

the SCOUT'S PENNY PLANE

By JERRY MURPHY . . . If you've ever been tempted to take a shot at indoor rubber modeling, but couldn't find a reasonable yet uncomplicated design to build, now is the time, and here is the ship you're looking for.

• This model is an ideal starting place for someone who is interested in flying indoor rubber. The basic construction used in the Scout's Penny is typical of that used in record-setting models. This model fulfills the requirements called out in the AMA Rulebook for the Novice Class of Pennyplane.

The Pennyplane gets its name from its unique minimum weight requirement. The total airplane less rubber must have a minimum weight that is equal to that of a freshly minted U.S. penny. That weight is 0.109 ounces, or 3.10 grams, if you want to think metric.

The Scout's Penny was designed as a special project for Colorado Springs Explorer Post No. 267. None of these boys had even seen an indoor model before I flew my paper stick model at one of their meetings. Their enthusiasm and desire to try it themselves, resulted in this project. At a second meeting, materials and plans were given to the boys and a contest was scheduled. Would you believe that all the models flew? Well they did and very well. In a 20 foot high gym with the heaters on full blast (remember it's cold here in Colorado). The top time turned in by the boys was 161 seconds.

If you want to join in the fun of pennyplane flying you will need to visit the local hobby shop and pickup the items listed in the bill of materials at the end of this article.

If this is to be your first indoor model, don't worry too much about weight. The models built by the Scouts weighed in at about 7 grams. My prototype weighs 5.2 grams, and it is an outstanding flyer. If you build your model in the 4 to 6 gram weight range, you will have a model that will fly very well and will be very easy to handle. As you become more accustomed to flying indoor then lighter models can be built. The only way to get down to the 3.10 gram minimum weight is to use selected indoor materials.

Now that you have rounded up all the needed materials, let's start building your Scout's Penny. A good starting place is the motor stick. Carefully draw the taper as shown on the plans, using a very sharp pencil and straight edge. Then cut the motor stick to shape. Now cut the tail boom to length and bevel the tail boom where it joins the body stick as shown in detail A on the plans. Now glue the tail boom to the motor stick. While this joint is drying, make the rear

rubber hook from 0.014 music wire. Insert the hook into the motor stick and wrap the hook/tail boom joint with thread and apply a coat of glue over this joint.

Make a thrust bearing from tin can stock. Don't use an aluminum drink can, as it is too soft. Use a large sewing needle to make the hole for the prop shaft. Glue the thrust bearing to the motor stick and wrap the joint with thread. Apply a coat of glue over this joint. Now for the part that separates first-place models from the pack. Grab the sandpaper and round all the edges of this assembly and lightly sand the whole thing.

TAIL

Take a good ruler and very carefully lay out 1/16 inch marks across the sheet of 1/32 balsa. Now with a new single edge razor blade, using a ruler as a guide, cut twelve 1/16 x 1/32 sticks. The longest stick you will need for your Scout's Penny is 12 inches long (30.48cm if you want to keep up with the metric thing).

Now look through your stack of sticks and select the lightest ones for the tail, and the two that are slightly oversize and the heaviest, to be the wing main spars.

Cover the plans with plastic film and carefully lay out the stab. The sticks are placed down on the plans thin side up. Do not stick pins through the wood, but form an X over the sticks as shown in the photos. Use a toothpick to apply the glue to each joint. Using scrap from the stab, lay out the fin. To make the covering easier, you can lay out the fin with the thick (1/16) side of the sticks down on the plans.

Once the glue has dried, carefully remove the stab and fin from the plans and trim off any excess glue.

WING

Cut the wing rib template out of the plans and glue it to a piece of heavy paper or thin cardboard. I used the cardboard from the back of writing tablets or a file folder to make rib templates.

Now with a sharp knife, cut a rectangle from your 1/32 sheet of balsa that is 5 inches long (with the grain) and 1-1/2 inches wide. Using your ruler, carefully lay out 1/16 inch marks along both 1-1/2 inch lengths of this rectangle. Using a very sharp modeling knife, such as **Model Builder's** Uber Skiver with the No. 11 blade, cut out at least 14 ribs. Why 14 when there are only 11 ribs in the Scout's Penny, you ask? Well, everybody

breaks at least two ribs, so why not have an extra?

