Cabbie

Bill Bowne

Cabbie started as a Ken Willard-designed Schoolgirl, shrunken and modified for foam construction. A little change here, a little change there, another change here…and it wasn't a Schoolgirl anymore. So, the new name, Cabbie (from CAbin BIplane, plus a few extra letters). Cabbie does have impeccable manners -- she'll fly slow enough to let you relax and enjoy the view, whilst being very stable and trustworthy. Go to full throttle, and she'll still be stable -- but she'll loop as long as you hold the stick back.

Cabbie boasts a grand total of 7 pieces of wood, none of them balsa. The rest of her bones are foam, a little carbon fibre, and some music wire.

A word about the mix of green and white foams. Except for the windshield, all the white foam is 6 mm Model Plane Foam (similar, I'm told, to the fabled 6 mm Depron). The green bits are 1/8" foam I hot-wired from house insulation foam, and that white windshield is 1/8" (actually 3 mm) Dollar Store foam. As the 1/8" poplar (lite) ply sold in the US is actually 3 mm, there are no potential metric/inch mismatches (it's a model airplane, not a Mars probe).

For higher stress areas, I used NON-foaming, Clear Gorilla (Polyurethane) Glue; foam-safe glues such as Foam-Tac and Foam-cure are fine for most remaining gluing, although I did use thin CYA on the main undercarriage and dihedral braces. Finally, I used clear Polycrylic water-soluble 'polyurethane' (it really isn't) to adhere Cabbie's bond paper markings.

One 'oopsie' I encountered is that Sharpie pens WILL bleed through acrylic paints, so please, either don't use them where the ink will be exposed, or use something else (i.e., a really soft pencil). Those little bits of blue ink you see here and there? Those were where the Sharpie I used bled through. Only a smear of glue over the marks sealed it enough to cover with paint.

Wing:

Aside from the spars and dihedral angles, both wings build up the same way. Gorilla glue (or CYA) the carbon fibre spar halves (lightly sand the spars to give the glue a better grip) to the ply spar brace. Let cure. As the wings have different dihedral angles, I recommend doing one wing at a time.

Cut the spar and dihedral brace slots in the bottom panels. Spread very thin layers of Gorilla glue on the bottoms of the step layers (an old credit card works fine) and laminate the upper layers to the lower ones. I like to do the laminating LE to LE, to make it harder for me to build two left wings (Harder, not impossible!). Wipe away any leakage and let the wings cure under heavy, flat weights.

Sand the root dihedral. Glue the spar assembly into the wing panels and join the panels (two boards, taped together and covered with plastic sandwich wrap, provide a simple jig). Let all cure completely before sanding in the airfoil.

Now, repeat the process for the other wing, keeping in mind the different dihedral.

Tail:

Remember which side the hinges will be on before cutting or sanding the control surface bevels. Sand the tail surface leading edges round, but leave the control surface trailing edges square. Yes, it goes against traditional balsa modeling experience, but it does work. Gorilla Glue the control horns into the rudder and elevator. Don't hinge the surfaces, yet.

Fuselage:

When cutting out the fuselage sides, make sure the space between the servo rails fits YOUR servos. Pin down the fuselage sides and glue on F2, F3, F4, and the 1/8" X 1/4" (3 mm X 6 mm) foam internal bits, using the bulkheads for spacing. Add firewall P1 and foam bulkheads F1 and F5. Let dry.

Glue on the opposite fuselage side, then glue the servo rails into place. Sand the servo rail ends flush with the fuselage outsides. Screw the servos into place now, whilst you have easy access!

Taper the inner fuse sides at the tail, then join the tail ends together over (and to) the tailplane. Leave the fuse bottom open, for access when installing the pushrods. Do use a scrap of foam, though, to elevate F6 and glue F6 between the sides.

Sand F6's top flush with the fuse sides, then add the aft fuse top. When dry, add the front fuse bottom, leaving room for P2.

