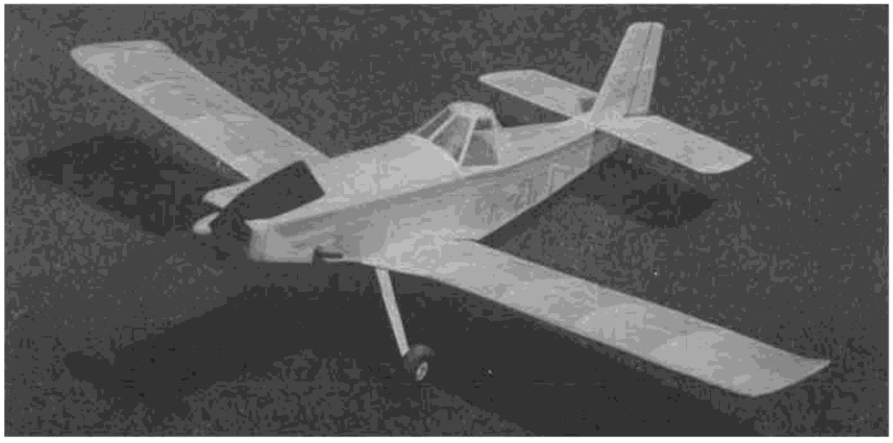


Peanut Embraer "IMPANEMA"

By WALT MOONEY . . . South America provides the subject for this month's Peanut, a cropduster especially well suited to novice builders.

• The state-of-the-art today in agricultural aircraft design is well known. It is a low-wing, highly-powered airplane with its dust or spray cargo carried over the wing, and its pilot cockpit located behind the cargo for impact safety. To provide the necessary good visibility for low altitude crop dusting, a 360° visibility canopy is provided, and the long nose is angled sharply down to provide as much view forward as possible.

The Embraer Impanema, built in Brazil, has all these characteristics, and at the same time has a unity of shapes that render it quite attractive. Especially if it is compared with some other aircraft designs of the same genre, whose designers have apparently felt their aeronautical masterpieces should look like a piece of farm equipment; a Fordson tractor, perhaps.

From a strictly Peanut modeling point of view, the Impanema has much to offer. It has a relatively long nose, non-tapered wings and horizontal tail, adequate dihedral and tail size, and a flat-sided fuselage. Although its aspect ratio is fairly high, so that a 13-inch Peanut cannot match a Fike for wing area, it is a very clean design aerodynamically and can be made a competitor with enough attention to keeping it light.

The plans are drawn for the use of 1/16 structure in most instances. This should be an aid to the novice builder. Thinner sticks could be used everywhere, and if you feel competent with the weaker wood sizes you'll certainly get a lighter model than the one in the photos, which weighs nine grams with a twelve-inch loop of 3/32 rubber.

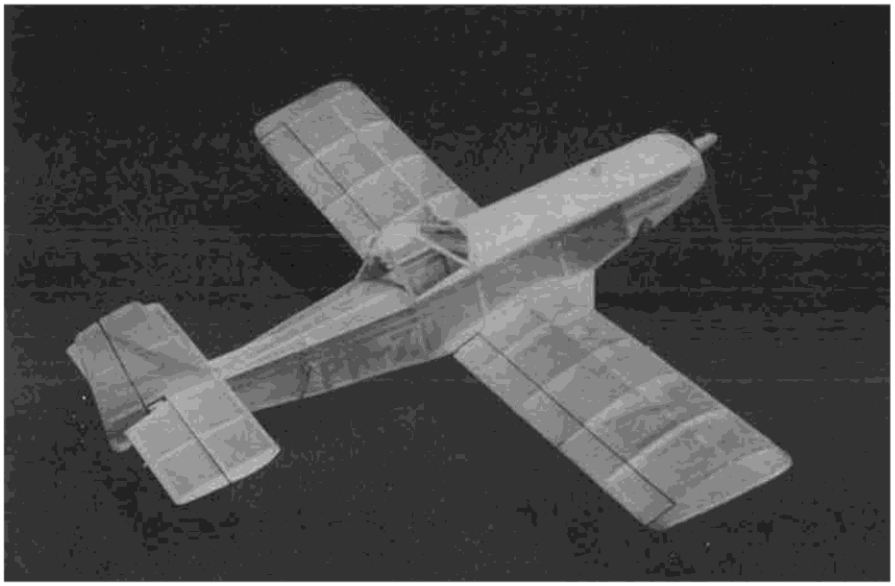
This model utilizes conventional construction techniques in all of its components. There is nothing new for anyone who has built a few kits. However, because I believe it is a suitable model for a relative beginner in the Peanut model game, we will discuss all the parts, some in more detail than others.

