



Blue Foam Wonder

The Blue Foam Wonder is a fantastic flying, mid-mounted motor, delta wing that is extremely versatile. You'll build several just for fun. The plane can fly slowly, 10 MPH, fast 65 MPH (so far, and still holding together), is completely docile or awesome in aerobatics, depending upon your setup. Perfect for the parking lot at work, the park, or a flying field; you'll love it!

I attended the SEFF 2009 event last May and participated in the Complete Destruction Foam Combat event. It was such great fun; I put forth a suggestion for a similar event at my home club's (Georgia Model Aviators) family day. With the green light, I proceeded to try and round up participants. "Don't have a plane," was the cry from my buddies I was counting on, soooo, I embarked upon a project to develop a low cost foamy that was easily produced (realizing I would have to be in production to make the event happen). The first generation of the Blue Foam Wonder (BFW) was created (I built 12 in one week, foam flying everywhere!). We are now into our 5th generation of BFW's

The initial goal in designing the BFW was to create a highly maneuverable, easy to build, airplane for under \$100, ready to fly with a 2.4 gig receiver. This goal was achieved, although there have been modifications that exceed the \$100 mark because of more expensive power requirements. More on this later.

List of Materials, Airframe

- Foam Sheets, Blue foam, 1-2'X4'X1/4", Depron (more expensive) 2-39"X13"X6mm, Foam Project board 1-20"X30"X3/16" \$1to \$5
- 1/4" Square stock, basswood or similar \$.75
- 4 popsicle sticks \$.25
- 2"x2" light ply, 1/8" to 3/16" \$1.00
- 2-12" .55" music wire or 1/8" dowel and .032" music wire for pushrods \$1.00
- 3 Hot glue sticks \$.75
- Packing tape for hinge material
- Velcro
- Paint or colored tape (optional)
- Total cost \$4.50 to \$9.50

Tools needed

- Sharp hobby knife (buy a new blade) or snap blade utility knife
- Metal yardstick or ruler
- Square
- Hot glue gun
- Pliers or Z bend tool
- 3/4" metal angle iron (optional)
- Soldering Iron
- Drill and Drill bits
- Small saw
- Wax paper

Electronics

- Transmitter with elevon mixing capability
- 2 channel (or more) receiver (72 MHZ \$20 Spektrum \$50)
- 2 -9 gram servos \$8-\$30
- Total Electronics Cost \$28-\$80

Power System

- 100-400 watt motor (keep it light, 20-50grams)
- 10-40 amp speed control (in line with power consumption)
- 350-1300 Li poly battery (2 or 3s)
- 6X4 to 9X5 prop, prop adaptors or prop savers
- Power System Cost \$35 to \$300

Total cost \$67.75 to \$400 ready to fly

CONSTRUCTION

Construction starts by cutting one 2' x 4' sheet of blue foam, trimming the edges, and laying out the wing plan on the foam. Plug in the glue gun and start cutting out parts. Measure the spars and cut from the ¼" square hardwood stock. From the remaining foam cut 6-1 ½" X 24" strips and put a 45 degree bevel on each long side. The bevel should be cut from the smooth side to the rough side. Cut a 45 degree bevel on the long axis of your elevons, again, smooth side to rough side, keeping the rough side on the bottom.

Hot glue the 1-1/2" strips together to form 90 degree triangles. Place a piece of wax paper on a flat table and place the main body of the aircraft, rough side up, on the wax paper. Lay a bead of hot glue on the spar stock and glue to the trailing edge of the main body. Repeat this process for the engine bay.

Install the triangle foam pieces on either side of the engine bay. Make sure the pieces are perpendicular to the trailing edge of the wing. Install a triangle foam piece to the center of the wing, on the bottom side, to form the main fuselage bottom section. Flip the wing over and trim off the excess triangle foam. Take some scrap foam and glue to the open section of the nose to create a solid nose cone. Laminate the pieces together and hot glue in place. Trim off the excess.

Install the triangle foam pieces to the center section of the wing creating a diamond shaped fuselage. The front piece of triangle stock on the top side does not run the full length of the airframe. This allows for flexibility in mounting your battery and electronics.

