

THE SHOWBIRD

The SHOWBIRD design was developed as a result of an attempt to build an extremely high performance sport/show plane utilizing a .40 engine. The all-up weight has been kept to a minimum for an airplane of this size which results in spectacular vertical performance. This lightness combined with the relatively large span (64 inches) results in such a slow stalling speed that NO LANDING GEAR ARE REQUIRED! This helps keep the weight and drag unusually low for a powered model. The bottom line is an efficient and rugged aircraft with 1.2 G acceleration!

CONSTRUCTION HINTS

We build all our wings on a jig. If you own one, you know why; if not, you really should consider purchasing this tool. It will allow you to nearly complete the SHOWBIRD (or even a larger wing) in one piece, holding it for you in all different attitudes--and not once will you need to worry about the straightness of the wing. It WILL be straight.

For those of you unwilling to go this route, we have provided for tapered block-ups for the spars and trailing edges. We will assume your building board is large enough to build the SHOWBIRD in one piece. If you are using a jig, you will need to transfer the location of the jig hole center lines to the ribs. These are available on the plans for a 50 mm jig spacing. Measure from the leading edge of the main spars to the center lines. (The airfoil is symmetrical and there is no dihedral.) Now transfer the location of each rib to the jig and proceed to frame up the structure.

If you are working on a flat board, pin the plans onto the board and cover with Saran wrap. Find the 32½" length of ¼" balsa sheet. Check that this part is straight and trimmed to a width of 5/8". Using a straight edge and knife split this part diagonally (from corner to corner) to produce a pair of block-ups for the main spars.

Note that the plans are drawn for construction of the SHOWBIRD upside down. This is because most of the work is on the bottom of the aircraft; mainly the hatches and systems. The airframe is completely symmetrical

(left/right and top/bottom) except for the hatches and the engine which is on the starboard side.

Note that the main hardwood spars and balsa leading edges must be angled slightly to meet properly at the wing center. The two main lower spars are now pinned in place on the plans using the taper blocks produced earlier. These blocks should come together with the main spars at the wing center. The ribs are blocked up at the trailing edge using a straight-edge $1\frac{1}{4}$ " above the board. Put all the full size ribs in place along with the top main spars and balsa leading edges. Add the $\frac{1}{4}$ " square balsa rear spars. When satisfied everything is in place and straight, glue the structure.

Motor mount construction is now begun by gluing the $1/8$ " balsa leading edge false rib to its plywood equivalent. Put these in place at the wing's center. The plywood outer face should be exactly at the center line as shown on the plans with the balsa part on the port (outboard) side. After insuring that the ply/balsa false rib is exactly on the center line (the engine thrust line is $0^\circ - 0^\circ$) glue it in place. Now measure the separation that the hardwood motor mount rails must have to accept your engine. This is done simply by placing the rails on the engine mounting flange and measuring the separation between them. These rails should be clamped in place against the plywood false rib temporarily and adjusted to the proper position as follows: the rails should go all the way to the back of the false ribs and stop flush there. The separation between the rails should be as measured before at both ends of the rails. The rails should also be centered vertically; that is the center line between the rails should coincide with the wing chord line. Finally, be sure that the rails do not angle up or down. This is best done by extending the rail lines aft to the trailing edge; they should be separated by the same distance as before and the center line between them should cross through the trailing edge. When satisfied the rails are in the proper place, mark the position by drawing lines on the false rib. The rails can now be glued in place. Glue the $\frac{1}{4}$ " balsa motor mount filler between the rails after trimming it to fit. Find the two halves of the plywood firewall. One of these must be cut out to accept the hardwood rails as shown in the plans. Now glue the firewall halves in place. ✓

Begin the sheeting process with the aircraft bottom trailing edge. Remember that since you are building the aircraft upside down, this is the top as you look at it. One of the $4" \times 3/32"$ sheets will need to be cut at an angle to meet the sheet from the other side. Glue well at the center line and don't

worry about the looks since it gets covered by the engine nacelle (fuselage). Don't install the aircraft top trailing edge sheeting yet as the elevons should be cut and marked first.

The leading edge sheeting is now installed top and bottom according to the following procedure: First, select a relatively soft sheet of 3/32" balsa. Glue the sheet to the spar along its entire length. The sheet should overlap the spar exactly. While the glue sets up, soak the outer side of the sheet with a very damp rag. This helps the balsa to curl and softens it to prevent splitting--especially important near the tips where the airfoil curvature is high. Trim the excess sheeting from beyond the tip rib and at the center where it meets the motor mount rails. Now curl the sheet and glue it to all the ribs and the leading edge. Finally, trim the excess sheeting at the leading edge and repeat for the other three leading edge sheets. If you find sheeting with 3/32" balsa tedious, just think how strong it will be!

