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Construction Manual for Yakovlev Yak-9D

Materials

This kit contains the following materials:

- This construction manual
- Plan sheet
- Decal sheet
- Laser-cut wood pack
- Plastic canopy
- Plastic cowl
- Plastic cowl scoop
- Plastic radiator scoop
- Plastic machinegun blister
- Plastic exhausts

To complete this kit, you will need the following additional materials:

- 3/32" Aluminum tubing, 3"
- 1/16" Music wire, 20"
- 1/16" x 4" x 15" Balsa sheet for wing and fuselage skin, 5 each
- 1/4" Balsa triangle stock, 12" long
- 1 each 1-1/2" Spinner (Goldberg or DuBro)
- Pink foam for fillets
- 1 each Wing mounting bolt
- Hinges (ailerons, elevator)
- Miscellaneous servo mounting materials and pushrods
- Glue, covering materials and paint
- 6-Volt Speed-400 power system

Construction

Wing Skins

- Each wing bottom skin consists of three laser-cut pieces: forward, center and aft. Gently clean up the mating edges of the pieces with 220 grit paper on a sanding block.
- Lay the pieces of a wing skin on a flat board or table, with the outer surface up. Run a length of masking tape along the join lines. Turn the assembled skin over, bend the joints open, and run a bead of aliphatic resin or wood glue down the joints.
- Lay the assembled skin back down on the board – masking tape side down. Run a damp paper towel over the joints to remove excess glue. Place a sheet of wax paper over the assembled skin. Then weight it down with another board, books or what have you. Keep the weight on the skin until it is completely dry.
- When the skin is dry, remove the masking tape. Lay a skin on a flat board with the outer surface up, and sand it smooth with 120 grit paper on a long sanding block. Be sure to keep your sanding motion at a 45 degree angle to the joints and wood grain. Clean the skin with a tack rag.
Note – it should not be necessary to sand the inner surfaces of the wing skin. Just be sure to remove any excess glue.
- Follow the same steps to assemble two wing top skins, using the supplied 1/16" x 4" x 15" balsa sheets.

- Lay a bottom skin on a top skin. Trace the shape of the bottom skin onto the top skin, adding a 1/4" margin at the trailing edge. Cut out the top skin.



Figure 1 – Top wing skin

Wing Panels

- Pin a lower wing skin to your building board. The lower skins are the ones with the rib and spar positions etched into them.
- Glue the ribs and main spar to the bottom sheet. Note that the spar is notched at the dihedral angle for root rib W1. To maintain an accurate Clark Y airfoil, moisten the leading edge of the sheeting and pack it up so that it follows the curve on the bottoms of the ribs.

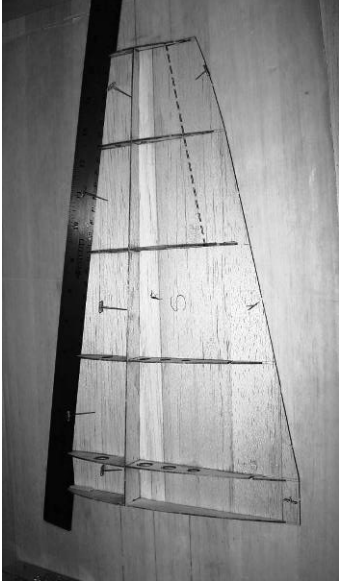


Figure 2 – Ribs and spar on wing panel

- Build the leading edge strip by slicing a short section (about 1-1/4") off the strip, following the angle shown on the plans. Reverse the short section and glue it in place on the back of the leading edge strip.
- Glue the leading edge strip in place against the front of the wing skin. Note that the leading edge strip sits on your building board, not on the wing skin. Cut and fit a short section of leading edge strip for the center of the wing.
- Glue the aileron spar to the bottom sheet and ribs.
- Glue the aileron leading edge to the bottom sheet, about 1/32" aft of the aileron spar. DO NOT glue the aileron leading edge to the aileron spar.
- Glue the stub ribs to the rear of the aileron leading edge and the bottom sheet.
- Cut three aileron crank bearings from 3/32" aluminum tube. Make them about 1/2" long.
- Make an aileron crank from 1/16" music wire and the three bearings.

