

## Sopwith Camel

Designed by Peter Rake

The Sopwith Camel was the most famous of a long line of planes built by Sopwith. Starting with early racers Sopwith entered WWI with the Strutter and the Pup. The Pup was one of the early successful single seat fighters and was loved by its pilots as nimble and relatively easy to fly. It was followed by the Triplane, which was basically a Pup with three wings. Extremely quick in the climb and very fast in the turn, the Triplane earned a great reputation. But, more advances were needed to meet the Axis airplanes. Out came the Camel. Very short nose and tail put almost all the heavy weight, pilot, gas, and engine, right at the center of the plane. The Camel could turn so fast many pilots couldn't control it. The spinning mass of the rotary engine on takeoff and landing meant that fast reflexes were needed to tame the beast close to the ground. The Camel was said to have killed more pilots than the enemy did in that plane, meaning that if the pilot learned how to control it, he was near unbeatable in a dogfight.

This Camel, designed as a sport scale model by Peter Rake, is a fast build for the intermediate builder. Construction is made easier through Peter's use of two piece fuselage construction. The front box section is built with slab sides and formers that help keep the sections square. The rear section is the familiar stick build with longerons and cross pieces built over the plans. When the front and rear are completed they are aligned and glued together. This method is simple and alleviates most problems associated with stick type fuselage construction.

The Camel uses full house controls, Aileron/Rudder/Elevator/Throttle. Four servos are required for this model, one in each bottom wing panel for the ailerons and two in the fuselage for elevator and rudder. The aileron servos must be about 3/8" or less to fit in the wing.

The recommended power for this plane is a geared sp400 and 8xNiMH cells. The prototype was flown with a sp400 and 3sLiPo and flew with a surplus of power, with loops from level flight and short takeoff rolls. I also flew it with a brushless Eflite 450 outrunner on 2s LiPo (3s was too much power). The only real modification necessary for upgrades is in the motor mount.

### Construction:

General: Use of CA or PVA for all construction with epoxy used for motor, landing gear, and wing mounts. I like med CA for stick type builds. Besides, it is so much fun to sand it off your fingers at the end of a day of building. When sheeting I change to thin CA. If you use CA I recommend having some acetone handy. That way when you stick your fingers together there is a chance to avoid an emergency room visit (acetone dissolves CA). Covering can be just about any type desired. Doculamis is good but it does require painting (I use latex interior house paint). So-Lite (Coverite Microlite) works well. Solarfilm, tissue, silkspan, silk, and polyspan would also make good covering material. Monokote and its competitive types are a bit heavy and will tend to warp the structure when shrinking. Hinges can be any type suitable for park fliers, tape, CA type, mylar, dubro, etc. I used the dubro micro hinges on mine, but, they are much stronger than needed on this plane. Control is through the use of GoldenRod sleeve and wire control to the elevator and rudder. Pull-pull would also be a good choice on this one. Ailerons are controlled with servos in each wing with direct links from the servo arms to the aileron horns.

Before you begin:

Make sure you have all the parts listed on the inventory sheet. I recommend removing the pieces as you need them. I also like to identify each piece from the plans. I mark the sheet next to the pieces rather than on the pieces. Pay special attention to the ribs as there are some subtle differences. If you have any discrepancies please email or call. Note that the plans include full size parts on them. If you break a piece then you can use the outline on the plans to make a new one. Or, you can give the plans to a buddy so he can scratch build a twin to yours. Better yet, have him order a short kit from us and you can do airshows together!

Go over the plans and the instructions at least once to make sure you know where all the parts go and in what order you build them. If anything looks confusing go over it until it is clear, or, shoot me an email (or phone call). Some folks like to build wings first, or tails, but, I like to get the fuselage over with. Since I'm writing the instructions that's what comes first.

NOTE: To scale purists. The basic plans do not include details like machine guns and such. These are left to you to figure out. I wish there was a good source of 1/9 scale WWI equipment but I have not found it. For my own MG's I use a piece of wood dowel and stick a short piece of Al tubing in the front for a barrel. That's all the Camel needs because the rest of the gun was covered by the hump in the cowl (which is where the Camel name came from). There are many other details you can add if you so choose.

#### Fuselage:

Begin by building the rear fuselage section over the plans. Cut the 1/8" sq sticks for the top and bottom longerons and pin in place. Fit the balsa sheet piece between them at the rear of the fuselage. Cut these to clear pushrods/cables for rudder and elevator. Then cut and fit the 1/8" square vertical joiners. When both sides are dry, remove from the board and pin them down over the top view of the fuse. Make sure the sides are square to the board. Fit the 1/8" balsa piece at the tail first, joining the tail of the fuse sides at the same time. Make sure everything stays straight and square as you do this. Then fit and glue the horizontal joiners as shown on the plans. There should be a horizontal joiner at the top and bottom where each vertical joiner is located. When finished you should have a completed rear fuselage!

