Toledo Mk2

63in Span Sports Aerobatic Slope Soarer for 4-6 Channel RC Equipment.

Designed by: Stan Yeo

Produced by: Phoenix Model Products

Introduction

The Toledo is a stylish aerobatic slope soarer originally designed in 1993 as respite from studying. At the time there was a dearth of 'T' tail sport slope soarers so it seemed the right time to build one. The last 'T' tailer I built was in the early seventies and flew with homebuilt Remcon Quantum 6 radio with 4 wire servos!

The performance of the Mk1 Toledo was a pleasant surprise as the light air performance was much better than expected and the model performed a very creditable outside loop despite the predominantly flat bottomed section. A similar cross-tail model fitted the same wing was unable to perform this manoeuvre. Remember this was in the days before computerised transmitters and economically priced micro metal geared servos. With modern R/C equipment, twin aileron servos and a lighter built-up wing replacing the foam veneer wing the performance has been further improved on the Mk2 particularly with regards to landings and aerobatics.

As mentioned above the Toledo Mk2 kit features a 'built up' wing thus minimising the use of fibreglass, epoxy and polyester resins which often cause an allergic reaction in some people. It also makes the kit more pleasurable to build! The kit is very comprehensive with virtually all the fiddly bits pre-cut. Also included are purpose designed wing servo mounts. If you are using a computerised Tx then the Ailerons can also function as Flapperons.

Radio Equipment Required

The recommended radio equipment required for the Toledo Mk2 is two metal geared servos i.e. Hitec HS82MG or the Ripmax New Power XL16HM or XL17HMB plus two standard size servos, a Square AA receiver battery and a 4/6 channel receiver. For Flapperons operation a 6ch transmitter and 6ch receiver is required.

Tools / Materials Required

The tools required to build the Toledo are a modelling knife with spare blades, a One Metre Straight Edge, a miniature David Plane,180grade Wet & Dry sanding block and soldering iron. The glue 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.

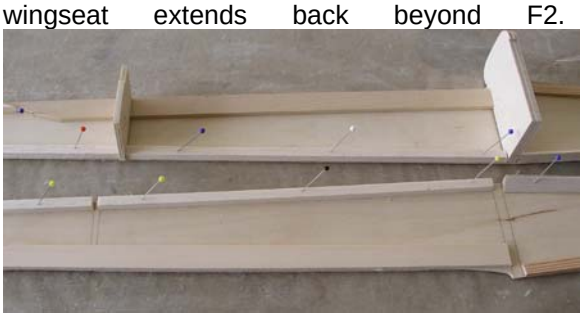
Building the Tailplane

1. Cut plastic Tailplane joiner tube to length plus 6mm.
2. Centrally position joiner tubes in pre-cut slots in Tailplane.
3. From scrap 1.5mm balsa sheet cut strips to fill the gaps above and below plastic joiner.
4. Assemble Tailplane and pin to building board over plastic sheeting.
5. Position 1.5mm balsa strips in the gap above plastic joiner and Superglue in position taking care not to disturb the position of the joiner. The slots were cut narrower than the joiner tube to hold them in position during this operation.
6. Remove Tailplane from plan and repeat Step 5 for the Tailplane bottom.
7. Trim ends of plastic tube.
8. Please note the following operations are carried out AFTER building the Fuselage.
9. Fit Tailplane Fuselage and check ends of Tailplane are parallel to Fin sides. Adjust as necessary.
10. Fit 0.8mm ply end plates and sand Tailplane to shape.

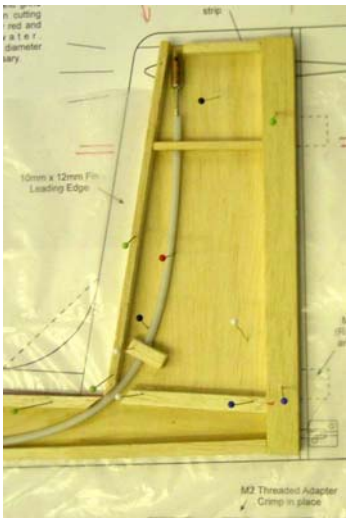
Building the Fuselage

11. 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.
12. Align the fuselage sides with the Wingseat and mark out the position of formers F2 & F3 on the inside of the fuselage sides ensuring there is a left and right side. Aligning Wingseat F2/F3 is to offset any variation in plan length due to changes in moisture content in the paper.
13. Cut slot for Rudder cable exit as indicated on plan (bottom of fuselage).
14. Using PVA (wood glue), glue spruce nose and wingseat strips to fuselage sides. Note

wingseat extends back beyond F2.



