

## **Building and Flying the Sbach3D-25 R/C 3D Model Aircraft**

Builders should check the thread at the ProBro website for pictures and more information.

### **Radio**

A minimum of a 6 channel computer radio with dual rates and exponential on the 3 control surfaces is required. Four micro size servos with metal gears are needed as well. Try to obtain the fastest acting servos that are available for your radio system.

### **Power System**

#### **Electric**

- 1 - 15 volt capacity 1000 to 1100 Kv Outrunner brushless motor
- 1 - 25 - 30 Amp continuous rated 15 Volt capacity brushless controller with a built in 5 Volt 3 Amp minimum capacity switching mode type BEC
- 1 - Card or software to change the settings in the controller
- 1 - 3S 11.1 Volt nominal 1300 to 1500 Mah Lipo battery
- 1 - Charger suitable for the batteries selected

The power system should be propped to draw about 25 to 30 amps static at WOT. Do not prop the motor to draw more than the maximum rating of the controller. You will need a Watts Up meter or similar tester to check this. Try using a 12x6 prop on a motor with a 900 to 1000 Kv and a 11x6 prop on a motor with a 1000 to 1200 Kv. It is not recommended that the system be flown unless the draw is checked.

#### **Glow**

For best performance the aircraft was designed around the .20 cu in to .25 cu in 2 stroke glow engines. It is recommended that the motor weight with muffler does not exceed 10 oz.

### Materials List

Amount	Size	Material	Location
4 -	3/16 x 3/16 x 36"	Spruce stick	Wing spars
1 -	3/16 x 3/16 x 18"	Basswood stick	Servo rails, Elevator joiner
1 -	3/16 x 5/16 x 12"	Basswood stick	Motor mount, Servo mount
1 -	1/4 x 9"	Balsa triangle	Fin
1 -	3/32 x 5/16 x 36"	Balsa stick	Canopy bow
5 -	3/16 x 3/16 x 36"	Balsa square	Wing, tail
2 -	1/8 x 5/16 x 36"	Balsa stick	Fuse stringers
5 -	3/16 x 1/4 x 36"	Balsa stick	Ailerons, Tail
8 -	3/16 x 5/16 x 36"	Balsa stick	Fuse, Wing, Tail
1 -	3/16 x 3/8 x 36"	Balsa stick	Wing leading edge
1 -	1/16 x 3 x 24"	Balsa sheet	Wing, Spar webs
2 -	3/32 x 4 x 36"	Balsa sheet	Ribs, Wing gussets
1 -	3/16 x 4 x 12"	Balsa sheet	Fuse nose block, Stab, Fin
1 -	5/16 x 1 1/2 x 12"	Balsa block	Top cowl, Fuse
1 -	1/16 x 4 x 13"	Plywood	Nose block
1 -	3/16 x 2 x 4 1/2"	Plywood	Wing joiner block
1 -	5/16" X 25"	Carbon Tube	Fuse
2 -	24" X 6'	Rolls	Covering

### Hardware

2 -	1/2 X 1/2 X 1/16 X 1 3/4"	Aluminum angle (electric)
2 -	.080 X 1/2 X 7"	2024-T3 Aluminum sheet
2 -	1 3/4	Lite wheels
2 -		Axles for wheels
1 -		Wire tail skid
4 -		Dubro #107 control arms
15 -		CA Hinges
4 -		2-56 Ball links
4 -		2-56 Locking clevis
4 -		2-56 Pushrods
4 -		4-40 X 5/8 Allen head capscrews & Nylock nuts
4 -		4-40 X 1/2 Allen head capscrews & Nylock nuts

## Sbach3D-25 Builders Manual

Look over the plans carefully and read through these instructions before starting construction so the build is thoroughly understood.

Cut the wing, fuse, rudder and stab layout drawings from the plans sheet. Allow enough room as needed around the layouts for taping to the build table.

Cut out the balsa nose block patterns, 1/16" ply doublers, wing attach parts, tail leading edges and wing rib patterns from the plans sheet allowing about 1/8" all around for final cutting. Using the patterns cut out all the parts to make a kit. Note the material type and thickness for each of the pieces and the grain location for the curved leading edges of the stab and fin.

Make sure the hole to be drilled in the wing joiner is the correct size for the tube.

### **Wings**

The wing has to be built first so that it can be mated to the wing joiner block. The wing is built in two panels upside down over the wing plan layout which is drawn upside down, that is the right wing is on the left side on the plans.

