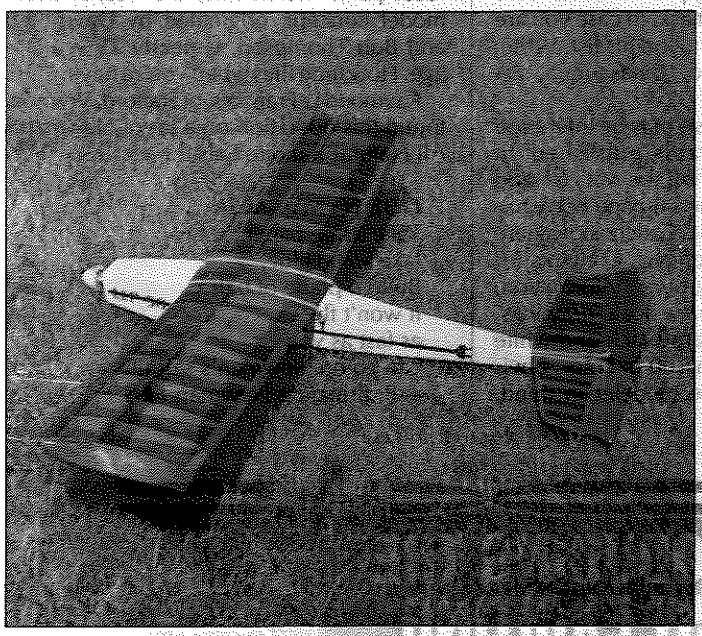
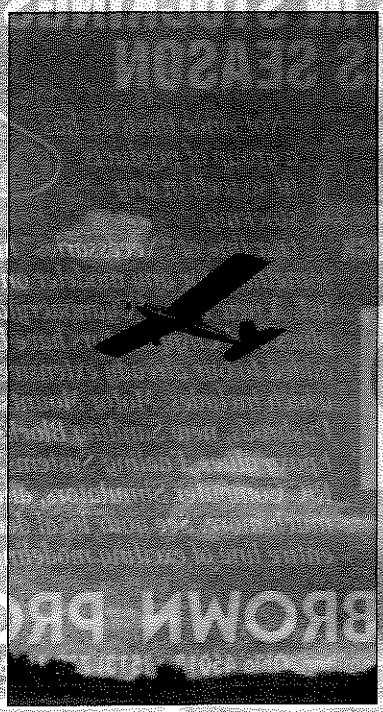
LLP-50

BY RON STANDLEY





This little model (38-inch span) is powered by a Peck-Polymers Silver Streak motor and six 1000 mAH AE cells. Radio is a Futaba FP-4NBL electric, with S133 servos and pull-pull cable linkage. Total weight is only 17 ounces, and total flight time averages 10 minutes (including a few aerobatics and some 1/2-power cruising).

This project started after a search for a small electric powered airplane. I found a few airplane kits and some nice designs in various magazines, but none were exactly what I was looking for. Most of the small airplanes were for the 05 size motors, with six or seven 1200 mAH cell power. This resulted in a plane larger and heavier than I wanted. My only recourse was to design a small plane more in line with what I was after.

This airplane is not a trainer. It is small, and does not have the power reserve that a good trainer should have. It is maneuverable, light and will produce flights of eight to twelve minutes under normal conditions. With a wing loading of around 10 ounces per square foot, it will thermal quite well. All balsa should be light except for the 1/8x1/4-inch spars; use medium balsa here. By accurately cutting the balsa, thin CA glue can be used for all assembly except as noted.

First, some quick specs on the airplane shown in this article. Wingspan is 38 inches (256 square inches), length is 25-1/2 inches, and power is a Peck-Polymers Silver Streak motor and six 1000 mAH AE cells. It is controlled by a Futaba FP-4NBL electric radio and S133 servos using pull-pull cable control. By using contest balsa and light covering, the weight of this combination came out to 17 ounces. I have been flying this configuration and can achieve flights of around ten minutes of sport flying (a few loops, spins, etc., and 1/2 throttle cruising).