I like to start by making the two fuselage side frames. First get a piece of waxed paper to place over the plan so the glue will not stick the balsa permanently to the plan. Both side frames are best made at the same time, one over the other, so they can be as nearly identical as possible. Cut two wing mount pieces out of sheet balsa to the shape shown in the fuselage side view. Pin these in place over the plan and then add the two lower longerons. Use as many straight pins as necessary to locate the longerons accurately. Now place the two upper longerons in place and secure with straight pins. Do not push the pins through the longerons, which may split them, rather put the pins on either side of the balsa sticks. Check to make sure your longerons are exactly one above the other vertically. Now carefully cut the uprights and cement them in place. Don't hurry this step. Make each upright fit precisely; if you cut one too short, make another and use the first part to make an upright for a further aft location. Note that the uprights at A and G are wider than the others. The one at the nose needs the extra strength because that's the one the model will be impacting on first, and the one at G has a hole drilled in it to accommodate the peg that supports the rear end of the rubber motor.

The fuselage frames must be allowed enough time pinned to the workboard for the cement to dry completely. I generally take this time to cut out all the ribs, tip pieces, and formers, and then assemble the tail structure and wing structure over the plan. All the wing ribs are alike, as fas as shape goes. This shape is shown on the side view. The root ribs have a short extension forward of the basic wing, also indicated in the side view. Root and tip ribs are thicker than the others for strength.

The tail structures are assembled by pinning the leading and trailing edges in place on top of the plan and adding the other pieces in a manner similar to the way the fuselage sides were assembled, except of course there is only one of each.

Start the wing in the same manner, by pinning the trailing edge in place over the plan. Now place the tip ribs in position against it and locate the leading edge against the front of the rib. (It is handy if you leave an inch or so of excess length at each end of the leading and trailing edges. First, you can pin through it without too much problem, and second, it allows for a little misalignment in the tips.) Now cement all the ribs in place. They should all be perpendicular



Much better looking than most ag-planes, the Impanema has all the right moments and proportions that go toward the making of a good flier.

Continued on page 80

to the workboard, except for the root ribs which should lean out at the top towards the wing tips, enough so that when the dihedral is added they will then be vertical.

Let these structures dry while rough cutting the nose block, cowl bottom, cowl sides and cockpit top.

Now remove the fuselage sides from the plan. They will come off the waxed paper easily but will be stuck together by the excess cement used in their assembly. Now is the time to perform a sanding operation on the frames. Get a sanding block wide enough to easily reach across the frames at their widest point. Using No. 300 or finer sandpaper, lightly sand both sides of the stuck-together frames. Use a razor blade to separate the sides. A thin double-edged blade, or better yet, half of one, makes a better separation tool than a thicker single-edge blade. If all you have is a single-edge blade, at least remove the backing stiffener. Slide the point of the blade between the longerons where they are not cemented together and slide it gently towards an upright location. Then angle the blade so its end slips between the uprights where they are also not cemented together. Now move the blade towards the excess cement at the joint and separate the sides by continuing this process all the way around the two fuselage side frames.

Cement a length of 1/16 square balsa on the inside of one of the frames at the aft upright. (The inside is the side that hasn't been sanded because it has just been separated from its mate.) When dry, sand it flush with the top and bottom of the frame. Then cement the other side frame to the first at the aft end. Check to see that the frames splay apart at the correct angle by placing them over the top view to dry.