[] Place the lower 36" X 3/16" X 3/16" wing spar over the wing plan. It will be cut in half to separate the panels after the bottom of the wing is built

[] Clamp the root ribs together with a piece of 5/16" thick scrap balsa in between to keep them square and when all is lined up glue the ribs to the spar.

[] Place each of the 3/32" balsa ribs in its proper location on the wing spars, square them up and glue them to the spars. Check that the trailing and leading edges of the ribs line up, trim as required.

[] Cut the 2 3/16" X 5/16" trailing edge spars to length and angle. Mark the centerline on the aft edge then bevel the edges about 30 deg from the center. Glue the trailing edge spars to the ribs in the notch provided.

[] Cut a 36" long 3/16 square in half for the lower wing spars (upper during the build). Mount them flush with the root rib and glue them in the spar cutouts in each of the ribs. Let the excess hang past the tip rib. The extra will be cut off later with a razor saw.

[] Cut the 2 3/16" X 3/8" leading edges to length and angle. Round off the corners of the front edge of each with a sanding block just enough that the corners will not show through the covering then glue it in the notch provided in the front of the ribs.

[] Glue the 3/16" square basswood servo rails in the slots in the first two ribs. Note that they will fit 1/16" below the surface of the rib. Temporarily mount the aileron servos, cover the area between the servo and the root rib with 1/16" balsa strips to attach the covering. Make a hatch around the rails on the left side and a cover with 1/16" balsa sheet for the receiver/battery.

[] Fit and glue the 3/16" X 1/4" tip reinforcement strip inside the last rib.

[] Fit and glue the 3/16" square balsa diagonal braces to the main spar and the trailing edge between the ribs starting at rib #2. Start from the top (bottom during the build, remember the wing is upside down) of the main spar to the trailing edge at rib #3 then to the bottom of the main spar at rib #4 then from the bottom at rib #4 to the trailing edge at rib #5 then to the top at rib #6. It is an alternating up and down zigzag pattern.

[] When the glue has completely cured remove the wing assembly from the table and turn it over to access the top side.

[] Cut the tabs off the ribs with a #11 blade.

[] Glue the 3/32" triangle gussets to the main spar, root rib and the trailing edge spar. They fit flush with the top of the root rib.

[] Trim off any spars that may extend past the root and tip ribs with a razor saw.

[] With a #11 blade and a straight edge carefully cut out the area in the root rib between the wing spars for the wing joiner block. Try the fit of the joiner block in the pocket formed by the wing spars and spar webs. Sand as required for a nice snug fit. After fitting mark the top and front of the wing joiner. The fuse tube goes through the center of the wing joiner so it is possible to glue it in upside down. This completes the wing.

## **Ailerons**

The ailerons are built after the wing. This is just a simple cut and glue the sticks over the plan.

[] Start by cutting the 3/16" X 5/16" leading edge spar to the length and angle shown on the plans. Mark the center line on the leading edge. Using the center line as a guide bevel the edges approx 30 deg back from center. This will allow the aileron to rotate through the full range of throw of 50 to 55 deg.

[] Cut the 3/16" x 1/4" balsa trailing edge to the length and angle shown.

[] Cut and fit the remaining 3/16" square ribs and the 3/16" thick spar doublers as shown in the plans.

## **Fuselage**

[] Start by making the canopy bow. Cut 2 pcs of 3/32" x 5/16" balsa strips 16" long. Stack the pieces together, stand them on edge and clamp them lightly together. Wick some thin CA into the first 4" of the laminate. After it cures lay it over the plans and bend it to the canopy outline. Use some heavy weights and clothespins to hold it in place and wick some CA into it. After it cures set it aside for final trimming and fitting to the fuse.

[] Glue the 2 3/16" x 5/16" hardwood motor mount rails to the 3/16" balsa nose block material. Check that the width is correct for the engine/motor that is to be used. The cutout will have to be widened for the outrunner motor. Builders may want to cut and fit the aluminum angles for the electric motor mount at this time.

[] Place one of the 1/16" plywood nose block doublers in its proper location on the plans. Bevel the slot for the fuse tube with a razor knife enough that the fuse tube fits nicely. Place the 3/16" balsa nose block in place on top then place the top 1/16" ply doubler on it. Once again bevel the ply so the fuse tube fits well. Glue the nose block assembly together. Use some heavy weights to hold everything in place. DO NOT glue the fuse tube in.