15. Glue strip longeron super structure to the fuselage sides.
16. Lightly sand edges of fuselage side to prepare gluing surface to receive top and bottom sheeting.
17. Build Fin super structure on one Fuselage side.
18. Solder Tailplane Brass Pivot to Elevator Bowden cable.
19. Install Elevator control cable in fuselage. Anchor cable to fuselage side every 100-120mm using spare 6mm sq strip to form a bridge secured with Superglue.
20. Measure distance between centres of Tailplane joiners and mark pivot hole centres on one Fin/Fuselage side. Also lightly mark neutral position of Tailplane on Fin.
21. Tape fuselage sides together and drill holes for Tailplane pivots. Cut out actuating joiner slot.
22. Join fuselage at Fin taking care to ensure that the Tailplane piano wire rods are square to the fuselage in ALL direction both sides. Check for full and free movement of Elevator control cable.
23. Fit 1.5mm sheet to top of Fin.
24. Check centre line on plan is straight and mark centre of formers F2 &F3.
25. Join fuselage sides (F2 & F3) together over the plan ensuring that it is both straight, square and not twisted! When glue has set fit F1 again carefully checking fuselage alignment.
26. Fit Rudder and control rods. Anchor to fuselage side every 100-120mm as per Elevator control rod. Before fixing control cables check control cable inners are not binding and move freely.
27. Fit Fuselage bottom front and back plus 10mm top nose sheet.
28. Carve out Noseblock to accept 80grms Nose weight. Additional Nose weight will be required internally to achieve recommended balance point.
29. Sand the front 3mm ply former F1 flat and fit Noseblock.
30. Mark position of fuselage sides on underside of hatch and glue tapered strips position. Align slightly outside of lines to allow for sanding.



31. Angle rear face of hatch to match front face of F2. Centrally position ply end face and Superglue in position.
32. Cut Hatch to length and slope end at front of hatch to match abutting face. Allow enough space between the front of the hatch for the two ply end faces plus enough to ‘jam’ a third ply plate (supplied) to hold the hatch in position whilst the ‘front end’ is sanded to shape. This gap is to allow for the thickness of the covering material and fitting/removal.
33. After sanding front of fuselage to shape remove hatch and mark position of 3mm hatch retaining dowel.

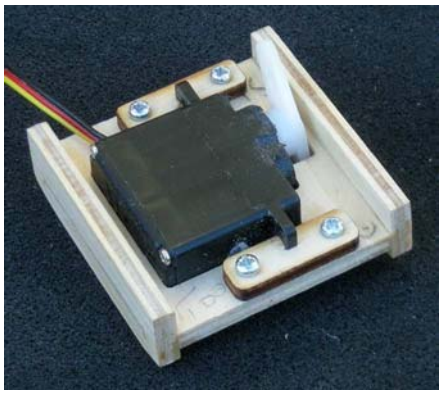
34. Drill hole in hatch for retaining dowel and transfer position of dowel hole onto ply hatch locating plate.
35. Drill Hatch dowel locating hole in fuselage.
36. Mark position of hole for Hatch Latch on rear of F2. Tape Hatch in place and drill 1.5mm hole thro’ F2 into Hatch.
37. Prepare Hatch Latch for fitting.
38. Fit ply Latch plate support.
39. Epoxy Latch assembly in place. Grease latch to avoid latch sticking.
40. Fit and hold wing in position and drill holes for wing retaining dowel brass tube. Use dowelling / spare drill to hold wing in position whilst drilling second dowel hole. (use drill described on plan).
41. Epoxy 6swg Brass wing dowel retaining tubes in place.
42. Mark and drill Wing Bolt in Wing. Glue ply hole support in place.
43. Mount wing retaining T Nut in balsa block and glue block wing nut plate.
44. Fit wing to fuselage and align the wing nut assembly plate. When aligned glue in position. *Tip: Use foam rubber underneath block to assist in positioning.*
45. Fit ply plate to front face of rear fuselage top sheeting. Apply Sellotape to front face. Do same to rear face of F2 and bolt wing in position.

46. Fit wing fairing ply alignment plates and balsa supports.

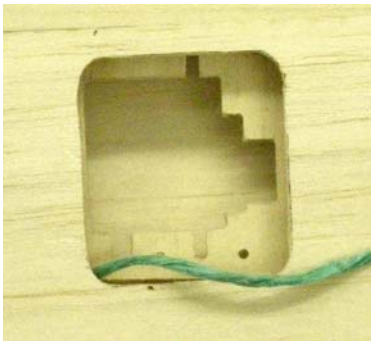
47. Carefully trim plastic wing fairing to shape using guide lines on fairing.
48. Cut wing bolt tube to size. Trim inside of tube to engage in locater in fairing.
49. Glue Fairing assembly in position. For additional support we used bath sealer for tube and wing sheeting joints.
50. Fit Rudder & Elevator servos as shown on plan.
51. Mount On/Off switch using switch plate provided. Bend switch operating rod to shape and dry fit. Remove before covering.
52. Cut Mylar Hinges to size (12mm x 25mm). Trim corners to stop the digging in and roughen gluing surface with wet & Dry and hinge Rudder. Do NOT glue until model is covered.

