Construction Notes
Boeing B-314, 1/16 Scale
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Tail:

Overview: The tail is constructed of conventional built-up balsa construction. The rounded leading and trailing edges are fabricated by laminating balsa strips around a particle board forming template. I cut a template that matched the entire outboard vertical tail profile. The vertical tails and horizontal stabilizer are fully sheeted with 1/16 balsa, followed by ¾ oz fiberglass, while the rudders and elevator are open framework, covered with fabric (i.e. 21st Century Fabric). The rudder servo is located inside the horizontal stabilizer structure, on centerline and near the elevator hinge line. There is a straight, fully supported pushrod running out to each rudder horn from the servo arm. I used a ball socket style in-line connection to the servo (aileron style connection). The rudder horn extends out straight forward from the leading edge of each rudder, and is housed internal to the horizontal stabilizer. The elevator servo is also located on the horizontal stabilizer. The control horns and pushrods are completely hidden when the tail assembly is mounted to the fuselage. The tail assembly is bolted to the fuselage with four 10-32 flat head screws. The photos below illustrate some of these details.

Wing:

The wing is conventional built-up balsa construction, built in three sections as shown on the plans. The wing joint is at the inboard edge of each aileron, and the primary joiner is a thin-walled aluminum tube fitting into a phenolic joiner socket in each wing section. I used Sig Mfg P/N SIGSH778, which is a good match for this application. The wing sections are retained with small aluminum straps that are screwed into plywood hard points (I use the inner tube from a nylon pushrod which is glued into the plywood as the screw receptacle. A 2-56 screw threads nicely into this tube, and provides excellent thread locking. I have used this technique on engine cowls, etc have never had one of these fasteners back out due to vibration).

Aileron and flap servos are located out in the wing. I also used a separate micro servo in each engine nacelle for the throttles. This provides very positive linkages to each engine and eases set-up to get the engines synched. See the general discussion at the end relative to engine set-up.

The spar is basswood or spruce and tapers from the root to the tip. It is .25" thick from the root to the break at the inboard edge of the ailerons, and is 1/8" thick outboard from there. Use shear webbing between the upper and lower spar, between each rib. Not shown on the plans is the plywood dihedral joiner. Don't forget this item!

The wing is sheeted with 3/32 inch balsa and finished with ¾ oz fiberglass. The engine nacelles are planked with 1/8 x 3/8 balsa strips.

The cowls are made by shaping foam blanks which are then fiberglassed. Afterwards, the foam is removed. I made the foam blanks by clamping a block of foam between two appropriately sized plywood disks and then using an electric drill as a lathe and shaping the foam with coarse sandpaper. You could also make a mold and then do a conventional lay-up.

Sponsons:

Overview: The sponsons are hotwire cut from EPS foam. The tip section is cut and shaped separately (it forms a bulbous tip), and then glued to the sponson. The entire sponson is fiberglassed after the joiner socket and hard points are installed. There is a piece of hard balsa epoxied to the step, to provide a sharp edge. The joiner system I used was bought from Sig Mfg (P/N SIGSH778). It is a set that consists of a thin-wall aluminum tube joiner and a phenolic receptacle. For the sponsons, you will need a longer aluminum tube to span through the fuselage and into each sponson, which can be obtained from any aluminum supply house. I got mine from McMaster-Carr.

Fabrication details:

1. Fabricate hotwire cutting templates for the root and tip sponson profiles. The root profile (without the step) is contained in the Excel file. I didn't generate a tip profile, but it can be easily derived by scaling from the root.
2. Make a blank for cutting each sponson. The blank should be a true rectangle, and of the correct span. I increased the sponson span on each side 2" greater than scale to alleviate the problem the full size plane had with dipping a wingtip into the water when taxing in a cross-wind. For the model this increased span was not enough; my plane still tips if there is a strong cross-wind. You might consider increasing the sponson tip volume or go even longer on the span. The downside to increasing the sponson span is poorer water handling (if the wings are not level during high speed runs, the lower sponson digs in and causes the plane to turn sharply).
3. Hotwire cut the blanks per normal cutting techniques.
4. Cut and shape the sponson tips
5. Bond the tips to the blanks.
6. Bond a piece of hard 1/8" balsa to the step edge
7. Fabricate four identical 1/16 plywood root face plates. Make holes in each face plate to accommodate the joiner tube and the 5/32 piano wire joiner pin (located near the trailing edge of the sponson). Important: These holes must be identically located on all four parts. Save two of the face plates for later installation on the side of the fuselage.
8. Bond the face plates to the inboard surfaces of each sponson. Make sure the inside edge of the sponson is at the appropriate angle to mate squarely with the fuselage before bonding the face plate.
9. Cut pockets in the foam on the bottom surface of each sponson and bond plywood hard points for the sponson attachment strap to bolt to (see the fuselage discussion for more detail about the attachment strap).
10. Cut pockets in the foam (from the bottom of the sponson) and install the joiner sockets. Use the beds from the blanks to jig each sponson up to horizontal. Make sure the joiner socket is level from side to side and