[] Cut the 2 1/8" X 5/16" fuse stringers to length. These are the stringers that glue to the fuse tube. Do not forget to cut the 3/16" notch at the rear of each for the fin post.

[] Cut the 5/16" fuse tube to length. Trial fit the nose block, the 2 5/16" balsa filler block pieces, the stringers and the fuse tube together. Trim as needed for a good fit. There will be a slot left in between the 5/16" blocks for the wing joiner block, check that it slides in nicely but do not install it yet. When the builder is satisfied with the fit, the nose block, fuse stringers and the filler blocks may be glued together. Leave the fuse tube in place as a gauge but DO NOT glue it in yet. Also be careful when gluing in the fuse sticks that it is not glued in accidentally. Use some heavy weights to hold everything in place.

[] Notch out the 3/16" X 5/16" upper fuse stringer for the fin post then glue it to the top of the nose block.

[] Cut and glue the 3/16" X 5/16" fuse vertical pieces in place between the stringers.

[] Glue the 4 3/16" x 5/16" basswood servo rails in place spacing them correctly for the servos to be used. The servos can be located anywhere between the trailing edge of the wing and the leading edge of the stab to achieve the proper cg.

[] Cut and glue the 1/4" X 5/16" balsa stab support in place remembering to cut out the notch for the fin post. Use the 3/16" X 5/16" balsa filler block and a scrap piece of 3/16" to maintain the proper distance between them for the stabilizer.

[] Notch out the lower fuse stringer then glue the 1/16" plywood tail skid support in place.

[] Glue the lower fuse stringer to the bottom of the nose block and glue the 3/16" x 5/16" verticals in place.

[] Glue the 5/16" thick balsa top nose block in place. Fit the canopy bow to the top nose block and turtle deck stringer. Glue them in place then cut, fit and glue the vertical pieces in place.

[] Remove the fuse from the building board and carefully slide the fuse tube back, insert the wing joiner block in its slot and then slide the tube into the 5/16" hole in the block. Check that it fits together nicely. Slide the wings on the joiner block and check the fit as well. If the airframe was built correctly all should line up square and tight.

[] Now the fuse tube can be glued in but first rough it up with sandpaper to help with the bond. Using slow curing epoxy coat the tube and all the wood surfaces to be glued. Slide the fuse tube between the fuse stringers, through the wing joiner block and into the fuse nose block. Note that the wing joiner can be installed upside down, be sure the flat part is to the top.

[] Place the fuse on a piece of wax paper on the building board with the wing joiner block hanging over the edge. Use weights and clamps to hold the fuse tube tight to the fuse stringers. Check that the wing joiner block is square to the fuse. Wipe off any excess glue. Let the epoxy glue fully cure.

[] While the fuse is off the building board build the fin and rudder. This is just a simple cut and glue the sticks over the plan.

[] Glue the fin into the slots in the fuse stringers and to the top of the fuse. It may have to be trimmed slightly where it joins with the turtle deck stringer. Glue the 1/4" balsa triangle to the back of the fuse and fin post. This completes the fuselage.

[] Mark the center of the leading edge of the rudder leading edge and bevel the edges as was done with the ailerons.

[] Cut the 1/4" x 5/16" balsa trailing edge and the 1/4" x 3/8" balsa bottom to the length and angle shown.

[] Cut and fit the remaining 3/16" thick pieces.

### **Horizontal Stab & Elevator**

Once again this is just a simple cut and glue the sticks over the plan. Build the stabilizer first.

[] Cut the stab trailing edge to length and bevel it 30 deg each side on the hinge line. Notch out the ends for the leading edge curved pieces. Cut the leading edge to length and angle then notch it out for the curved tips. Lay them all on the plan and glue them together.

[] Glue in the 3/16" square ribs and the 3/16" X 3/4" center section parts in place.

[] Cut out the 3/16" x 5/16" balsa elevator leading edges to fit the 3/16" square hardwood joiner. Glue them and the joiner together with epoxy.

[] Cut the 3/16" x 1/4" and 5/16" balsa trailing edge parts and glue them in place.

[] Cut and fit the remaining 3/16" thick pieces.

[] After completion mark the center hinge line of the elevator leading edge and bevel it 30 deg each side, this will give 55 deg of movement both ways which is the max required.

