Curtiss XP-40Q Construction Manual

Thank you for purchasing this kit-we hope you will enjoy building and flying the last of the Curtiss P-40 series of fighter planes.

Start construction by assembling the laminated keel elements of the fuselage. These are made with very firm 1/32 balsa strips and 3/32 square balsa. No soaking is required to form. Use white or cellulose glue for laminating. I use pins set about an inch apart at the outside curve of the keel on the draw sheet to control the position of the strips as laminated over the plan. Make sure the thickness of the side keels will fit into the former notches prior to assembly-lightly sand the thickness until a snug fit is obtained into the former notches after the glued laminates are dry.

Tips on fuselage formers: Add 1/32 x 3/32 strips at the top and bottom ends where the grain is vertical, laminated across the grain of the former. Do this before removing the parts from the part sheets. Use cellulose glue and then slice off after former installation or remove using acetone to dissolve the glue. Or you can just leave them if you want-the weight penalty is not much. This helps minimize the nuisance cracking of the former that is so typical of this style of construction. On former F-5 through F-7, add a strip of scrap balsa vertically near the attach point to the keels, top and bottom. The reason for this is to keep the formers from flexing during assembly and affecting the wing joint locations. I also add some scrap balsa bridging between the upper and lower keels near these same frame locations to render the wing carry through section fairly rigid during the assembly process. All of this is removed after the formers are installed and most stringers in place.

Continue assembly by adding all the stub spars on formers F-5 through F-7. Pin each former half over the drawing and use 1/16 x 1/8 firm/hard balsa for the stub spar material. Bond the upper and lower stubs to each frame, left and right. Remove from the plan and check the fit of W-1C to the end of the former, making sure there is a good fit with the rib notches and the rib seats against each former.

With all the fuselage keels in position, start former installation at F-5. Block the former square to the building surface on station and prefit top and bottom to the keel. Check the part for location using one edge of the notch for the side keel as a reference, projected to the plan using a small square or other accurate block. Use the same edge feature for all the former locations and you will get a pretty accurate result when adding all the stringers, etc. Adjust notching at the top and bottom of the former for fit to the keels and bond in place when you feel the position is as accurate as you can get it.

Use wing rib W-1C as a gauge to set formers F-5 through F-7 to ensure a match to the wing spars when the wing panels are installed. Dry install the rib W-1C and use scrap 1/16 balsa to wedge the gap at the stub spar locations to maintain the proper location of W-1C to F-5. Set the remainder of the wing carry through formers utilizing W-1C and their respective stub spars to set the station position at the wing interface, and the station for attachment to the top and bottom keel. Check the side keel slot for location as noted above and bond. Leave W-1C in place until the 1/16 square stringers are installed to stabilize these formers. Install the rest of the fuselage formers on station and per the side keel notch. Don't forget to install the F-10A subframe. Install the WF-1 between F-8 and F-9. F-4 installs after the side keel is in place-don't forget to include it!

Install the side keel. Install F-12 & 15 between F-10 and F-11 in their respective notches. Assemble the filler blocks F-13 & 14. Position over plan against the top of F-12 and trace the edge of F-12 onto the bottom of the filler. Cut off the excess material on the side to match F-12 as installed. Now carve out the underside of the filler as much as you dare-remember you still need to blend the remaining outside material to the fuselage contour and fin. Glue the filler assembly in place against F-10 and the top of F-12.

Install all the main 1/16 square stringers-use very firm to hard balsa for these. On F-11 you will need to remove material below the side keel to allow the termination of all the stringers as shown. Don't bother installing the stringers under the wing until after the wings are installed as these tend to break easily during handling for that step.

Remove the fuselage half shell assembly and install the opposite side formers, keel and stringers. Square up using F-5 as the most accurate frame location. I make a scrap 3/16 filler assembly that fits between the stub spars on the former to project the flatness of F-5 to the opposite side. Pin this on, then assemble the opposite side former to it. Again, use the W-1C rib as a gauge to set formers F-5 through F-7. The rest of the framework is installed as done on the opposite side. The use of some sort of jig is strongly suggested to support the half shell upside down while you build up the right side of the fuselage.