Find those two sticks that you put aside and lay out the wing leading and trailing edges. Go ahead and cut the LE at the dihedral breaks. Glue 1/16 x 1/32 sticks thin side up to the main panel LE and TE to form the cross member of the compression ribs. Remember, don't stick pins through the wood. Now place the ribs on the plans and trim them to length at the trailing edge. This means you put the leading edge of the rib up against the leading edge spar and trim the rib to fit by cutting it to length at its trailing edge.

After the glue is dry, carefully remove the tip panels from the plans. Bevel the spars as shown on the plans and glue the tips to the main panel with the 2-1/2 inch of dihedral required. Make sure that both the LE and TE of the tip rib are 2-1/2 inches off of the building board. After all the glue has had time to dry, remove the finished wing from the plans and carefully remove any excess glue with a very sharp knife.

COVERING

Take the finished wing and tail and use them as patterns to cut out the tissue. Cut the tissue slightly oversize and the grain of the tissue should be running span-wise, that is to say, from tip-to-tip of the wing and stab. Use your small brush to apply a coat of clear dope to the outline of the fin. Lay the tissue over the fin and carefully press the tissue down over the outline of the fin. Now cover the stab in the same way. Don't try to pull the tissue very tight as that will warp the structure. Don't water-shrink it either, just leave it as it is.

The wing is covered in three sections, first the main panel and then the two tips. Put a coat of dope on the top of the LE and TE spars and the top of the outboard compression ribs. Lay on the tissue like you did on the tail. After the tissue is dry, trim the excess off the compression ribs with a new, never before used razor blade.

Now comes the only tricky part, covering the tips. Lay the tissue on the tip and trim the inboard edge so it fits the compression rib. Now apply a coat of dope to the outline of the tip and carefully press on the tissue. After all the dope is dry, take your new razor blade and trim off all the excess tissue. As you do this trimming, you will find places where the tissue isn't stuck to the wood. Just take your brush and apply additional dope to those spots and press the tissue down.

ASSEMBLY

Cut the wing posts to length from 1/16 sq. balsa and sand them round. This is easily done by rolling the wood between your fingers while applying light pressure with the sandpaper.

After the posts are round, let's make the tissue tubes that are used to mount the wing to the motor stick. Cut a piece of scrap tissue approximately 1/2 inch x 4 inches long. Wrap the tissue one time around one of the round sticks, then smear glue over the remainder of the tissue. Quickly wrap this tissue around the post, forming a tube that is a 1/2 inch high. Before the glue can dry, slide this tube off the post and let it dry. After it is dry, cut it in half, producing two 1/4 inch long tubes. Glue these two tubes to the motor stick as shown on the plans.

Now take the two wing posts and glue them to the wing. Note that the left wing is longer. After the posts are dry, make the wing braces as shown and glue them in place.

Glue the stab and fin to the tail boom and you have something that looks like an indoor model.

PROP

The heart of any rubber model is its prop. This is the one component that controls how well your model will fly. A super airframe won't fly very well if it is coupled to a poorly built prop. The prop should be light and true, to be good.

Cut the blade outline out of the plans and glue it to heavy paper or cardboard, to make a template like your wing rib. Now cut two blades from the 1/32 sheet balsa. The wood grain should run parallel to the spar. Take a few minutes to sand each blade so that it is about 1/3 thinner than the original thickness of the balsa. Mark the spar position on the sanded blades with a sharp pencil. Now soak both blades in hot water for about 15 minutes.

While the blades are soaking, cut the spar to length from 1/16 sq. balsa. Glue the reinforcing 1/16 sq. stick to the center of the spar and sand the rest of the spar round. Install the prop shaft which has been formed from 0.014 music wire. Take a 4-1/4 inch diameter, 7 inch high can (10.8cm x 17.8cm for you metric fans) and draw a vertical line on it with a felt-tip pen. Now measure around the top of the can from where your vertical line stopped, four inches, and mark the can there. Now draw a line connecting this mark with the one on the bottom of your vertical line. This line will be the center line of your blades when you lay them on the can to form their airfoil and twist.

