CURTISS P-40 WAR HAWK/KITTYHAWK

P-40s SAW ACTION IN MORE COUNTRIES AND THEATERS OF ACTION THAN ANY OTHER FIGHTER

BY JERRY L. BATES

The Curtiss P-40 was born in 1939, the offspring of a design begun four years earlier, in 1935, and went on to serve in more roles and for more Allied countries than any other fighter ever produced. Even before the United States entered World War II, the P-40 was already being used against the aggressor by the American Volunteer Group in China known as the Flying Tigers. The P-40 was used in all theaters of operation, and served throughout the course of the war.

This model is 1/5.5 scale, with a wingspan of 82 inches and a wing area of 1105 square inches. The design is based on the Super Tigre S-2000 Series engines, but .90 glow two-cycle through two-cu.-in. gasoline engines may be used. Dave Platt "competition plus" retracts with 90-degree rotating modification were used. Custom-designed 5-1/4-inch-diameter scale wheels and tires are being offered for this plan set by Williams Bros., Inc.

While not a first-timer's scratch-building project, the model has been designed so that a modeler with one or two beginners' projects behind him will have no trouble completing it.

Construction of the model will be easier and less time-consuming if you make up a basic "kit" in advance.

First, cut out the wing ribs, dihedral braces, stabilizer and rudder parts, etc.

Next, review the construction manual to familiarize yourself with the basic steps of assembly.

If you choose to power your model with a Super Tigre S-2000 Series engine or equivalent, you can build entirely with standard weight balsa. For a 15-pound model with a .90-size two-stroke for power, use four- to six-pound balsa throughout, except for spars and stringers. Substitute lite-ply for aircraft ply except for the dihedral braces. This lightweight version should be attempted only by an experienced builder capable of determining where to save weight without sacrificing strength. A 35-40 cc gasoline-powered version can be built by cutting all fuselage formers from lite-ply and using spruce for all the stringers, crutch, keel, backbone, and wing spars.

A complete step-by-step construction manual is included with the plans. All building is done over the plans in the conventional manner.

Construction begins with the left wing panel.

After sheeting the top of the left wing panel, remove it from the plans. Align the left panel with the right panel at rib #1, and prop up the tip so that there is 9 1/2 inches between the work surface and rib 13 at the lower 5/16 sq. spar. Build the right wing panel onto the left. Remove the wing from the building board, and turn it over. Install the hardwood retract mounts. The bottom of the wing can now be sheeted. Add the tips, ailerons, flaps and servos.

The tail feathers are next. The horizontal and vertical stabilizers are divided through their centers; the first half being built and sheeted over the plans, then removed; and the second half built onto the first half. The rudder and elevators are built around a center sheet. After adding the leading edges, the ribs (3/32-inch strips) are glued to each side and sanded to shape.

The fuselage is constructed in two halves (top and bottom) around a crutch. Pin the crutch to the plans and add the top half of the formers. Install the stringers and sheet the fuselage while still pinned to the plans. Before removing from the plans, add the horizontal and vertical stabilizers. Remove assembly, add the remaining formers and stringers to the bottom of the fuselage, then sheet.

After joining the wing and fuselage, the major construction is finished. Completion from this point depends on your skill level, and just what you want your model to represent (i.e., stand-off scale, sport scale, masters, etc.).

Some of your work in this area can be eased, as several fiberglass and resin cast parts are being offered for this design. A fiberglass cowl as well as the carburetor airscoop, belly pan, main gear strut covers, wing fairings and static display spinner are available. Resin cast exhaust stacks, early (round), and late, (flared) and scale propeller blades are available, along with clear plastic wind screen and canopy. A scale 5 1/2-inch-diameter fiberglass flight spinner is also available, and comes complete with aluminum backing plate and prop adaptor nut with mounting screw.

Available vacuum-formed parts include the machine gun magazine bulges under the wings, as well as the windscreen and canopy.

Before application of its final details, the prototype was given a protective coat of olive drab and gray. The model was fitted with an ST-2500 with O.S. 108 carburetor for in-flight needle valve adjustment, a 15x10 prop, and a 24-ounce fuel tank. Dry weight was 18 pounds.

