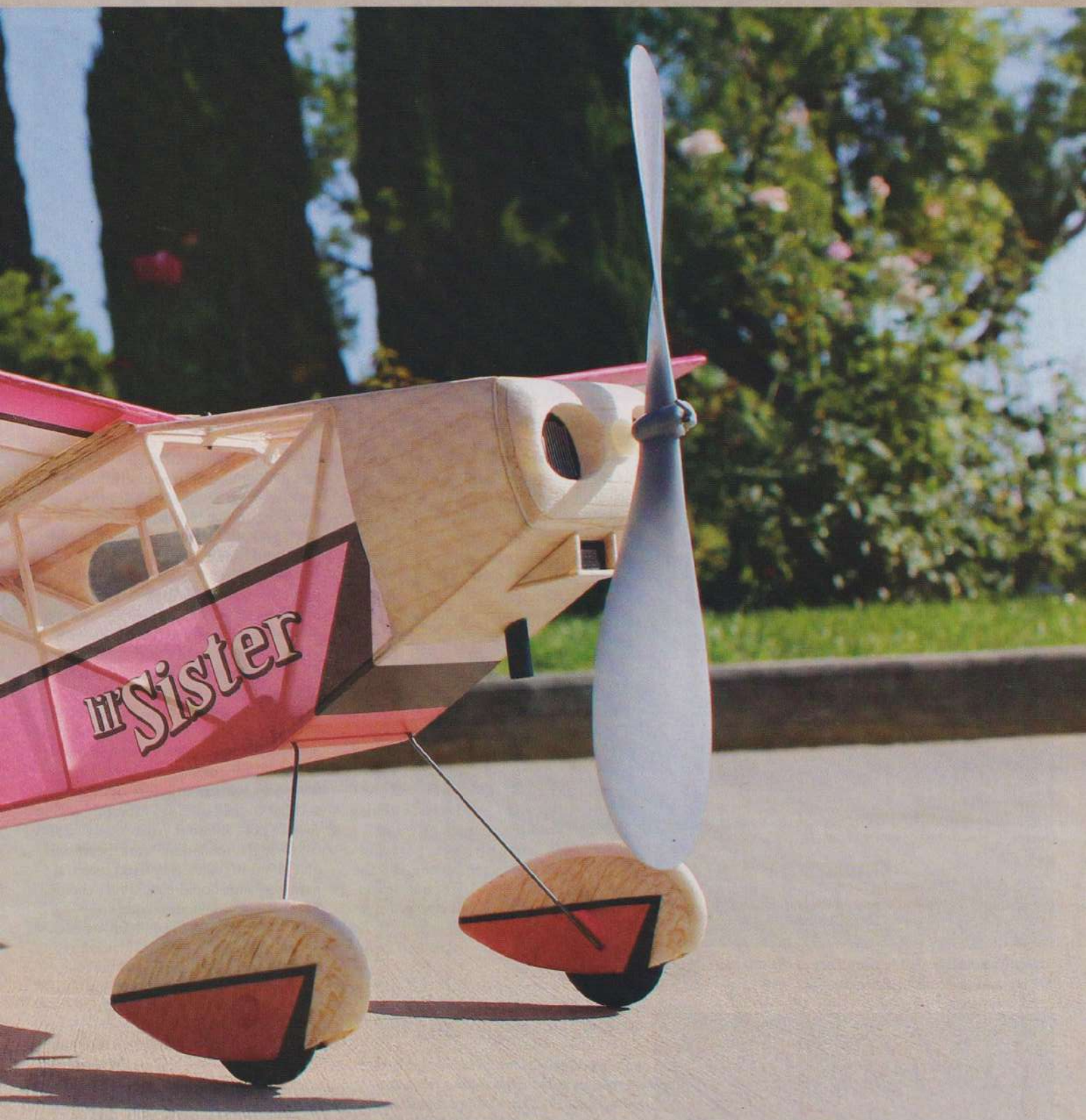




Sweet Lil' Sister

Who could resist a sweet lil' sister like this? A great little outdoor Embryo Class sport flier for all you builders out there that like models that look like they should and with a little pizzazz!

