Having Fun With Floats

Six years ago I was talked into giving float flying a try. Not having any float flying experience I was a little bit hesitant when we arrived at the lake. All I could see was my new “Balsa USA Laker” amphibian becoming a submarine or a floating pile of balsa. I was amazed when the initial take off was just as easy (if not easier) than flying from the field and landing was a breeze too. After my first flight I was hooked and knew I had to have another float plane. Instead of building a new airplane I chose to add floats to my .60-size Big Stick and ordered a set of built-up wood floats from Great Planes. It was then I realized there are some crucial setup rules that must be followed when converting to floats or you will be disappointed in the end result. Either you airplane will not be able to break free of the water and you’ll be taxing a boat with wings or you will be retrieving your airplane (hopefully by boat) from the lake. The Big Stick fly’s very well and continues to be a whole lot of fun. I found a great article in the September 2000 Model Airplane News magazine that details how to set up floats. I have taken excerpts from this article in hopes it will help other RC’ers to try this exciting facet of our hobby.

Types of Floats

Basically there are four types of float materials. Wood kits that are built up balsa and light ply, foam that are pre-cut, molded plastic, and ready-made fiberglass. The wood and foam floats require some type of covering. Usually they are balsa sheeted and then covered with MonoKote or a similar material, although 3/4 oz. fiberglass cloth and fuel proof paint works best. This method also adds strength to your floats. The choice is how much do you want to spend and how much effort are you willing to put forth. Floats range in price from about $20 up to as much as $500+ for a set of 1/4 “scale” fiberglass floats.

If you can build an airplane you can build a set of floats. The construction of wood floats is similar to that of a fuselage in that you have sheeting, formers, stringers and doublers at all stress and mounting points. Foam floats usually have a spruce, or other hardwood, spar running the length of the float for mounting purposes. Floats usually have two bottom shapes, vee-bottom (sometimes called EDO) or flat. Vee looks more realistic and tracks better than flat-bottom, but they are not as maneuverable, causes more water spray, and cost a little more.

Hanging Your Floats

The biggest challenge is the placement and attachment of the floats to your airplane. In most cases the forward strut is attached to the fuselage just forward of the wings LE and the aft strut is attached just aft of the wings TE. The fuselage “must” be reinforced at the attachment points with 1/8” to 1/4” aircraft ply installed under a former and gussets should also be used for added strength. In actuality it is pretty much up to you when it comes to attaching floats unless you buy a set of floats for a specific airplane. Float struts must be custom made for most models and music wire is usually used. I used a set of Great Planes .60-size floats which came with pre-bent 3/16” music wire struts for my .60 size Stick. It was just a matter of getting the right placement and adjusting the struts to get the correct float incidence. Great Planes suggests using the existing wheel struts as the forward strut and setting the rear strut to obtain the correct incidence. If you do this you must put a diagonal brace on the forward strut as well as the rear strut. If your model has a formed-aluminum front strut a diagonal brace is not required but it will look odd with a music wire rear strut. You could try and find a formed-aluminum strut to use as the rear strut but it may be difficult to find one that allows for the correct incidence. Both front and rear struts must also have cross bracing between the floats.

The thickness of the wire used for the struts depends on the size of the airplane. On .40-size either 1/8-inch or (preferably) 5/32-inch wire is fine. For .60-size I use 3/16-inch wire and ¼-inch wire for heavy quarter-scale airplanes.

Hanging your floats is not as difficult as it seems if you follow a few basic setup rules.

- The float length should be between 75 and 80 percent of the fuselage length (as measured from the engines thrust washer to the rudder hinge line).
- The planes CG should be at or slightly forward of the float step.
- The float tips should extend at least 2 inches in front of the propeller.
- There should be at least two inches of clearance between the tops of the floats and the tip of the propeller.
- The floats should be set parallel to the planes datum line or with 1-1/2 degrees of positive incidence.
- The centerline distance between the floats should be between 20 and 25 percent of the models wingspan.

In the following figure, point A is the point where the front strut is attached to the fuselage. Point B is where the rear strut attaches to the fuselage. Points C and D are where the front and rear struts (respectively) are attached to the floats. The wire between points A and D is the diagonal brace. Crossbars are the members that go between the floats at points C and D.

