WingBAT 48e

48in Span Electric Sports Aerobatic Model for 4 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 to add a motor to the WingBAT48 but electric instead of IC. Whilst there is very little difference in the construction between the two versions other than the nose section we have had to move the Elevon servos outboard in the wing to accommodate the economically priced 2200mAhr 3S LiPo. Flying wise the WingBAT48E returns a spritely performance being capable of inside and outside loops, rolls and sustained inverted flight. The roll rate is not quiet in the blink and miss category but still impressive.

Radio Equipment Required

The recommended radio equipment required for the WingBAT 48 is two metal geared micro servos such as the Hitec HS82MG or the Ripmax New Power XL-16HM/17HMB, a 4 channel receiver with a 4ch transmitter with Elevon mixing. The recommended electrics are a 2836/08 1120Kv motor, 40A ESC and 18/2200mAhr 3S LiPo.

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

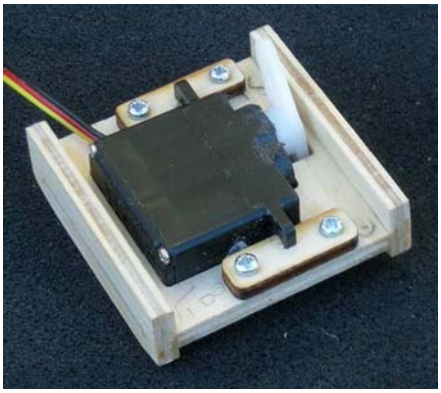
1. Lightly sand the fuselage sides, top and bottom with 180 grade wet and dry to remove the 'release' agent. Remove dust with a small brush or vacuum cleaner.
2. Mark out the position of formers F2 & F3 on the inside of the fuselage sides ensuring there is a left and right sides are correctly indentified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

4. Glue strip longeron super structure on the fuselage sides.
5. Lightly sand edges of fuselage sides to prepare gluing surface to receive top and bottom sheet.
6. Join fuselage sides together over the plan ensuring that both are straight and square. Note position of motor wire slot in on the side of F1. Also Fin slot in F3 is uppermost!!
7. Fit fuselage front top sheeting.
8. Glue Fin parts together.
9. Using the Fin to aid location fit top rear sheeting.
10. Glue 0.8mm ply faces to ends of top sheeting in preparation for hatch. Cut hatch to length. Adjust angle of ends for neat fit. Fit ply end plates, locating tab and Latch (see plan)
11. *Build wing*.
12. 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.
13. Securely holding wing in position drill pilot hole for wing dowel. Enlarge hole in wing and F2 to accommodate wing dowel brass retaining tube.
14. Epoxy dowel tube in position.
15. Fit Fuselage bottom front and 3mm sheet bottom rear including spruce support strip.
16. Using the wing to align the wing retaining nut plate, assemble and fit said plate.

17. Run thin Cyno around wing dowel hole in F2 to help prevent enlargement in use.
18. Sand fuselage to shape. Fit motor to F1.
19. Cut hole in motor cowl to suit motor. Fit cowl in position and check that the front of the motor protrudes through the cowl. Sand fuselage to suit. Sand air duct channel.

Building the Wings

1. To protect the plan during construction cover with thin clear polythene sheet 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. Check also that it is the ***bottom*** sheet. The top sheet has exit holes for the servo leads.
4. Accurately mark position of mainspar on bottom sheet and using a straight edge to align the spar glue and pin mainspar in place.
5. Elevate underside of sheeting front and rear with scrap to conform with airfoil profile
6. Omitting sub-ribs W1A/B glue wing ribs in position using guide lines on plan.
7. Glue 6mm strip to front of Mainspar 1mm from the top. Ensure that it is a snug fit between the ribs.
8. Glue together Wing Servo Mount Assembly using PVA and before glue sets fit mount into servo bay between W5&6. Consult plan as they are handed i.e. there is a left and right hand! Push sides of servo mounts against W4&5 to make good gluing contact. Note mount is 3mm to rear of mainspar at W6