Now, remove the wing from the plan and proceed to put in the dihedral. Cut the leading and trailing edges at the inside of the root ribs. Pin the center section of these parts to the plan once again. Now get a couple of blocks about a half inch thick and block up the wing tips to exactly the right dihedral angle. Carefully taper the center parts to a good fit and cement the leading and trailing edges back together. Now select a firm piece of balsa for the wing spar. Crack it in the appropriate places and cement it in place in the rib notches. It will have to be tapered at each tip to match the slant of the wing tip pieces.

Now the fuselage crosspieces can be cut and cemented between the side frames. All the crossbraces between the sides from A to D are the same length. The front one is wider than the others, which are made from the same size sticks as the longerons. Because the fuselage must be a good fit between the wing root extensions, it's a good idea to check the length of these forward crossbraces and adjust their length as necessary. It's tough to make the fuselage just a little wider or narrower after the crosspieces are cemented in place. Cement the crosspieces in place from A to D. Then, working from the rear, cement the crosspieces in place from H to F. Finally, cement the crosspieces at E.

Now add the formers to the top crosspieces at the proper places. The three top stringers are cemented in the notches of E, F, G, and H.

Cement the side cowl pieces in place on the outside of the fuselage frames between A and B. They should be an exact fit over the longerons and the uprights but must not extend beyond. Use a sharp razor blade to trim off any excess.

Now cement the bottom cowl block in place. Then add the top cowling, made of thin sheet balsa, from A to D. Select a piece of soft, flexible A-grain wood for this application. This cowl is essentially flat on top, but has rounded corners which will have to be bent into the sheet. Make the cowl sheet a little oversize all around. Cement it in place over only the flat portion of the formers and let it dry. Then carefully bend it around the corners and trim it to fit. Finally, cement it to the former corners and to the top of the longerons.

Cut a backing block for the rough noseblock, to fit snugly into the front of the fuselage frame at A. Cement it to the noseblock. Trim the top cowl sheeting to be flush with A and D. Put the noseblock in place and, with a very sharp blade, proceed to carve the nose to the correct, final shape. This can also be accomplished using a sandpaper block, using medium and then fine sandpaper, if carving with a blade is not to your liking. It takes a little longer, but is not so easily overdone.

Sandpaper all the structures to nice, smooth contours. The leading edges of the wing and the tail are rounded for a good airfoil. The trailing edges are tapered to a near knife-edge for streamlining.

Now bend the landing gear wire. It should be a good fit into the fuselage at C. Cement it securely in place.

Now cover the model with Japanese tissue. The prototype Impanema was white all over with a medium blue trim color. I used white glue (Elmer's or equivalent will do), thinned with an equal part of water, to attach the tissue to the framework. When covering, make sure that the grain of the tissue is aligned with the long dimension of the part. Cover as large a section as you can without getting excess wrinkling. The wing, for instance, can be covered with three pieces of tissue: a single piece can be used to cover the entire lower surface from tip to tip and a single piece can be used to cover each of the upper wing surfaces from root to tip. Using a small paint brush, put a thin coat of thinned white glue only on the extreme outline of the part to be covered. (In other words, do not put glue on the wing spar or the inner ribs.) It is put on the leading and trailing edges and on the extreme tip rib and the root rib. Lay the tissue carefully on the part and then gently stretch the tissue across the part. It usually works better if you work from the center towards each end. Get the tissue as smooth and wrinkle-free as possible, but don't get it so tight that it warps the structure. When the bottom surface has been covered, set it aside to dry. Then cover one side of the rest of the parts and let dry. After the first side is dry, use a sharp razor blade to trim the tissue to the exact outline of the part. (Wet tissue cannot be trimmed worth a hoot; all it will generally do is rip, tear, or pull loose from the part.)

After the second side is covered and the glue is dry, use a razor blade to trim the tissue about 1/8 of an inch outside of the structure. This is then wrapped around the edges and, using white glue, is cemented to the first layer of covering. Completely covering the edges is not real important with a white airplane, but if the airplane is covered with colored tissue and you don't overlap the paper you get white outlines that you probably didn't want.