Take the two wet blades and place them on top of each other. Now lay them on the can so that the angled

line passes through the line you drew on them for the prop spar. Use gauze or strips of cloth to hold the blades tightly to the can. You can either bake the blades dry in a 120° oven for one hour, or let them stand overnight.

After the blades are thoroughly dry, remove them from the can and carefully separate them. Lightly sand each blade and glue it to the shaft. Don't goof and make a left-hand prop or your Scout's Penny won't fly correctly. Looking from the front, the leading edge of the right-hand blade is up and angled out toward you, the leading edge of the left-hand blade should be down and angled out toward you. The blades should be at a 45° angle to the prop shaft at the end of the spar. The blades are glued onto the front of the spar. Don't use too much glue or you will have a prop that is too heavy. Hot Stuff can be used here to make a lightweight and strong prop. Once the blades are mounted on the spar, hold the prop by the shaft and blow on it. It should turn counter-clockwise; if it doesn't, then remount the blades.

Sand the finished assembly so that it is balanced and check that both blades are at the same angle to the prop shaft. Once you are satisfied with your prop, make two washers out of thin plastic like that used for windshields; or to package small items such as glow plugs, and put them on the shaft.

FLYING

First, find or make a cardboard box to hold your model. Once you have it safely inside your flying site, assemble it and check for damage and warps. Install the prop in the thrust bearing and apply one drop of 3-in-1 oil.

Make a loop of rubber from 1/16 x 1/32 rubber that is 10 inches long. A square knot is about the best to use. Lightly lubricate the rubber, and let's fly. Use your winder to put in about 250 turns, and gently launch your Scout's Penny into level flight. If it stalls, push the wing leading edge wing post down into the tissue socket until a smooth flight is obtained. If your Scout's Penny dives to the floor push the trailing edge wing post down into its socket until a smooth flight is obtained. Once you are happy with the flying of your model, increase the number of turns and watch it go.

When you are obtaining the best performance from your Scout's Penny, it should be landing with about a half row of knots in the rubber. If it either runs out of turns or lands with too many turns left in the motor, you can get better performance. The chart below will help you correct the problem:

Problem: Dead stick landing.

Solutions: (a) Use longer motor of the same size, rubber, or (b) use same

length motor of smaller size rubber.

Problem: Too many turns left.

Solutions: (a) Use shorter motor of the same size rubber, or (b) Same length of larger size rubber.

If your model should power stall just after launch and then fly okay after the motor has run down a few turns, try decreasing the wing's incidence very slightly by pushing the leading edge wing post into its tissue tube about 1/32 inch. If that doesn't solve the problem add a little nose weight to the model.

MATERIAL LIST

1/32 x 2 x 36. Contest Balsa — one sheet.

Look over your choices very carefully. This wood is going to be the basic material used in the construction of your Scout's Penny. It should have a straight grain and should be warp-free.

1/8 x 1/4 x 36 — one.

1/8 x 1/16 x 36 — one.

These sticks are for the motor-stick and the tail-boom. They should be relatively hard balsa with straight grains and warp-free.

1/16 x 1/16 x 36 — two.

0.014 music wire.

Model cement.

Small bottle of clear dope.

Japanese tissue — one sheet.

This is a critical component to your model. I suggest that if your dealer doesn't carry good, high quality tissue, you try one of the sources that advertise in **Model Builder**.

Rubber — Sterling Flight Center's 1/30 x 1/30 and 1/30 x 1/16, about ten feet of each.

TOOLS AND SUPPLIES

1. Two single-edge razor blades
2. One dozen straight pins
3. Wax paper
4. Sewing thread
5. Small paint brush
6. Extra-fine sandpaper
7. Six round toothpicks
8. Rubber lube
9. Winder

If you want to use the best materials available, I suggest that you try one of the indoor specialty mail order shops, such as: Micro-X Products, P.O. Box 1063, Lorain, Ohio 44055.

They can supply top quality supplies, such as pre-cut indoor wood, very lightweight coverings, thrust bearings, washers, and rubber.

For a super winder, send off to Bob Wilder, 2010 Boston St., Irving, Texas 75061. It costs about \$30.00, but it is worth it. If you have a 16:1 Midwest winder, you might want to glue the conversion chart to it to make its use easier.

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