

Wowings Booby

CONSTRUCTION MANUAL



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Thank you very much for purchasing the Booby. Although made primarily of soft EPP foam, this RC slope glider is still capable of causing significant damage to property and serious personal injury or death to bystanders or yourself. Please ensure that you fly this model in a safe and responsible manner and obey your local laws and regulations. By building and/or flying the Booby you assume all responsibility for any damage or injury it may cause. Wowings accepts no liability for any damage or injury caused by our products. If you do not agree to these terms, please contact your place of purchase prior to commencing construction to arrange returning this kit for a refund.

Now onto the fun stuff... First, please ensure that nothing is missing from the Booby kit and that none of the contents have been damaged. If anything is missing or damaged please contact your place of purchase immediately to make arrangements for replacement parts to be supplied. Your Booby kit should contain the following:

- 2 x EPP foam wing outer panel segments (each with two panels joined together)
- 1 x EPP foam wing central panel
- 2 x lengths of black fiberglass spar
- 5 x lengths of balsa (two marked with outlines for ailerons, two marked for trailing edge pieces and one for elevator)
- 3 x steel pushrods with clevises attached
- 1 x piece of coreflute marked with outlines for two fins
- 1 x black fiberglass internal spar joiner
- 2 x packs of Dubro nylon control horns (total of 4 control horns)
- 2 x packs of Dubro E-Z connectors (total of 4 connectors)
- This construction manual!

To complete the kit you will require the following tools and supplies:

- Sharp trimming knife (large retractable disposable type is ideal)
- Sandpaper and sanding block, screwdriver, drill, pliers and ruler
- 48mm (2") wide cross-weave filament tape
- Covering material (eg. coloured packing tape or iron-on film such as UltraCote or Profilm)
- 3M "Super 77" or 3M "Multi-Purpose" spray adhesive
- 5 minute epoxy glue (eg. Selley's Araldite)
- Goop/Goo glue (eg. Pacer's Zappa-Dappa-Goo II or Second Wind's Shoe Goo II) or Polyurethane glue (eg. Selley's Durabond, Gorilla Glue or Elmer's ProBond) or 30 minute epoxy glue (not ideal).
- Hot-melt glue – not essential
- 1mm (1/16") thick lead flashing and/or lead pieces for nose weight

The following radio equipment is recommended:

- Rechargeable receiver battery pack (4 x AA size cells) in flat configuration.
- Receiver (minimum 2 channel)
- 2 x standard size servos (eg. BlueBird BMS-621, GWS S03TXF, Hitec HS-322)
- 1 x mini servo or metal-g geared micro servo (eg. BlueBird BMS-380MG, GWS MINI, GWS S3002, Hitec HS-85MG)
- 1 x 300mm (12") servo extension lead for one of the aileron servos
- 1 x "Y" lead for the aileron servos

Read through the following instructions entirely prior to starting so that you have an overview of what is involved. Please don't be tempted to deviate from these instructions unless you are an experienced builder and are certain that your changes won't negatively affect the structural integrity or flying performance of the Booby. These instructions are based in metric units but I have also tried to include the equivalent imperial measurement as much as possible. For your reference, 1 inch (") equals 25.4 millimeters (mm). These instructions are also available in colour as a MS Word document online at www.wowings.com/instructions/wowings_booby.doc

SPAR INSTALLATION

Polyurethane (PU) glue is probably the best option for gluing in the wing spar. It foams up and expands during the curing process and penetrates into the surrounding EPP foam creating a strong tight bond without adding a lot of weight. However, if not used properly it can create a mess and possibly even ruin the wing. For this reason, these instructions will focus on using more fool-proof glues instead. If you decide to try using a PU glue for the first time, it's best to experiment a little on some scrap EPP before applying it to your wing. Ensure there's a layer of waxed paper between then wing and the bottom wing bed because the PU glue penetrates through the EPP easily. Be sparing with the amount of PU glue used and wipe the spar with a damp cloth prior to gluing in place to help the glue activate. Ensure that the wing is adequately weighted down in its beds while the glue is curing.

If you want your Booby to be compliant with EPP slope combat competition rules, you may need to trim the spar by about 25mm (1") at the wingtips before gluing in place so that it is set back far enough from the wing's leading edge. Please consult your local rules for specific requirements.

1. Locate the two lengths of black fiberglass spar and the internal spar joiner. Use 5 minute epoxy glue to attach the two spar halves together over the internal joiner, creating a full length straight spar.
2. Remove the foam wing cores from their beds. Gently bend open the spar slot and carefully remove the foam "noodle" from the spar channel. Trial fit the spar to ensure that no bits of foam have been left in the spar channel. It should fit easily without the spar slot opening being forced apart. Also check for acceptable alignment of the two outer wing sections with the central wing panel. Remove the spar and put it aside to be used shortly.
3. Glue the two outer wing sections to either side of the central wing panel using hot-melt glue or spray adhesive (epoxy is also OK but a little brittle). Align with the panels' spar slot and ensure the top and bottom surface of each panel is also flush.
4. Lightly sand the fiberglass spar to roughen its surface and remove any remaining mold release agent and wipe off the dust.
5. Gently bend open the spar slot and run a bead of goop/goop style glue (30 minute epoxy is also OK but not as good) inside the spar channel. Starting at one wing tip, bend open the spar slot and push the spar down into the spar channel. Once the spar has been inserted, use a piece of dowel, or back of a pen or pencil, to push the spar firmly all the way down into the channel so that the glue is forced up and around the spar, coating it entirely. This process can also be helped by repeatedly bending the wing chord-wise, temporarily closing and opening the spar slot to help work the glue around the spar and centre the spar in the spar channel. Wipe off any excess glue.
6. Place the entire wing back into its foam beds and rest it on a completely flat surface (eg. table or floor). Weight it down so that the wing is kept flat and completely snug with the bottom curve of its foam beds. To avoid deforming the foam make sure the weights aren't

too heavy and that they are spread fairly evenly. Plastic shopping bags partly filled with sand make ideal weights. It may be easier if you remove the top portion of the wing beds by cutting along the leading edge. Leave overnight (or as per glue's instructions) in this position while the glue fully cures.