When covering the sheeted part of the fuselage, use the same technique. Put the glue only around the extreme outline.

After the model has been completely covered, the tissue should be shrunk tight by lightly wetting it with water. This means just fogging the water on so the tissue is slightly damp. For years I used a Mennen spray deodorant bottle (plastic) to get the fog, but it finally wore out. The best sprayer I've found to replace it is the one that comes with X-14 Instant Mildew Stain Remover. After you've removed the mildew around your shower stall, this sprayer can be filled with water and adjusted to give a very fine fog. Do not spray directly on the part, but rather across the part, about a foot above it. All the heavier, higher speed fog particles will go beyond the part and the light, gentle ones will fall onto your tissue like snowflakes into the Volga. Stand the parts on edge against a bottle or similar support to dry. This will prevent the tissue from attaching itself to a flat surface, and if any of the white glue is dissolved it will minimize the chances of it sticking to something.

Give all the tissue-covered parts a light coat of thin dope after the water has thoroughly dried. After the first coat of dope, make the details for the model and attach them. These include the inlets, the exhausts, and the cabin. Cut and fit the cabin framing. Use model railroad basswood or hard 1/32x1/16 balsa sticks for the frames. Make a dummy tail wheel. It doesn't have to revolve, just has to look right.

The spinner for the propeller can be carved out of balsa, or you can do as I did. I found a blue plastic cap for a ballpoint pen which had the right shape and cut it off to length, then notched it to fit over the prop. No freewheeler is used on this propeller installation. The model is quite capable of doing about a minute, so the drag of a static propeller will help keep from losing the model in a thermal.

The landing gear leg spring simulations are made from soft white plastic sheet taken from a pocket protector. This can be cemented to the wire and

will flex with the wire so that it will last in spite of ground impacts that would destroy a rigid simulation.

Finally, you can add the color trim and registration letters. Unfortunately, type 52 Polaroid film doesn't distinguish very well between blue and white tissue, so the trim shows poorly in the pictures. The registration is PP-ZIP on both sides of the aft fuselage, on the top of the right wing, and bottom of the left wing. There are two blue stripes on the fuselage above the lettering and the wing tips are blue with a thin blue strip inside the tip. Tires, exhausts, the backside of the prop blades, and control surface outlines are black. The front side of the prop blades is silver. The tips of the propeller blades should be red or yellow. The vertical tail has a blue tissue speedbird on each side.

The windshield and cabin windows are made from thin clear plastic. Carefully cut and trim each piece to fit before cementing it in place.

Now cement the horizontal tail in place, then the vertical tail. Make sure they are in exactly the right position. Carefully fit the wing in place and check to see that it has the proper relationship to the tails. It should not lean but should make a symmetrical image when observed from the nose or the tail.

Each wing should be twisted to give about 1/8 inch of washout, measured at the trailing edge of the tip rib relative to the root ribs.

A single loop of 3/32 rubber a foot long was used to test fly the Peanut Impanema and provided adequate power for outdoor flight. The model flies in wide left circles under power and in right circles once the propeller has stopped.

What can you do if your model refuses to fly like the original? The most likely problem is that the airplane is tail heavy. Make sure your model will balance in a level flight position when held by the fingertip at each wing tip in line with CG (center of gravity) arrow on the plan. Ballast it if necessary, using modeling clay or other suitable weight. The next most probable problem is an unwanted warp. Applying a little heat to the surface while twisting it to oppose the warp will help here. Try gliding the model power off. If necessary, remove the propeller and nose block and ballast the nose with modeling clay to replace their weight and adjust the surfaces until you get a straight, smooth glide. Now try the model again. The next most likely problem is a thrust line that needs adjusting, and the most likely required adjustment is downthrust. Put a thin shim of balsa between the nose and the top of the noseblock so the propeller shaft points down a little and prevents a power-on stall. If the glide is good, use thrustline adjustments to get the power pattern you want. •