The SHOWBIRD's elevons are constructed as part of the wing and cut away after sanding. You can save yourself some effort later by marking the elevons and precutting the ribs. Referring to the plans, mark the elevon cut lines 2½" forward of the trailing edge. Cut through the aircraft bottom trailing edge sheeting to mark the line at the inboard and outboard extremes of the elevons and at each rib. Do not cut the sheeting yet except for these marks. Now the ribs should be partially cut through--if you accidentally cut through the rib, simply tack glue it back in place. The aircraft top trailing edges should now be installed. Mark the same elevon cut line at the inboard and outboard extremes as you did for the bottom trailing edges. The aircraft top center section sheeting can be completed now. Remember we are building the aircraft upside down so it is the bottom as you look at it.

Before sheeting the aircraft bottom center section (top as you look at it) mark the location of the inboard ribs on the leading and trailing edges. This information along with the data on the plans will enable you to cut out the hatches after the sheeting is complete.

Complete the aircraft bottom sheeting now (top as you look down at it) and cut out the hatches as shown on the plans. Remember not to put any glue on the rear spar between the central ribs since that will make it hard to remove the aft hatch. Also, try not to damage this spar when cutting out the rear hatch.

The rear spars are reinforced now by connecting them with a piece of 3/32" balsa webbing made from scrap. Cut and glue the 3/32" X ½" cap

stripping in place.

Turn your attention now to the forward hatch area. The 1/8" ply bulkhead should be glued in place now; refer to the plans. This bulkhead serves to strengthen the center section significantly as well as taking launch and landing loads. Brace the forward hatch area on all sides using scrap 3/32" balsa so the hatch will have something to seat on. Use pieces of hardwood cut from the excess of the spars and sheet metal screws to retain the hatch as shown on the plans.

Cut out the finger holes in the aircraft bottom between the hatches as shown on the plans. Using 3/32" scrap balsa build a box for each finger hole just over one inch deep. These boxes will keep fuel out of the hatch area as well as strengthen the sheeting for handling and launching loads. Glue the two 1/16" plywood reinforcing parts in place to take thumb and finger pressures.

The rear hatch should now be completed just as the forward hatch with scrap balsa and hardwood. Since this hatch receives more frequent access, we retain it with two screws at the back instead of four, and hardwood forward as shown in the plans.

If you marked the elevons previously as suggested, these can now be cut out easily. Finish the elevons by installing sub-ribs in the ends using scrap balsa. Make a channel in each elevon to take the control torque tube using scrap hardwood as shown in the plans. Sand or cut each elevon as shown to provide freedom of movement; the elevons will be hinged at or near their top surfaces. Install the torque tubes (Rocket City "strip aileron horns with swivel" or equivalent) and complete the elevons using the 3/32" balsa parts provided to complete the elevon "boxes".

Sand the airframe in the vicinity of the elevon bays and insure that the elevons fit the bays. Add the 1/16" plywood elevon bay stiffeners. Install the wing tip blocks and carve them to the outline shown.

SYSTEMS

The Systems installation is rather simple on the SHOWBIRD; we recommend the layout shown in the plans. We have found the homemade mixer drawn on the plans to be precise and reliable. It is easy to construct using 1/8" hardwood dowel and scraps of nyrod sheath and hardwood.

Alternatively, an electronic mixer may be used. This simplifies things since each servo drives a single elevon directly and there is no mixer slop.

Frankly, we have not found any mechanical mixers (other than variations of our drawing) with enough precision and ease of movement for the job.

The aft location of the battery allows for the weight of a .40 size engine up front. This will provide awesome performance--don't be tempted to use a larger engine. Smaller engines are easily accommodated without adding ballast by relocating the battery forward.

The SHOWBIRD provides adequate room for a square 8 oz. (Pylon brand) fuel tank. Again, this is the "airshow" setup and assumes a Schnuerle .40; for smaller engines use a 4 - 6 oz. tank. Even if you are using a .40 the 8 oz. tank is a bit oversize--use a smaller one unless you really want to go 80 mph for 15 minutes!

We recommend the Tatone flat muffler. It will be all but invisible in the air and does not need to be protected by any sort of landing skid. If you use a muffler that hangs down, then a protective skid is required unless you will be landing in tall grass only. The skid will be bent to shape and retained using a landing gear block notched to accept the 1/8" wire.

NACELLE CONSTRUCTION

The nacelle is quick and easy to assemble since the sides have been pre-cut.