WING ASSEMBLY

7. Locate the five (5) pieces of balsa wood. Two are marked out for the two fixed trailing edge pieces and two are marked out with the two ailerons. The fifth blank piece will be used for the elevator. Using a fine-toothed mitre saw or sharp knife, cut out the trailing edges and ailerons along the outlines marked.
8. Hold the trailing edge pieces up against the foam trailing edge of the panels to either side of the central wing panel to make sure they fit nicely. The bottom surface of the balsa trailing edges is the one with the smoother cut surface that had the cut-out lines marked on them (and the one that meets its leading edge at a 90 degree angle). When butted up against the foam sub-trailing edge, the bottom surface of the balsa trailing edge piece should form a continuation of a straight line from the rear half of the airfoil shape.
9. Once you are happy that they will fit nicely, round off the top and bottom edges of both ends of each balsa trailing edge piece to make covering easier later on.
10. Use 5 minute epoxy or hot-melt glue to glue one of the balsa trailing edge pieces to the foam. Hold in place with masking tape if needed and use a straight edge (ruler) held against the rear section of the bottom of the wing and the bottom of the balsa trailing edge to ensure correct alignment. Once the glue has cured, repeat this process for the second balsa trailing edge piece.
11. Trim and/or sand off any excess glue along the trailing edge joints. Ensure that there is a smooth progression from the foam to the balsa so that it forms a nice continuation of the wing's slightly reflexed airfoil shape.
12. Using a sanding block, sand a 45 degree bevel along the leading edge of each balsa aileron, with the 45 degree opening on their bottom surface (ie. hinged on top surface).
13. Round off the top and bottom edges of each end of both ailerons to make covering easier and put them aside to be installed later.
14. Using the unmarked balsa elevator piece, hold it above the foam sub-trailing of the wing's central panel. Mark its correct length so that it fits in-between the two balsa fixed trailing edge pieces with a small gap of around 2mm (3/32") either side to allow for free movement once everything is covered. Cut the balsa elevator piece to length.

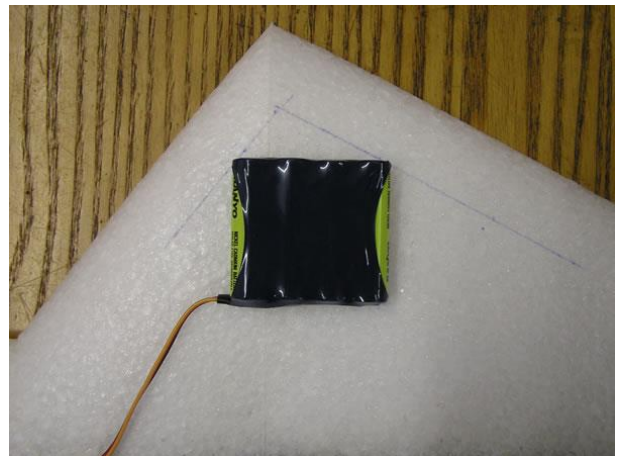


15. As per ailerons, sand a 45 degree bevel along the leading edge of the balsa elevator, with the 45 degree opening on its bottom surface (ie. hinged on top surface).
16. As per ailerons, round off the top and bottom edges of each end of the balsa elevator piece and put it aside to be installed later.
17. Round off the top and bottom edges of each wing tip using a sharp knife. You may also wish to round the leading edge corners of the wing tips when viewed from above.
18. Locate the piece of coreflute supplied in the kit and cut out the two fins as marked.
19. Mark out where the slots for the fins will go on the wing. You'll need a slot 2mm to 3mm (3/32" to 1/8") wide and 75mm (3") long, with the back of the slot starting 100mm in front of the wing's trailing edge (trailing edge of the balsa). It should be positioned just outboard from the panel join line so you don't have to cut through the glue.
20. Cut out the slots with a very sharp blade, being extra careful to keep the cuts vertical. Poke out the foam from the slots with the end of a ruler or a metal pushrod.
21. Test fit the fins to ensure they fit tightly in the foam in a vertical position and that their trailing edge is in line with the wing's trailing edge. When pushed all the way down they should butt up against the contour of the top surface of the wing. Remove the fins and put them aside for later.

RADIO EQUIPMENT INSTALLATION

If you want your Booby to be compliant with EPP slope combat competition rules, you may need to position your battery pack and/or nose-weight further back than instructed. Please consult your local rules for specific requirements. Doing this will increase the all-up weight of the finished model a little due to the extra nose-weight required to balance correctly.

22. Gather together all the radio equipment you plan to install into the glider and test that it is all working properly. If your transmitter and receiver batteries are not fully charged, charge them now.
23. Once the glue for the spar has cured, remove the weights and foam beds from the wing. It's now time to install the radio equipment.
24. Draw a line 30mm (1 3/16") back from the leading edge of the outer wing panels near each nose. Draw another line 20mm (3/4") back from the leading edge of the inner panels near each nose. For safety and durability reasons nothing should be embedded into the foam in front of these lines
25. Lay your receiver's flat battery pack squarely on top of the wing at one of its noses so that two of the battery pack's corners are touching the lines you just marked. Trace around it with a pen and then cut around this outline all the way through the foam. Remove this foam plug and draw a line vertically up its front side for later reference.
26. Hold the side of your battery pack against the side of the foam plug so that it is centered and trace lines to mark out the thickness of your battery pack. Repeat this for all four sides and then cut off a bottom slice (base) and a top slice (lid) along these outlines. Mark the top of the slices with an "x" for later reference and discard the remaining piece of the plug.



27. Using hot-melt glue (best), spray adhesive (sprayed into a puddle and then spread on) or 5 minute epoxy (not ideal), glue the base slice back into the bottom of the battery cut-out hole, creating a base for the battery recess. Use the markings you made to orientate it correctly, ensuring a perfect fit.

28. Mark out the same size area (approx. 50mm x 55mm) in the same position on the other nose. This recess will be used later for accommodating weight in the form of layers of 1mm (approx. 1/16") lead flashing to balance the glider correctly.

Make the base slice of this recess a little thicker, say 10mm (3/8"). Put the remainder of the foam plug aside for later use.

