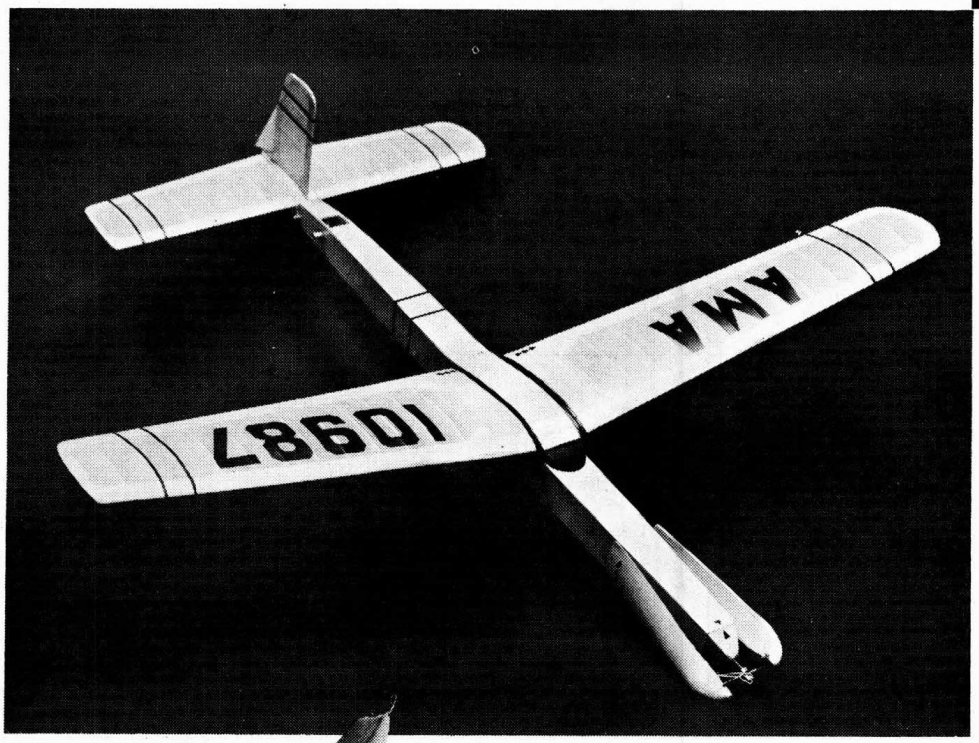
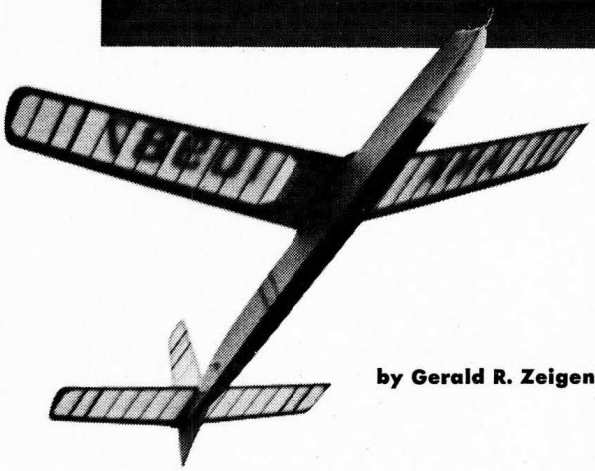
Two years of development went into this fine flying unlimited rubber-powered model. A real contest hound, it's seen two Nats.

DART



Smooth, functional lines show in any good contest ship. Here you have a model that fills the need for contest flying and which packs into a small space for distance meets. Note the simplified prop hub assembly. It is tight and stable. Below: Gerry packs in some 800 turns and then sets the ship loose for high angle climb.



by Gerald R. Zeigenfuse

● About two years ago while experimenting with a 50 gram (about 1¾ oz.) motor in our Wakefield model we were surprised to find that performance hadn't suffered as much as we had thought it would. It then became apparent that a large wad of rubber isn't a prerequisite for high performance. We pondered upon this idea until we learned that the A.M.A. dropped the weight rule for Unlimited rubber. Dart was designed to take advantage of the new rule and also to prove or disprove our theory about the amount of rubber needed for high perform-

ance. We also tried to keep it from looking like the average run-of-the-mill rubber model as much as possible.

