

## **SPARROWHAWK CONSTRUCTION**

### **INITIAL FUSELAGE CONSTRUCTION**

Start by cutting out two sides from 1/16" balsa and two doublers from 1/64" ply. Mark the positions of all formers etc. then glue the doublers to the balsa fuselage sides, remembering of course to make a left and right side! I used Gudy870 photo-mounting adhesive film for this purpose.

Glue the upper and lower 3/16" square longerons in place (disregarding the slight step where the 1/64" ply doublers end) then glue formers F3, F6 and F7 in place on one side using a set-square to confirm correct alignment. Join the other fuselage side to these formers over the plan to ensure that the formers and fuselage sides are at the correct alignment with each other.

Glue the 1/8" ply wing bolt mounting plates in position, noting they are NOT drilled and tapped for the nylon bolts at this stage.

Lightly score the outside of the fuselage sides vertically with a hobby knife at F3 then carefully crack the sides (without breaking the joint completely) so that F2 can be fitted with slow cyano or epoxy. The cracked fuselage sides are then reinforced on the outside by soaking with cyano, and on the inside with a fillet of cyano and baking soda. The resultant structure should be at least as strong as before being cracked.

Install the 1/4" balsa sheet floor between F3 and F2, and the 3/16" balsa triangular gussets between F3 and the fuselage longerons as shown in the main top view of the fuselage.

Lightly score and crack the fuselage at F7 in the same way as you did at F3, before joining the fuselage sides at the rear (with formers F8 and F9 sandwiched between). Reinforce F7 as you did F3. Fit the rudder and elevator snake outers.

Fit the soft 1/16" balsa rear fuselage top deck sheeting.

The 1/8" balsa hatch floor is now marked and cut out and F3A and F4 attached to it. Temporarily attach this sub-assembly in position on the fuselage using adhesive tape to hold it, then cyano F5 and F2A to the hatch floor, using the alignment against F2 at the front and F6 at the back to ensure the correct slope of these formers.

Glue the 3/16" square hatch longeron in place then sheet the hatch with light 1/16" balsa, using two pieces divided down the fuselage centreline. It may be possible to achieve most of this operation in situ with the hatch in place on the fuselage, thus ensuring a good fit. The use of non-adhesive plastic wrap between the hatch and fuselage may prevent inadvertent adhesion of these separate components during this phase of the construction. Alternately, the sheeting may be applied with the hatch removed from the fuselage, and any twisting corrected later. NOTE: the balsa hatch sheeting extends forward of F2A, in line with the front of F2 (examine drawings and photos to clarify).

Cut out the cockpit opening in the hatch.

Glue cowl formers and 1/64" ply cowls to both sides of the fuselage.

Cut out all the tailplane, elevator, fin and rudder parts from light 1/4" balsa, join elevator halves with hardwood joiner, then shape all. Trial fit hinges.

Glue 3/16" balsa tailplane mounts in place and fit horn to elevator (made from threaded 2-56 rod, glued into the hardwood joiner). Glue the scrap 1/8" sheet balsa piece in the fuselage behind the trailing edge of the wing seat (see side view of fuselage). Fit servo tray and any reinforcements necessary. Sheet bottom rear of fuselage as far back as F9.

With the hatch taped in position on the fuselage, temporarily lightly cyano F1 to the front of the fuselage then carve to shape. Note, F1 must be extensively hollowed to clear the gearbox, when fitted.

## WING CONSTRUCTION

The plans show templates for either single-template or double-template cutting of the wing profiles; dealer's choice as to which you use (double are more accurate, single more convenient).

The centre-section core is cut using two wing root templates, noting that the balsa leading edge is thicker than the main wing, resulting in a slightly different alignment of the template (see drawings on plan).

Prepare the root section of the main wings by hot-wire cutting (HWC) to the correct dihedral angle

Cut the main panels with the flat lower surfaces of the root and tip templates PARALLEL as shown on the drawing. Contrary to initial impressions, this does not give a wing without twist, in fact due to the different root and tip airfoils used it actually gives a small geometric washout (due to the different centre-lines of the airfoils) and a small aerodynamic washout (due to the difference in zero-lift angles of the airfoils of about 0.5 degrees).

Sheet the wings and centre-section using one of the usual techniques - epoxy, contact adhesive, etc. - I used the Gudy870 again for this. Fit centre section leading and trailing edge. Shape.

Study the drawings and photograph of the landing gear assembly until it makes sense (!) then transfer the location of the various wooden L/G mounting components to the lower surfaces of the wings.

Using a 1/16" wide saw blade (or a number of hacksaw blades taped together to make 1/16" thickness) cut two vertical 1/16" wide slots in each wing panel, into which 1/16" ply plates slightly deeper than the thickness of the wing are temporarily slid. Mark the airfoil top and bottom contours onto the ply plates, as well as the locations for the 1/4" U/C blocks. Remove the ply plates from the wing cutouts and trim to the airfoil shapes traced.

Using the drawing of the wing cross-section at A-A as a guide, mark and then cut out the slots in the ply plates for the 1/4" x 3/4" hardwood blocks to sit.

Cut out channels in the lower surface for the 1/4" x 3/4" plates, then epoxy first the 1/16" plates then the 1/4" x 3/4" plates in place.

Trim the trailing edge of the wing panels to match the aileron cutouts, then face these with 3/16" balsa. Fit the LE and TE pieces as well as the 1/16" balsa pieces at the inboard wing/aileron division. Fit the wingtip then tack the ailerons in place (to aid in shaping). Cut out and line the aileron servo boxes (rectangular on the plans, I made mine circular. rectangular is easier).

