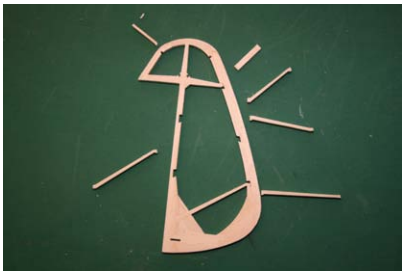
2.41.3 Next fit the axle boxes TW5 to the bottom of TW4. Note these fit around the end of the legs of TW4. This is best done by applying a very small drop of *slow* cyano to the bottom of the fork leg, and placing the axle box in position with a pair of tweezers, nudging it into position. Repeat for the other side, and then it's ready to fit to the underside of TW1/TW3 assembly. You will need to sand a chamfer on the top edge of TW4 – see drg GNF234-1 – so that it fits snugly to TW3 for the strongest joint. (Make sure you chamfer the side *opposite* to the axle boxes).

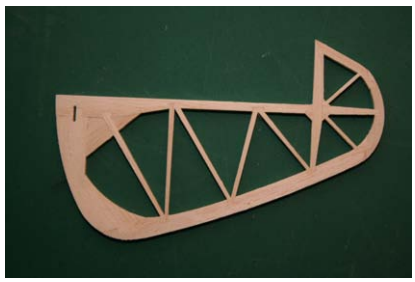
2.41.4 The tail wheel runs on an axle of 1.5mm carbon rod. Before fitting this though it's best to paint the assembly and the wheel centre to your preferred colour scheme. Cut the carbon rod to the width of the forks TW4, and thread it through the axle boxes trapping the wheel in the middle. Fix the axle with a *very* small amount of 5 min epoxy. To do this just push the axle in a bit at one side, and place a pin heads worth of epoxy in the depression so formed, repeat the other side, return the axle to flush each side, wipe off any excess, and you're done.

2.41.5 The tail wheel assembly can now be fitted to the underside of FT4, where you will find a slot just the right size to take the tab on TW1. Mark out and drill 1.5mm pilot holes for the two fixing screws in TW2, and fix in place with No2 x 6mm self tapping screws (part STS2/6).

2.42 RUDDER

2.42.1 This is constructed similarly to the fin. You will need parts Rr1 ~ Rr17. As usual, assemble the parts dry starting in number order with the main frame parts Rr1 ~ Rr8, followed by the diagonal braces Rr9 ~ Rr15, and finally the fillets Rr16 & Rr17. Lay the parts over polythene sheet so they don't stick to the workbench. Leave enough plastic to one side so that it can be folded over the assembly once the glue is applied. You will find that all the parts fit snugly and smoothly together, if they don't they are in the wrong place or the wrong way round. As usual, we would recommend you secure each joint by using penetrating cyano or aliphatic, (with the exception of fillets Rr16 & Rr17 where normal resin or slow cyano would be better), followed by placing a weight across the whole assembly until dry. This of course won't be very long if using cyano, so make sure everything is super flat as the glue is applied.





(Note: While the more conventional method of applying white glue to each joint in turn as it is assembled is theoretically possible, the amount of time this takes means that the glue for the first joints will begin to harden before all the joints are completed, which makes it more difficult to keep everything flat and perfectly in line. And of course all the joints must be completed first to ensure correct alignment. Furthermore, the joints are such a close fit that the glue can be wiped away from inside the joint).

2.42.2 Once dry, you can plane and sand the rudder to section. First of all, using a soft pencil with a not-too-sharp point, run the pencil around the edge of the rudder to mark the centre line – use the tip of your second finger which is supporting the pencil point, as a gauge to get a line at the half thickness point. Start with the trailing edge, using a razor plane, making sure the grain doesn't cause the plane blade to 'dig in'. As you shape the rudder, do a little at a time each side, constantly comparing the distance from your shaped edge to the centre line. It is only necessary to shape the trailing edge of the rudder, Rr4, leaving the diagonal braces at full depth. Match the leading edge to that of the fin, (if you've already shaped the l/e of the fin), keep a similar section around the top of the rudder, and blend to a gentle taper to the trailing edge with a thickness there of about 2mm. Leave the bottom of the rudder mostly untouched except for a little rounding off, and blend in with the trailing edge section. Gently sand smooth all over. Note the slot at the bottom for the rudder horns, but these are best not added yet.

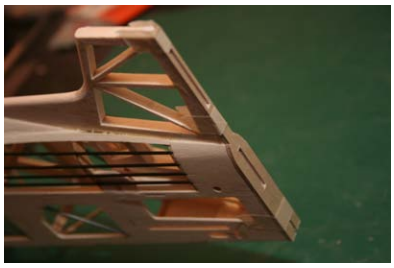
2.42.3 Next job is to hinge the rudder to the fin. This is most satisfying because it completes the body shape … well, almost, because the cowl isn't fitted yet, but

that's not far away. (And there's nothing like a smoothly hinged control surface to dwell on for a while). You'll need to remove the tail wheel assembly, if you've made it already, just for the moment. The hinge is made up by alternately gluing clear plastic 2mm tube fin-rudder-fin-rudder-fin and so on, then pushing the 1mm wire through the lot as a hinge pin. In order for this to work the tubes have to be *exactly* in alignment, and also the correct length. This is potentially quite difficult, but we have provided templates with which if you follow the following notes carefully you will have no problems. Choose a quiet moment, and make sure you have a clear space on your workbench with the items you need close to hand. The templates are machined from 1½mm ply, and they are FHTG, (Fin Hinge Tube Guide) and RHTG, (Rudder Hinge Tube Guide). The general principle will be to use a very, very small amount of glue to tack the tube in place using the guide, then removing the guides and adding fillets of glue afterwards for strength.