Trace the diamond shaped fuselage of the front section onto a piece of light ply and cut out. At this point I usually center and install the motor mount to the plywood before gluing to the airframe. This saves a small amount of frustration at the time of motor installation. Hot glue the assembly to the airframe.

Install the rudders on the airframe, again making sure they are perpendicular to the trailing edge of the wing. Failure to do this step can result in an aircraft that could have a rudder turn.

Paint or color your Blue Wonder before installing your elevons. Colored tape adds strength to the airframe, but it also adds weight. Use lightweight tape.

Place your elevons next to the airframe and cut a piece of the packing tape the length from the rudder to the tip of the wing. Attach the tape to the wing and with the beveled side of the elevon against the wing (full down position) attach the tape to the elevon. Cut a piece of tape to length for the inboard section of the elevon and attach the tape to the wing and elevon. Make sure to have the elevon in the full down position when attaching the tape. Flip the airframe over and repeat the same process making sure the elevon is in the full up position. Push the tape into the gap between the wing and elevon so that there is full free movement in the elevon.

Place one of the servos, with arm attached, on the outboard side of the rudder and cut a small slit in you elevons in line with the servo arm. This slit is where you will install the Popsicle stick control arms, which I highly recommend. Cut a length of Popsicle stick 1-1/4" in length from the rounded end, and drill a hole to accept the wire servo linkage. Push the control arm through the foam slit, put a small amount of hot glue in the slit, and re-install the control arm flush with the bottom. Install a 1" length of Popsicle stick on the bottom to reinforce the control arm.

Servo installation is simple. Servo location is at the front of the motor bay on the outside of the rudders. Cut a small hole in the rudder to accommodate the servo wire. Electrically center the servos. Bend the music wire into Z bends on both ends and install into the control arm and servo arm. Apply hot glue to the servo and mount to the airframe. Make sure the elevon is in a neutral position (level with wing). Push the servo wire lead through the hole. Repeat for opposite side.

Install the motor remembering to place the prop in the correct position (it's a pusher). Speed controls and receivers can be mounted forward of the center triangle section. Hot glue, double sided tape, all work well. The battery will be mounted ahead of the center section with Velcro. Center of gravity (CG) is 3/4" to 1 1/4" ahead of the forward edge of the motor bay. Adjust the location of the battery to achieve the proper CG and your style of flying

POWER SYSTEM

I have flown the BFW on power systems as low as 75 watts and as high as 450 watts. CD Rom motors with 9X5 props work well. These are the cheap disposable foamy combos that are available in the 15-25 dollar range (<http://www.graysonhobby.com/catalog/tower-2408-star-graysonhobby-combo-firewall-p-568.html>). A midrange setup is a Welgard 2212-10, 8X4 Prop, and a 20 amp speed control with a 1000mah 3 cell 20C battery (<http://www.graysonhobby.com/catalog/brushless-outrunner-motor-gh2212-series-p-427.html>). Our favorite power setup is a Microdan (GoBrushless.com) 2505 2535KV motor with a 7X5 APC prop, a 25 amp speed control, and a 1300mah 2 cell battery 20C.

This combination allows for vertical takeoffs, is light for slow flight, and has a nice top speed. Put a 3 cell battery and a 40amp speed control and the word "rocket" comes to mind.

SETUP

Set your radio to elevon mixing and make sure your elevons are working properly. For the initial flight, I recommend servo throws to be in the 75% range with approximately 1/2" of travel up and down. Make you CG neutral. Trim the plane to straight and level. Later, you can adjust your throws accordingly. Mine are at 150% (1 1/2" up and down) and the airplane will literally turn 180 degrees in less than 1 foot, and a roll rate comparable to a high speed drill.

FLYING

The Blue Foam Wonder is joy to fly. The airplane has good tolerance for wind and will penetrate over 15 MPH winds. The BFW can be a docile slow flyer, or an aggressive speed combat ship. Build two; give one to a friend, and combat! Guaranteed to bring smiles. Slow the BFW down with a slight turn to the right and have it descend touching a wing tip and pulling out, it will slowly spiral to the ground and launch itself back into the air. Place the BFW on its tail with full down elevator, and hit the throttle for an exciting vertical launch. Fly the plane inverted into the wind and go into a Harrier. Fly low and slow, less than 1 foot altitude. Practice catching the Blue Wonder instead of landing. Above all have fun.....that's what it's all about.