- Trim a slot in the aileron leading edge for the aileron crank. Glue the aileron crank in place, with glue on the bearings where they pass through ribs W2, W3 and W4.

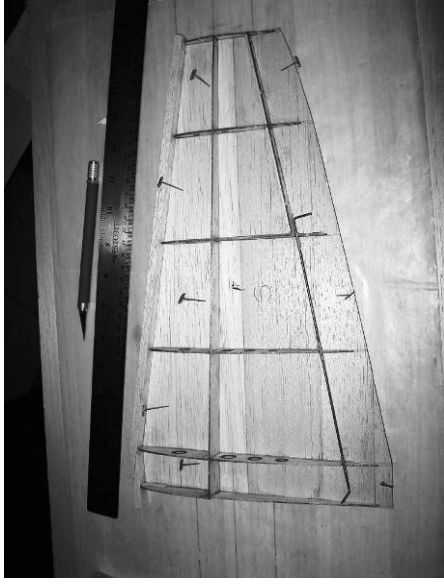


Figure 3 – Wing panel assembly

- Use scrap balsa to make a bearing block for the aileron crank. DO NOT glue the music wire crank to the bottom skin or to the bearing block.
- Glue scrap 1/16" or 1/8" balsa reinforcements to the outside rear portion of rib W1. Using a sharp #11 blade, cut a slot in root rib W1 for the wing bolt, but don't cut the reinforcements. The center of the slot should be about 1/2" forward of the trailing edge. Notch the bottom skin so that you can find the bolt hole later.
- Using a long sanding block and fine grit sandpaper, sand the assembled wing panel to prepare it for the top skin. Sand the airfoil angle into the trailing edge, so that the trailing edge is about 1/32" thick.

- Put the washout jig in place under the wing trailing edge. The thick end of the jig goes at the wingtip. Pin the wing down.

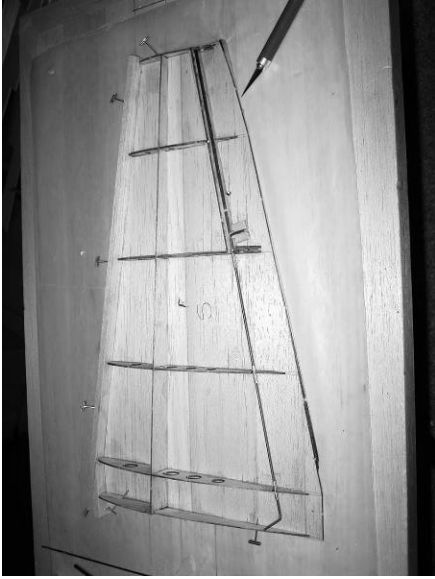


Figure 4 – Wing panel pinned to washout jig

- Cut a hole in the top skin for the aileron crank.
- Apply a thin bead of Pro-Bond or aliphatic resin to the tops of the ribs and spars and along the top of the leading and trailing edges. Lay the top skin in place and pin it firmly to the ribs and spars. Let the wing assembly dry.
- Laminate two WT pieces to make a wing tip block. Glue the wing tip block to the wing.
- Notch the leading edge for the 1/8" dowel.
- Sand the wing panel to its final shape.
- Repeat these steps with the opposite wing panel.

Wing Panel Joint

- Use a long sanding block to prepare the root rib faces for joining.
- Join the panels using 15-minute epoxy between the root ribs. Use masking tape to hold the bottom skins flush. With one wing tip flat on the building surface, elevate the other wing tip to the required total dihedral.
- Reinforce the root rib joint by wrapping it with nylon or glass cloth. Saturate the wrap with CA.
- Use a 1/8" drill bit to clear the wing bolt hole and the dowel hole in the leading edge.
- Use a sharp #11 blade to cut the ailerons free from the wings. Use a sanding block to finish the aileron leading edges and the aileron slots in the wing.
- Cover the wing as desired. We suggest using either 1/2-ounce fiberglass cloth and finishing resin, or Doculam.
- Hinge the ailerons.
- Install the 1/8" dowel in the leading edge. The dowel should project about 1/4" forward of the wing.