First be sure the aft hatch is in place and that the center lines have been drawn on the wing top and bottom. Now put the fore and aft side pieces in place (four parts in all). After checking that they are centered and separated evenly from fore to aft by $1\frac{1}{2}$ ", glue them in place. Add $\frac{1}{4}$ " triangle stock along the top and bottom of the sides--be sure it is flush with the top (bottom) to mate with the top (bottom) block. Add additional triangle pieces to brace the firewall to the sides. Now glue the top block in place.

Carve the front of the top block to continue the slant line of the nacelle sides. Glue the front top block in place.

If a muffler protector is required (see the systems section to decide), the slotted block should be installed just behind the firewall.

The aft lower nacelle block should be carved and sanded at the front where it stops in the center of the aft hatch. This is much easier to do before gluing the block. This is also a good time to fuel-proof the motor mount area.

Now glue the fore and aft lower nacelle blocks in place. Retain the plywood access cover at the back of the battery compartment with wood screws.

Check the fit of the spinner planned for the aircraft and the nacelle is ready for carving and sanding. Refer to the cross sections shown on the plans.

The vertical fin is constructed as a laminate of 3/32" X 3" balsa sheets. A packet of 5 sheets is provided, glue the fin halves together cross-grain as shown on the plans. The fin is then cut out as per the outline shown. Cut a 1/4" deep slot in the top of the nacelle to accept the fin.

If rudder control is required the rudder should be cut out and hinged at this time. This is purely optional; three channel control is fine for almost all maneuvers and "adds lightness". A torque tube control arrangement is shown on the plans similar to the elevon drive.

Don't forget to install the "dove tail" pieces at the aft end of the nacelle. Sand and cover all the parts. Glue the vertical fin in place and hinge the elevons.

SETUP AND FLYING

For the first flight, set up the control system so that neutral stick produces a slight "up" reflex in both elevons. Be sure that the controls are free and smooth. It is usually desirable to have a little more roll authority than pitch authority; if in doubt use lots of both and a forward C.G. location.

The SHOWBIRD should be balanced laterally on the crankshaft center line. As shown on the plans the aircraft will accept a wide C.G. range--this is a result of the large elevon areas. Use a slightly forward location and don't use more than 1/2 tank of fuel for the first flight.

Ready to go? Fire her up and do a final control check. Launch gently and with low power. Remember, this aircraft has very light wing loading and will nearly fly right out of your hand. On landing, throttle way back or shut the engine down altogether; be prepared for an extremely flat glide and low stall speed. If you have time, check the power off stall characteristics. You will want to adjust the pitch authority so that full aft stick just barely produces a stall.

Good Luck and Good Flying!

PACIFIC AIR

SHOWBIRD PARTS LIST

- 2 Hardwood motor mounts 3/8" X 1/2" x 7 5/8" ✓
- 2 Piece ply firewall 2 3/4" X 1 1/2" X 1/8" split 3/4" each side ✓
- Filler (Balsa 1/4" Sheet) 3 1/8" X 1 7/16" ✓
- 1 Motor Mount ✓
- 1 Set 3/32" full size balsa ribs ✓
- False Rib 1/8" ply ✓
- False Rib 3/32" balsa ✓
- 12 Sheets 3/32" X 4" balsa ✓
- 4 Hardwood 1/4" sq. spars ✓
- 2 1/4" sq. X 21" balsa rear spars ✓
- 2 36" X 1/4" Triangle for nacelle ✓
- 1 6" Piece 1/2" triangle balsa ✓
- 1 2" X 20 1/2" X 1/2" Balsa top nacelle ✓
- 1 6 5/8" X 2 5/16" X 1/8" Plywood center section bulkhead ✓
- 1 2" X 7" Balsa top front nacelle ✓
- 2 3" X 1/2" Balsa forward nacelle sides ✓
- 2 3" X 1/2" Balsa rear nacelle sides ✓
- 1 Bottom block 1/2" X 2" X 5 1/2" ✓
- 1 Forward bottom block 1/2" X 2" X 3 1/2" ✓
- 1 Rear bottom block 1/2" X 2" X 10" ✓
- 1 1/8" Plywood oval battery access cover ✓
- 1 5/8" X 5/16" X 2 3/4" Landing gear block for 1/8" wire ✓
- 1 1/4" X 5/8" X 32 1/2" block-up stock ✓
- 2 1/16" X 7/8" X 20 1/2" Plywood elevon bay stiffeners ✓
- 2 3/32" X 1" X 20 1/2" Balsa elevon sheeting parts ✓
- 1 Set vertical stabilizer parts ✓
- 2 36" X 1/2" Cap stripping ✓
- 2 1/8" Dove-tail pieces ?
- 1 Set of plans ✓
- 1 Set of instructions and parts list ✓
- 2 1" X 1" X 8 1/8" Wing tips ✓
- 2 1 1/8" X 1 1/2" X 1/16" Plywood finger hole reinforcers ✓