FUSELAGE CONSTRUCTION

Cut two identical fuselage sides according to the plans. Pick one side and mark as the right side. Cut formers F2 and F3 from 1/32-inch ply. Cut F1 from 1/16-inch ply. All other fuselage parts will be cut to fit as they are installed.

Lay the right side on the plans and mark the location of formers F2 and F3 on it, then align the left side on the right side and transfer the former marks to the left side. The two fuselage sides should now show the position of formers F2 and F3. Trim 1/16 of an inch from the front of the right side and mark the position of F1 as flush to the front of each side. This will give the proper right thrust to the motor mount F1.

Pin the right and left sides down on a building board. Be sure the inside of both sides are up (you should see the marks locating the formers). It is not necessary to pin the sides on the plans, since the critical locations of the formers are marked on the sides. Again, note that the position of former F1 on the right side is 1/16 of an inch back from the position shown on the plans, since this side is 1/16 of an inch shorter than the left side (the plans show the length of both sides, before the right side is trimmed).

Glue formers F2 and F3 in place on the right side, keeping both vertical to the side. Note that the notches on F3 are at the bottom.

Glue the 1/8x5/16-inch brace for former F2 in place on the right side behind F2. Glue the 1/8x5/16-inch brace for F2 on the left side, located to the rear of the mark for F2.

Glue the top and bottom 1/8-inch square stringers to the right and left sides. The bottom stringer slides into the slot at the bottom of F3. Glue the 1/8-inch square stabilizer support stringers in place on both sides.

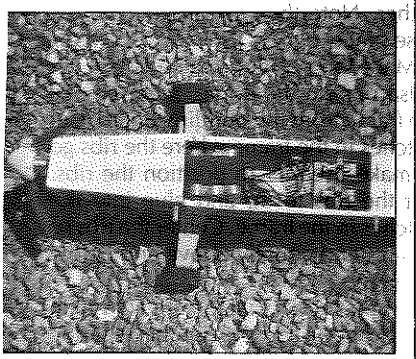
Glue the 1/8x5/16-inch wing saddle braces to both sides, and trim to the contour of the wing saddle.

Glue the 1/8x5/16-inch front motor mount (F1) braces to both sides. These braces are positioned 1/16 of an inch back from the front of each side.

Join the left and right fuselage sides by gluing the left fuselage side to formers F2 and F3. F3 should slip into the slot created at the back of the left side wing saddle brace. F2 should rest against the front of its brace on the left side. Before gluing, squeeze the back of the fuselage sides together so they meet to check the alignment. This step

is critical to the alignment of the fuselage.

Bring the fuselage sides together at the back and glue. Square off the end, and glue a piece of 1/16-inch scrap balsa,



with the grain horizontal, as former F4 across the fuselage ends.

MOTOR INSTALLATION

The method of mounting the motor depends on which motor is to be used. This article will describe the installation of the Peck-Polymers Silver Streak motor. Any of the small 50 watt motors can be used, including an Astro Flight 020 Cobalt. In the case of the Astro Flight, mounting is a little more difficult since the brush holder ears keep it from being installed through the front of F1.

Cut the hole in former F1 for a loose fit around the motor to be installed. Allow at least 1/8-inch clearance around the case of the motor for cooling. Glue F1 in place against the 1/8x5/16-inch braces on the left and right fuselage sides.

Glue the 1/8x5/16-inch braces at the top of both fuselage sides, between F1 and F2. Trim to the profile of the fuselage after gluing. Glue a 1/8x5/16-inch horizontal brace at the back of F1 between the braces just installed. Glue a 1/8x5/16-inch horizontal brace at the front of F2 between the braces just installed.

MOTOR MOUNT

The motor mount is designed to break away and allow the motor to be pushed back into the fuselage in case of a sudden stop. This, and using a folding prop, should help keep the motor shaft from bending. I know that this works, having had a few opportunities to test it.

