

# Sierra Mk2

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

Designed by: Stan Yeo

Produced by: Phoenix Model Products

## Introduction



The Sierra was originally designed in the early 80s to put some fun back in our slope soaring as at the time all the models we were flying had fully symmetrical wing sections. So when the lift was less than brilliant, which was quite often, all we could do was stooge up and down the slope imitating raw beginners trying to keep their model airborne. So when the Sierra came along with the renowned semi-symmetrical Eppler 374 wing section all of a sudden we found we could perform the complete slope aerobatic schedule, less the inverted manoeuvres, in much lighter lift conditions and really enjoy our flying. There was an instant clamour locally for kits and the first batch were supplied in a poly bag with no instructions or plan! The Mk2 has replaced the foam veneer wing with a simple fully sheeted built up wing with twin aileron servos using our bespoke mounts to take advantage of latest developments in computerised RC equipment. With flap elevator coupling in looping manoeuvres the Sierra is capable of virtually any non-powered aerobatic manoeuvre by a competent pilot. The Fuselage construction is unchanged with ply fuselage sides and balsa sheet top and bottom. For modellers allergic to epoxy resin and superglue the Sierra can be built almost entirely with PVA wood glue or aliphatic PVA. For most joints these are the recommended glues particularly when building the wing.

## Radio Equipment Required

The recommended radio equipment required for the Sierra is two metal geared micro 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 a 6ch receiver is required. Sundela board is recommended as a building board. It 10mm thick, you can push glass headed pins into it and they not pull under normal pinning loads.

## Tools / Materials Required

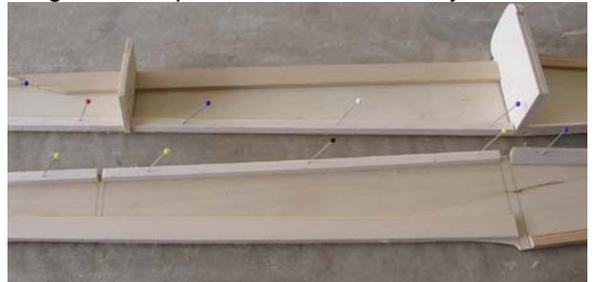
The tools required to build the Sierra are a modelling knife with spare blades, a One Metre

Straight Edge, a miniature David Plane, 180 grade Wet & Dry sanding block and soldering iron. The glue used to build the model white PVA wood glue, thin Superglue (please observe safety precautions) and a small quantity of two part epoxy. We recommend using a polyester 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*

## 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. 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 with the Wingseat is to offset any variation in plan length due to changes in moisture content in the paper.
3. Using PVA (wood glue), glue spruce nose and wingseat strips to fuselage sides. Note wingseat strip extends back beyond F2.



4. Glue strip longeron super structure on the fuselage sides.
5. Lightly sand edges of fuselage side to prepare gluing surface to receive top and bottom sheeting.
6. Cover plan with cling film and position fuselage sides over top view of plan and fit formers F2 and F3 ensuring fuselage is straight and square.
7. Join fuselage at the tail. When glue has set remove fuselage from plan and fit nose former F1.
8. Drill holes in sides of fuselage to accommodate Rudder and Elevator control snakes.
9. Install control snakes in fuselage. Anchor to fuselage side every 100-120mm using spare 6mm sq strip to form a bridge secured with Superglue.
10. Fit Fuselage bottom front and back plus 10mm top nose sheet.
11. Carve out Noseblock to accept 90grms Nose weight. Approximately a further 60grms of nose

weight will be required inside the nose area to achieve the correct Balance Point.

12. Sand the front 3mm ply former F1 flat and fit Noseblock.
13. Angle rear face of hatch to match front face of F2. Centrally position ply end face and Superglue in position.
14. 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 fitting/removal.
15. After sanding front of fuselage to shape remove hatch and mark position of 3mm hatch retaining dowel.
16. Drill hole in hatch for retaining dowel and transfer position of dowel hole onto ply hatch locating plate.
17. Drill Hatch dowel locating hole in fuselage.
18. Mark position of hole for Hatch Latch on rear of F2. Tape Hatch in place and drill 1.5mm hole thro' F2 into Hatch.
19. Prepare Hatch Latch for fitting.
20. Fit ply Latch plate support.
21. Epoxy Latch assembly in place. Grease latch to avoid latch sticking.
22. Mark the centre of the Tailplane and lightly draw a centre.
23. Fit the triangular strip to the base of the Fin and glue Fin to Tailplane checking that it is both square and perpendicular. If Fin is not perpendicular slice the triangular strip along the grain on the side the Fin is leaning towards and force a strip thin card in the slot. When happy lightly super glue in place.
24. Join elevators and shape to section profile and dry hinge.
25. Repeat procedure for the Rudder.
26. Glue Tailplane in place again checking that it is square to the axis of the fuselage datum horizontal.