Once the fuselage assembly is stable, remove from your jig and finish installation of any stringers (except under the wing as noted earlier). Install soft 1/8 balsa sheet planking between stringers in the nose area. Where the exhaust system will protrude, radius the ends of the planking to provide a pocket for the exhaust system subassembly. Leave this subassembly out until after covering-seal and paint the exhaust system before gluing into the pocket left in the fuselage. Add the motor peg fillers, the filler in front of the horizontal stabilizer leading edge. Install the filler at the front of F-5 at the wing leading edge, using dry installed W-1C to determine the outboard location. This filler is made from soft ¼ balsa scrap-consider hollowing to remove excess weight prior to installation. Prior to installing F-1A, sand the right thrust angle into the front of F-1. Add the fillers for the heat exchanger exhaust duct on the lower fuselage near F-4 if you want to add this as a three dimensional feature. Simple black markings on the covering tissue can also be used to represent the exhaust duct opening on the finished model if you want to save some weight and complexity.

Assemble the noseblock discs NB-1 & 2 using a 1/8 diameter wire to index together. Build up the noseblock plug assembly using NB-1 & NB-4 (ply). Use 1/8 wire to align the nose block assembly elements and bond together, then turn lightly in a drill press or drill motor using a wire mandrel or machine screw (#8) and nuts to resist slipping. Check for a close slip fit with the hole in F-1A. With the wire mandrel installed in the noseblock disc assembly, glue the plug assembly to the noseblock disc assembly using the center hole for alignment. Turn this assembly in the drill press to lightly taper the noseblock discs to blend into the spinner contour-use S-1 to determine the diameter at the forward end of the noseblock disc assembly. Remove the turning mandrel and fit the complete noseblock assembly into the front of F-1A to provide guidance when shaping the nose contours of the fuselage. Make sure you have the key installed to allow the noseblock location to repeat.

Wings are straightforward construction. There are 1/16 square doublers on the inboard sections of some of the spars-make sure you bond these together before installing. Use very firm to hard balsa for the spar segments. Note that the LE-1 segments have integrated standoff tabs that are to be removed after the wing is bonded together and prior to shaping. These tabs are against the

building board to hold LE-1 to the proper height for all rib ends. Shape the wing by blending the leading edges and tapering the trailing edge, etc. before installing to the fuselage.

Wing installation works best as follows: assemble one wing panel to the fuselage by best fitting to the lower edge of formers F-5 through F-7 relative to the wing attach point. This sets the incidence angle of the wing which is designed into the fuselage assembly. When satisfied with all joint contact at the stub spars and ends of formers, bond with thin CA. Make sure you get decent bonding between the stub and wing spars as this is the primary load path for the wing stresses. The installation of the second wing is critical to be at the same incidence angle as the one just installed. A way to do this accurately is with a simple jig that takes about 10 minutes to make:

Cut a strip of corrugated cardboard about 2 1/2" wide very evenly, no tapers. The flutes of the corrugation should be running the 2 1/2" dimension, not lengthwise. You need a strip 20 1/2 inches long. On the drawing top view of the fuselage, form a box in trapezoidal form that matches the locations of W-1C on the drawing. You are creating a saddle that the fuselage will nest in and allow contact with the bottom of W-1C on the wing installed, and the bottom of the formers F-5 through F-8 on the opposite side for the wing yet to be installed. Where the cardboard bridges the fuselage, cut a relief to clear the fuselage structure completely-nothing touches but the W-1C rib stations. Pin blocking to the building board to maintain the location of the cardboard jig on top of the plan. Place the fuselage with wing attached onto the jig and align with the W-1C locations. Measure the installed wing tip dimension from the building board surface and provide blocking for the opposite wing to allow rig to the same dihedral angle. Position the remaining wing panel to the jig and block up the tip, check joint fit, etc. Confirm that the bottom of both wings W-1C is sitting on top of the jig edges, and then bond the remaining wing to the fuselage and stub spars. Remove and install the ventral area stringers, other fillers etc. to complete the fuselage.

Now the fun part-those pretty wing fillets. You can do these any way you like, including using 1/16 square stringers in the fillet area and covering with tissue, ala the Earl Stahl Spitfire Mk III design. Whatever method used, try not to add anything heavier than what is shown on the drawing. The 1/32 balsa sheet method is light, adds stiffness and can be sanded and repaired easily. You just cannot make one piece of balsa conform to that shape, so use the flat patterns provided and install it in segments using scarf joints. It's very easy to do, and is a standard full scale practice on a shape like this. Once sanded, you will be pleased with how even it looks. Also, save the flat patterns for installing the tissue covering over these, as the tissue has the same forming problem the wood does! One tip-use soft balsa sheet and block sand to about .025 inches thick before cutting out the fillet pieces. Mostly it can be installed dry, but if coaxing is needed, wet it and work into place. Grain direction is important on thin material, so cut per flat pattern orientations shown. Also, the flat patterns are slightly oversize to allow some fine tuning of each segment as you prefit for installation.