Start assembling the mount by cutting a 1-1/2x1-3/4-inch piece of .025 clear semi-flexible plastic. This is the same plastic that is sometimes used for model airplane cabin windows. Cut a hole in the center for the motor shaft, and two holes for the motor mounting screws. Attach the motor to the mount, and insert the motor into F1. Locate and drill four holes at the corners of the mount for sheet metal mounting screws. Don't pre-drill the screw holes in F1; let the sheet metal screws tap their own holes. After the mount is fitted, remove the motor from the mount, and cut the mount into two triangle shaped pieces as shown on the drawing. This will allow cooling air to flow around the motor. Also, it will be easier for the motor mounting holes to split open and free the motor to push back into the fuselage (the aforementioned sudden stop). You might make a spare mount at this time to keep in your field box.

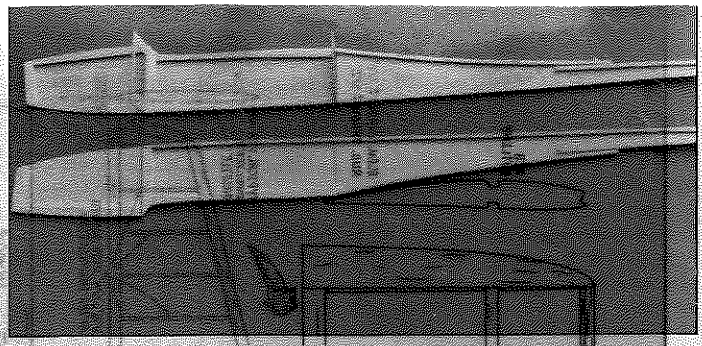
MORE FUSELAGE CONSTRUCTION

Locate and drill the holes for the 3/16-inch wing hold-down dowels. The dowels should be flush against F2 and F3 for gluing later. Remove the dowels until after covering.

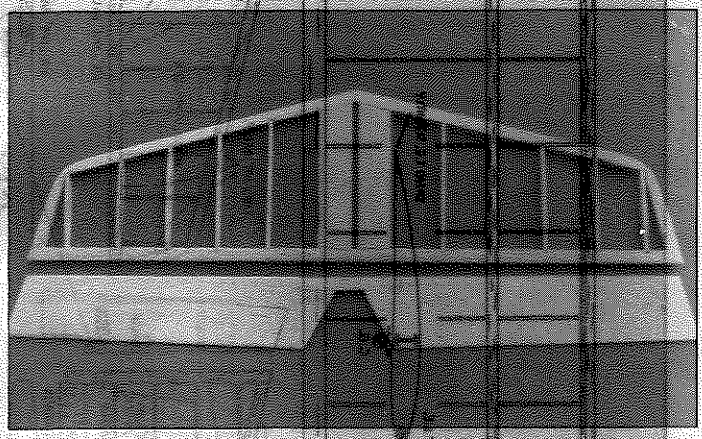
Sand the front top of the fuselage for a good fit for the 1/16-inch balsa top, and glue the top in place. The grain for this piece runs front to back. Glue the 1/8x5/16-inch balsa lower front fuselage braces in place. Trim to the contour of the fuselage after installation. Glue the 1/16-inch lower front fuselage sheeting in place with the grain crosswise. Glue the 1/32-inch ply fuselage bottom in place, and drill a few 1/2-inch holes for cooling. As the Silver Streak motor draws eight amps or less, the motor, battery and speed control don't require much ventilation.

If you are going to use a landing gear, install the 1/8-inch plywood landing gear brace behind F2. It goes between the 1/8-inch stringers and flush to the back of F2.