Fuselage

BE SURE TO MAKE A LEFT SIDE AND A RIGHT SIDE!

- Glue the wing saddle doublers to the fuselage sides.

- Glue the 1/4" triangle strips along the bottom rear of the fuselage. Trim the triangle strips so that the fuselage sides can be pulled together at the rear.

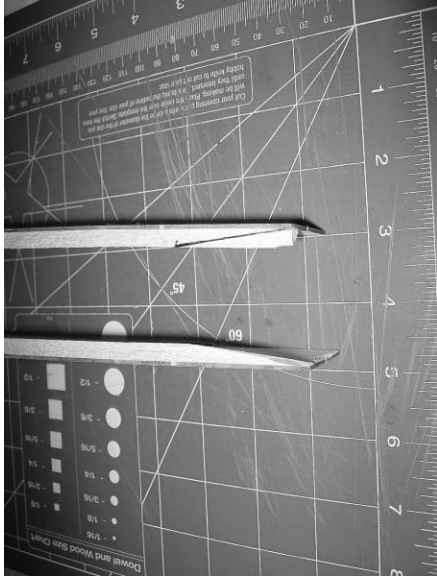


Figure 5 – Trim triangle strips at fuselage rear

- Glue two sets of 1/16" reinforcements FR2 through FR6 to formers F2 through F6.
- Glue formers F2, F3 and F4 to one fuselage side. The forward side of the former should be on the line etched on the fuselage side. Make sure that the formers are at 90-degree angles to the fuselage side.

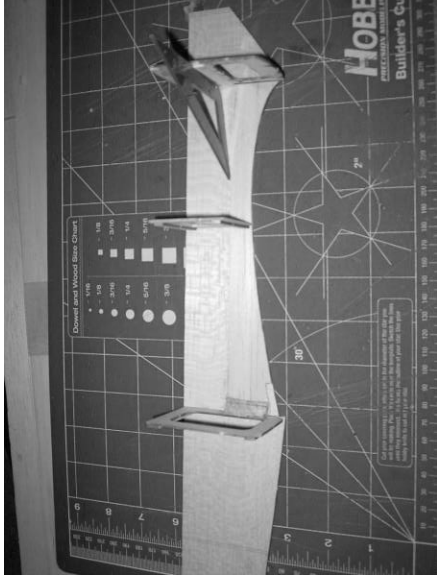


Figure 6 – Glue formers to one side of fuselage

- Glue the other fuselage side to formers F2, F3 and F4, making sure that everything is square.
- Laminate the two 1/16" ply wing mounting blocks WM together. Glue them into the slots in the wing saddle doublers, making sure that they are flush with the wing saddle.

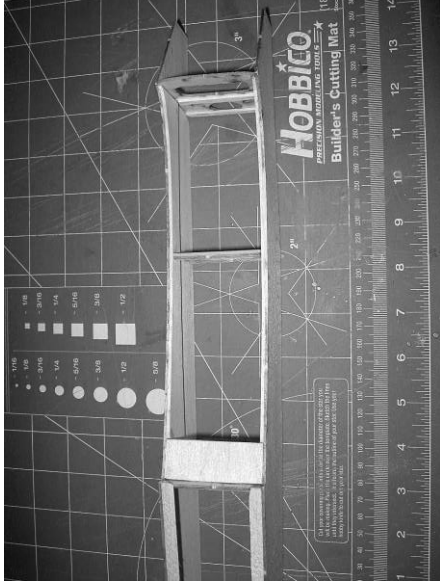


Figure 7 - Wing saddle

- Use scrap 1/4" balsa triangle to reinforce the joint between F4 and the fuselage sides.

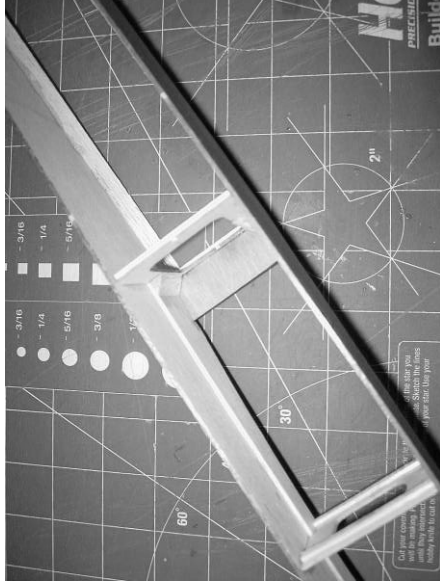


Figure 8 - Add second fuselage side

- Score the fuselage sides at the rear of F4 and gently crack them so that the ends of the fuselage can be brought together.
- Glue the fuselage sides together at the rear of the fuselage. Make sure that the fuselage is straight and true.