We made a decision to fly her now, so we could see if any changes would be required to the plans, and Greg Grigsby, a fine young pattern flyer from Fort Walton Beach, Florida was recruited as test pilot.

Flight testing was done at OLF Holley, a U.S. Navy field used to train pilots out of Pensacola NAS.

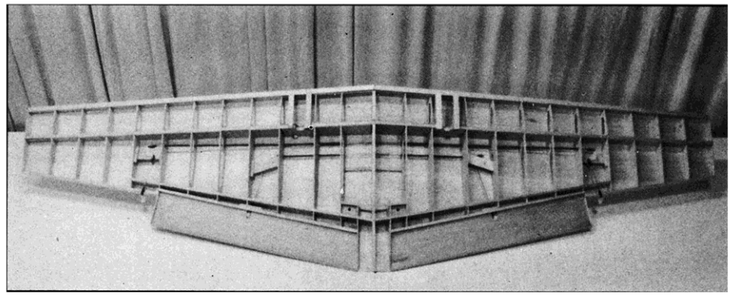
All systems were checked, and double checked.

One warning note: Do not attempt to fly this plane until it will balance with the main gear retracted, and the fuel tank empty!

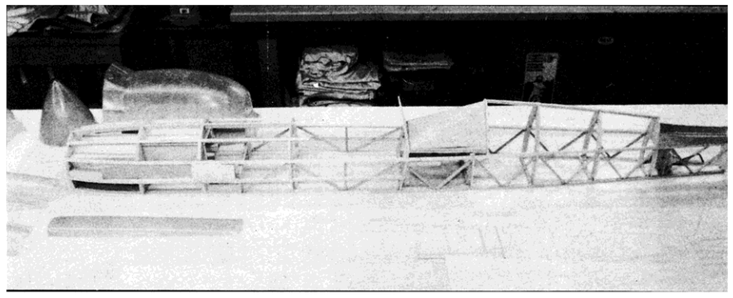
Things looked pretty sad at the start when, even after four attempted takeoffs and four aborts, we just couldn't get her off the ground. She just wouldn't track on roll-out, and the crosswind didn't help either.

After surveying the situation, the rudder throw was increased, and 1 1/2 degrees of toe-in was added to each main wheel. That did it — off she went, straight as an arrow! After a couple of laps around the patch to get the feel, the gear was retracted. You'd think she would be quite a handful when those big wheels turn into the wind, particularly since the airlines are restricted so the gear retracts out of sync, but surprise, surprise — it was no big deal.

The first flight consisted of the basic maneuvers, fly-bys and touch-and-goes. Application of 20 degrees of flaps results in slight nose-down pitch and good speed reduction. With the generous dihedral and washout she practically lands herself, and is rock steady, right down to a three-point touchdown. Be certain to ease in the elevator on turns until you get used to its response rate (another effect of lots of dihedral). Ailerons are effective at all speeds. She'll even *snap roll* — (it ain't scale, but it sure is fun).



The wing is built in one piece, then, after all the goodies are installed and checked, the wing is sheeted.



The fuselage is built using the time-tested crutch method. The fuselage is sheeted while both halves are still attached to the building board.

The second flight was for more of the same, and some high-speed work. Top level flight speed of 95 mph actual, or 522 mph scale. At a more scale speed of 358 mph, she will perform all prototypical maneuvers.

The third flight was used to see what she could do or, to put it differently, to see if we could tear the wings off. We couldn't. We all took turns at the sticks, and when we got through flying, we were unanimous in our proclamation that "this P-40 is one fine flying airplane."

Thanks, Greg, for ensuring an excellent debut.

Originally, this was to be a three-month project; it's now been *more* than two-and-a-half years! There were many times when I wanted to quit, and would have, were it not for two great friends. Thanks to Jack Dorman of J.D.'s Scale Models, Fort Walton Beach, Florida for his technical expertise, and to William Moore of Mobile, Alabama for his historical research.

SOME HELPFUL HINTS ON SCRATCHBUILDING YOUR CURTISS P-40

Cut out the wing ribs, dihedral braces, stabilizer and rudder parts, etc., noting that the formers are shown with cross-grain reinforcing. This is necessary only if you use four- to six-pound-weight balsa. The lightening holes shown are for this weight balsa also.