2.42.4 The fillets of glue will only be as strong as the material it's fixed to, and except for the ply fin post the rest is light - and therefore soft - balsa. This applies to the elevator and stabiliser and of course the rudder. The best way to strengthen the surface that the tubes are glued to, is to use a penetrating glue such as Superphatic or thin cyano. We prefer Superphatic applied quite liberally and left to soak in and dry overnight, and which also reacts well to RC Modellers Glue which you may choose to use later. If using cyano, treatment is best done outdoors because of the fumes it makes.

2.42.5 Next, you need to cut sections of tube to exactly the right lengths. Lightly abrade it all around along a 20cm (8") length or so, then with FHTG on the bench, lay the tube into one end of a slot and mark the other end of the slot with the scalpel blade. Best not to remove the blade at this point, but just lift the tube and blade together and place on your cutting mat, rolling the tube under the blade to cut through. Repeat for all the remaining slots, and also for RHTG. If you make a mistake, cut another piece until you have it just right. Lay them on the bench in order.

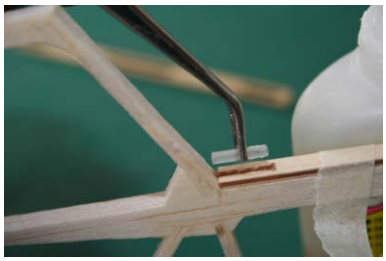
2.42.6 Now you need to treat the slots in the guides with petroleum jelly (Vaseline™), which has the useful property of preventing most glue from sticking to it, besides being good for your skin. You need this because you are going to glue the lengths of tube to F10 using the guide, but of course you don't want to accidentally glue the tube to the guide as well. So at this point, using a small brush or the side of a scalpel blade, apply a thin smear of Vaseline to the guide inside each slot, keeping your fingers well away from the stuff. Applying too much Vaseline will end up with it smeared all around the tube as well, which would be difficult to remove. You will have to do a little bit of that anyway, but it's best to minimise it.



2.42.7 Very lightly sand the back of the fin post F10 and then offer up FHTG to the back of F10 – it's the same shape so it's not difficult to line up, but do make sure it's level top and bottom and tape in place.

2.42.8 Next you need a very small amount of epoxy or slow cyano , and then either: (a) apply a TINY amount to the surface of F10 in the middle of the slots – use the tip of a piece of the 1mm wire for this – one dot for the shorter slots, two for the longer ones.

Or: (b) holding each piece with tweezers, apply the glue directly to the tube.



2.42.9 Using tweezers, drop each tube length into it's respective slot, tapping gently into place. Wait plenty of time (if using epoxy) for it to cure, and then carefully lift off FHTG. Best way to do this is to insert a scalpel blade under the guide and *gently* twist the blade to prise the guide away. You will see all the tubes perfectly aligned, but remember at this stage that they are only tacked in place.

2.42.10 Next up is the rudder. (Remember to strengthen the surface with penetrating glue). Position the rudder tubes using RHTG, making sure of course that it's the right way up! – i.e. open slot to the top and aligned right up at the top of the rudder post – this will give the correct alignment between the fin and rudder.

2.42.11 Fix the tubes permanently - with fillets of RC Modellers Glue or cyano. Because of the release agent (Vaseline) used in the tube location jig, there may be traces of it left on the sides of the tubes which would interfere with the bond of the glue fillets. The best way to remove this is with a cotton bud moistened with methylated spirits.

RC Modellers Glue (from Deluxe Materials - as is Superphatic) is recommended for the fillets since it bonds well to the plastic tube. Apply it both sides. Once dry, it is VERY important to scrape away ALL traces of glue that may have got on to the front of the tubes – this would otherwise cause the hinge joint to bind.

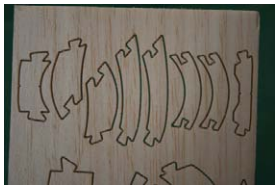
Cyano also works well, using the thick kind to make up the fillet, which can be made thicker still with 'micro balloons'. Make absolutely sure that no cyano gets into the inside of the tubes.