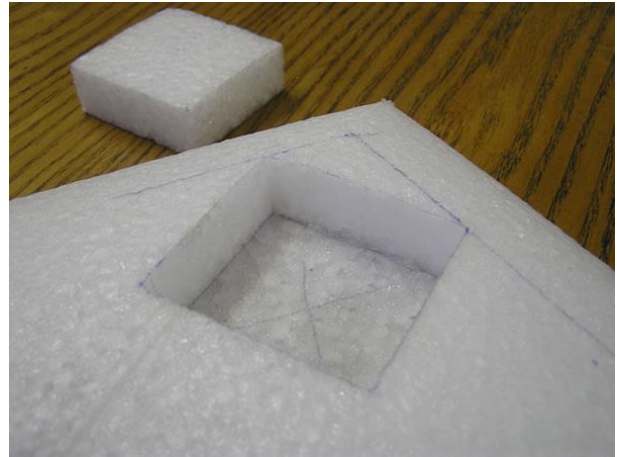
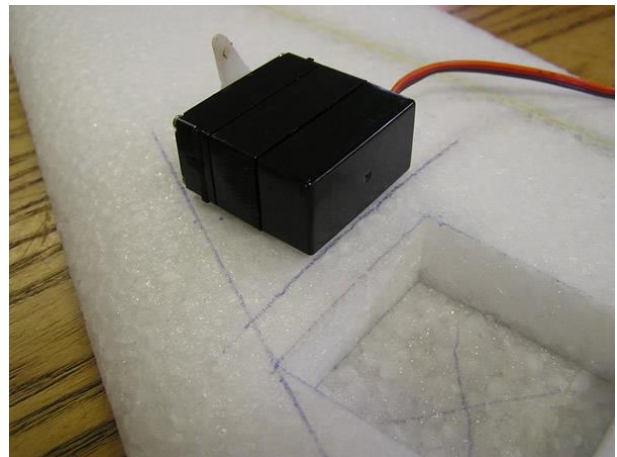
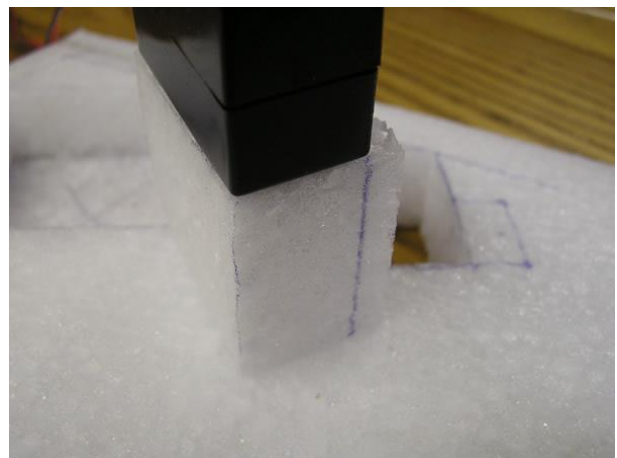
29. Next are the servo recesses. Decide whether you want to remove your servos' mounting lugs. These are generally not required for foam gliders and removing them can make mounting into foam a little simpler. Base your decision on the likelihood of requiring the mounting lugs on the servos for a different style of model in the future and the availability and expense of replacement servo cases.

30. Lay one of your standard size aileron servos on top of the wing slightly outboard (towards the wing tip) of the battery pack recess so that there's 10mm (3/8") of foam between it and the edge of the battery pack recess and so that one of its corners (or servo mounting lugs) is touching the line you marked 30mm (1 3/16") back from the leading edge. The servo needs to be aligned so that the servo arm movement is at right angles to the spar (or parallel with the line of flight). Trace around the servo and cut around this outline with a sharp knife all the way down through the foam. Push out the foam plug and mark with a vertical line down its front side for later reference.

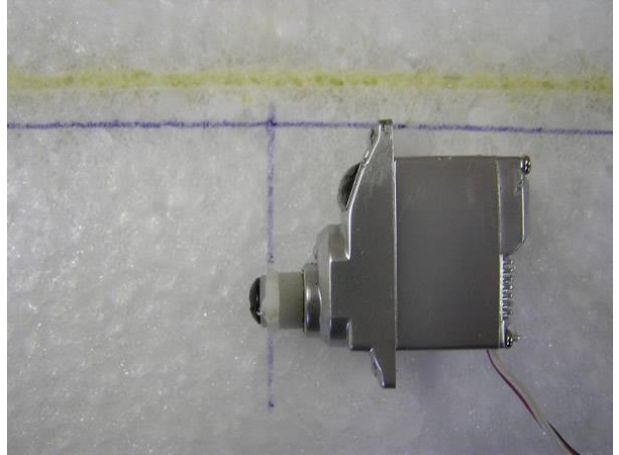
31. Hold the side of your servo against the side of the foam plug flush with the top surface and trace out a line. Repeat this for all four sides and then cut off a bottom slice along this outline. Mark the top of this slice with an "x" for later reference and discard the remaining piece of the plug.

32. Glue the bottom slice of the foam plug into the bottom of the servo cut-out hole forming a base for the servo recess. Use the marks on its front side and top to orientate it correctly, ensuring a perfect fit.

33. Repeat this process for the second aileron servo recess on the other side of the wing.



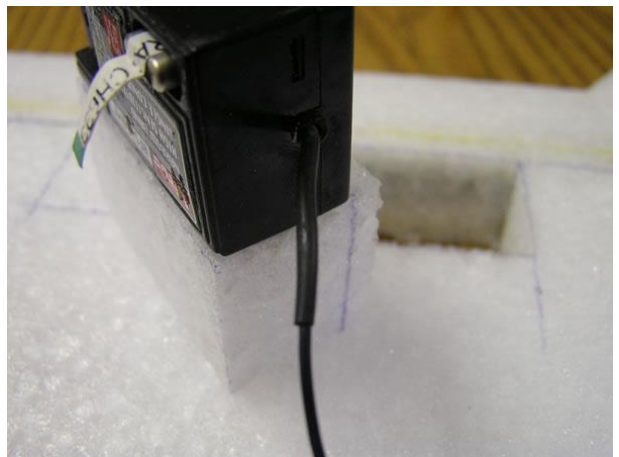
34. Draw a line 5mm (3/16") back from the edge of the spar slot in the middle of the central wing panel. Draw another line at right angles to this in the exact middle of the wing running a little way towards the trailing edge.
35. Lay you mini size elevator servo on top of the wing so that one of its sides (or mounting lugs) is up against the line you marked 5mm (3/16") back from the spar slot and its servo arm is in line with the line you marked as the middle of the wing. Trace around the servo and repeat the process of a creating a servo cavity as per the aileron servos.