Our next major step is gluing on the wings (last check — you did screw in the servos, already, right?). The procedure is simple, but requires careful attention and frequent measurement to ensure all stays in alignment. Being off by 2 or 3 mm may not be a problem with a Giant Scale model, but it's a major headache at Cabbie's size.

By keeping the wing bottoms parallel to each other and to the tailplane, we ensure that both wings have the same angle of attack. So, on a FLAT surface, invert the fuselage, level the tailplane, and glue the bottom wing in place with the wing bottom parallel (front-to-back) to the tailplane. Let dry completely.

When all is dry, flip the model over, re-level the tailplane, and glue on the top wing. Again the chorus sings "Let dry completely!".

Sand the wing TE to fair into the turtledeck, cut slots for the fin tabs, and glue the fin into place. Again, keep everything carefully aligned.

Whilst the fin dries, bend the music wire landing gear and 'sew' it onto P2 with strong thread or stranded fishing line (NOT monofilament line, as that resists gluing AND stretches). Soak the thread with thin CYA. Solder washers on the axles, inboard of the wheels.

This is a good time to install your receiver -- I waited until later and had to do it with a haemostat and some nasty words. Bind the receiver, plug the servos and ESC into it, and Velcro it to the bottom wing. Now we can add P2 and the U/C, plus the windscreen.

After the windscreen's dried, wrap masking tape around the wing LE, in line with the fuselage side. Sand through the LE, continuing the fuse side's windscreen line through the wing. Most of each wing's strength is in the spars, so we can afford to cut away some foam.

Depending on how you plan to paint your Cabbie, you may want to permanently hinge the control surfaces now, or temporarily hinge them (masking tape is fine, temporarily).

Install the rudder and elevator pushrods. I used short lengths of plastic tubing braces where the pushrods go through F5, F6, and the outer fuselage. Make up a rudder pushrod brace from an old servo arm or ply scrap and glue it into the fin. I used small Z-bends and mini quick links on the pushrod ends, with DuBro micro EZ Connectors on the servo arms. You may prefer to use micro clevis or other micro links-- DuBro has several products for the new breed of smaller models.

Lay a patch of plastic sandwich wrap loosely over the battery hatch opening. Pin the hatch liner in place from the fuselage outside, then glue the hatch top to the liner. Add the rest of the nose sheet, using sandwich wrap to insulate those bits from the hatch. Let dry.

Remove the pins and lift off the hatch. Slot it for the dessert stick end handle, cut a small gouge in the hatch rear, and firmly glue handle and magnet in place. Likewise, glue the matching (check for correct 'polarity'!) magnet to the windscreen bottom. Glue small strips of paper over the magnets to ensure they stay in place. Hinge the hatch front with bandage tape.

Sand the fuselage edges, starting with 120 grit, then go on to 200 and 400 grits, rounding off the corners. Fill dings with balsa filler (tint with a few drops of white acrylic paint, if desired).

Final assembly:

Screw on the motor, adding washers to get approximately 3 degrees right and down thrusts. Slit the tailplane and glue in the tailskid. Slide on the wheels, retaining them with collars.

Finishing:

Low-temp shrink films add excess weight, it's hard to avoid the iron dinging the foam, and they don't work well with Kfm airfoils. So, I paint ships this size with water-based acrylics (many rattle-can paints devour foam -- always test each paint on scrap bits of each type of foam you're using!).

I did the checkerboard trim and cabin details in several computer graphics programs, printing them onto bond paper. Tack down the paper bits with an ordinary glue stick, then seal them with a few LIGHT coats of clear water-based acrylic.

Cabbie balances approximately 1.7" (43 mm) behind the top wing LE. Initially, we flew her on a 2S300 lipo and APC 6 X 4 prop. At 5 5/8 oz (~161 gm), the 23 watt output yielded 65 watts/lb. Not enough for vertical performance, but, when combined with Cabbie's (slightly) under 4 oz/ft^2 (11.9 gm/dm^2 wing loading, it was enough for relaxed small-field flying. After a bit, I swapped out the prop and battery for something a bit more energetic (details a few lines down!).