We built the model to fly in the 1957 Nats at Willow Grove. It was just full of bugs. Just what one might expect when trying such a radical change from previous designs. We flew it anyway and finished well down on the list. One flight with the nose block in upside down didn't help either. Our model at that time was capable of only 2:50 to 3:00 in still air.

Well, back to the drawing board we went. The model presented here has all the bugs worked out. It possesses a very fast climb and an excellent glide made possible by the light weight and the best propeller-motor combination we have used to date. The all-up weight is 6½ ounces. In still air the model is in the 3:45 to 4:00 class.

Interested? This model is easily constructed by anyone except the rank beginner. Remember that the performance suffers with any increase in weight from that which we have specified. For this reason we have included all the important weights of the stock to be used to insure that your model will be as near a duplicate of ours as possible. The plans are ¼ size and all the important dimensions are given to speed the scaling up process.

WING, STABILIZER & RUDDER: The flying surfaces utilize sparless construction for simplicity. The plug-in wing reduces damage to the wing considerably and is well worth the little extra time spent building it. Begin by selecting a light, firm, straight-grained ⅜" x ¾" strip. Since a ⅜" x ¾" strip is an odd size you may have to strip it from sheet. A 2" wide sheet should weigh about 2 ounces, no more. Shape the leading edge and then taper it from ¾" wide at the root to ½" at the tip. The thickness is automatically reduced proportionately if the leading edge is shaped before tapering. Be sure to make one for the right and the left side.

The trailing edge is ¼" x 1" tapered trailing edge stock cut and tapered as per the leading edge. Notch the leading and trailing edges and then pin them to the plan. Note that the trailing edge is blocked up 1/16". Cut out all the wing ribs from soft 1/16" sheet and cement them in place.

Build the wing tongue boxes into the wing at this time also. They are constructed of three layers of hard 1/16" sheet. The first layer is cemented in with the grain running chordwise, the second, which has the tongue outline cut into it, has the grain running spanwise, and the third layer is cemented in with the grain chordwise. Complete by adding the two top ribs and the 3/16" sheet gussets. After the wing has dried thoroughly, lift it from the board and bevel it in the same manner as you would bevel a hand-launch glider wing. This is to insure that it fits flush against the fuselage.

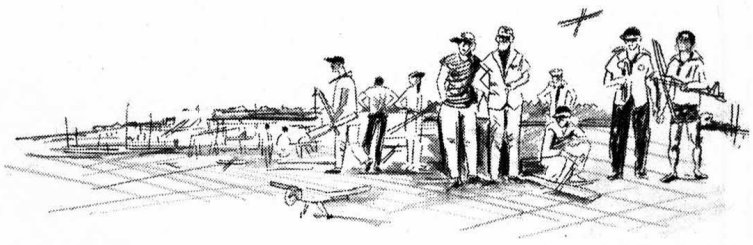
The stabilizer is constructed very similar to the wing. Light weight here is very important so use a soft ¼" x ½" strip for the leading edge and a medium weight 3/16" x ¾" trailing edge. The trailing edge is not blocked up. Don't cut the slot for the rudder until the stabilizer is complete.

The rudder is constructed with a hard ⅛" x ½" outline and 1/16" x ⅛" ribs. Spot cement the movable trim tab in place during construction. It is cut away after covering to install the soft aluminum or tin hinges. The rudder is then cemented to the stabilizer after both have been covered and doped.

Cut out the wing tongue from 1/16" plywood that is free from warps. Cut a notch on the centerline and crack it for dihedral. Pin one wing panel to the board and slide the tongue into it. Then, slide the other wing panel over the tongue and block it up 7½". Fill the notch in the tongue with cement and also cement a small ⅛" sheet brace to the tongue. This will give each wing panel 3¾" dihedral. After covering and doping, the wing will bow ¼" giving each wing panel a total of 4" of dihedral.