The struts are formed in the shape of a trapezoid with the length of the top side equal to the width of the fuselage at the attachment points and the bottom side equal to the spread between the float centerlines. The crossbars that form the trapezoid actually extend beyond the edges of the trapezoid to provide the attachment points for the floats. The easiest way to make float attachments is to use a flat board to represent the top of the floats and then to block up the fuselage in the appropriate position above the board. Next draw two parallel lines on the board making the distance between them equal to the spread between the float centerlines, then draw a centerline between them. Next draw two lines across and perpendicular to the first lines with the distance between them being equal to the distance between points C and D. The points at which these lines intersect the first two parallel lines are the locations of the four mounting points on the struts. The strut-mounting blocks are attached to these points with the crossbars installed in the mounting blocks. On the float, carefully measure the distance from the step to the attachment point for the front strut, and use this measurement to position and draw another perpendicular line on the board. This is the “step line”. Draw one more line ½ inch in front of the step line and label it “CG.” Block up the fuselage over the centerline at the height needed to keep the propeller 2 inches above the board. The planes CG should be directly above the “CG” line, and the planes datum line should be at 1-1/2 degrees positive angle relative to the top surface of the board. 2-inch thick Styrofoam makes good fuselage supports and can easily be cut to shape.

After completing the above, determine the height of the forward strut by measuring the perpendicular distance from point A on the fuselage to the forward crossbar. (This is not the distance between A and C.)

Draw the front strut to use as a pattern to make the front music wire strut. The strut should be tightly bound to the crossbar with copper wire and silver-soldered. Next, attach the strut to the fuselage and the building board and re-block the fuselage over the board. If the strut failed to come out exactly as the pattern, just reposition the fuselage to get things lined up properly, and re-measure to obtain the correct height of the rear strut.

When you are finished making the rear strut, attach it to the fuselage and board, and make sure everything is positioned properly. Use shims if necessary to make minor adjustments.

Finally, measure the length of the diagonal braces, bend them and silver-solder them between the top of the forward strut and the bottom of the rear strut. I use the appropriate size bearing blocks (determined by wire diameter) and wheel collars to attach the struts to the floats. This works very well and allows for easy removal of the floats.

Steering

The standard air rudder does not usually allow for maneuverability of an airplane on floats. You will have to install a water rudder on either one or both floats. The size of the water rudder depends on the size of the airplane. On my 10 lb., .60-size Stick I used a 2-1/4 x 4-1/2 inch water rudder and it works fine. Most float kits include the water rudder designed for those size floats. If you are scratch-building, William's Brothers has two sizes available and there are other manufactures that offer a variety of water rudders as well. All water rudders that I've seen sold separately include the mounting hardware.

There are several ways to operate water rudders. If the airplanes air rudder extends to the bottom of the fuselage, the simplest linkage is to attach a separate control horn to the bottom of the air rudder and run a flexible cable pushrod under the fuselage, down one strut and back to the water rudder. If the air rudder does not extend to the bottom of the fuselage, you can run the pushrod from the rudder servo and out through the bottom of the fuselage and back to the water rudder. Or, simply insert a rod with a steering arm into the nose wheel bracket and run a pushrod to the water rudder. Another great setup is to use thin flexible steel cable (U-control cable for example) and set up a "pull/pull" system to two water rudders. To do this use a double control horn at the bottom of the airplanes air rudder and run three cables as follows:

- First, from the right side of the air rudder horn to the left side of the float's tiller arm;
- Second, from the left side of the air rudder horn to the right side of the left float's tiller arm:
- Third, from the right float to the left float.

The first two cables run under the fuselage, down the strut and along the top of the floats. The third cable runs along the top of the floats and up and over the rear strut. Run the cables through small-diameter plastic tubes which can be heated and bent at 90-degrees. Attach these to the rear strut with thread and CA.

Waterproofing

There are a few things you should do to make your model waterproof. Wrap you Rx and battery in a plastic bag and then in foam rubber. Mount your switch inside the airplane and use a this push/pull wire that exits the top or side of the fuselage to operate the switch. Some modelers use "hooded pushrod exits wherever water is likely to enter. I just usually stick a gob of Vaseline over the pushrod exit holes when I get ready to fly. Pay particular attention to having a good wing saddle seal. I also use silicon sealant where my fuel lines exit the firewall. The most important thing is to have a good engine with a "reliable" idle, or a good retrieval method! I use fiberglass reinforced props because water can eat up wooden prop but others use wood without a problem.

Flying

Flying a float plane is a little different in that it's tail doesn't lift as speed increases. Instead, the floats gradually rise until they are "on step", at which point the airplane really accelerates. During takeoff, watch to make sure the airplane doesn't bounce into the air before it's ready to fly. Allow the airplane to reach flying speed before applying any up-elevator. If using the single rudder method, as you become airborne your airplane will have a tendency to dip the wing on the side your water rudder is located due to the increased drag of the water rudder. Because of the added drag and weight of the floats, the airplane will not fly as fast as it did without floats, and it's vertical performance will be somewhat diminished. Other than that it should fly pretty much like it did before you added the floats.

