage by three nylon bolts, this method enables easy removal if so desired. Although not shown on the plan, a small amount of 'toe in' on each wheel will give better ground handling.

## R/C installation, covering and flying

By installing the rudder and elevator servos towards the rear of the cockpit area, you'll find there is still room to place the battery pack (and possibly receiver) directly

beneath the cockpit. If you prefer to place the power pack and Rx in either one of the two front compartments, you may have to add a little ballast to the tail to keep the c.g. to the correct spot. The aileron servo may require an extension lead; to make the process of fitting the wing to the fuselage as easy as possible leave the connecting leads exposed near the bottom of the strut assembly.

Covering and painting of the model is your choice; we used white Solarfilm over 90% of the frame - thus the name 'Casper'! The cowling and spats will need at least two primer coats before final sanding and gloss paint, etc.

Flying this design is sheer pleasure. Whilst not intended for high speed aerobatics a .35 or .40 engine will provide the more experienced flyer with a fairly impressive performance - if you want a more 'realistic' flying model then a .30 should be used. The glide is very good and quite fast for this high winged, fat bottomed aerofoil model - allow plenty of runway for the first few touchdowns! Take off is again realistic; if the tail needs a little down elevator to unstuck be careful not to apply too much (other modellers love a good laugh!) Control response is good throughout the speed range and 'Casper' will perform most aerobatics including rolls but bear in mind that this high wing design is not a pattern ship!