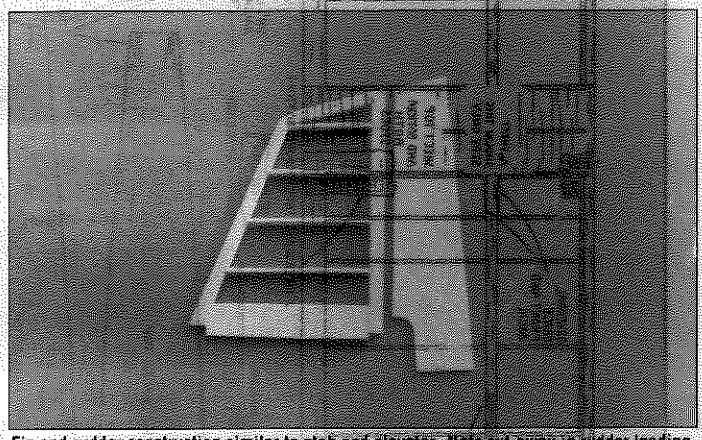
Sand the top and bottom rear fuselage sides for a good fit with the rear top and bottom sheeting. Glue the 1/20-inch rear fuselage top sheeting in place. The rear fuselage bottom sheeting will be glued later, after the rudder and elevator cable routing is checked.



Fuselage sides ready for joining. The right side is cut 1/16-inch short at the nose to produce needed right thrust when the motor is mounted.



Stab and elevator. Note that ribs are notched into leading and trailing edges of stabilizer. This is good construction technique, and tighter than using gussets to reinforce the joints.



Fin and rudder construction similar to stab and elevator. Note cut-away in rudder leading edge to clear elevator joiner.

Wing panels completed and ready for joining. Tips are beveled 30 degrees on the inside to produce a Hoerner tip effect when glued in place. Note that turbulator spar seen in lead photo is missing. This was added by designer after several months of flying. It's a 1/16 x 1/4 inch spar, inserted vertically about 1/3 of the way back from the leading edge to the main spar. It seemed to slightly improve low-speed handling.

web to the rib and spar, extending outboard to the location of the third rib. Continue working toward the outboard end, gluing ribs and shear webs in place, until all ribs except the center rib are in place. At this point all ribs and shear webs, except the center rib, are glued to the lower spar and trailing edge.

Glue the 1/4-inch square leading edge stock in place on all ribs. Fit the top spar in place. It is important that the top spar lies flush with the top of the ribs and shear webs, so trial fit the spar in place. Sand any high spots on the ribs or webs to obtain a close fit. It may be easier to remove the wing panels from the plans to do this. Glue the top spar in place. If the wing is removed from the building board for this step, make sure the wing is not warped when the top spar is glued in place.

The wing tips are shaped from 1/8-inch balsa to the profile shown on the plans. Sand the tips to shape, and sand a 30 degree angle at the inner edge where it attaches to the outer rib on the wing panels. Also taper the outer edge of the tips to about 1/16-inch thick to remove extra weight. Sand the outer wing ribs flat where the tips will be attached, and glue the tips in place. They should be centered from the L.E. to the T.E., and droop down 30 degrees.

Prop each wing panel up so the outboard rib is 1-1/2 inches off the building surface. Sand the inner edges of the wing (top and bottom spar, and the L.E. and T.E. ends) until they are vertical to the building surface. Use a sanding block long enough to span the chord from the L.E. to the T.E. to maintain a straight edge. This establishes the angle at the center point where the panels join.

Sand the L.E. to the profile shown on the plans, and taper the trailing edge to about 1/32-inch thickness. Be careful sanding since the structure is somewhat flimsy until the covering is applied.

Glue the panels together. This is critical so check all joints carefully for a good flush fit. Start by gluing the 1/32-inch ply dihedral braces to the spars on one panel. Use epoxy here. After the glue sets, fit the other panel, doing additional sanding as necessary for a good joint at the spars, and leading and trailing edges. Epoxy the two panels together, keeping the 3-inch total dihedral.

Fit the two center ribs to the joined wing panels by removing a section of the center of the ribs as required. Glue in place.