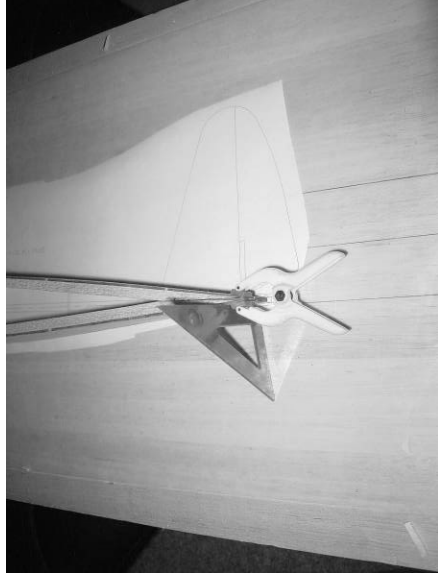


Figure 9 - Join fuselage sides at rear

- Use a sanding block to deck sand the edges of the fuselage. All formers, triangle strips and fuselage sides should be flush.
- Glue formers F5 and F6 in place. Note that the cutout in the edge of F6 goes on the left side of the fuselage.
- Glue a 1/8" x 1/4" balsa strip between the tops of F4A and F6.
- Glue a 1/8" x 1/4" balsa strip between the tops of F1 and F3A.

- Align the firewall F1 with the fuselage sides and glue it. Note that the two etched lines on F1 mark the upper position of the fuselage sides.

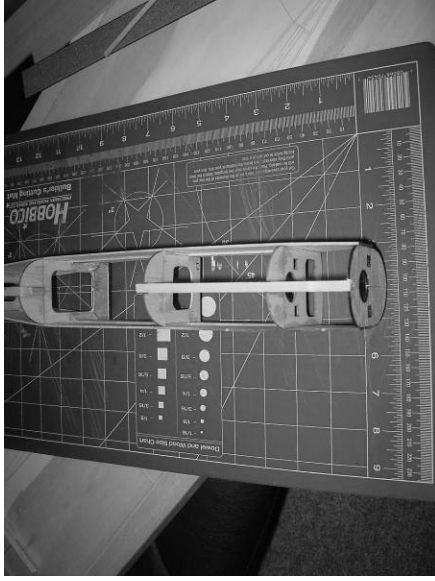


Figure 10 – Add fuselage stringers and firewall

- Glue formers F2A, F3A and F4A in place.

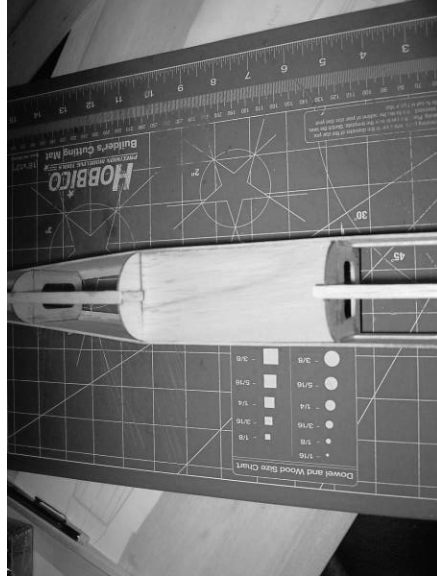


Figure 11 – Add rear stringer and cockpit floor

- Add a cockpit floor from scrap balsa if desired. Sheet or plank the top of the fuselage between F1 and F4A with 1/16" balsa.

Note: Dampen the balsa with a weak ammonia and water solution and mold it around the fuselage formers. When it's dry, trim it to size and glue it in place.

