Nothing *flies* quite like one

J-3 CUB

by Pat Tritle

IF THERE IS one aircraft that has come to represent all of the early lightplanes, it has to be the Piper Cub. Designed in 1937, the J-3 Cub was essentially an upgrade of the J-2, and it underwent a number of changes and improvements throughout the years.

Early J-3s were equipped with wood wing spars and the single ignition Continental A-40 engine, which was later upgraded to the Continental A-50 and Lycoming 0-145. Ultimately, the Cubs were equipped with Continental A-65s, 65-horsepower Lycomings, and a few 65-horsepower Franklins.

Later models were upgraded to 75 horsepower, but the most common Cubs, including the L-4 Grasshoppers, were powered by the 65-horsepower Continental. And the wood spars were replaced by extruded aluminum in later models.

There is irony in the Taylor/Piper story. While C.G. Taylor was hospitalized with appendicitis, William Piper put Walt Jamouneau to work on the J-2 upgrade. Upon C.G.'s return, Taylor and Piper had a falling out over the J-3 redesign and Taylor left the company to start his own venture, thinking that the new J-3 Cub would be a flop.

In all, 14,125 Cubs—civilian J-3s and military L-4s—were built during the design's 10-year production period, from 1937-1947. Today the Cub is as popular as ever, with nearly 4,000 J-3s and L-4s still flying.

During its 72-year life span, the J-3 has been used to train

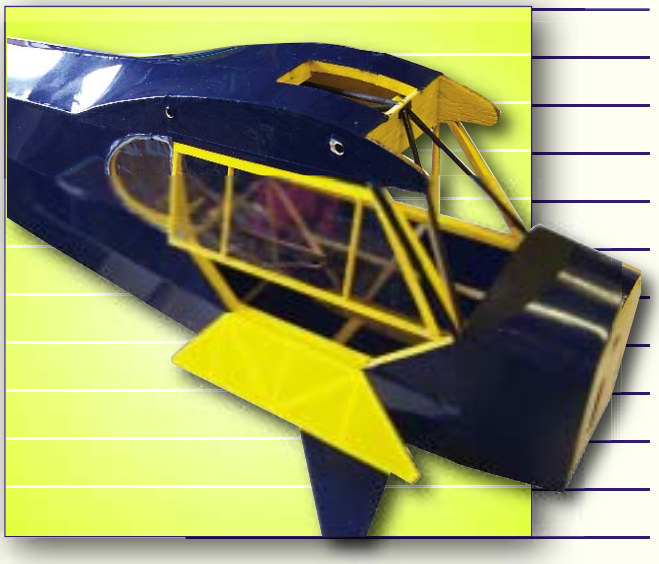
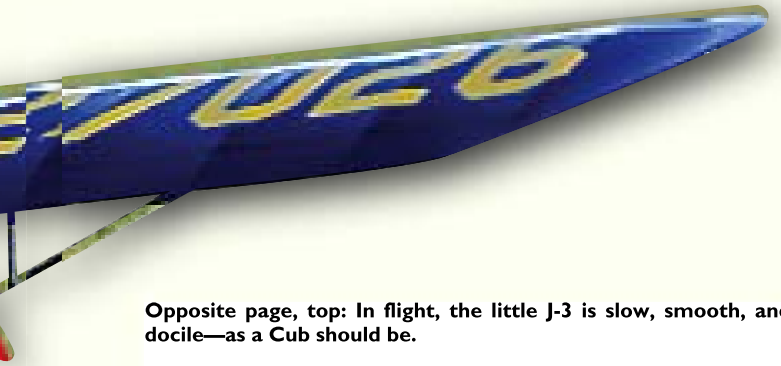


Photo by the author



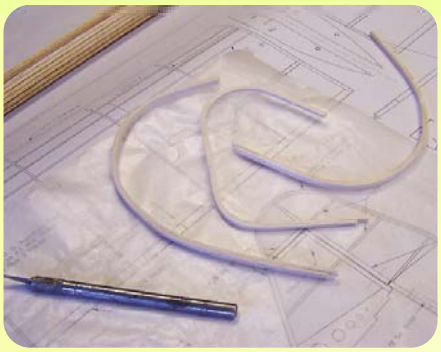
Opposite page, top: In flight, the little J-3 is slow, smooth, and docile—as a Cub should be.

Opposite page, bottom: Pat originally designed the model for three-channel RC. A special request from *MA* convinced him to incorporate a wing option that includes aileron control.