Epoxy the wings together to the centre-section at the correct dihedral, then finish shaping.

Cut out channels for the aileron servo leads if these were not installed before sheeting. Collect the wires together in the centre-section and then fill in channels. Apply a glass-fibre bandage to the dihedral breaks (2oz cloth or better still 2 layers of 3/4 oz). Use epoxy, PVA or WBP for this.

Sandwich the 1/64" ply wing root fairings between the wing and fuselage then tape the wing in to position. Using a scrap piece of wing dowel with its end soaked in dark-coloured felt pen, push through the dowel holes in F3 against the leading edge of the wing centre-section to mark the dowels' position, then remove.

Drill the dowel holes and glue dowels to front of centre section. Glue a 1/16" ply plate on the BOTTOM surface of the wing where the wing bolt will go (not shown on plans), then re-fit wing to fuselage. Drill for mounting bolt. Tap ply plate in fuselage to accept bolt. Cyano the 1/64" ply root fairings into position. do not fill in the fairing contours yet.

Glue balsa block headrest to fuselage, make up and fit tailskid and its mounting plate - install, then finish sheeting between F9 and rear fuselage.

Fit the remaining scrap balsa side formers and 1/16" bottom sheet to the underside of the wing to blend in with the fuselage contours, cutting a suitable hole for bolt access.

Using lightweight filler, blend the wing root fairings into the fuselage (refer to photographs and drawings)

## UNDERCARRIAGE

This looks tricky but is actually harder to describe and draw than it is to achieve. Start by cutting and bending the front and rear landing gear struts for each wing, and cutting the axles to length, all from 1/8" piano wire. The 1/4" wooden blocks that sit in front of and behind the front landing gear strut are now epoxied into position on the 1/4" x 3/4" plates, exactly 1/8" apart (the width of the wire). Once set, the front L/G strut is slotted into the groove between these two blocks, the trench then being covered with a thick ooze of epoxy (preferably containing a filler such as graphite powder or even sawdust). Whilst this is setting the leg is held in correct alignment by balsa or card templates. The angle can be readily traced from the plan drawings.

When this leg has been set in its position by the cured epoxy, the rear strut may be bound into position with fuse wire, then the rear of it secured to the rear wooden block with a saddle clamp. The two struts may now be soldered together.

Prepare the K&S 1/8" inside-diameter square tubing to the length shown on the drawings, then drill with a 1/8" drill to accept the axles. Slip the wheels on the axles, the axles into the square tubing, then epoxy the square tubing onto the front landing gear legs. Use a piece of 1/32" piano wire across each front strut as a brace to prevent spreading (which would enable the axles to pop out of the square tubes).

Cut out from paper the wheel pants to trial fit on your model. Once any small adjustments to shape have been made if necessary, transfer outline to your material of choice for the pants - 1/64" ply, litho plate or thin plastic. I used ply. You can steam the leading edge radius around a broom. Additional reinforcing may be necessary inside, probably not if you use litho plate.

I attached the pants to wing-mounted balsa blocks with clear packing tape. This is a practical method with film covering. If you use a painted finish you might have to be careful, or use screws instead.

## FINISHING and FITOUT

Plastic iron-on films are ideal for this model. I used Monokote (Blue Mist, I think, was the colour) and Fablon for the letters. A cleaner covering job can be done if the individual surfaces are covered before assembly, ie. rudder, fin, ailerons, tailplane, elevator, wing, fuselage, air scoop and hatch. The Miles falcon logo was found on a website (sorry, can't remember which one!) and printed onto inkjet material then stuck on the model.

After covering, the tailsurfaces may be attached (remove film to ensure good adhesion for the epoxy) and controls hinged and connected. Use the throws on the plans and there will be no nasty surprises.

After installing the motor and gearbox, F1 is lightly attached to the top of F2 and the lower fuselage with cyano glue, in such a way that it provides rigidity to the engine mount but can easily be separated with a sharp blade if necessary for motor replacement.

The hatch is side-hinged on the LHS between F3 and F6 with clear packing tape. Hinges could be used with a painted finish. The aerial can be mounted inside the fuselage or out in the open attached to the fin. I mounted the receiver in front of F6 for the first flight, behind F6 thereafter. An exit hole for the cooling airflow can be made in the scale position under the RHS cowl.

The windshield should be fitted after finishing if using film covering. The cushion on the headrest will need to be velcroed on if fitted, to allow hatch removal. Williams Bros make a good '30s scale pilot that fits this model.

## SOME GENERAL THOUGHTS

This model captures the feel of the "Golden Age" exceptionally well, and has very benign, enjoyable handling. Being equipped with high Lift/Drag ratio wing sections and a light wingloading the Sparrowhawk enjoys a wide speed range, and is capable of safely flying from tight fields on the cheapest power systems. Whilst brushless motors would work beautifully in this design they are by no means necessary - around 250W input is all that is required in my prototype with its ageing buggy-motor powerplant.

By the way, the Sparrowhawk could be built a fair bit lighter than my prototype model, which used some particularly heavy sheets of wood, especially for the wings. I also used a heavy (4 x 500AR) receiver battery, which could be replaced with a lighter version, or eliminated completely with BEC. The cells I used (same weight as the CP-1700s) could be replaced with NimH, LiPo or even CP-1300 cells for a significant weight saving.

Safe landings!