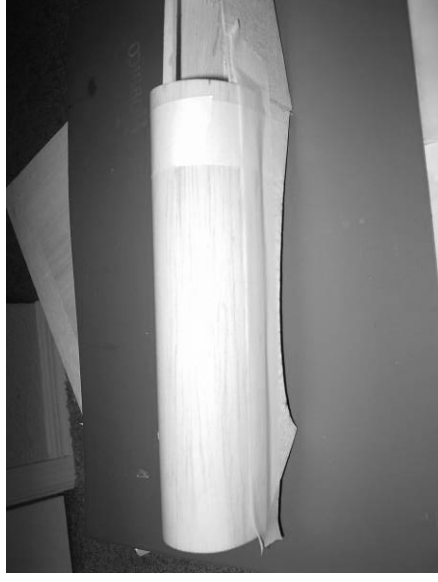


Figure 12 – Mold balsa skin for front fuselage

- Sheet or plank the top of the fuselage between F4A and F6 with 1/16" balsa.

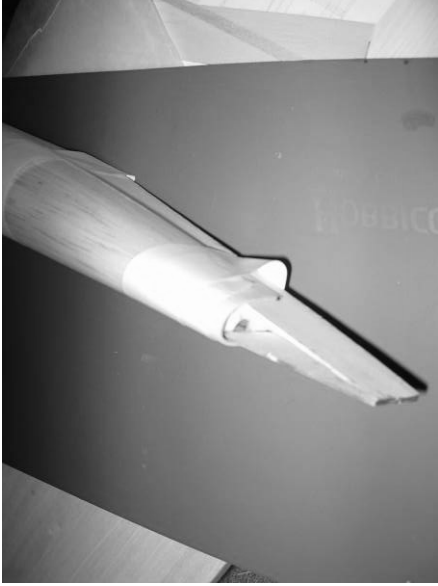


Figure 13 – Mold balsa skin for rear fuselage

- Cut the cockpit opening from the top sheet. You can trace the pattern from the plans.
- Hold former F2B against F2, and mark the wing dowel hole on F2. Drill the wing dowel hole in F2.
- Glue F2B to the front of F2. Do not get any glue on the dowel!
- Check the wing alignment. Then drill through the wing and wing hold-down plate with the appropriate size drill. Tap the wing hold down plate for the wing mounting bolt.
- If you're using a flexible pushrod for elevator control, install it now.
- Sheet the bottom rear of the fuselage with 1/16 balsa with the grain across the fuselage.

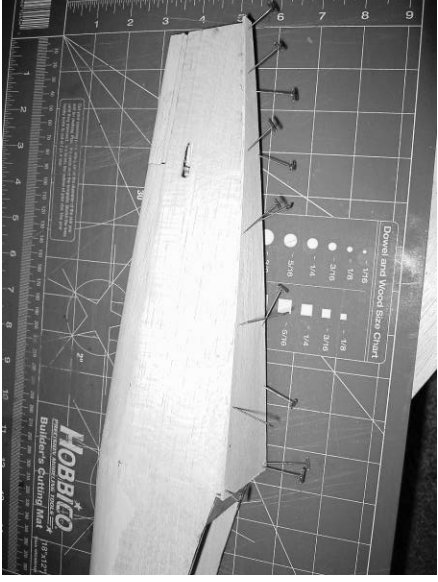


Figure 14 – Sheet bottom rear fuselage

- Sand the bottom corners of the rear fuselage to a uniform 1/4" radius.
- Sheet or plank the lower front fuselage between F1 and F2 with 1/16" balsa.

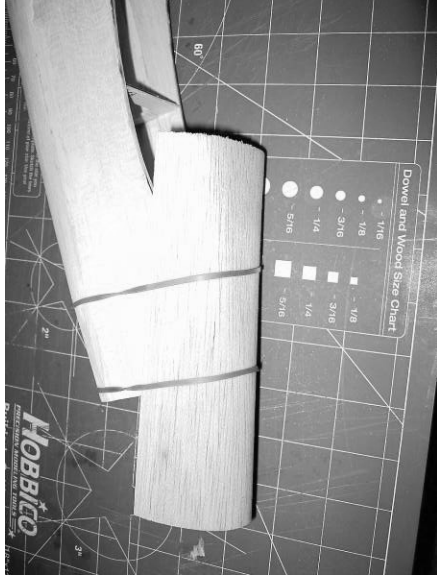


Figure 15 – Sheet bottom front fuselage

- Make a "T" from scrap balsa to simulate the fin and horizontal stabilizer. Tack-glue the "T" in place at the rear of the fuselage.