### **Trial Assembly**

Hinge type is at the discretion of the builder, CA hinges are recommended. It is suggested that the hinge slots be cut and the fit checked before the aircraft is covered.

[] A pattern for a flat sheet aluminum landing gear leg is shown on the plans sheet. Cut two out of .080 6061 or 2024 aluminum and bend them to

the angle shown. Drill the holes for the wheels and the 2 holes to bolt the gear to the fuse. A Williams or Tetherite gear may also be used. 1 3/4" thin wheels are suggested.

[] Fit the wing over the joiner block to the fuse making sure the parts slide together nicely and the wing fits tight and square to the fuse.

[] Check that the stab and elevator slides into its slot in the fuse. Notch out the fuse stringers in the area of the stab joiner to insure full elevator travel.

[] Check that the servos fit in their locations then drill for the servo mount screws. Fit the wing hatch cover then drill for the screws. If the tail servos are located in the frontmost bay check that the arms do not interfere with the ailerons.

## **Covering**

About 2 rolls of covering will be required if a multi color scheme is used. Covering type, color and brand is at the discretion of the builder.

[] Sand smooth each of the main sub assemblies making sure there are no glue lumps or high spots as these will show clearly through the covering.

[] Use a light weight covering film. Coverite Microlite was used on the prototype.

[] After covering cut out the covering over the holes for the servos, servo wires, landing gear bolts and motor mount bolts with a sharp blade. Cut out the area where the wing will be glued to the fuse

## **Final Assembly**

[] Glue the hinges in their location in each of the control surfaces.

[] Install the tail servos and run the wires forward into the slot cut in the wing root sheeting, servo extension wires may be required to reach the hatch in the wing. The servos may be located one bay forward or back if required to achieve proper cg.

[] Glue the ailerons and hinges into their respective wing panels. Mount the servos and aileron control arms, cut and fit the pushrods to length.

[] Coat the wing joiner block and the root rib with epoxy. Slide each of the wing panels on the joiner block and against the fuse.



[] Pull the tail servo wires into the wing hatch and pull the right side aileron servo wire through into the left side hatch.

[] Check that the wings are held straight and square with the fuse and each other until the glue cures.

[] Remove the covering from the stab in the area that will be glued to the fuse.

[] Slide the elevator in the slot in the fuse. This must be installed before the stab as you cannot get it in after.

[] Slide the stab into the slot and square it up with the wing and fuse. Glue it in with epoxy glue. Glue the elevator hinges into the stab.

[] Hinge and glue the rudder in place.

[] Mount the control arms then cut and fit the pushrods to length.

[] Make the motor mount from 2 pieces of 1/16" X 1/2" X 1/2" aluminum angle 1 3/4" long. Drill the holes for 4-40 bolts in the fuse nose block and the aluminum angles as shown in the plans. Mount the motor and drill out the angles to suit the motor mount bracket.

[] Attach the main gear to fuse with 2 4-40 X 5/8" bolts and locknuts. Mount the wire tail skid with 2 small wood screws.

## **Electric**

[] Mount the controller on the left side of the fuse between the motor and wing with velcro or elastic bands and cup hooks.

[] Stick some velcro strips in the area between the motor and the leading edge of the wing. The batteries may be mounted anywhere there to obtain the optimum C of G. Use the lighter or heavier batteries to obtain the proper C of G if required. Some builders may want to use cup hooks and #64 elastic bands or velcro straps to hold the batteries tight to the velcro strip.

[] Check that the motor rotation direction is correct and that the throttle stick movement is in the correct direction with the propeller removed! Some controllers require that the setpoints for the throttle range movement be set before operation. Refer to the controller manual for this.

## **Glow**

[] The engine should be located and bolted in place last. Slide the engine forward or back in its slot as required to obtain the proper C of G location.

[] When the engine has been bolted in place mount the tank on the opposite side with a pad of foam under it and cup hooks and elastic bands to hold it in place. A 2 to 3 oz tank should be sufficient.

[] Mount the throttle servo control arm then cut and fit the pushrod to length.

### **Flight Testing**

The airplane should fly neutral balanced at 4 to 4.25" back from the wing leading edge measured at the wing root. This is 33% to 35% of the wing avg chord.

Check that all the control surfaces move in the proper direction. Start with 45 deg deflection on high rate with 30% expo and 20 to 25 deg deflection on low rate with 20% expo on all the control surfaces.

These are suggested starting points, experienced flyers may want more than this but it is recommended they start with this setup first.

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