36. Next to the recesses for each of the servos, mark out the area required to accommodate the servo arm and its movement. The area will be about 10mm wide by 20mm long (3/8" by 3/4"). Cut out a triangular shaped wedge down to the depth of the servo recess's floor.

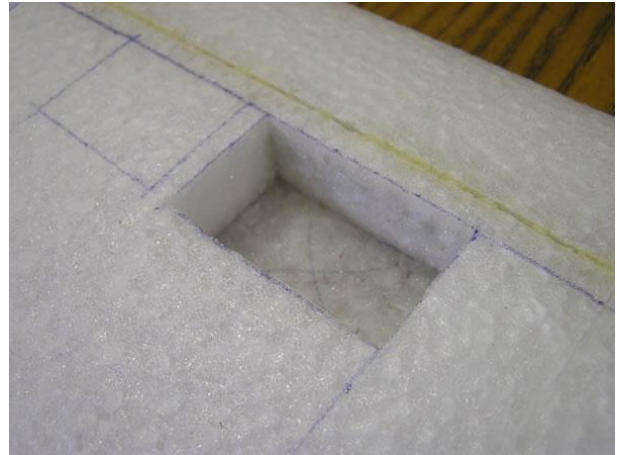


37. Choose a place for your receiver that is 5mm (3/16") back from the edge of the spar slot and to one side (closer to the battery pack) of the central wing panel. If possible, position it so that it can be easily reached by the leads of the battery pack, elevator servo and one of the aileron servos without the need for extension leads. The other aileron servo will usually require a 300mm (12") extension lead.
38. Trace around the receiver with a pen and then cut out along this outline all the way down through the foam. Remove this foam plug and mark its front side with a vertical line for later reference.
39. Decide whether you want to mount your receiver flush with the top surface of the wing or embed it beneath the surface. Base this decision on the layout and size of your receiver and whether you intend to use a switch or plug the battery plug directly into the receiver. I personally try to use receivers that have the plug sockets on the top surface (and preferably the crystal as well) and mount them flush with the top surface of the wing. This means the servo plugs are sticking up proud from the wing surface (adding a little extra drag and ugliness) however this makes it simple and convenient to just plug in and take out the battery lead to turn it on and off and have easy access for charging.
40. Hold the side of your receiver against the side of the foam plug in the desired position (eg. flush with the top surface) and trace the line(s). Repeat this for all four sides and then cut off a bottom slice along



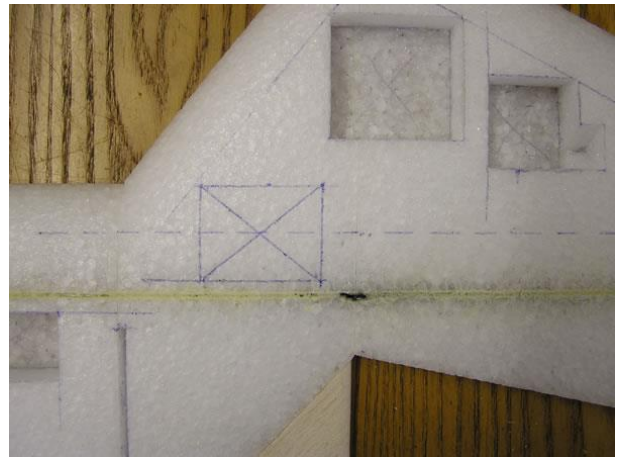
this outline, and a top slice if you've decided to have your receiver embedded below the surface. Mark the top of the slice(s) with an "x" for later reference and discard the remaining piece of the plug.

41. Glue the bottom slice of the foam plug into the bottom of the receiver cut-out hole forming a base for the receiver recess. Use the marks on its front side and top to orientate it correctly, ensuring a perfect fit. If you have a top slice, put it aside for later use as lid over the receiver.



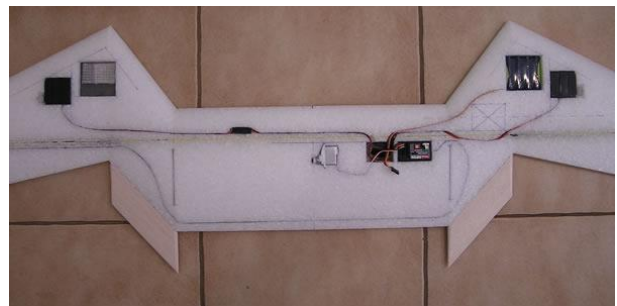
42. Mark out an area next to the receiver to accommodate the excess length in the battery and servo leads. An area approximately 30mm by 40mm (1 3/16" by 1 9/16") is usually plenty. Cut out a foam plug using the same method used for the receiver and servo recesses and glue back in a 5mm to 10mm (3/16 to 3/8") slice to form a base. Keep the remainder of the foam plug for later use.

43. Decide if you wish to install an optional ballast system such as ballast boxes or ballast tube(s). Ballast is removable lead weight positioned exactly on the glider's centre of gravity (CG) so that it increases the model's weight without affecting the model's point of balance. Increasing the Booby's weight (higher wing-loading) will improve its penetration in very windy conditions (over 30 knots) resulting in increased speed. Given that the Booby already has quite a high wing-loading when un-ballasted and is a fast low drag design, we do not believe that provision for ballast is necessary, so simply mention it here as an option without going into installation details. If two ballast boxes or two ballast tubes are installed they can be positioned at the Booby's CG (140mm back from the noses) in the middle of each intermediary panel (between central wing panel and outer panel). A single ballast tube should also be able to fit into the leading edge of the central panel at the CG but would forfeit compliance with combat competition rules.