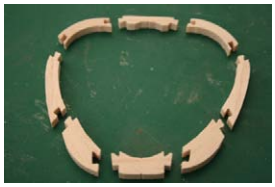
2.42.12 Take the 1mm wire, and file or grind a tapered bevel on the end. Assemble the rudder into position, and insert the wire into the lowest tube, (this will be on the fin post), and then all the way to the top. Cut off the wire about 2~3mm below the bottom of the fin tube, so there is something to hold on to if you wish to withdraw it. WARNING: Don't be tempted to cut the wire while it is still fully inserted – the force associated with cutting the wire will propel the wire into the soft balsa at the top of the rudder, and there may be no wire left sticking out to grab hold of, so you can't get it out … (how do we know that? – (2)). So - once you've marked the length required, pull the wire out a bit and grip it firmly before cutting. Note that when the tail wheel assembly is replaced, this will stop the wire falling out. You should now have a freely pivoting rudder, which can easily be removed for covering, and for repair or replacement if necessary. If there is any trace of binding, recheck possible build up of adhesive around each pivot tube.

2.43 COWL

2.43.1 From one end to the other – however finally screwing the cowl to the fuselage depends on the motor being fitted, so that will depend on making the motor mount first. However, that doesn't stop you making the cowl – and anyway you can turn to the relevant section, (2.51), to see about making the mount for the motor of your choice – whether electric or i.c. If it will be electric, we have provided a universal motor mount that will fit virtually any brushless electric motor, (as far as we know), that's useable in the Greenfinch. Let us know if you have a problem. If it's i.c. we may also have custom mounts for 10 to 25 size (1½ ~ 4 cc) motors - ask us about your proposed motor.

2.43.2 The 5mm balsa sheet B50/3 has most of the bits you need, though the 0.8mm ply parts MC2a & MC2c which you will need to make the first former assembly MC2, will be found on sheet P08/3. Glue together MC2b from the 8 pieces, lightly sand both sides then laminate the ply pieces each side, MC2a being at the front. This former assembly is extremely important, since the sides have to be chamfered at exactly the correct angle so that the cowl MC1 will take up the correct shape, when it's wrapped around it. For this reason we have faced this former with the ply parts so that their edges can be used as guides. For this to work properly it is essential that the three pieces are laminated with the central clearance hole exactly in line. Note also that there is a small notch in the upper and lower centre of each of the three pieces, which should all be in line of course. Now carve & sand around the former until the ply edges are just being met, and are chamfered at the same angle as the balsa centre. Note there is just a slight chamfer on the upper edge.





2.43.3 *(Please note: the following pictures show louvres fitted in the cowl sides - these are now discontinued. Other changes include 0.8mm ply MC1c instead of 1.5mm shown, also 0.4mm MC1d on the inside of the cowl in line with MC1d)* Round off the outer edges of MC1c and bond to the lower rear outer edges of MC1. MC1c is provided to reinforce MC1 at the screw attachment points, and also to partially hide the screw heads – note the holes in MC1c are clearance around the screw heads. Also glue the extra reinforcement 0.4mm parts MC1d to the inside of the cowl and in line with MC1c. There is also reinforcement provided at the centre top fixing screw (parts MC1a and MC1b – designed to look a bit like an oil filler, or inspection point), but these are best fitted later when the exact position of the cowl is decided. You can also just use MC1b alone, if you prefer, similar to MC1c, and dispense with MC1a.

2.43.4 Now do a trial arrangement of MC1 around MC2. Note there is an alignment notch in the centre front. Draw some parallel lines along the top edge of MC2 (photo) and note the three holes either side of the central notch, which when looked through can pick

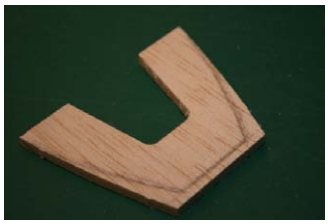
up the parallel lines and help you to keep MC1 square with MC2. Pull the cowl down each side of MC2, lining up the bottom edges with MC2, and arranging MC1 to fit close to the chamfered angle on MC2, and that the edge of MC1 is parallel and flush with MC2 at the top centre.

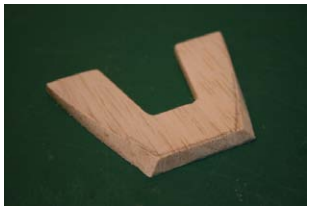
2.43.5 Using either slow cyano or rapid epoxy, join the centre straight section of MC1 to the 30mm or so top edge of MC2, making sure it is central and absolutely parallel. If the front edge of MC1 is just a little bit (¼ mm say) behind the front edge of MC2 it is easier to see if it's lined up exactly parallel. Once cured, *practice* once again pulling MC1 down one of the sides – pulling quite hard as you form it around the shape of MC2, noting that it is possible to get the cowl edge to line up quite closely with the front edge of MC2. You may notice that MC1 is just a little proud of MC2 at the upper section where it begins to curve around. This is ok, you can smooth it off later. Make a mark on MC2 where the bottom edge of MC1 comes. Now apply epoxy or slow cyano all the way to this mark, pull MC1 down and around, and clamp with three mini clamps. Do one side at a time!