Flying:

It took several weeks of watching the weather, before my Micki (my wife, photographer, and favorite flying buddy) and I dared take Cabbie out for her maiden. When it wasn't too windy, it was too hot. Then came the rare not-so-windy, not-so-hot day… But, we forgot the camera, so there are no in-flight shots.

It took a few tries to get Cabbie off our grass runway, but holding full up as I applied power lifted her enough to clear the grass. Once aloft, it was time to throttle back and do a slow climb whilst checking trims. Do put in the downthrust shown on the plans (add washers behind the motor top screws, if needed), otherwise Cabbie with stick her nose up and try to emulate a skyrocket.

My routine with models lacking ailerons is to put the rudder on the aileron stick, but also 100% mix rudder into ailerons. That way, if I forget I'm flying without ailerons and I nudge in a bit of rudder, the model will still get my command (and, hopefully, obey it).

I can't claim Cabbie flew 'right off the board', but I think requiring only two clicks of rudder and a few washers of downthrust counts as being pretty close. Stalls were almost non-existent, with power off and full back stick resulting in only a gentle nodding. Loops were quick and easy; barrel rolls, though, were slow and Cabbie tended to lose way too much altitude -- don't even think about trying one unless you've climbed well above the treetops. Landings were easy, but she will tumble if the grass is long.

After a few flights, I swapped the 2S300 for a 3S300. To keep the amps down, I also swapped the APC 6 X 4 for a GWS 5 X 3 (Orange). For a gain of about 20 grams, the power to weight went up to nearly

98 watts/lb., with the reward of a much brisker takeoff, faster flight, and much snappier acros. All without losing Cabbie's gentle nature at lower throttle.

Throws:

Rudder: about 8 mm (5/16") left/right

Elevator: about 8 mm (5/16") up/down

Equipment Used:

Hinges	Blenderm brand clear bandage tape
Linkage	Dubro No 848 micro control horns
	Dubro No 845 mini E/Z connectors
	Dubro No 849 micro E/Z links
Wheels	DuBro No 150MW 1.5" wheels
Motor	Turnigy LD1510A-02-P, 2200 Kv, 14 gm
Receiver	Lemon Spektrum-compatible 7-channel DSMX
Esc	Turnigy 6 amp
Servos	Turnigy S0361 4 gm (2)
Battery	3S300 mAh lipo

Internet Links

DuBro Products: https://www.dubro.com

Imagery

Shot 1. Finished Cabbie

Shot 2. Dihedral angle guides computer-printed and pinned to ceiling board ease making spars with the correct dihedral angles.

Shot 3. Dedicated 1/4" ply sanding blocks for the KFm2 airfoil, with sandpaper glued inside the block. Wrap the cut-out bits in plastic sandwich wrap and use to hold the sandpaper in place whilst the glue dries.

Shot 4. Don't let the enormous parts count dismay you!

Shot 5. Bulkhead and wing braces glued on, just as if we were building a balsa model.

Shot 6. Firewall through F5 glued in place. Small corner braces made from bits of aluminum stock help keep things square.

Shot 7. Aft fuselage joined over the tailplane. Note the wood scraps used to keep the tailplane steady, without denting or perforating it and the extra corner brace displayed on the tailplane.

Shot 8. Small bubble level confirms the tailplane is level to the jig, making a reference for levelling the bottom wing.

Shot 9. With the bottom wing blocked up and the tailplane level, the weighted-down top wing joins the party (I knew those remodeling threshold scraps would be useful!).

Shot 10. Bracing the fin with bigger triangles, using scrap foam to fit the triangles to the fin. Couldn’t find the wood bits I used before, so here I used foam to hold the tailplane.

Shot 11. Short lengths of plastic tubing brace the pushrods through bulkheads.

Shot 12. Access to the servos is tight, so get as much done as you can before sheeting the fuse bottom.