44. Cut slits into the top surface of the wing to accommodate the battery lead and servo leads. The receiver antenna should be kept a little clear (and avoid any crossing) of the servo leads, battery leads and spar to avoid possible interference with the radio signal from the transmitter. Cut a slit for the receiver antenna that loops around the fin slot and then runs about 20mm (3/4") in from the central panel's foam sub-trailing edge and then out to the wingtip.

45. Fit the battery pack, receiver and servos into their recesses. Plug everything together and test that it is working correctly. The two standard size aileron



servos plug into your receiver's aileron channel via the "Y" lead, with the servo on the other side of the wing requiring a servo extension lead (300mm). The mini size elevator servo is plugged into the elevator channel of your receiver.

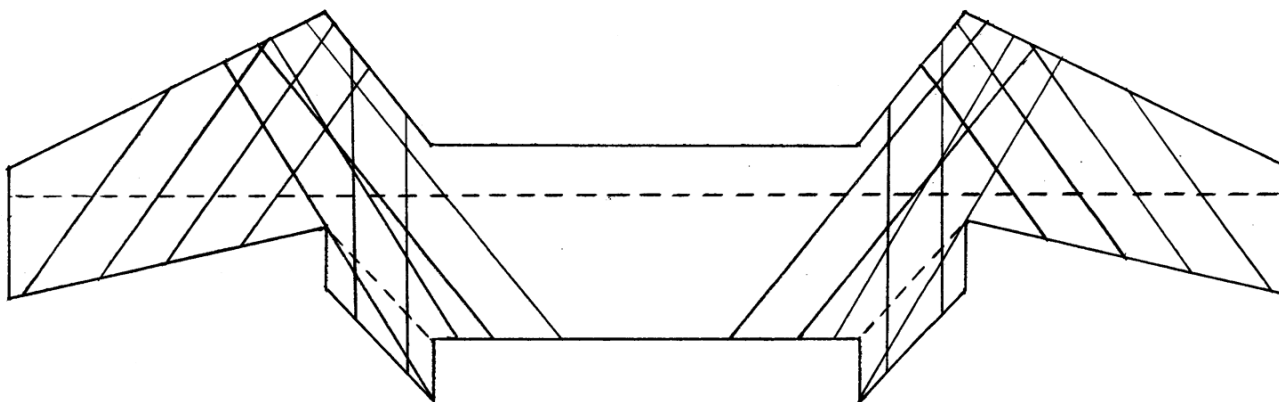
46. Make sure the servo arms are centered in the correct position when everything is turned on and the transmitter trims are in their neutral position. The servo arms should be pointing directly upwards, or leaning just slightly rearwards. Unscrew the servo arms and adjust if required. Also check for correct direction of servo travel and reverse via your transmitter if required. Viewed from above, when your transmitter's elevator stick is pulled back for "up" control, your elevator servo's arm should move forwards (towards the leading edge of the wing), and should move backwards when "down" control is applied. When your transmitter's aileron stick is moved to the right for "right roll" control, the right aileron servo's arm should move forwards and the left aileron servo's arm backwards, and opposite when "left roll" control is applied.
47. Perform a "range check" for your radio equipment now. You should be able to control the servos smoothly with no "jitters" from 10 paces away with your transmitter's aerial fully retracted (not extended at all).
48. Once you are satisfied that your radio equipment is functioning correctly, it's time to start building it into your glider. Soon, retrieval of radio equipment will require some surgery on your glider, so it is best to make any necessary adjustments or repairs now. Also keep in mind that you will need to have access to a means of charging your receiver's battery pack once it is embedded into the glider. This can be by means of a special switch with charging socket, or as simple as having access to the battery pack's plug (perhaps just having it plug into an exposed socket of your receiver). If installing an exposed switch, orientate it so that the "on" position is towards the rear of the glider so that if it brushes up against something while flying it doesn't switch off.
49. Coil up the excess length in the leads and insert into the recess you made next to the receiver. Slice off an appropriate thickness from the top of the remains of this cavity's foam plug to form a lid and glue it in place flush with the top surface of the wing.
50. If you chose to embed your receiver below the wing surface, glue the top slice from your receiver's foam plug in place now so that it is flush with the top surface of the wing.
51. Glue the top slice of your battery pack's foam plug so that it is flush with the top surface of the wing.
52. Mark the mid point of the central wing panel towards its leading edge.
53. Cut 3 pieces of lead from a flat sheet of 1mm thick lead flashing, each measuring the same size as your battery pack's recess (approx. 50mm x 55mm).
54. Insert enough lead into the recess on the glider's other nose (the one that doesn't contain the battery pack) so that the glider balances exactly at the mid point you marked on the central wing panel. It will likely require around 2 ½ pieces of the lead flashing (approx. 100 to 110 grams). If the final piece is not a full piece, place it as far forward in the recess as possible and tape it with some filament tape to the piece which is underneath to prevent it from shifting.
55. Measure the distance at each corner from the top of the lead to the top surface of the wing. Cut a slice of appropriate thickness from the top of the remains of this cavity's foam plug to form a lid. Glue this in place so that it is flush with the wing's top surface.
56. Cut and/or sand off any excess glue from around the foam plugs so that they're all flush with the surface of the wing.

TAPING & COVERING

These instructions are based on using 48mm/50mm (2") wide strapping tape with fiberglass filaments, hereto referred to simply as "filament tape". We recommend using the cross-weave variety throughout. However, for those of you wanting to keep weight to a minimum (sacrificing a little strength and durability), this can be replaced in many instances by the uni-directional (length-wise filaments) variety or even just 36mm (1 1/2") wide filament tape (uni-directional filaments). In instances when it's crucial to stick with the 48mm/50mm (2") cross-woven filament tape we will refer to "cross-weave filament tape".