2.43.6 While that is setting, cut out the ply MC6, and also assemble the 6 separate parts for each of MC3, MC4 & MC5. These have been arranged so that the grain runs tangentially around the former which will assist final shaping. Note however that MC7 is in one piece and that the ply MC8 fits inside the aperture in MC7 flush with the front surface, though this is optional and is best fitted later, (once issues related to down and side thrust are sorted). When dry give each former a light sanding each side to ensure it is completely flat, and then laminate together MC3 ~ MC7 in number order. Glue MC4 to MC3 first – leave to set with a weight upon it. Then glue MC5 to MC4. Resin or slow cyano is fine, (needs to be a glue that will carve and sand easily, so NOT epoxy), but do ensure that all the parts stay in perfect alignment – use the upper internal cut outs as a guide for MC3 ~ MC5. For MC6 & MC7, use the lower and side ventilation apertures for lining up. Not forgetting the alignment notches in the upper centre of course.

2.43.7 Lay the MC1/MC2 assembly face down on sandpaper and smooth off the front face. Now bond the laminated assembly to the front of MC2. Looking into the cowl from behind, note there might be some gaps between MC1 and MC2 – these might have been filled by squeezed out epoxy of course, but if not, squeeze some in at this stage, using a brush or a cling-film covered finger to make sure there's a good fillet around the inside.

2.43.8 Mark out the upper and lower edges of MC9 as diagram on drawing. The lower front edge has to be chamfered to the line so that it butts up to the rear of MC2 at the correct angle, and the sides so that they fit inside MC1, though the side chamfer is reduced to the rear. The upper rear surface is chamfered not only because it allows cooling air to escape more easily, but it also looks better. Now glue MC9 in place. Use a slow drying glue so you have time to adjust the fit.





2.43.9 There is now rather a lot of carving to do. The reason you make all the front formers in 8 parts is so that the grain runs as tangential as possible to the edge of the completed former. This makes it very much easier to carve the angles required, whether you are using a modelling knife, (our favourite for this is a

Swann Morton wth a No26 or No23 blade), a razor plane, or (initially) a very coarse sanding block. Or all three. Start by shaping the sides to the angle of the cowl MC1, moving slowly down the side to the undersurface where the angles get quite steep. Do small amounts at a time,

checking often to see how it's going. There is no absolute correct shape for the cowl, just try to get a smooth transition from one curve to the next. At the front the slope from the side will come very close to the upper cooling slots. **Leave yourself plenty of time for this.** Also, cut away the steps in the cooling ducts from front & rear.

2.43.10 Now offer up the cowl to the fuselage, and we will assume at this point that you have the motor mount fitted and your motor in it. (See section 2.51). Slide the cowl over everything, and arrange the front face of the cowl to be about 2mm behind the face of the propeller driver or spinner back-plate. We recommend that the motor is set up with about 1½~2° down thrust and right side thrust, and that means that if the cowl is set up square with the fuselage, the spinner will be at an angle to the front face of the cowl. If the front of the cowl is interfering with the propeller, it's better just to sand away the front of MC7 until it is parallel to the spinner or rear of the propeller. The ply infill piece MC8, (fits inside the aperture in MC7), can then be fitted if required. Once you are happy with the position of the cowl relative to the propeller, squeeze in the sides of the cowl against the fuselage sides, (see drg GNF234-12), and arrange the bottom of the cowl to be flush with the bottom edges of FB6 on each side. Also make sure that the cowl is square to the fuselage, which you can do by lining up the back of MC9 with F1. Holding the cowl securely in this position, mark through the three holes on each side with a biro or soft pencil onto the fuselage sides. Remove the cowl, and drill 1.5mm pilot holes for the cowl retaining screws.

2.43.11 ***(see also 2.43.12!)*** Now re-fit the cowl, but this time place some plasticene, BluTak™ or similar under the upper rear centre of the cowl somewhere near where the pilot hole for the fixing screw is in part CP1. Also put a light smear of Vaseline™ across the top of CP1, otherwise the plasticene will stick to hat as well and you won't be able to get the cowl off! (How do we know that? – (3)). Fix the cowl on both sides (at this stage, one screw in the centre is enough), and press down the cowl at the centre top. Remove the cowl, and you will have an imprint of where the pilot hole is. Well, it's a little 'pip' rather than an imprint, so if you have a centre punch or similar, (an old biro?), press it through the pip to make a good mark for your drill. Drill through MC1 2mm dia. at this position, and add the reinforcement MC1a centrally over the hole with the collar MC1b on top of it. This can represent a dummy filler or inspection cap of some kind, but if you prefer, you can use just the piece MC1b glued directly to MC1 in the same manner as for MC1c. Add the top centre screw and note how the cowl forms itself into the curvy Greenfinch shape, with air vents at the rear upper sides. (Drg GNF234-11)

2.43.12 Laminate 0.4mm ply part MC1e under the upper rear centre of the cowl - this has the grain crosswise, stiffens and maintains the form of the upper cowl and provides reinforcement where the upper front edge of the main hatch fits. It also flattens the top of the cowl sufficiently such that depending just how your cowl is fitting, (e.g. whether you're using down thrust), the cowl ***may not need*** the centre screw referred to above in order to bring the top of the cowl down to the CP1 assembly. In which case if you wish, leave it out. Otherwise, drill through for the screw clearance hole, (or fit this part before ***2.43.11*** above).