By Steve Higginson



I must whole-heartedly confess, I have a real hard time designing model aeroplanes that don't look like, what I think, aeroplanes should look like. The graphic artist in me tells me to "think it out, make it fit the formula, balance the proportions and make it look good". Perhaps one of the hardest things to accomplish is keeping it simple AND making it look good. And... the next hardest thing to do is make it light enough to keep the wing loading down

so it will fly great but make it strong enough to survive the knocks that everyday flying can force on a model. Remember the golden rule: As mass increases, force of impact increases exponentially.

The Lil' Sister hits right on the money with most of these points and it is very simple to build and the wood sizes are reasonable for anyone who can work there way around peanuts, walnuts, Bostonians, etc. etc. My Lil' Sister weighs in right around 16 grams

as pictured here with a Peck silver plastic prop and no rubber. I am going to fit it with a carved balsa propellor from Zephyr Model Motors that will trim off another gram and a half. This will get me down close to my goal of 14 grams to meet the minimum weigh limit of 14 grams imposed by many competitions. (For a copy of the complete Embryo Class Endurance rules, go to: aeromodeler.com).

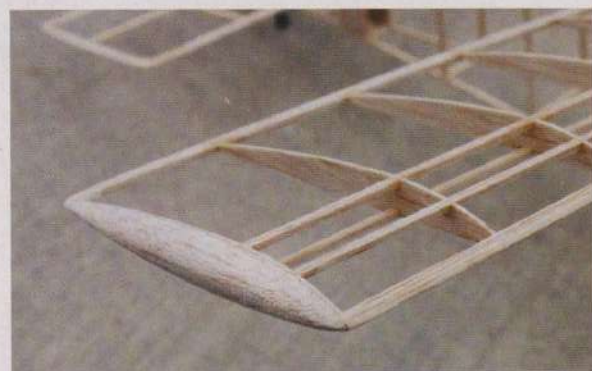
Construction of the Lil' Sister is very



Cowl construction is clean and simple and adds a lot to the overall appearance of the model. The curved cowl "cheeks" adds very little extra weight while upping the aesthetic personality significantly. Note the "Plug-In" U.C. gusseting and structure.



Tail plane structure is as simple as they come.



Wingtip detail shows the simplicity of the wing assembly. Strong and light will make it fly right.



Tiny (1/16" dia. X 1/32" thick) neodymium magnets aid in keeping the nose block in place during flight.



A simple, light and strong airframe is essential to a good performing Embryo.

straightforward and throws no punches as she goes together. As always, wood selection is of prime importance with these smallish airframes, so go as light and strong as you can keeping in mind the type of flying you intend to do. For the prototype, I did not go for ultimate weight savings and I typically want to get a new design up and flying well before I go for broke (maybe a bad choice of words) and set my sights on competition.

Fuselage

The bulk of this design is strip wood. For the fuselage, I chose some good and springy 10-12 pound "A" grain stock for my longerons and cut my own strips so the consistency was as close as possible. I used this same strip stock up front and wherever strength was needed. For uprights and cross-members behind the wing, I selected some 5-7 pound stock. My general rule of thumb is to put the weight where it is generally needed so as not to add gobs of clay to make it right for flight.

All of the cross-members from the wing T.E. forward are of the same length. This feature makes mass production a snap (again, maybe a bad choice of words) as all can be ganged together and cut/sanded to the same exact length. This also promotes a nice, square fuselage structure. Build the fuselage sides one on top of the other in the standard fashion. Be aware to build the right side nose upright 1/16" aft of the left side to build in the proper 2° of right thrust.