perpendicular to the root rib. Bond both sides simultaneously, and use a joiner tube to make sure everything is lined up. Install brass tubing receptacles for the 5/32 diameter piano wire alignment pin that is located at the rear of the sponson. This pin, together with the main joiner tube, will ensure that the sponsons are aligned when plugged into the fuselage. During the time the epoxy is curing, the sponsons are positioned root to root, with the root ribs spaced about ¼ inch apart. If everything is aligned, then the sponsons should fit properly when plugged into the fuselage.

11. Fiberglass the sponsons. I used one layer of 5 oz cloth on the bottom, followed by one layer of 2 ½ oz cloth, and two layers of 2 ½ oz cloth on the top.

Fuselage:

Overview: Build the fuselage last. You will need the wing and stabilizer to allow final shaping of the fuselage saddles. The fuselage is constructed of epoxy fiberglass over expanded polystyrene (EPS) foam. The basic approach is to shape the foam blank to the proper contour, install the fore and aft wing support bulkheads and then apply the fiberglass. Minimal thickness of fiberglass is applied to keep the weight down. From about two inches above the anticipated waterline and below is left as solid foam. Some hollowing can be done above that point to reduce weight and to allow for radio installation. I kept the foam in the lower areas to completely negate any issues of hull penetrations allowing water into the hull, with the associated weight/CG issues. I have seen guys lose flying boats because they sprung a leak and didn't realize that they were taking off with a bunch of water in the hull. The following describes how I constructed my fuselage. There are certainly other ways to skin this cat, so the builder may use other techniques. Since I did not develop fuselage sections, you will have to obtain a plastic model of the B-314 to refer to while shaping the fuselage. I bought mine from Historic Aviation, and it was 1/144 scale. The decals in this kit will come in handy when you finish your plane. I scanned the decals and blew them up 9x to bring them into 1/16 scale, and then printed ink jet decals from these images. All of the "N" numbers, PAA markings, etc were made this way.

Detailed discussion: Obtain a large enough blank of foam to allow shaping the hull in one piece. I bought my foam from Aircraft Spruce and Specialty, and used "blue" EPS. The blank was 12"x24"x 10 feet long.

1. True up the blank into a rectangular cross section, and apply a longitudinal guideline on both sides. Make sure this line is true from one side to the other.
2. Using the fuselage side view, transfer the outline to each side of the foam blank. With a helper, hotwire cut the outline, making sure that you remain outside the true fuselage outline.
3. Using a large sanding block and 60 grit sandpaper (my block takes a half sheet of sandpaper, cut lengthwise), sand the profile to match up with the drawn outline, making sure the cross-section is a true rectangle throughout the length of the fuselage.
4. Draw a centerline on the top and bottom surfaces of the fuselage, and transfer the top view outline to the foam (top and bottom surfaces).
5. Again with a helper, hotwire cut the top view profile, keeping to the outside of all lines.
6. Sand the top view profile to the final shape, again being careful to maintain a true rectangle for the entire length of the fuselage.
7. Draw the hull chine lines on the sides of the fuselage
8. Using the hotwire cutter, carefully rough shape the forward and aft hull surface (the "V" part of the hull), followed by careful final shaping with a

sanding block. Final sanding is done with 100 to 150 grit paper. Note: In order to finalize the aft part of bottom, you will have to shape the lower fuselage from the hull surfaces to the tip of the tail concurrent with shaping the “V”.