The front fuselage is a box. First assemble the F1 and motor mount assembly. Note how the motor mount pieces set the down and right thrust on the motor. Don't assemble it upside down like I did or you'll have left thrust! Now use F1 (with the motor mount) and F3 to join the fuselage sides together. Use squares and bracing to hold everything square until the glue sets.

Note: if you are using a different motor I still suggest using the original mount as a basis for mounting the new motor. When installing the Eflite outrunner I measure and sawed off the original mount, then attached a new firewall to it with side braces.

Next, join the front and rear fuselage sections together. It is easiest to do this over the plans, making sure everything is lined up straight and square. Doing this upside down is easier too. You may have to shim one side to make it line up correctly.

Optional: If you choose to lace the undercarriage to the crossmembers, it is probably easier to do it before installing the crossmembers in the fuse. I used small plastic U/C saddle clamps to attach mine so I left the U/C until last (after covering).

Now install the cabanes, front one to F1 and rear one to F2. Then install F2 in the fuse along with the U/C crossmembers and the 1/8"x1/8" sq cross members. Now install the servo mounts. Determine the desired location and install the servo mount rails. Cut to the fuse width, cut out sections for each servo, and glue in place.

Onto the rest of the fuse. Install the fuse side and top formers. Then attach the sheeting to the top and side (I leave the bottom off until I'm ready to install and connect the servos. It is best to use ammonia, or at least water, to wet the 1/16 sheet before bending it over the formers. I started with the rear deck (behind the cockpit). Then the front deck. Then each side. Then I put the balsa block up front. I square off the fuse at F1 so I can install the cowl later. I don't shape the balsa block until I have the cowl ready as a reference.

Now on to the cowl. The two C2's are setup. I like to glue pieces of balsa (1/8x1/8) to space and square them. The piece of 1/32 ply is wet and curled around them, keeping everything square. Use rubber bands to hold it in place until it dries out. Then carefully fit and glue it to the two C2's. Then the front rings, C1's, are glued in place. Tack the cowl to the fuse and mark where to shape the fuse to (especially the balsa block).

At this point I like to install all the stringers. They help strengthen the fuse for the rest of the work. If you break one while handling, congratulations! You've joined the club. I don't know of anyone who has gone through a whole build without breaking at least one stringer.

Now shape the front of the fuse and cowl, rounding everything to shape, smoothing all the seams, and filling all the holes. Cut the cockpit to shape (carefully, it likes to split).

Congratulations, the hard part is over, IMHO!

Fin/Rudder:

While you have this section of the plans on your board go ahead and build up the fin and rudder. The outline of the rudder and fin is made by laminating thin pieces of balsa in a curve that follows the shape of the parts. If this is the first time you have tried this do not fret, it is not as hard as it looks. You might want to practice a bit on just making a curved piece before trying the actual part. There are also two ways to do the curving. One is to make a form from balsa, foamboard, matte board or similar and the balsa strips are curved around it. The other method (my favorite just because it is simpler for me) is to work over the plans on the building board, using pins around the inner curve as a form for bending. There are also opinions of how to glue the laminations together. I like to form the bends and then use thin CA. Others like to apply wood glue (white or yellow) as they are bending the pieces.

The laminating pieces are 1/32"x1/8" sheet. You will have to strip off some 1/8" pieces yourself using a straightedge and knife on the 1/32" sheet we include in the kit (we tried packaging it as sticks but broke more than we could get in the kit, so, we just sent a sheet instead). Soak the strips in water (ammonia is even better) for about 5 min. While they are soaking use a series of pins on the inside of the fin/rudder outline (do both the fin and rudder at the same time). Put pins closer together near the front fin area (sharp bend), about every 1/16", and fewer around the rear, about every 1/4". Start at either end and lay up 4 strips against the pins. Use pins along the outside as you go along to hold the shape. To curve the balsa I use one hand pulling the end of the strips and the other pushes the strips

against the pins, working my way slowly around the outline. If the strips break (and most of the time they will break at least once somewhere) push against the break with a piece of 1/8" scrap balsa and pin the scrap in place. When the strips are all in place let them dry out. Remove some of the pins and then apply glue to the laminations (if you haven't already). Let dry.

Now finish framing up the rudder/fin. First glue in place R1. Then cut and install the 1/8"x1/4" fin TE and rudder LE. Then install the 1/16"x1/8" 'ribs'. After everything is dry, cut apart the rudder and fin.