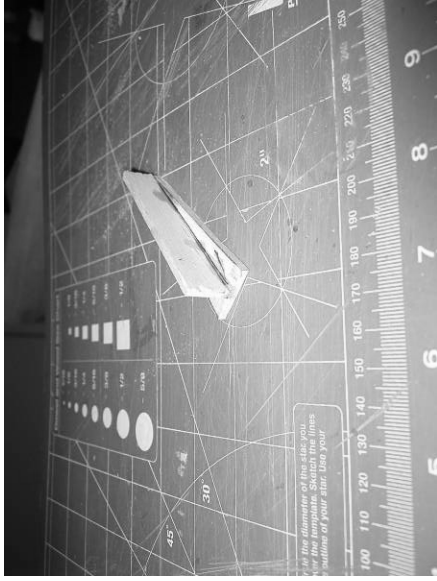


Figure 16 – Scrap balsa "T"

- Tack-glue the tail blocks TB on either side of the "T". Shape the tail blocks to the fuselage contour.
- Remove the tail blocks and "T". Discard the "T". Hollow the tail blocks.
- Glue the horizontal stabilizer to the fuselage. Make sure that it's aligned with the fuselage and wings. Cover the top of the fuselage between the elevators with a scrap of balsa.
- Assemble the fin and rudder. Insert the assembly into the slots in the horizontal stabilizer and glue.
- Glue the tail blocks in place.
- Fill in the small space between F6 and the fin with scrap balsa.
- Build the wing fillets from scrap 1/16" balsa and pink foam.

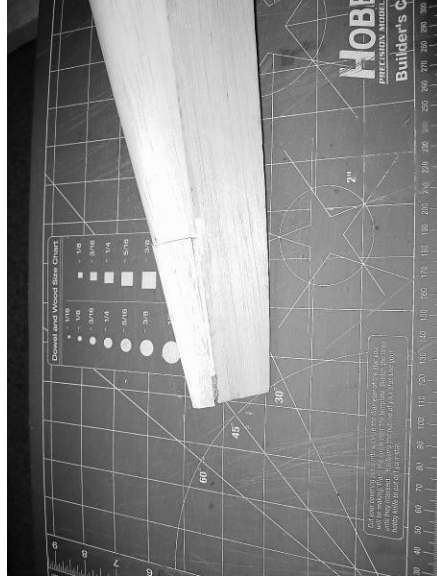


Figure 17 – Shape tail blocks

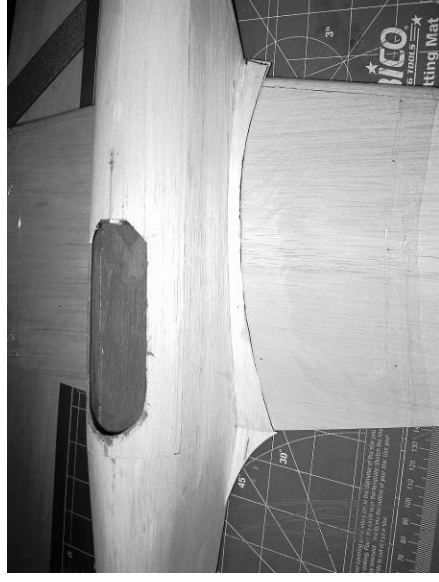


Figure 18 – Wing fillet base



Figure 19 – Foam blocks added to fillet base

- Trim about 1/8" from the bottom of the vacuum-formed plastic cowl.



Figure 20 – Mark cowl for trimming

- Cut two 1/4" square hardwood motor mount sticks 4-1/2" long. Bevel the forward outer edges of the sticks

about 1/16". Push the motor mount sticks through F1 and F2 but don't glue them in place.