27. Fit and hold wing in position and drill hole for wing retaining dowel brass tube (use drill described on plan). Drill a pilot hole first using a long 3mm piano wire drill.
28. Epoxy 6swg Brass wing dowel retaining tubes in place.
29. Using the wing, align the wing retaining nut plate, assemble and fit said plate.

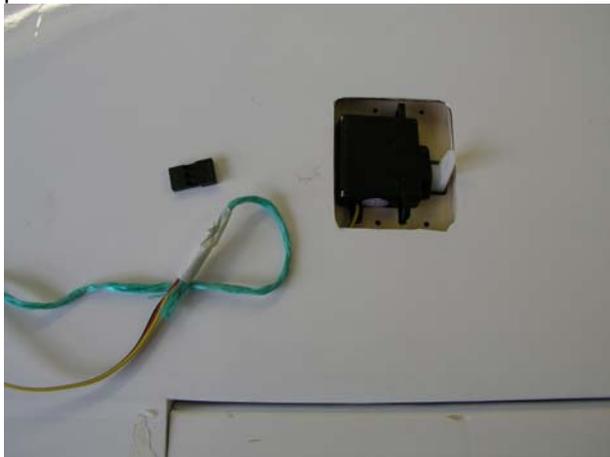
30. Bolt wing in position and fit front wing fairing. Use filler to help with shaping.
31. Fit Rudder & Elevator servos as shown on plan.
32. Mount On/Off switch using switch plate provided.
33. Cut Mylar Hinges to size (12mm x 25mm). Trim corners to stop the digging in and roughen gluing surface with 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. 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. Note rear of sheet overhangs rear spar by 1.5mm.
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 and rear with scrap to conform with airfoil profile
6. Omitting W1 glue wing ribs in position.
7. 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.
8. Using guide lines on plan glue ribs in place. For the servo bay ribs use servo mount for alignment.
9. Build second Wing.
10. Trim and align the root end of each wing panel. Note the main spars should be in a straight line.
11. Fit Spruce rear spar reinforcing strip and W1 ribs
12. Fit 12mm wing dowel sub-ribs W1A and W1B.
13. 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.
14. 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.
15. Fit leading and trailing edges.
16. 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.



17. 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.
18. Sand wing tips to shape.
19. Fit centre section trailing edge.
20. Shape Ailerons and cut to length. At this stage do not make allowance for 0.8mm ply ends.
21. Tape ailerons in position using Wing Tip as a reference. Check for twist.
22. Mark TE position on centre section trailing edge. Lightly draw a line across TE.
23. 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.
24. Cut slot for aileron control horn. Needs to snug fit. Superglue in position AFTER covering.
25. Fit 0.8mm ply Wing Bolt washer. Give wing a final sand using 320 grade Wet & Dry.
26. Draw a line on underside of Ailerons to indicate extent of shaping required for down going Aileron relief. Shape ailerons and cut to length allowing for 0.8mm ply end plates.
27. Cut slot in Aileron for fibreglass control horn. Do NOT glue in position until Aileron is covered.
28. Fit centre wing fairing complete with ply end plates.



### **Covering & Finishing**

1. The originals were covered in heat shrink film and 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 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. Glue Aileron control horns in position.
6. Hinge Ailerons using thin Superglue and fit aileron servos.
7. Centre Aileron servos and adjust Aileron pushrods. When satisfied tape servo covers in place.
8. Fit controls, hinge rudder, carry out final adjustment to elevator neutral and balance the model including the wings (laterally).
9. Set the control movement as per the plan i.e. Elevator +/- 10mm. Rudder +/- 30mm. Aileron Up 16mm Down 13mm. Up Elevator Flap Down 2mm. Down Elevator Flap Up 4mm. Landing Flap1 Up 6mm Landing Flap2 Up 16mm. Balance point 70mm +/- 5mm 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.
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 set-up and ready to go choose a suitable site and day to test fly 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 Sierra 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](http://www.phoenixmp.com). They include basic aerobatics, a discussion on landing techniques and more detailed information on model preparation.

Happy landings,

*Stan*