If you choose to power your model with the Super Tigre S-2000 Series engine or equivalent, you can build entirely with standard-weight balsa. Enlarge the lightening holes by connecting the circles within each rib bay to form ovals instead of the individual circles shown.

If you wish to build a 15-pound-weight-range model, use four- to six-pound balsa throughout (except for the spars and stringers) and substitute lite-ply for aircraft ply where indicated (except for the dihedral braces, former F-2, and part WF-1).

For power, you can use a .90-size two-stroke. This version should be attempted only by an experienced builder, capable of determining where to save weight without sacrificing strength.

A gasoline-engine-powered version can be built by cutting all balsa formers from lite-ply and using spruce for the stringers, crutch, keel, backbone and wing spars.

For more information on scratch-building, I suggest the following books: *There Are No Secrets* and *Master Modeling* by Harry B. Higley & Sons, Inc., P.O. Box 532, Glenwood, Il 60425.

Three adhesives are used in the basic construction of this model: Cyanoacrylate (Cya) is used for the majority of construction; aliphatic resin (white glue) is used to attach sheeting to the structure. In the interest of brevity, these instructions will use the word "glue" in lieu of the term "cyanoacrylate." White glue and epoxy will be called for where needed.

Pin the rib jig in place over plan. Place a 1/4-inch x 1/8-inch strip of balsa between the lower 5/16-inch square spar, and pin in place over plan. Space wing ribs #4 through #13 along the spar at their locations, and pin in place. Put the top 5/16-inch-square spar in place, along with the top and bottom 1/4-inch-square spars.

Make sure the ribs are square with the building board, and aligned with the plan. Make sure all spars are in place, and flush with the ribs. Check the alignment of the ribs along the leading edge.

Now glue the ribs to the spars. Glue ribs #2 and #3 to DB-2, and epoxy DB-2 to face of 5/16-inch-square spars. Glue the 1/4-inch x 1-inch aileron spar and the 1/8-inch x 1/2-inch flap spar in place.

Mark wing center lines on each side of DB-1 and DB-2. Cut halfway through the front face of DB-1, along the wing center line, so DB-1 will conform to the leading edge sweep-back. Epoxy DB-1 and DB-2 in place. Align rib #1 with center lines of DB-1 and DB-2, and glue in place. Add rib #1A, and make up the wing hold-

down platform, and epoxy in place. Install the 5/16-inch-square and 1/4-inch-square sub spars. Glue the 1/16-inch spar shear webs in place. Glue the 1/16-inch flap T.E. sheeting in place, and bevel as shown.

The flap and aileron control system can now be installed.

Build the bellcrank platforms, and install along with the bellcranks. Make up the pushrods to the bellcranks, and route them to the control surfaces and servo compartment, respectively, leaving enough extra length for hook-up at the servos and control horns.

Epoxy the 1/8-inch plywood retract mount braces in place. Trim and sand the top edge of the 1/4-inch sheet aileron spar to conform to the rib profiles. Lightly block-sand the ribs to make sure they are all aligned.

The top of the wing panel can now be covered. Make certain that the wing panel is securely pinned to the work surface. Edge-glue the 3/32-inch sheeting to make a single sheet large enough to cover the panel in one application. Trim the leading edge of the sheet, and bevel to match the wing leading edge. Place a bead of white glue on top of all ribs and spars which will be in contact with the sheeting. Place the sheeting over the wing panel, and raise the sheeting trailing edge until the leading edge of the sheeting meets the juncture of the ribs and wing leading edge. Hold the sheeting firmly in contact with the wing leading edge, and wick thin cyanoacrylate along this seam. (This is easier to do if you have some extra hands.) In any case, if you practice this procedure on scrap material before you apply the white glue to the ribs, the results on the airplane will be more satisfactory.

Press the sheeting down to make contact with the ribs and spars, and pin in place. Work along the length of the wing from the leading edge to the trailing edge. Use a lot of pins, locating them at 1/2-inch centers along ribs and spars. (A mixture of 50 percent water and 50 percent ammonia, lightly sprayed on the exterior face of the sheeting, will help it conform to the rib contour.)