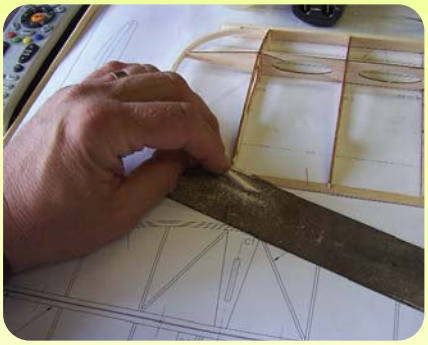
Above right: The cabin door can be hinged to the fuselage with colored vinyl tape, hinge tape, or covering material. When left open, it provides excellent electronics cooling.

Below right: The vacuum-formed plastic cowl is assembled and mounted. Painting and detailing is done during final assembly. The dummy engine is a *must*.

J-3 CUB

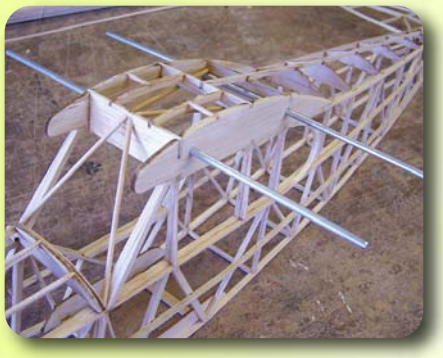


Wingtip and tail-section outlines are bowed from balsa over a form made from 3/16-inch artist's foam board, using the provided patterns.

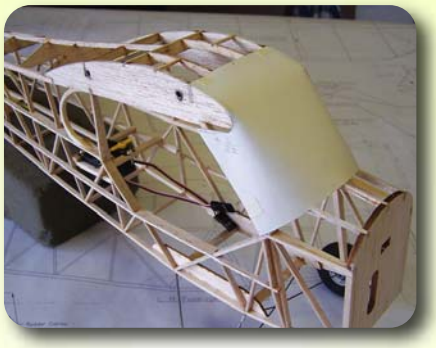


The wingtip bow is glued in place at the LE and main spar, and then an angle is sanded into the TE to conform to the TE.

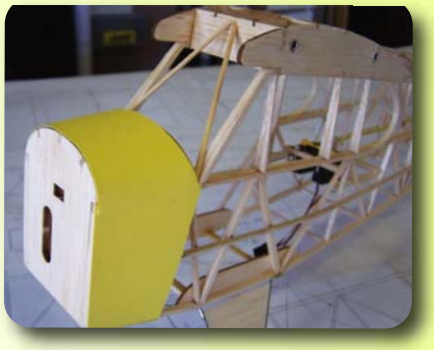
The 1/16-inch-OD aluminum-strut retention tubes are lashed to the wing panels with Kevlar thread and secured with a drop of thin CA.



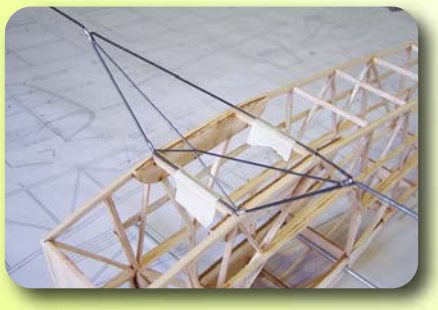
The 1/8-inch-diameter aluminum wing dowels are fitted into the fuselage, and then the 1/16-inch dowel cabane bracing is added.



A paper windshield pattern is fitted to the fuselage and trimmed to fit. The windshield will be glued in place after the model is covered.

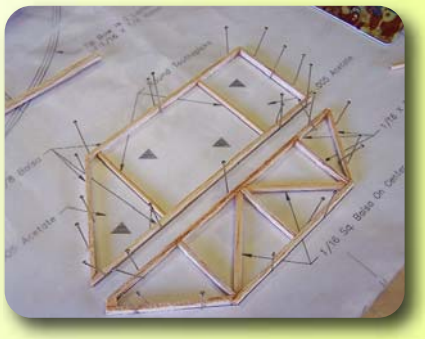


A boot cowl is made from file-folder paper and adhered with white glue. The paper takes covering almost as well as wood does and simulates aluminum skin.