2.43.13 These photos show the external MC1d, (shown 1.6mm thick but now 0.8mm), and the internal 0.4mm MC1e.

2.43.13 Those with i.c. engines will benefit by coating the inner surface of the cowl with finishing resin and perhaps a single layer of glass cloth. This would also provide extra accident resistance even for electric powered models of course. Re-fit to the fuselage with the resin still wet, but cover the fuselage with cling film and then smear that lightly with Vaseline first!

2.44 ACCESS PANELS

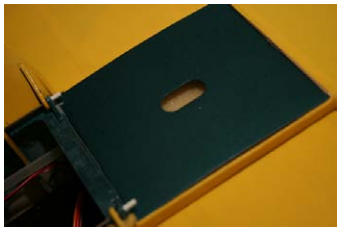
Refer to Drawing GNF234-1

2.44.1 There are two access panels, one covering the wing joiner box and Receiver section, FB3 ...

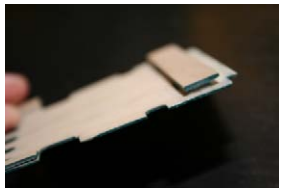
... and one covering the tank/ESC/undercarriage section, FB5.

They are designed so that they can be sprung into position, using the natural flexibility of the 0.8mm ply to hold them in place without any screws springs, clamps, or magnets.

2.44.2 In order to clip FB3 into place, there is one projecting tab at the front and two at the rear. The front tab is piece FB3a and the rear double tab is FB3b. Line them up using the 2mm registration holes and the 2mm tube, and bond securely. Install by locating the front tab into the slot in the bottom of F3, bend FB3 into an arc so that the two rear tabs can be lined up with the slots in F4, then just let the panel straighten into the slots. To remove the panel, insert a finger tip into the centre hole, pull gently, pop one end out then withdraw the other.



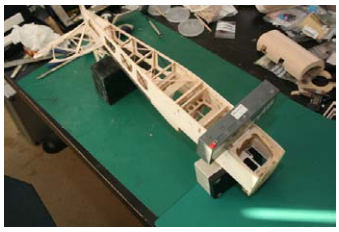
2.44.3 FB5 fits by sliding it rearwards so that it's tab engages under the rear edge of FB2, (which isn't fitted yet but is just about to

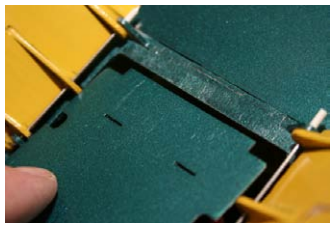


be) and then the forward sides of it engage with the slots in FS2a each side. To enable this, the rear tab FB5b has to be spaced away from FB5 by

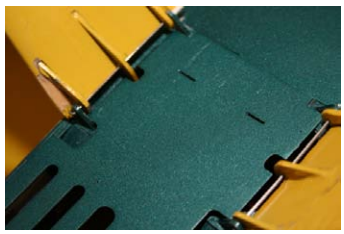
piece FB5c. The front tabs FB5a are fixed each side directly with no spacer. As before, line up the registration holes, and bond securely. Next step is to try and engage the tab FB5b under the rear edge of FB2, but since the spacer FB5c is the same nominal thickness as FB2, it may be a little tight. So sand the rear edge of FB2 just a little until FB5b slips easily onto it. Note: The FRONT edge of FB2 is marked with a couple of holes.

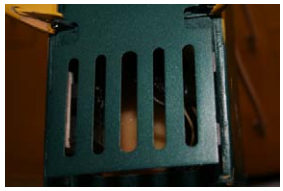
2.44.4 Next, glue FB2 into position, (it can only be fitted one way round – but that will be with the holes towards the front). Now you can fit the panel by sliding FB5b under the

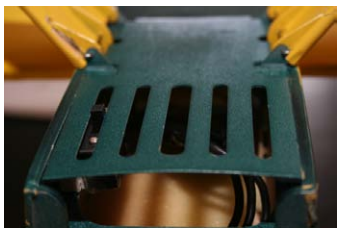




rear edge of FB2, and then curve the front of FB5 into a small arc so that the tabs on FB5a line up with the slots in FS2a. It will click into place leaving FB5 with a slight curve which looks quite elegant, and keeps it engaged.



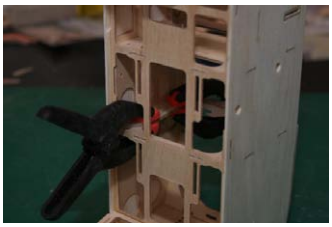


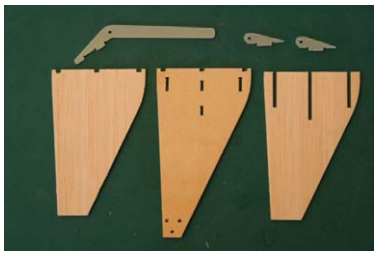


2.45 UNDERCARRIAGE

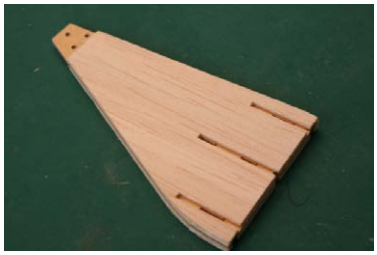
2.45.1 Study the drawing GNF234-1 & GNF234-2 regarding the position of the four Epoxy Glass pieces UC5. These provide not only the pivots for the u/c, but also the spring location, so that all suspension springing loads are absorbed by just the UC5's which are strongly located within the module formed by the fuselage sides, formers F2 & F3, and FB2 & FT1. The firmness of the spring can be increased to suit the weight of the motor/drive system by moving the spring to a higher slot in UC5.