When performing a roll maneuver, a float plane will really whip around during the last half of the roll due to the pendulum effect. Landings have to be made a little faster due to the increase in wing loading. A "perfect" landing is made when the float's step and transom touch the water surface at the same time.

Added Stability

I have heard that an additional air rudder/fin area helps the stability of an airplane equipped with floats. Up to a 25-percent increase is usually recommended. This is easily added in the form of a fixed fin under the fuselage. The Great Planes float kit I used have the material for this additional fin. Although I did build this fin, I have yet to install it and my Stick fly's very well without it. I have been to quite a few float fly's and have not personally seen one used except on J-3 Cubs. I suppose it might help during takeoffs.

SETUP RULES

Several basic guidelines should be followed when considering the size and position of floats relative to a model's fuselage:

- The floats' length should be between 75 and 80 percent of the length of the fuselage (measured from the engine's thrust washer to the rudder hinge line).
- The plane's center of gravity should be at or slightly forward of the float's step.
- The floats' tips should extend at least 2 inches in front of the propeller.
- There should be at least 2 inches of clearance between the tops of the floats and the tip of the propeller.
- The floats should be set parallel to the plane's datum line or with 1½ degrees of negative incidence.
- The centerline distance between the floats should be between 20 and 25 percent of the model's wingspan.

Floatplane setup

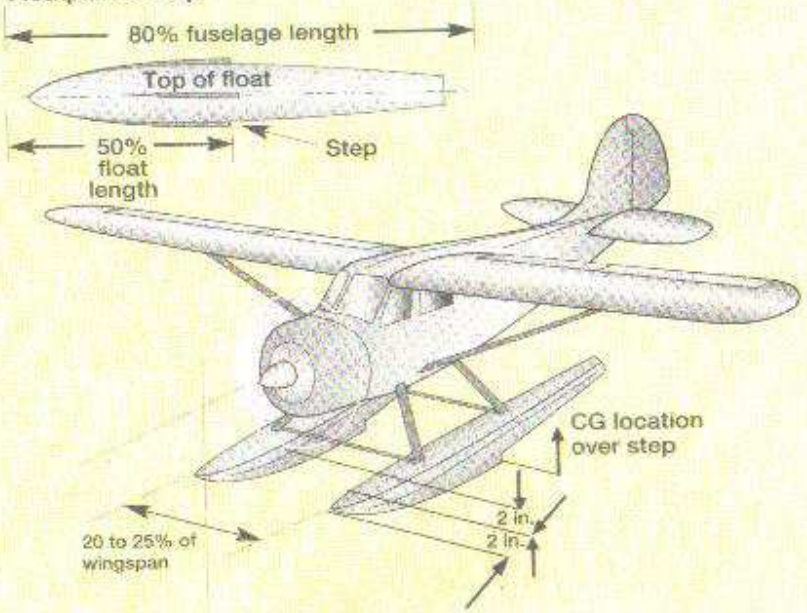
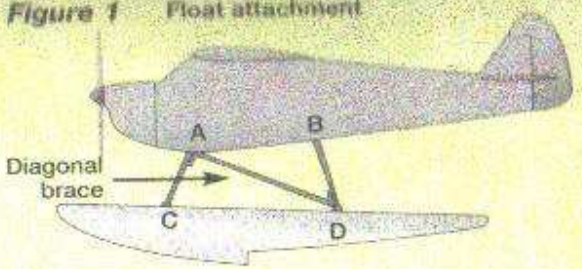
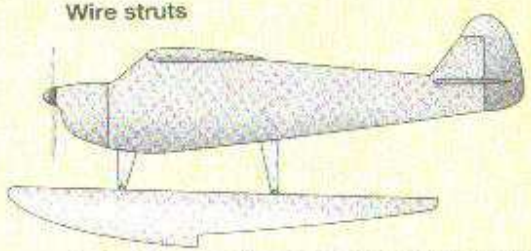


Figure 1 Float attachment

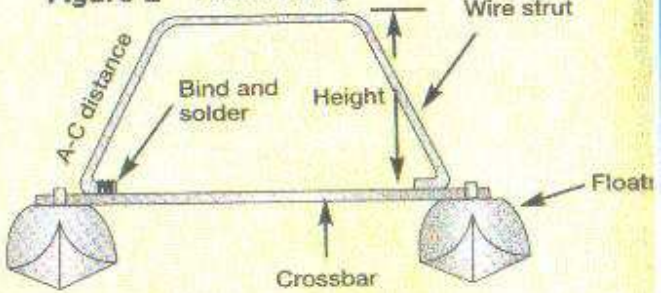


Wire struts



Formed-aluminum or fiberglass landing-gear struts don't require diagonal bracing.

Figure 2 Float bracing



Typical wire strut with crossbar brace forming a trapezoid