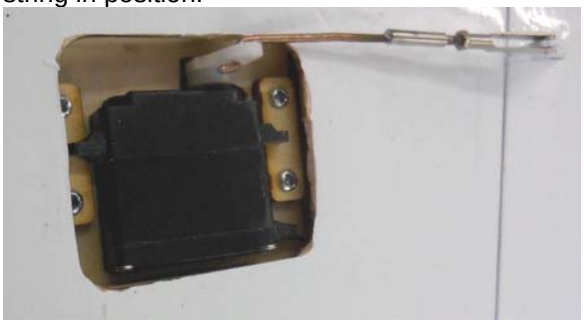


9. Build second Wing.
10. Trim and align root end of each wing panel taking into account wing sweepback.
11. Glue panels together. Fib Sub rib W1A.
12. Glue balsa spacer to rear of mainspar where they meet along with 1.5mm ply Wing Brace. Do same for rear ply brace.
13. Glue Sub rib W1B in position.
14. 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.

15. Thread string through servo bay and ribs and top sheeting to aid final servo installation.
16. 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.
17. Using a David Plane / 180 grade Wet& Dry sanding block trim leading & trailing edge sheeting until level with the wing ribs. *Tip* – make sanding block using 180 grade Wet & dry double sided taped to 12x75x250mm balsa sheet.
18. When satisfied place Sellotape along edge of sheeting top & bottom to minimise glue overspill (Demonstration photo). Tip: Do not try

to align Sellotape with edge of sheet but let it overlap and trim with a sharp scalpel.
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. Fit centre section trailing edge.
21. 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.
22. Sand wing tips to shape.

23. Shape Ailerons and cut to length. Mark left and right. At this stage do not make allowance for 0.8mm ply ends.
24. Tape ailerons in position using Wing Tip as a reference. Check for twist.
25. Using ailerons as a guide mark TE position on centre section trailing edge. Lightly draw guide line along TE.
26. Shape centre section TE to shape using Elevons aligned with Wingtips as a reference. When complete add 0.8mm end plates.
27. Cut Elevons to length allowing 2mm for ply end plates and the thickness of covering material.
28. Angle Elevon leading edge as shown on plan to allow for up and down movement.
29. Temporarily fit Elevon servos in position. Leave string in position.



30. Using Masking tape temporarily hinge Elevons and determine position of slots for Elevon control Horns.
31. Cut slot but do not glue horns in position until Elevons are covered.
32. Remove Elevon servos to avoid damaging leads during covering.
33. Attach wing to fuselage and using scrap balsa and lightweight filler build leading edge fairing. When finished run thin Cyno over the surface to harden it.
34. Give wing a final sand using 320 grade Wet & Dry.

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 then shrinking with a Heat Gun.
5. After covering fit model electrics and Elevon servos. Centre servos using transmitter sub-trims.
6. Glue Elevon control Horns in position and hinge Elevons using Sellotape Diamond or suitable alternative.
7. Assemble Elevon control rods. *Tip* – Use FRY Power Flux to aid solder wetting.
8. The Balance Point (C of G) on all flying wings is critical, no less so on the WingBAT48E. Firstly balance the model laterally by adding weight to the wing tip of 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) with a 2200mAhr 3S LiPo with the battery as far back as it will go 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 i.e. wind not too strong or too light. We strongly recommend you get an experienced helper to launch the model. On launching, the model will enter a shallow descent until it gains flying speed so be prepared to apply UP elevator to counteract this. Early flights with flying wings, until the model is properly trimmed, carry a higher risk than more conventional models but once trimmed there is little difference. Performance with the recommended power train is more than adequate with a 70 degree plus power climb. If the model has been built and set up according to the plan very little trimming should be required. As previously mentioned the WingBAT 48E is capable of almost any manoeuvre expected of a flying wing including inside / outside loops and sustained inverted flight so be creative in your flying. There are a number of related articles, both on flying and model electrics, our website www.phoenixmp.com.

Happy landings,

Stan

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