The instructions also assume covering with 48mm/50mm (2") wide coloured polypropylene tape due to its simplicity and cheapness. Those who wish to spend a little extra money and care can use a variety of other covering materials such as Ultracote, Oracover and Profilm. These iron-on coverings provide a much nicer finish but are a little trickier to apply correctly. If using an iron-on covering, be sure not to use too high a heat or it may deform (melt) the foam. Also be careful not to introduce any warps or twists into the wing when shrinking the covering. 3M Super 77 ("multi-purpose") spray adhesive is still required when using an iron-on covering.

57. Thoroughly remove all dust from the glider and your work area.
58. Use masking tape to mask off any exposed radio equipment that you don't want to get sprayed with glue.
59. Go outside and spray the entire bottom surface of the wing with 3M Super 77 ("multi-purpose") spray adhesive and then place it upside down on a cardboard box (or anything else to keep it up off your work surface). Let the spray adhesive dry for about 5 minutes (or until aggressively tacky).
60. Now it's time to apply the filament tape. This provides essential tensile strength to the EPP foam wing and helps to keep the glider rigid during flight. For each piece of tape applied, overhang the wing by 25mm to 50mm (1" to 2") and wrap around to the opposite surface of the wing. When a piece ends at the balsa trailing edge, you can just cut it off flush with the edge (don't wrap around). Rub each piece that is laid down with some fine sandpaper to remove any release agent from the tape's backing for better adhesion of subsequent layers of tape, spray adhesive and covering. Thoroughly wipe off any dust that is created each time.



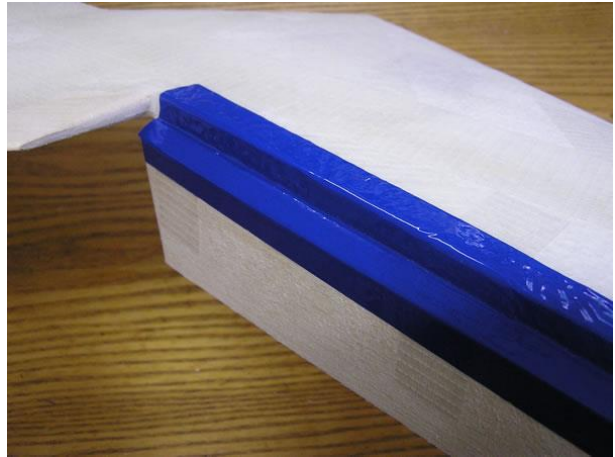
61. Apply strips of filament tape to the bottom surface of the wing as per the above illustration.
62. Then, lay a piece of cross-weave filament tape along the spar line and wrap around at the tips. Position so that about 1/3 of the width of the tape is behind the spar and 2/3 in front.

63. Now spray the entire top surface with 3M Super 77 (“multi-purpose”) spray adhesive and let dry for 5 minutes (or until aggressively tacky).
64. Apply cross-weave filament tape patches over the servos and receiver (if mounted flush with the top surface) to help hold them securely in place.
65. Apply strips of filament tape to the top surface of the wing as per illustration (same as bottom surface). You may need to cut out little sections of the tape to allow for servo arm movement and any protruding wires or switch.
66. Lay a piece of cross-weave filament tape along the spar slot, positioned so that about 1/3 of the width of the tape is behind the spar slot and 2/3 in front of it. Wrap around the ends of the tape at the tips.
67. Spray the leading edges of the wing with 3M Super 77 spray adhesive and let dry for 5 minutes (or until aggressively tacky).
68. Using cross-weave filament tape, lay a length along each of the five wing panels’ leading edges so that half of the width is on the top surface and half on the bottom surface. Split and overlap the tape at the panel joins and split and wrap around at the noses and wing tips.
69. Spray the underside of both balsa ailerons and balsa elevator and the underside of the foam sub trailing edges with spray adhesive. Let dry for 5 minutes (or until aggressively tacky).
70. Split a length of filament tape in half and cut into nine (9) 65mm (2 1/2”) long strips to be applied shortly.
71. The balsa ailerons are orientated so that their narrower end is at the wing tip. Position one of the ailerons so that there is a 2mm (3/32”) gap between its end and the end of the fixed balsa trailing edge and lay it upside down on top of the wing so that its leading edge is in line with the foam sub trailing edge. Use the 65mm (2 1/2”) long, 25mm (1”) wide, strips of filament tape to attach the balsa aileron to the foam wing by wrapping around pieces at either end and in the middle of the aileron.
72. Now rotate the aileron around so that it is in its correct position, butted up against the foam trailing edge with the 45 degree beveled opening at the bottom.
73. Repeat this process for the second aileron.
74. Repeat this process for the elevator, ensuring that the elevator is centered between the trailing edge pieces with an adequate gap at each end (around 2mm).
75. Spray the top of both balsa ailerons and elevator and the rear portion of the adjoining foam sub trailing edges with spray adhesive. Let dry for 5 minutes (or until aggressively tacky).
76. Lay strip of cross-weave filament tape down the entire hinge line of one aileron on the top surface, positioned so that 1/3 of its width is on the aileron and 2/3 on the foam.
77. Repeat this same process for the second aileron and elevator.
78. If you feel inclined, you can now iron down all the filament tape with very low heat, paying particular attention to the tape edges. This helps it adhere to the foam a little better, smoothes out minor wrinkles and can help make it less visible after covering.



79. It's now time for covering. Spray the entire underside of the glider with spray adhesive and let dry for 5 minutes (or until aggressively tacky).

80. Bend over the ailerons and elevator and cover the hinge gap area using 48mm or 50mm (2") wide coloured polypropylene covering tape. Then proceed with the rest of the wing's bottom surface starting with the elevator. Let the tape overhang at the trailing edge of the elevator, fixed trailing edge pieces and ailerons (it will be trimmed later) and tape right over the gaps between the ailerons/elevator and fixed trailing edge pieces (these will be cut free later) but wrap around 25mm to 50mm (1" to 2") overhangs at the wing tips. Working your way forward, lay down each strip of tape spanwise (tip to tip) overlapping the previous one by 5mm to 10mm (3/16" to 3/8"). Don't worry about overlapping the leading edge of the wing, just trim off flush for now (it will be covered later).



81. Turn the wing over and spray the entire top surface of the wing with spray adhesive and let dry for 5 minutes (or until aggressively tacky). Cover as per bottom surface.