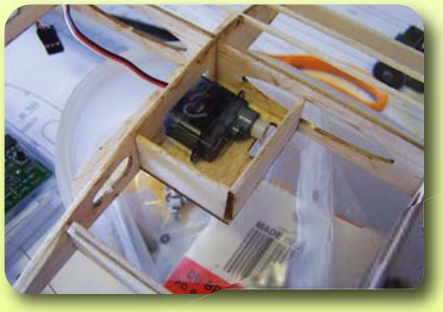
Front gear assembly is soldered off-frame. The rear strut is adjusted for a good fit and soldered to the finished front strut while taped in place on the fuselage frame.

Jury struts are fitted into the wing and bound to struts with Kevlar thread, and then they are secured with thin CA.



Above: The side cabin door is built over plans sanded to final shape, and then it is fitted into the fuselage frame.

Far left: The aileron wing is built directly over plans, as was the three-channel wing. The aileron hinge spar is reinforced with balsa, to prevent it from pulling in as the covering is shrunk.



Near left: Aileron servos are glued in place using silicone adhesive. To reduce adverse yaw, the aileron is larger than scale to make it more effective with less throw.

The Cub handles nicely with aileron wings and slideslips beautifully.

countless military *and* civilian pilots. It has also provided many hours of enjoyment flying low and slow, watching the scenery slip by slowly.

It has been said that "the Cub is a great airplane as long as you don't have anywhere to go." Having spent many hours in the "family Cub" as a kid, I say it's a great airplane whether you have a place to go or not.

The Model: If there is one aircraft that has been "overmodeled," it has to be the Piper Cub. This is because it's a terrific and recognizable design that flies well. I've built or flown several models of J-3s and Super Cubs, ranging in wingspan from 12 feet to 36 inches and weighing between 36 pounds and 5 1/2 ounces, and I've loved them all.

A few years ago I discovered that for park flying, 40-inch-span lightplanes were the perfect size and weight for GWS IPS power and flew beautifully as three-channel models, but they were also well suited for four channels. And a collection of scale models is incomplete without the venerable old J-3.

I designed the 40-inch Cub to be configured as either a three- or four-channel model by simply building the wing of choice. And since the wings plug into the fuselage, the design can be constructed both ways merely by fabricating a second set of wings.

Construction is primarily of balsa. The stick-and-tissue building style makes for a nice scale appearance and provides a strong yet lightweight airframe that is flown with economical power to provide scalelike flying qualities.

The design features a functional cabin door, for easy battery access. To help keep the airframe light and sturdy, the wingtip and tail-section outlines and cabin D windows are bowed from laminated balsa.

CONSTRUCTION

Begin by bowing the laminated outlines. Make the bowing patterns from 3/16-inch-thick artist's foam board using the templates provided.

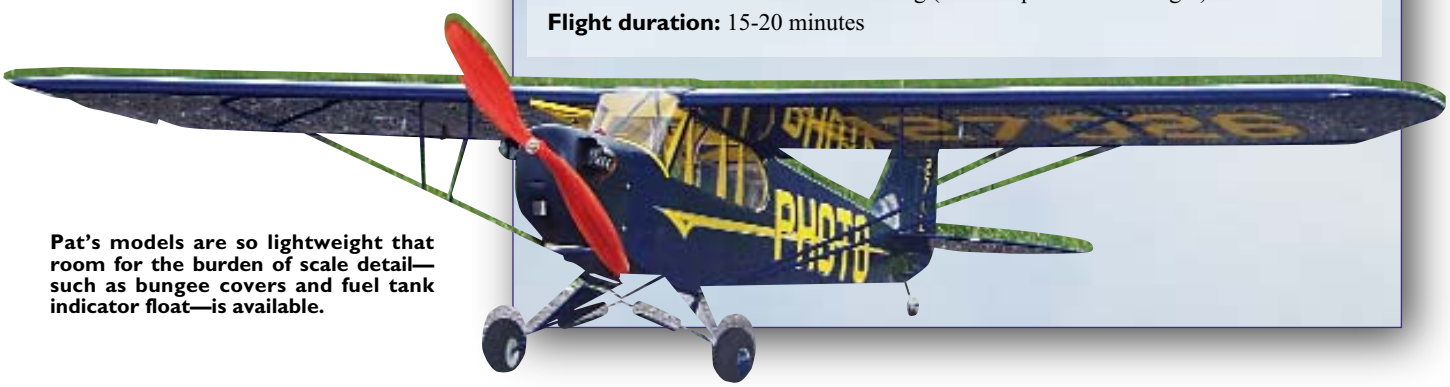
Soak some medium-firm wood in water for an hour or so, to soften it. With the balsa pulled around the form and glued, you can put the wood in the microwave for 12-14 seconds to accelerate the drying process.