Allow the wing panel to sit overnight to ensure that the glue is dry. The wing panel can now be removed from the building surface. Trim along the trailing edge, aileron cutout, and flush with ribs #1 and #13.

Pin the rib jig and 1/4-inch x 1/8-inch spacer over the plans, making sure the spacer extends 1/4 inch beyond rib #1. Place the left wing panel over the plans, so that rib #1 matches, and the panel is resting on the rib jig and spacer. Prop up the left wing panel, so that there is 9 1/2 inches between the work surface and rib #13 at the lower 5/16-inch-square spar.

Take time to ensure proper alignment, and secure left wing panel in position. Glue left wing panel rib #1 to right wing panel #1, then proceed with construction for left wing panel.

After you have sheeted the right wing panel and it has dried, the wing can be removed from the working surface. Trim and sand the lower 1/4-inch sheet aileron spars and the 1/8-inch flap spars to conform to the rib profiles. Lightly block-sand the ribs to make sure they are in alignment.

Build the ailerons and flaps and hinge them to the wing.

Notice: *Do not* glue them in place yet; this should be done only *after* you cover the wing.

Cut out the top wing sheeting in the servo area, then install the servo mounts and servos. Use 1/8-inch balsa to box this area in with the wing sheeting. This is done to replace the strength which was lost at the wing center section when the wing sheeting in this area was remodeled.

Make the pushrod connections to the servos and the control horns. Epoxy the 1/2-inch-square hardwood retract mounts in place. Trial-fit the retracts, and route the air lines to the wing center and through the sheeting for make-up to the air-support equipment. Make certain that the retracts will slide fore and aft when seated on the retract mounts. Remove retracts.

The bottom of the wing can now be covered. Sheet up to the edges of the 1/2-inch-square retract mounts. Mark the wheel well openings, and cut out. Remove portions of ribs #3 and #4 in the area of the wheel wells. Use 1/16-inch ply (with grain vertical) to line the wheel wells.

The scale gear strut covers, doors and leading edge mechanism covers can be constructed of foam and covered with fiberglass. Build this as a unit, then remove from wing. Remove foam and cut the doors free. Add formers A through F to lower wing center section, and plank with 3/32-inch x 1/4-inch balsa. Notice that the forward section is carved from block balsa and hollowed out. Add the wing tips.

Completion of the wing from this point depends on your method of finishing. I choose to finish-sand the wing, then cover it with 3/4-ounce fiberglass cloth and K&B clear epoxy paint. With the surface thus prepared, the scale details are added.

The horizontal and vertical stabilizers are built as noted on the plans. The rudder and elevators are built around a 3/32-inch center sheet (1/16-inch may be substituted to reduce weight). After adding the leading edges, the ribs (3/32-inch x 3/8-inch strips for elevator, and 3/32-inch x 1/2-inch strips for rudder) can be added. Hinge the elevators and rudder in place, and sand the ribs to shape with a sanding block.

The fuselage is constructed in two halves (top and bottom) around a crutch. Pin the crutch to the plans, and add the formers. Note that the crutch must be pulled in equally on each side, to mate with formers F-7 through F-11. Make sure that everything is square and in alignment. Install the long 1/4 sheet cowl rib from F-1 to F-5.

Epoxy the 1/2-inch x 3/4-inch hardwood motor mounts in place. Add the exhaust stack floors (ESF), and engine box parts EB-1, EB-2 and EB-3. Add the 3/8-inch x 1-3/8-inch x 2-3/8-inch balsa filler blocks to the rear of exhaust stack floors, and sand to match shape of F-3.

Epoxy the battery box parts BB-1 and BB-2 in place. Add the six cowl formers between F-1 and F-3. Add the 1/4-inch-square stringers from F-3 to F-11 (which run along the sides of the cockpit) and the 1/4-inch-square backbone. Install the horizontal stabilizer doublers (WS-2).

If you choose to incorporate a retractable tail wheel, now is the time to install the required bulkhead and fittings, as well as the control system for the tailfeathers.