82. Using a straight edge (ruler) and sharp knife, trim off the tape that is overhanging the trailing edge of the wing, elevator and ailerons. Leave about 3mm (1/8") back from the trailing edges so that the tape is sealed to each other (sticky side to sticky side).

83. Lay strips of the coloured covering tape along the leading edge of each wing panel so that half of the width is on the top surface and half on the bottom surface. Split and overlap the tape at the panel joins and split and wrap around at the noses and wing tips.

84. Cut free the elevator and ailerons and then wrap a piece of covering tape around each exposed end of the ailerons, elevator and fixed trailing edges so that there is no balsa exposed.

85. Apply trims, stripes and/or decorations if desired.

LINKAGE HOOK-UP

86. Draw a line on the ailerons and elevator straight back from each servo arm. Measure 7mm (9/32") back along this line from the elevator and aileron's leading edges (hinge line) and mark with a pen. This will be the position of the front of the base of the Dubro control horns.

87. Locate the two packs of Dubro control horns included in the kit. Separate the control horns and their mounting back plates (you will have one spare). Hold the elevator's control horn in place and mark the position for the two mounting holes. Drill the holes and install the control horn by screwing it onto its plastic back-plate, sandwiching the balsa elevator in-between. Repeat for both ailerons' control horns.

88. Locate the two packs of Dubro E-Z Connectors included in the kit (you will have one connector spare). Install the Dubro E-Z connectors onto the control horns. Just use the re-useable nylon push-nut for now until its position on the control horn has been finalized. The second hole from the top is a good place to start. Later, when you're sure about their position, it's a good idea to remove the nylon push-nuts and replace them with the permanent metal ones. I usually also then put back the nylon ones over the top as well... just to be sure to be sure.
89. Locate the three metal pushrods (with attached steel clevises) included in the kit. Screw the clevises so that they are positioned towards the middle of the threaded section of the rods to allow adjustment either way if required. If using a mini size servo with standard nylon gears, it is a good idea to make a "v" bend in the pushrods directly behind the threaded section. This helps absorb shocks to the servo initiated by the control surface being hit, reducing the likelihood of the servo gears getting stripped and requiring replacement (annoying).
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90. Push the metal pushrod through the hole in the elevator's E-Z connector (ensuring its lock-screw is unwound) and attach the clevis to your servo arm, clamping together with a pair of pliers. Repeat for both the aileron's pushrods.
91. Turn on your receiver and transmitter so that the servo arms are centered. While holding the pushrod in place, move the elevator (the E-Z connector should be free to slide up and down the pushrod) so that it forms a straight line continuation of the bottom surface of the airfoil. Incidentally, if you glued the fixed trailing edge pieces accurately it should also line up with these. While in this position, firmly tighten the lock-screw on the EZ-connector to fix it to the pushrod.
92. Repeat for both of the ailerons. Accurate alignment is particularly critical for these.
93. Trim off the excess length of the pushrods using a pair of side-cutters/pliers.

FIN ATTACHMENT

Attachment of the front portion of the fins can either rely on a friction fit into the foam or be held in place with tape as per the following procedure. We suggest not gluing them into place because it can make replacing them after damage difficult.

94. Remove the covering from over the fin slots on the top surface of the wing and insert the fins into the wing so they butt up against the contour of the top surface of the wing.
95. While in this position, mark a 10mm (3/8") long line at the leading edge of each of the fins level with the top surface of the wing.
96. Remove the fins and cut a 10mm (3/8") long slit through the leading edge of each fin along the lines you marked.
97. Take a length of cross-weave filament tape and apply covering to it to match the top surface of the wing near the fin. Alternatively use a good quality thick clear tape that is UV resistant.

98. Cut off a 25mm (1") piece of this covered tape and slide it into the slit you made in the leading edge of the fin so that the fin has tape sticking out either side and in front of it. Push the fin all the way down and secure with the tape onto the top surface of the wing.
99. Take another strip of this covered filament tape (or clear tape) and secure the trailing edge of the fin by wrapping the tape down and around to the bottom surface of the fixed balsa trailing edge piece. The fin should be secured down on top of the fixed balsa trailing edge piece (not against its end) so that the elevator is still able to move freely. The tape prevents the fin from ever getting pushed sideways into the elevator's path and hindering its movement.
100. Repeat for second fin.

BALANCING AND FINAL SETUP

101. Now it's time for the most important step in this glider's construction; adjusting the glider's centre of gravity (CG), also known as its balance point. If the glider is not accurately balanced it will not fly well and may not even fly at all. An incorrect centre of gravity is the second most common cause of poor flight performance, so take extra care here.
102. First, double check that your glider is still balanced side to side. The Booby should balance in the middle of the central wing panel. If required, you can embed a small piece of lead into one of the wingtips towards the leading edge or remove/add lead from the lead weight already placed in the nose. If one wing half is heavier than the other, the glider can have a tendency to roll one way better than the other or consistently drop one wing tip when stalled (ie. one wing half is stalling prematurely). Another sign that the wing is unbalanced (or warped) is when there is a noticeable difference between the left and right aileron's neutral trim position for straight level flight.
103. Now it's time for the fore-aft balance. The Booby has been designed to balance at 140mm (5 1/2") back from the tip of each nose. Carefully measure this distance back from each nose and clearly mark it with a pen on the bottom surface of the wing.
104. Measure it again, it needs to be exactly one hundred and forty millimeters (five and a half inches) back from each nose of the glider. Importantly, if you have rounded the noses of the glider you need to project lines from the leading edges and measure from where the tip of the noses would have been.
105. Now determine where your glider's current balance point is. There are several ways you can do this. Manufactured balancing stands are best, but you can also make your own by vertically mounting sticks of dowel into a base of wood with the dowel ends sharpened like a screwdriver tip, or similar arrangements. As a next best option, you can also use your fingers (finger nails for accuracy) or a sharp edge of a table if you're careful enough. The idea for all these methods is to find the distance back from the wing's noses where it balances ie. where it is sitting horizontally and can be made to tip forwards as easily as it can be made to tip backwards.
106. The best way to add weight is to drill holes in the noses just in front of the battery pack (be careful not to let the drill bit touch the batteries!) on one nose and the corresponding position in front of the existing lead weight on the other nose.
107. Temporarily tape varying amounts of lead weight in this position and keep re-checking the balance point until the correct balance is achieved. Typically you will require 40 to 50 grams of lead in each nose to achieve correct balance but this is a guide only as the amount actually required can vary considerably due to a number of factors. It's the point at which it balances that is critical not the amount of lead used to achieve this.

