WingBAT 48

48in Span Sports Aerobatic Slope Soarer for 2 Channel RC Equipment.

Designed by: Stan Yeo

Produced by: Phoenix Model Products

Introduction

The original WingBAT, which was first designed in the early 1990s, was a very popular model (we still have a prototype WingBAT which we fly occasionally. There were two versions of the WingBAT, one with a 45in (1143mm) wingspan (the original and a gale 'gobbler') and the *PLUS* version with a wingspan of 57in (1450mm) and a slightly more docile flight performance. Both in time were converted to IC and loads of fun to fly. The smaller IC version had a blink and miss roll rate like its glider forbear. It was therefore natural, when in re-introducing some of our models from yesteryear, that the WingBAT should be reworked. After careful consideration we decided to 'stretch' the 45in version to improve the light lift performance without compromising manoeuvrability. The all-wood wing construction features a fully sheeted wing with a full depth reinforced main spar. This method of construction is both light and strong whilst being quick and easy to build. The simple, ply sided fuselage with balsa sheet top and bottom is again quick and easy build. The flight performance is similar to the original and should be within the capabilities of any model glider flyer with some aileron flying experience.

Radio Equipment Required

The recommended radio equipment required for the WingBAT 48 is two mini / metal geared micro servos such as the Hitec HS225BB (used on prototype), HS82MG or the Ripmax New Power XL-16HM/17HMB, a Square AA receiver battery pack and a 4 channel receiver with a 4ch transmitter with Elevon mixing.

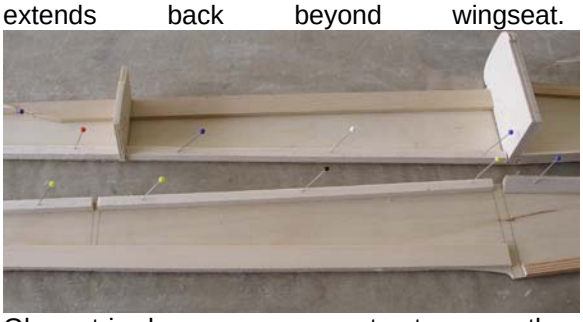
Tools / Materials Required

The tools required to build the WingBAT 48 are a modelling knife with spare blades, a One Metre Straight Edge, a miniature David Plane,180 grade Wet & Dry sanding block and soldering iron. The glues used to build the model are white PVA wood glue, thin Superglue (please observe safety precautions) and a very small quantity of two part epoxy. We recommend using a polyester heat shrink film for covering such as Oracover/Profilm or the thinner more economic version Easycoat.

Please Note for ALL wood joints use PVA wood glue unless otherwise stated. Also for maximum glue joint strength we recommend lightly sanding laser cut edges before gluing.

Building the Fuselage

1. Lightly sand the fuselage sides, top and bottom with 180 grade wet and dry to remove the 'release' agent. Remove dust with a small brush or vacuum cleaner.
2. Mark out the position of formers F2 & F3 on the inside of the fuselage sides ensuring there is a left and right side.
3. Glue F2 and F2A together as shown on plan.
4. Using PVA (wood glue) or if preferred thick cyno (DeLuxe Rocket), glue nose and wingseat strips to fuselage sides. Note wingseat strip extends back beyond wingseat.

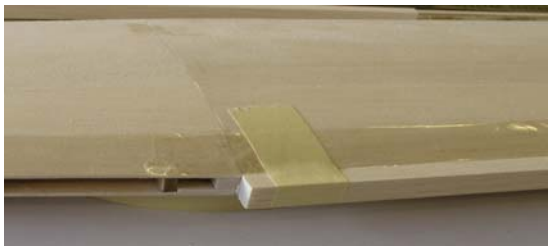


5. Glue strip longeron super structure on the fuselage sides.
6. Lightly sand edges of fuselage side to prepare gluing surface to receive top and bottom sheet.
7. Join fuselage sides together over the plan ensuring that both are straight and square.
8. Fit fuselage top sheeting adjusting edge joints as required.
9. *Build wing*.
10. Fit wing to fuselage and mark position of wing retaining dowel hole centre on front face of F2A. Centre should be the middle of the leading edge in line with LE joint.
11. Securely holding wing in position drill pilot hole for wing dowel. Enlarge hole in wing and F2 to accommodate wing dowel and brass retaining tube.
12. Epoxy dowel tubes in position.
13. Fit Fuselage bottom front and 3mm sheet bottom rear including spruce support strip.
14. Sand the front 3mm ply former F1 flat and fit Noseblock.
15. Sand and shape nose / fuselage to achieve the smooth lines shown on the plan.