Sand everything smooth. If you want, sand a slight radius around the outline of the rudder and fin. Sand a bevel to the front of the rudder LE.

#### Stabilizer/Elevator:

This part is much easier than the rudder! Pin down T1, T2's, and T3's. Get out some 1/8"x1/4" stick material and start laying it down. Stab leading edge first. Then Stab tips, then stab TE. On to the Elevator TE, then tips, then LE's. Use 1/16"x1/8" strip to make the ribs. After everything is glued and dry remove from the board and sand. Bend a wire joiner and fit to the elevator halves. Note: you can also use a piece of 1/8" dowel as a joiner, fitted into the LE of the elevator halves.

Now shape the outer curves of the elevator and stab. Sand a bevel on the front of the elevator LE's.

#### Wings:

The wings are basically four panels, top and bottom the same, with the top joined by the center section. Don't forget to build 4 different wing panels! One top left, one top right, one bottom left and one bottom right! The bottom panels house the aileron servos.

First, select the appropriate spar pieces and cut to length. Then notch the ends to fit the wingtip section. Pin down the TE and T1's, then the spars. Layout all the ribs paying attention to which ones go where. Fix in place with pins. When assembling the bottom wing panels fit the H pieces and 1/32"ply servo mounting plate. The plate can be made removeable or fixed in place. When assembling the top wing place the 1/8" liteply strut plates in position. Now pin the LE in place (1/4"x3/16" stick). Place the aileron pieces in their proper positions. Once everything is in place you can start gluing parts together. If you are using wood glue (yellow/white/PVA) then simply remove a piece, apply the glue, and set the part back in place, using pins when needed.

Install the strut attachment sockets (S1 and S2) to the ribs where located. Remember for the top wing the sockets are at the bottom edge of the rib. In the bottom wing the sockets are at the top edge of the ribs.

Last, install the 1/16" sheeting over the center section and the inboard bays of each of the bottom wings. You can install the CS filler blocks at the rear of the top wing center section at this time.

Once everything is dry then you can remove from the board. Cut away each of the four ailerons.

Note: I know that each of the ailerons should be exactly the same. Mine never are. So, I recommend you mark them somehow as to where each one goes.

Shape the LE to a nice curve as shown on the plans. Taper the TE as desired. Shape the CS filler to a nice curve and taper even with the wing ribs. A razor plane or sanding bar is really nice for this part.

#### Controls:

At this point fit all the radio gear, motor, and controls to the fuselage. If using sleeved wire for rudder/elevator, fit the sleeves to the fuse and select the exit location in the sheet at the rear of the fuse. For pushrods, test fit so the rods will clear the slots in the rear fuse sheet. For aileron control, attach the servos to the wings. I like to use silicon caulk to secure the servos. Another good alternative is to wrap the servo with a layer of tape and secure with hot glue.

When mounting the motor make sure it has the desired down/right thrust and the prop shaft exits at the center of the cowl and that the prop will clear the front of the cowl.

Install 1/16" sheet to the bottom fuselage, from the rear U/C crossmember to the back of the fuse box.

#### Covering:

This is the point at which I like to cover all the parts.

#### Assembling:

Rigging the wings is a lot simpler than it sounds. Install the top wing with the plane upside down. The top wing is flat so just lay it down on the bench. The fuse is aligned to the top wing by jiggling it in place. Make sure the top wing incidence is as shown on the plans. Then locate where to drill the holes for the saddle clamps that will hold the cabanes to the top wing. Use a pilot drill to make the mounting holes. Then attach the top wing to the cabanes with the clamps.

Note: Saddle clamps can be made several different ways. You can buy them, bend some brass strip, or use plywood. I used 1/16" ply (approx 1/2"x1/4"), put a groove across the center of each piece about half the size of the wire and drilled a hole at each end. You can also fit small brass tubes to the top wing and slip the cabane ends into the tubes. This is the preferred method if you choose to make the wings detachable.

Now you are ready to install the bottom wings. Use the dowels to locate the wings to the fuse and test fit the wing struts. The struts are not the same, make sure you have front and back in proper positions. You will probably have to jig the wings in position as the glue sets up. Do this as you dry fit so you can check wing incidence. The bottom wing has quite a bit of dihedral that is set by the wing struts. Critical measurement here is to make sure the LE of both wings are perpendicular to the fuse, parallel to each other, and parallel to the top wing LE. I like to glue wings in place with epoxy (30 min). Second choice is wood glue. Both allow some time to fix any alignment issues before the glue sets up. Apply the glue to the struts/ sockets, wing roots and put together. Make sure of the alignment, again! Let dry.