2.45.2 First bush the holes in the bottom of the four UC5's with the usual 2x1mm tube. Cut the tube into approx. 5mm lengths, insert each piece and fix with one drop of thin cyano. Wait a few minutes, and then slice off flush each side. Using slow cyano or high strength epoxy, glue each UC5 against the face of F2 and F3 as shown, butting up against FS7 at the side and FT1 at the top. Use M2 x 6 screws through the two holes in each UC5 into the matching holes in the formers to pin in place – don't bother with nuts, just glue the lot in. Clamp tightly until set.



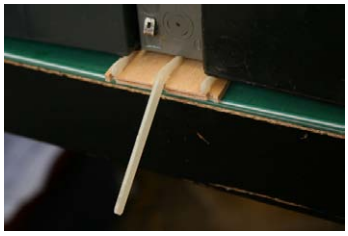


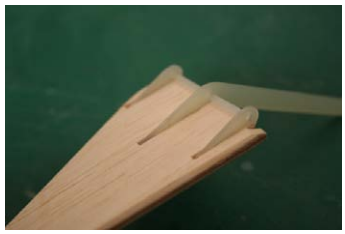
2.45.3 Be sure to make the u/c legs up as a mirror image pair. The leg has a ply inner core UC1 which is faced on the inside with balsa UC1b (the slotted one) and the outside with UC1a. The epoxy glass pivot bearings and spring lever fit into the slots in the ply core. The balsa can be laminated with either slow cyano or resin glue. If using cyano, you can assemble the epoxy glass parts to the ply core first if you wish, and then add the facings, but make sure that the adhesive is evenly spread over all the contact areas and firm pressure applied. If using resin, then this will make the facings curl, and you will need weights to keep everything flat and this is easiest if you haven't yet fitted the epoxy parts.



Sand smooth and round off the front and rear edges.

2.45.4 Trial fit the epoxy glass pivot bearings UC3 and spring lever UC4, ensure they bed in snugly and sight through the 2mm pivot holes to check they are in line. In this photo just the outer facing has been laminated with cyano and the epoxy parts bonded with high strength epoxy. These have to be bushed with the 2mm dia. plastic tube and this is most conveniently done in one piece spreading between the pivot bearings since this neatly guides the wire pivot pin through the assembly. (However, it's easier to cover the top edge of the leg if the tube isn't fitted, so you may wish to cover the leg first). Use cyano, slice the tube off flush with the outside of the pivots.

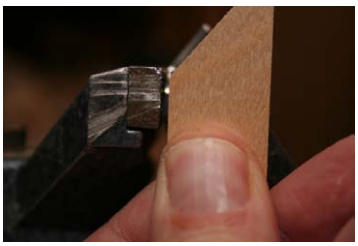




Use 5mm balsa scraps if laminating the inner face with resin after fitting the epoxy glass parts.

2.45.5 Now you need to bend the aluminium axle plates UC2 to the correct angle. We provide a template, UC7, which will help you set the angle (42°). First, with a junior hacksaw, or triangular file, cut two small slots about ⅓mm deep across UC2 just inside the edges of the indents in either side. This slot must be on the inside of the axle plate, so be sure to make one opposite to the other.

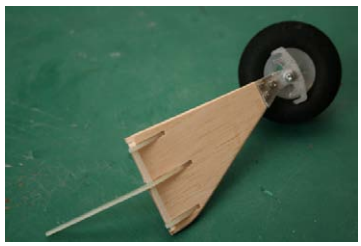
(Check again!). Now place the lower end of UC2 in the jaws of a vice, with the lower edge of the lowest slot just level with the top edge of the vice jaws. Now with *gentle* blows from a hammer, bend the upper section over a bit at a time until the angle is the same as the template (42°). Position the template in front of the vice jaws as you progress to make sure you don't overdo it. If you end up with an angle a bit more than the template, rather than try and unbend it, (which will weaken it) just make the other axle plate the same.



2.45.6 Bolt the axle plates to the underside of each leg with three M2x6 bolts, nuts and lock-washers as shown in the photo. *Do not over-tighten. It is very important* to use washers under the heads of the bolts - without these the ply may be crushed and severely weakened.