Once you have the side built and all the glue gobs sanded smooth, block the sides perpendicular to the building surface and over the top view of the plan. I use a pair of 2" sq. steel machinists angles for the task. They

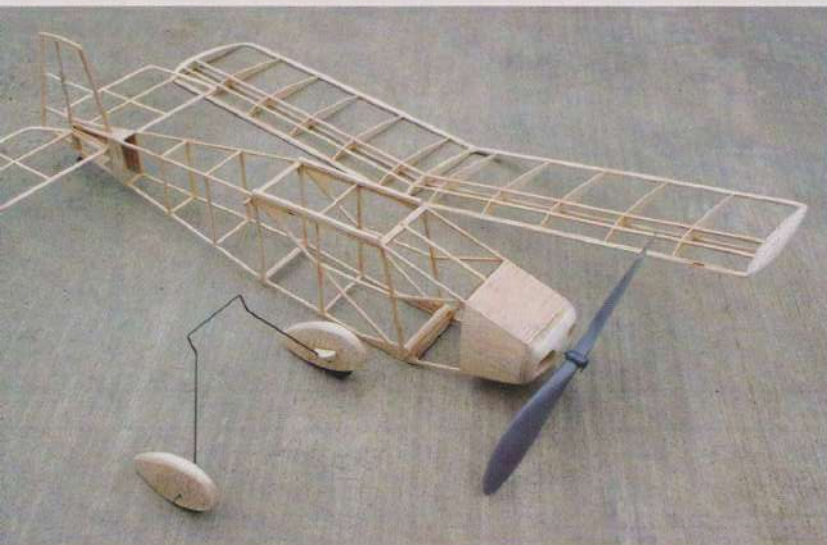
are dead on square and weigh a lot so they don't move around easily. I find that flat magnets like the ones that fall off of decorative refrigerator magnets work great for keeping the fuselage side pinned to the steel angles.

I use my "exact" length bottom/front (from the wing T.E. forward) cross-members as spacers to line everything up on the plan, then glue them in. When dry, I flip the structure over and set up to do the top/front cross-members in the same fashion.

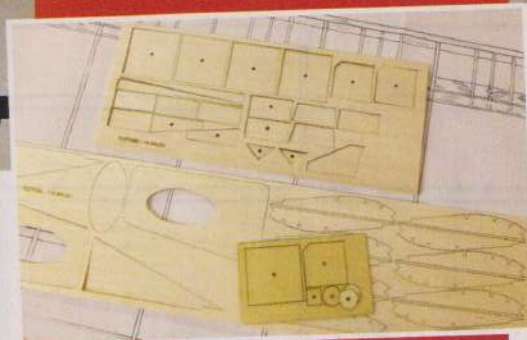
When dry, I glue in the front/ top and bottom filler panels. The fuselage is pretty solid at this point and it is time to "crack" the fuselage longerons at the wing T.E., set the structure right side up and flat to the building surface then glue the tail post together. Measure twice and cut once the remaining cross pieces and glue them in. With very little care and patience, you should have a very square, non-banana fuselage assembly.

For strength, 1/16" sq. doublers back up the diagonal uprights and add the assorted gussets as shown on the plan. The cowl is simple, strong and the sides need a little clarification. The plan shows cowl cheek uprights (flat on one side, curved on the other) that are sanded to the curved shape. The front ones start life as 1/16" sq. and the rears begin as 1/16" x 3/16". The fronts glue right on top of the side, nose uprights. The rears inset just in front of the second upright. Cut some light "A" grain 1/16" sheet to fit the cowl side space and bevel the top and bottom inside edges so the sides will fit flush to the top and bottom longerons. Doing is so much easier than explaining.

The nose block is a standard affair, with one exception, and it is builder's choice here. I like to use neodymium magnets to hold my nose blocks in.



The removable U.C. will allow Lil' Sister to be broken (another poor choice for words) down as to facilitate easier transporting and storage.



Some of the beautiful laser cut parts from the short kit available through:

www.aeromodeler.com



A slick little wing hold down I have adapted started life as a Dubro® Micro Ball Link (For .032 Pushrod. Cat No. 928). It's just another on a long list of repurposed hardware. I have had hundreds of flights on models using these and have yet to lose a connection.