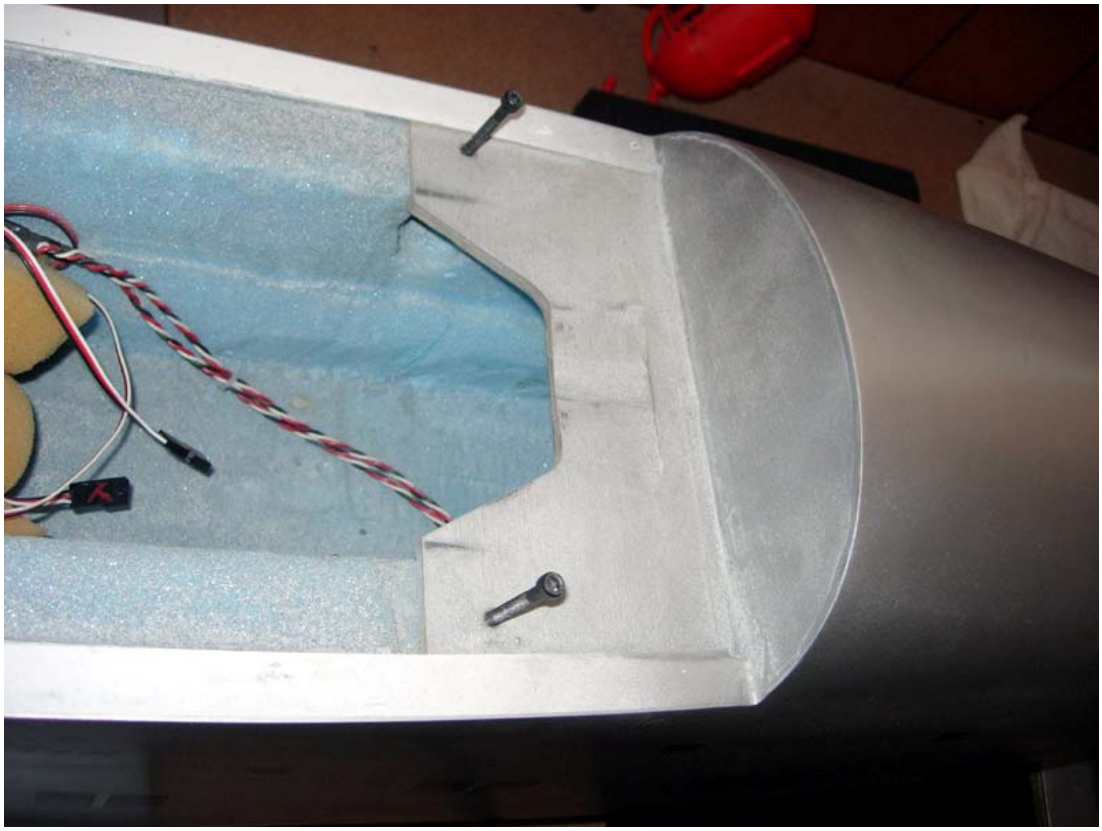
9. Install a wood insert (1/4” thick balsa with 1/16 plywood aft face) at the main hull step to provide some structural support to this edge, which otherwise would be very easily damaged during the ensuing building activities. At this point, the fuselage should look like this photo. The fuselage is still rectangular in cross section, except for the hull (which is a “V” with sharp corners) and the aft lower section to the tail (which is a “V” with rounded corners):

10. Using the plastic model as a guide, shape the fuselage cross-section to match the correct contours. Take your time here; this is the most critical portion of the fuselage build. I spent about a full week shaping, working a little at a time, and spending a lot of time looking over the fuselage to make sure that the shaping was symmetrical and there were no humps or hollows. Note: You will not be able to finalize the upper fuselage in the area between the wing leading edge and the trailing edge. The upper fuselage between the wing trailing edge and the stab is almost a full round section, while between the wing spar and the cockpit, it is almost rectangular. Leave the

transition area near the center of the wing largely unshaped until this section is cut from the main fuselage blank.