Fit and glue the 1/16-inch balsa center section sheeting. The top and bottom surfaces are both sheeted. Extend the sheeting to the front of the L.E. and back of the T.E. Sand the sheeting at the front so it is round to match the L.E. contour.

Sand the sheeting smooth, and glue a 1-inch wide strip of fiberglass tape completely around the center of the wing. It works quite well to use thin CA to attach the glass tape, and follow with thick CA to fill the fabric, wiping with a paper towel before the glue sets. Sand the tape smooth after the glue sets.

BODY PARTS ALIGNMENT

Trial fit the vertical fin into the slot in the horizontal stabilizer. The fin should be perpendicular to the stabilizer. Remove the fin and pin the stabilizer onto the fuselage. Check the fit of the wing onto the fuselage. Sand the wing saddle or the stabilizer mount as necessary so the wing is parallel to the horizontal stabilizer.

CONTROL CABLE FITTINGS

Fit but do not glue the 1/16-inch ply cable horns to the elevator and rudder by cutting a 1/16-inch slot 1/8-inch deep in the rudder and in the elevator connecting brace as shown on the plans. Cut a 1/16-inch wide slot in the rudder horn, and a 1/8-inch wide slot the elevator horn, each slot 1/8-inch deep.

Trial fit the servos, marking the height of the servo wheel on the inside fuselage sides. Cut a few 1/2-inch long sections from small diameter plastic tubes. These will need to be bent where they go through the fuselage panels, so determine the angle of each tube by poking small holes in the fuselage panels at the points indicated on the plans, and running the cable from the control horn, through the holes, and to the mark indicating the servo wheel locations. Note the angle of the cables going through the fuselage, and bend the tubes (over a warm soldering tool or Monokote covering iron) to those angles. Glue the tubes in place and cut flush with the outside of the fuselage. Glue two more 1/2-inch pieces of plastic tubing where the cables will enter the fuselage at the front of the stabilizer mount. These should not need bending since the cable run to the rudder servo should be almost straight. Glue the 1/20-inch lower fuselage rear sheeting in place.

COVERING

Sand all structures to remove extra glue, rough spots, etc. Cover with your favorite material, the lighter the better. After the wing is covered, put 1/8 inch of washout at each tip. (when each panel is flat on the board, the rear of the wing tip should be 1/8 inch off the surface). Cover the remaining parts of the airplane.

Glue the rudder and elevator horns in place. Attach the rudder to the fin, and the elevator to the stabilizer, using a full length of clear plastic tape as the hinge. As shown on the plans, glue a small hinge just above the rudder control horn. This is needed to keep the rudder from being pulled to either side by the cables.

FINAL ASSEMBLY

Glue the completed fin to the stabilizer, and then this assembly in place on the fuselage. Be sure to check the alignment with the wing before the glue sets. Glue the wing mounting dowels in place, and attach the landing gear if being used. Install the radio gear, motor and battery, and check the balance. Move the receiver and/or battery to get the balance point as shown on the plans. It may work best to use a battery pack containing six 800 mAH or 1000 mAH AE cells arranged in a two-by-three block, and located in the radio compartment just behind F2. I secure the flight battery by gluing a small piece of velcro to the fuselage bottom just behind F2, and using two pieces of velcro to go around the battery (opposite types, each a little longer than 1/2 the distance around). Then just push the loop onto the bottom piece, with one of the overlaps at the top so it can be opened to change the battery pack.

FLIGHT TRIMMING

Proper trimming is critical to the performance of this plane. It is possible to fly with a nose-up trim, but the plane will need full power just to maintain a constant altitude. With the balance point as shown on the plans, trim the elevator to obtain a smooth glide with power off, and straight level flight at about 1/2 throttle setting.

Lastly, the name. It should be apparent the 50 in the name LLP-50 is for the motor wattage, but what is LLP? Well, if you build one, you will notice it's made from Lotsa Little Pieces. ***MB***

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