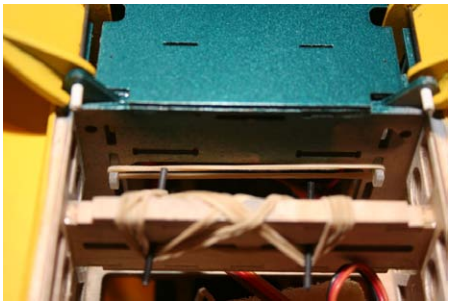
2.45.7 At the top of each leg, on the outside, sand a small chamfer. *However, on the inside sand a much bigger chamfer down to the ply core, particularly on the short edges outside the pivot plates – this last is important to allow the legs to settle into alignment when you fix the legs into position on the UC5's. See pictures section 2.45.4 on previous page.*

2.45.8 **WHEEL ASSEMBLY**. Each axle is an M3 x 25mm bolt. Thread a washer onto the bolt, insert the bolt through the wheel, add another washer, then two nuts. It's a good idea to use a low strength Thread Lock with these nuts. Adjust the first nut to give a smooth running fit without excess play. (Do it up gently finger tight, then back off one flat – ie 60˚). Then lock the second nut against the first, (use two spanners for this, keeping the nut closest to the wheel stationary, and tighten the second one on to that). Check the wheel still able to rotate freely, add another four washers to give the clearance required if you are fitting spats, then insert into the axle plate, followed by another washer, spring washer and nut to lock the axle to the axle plate. See the notes on the drawing. The spats, if you are using them, can be fitted later. Then it may be necessary to adjust the number of washers to get the best clearance between the wheel and the inside of the spat.



2.45.9 To fit the legs, turn the fuselage upside down, and place one of the legs with the bearing pivots UC3 just inside the fuselage bearing supports UC5. Select a length of 1mm wire for the hinge pin, bend a small return, (about 2mm) on one end, cut it about 10mm over-length, file the burr off the end and insert through the assembly. The hinge pin can be retained with a short length of tube epoxied into place or alternatively the back end of the pin can be retained with about 10mm of 1.5mm heatshrink tube shrunk into place – this can be slit and easily replaced if you need to dismantle the undercarriage for any reason. Note that the spring lever projects up inside the fuselage, and at the moment is free to flop about. You will see that the parts UC5 have a number of slots, and it is through these slots that you insert the epoxy glass spring beam UC6, passing firstly through the slots in F2/UC5 and then through UC5/F3, trapping the lever UC4 between the spring and the fuselage side. The higher the slot chosen, the stiffer the springing. Use one of the lower slots to start with, and increase stiffness as required depending on motor and/or battery weight.

2.45.10 Repeat for the other leg. Use a rubber band stretched between the rear ends of UC6 – notches are provided for this – to secure them in position.



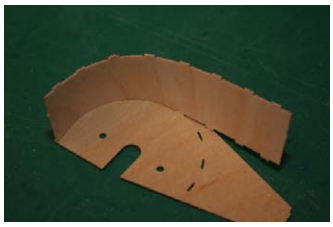
You will see a little free movement of the spring lever between the spring beam and the fuselage side. This gives the wheels a bit of realistic positive camber when in the unloaded (flying) condition. However, if you like you can damp out the free movement by using a self adhesive foam pad fixed between FS1 and the spring lever UC4.

2.46 WHEEL SPATS

2.46.1 These can take a little while to make but are very satisfying to do. They are a good task to have running in the background while you are getting on with

other assemblies and waiting for joints to dry. They are made from a thin ply chassis, (two sides and a wheel arch), which is then laminated on each side and top with five layers of balsa, which are then carved and sanded to section.

2.46.2 Start with the ply parts SP1, SP2 and SP3. Note the spats are handed of course so be sure to make one opposite to the other. First off, dampen the wheel arch SP3, and

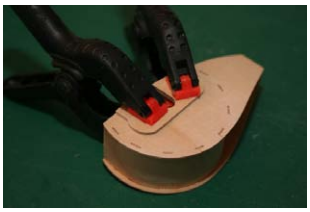


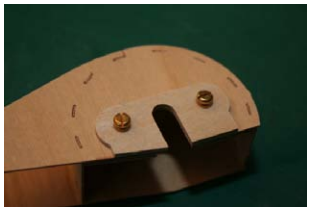
gently form it into a curve between thumb and fingers. You can see the radius required by the slots in SP1 and SP2. The inner wall of the spat chassis is SP1, lay that on the workbench and insert the tabs of SP3 into the slots in SP1, starting at the centre top and working down each side, but don't glue the joint yet. Next cut out SP1a and SP1b and fix in place as shown on the drawing, tucked up against SP3, bottom edge flush with SP1 and the small rectangular slot centred over the 2.5mm hole in SP1, and bond firmly with slow cyano or resin. Note that the sides of SP1a & SP1b butting up to the wheel arch do not follow the curve of the arch, but straighten up – this is what happens to the arch at the ends, despite the apparently curved position of the wheel arch slots at each end. The rectangular slot in SP1a & SP1b is to trap the head of the spat retaining bolt, which will have it's head filed with two parallel sides to fit within the slot and prevent it turning.