108. Don't try and fudge the measurement and think you'll get away with it!

109. Once you have accurately determined the amount of lead needed for correct balance, drill the holes in the foam to accommodate it. Drill from the bottom surface and stop before penetrating through to the filament tape on the top surface of the wing. You can then fill these holes with the lead shaped into cylindrical pieces eg. fishing sinker hammered into shape or a piece of the lead flashing rolled into a cylinder. Secure and conceal the nose weight by covering with a patch of cross-weave filament tape and coloured covering tape.



110. Having the balance point further forward (a few millimeters) has a greater stabilizing effect ie. it will tend to hold onto a level flight path stronger and/or return to a level flight path quicker. This is in fact desirable for less experienced flyers, and in these situations a balance point as far forward as 135mm (5 5/16") could be considered. The trade-off with a balance point further forward than it needs to be is that more up trim is required for level flight, adding to the glider's drag (reducing maximum flight speed) and reducing the maximum amount of lift the wing can generate before stalling. The glider also becomes less responsive to control inputs (less aerobatic and maneuverable), doesn't retain as much speed in its turns and doesn't fly as well upside down.

111. The third most common cause of a poorly performing glider is incorrect control surface movement. Too much movement and the glider will become hard to control, easier to stall and generally not very fun to fly. Too little movement and the glider will become unresponsive and also not very fun to fly. The correct amount of elevon and elevator movement for the Booby is determined by its balance point (a more forward balance point requires more control movement), the pilot's skill level (beginners should have less control movement) and desired flight characteristics (less control surface movement offers more precise control over the glider while greater movement offers more responsiveness). As a guide, the trailing edge of the ailerons (furthest point inboard) should be able to move 20mm to 25mm (3/4" to 1") up and 20mm to 25mm (3/4" to 1") down from their neutral position ie. a total movement of 40mm to 50mm (1 1/2" to 2"). The elevator requires less movement. Around 10mm to 15mm (3/8" to 9/16") up and same amount down ie. total movement of 20mm to 30mm (3/4" to 1 3/16").

112. The amount of control surface movement for the elevator and ailerons can be adjusted either mechanically or electronically via some transmitters. If your transmitter has "end point adjustment" (EPA) then adjust this setting until you achieve the desired amount of movement for that control. To mechanically adjust the amount of movement, you can either move the E-Z connector up or down a hole on the control horn and/or move the pushrod clevis up or down a hole on the servo arm. To increase the amount of control surface movement initiated by the servo you can move the E-Z connector down a hole on the control horn (closer to the hinge line) and/or move the pushrod clevis up a hole on the servo arm (further away from the servo). To decrease the amount of control surface movement initiated by the servo you can move the E-Z connector up a hole on the control horn (further away from the hinge line) and/or move the pushrod clevis down a hole on the servo arm (closer to the servo).

113. The fourth most common cause of a poorly performing glider is radio equipment that is setup incorrectly, has faulty components, flat batteries or suffers interference. Double check that everything is functioning correctly and that the elevator and ailerons are moving in the correct directions. When viewed from the rear, the elevator should move up when your transmitter's elevator stick is pulled back for "up" control and should move down when the elevator stick is pushed forward for "down" control. When your transmitter's aileron stick is moved to the right for "right roll" control, the right aileron should move up and the left aileron should move down, and when the aileron stick is moved to the left for "left roll" control, the left aileron should move up and the right aileron should move down. Fully charge both your transmitter's and receiver's battery packs and perform a "range check" prior to your first flight. Don't forget to also always make sure that no one else is using the same radio frequency as you prior to turning on your transmitter at the flying site.

LAUNCHING TECHNIQUES

The Booby is launched by hand. It can be a little awkward to launch effectively by yourself at first but becomes much easier with practice. If there's plenty of lift and you can launch from the edge of the slope the simplest and easiest method is a side-arm launch holding onto one of the Booby's noses or a wingtip with one hand and gently throwing it into the lift like a discus. If more power is needed, the method that works best for me is to grab onto the leading edge of the wing's central panel with one hand, with you fingers on top and thumb below. With the glider tilting slightly away from your body (so that the wing clears your head!) and your transmitter ready for use in your other hand, its a matter of throwing it with a fairly straight arm (like a cricket bowler or someone throwing a hand grenade) releasing it with it's noses pointed at the horizon. If you are not confident in launching it this way it's a good idea to have someone launch it for you, especially for its first flight. They'll be able to do it easier with two hands, one on each nose, so that the bottom surface is resting on their palms and their thumbs wrapped around over to the top surface. Another way is to grab onto each of the fixed trailing edge pieces with fingers curled around to the top surface of the wing. With both of these techniques it's then a matter of holding it over one's head and throwing it, keeping it pointed at the horizon.





For those of you that may be wondering what I believe the first most common cause of a poorly performing glider is... it's the pilot! Of course the opposite is also true; an expert pilot can often even manage to make a dodgy glider look like it's flying well. These instructions won't go into any details about correct flying techniques because the glider is designed for experienced flyers. If you lack experience and/or good flying skills it's always best to have someone check your glider over prior to its first flight, trim it out for you and be there to offer suggestions to overcome any difficulties you are having flying it. Most people are usually more than happy to help if you ask them nicely.

PLEASE KEEP IN TOUCH

If you have any questions about the construction process, or the flying behaviour of the Booby, please don't hesitate to contact Wowings by e-mail to sales@wowings.com . Similarly, feedback (good, bad or a little of both) relating to any aspect of the Booby and these instructions is always welcomed at feedback@wowings.com , as are a couple of gif or jpeg image files of you and your glider (preferably at your favourite local slope site) or even a short video clip.

HAPPY FLYING!!