Stabilizer and fin construction are very straightforward. When covering the stabilizer, add two extra layers of tissue top and bottom where the incidence shims are used. Just local patches are enough-this keeps the shims from breaking through the tissue during the flight trim phases.

Finish sand the fuselage assembly and wing fillets, etc to shape. On the tail, the filler area gets sanded to contour to match the fin attach point. There are two options to consider relative to flight trimming. Option one is to bond the fin at the tailpost and leave the rest of the fin joint dry to allow some discrete positioning of the whole fin to help obtain the glide circle. Use a pin

through the base of the fin L.E. to allow pinning into the filler to make these adjustments during the initial flying sessions. Once the fin rig is set, apply some glue spots to secure the fin and finish sanding the profile of the filler to blend to the fin as rigged, and then cover the joint area with tissue to clean up and strengthen the installation. This means leaving the footprint of the filler at the fin joint a little bigger to allow positioning of the fin if you want to have a smooth transition after. It's more work, but does allow some excellent adjustment capability. The other option is to install the fin prior to covering the fuselage and blend the filler to match. There is a rudder tab of balsa provided within the fin structure that can be deflected to help with the flight trim process so it's up to you for what you are comfortable with.

Cover the model and seal with your favorite method. Install the formed plastic heat exchanger and the landing gear fairings, etc. Install on the covered model using dots of cellulose cement or Formula 500 glue. Once set, finish with strips of dampened tissue that laps onto the wing surface to cover the joint between the wing covering and the fairings for a neat finish. Also, steam some washout into the wings, about 1/8" at each tip after finishing.

Install the horizontal stab through the fuselage slot (check this fit before covering the stab). The wedge incidence shims work well (use soft wood for easier trim at the end of the process), but glue on half of each set already trimmed the width of the fuselage to the top and bottom of the covered stab to match the notch location in the fuselage slot for shim capture. The stab fits into the notch at the forward end of the fuselage slot, and the trailing edge moves up and down for incidence adjustments. Use small dots of glue to hold the stab into the notch. On the shim halves left to install, make them long enough to grasp for adjustment during flight tests. Once flight trim is set, bond the shims in place using cellulose glue dots to secure, and trim off the excess flush to the fuselage sides with a sharp new razor. Now cover the gaps above, below and aft of the stab with tissue fillets to complete the fuselage covering and secure the stab from further movement. No need to bond the stab into position as the tissue fillets will hold nicely.

Propeller and spinner assembly

The plastic spinner along with a Czech plastic P-30 prop offer optimum performance for this model. Two versions are noted on the drawing-one using a spring loaded clutch method to allow motor braking and the other the standard prop shaft utilizing the stock prop freewheel drive feature. For the uninitiated, the clutch version with motor braking allows a much longer motor and management of the flying center of gravity by maintaining a slight tension in the motor strands and keeping the mass approximately in the same location on each flight.

For the clutch version

Alter the prop hub carefully by opening up the prop shaft hole using a series of drills until you can fit and bond the 5/32 O.D. aluminum tube into the hub, using thin CA. Add the 7/32 O.D. aluminum tube spacer using thin CA to bond to the 5/32 tube at the forward end. File the forward ends flush and deburr, etc. Make the 3/16 O.D. drive tube and bond this to the 7/32 tube using thin CA adhesive. This completes the prop hub modification.

Alter the aft edges of the prop to fit against the spinner disc assembly. Start the trim at the root of the blade as molded, removing material as you progress outboard.

Assemble the two spinner backplate discs S-1 & 2 using a piece of 1/8 O.D. aluminum tube as a pin to center. Alternate the grain to be at 90 degrees for improved strength. Note that the forward disc is smaller, creating a step that the spinner edge fits into. Drill a 1/8 diameter hole through a piece of scrap wood that is 90 degrees to the surface of the wood. Push the 1/8 O.D. aluminum tube into this hole, leaving enough protrusion to assemble the disc assembly and plywood reinforcement disc NB-5 to it, and CA bond together with the aluminum tube end flush to the surface of NB-5, then remove from the jig carefully by pushing back on the tube through the drilled hole.

Prior to cutting the prop blade relief slots in the spinner cone, prefit to the disc assembly to it and make any minor adjustment needed to get an even seating of the cone into the step along the edge.

Cut the prop relief slots in the spinner per the markings on it. These markings are set for the Czech P-30 prop. Assemble the prop onto the disc assembly with the prop shaft wire and a 3/32 O.D. aluminum bearing tube. Continue prefitting the spinner to the prop-use small files or a small emery sanding board to increase the depth of the slot as needed to allow the spinner to seat against the stepped area as done earlier. Paint the spinner cone and set aside until ready to be installed.