TIPS

- In laying out the pattern, use a yardstick and square to create straight and perpendicular lines.
- When cutting foam, be sure to use a sharp knife and metal yardstick to guarantee smooth edges.
- The 45 degree bevel can be easily made with a 3/4" piece of angle stock. Lay the stock upside down on the foam and, using a long snap blade, cut each side of the triangle. This makes perfect 1 1/2" strips for making triangle stock.
- When using the hot glue gun, be careful to not get hot glue on your fingers. It sticks extremely well, **and burns!**
- When painting blue foam, lightly spray the foam. Most paint attacks the foam, but if applied in light coats, the paint takes without damage.
- I use clear packing tape for the elevon hinges, but have had great luck with strapping tape as well
- Popsicle sticks work very well, but you can choose conventional control arms.
- Servo installation is simple fast and easy



#1
Blue Foam Wonder kit. Use hot melt glue or foam safe CA to assemble your airplane.



#2
Glue $\frac{1}{4}$ " wood spars into place.



#3
 $\frac{1}{4}$ " wood spars glued into place on trailing edge and front of motor bay opening.



#4
Attach elevons with tape of your choice.



#5
Glue the battery support in place on bottom side of plane as shown.



#6
Cut $\frac{1}{4}$ " slots on both sides of battery support for the Velcro battery strap.



#7
Velcro battery strap shown from bottom side.



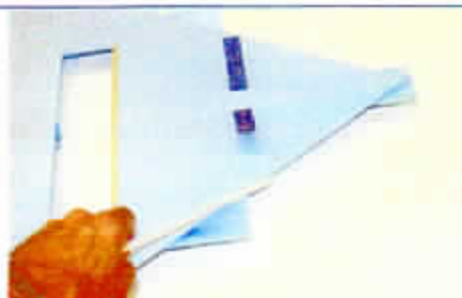
#8
Velcro battery shown from top side.



#9
Glue side triangular stiffeners into place as shown on bottom side of plane.



#10
Glue center triangular stiffeners in place as shown. (The triangular piece that is filled in with foam on one end should face the front of the plane).



#11
Cut side triangular stiffeners to match leading edge of plane.



#12
Cut center triangular stiffener to match nose of plane.



#13
Shape the nose of plane as shown.



#14
Glue center triangular stiffeners into place as shown on top side of plane.



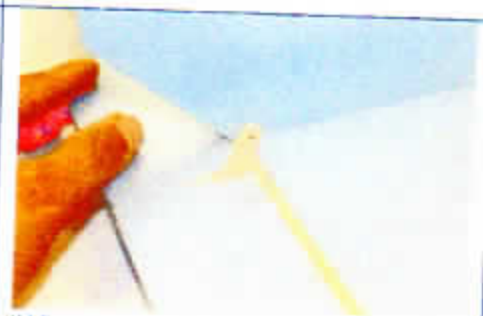
#15
Glue vertical stabilizers in place as shown.



#16
Glue vertical stabilizer support braces into place as shown.



#17
Glue motor mount into place as shown.



#18
Glue control horns into place on elevons in slot provided.



#19
Install push rods as shown.



#20
Center servo and install servo horn at 90° to servo. Use straight edge to level elevon, glue servo in place as shown.



#21
Attach receiver with velcro in location as shown.



#22
Install motor and speed control as shown. (No need to purchase a pusher prop, just install regular prop backwards on motor shaft.)



#23
Adjust your CG by sliding battery forward or back. CG is 3/4" to 1 1/4" ahead of motor bay opening.

Set your radio to elevon mixing and make sure your elevons are working properly. Adjust elevons to have approximately 1/4" of travel up and down on low rates and 1-1/2" of travel up and down on high rates. Use 50% to 70% expo on high rates if your radio has that capability. On high rates the airplane will literally turn 180 degrees in less than 1 foot, and a roll rate comparable to a high speed drill.