If you use flexible control rods, as shown, be sure to secure them with adequate braces at each former. Install the remaining stringers.

Carefully remove the fuselage framework from the plans, and taper-sand the crutch to blend with the lower formers. Pin the fuselage back in place over the plans through the edges of the crutch. The framework can now be sheeted.

Begin by sheeting each side of the framework from the center of the crutch to the top, working evenly from side to side so the last piece of sheeting is at the fuselage top. The upper portion of the fuselage, behind the canopy, must be strip-planked to match the contours of the formers.

Carefully cut the sheeting away behind F-10 to match the horizontal stabilizer doublers (WS-2). Fit the horizontal stab, adjusting as required for two degrees of positive incidence, and to make it square with the fuselage. It should be an equal distance from each tip to the plans, and from the same point on each tip to the top center of F-1. Epoxy stab in place at this location. Epoxy the vertical stab in place, making sure it is square to the fuselage — an equal distance from top of rudder post to each horizontal stab tip, and in line

with the fuselage centerline.

Cut out the sheeting for the canopy, and install the instrument panel blank.

Carefully measure the area of the rear vision panels in the side of the fuselage behind the cockpit. Trim away small portions of the sheeting until the edges of the former cutouts are exposed. Trace the rear view panels on the fuselage to align with these points, and remove the sheeting in this area. Line the interior of the rear vision panels with 1/16 balsa. This assembly can now be removed from the plans.

Epoxy the fuel tank parts (TB-1, TB-2, TB-3 and TB-4) in place. Install formers F-3a through F-11a. Add the 1/4-inch-square keel and stringers. Epoxy FB-1 parts and F-3a doublers in place. Install the wing saddles (WS-1). Epoxy WF-1 to F-6a and WS-1. The lower portion of the fuselage may now be sheeted.

Carefully cut away the sheeting to match the wing saddles. Fit the wing to the fuselage, and square up. Block up the fuselage so that the crutch line is level, and the horizontal stabilizer tips are at an equal distance above the work surface. Trim the wing saddle, as required, to produce 1 1/2 degrees of positive incidence. Temporarily fasten the wing to the fuselage in this position, and then remove model from the working surface. Mark the position of the wing dowels in the wing through the holes in F-3a.

Remove the wing, and install the 1/4-inch hardwood dowels in the leading edge. Reinstall the wing to the fuselage. Align and drill 3/16-inch-diameter holes through the holes in the 1/8-inch plywood hold-down plates in the wing, into the 1/4-inch-thick WF-1. Tap the holes in WF-1 for 1/4-20 thread, and secure the wing with nylon bolts.

Install the 3/32-inch-sheet closure between F-3a and F-4a.

Carve the balsa block, and glue to the sheet closure and F-4a. Carve and glue in place the balsa block for the bottom of the fuselage behind former F. Carve and install the air inlet scoop.

Install the engine, fuel system and throttle servos.

Complete the installation of the control systems, air/retract systems, etc.

Cut out the exhaust stack ports, and fit the windshield frame, windshield, canopy rails, etc.

The fuselage may now be glassed.

This completes the basic construction of the model. You may choose to build the assemblies in a different order, or change the order in which the assemblies themselves are built, but in any case, let your experience and knowledge be your guide.

Shown here are Jerry Bates and some of his many friends who assisted him in building and flying the aircraft. Jerry is particularly grateful to Jack Dorman for all the help he provided throughout the project.

I won't try to tell you how to detail your model, since this is best determined by each modeler, based on his own desires and the intended use of the model. Use of the scale reference materials mentioned on the plans will help the modeler in detailing this plane to any degree he desires.

Finishing is another area where no two modelers do exactly the same thing. For those of you who have not selected a favorite method, the Harry Higley books mentioned in "Getting Started" (in an earlier paragraph of this article) will allow you to compare several systems, and make your own choice.

If you elect to cover your model with fiberglass cloth, give Dan Parsons a call at (505) 296-2353. Dan offers the highest-quality fiberglass cloth and best epoxy system I have ever used, and once you've used it, I'm sure you'll agree.

Good luck with your P-40. ●