2.46.3 Turn the assembly over and press the other side of SP3 into SP2 – this time start at the front end of the arch and work around clicking each tab into place. Check all square, and that the tails of SP1 and SP2 meet when pulled together at the rear, (use tape to hold them together), and apply Superphatic with a brush to all joints, both inside and outside the wheel arch and also the ends of the SP3 tabs as they appear through the slots. Place the assembly on it's side, with weights on top until dry.

2.46.4 Repeat for the other spat, making VERY sure that this time SP3 is on the other side of SP1 than before!

2.46.5 Next bond the Spat Bolt Retaining Plate SP5 to the outside of the inner face of each spat. Use a couple of M2.5 screws temporarily placed through the holes to ensure it's perfectly lined up with SP1.





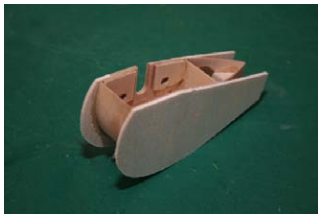
While that is drying, cut out and laminate the two 5mm balsa pieces SP19 – these parts make a jig to hold the rear of the chassis together at the correct angle.

2.46.6 Push the rear sections together into the 'V' of the SP19 jig, and use a rubber band around the assembly to hold it there. Now glue the two triangular parts SP15 into the joint, one near the top and one towards the bottom, but make sure there is space (around 1½ ~ 2mm) at the bottom to fit in the balsa cover plate SP17 flush with the base of the spat, but don't fit SP17 just yet. That completes the basic ply chassis.

2.46.7 First of the balsa laminations to fit is SP4, which fits up against SP1 and around SP5. If you use resin, spread it evenly with a brush, and use weights while it dries to prevent the balsa curling up. Keep the rear end pulled in with tape. Slow cyano also works well and is very quick of course, but make sure it's evenly spread out. However, cyano does tend to harden the balsa which can make carving a little more difficult, and also more rapidly takes

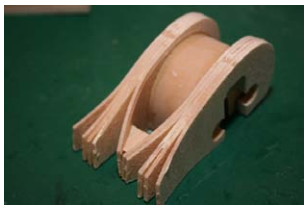
the edge off your scalpel or razor plane blade. It is likely that SP4 and SP5 are not exactly the same thickness, so once the SP4's are dry, place that face on a sheet of sandpaper and sand it flush all over to accept the next lamination.

2.46.8 From now on, there are two techniques you can use, depending on how much time you have. You can laminate one piece on both sides at a time, pulling them in at the rear with tape, and leaving the assembly weighted down on it's side until dry. Once again it's important to ensure the glue is evenly spread. This is the safest way to proceed, but it also takes the longest time.



2.46.9 The second technique is slightly different, in that the pieces can be built up on each face all at the same time – up to the five pieces each side - but only glued over the flat area at this point. (Once that is all dry, glue is applied to all the curved faces, and the whole lot pulled in at the rear together in one go – but this can only be done with resin glue, not cyano, - see next note). Depending on how confident you feel, all five pieces could be done at once. They can be laminated directly to the chassis, or laminated first as a sub-assembly apart from the chassis, but remembering of course to only apply the glue over the non-curved area. (Best, in fact, to leave the glue a few millimetres short of the curved area). In any event, make sure that the pieces are reasonably closely in line, paying particular attention to the rear ends and the forward edges, and that they don't migrate before the glue has set. You will need particularly heavy weights to control the curl of the wetted balsa if you're doing more than two or three at a time.

2.46.10 The inner face of each spat has SP6 over the SP4, and then three SP7's. The outer face has five SP8's. If you've proceeded as 2.46.8, then you're now done with this stage. If you've gone with 2.46.9 then the next step is to apply resin glue to all the interleaved areas, using a brush to get it right into the areas close to the edge of the straight section already glued.



(This isn't practical with cyano of course, and would take too long. In any event, if you were happy to use cyano, you would be glueing one lamination at a time very quickly). Once that is done, pull both sides together evenly and use tape, or rubber bands, to hold the lot firmly.

2.46.11 Once dry, sand the top surface to make it level and smooth enough on which to mount the upper laminations. Use a sanding block or – better still - drag the spat upside down across sandpaper flat on the board. Then repeat for the underneath of the spat, and also the tail end, getting it nicely smooth and squared off.

2.46.12 The upper laminations are each made up from one longer and one shorter section. We recommend using either pva or aliphatic resin for this, (although slow cyano can be useful with a slightly modified technique – see later note). Use the longer lengths starting from the front and bending around to the flat section at the rear..

Moisten the balsa well on the top side, and rather less on the under side. *This serves two purposes* – firstly, it softens the balsa so it more easily bends around the curve, and secondly it balances out the wetting effect of the glue. If you don't do this, after you've wrapped the lamination into place, the balsa expands on the face with the glue on it, and this will force the lamination away from the surface to which you're trying to fix it. By wetting the balsa first you pre-expand it, so that as the glue dries, the balsa shrinks back a bit which pulls it tight to the laminated joint.

Hold SP9 in place with rubber bands. When set, add SP10 to the end of it over the flat section, also pre-wetting the outside but not necessarily the