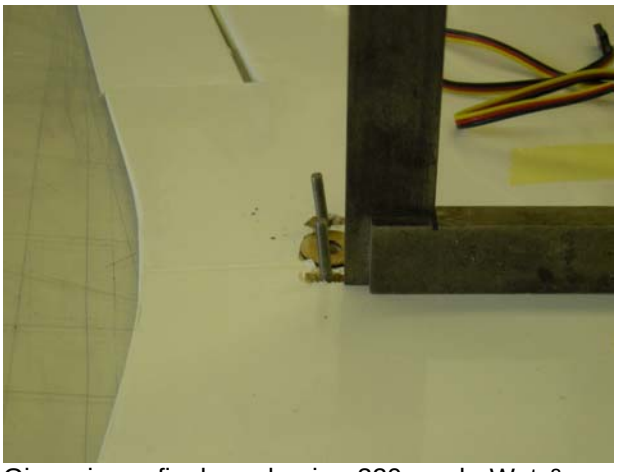
16. Using the wing to align the wing retaining nut plate, assemble and fit said plate.
17. Cut mounting holes for On/Off switch.
18. Run thin Cyno around wing dowel hole in F2 to help prevent enlargement in use.

Building the Wings

1. To protect the plan during construction cover in thin clear polythene or cling film.
2. Join front & back 1.5mm sheeting. Use metal straight edge to trim for a good joint. The sheeting has been Laser cut but may require further trimming due moisture changes in the wood. Sellotape them together along the joint. Hinge joint back and insert PVA glue. Place on flat surface and wipe away excess glue. Run Sellotape along top of joint. Weight down until glue set. Repeat for other three pieces.
3. Accurately align bottom sheet on plan and pin in place. Note sheeting overhangs wing ribs by approximately 2mm front and back.
4. Accurately mark position of mainspar on bottom sheet and using a straight edge glue and pin mainspar in place.
5. Elevate underside of sheeting at front with scrap to conform with airfoil profile
6. Omitting sub-ribs W1A/B glue wing ribs in position.
7. Glue 6mm strip to front of Mainspar 1mm from the top. Ensure that it is a snug fit between the ribs.
8. Using guide lines on plan glue ribs in place.
9. Build second Wing.
10. Trim and align root end of each wing panel taking into account wing sweepback.
11. Glue panels together.
12. Glue 0.8mm ply rear floor panels in place.
13. Glue 12mm sub rib W1A in position.
14. Using Elevon servos as guides fit and glue servo beams in position. Trim to W2 rib contour.
15. Fit sub-ribs W1B.
16. 
With ‘joined’ wing panels pinned to building board at the root and leading edge of tip raise trailing edge at tips with 6mm balsa blocks to build in washout. At mid-span to keep trailing edge straight insert 3mm blocks.
17. Trim and fit 1.5mm top sheeting in place taking care to ensure that it is making contact with both the wing ribs and the mainspar. Tip: Use masking tape to support sheet whilst glue sets.
18. 

Using a David Plane / 180 grade Wet& Dry sanding block trim leading & trailing edge sheeting until level with the wing ribs. When satisfied place Sellotape along edge of sheeting top & bottom to minimise glue overspill. Tip: Do not try to align Sellotape with edge of sheet but let it overlap and trim with a sharp scalpel. *Tip*. We make sanding blocks using 180 grit Wet & Dry stuck to 12mmx75mmx230mm (1/2x3x9in) balsa sheet

using double sided tape.
19. Carefully plane/sand both rear spars and leading edge to shape. *Tip:* when using David Plane set blade at slight angle so that the cut is thinner on one side of the plane. It helps control thickness of cut.
20. Prepare centre section trailing edge to accommodate Elevon torque rods.
21. Fit centre section trailing edge including aileron torque rods taking care not to let any glue come into contact with the torque rod!
22. Glue 0.8mm ply end ribs to balsa tips. Again there is a Left & Right! Roughly shape and glue tip in place taking care to align tip end rib with wing end rib.
23. Sand wing tips to shape.
24. Shape Ailerons and cut to length. Mark left and right. At this stage do not make allowance for 0.8mm ply ends.
25. Tape ailerons in position using Wing Tip as a reference. Check for twist.
26. Using ailerons as a guide mark TE position on centre section trailing edge. Lightly draw guide line along TE.
27. Shape centre section TE to shape using Elevons aligned with Wingtips on as a reference. When complete add 0.8mm end plates.
28. Cut Elevons to length allowing 2mm for ply end plates and the thickness of covering material.