Assemble the noseblock with the spinner disc per the drawing. The compression spring used in the clutch should be no bigger than 3/32 diameter to prevent dragging on the sides of the drive tube during the freewheel mode. The spring should also provide light pressure to disengage the drive tube. I have used a small compression spring salvaged from a CD drive in a car stereo-these are typically shock mounted with a variety of springs-there are several that are nominally 5/8" long and tapered to 1/16 diameter at either end. If something like this is not available, look for a light duty ball point pen spring. Too much force in the spring will tend to disengage the clutch too soon, so be prepared to experiment with spring force a bit to get it just right. Don't forget the Teflon washer at the bottom under the spring-the prop assembly must free-wheel with no drag otherwise you have a speed brake during the glide phase.

The aluminum bushing at the front end of the spring is there to prevent the spring from following the bent prop shaft end out of the drive tube under compression. You can substitute a small brass grommet for this-typically the one found in R/C servo mounting grommets, provided the head clears the drive tube inside diameter. Press a short length of 3/32 O.D. aluminum tube into the grommet to improve centering on the prop shaft. Make sure the spring and bushing do not rub on the sides of the drive tube during free wheel mode. The prop assembly should turn easily in the air if you walk with it. If it doesn't, work on the fit of components until it does.

Bench run the prop assembly to adjust the stop screw. The motor should run down to almost no power before the spring pushes the wire tang free from the drive tube and the hook hits the stop screw. Too much spring force will leave a lot of power still in the

motor when the shaft is stopped not to mention a loss of clutch traction before the motor runs down. Fine tuning will come with everything installed in the model.

For the standard hub version

Alter the blade edges as shown to fit the spinner backplate. For the aft spinner backplate, remove the core at the center of S-1 to provide the larger diameter which is sized to fit the major diameter of the Peck thrust bearing (part number PA019). Now fit the forward disc to the aft using the 1/8 diameter thrust bearing shaft to align. Check for uniform step around the edge, and bond together with grain at 90 degrees for strength. Remove the thrust bearing and trim the 1/8 diameter shaft to be flush to the front of the forward disc. Bond the thrust bearing into the disc assembly for stability. Prefit the spinner as described earlier and set aside for installation later. Assemble the noseblock with prop shaft per drawing.

It is strongly suggested to conduct all initial flights without the spinner cone installed, as this will be quickly destroyed in the inevitable crashes during trimming sessions. Once the glide and power phases are perfected, install the spinner cone using Formula 500 glue or cellulose cement by bonding to the stepped area the aft edge of the spinner cone fits into.

Flight trimming tips:

Glide test first- remove the noseblock completely or don't install the prop until after the trimming session. Add temporary nose ballast and test glide and adjust airplane CG location and incidence until the glide is as flat as you can get it. Also be looking for a very desirable shallow right, left turn or straight ahead glide pattern. Any sharp turn to left or right must be corrected with washout adjustments and/or rudder tab adjustments. Once the glide performance is set determine the actual CG location and make a small mark on the airplane for reference. Now add the noseblock and prop, motor, etc. and return to the CG marks for checking balance. Add nose or tail ballast as needed to re-establish the balance point found during the glide trim session.

Now start some low power trim flights. Using 3-4 in/oz torque or hand winds, launch into any wind and observe for pitch up or down and turn direction. Adjust the thrust line using the three screws to cant the noseblock and counter bad characteristics. A climbing turn to the left is most likely and if this is stable then go with it. If possible, adjust for a climbing right turn to resist torque, but if this is not stable don't force it. In truth, low wing models are hard to flight trim, and any stable flight pattern should be considered acceptable, hopefully with some shallow turn to left or right as the power runs down to stay in lifting air. Once a reliable climb under full power is achieved you can go back and fill any gap between the back of the noseblock and front of F-1A with the laser cut thrust adjustment filler to improve the looks of the model. Just cement to the front of F-1A with the notch feature at the bottom; that side matches the contour of the scoop edge in F-1A. Then blend to the contour of the existing nose of the airplane, followed by block sanding the front until contact is made with the three screw heads. Seal with dope, etc and cover with tissue, colored dope to match the existing finish.

I have flown this model with up to 15 in/oz of torque, but it seems most reliable around 10-12 in/oz. Seek the longest motor run you can get without high torque and you will be rewarded with a long circular cruise under power and more loiter time for lifting air. Knowing the model trim under given power is key to success in contests-don't violate your standard, and always set trim to maximum power conditions the model is capable of handling.