This is another case of making a little extra weight work for its place (remember, I hate globs of clay messing up the good looks of my models). In this case, I inset $4\frac{1}{16}$ " dia. X $\frac{1}{32}$ " magnets into 2 additional side strips and inserted them flush into the nose plug opening (see photo). I then fitted a standard nose plug to the nose block for a snug fit.

To line up the corresponding magnets in the nose block, simply allow the four magnet mates to find purchase on the fuselage side of the nose (don't worry, you can't stop these little devils from lining up their polarities. Now, simply press the nose block assembly into the nose to make four magnet impressions into the nose block. Using a $\frac{1}{16}$ " drill by hand, simply make a shallow hole for each of the magnets to fill. The last trick part is to unstick the magnets one-at-a-time from their mates and without flipping them over (you don't want to switch the polarity) glue the magnets into their corresponding holes. Once you have all four-magnet pairs lined up, just plug your block assembly in and it will snap (there's that bad word again) into place with authority. You will never have a nose block fall out in flight again. Now you can sand the nose block assembly to final shape flush with the cowling.

Bend up the undercarriage from .028 music wire to match the pattern. Here's another builder's choice again to make the gear solid or of the plug-in variety. The assembly method is really the same only with the plug-in; you don't have to cover around wire sticking out of your fuselage. Also, removable undercarriages usually make the model easier to transport and store.

Wing

Not much to say here. The wing is about as simple as they come. Fourteen ribs ($12\frac{1}{32}$ " and $2\frac{1}{16}$ ") are all the same shape and can be duplicated by temporarily gluing blanks together with glue stick and cutting them

all out at once. Then soak them in a bath of 91% Isopropyl Alcohol until they all fall apart from one another.

The wing is built in one piece and all finish



In Embryo Endurance Competitions, you are rewarded with extra points for adding scale-like bits to your model. Scoops, exhaust, wheel pants and cylinder fin-ish details go a long way to bringing spunk into a well-executed design.

sanding is done before cutting the two halves at the root rib intersection. Notch the T.E. and pin it flat to the plan. Pin the lower spar into position and plug the $\frac{1}{32}$ " rib tails into their corresponding notches, set over the spar, square and glue. Align the L.E. with the ribs and glue. Using the "dihedral gauge," set the $\frac{1}{16}$ " root ribs at the proper angle and allows

the bottom of the ribs to butt into each other to ensure correct alignment and glue the root ribs. Fit the top spars and glue into place. Glue in all eight $\frac{1}{16}$ " scrap gussets.

Remove the wing assembly from the board and carefully. Make the wing tips from soft balsa by roughing them to size and shape. Glue them to the end ribs securely. Begin sanding at the tips then work your way to the L.E. and sand the length to a "D" shape then carefully flush sand all joints. When satisfied with the overall wing structure, cut through the L.E., T.E. and all spars. Separate the root ribs if they are stuck together. Sand the L.E., T.E. and all spars flush to the root ribs using a block and 220-grit sandpaper. Pin one half of the wing assembly flat to the building surface and block up the other tip 2" and glue the root ribs together. Finish sand the completed wing assembly with 400-grit sandpaper.

Tailplane

Simple and very basic here. $\frac{1}{16}$ " sq. and $\frac{1}{16}$ " x $\frac{1}{8}$ " stock. Make sure your joints are perfect before gluing. This is the best way to ensure against warps after covering. After assembly, remove from the building surface and flush sand both sides of the rudder and tail with 400-grit sandpaper. Gently ease the edges on the tail. Ease the edges of the rudder as well but do not round off the rudder to fuselage mating surface.

Covering

Japanese tissue is my covering material of choice. I draw up all my graphics on my computer, including color, and then print the designs directly onto white Jap tissue with my laser or inkjet printer. (FREE PDF downloads for the graphics shown in this article are available in Pink, Red, Blue Yellow, Green and Orange with Black at: aeromodeler.com minus the AMA number of course.)

I hope you enjoy the build and happy flying. ●