Building the Wings

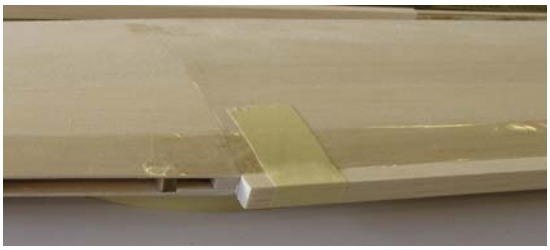
1. To protect the plan cover in either thin polythene or cling film.
2. Glue together Wing Servo Mount Assembly using PVA. Consult plan as they are handed i.e. there is a left and right hand! If you make a mistake the mount can be disassembled in water!
3. Join front & back 1.5mm sheeting. Use metal 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.
4. Accurately align bottom sheet on plan. Note rear of sheet overhangs rear spar by 1.5mm.
5. Accurately mark position of mainspar on bottom sheet and using a straight edge glue and pin mainspar in place.
6. Elevate underside of sheeting at front and rear with scrap to conform with airfoil profile
7. Omitting W1 glue wing ribs in position.
8. Glue 6mm strip to front of Mainspar 1mm from the top. Ensure that it is a snug fit between the ribs.
9. Glue together Wing Servo Mount Assembly using PVA and before glue sets fit mount into servo bay between W4&5. 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.
10. Using guide lines on plan glue ribs in place. For the servo bay ribs use servo mount for alignment.



11. Build second Wing.
12. Trim and align root end of each wing panel using a straight edge to align the mainspars. Glue panels together.
13. Glue 0.8mm ply floor panels in place.
14. Fit Spruce rear spar reinforcing strip. Ribs W1 ribs and 12mm sub-ribs W1A
15. Thread string through servo bay and ribs to aid final servo installation
16. Trim and fit 1.5mm top sheeting 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.



17. 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.



18. Carefully plane/sand both rear spar 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.
19. 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.
20. Sand wing tips to shape.
21. Fit centre section trailing edge.
22. Shape Ailerons and cut to length. At this stage do not make allowance for 0.8mm ply ends.
23. Tape ailerons in position using Wing Tip as a reference. Check for twist.
24. Mark TE position on centre section trailing edge. Lightly draw a line along TE.
25. Shape centre section TE to shape using Aileron as a reference. When complete add 0.8mm end plates and mark position of aileron control horn.
26. Cut slot for aileron control horn. Needs to snug fit. Roughen surface and superglue in position AFTER covering.

27. Fit 0.8mm ply Wing Bolt washer. Give wing a final sand using 320 grade Wet & Dry.
28. Draw a line on underside of Ailerons to indicate extent of shaping required for down going Aileron relief. Shape ailerons and cot to length allowing for 0.8mm ply end plates.
29. Cut slot in Aileron for fibreglass control horn. Do NOT glue in position until Aileron is covered.

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 instruction 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. Spray wing fairing to match your colour scheme (rattle can) (Hycote gloss white is a perfect match for white Profilm). Mask wing first!
6. Fit aileron servo output arms in centre position.
7. Superglue Aileron control horns in position and hinge Ailerons using UV resistant clear plastic tape and fit aileron servos.
8. Centre Aileron servos using transmitter sub-trim and adjust Aileron pushrods. When satisfied tape servo covers in place.
9. Fit controls, hinge rudder, carry out final adjustment to elevator neutral and balance the model including the wings (laterally).
10. Set the control movement as per the plan i.e. Elevator +/- 8 degrees. Rudder +/- 30mm. Aileron Up 16mm Down 13mm. Up Elevator Flap Down 3mm. Down Elevator Flap Up 4mm. Landing Flap1 Up 6mm Landing Flap2 Up12mm. Balance point 62mm +/- 3mm from Leading Edge. Exponential is recommended for both Aileron and Elevator controls. Typically 30%. Landing flap will require up elevator to compensate for nose down attitude when deployed.
11. 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 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. If set up correctly very little trimming should be required. The Toledo is capable of almost any manoeuvre that a non–powered model can perform including in the right conditions sustained inverted flight, inside and out side loops with rolls in the middle. 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