29. Angle leading edge of Elevons to allow for up and down movement.
30. Cut slot drill / hole for Elevon torque rods in ailerons. Attach 0.8mm ply Elevon end plates.
31. Cut Mylar into 12mm wide strips. Remove sharp corners. Hinge Elevons using Mylar strip but do not glue.
32. Attach wing to fuselage and using scrap balsa and lightweight fill build leading edge fairing. When finished run thin Cyno over the surface to harden it.
33. To assist in the mechanical operation of the Elevon control rods it necessary to rake the torque rod 15 degrees to the rear. This is easily done using two short lengths of tubing slid over the ends of the torque rods and twisting them taking care to ensure both torque rods have the same rearward slant with Elevons in neutral.



34. Give wing a final sand using 320 grade Wet & Dry.
35. Mount Elevon servos and construct control rods. Note it is possible to drill a second hole in the torque rod ear to aid the control rod geometry.

Covering & Finishing

1. The originals were covered in heat shrink film (Profilm/Oracover). This has proved more than adequate. Should you wish to cover in a different material please take into account any potential weight penalty that it may incur and puncture / tear resistance / repairability.
2. Give the complete model a final sanding with 320 grade Wet & dry. DO NOT use a sanding block on wing sheeting. It thins the sheeting on top of the rib and seriously weakens the wing.
3. Before covering vacuum clean the model to remove embedded dust to avoid 'pimpling' when covering.
4. Please follow the instructions for the covering material being used. Normal procedure is to tack the material at one end. Tack the other end and then proceed to gently stretch and tack along its length before sealing all along the edges and shrinking with a Heat Gun.
5. Check Elevon Torque Rods for 15 degree rearward rake. Adjust as necessary using tubing as levers and thread protectors.
6. Roughen surface of Mylar hinges and fit Elevons. Glue Mylar hinges in place using thin Cyno.
7. Fit Elevon servos. Centre servos using transmitter sub-trims and fit control rods adjusting to length as required.
8. The Balance Point (C of G) on all flying wings is critical, no less so on the WingBAT48. Firstly balance the model laterally by adding weight to the *light* wing. To balance the model longitudinally we recommend taping a hexagonal pencil laterally along the balance point line. The prototypes required a small amount of tail weight (25g) to achieve a balance point of 122mm +/- 2mm from the rear face of F2.
9. Set the control movements as per the plan i.e. Elevator - Up 9mm Down 8mm. Ailerons - Up 13mm Down 12mm. For smooth control response Exponential is recommended for both Aileron and Elevator controls. Typically 30-40%.
10. If using 2.4Ghz R/C equipment it is often recommended that you re-bind / pair the receiver to update failsafe settings. Please consult your equipment manual.

Flying

When satisfied the model is set-up and ready to go choose a suitable site and day to test fly it i.e. wind not too strong or too light. If you are inexperienced on this type of model as a minimum get an experienced helper to launch the model. Be prepared for immediate elevator input as the amount of reflex (up elevator) is determined by C of G position.

We have found the best launching technique is to hold the model with the fore finger pointing backwards underneath the wing leading edge with the thumb and second finger gripping the fuselage side just in front of the wing. The forefinger is in the position recommended to prevent the model being launched nose down into the ground! Depending on the wind strength will depend on how hard the model is thrown.

If the model has been built and set up according to the plan very little trimming should be required. The WingBAT 48 is capable of almost any manoeuvre that a non–powered flying wing could be expected to perform including in the right conditions inside / outside loops and sustained inverted flight. The only real limitation is your flying ability and imagination! There are a number of articles on flying slope soarers on our website www.phoenixmp.com. They include basic aerobatics, a discussion on landing techniques and more detailed information on model preparation.

Happy landings,

Stan