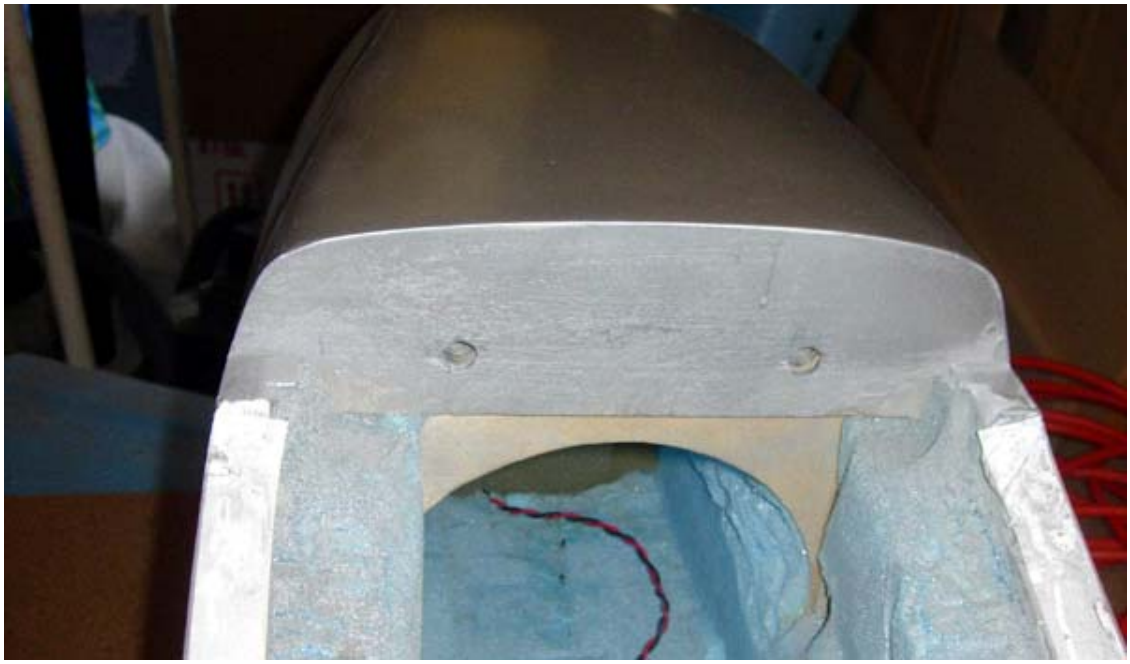
11. Install 1/16 plywood aft hull edging, from the main step to the “point” at the end of the aft hull surface.
12. To reduce the chance of damage to the bottom of the hull during handling, I fiberglassed the lower (“V”) surfaces at this point. I used one layer of 5 oz cloth all over, followed by a second layer of 2 1/2 oz cloth on the forward section after the first layer has cured and been sanded.
13. Draw guidelines on each side of the fuselage that run from the tip of the nose to a point that breaks out on the bottom near the tail. This line should be parallel to the true horizontal plane of the fuselage. Make sure the guidelines are true from one side to the other.
14. Using a hotwire cutter, cut the fuselage along these guideline (the fuselage will now be in two pieces; upper and lower).
15. Hollow out the fuselage sections (upper and lower) as desired with a hotwire cutter. I suggest that no foam be removed from about 5 inches from the bottom surface of the hull and below. Also, keep at least a 2 inch wall thickness in all hollowed out areas. You should have a passageway that runs all the way to the horizontal tail to allow running servo wires, etc.
16. Glue the top and bottom sections back together with a thin layer of epoxy adhesive.
17. Draw the wing rib guidelines on the side of the fuselage. Be very careful to get the correct incidence angle. Using the wing root rib outline draw the wing saddle on each side of the fuselage. Make hotwire cutting templates that conform to the wing rib profile and the wing saddle surfaces. Attach these templates to each side of the fuselage and hold in place with nails pushed into the foam. Using a hotwire cutter and cutting against the templates, remove this section of foam from the main part of the fuselage. Save this piece for later shaping, fiberglassing, and installation on the top of the wing to form the fuselage faring (this piece will be cut in two at the wing spar location, and each piece shaped separately).
18. Fabricate the fore and aft bulkhead for the wing saddle area. Fit them into the foam fuselage and epoxy in place.
19. Block the fuselage upright and level with respect to the hull keel. Calculate the appropriate incidence angles for the stabilizer and wing by taking the difference of the incidence angles shown on the 3 view drawing for these items versus the hull keel.
20. Using an incidence meter and the wing center section, sand the wing saddle to achieve the proper angle and fit. Make sure the wing is level from side to side.
21. Repeat this process for the stabilizer.