The "Sources" list at the end of the article contains a Web site address for a detailed how-to on bowing outlines.

Tail Sections: With bows made, cut all the parts using the patterns provided to make print wood or obtain a laser-cut parts pack from Pat's Custom Models.

J-3 CUB

Type: RC Scale park flyer
Skill level: Intermediate builder, novice pilot
Wingspan: 40 inches
Wing area: 230 square inches
Length: 25.5 inches
Weight: 7.2-8.0 ounces
Wing loading: 4.5-5.0 ounces/square foot
Power: Maxx Products International EPU-4 motor, GWS 8 x 6 propeller, 430 mAh 2S Li-Poly battery
Radio: Three to four channels with 3- to 6-amp ESC, two to four micro (4 gram) servos
Construction: All balsa (laser-cut short kit is available)
Finish shown: Solite iron-on covering (or use equivalent in weight)
Flight duration: 15-20 minutes



Pat's models are so lightweight that room for the burden of scale detail—such as bungee covers and fuel tank indicator float—is available.

The rudder and horizontal stabilizer are built over the plans, using wood sizes shown. Pin the shaped parts and frame the assemblies around them. When dry, remove the parts from the board and sand to shape. Make hinges from 1/8-inch-wide strips of thin CA hinge stock, but don't glue them in until after the frames are covered.

Bend the tail wheel strut to shape from .032-inch wire, using the provided pattern. Fit it into the rudder as shown and glue in place.

Wing: Before beginning wing construction, decide whether you will build the three-channel, the aileron version, or both. Plans and parts are provided for both assemblies, so keep a close eye on the part numbers used for your choice.

Since the wing panels plug in, dihedral is set up by the two root ribs. Pay close attention as you select the components.

For the three-channel wing, pin parts A2 and A3 in place over the associated wing plans. Dry-fit ribs R2, R3, and R4 onto main spar A1. Pin the 1/16 x 1/4 TE over the plans, followed by the rib/spar assembly, and glue in place.

Fit and glue in place the R1 ribs, 3/16 x 3/8 balsa LE, and tip bow. Cut the 5/32-inch-OD aluminum socket tubes to length and glue them into the wing at R1 and R2, and then adhere the the 1/16 square balsa top spars.

When dry, remove the wing panels from the board and sand to shape.

Begin the aileron wing by pinning A2A and A3A in place over the plans. Build up the aileron spar assemblies using the detail drawing provided. Be sure to make a left-hand and a right-hand assembly.

Bring together ribs R2A, R3A, R3B, and R4A onto main spar AA1. Pin the 1/16 x 1/4 TE over the plans. Then attach the rib/spar assembly and aileron spar assembly AS1, and glue in place.

Fit and glue the R1 ribs and the 3/16 x 3/8 balsa LE in place. Do the same with the tip bow. Cut the 5/32-inch-OD aluminum socket tubes to length and glue them into the wing at R1 and R2A, and then cut and install the 1/16 square balsa top spars.

Sand a bevel into aileron hinge spar AS2 using the R3B rib detail drawing as a reference. Glue aileron ribs AR and ARA in place on AS2, and then glue the assembly in place on the TE.

When dry, remove the wing from the board and sand to shape. Cut the aileron from the wing and sand it to final shape, and then fit and adhere AHM in place flush with the bottom of the aileron assembly. Cut the hinges 5/32 inch wide and fit them in the aileron, but don't glue them in until after the frames are covered.

Fit and glue SM1 and SM2 servo mount gussets in place on A2A. Neutral the servo and, with the output arm screwed in place, bond it to the mount with silicone adhesive.

Fuselage: Constructing this section begins with side frames. Because the side door opens, the right and left frames are different, so separate framing plans are provided for each.

Build both frames over the plans using wood sizes shown. Pin B1L and B1R in place and frame the sides around it. Locate and glue B2 to the inside of each frame. Adhere B3 flush with the outside edge of the right-hand side frame.

When dry, remove the frames from the board. Make the landing gear beams from 1/8 x 3/16 balsa. Gouge appropriate-size slots in the front and rear beams, and pin them in place over the top-view drawing.