Turn the airplane right side up. At this point it is convenient to attach the LG if you have not already done so. I like to attach each leg to the fuse, then bind and solder the joints. Place rags under the LG so that if solder drops it won't burn a hole in your new wing covering!

Assemble the ailerons to the wings with your hinges of choice. Install the aileron control horns and

the linkage to the aileron servos. Now install the aileron to aileron linkage.

Option: Another method for the aileron to aileron linkage. Use 1/16" brass or Al tubing. Cut four 1/4" lengths and glue into each aileron TE (angle them so they are parallel to the wing struts). Cut a piece of tubing about 1/8" shorter than the required length. Use a piece of tubing (small shrink tubing works) and slip over each 1/4" "stub". Slip the long piece of tubing in place between the ailerons. When all the ailerons are properly aligned apply a small drop of thin CA to the plastic tubing to lock in position.

Assemble the elevator to the stabilizer. Insert the hinges for the elevator to the stab. Then assemble the rudder to the fin using hinges. These also have control horns that need to be installed depending on your chosen method of movement (pull-pull, pushrod, cable, etc).

Attach stabilizer to the fuse. Note that you will have to insert a wedge to obtain the correct stab incidence. Set the plane in a steady position and dry fit the stab until it is at the proper incidence. Set it in position on the fuse and align it with the wings. Measure from wingtip to stabilizer tip and adjust until both sides have the same measurement. Mark the position (dry erase markers work good for this). Step back and look at the stab in reference to the wing and make sure both are 'level'. If not then shim the stab on one side or the other. Once level and position is marked then remove stab from fuse. Apply glue and put stab back in place, checking again to make sure it is level and aligned with wings.

Once the stab glue is set, then on to the fin/rudder. Do a dry fit of the fin to the stab. Make sure there is free movement of the elevator and rudder, even at full travel. Remove the covering where the fin will be glued to the stab. Align the fin over the stab and glue in place. Use a square to make sure the fin is at 90 deg to the stab.

Assemble the wheels. Glue the balsa/ply sandwich together and attach the doubler. Install a brass tube inside the wheel center. Cut a section of foam cord to length and glue around the rim of the wheel. Put the wheel on the axle and fix with a soldered washer or wheel collar. Fit a cardboard 'cone' to the outside of the wheel to simulate the canvas wheel covers of the original spoked wheels.

Attach the 1/32" ply bottom fuse hatch with tape (hinge tape works well for this). To keep the hatch closed you can install small magnets in the sides of the fuse, or simply put a small screw at the back edge of the hatch.

Attach the cowl to the fuse. I normally just use three or four dabs of silicone caulk for this. It holds well, yet when you need to get to the motor it can be easily sliced with an Xacto knife blade or razor blade.

Connect the rudder and elevator to the respective servos. Make sure the controls are all centered when the servos are centered. This makes the maiden flight go much smoother.

Painting/Trim:

Mask areas where you don't want paint, including control horns and control wires, wheels, prop/motor, etc.

You can apply trim at this point. For masking I like to use low tack masking tape or vinyl trim tape.

Do not use electrical tape, it will peel anything off, including the covering.

You are done!

Make sure all your controls are centered. Turn on the transmitter and connect the battery. Check all controls for proper direction and end point adjustment. Make sure the controls are all centered. Secure airplane. Check motor at partial and full throttle. Caution: keep body parts away from moving propellor!! Make sure propellor and moving motor parts are not rubbing against any airplane parts. Make sure battery is secure in the airplane.

Check the CG under the top wing of the airplane. If not within 1/16" of the recommended position, add weight to the nose or tail until properly balanced.

You are ready to fly.

Have fun and send pictures.

charlie bice  
manzano laser works

## Parts List:

### -Documents

Instructions 1  
Parts list 1

### -Laser cut parts sheets

1/16" sheet 3  
1/8" sheet 3  
3/32" sheet 1  
1/8" Liteply parts 1  
1/16" ply sheet 1  
1/32" ply sheet 1  
1/32" ply hatch 1

### -Balsa sheet

1/16 2  
1/32 1

### -Balsa sticks

1/8x1/16 6  
1/8x1/8 4  
1/8x1/4 8  
1/8x3/8 2  
3/32x3/8 2  
3/16x1/4 4

### -Bass sticks

1/8x1/4 4  
1/8x3/16 4

### -Balsa block

1

### -Dowels

1/8 2

### -Wire

0.047" (18ga) 2  
0.062" (16 ga) 2

-Pink Foam ~4"x20"

-Foam cord 3/8" dia 15"