- Put the cowl in place on the fuselage. Make sure it's straight and square to the fuselage.
- Push the motor sticks forward until they just touch the cowl. Remove the cowl and tack-glue the motor mount sticks in place.

Use a rubber band to hold the motor to the motor mount sticks. Fit the cowl in place and install the spinner. Adjust the motor and cowl until the fit is perfect. Then drill 3/64" holes through the cowl into the ends of the motor mount sticks. Attach the cowl to the motor mount sticks with small screws.

- Glue scraps of 1/16" balsa to the bottoms of the motor mount sticks. Then glue the 1/16" motor mount base MM to the 1/16" scrap. Trim MM so that the cowl fits correctly.



Figure 21 – Motor mount completed

Note – you can glue strips of scrap plastic inside the cowl to reinforce it.

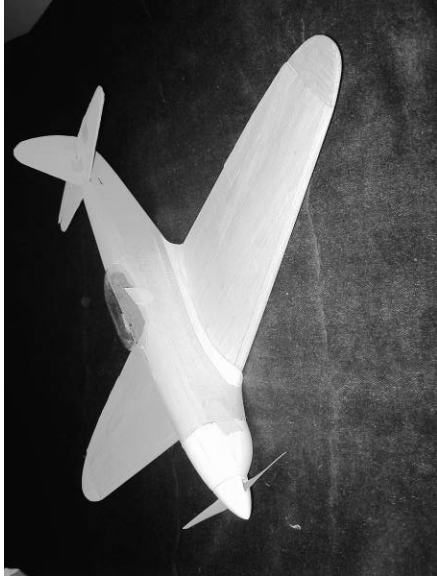


Figure 22 – Trial assembly of model

Scale Details

- Cut and trim the plastic radiator. Glue the laser-cut 1/16 balsa base (SB) into the radiator. We recommend using magnets to attach the radiator to your model.
- Cut and trim the plastic machine gun blister, and attach it to the fuselage in line with the gun trough. NOTE: The Yak-9D had only a single fuselage-mounted machine gun.
- Cut and trim the plastic cowl scoop, and attach it to the cowling.
- Cut and trim the plastic exhausts, and glue them to the cowl.

Finishing Your Yak

- We suggest covering the entire model (except the plastic bits) with 1/2-ounce glass cloth and finishing resin for maximum strength. For a lighter weight finish, 'glass' only the bottom of the fuselage and cover the remainder with a lightweight film such as Doculam.
- Apply a light coat of primer – just enough to fill the weave of the glass – and sand most of it off.
- Paint and decorate the model as desired – see the Paint and Markings Guide on our Website for more information.
- Finally, seal the entire model with a light coat of Krylon clear.

Decals

CAUTION: You must seal the decals before immersing them in water!

The decals included in this kit are printed with Epson DuraBrite™ inks on premium inkjet water-slide decal paper available. Follow the steps below to achieve a great looking set of markings on your model.

- Seal the decals with several thin coats of Krylon Crystal Clear™ spray varnish. Make sure you thoroughly cover the ink; this will prevent smears and stains during everyday handling.
- Make sure the surface where the decal is to be applied is smooth and glossy. Matte surfaces will permit tiny air bubbles to be trapped between the surface and the decal, thus spoiling the decal.

- Cut out and trim all the markings that you plan to apply in this session.
 - Dip the decal in a bowl of water for about 30 to 40 seconds. Using your fingers, gently try to slide the decal off the backing paper. As soon as the decal slides, slide it off the backing paper and onto the model in the desired position. Use a soft absorbent cloth to gently blot excess water from the decal. Allow the decal to dry.
- TIP** – You can practice with bits of decal cut from the copyright notice.
- Spray a coat of Krylon Crystal Clear varnish over the decal.

Flying Setup

- Keep the model as light as possible for best performance.
- The Yak should balance at 2-1/4" behind the leading edge at the center chord. This is approximately 24% of the mean aerodynamic chord (MAC). For the first few flights, you may want to move the balance point forward 1/4".
- Set the control throws to:
 - Elevator: 1/2" up – 1/2" down
 - Ailerons: 3/8" up – 1/4" down

HELP!

If you have questions or need help with assembly of the kit, drop an email to tom@warbirdkits.com.