Using triangles or machinist's squares to ensure vertical alignment, glue the fuselage sides in place on landing gear beams; remember that the door is on the right-hand side. Assemble former 2/2A and glue it in place along with cabin formers 3, 4, 5, and 6. Adhere the B4 ribs between formers 3 and 4.

Sand the bevel into the fuselage sides at the tail end. Using the triangles or squares, pull the tail post together and glue. Fit and adhere formers 7, 8, 9, 10, and 11 in place on top of the fuselage. When dry, remove the frame from the board and add all 1/16 x 1/8 balsa bottom crosspieces.

Glue former 1 in place flush with the front of the fuselage frame. Notice the orientation of the motor-mount-stick hole in the detail drawing; it is offset to accommodate motor right thrust.

Build up the motor mount and glue it in place to the firewall. Using the remaining cross-sectional drawings, add balsa stringers and cabin outfill, and sand to shape.

Fitting Wing Struts: Build wing lift struts over the plans using wood sizes shown. Two patterns are provided, since the three- and four-channel wing dihedral angles are different. Cut the struts a bit overlength on the outboard end, to be trimmed to fit later. Bend the .032-inch-diameter wire retention clips to shape, and adhere the bottom clip in place on the struts.

Cut six pieces of 1/16-inch-OD aluminum tube 5/16 inch long. Use thread to lash the strut retention tubes in place on the fuselage and wings, and secure with thin CA. Cut 1/8-inch-OD aluminum dowel to 8 1/2 inches long to make the wing mounting pins, and slip them into the fuselage.

Slide the wing panels onto the dowels, and fit the struts into the tube sockets on the fuselage. Trim the front strut to length, and then set up the outer fittings and glue them into the struts.

Twist approximately 1° of washout into the wing panels. The amount of washout isn't as critical as both sides being the same. Trim the rear struts and fit the retention clips into the strut, and glue.

Be careful not to accidentally glue the retention clips into the tubes, or you will be unable to remove the strut from the wing.

Bend the jury struts to shape using the appropriate pattern. Slip the strut into the holes in A2/A2A, align vertically, use thread to lash them to the lift strut, and secure with thin CA.

Add the 1/16 x 1/8 balsa strut fairings to the jury struts to complete the process.

Landing Gear: Employing the patterns provided, bend the landing gear components to shape from the appropriate wire sizes. Lay out the front strut and solder together using Stay-Brite silver solder. Tape the front and rear struts to the fuselage and solder.

Remove the landing gear assembly from the fuselage and wash it with soap and water to prevent corrosion. Now use thread to bind the landing gear assembly to the beams, and secure with thin CA. Add the 1/8 scrap balsa gussets and 1/16 balsa fill.

Use the patterns provided to make the boot cowl sections from yellow file-folder material, and adhere them in place with white glue. Start with the bottom, go to the sides, and then bond the top.

To complete the fuselage assembly, build the upper and lower cabin side doors directly over the plans, from the wood sizes shown. Sand to shape.

Mounting Servos and Motor: Glue servo mount rails and beams in the fuselage. Space the rails to fit your specific unit.

Screw the servos in place and run in the elevator pushrod tube (Sullivan item 507), supported at both ends and in a couple of places in the middle using standoffs made from short sections of the included pushrod sheathing. The pushrod will be made from .025-inch-diameter wire.

Fit the rudder and elevator into the fuselage, and run in the rudder pull-pull cables using the routing diagram on the plans. Tie the cables off on the toothpick control horn and note the exact location where the cable will exit the covering. Mark that location on the plans.

Set up the motor and ESC, and test the system for proper rotation. Fit the motor onto the mount stick and secure it with a dab of silicone adhesive.

Now is a good time to assemble the model and double-check for problems that might arise. If an issue crops up, fix it now, while things are still easy to access.

Covering: You can cover the Cub with tissue, light silkspan and dope, or iron-on covering. The best choice for iron-on is Coverite Airspan or Litespan, if you like the doped-tissue look. A good Mylar is Coverite Microlite, also sold as Nelson Hobby Specialties' LiteFilm and So-Lite. Whatever you choose, follow the manufacturer's instructions for best results.

I don't recommend iron-on materials such as MonoKote or UltraCote; their excessive shrinking qualities will damage the light structure, and the excessive weight will adversely affect the model's flying qualities.

Begin by covering all frames except the vertical fin and fuselage top. With the frames covered, plug in the wings and fit the horizontal stabilizer in the fuselage, align using the wings for reference, and adhere in place.

Align and glue in place the vertical fin.