22. Fiberglass the entire fuselage. I used 2.5 oz cloth as follows: Four layers in the area of the stabilizer attachment, transitioning to two layers along the aft fuselage, with a transition again to three layers from near the aft wing attachment bulkhead and forward, and four layers from near the forward wing attachment bulkhead forward. So far, my fuselage seems plenty strong, and is resistant to hanger rash in the areas that are prone to be banged into things. Note: After the first layer of fiberglass has been applied to the sides of the fuselage, the spray rails are built along the forward hull chine (from the main step forward to the bow section). Bond 1/64 plywood along the sides of the fuselage, that extends about 1/8 inch below the hull chin edge. Then make a fillet between the hull surface and these plywood "lips" using microballoons/epoxy filler, shaped with a coin (penny or nickel) that is dragged along the hull/plywood interface. The result is a radiused lip that will deflect spray from the hull downward and away from the props. After the spray rails are complete, use some filler to transition to the 1/64 step formed by the plywood on the side of the hull, and add the remaining fiberglass layers.
23. Do a check fit of the wing and stabilizer, by again repeating the incidence meter measurements per above. Trim the saddles as necessary to achieve the proper incidence angles and to ensure that the wing and stabilizer are true side to side.
24. Fabricate the attachment hard points for the wing and stabilizer attachment bolts and epoxy in place, making sure that there is a good bond joint to the fiberglass fuselage skins on each side..



Aft wing attachment plate (1/4” ply)

25. Fabricate the plywood interface piece for the forward part of the wing. I used two 3/8 inch diameter dowels for the forward attachment. Match this part to the forward bulkhead and transfer the holes for the dowels to ensure that they line up. See the photos below for how this part fits onto the wing.



26. Apply a 1/16” thick by ¾” wide plywood wing saddle plate to each side of the wing saddle and epoxy in place by bolting the wing on to hold in place. It may be necessary to trim the fiberglass and foam back slightly to make room for the plywood plate.
27. Any remaining gaps between the wing and the wing saddle can be filled with epoxy/microballoon filler material. Tape plastic food wrap to the bottom surface of the wing, apply microballoon/epoxy filler material on top of the wing saddle, and bolt the wing in place. Clean up any filler that squeezes out. After the filler cures, remove the wing, and you will have a perfectly fitting wing saddle..
28. Layout the location for the sponsons and bond a root rib to each side of the fuselage, along with the phenolic joiner socket. The root rib is 3/16” balsa with a 1/16 plywood face plate laminated to the outboard surface (these face plates were made during the sponson construction; see above). Before the adhesive cures, temporarily install the joiner tube and sponsons to ensure that the sponsons will be true with respect to the fuselage and the wing (no side to side tilt), and that they will fit tightly to the root rib.
29. The sponsons are retained by a single .090 thick by .375” wide aluminum strap that runs all the way through the fuselage and is screwed into hardpoints on the bottom of each sponson. The sponsons are removable, if desired for transport. This strap must be securely epoxied into the fuselage, after it has been properly positioned with respect to the sponsons.
30. Make fillets all around the root rib with microballoons/epoxy filler.
31. Sand, prime, sand, ……, paint. Decals were made by scanning the plastic model’s decals, enlarging the images, and printing them on inkjet decal

paper. The windows and doors were generated in Powerpoint, using rectangle shapes with rounded corners (black outlines). The window shading was a gradient shade with gray, darker at the top / lighter at the bottom.

General Comments:

I did not include a water rudder on my plane. Instead, I obtained directional control while on the water via differential throttle application, linked to the rudder. This is how I set my engines up: To facilitate on-water steering and synching the engines, I set my throttles up on two channels. One channel controls the engines on the left wing, while the other channel controls the right side. The two channels are mixed together, and engine synching (left side / right side) throughout the RPM range can be facilitated via the mixing curve available on the Futaba 9 CAP or similar computer radio (note: The engines within each side are manually synched by adjusting their respective throttle linkages). These two channels are also individually mixed with the rudder channel: The throttles on the left side advance with right rudder, and the throttles on the right side advance with left rudder. In no case are throttle retarded with rudder inputs (the mixing is one-way only). This has proven to be very effective for directional control on the water, even while taxiing with a cross-wind.