FUSELAGE: Begin by cutting the fuselage sides from light, straight grained 1/16" sheet. We recommend that the over-all weight of a 1/16" x 3" x 36" sheet be no more than ⅜ ounce. Mark the upright locations on the sides and then lay them on the board bottom edge to bottom edge with the inside facing up. Brush on contact cement at the upright locations and at the places where 1/16" sheet reinforcing is shown. Then brush contact cement on a 3/32" sq. strip and the 1/16" sheet reinforcing. After waiting the required 15 or 20 minutes place the 1/16" sheet strips and the 3/32" sq. strips on the sides in their respective places. Then, cut the sides apart and trim the excess wood away.

We assembled the fuselage sides by



cementing them together with the widest cross-braces going in first. Be sure the wing tongue is in place before putting in the cross-braces—not cemented in, just in place. After allowing about ½ hour for the cement to set, pull the sides together at the rear and cement. Also, pull the sides together at the nose and cement the 1/8" sheet pieces in place. Add the 1/16" bulkhead at the front of the stab platform. The sides are now bowed and now all that remains is to cut the remaining 3/32" sq. cross-braces to fit and cement them in place. Now, center the wing tongue and cement it. Cement the two 1/8" sheet tongue braces in on top of the tongue.

Plank the top and bottom of the fuselage with 1/32" sheet. Note that the grain on the bottom runs opposite that on the top. A sheet of 1/32" x 3" x 36" should weigh no more than ¼ ounce. Don't forget the thread binding around the nose as it adds a great deal of strength where it is really needed. Cut out from 1/8" sheet the root ribs and cement them in place. The balsa fairing block is carved to shape and cemented in place. Last, add the 1/16" sheet stabilizer platform, the 1/8" sheet subrudder, the celluloid reinforcing for the rear motor hook and the 1/8" dowel for the stab hold down rubber bands.

COVERING: The entire model is covered with Jap tissue. Choose a bright color for visibility. Before covering, brush a coat of clear dope on every part of the airframe that will have the tissue attached to it. Sand the fuzz off and then cover. After water shrinking, brush on two coats of thin clear dope, then one coat of plasticized, thin clear dope. Plasticize the dope by adding a few drops of castor oil to every 4 ounces. Use colored tissue for trim.

PROPELLER AND NOSEBLOCK: Start by obtaining a 1" x 2" medium-weight balsa block and layout as shown on the plan. Cut the block with a jig saw or coping saw and then cement the two halves together. When carving a two blade prop do not finish one blade first and then the other, but complete one step on one blade and repeat it on the other. Rough balancing should also be done after completion of each step. After carving is completed, work the prop over with plenty of sandpaper. Cement a 3/8" x 2" piece of 1/16" plywood to the back of the hub and install a ½" length of 3/32" o.d. tubing into it. Make the hinge next and attach to the prop by binding with thread and cementing well. Do not bind to the center of the hub as yet. After the hinge is installed, cover the prop with tissue and apply several coats of dope, sanding after each coat for a nice finish.

Now, the front end of the 1/16" wire shaft is bent. The shaft is installed and the thread binding is completed on the hub. Balance the prop by adding dope to the lightest blade. Now, cut the blades so that they are free to fold

The nose block is carved from a 1" x 1¼" x 1½" block. The plug which fits into the fuselage is laminated from 1/8" sheet and 1/16" plywood and cemented to the nose block. The nose block should be a snug fit inside the fuselage. Drill a 1/8" diameter hole through the nose block and insert the bushing. It is made by slipping a 3/32" o.d. tubing into a 1/8" o.d. tubing and then inserting it into the nose block. We prefer this type of bushing over a single piece of 3/32" o.d. tubing because the smaller diameter tubing will cut into the sides of the nose block when subjected to any kind of punishment. Add the aluminum or tin thrust bearing. Slip the tensioner spring over the shaft along with a short (3/16") length of tubing and the ball bearing washer, and insert into the nose block and bend the loop at the rear. Slip fuel line tubing around the loop to prevent the shaft from cutting the rubber motor. Bend the loop as close to the back of the nose block as possible. If you don't, you will have to back the wood screw out too far to engage the stop on the shaft. The wood screw will work loose in short order and come out. Position the screw so that the blades will fold flat against the fuselage sides. A small rubber band is used to pull the lower blade up into place .

FINAL ASSEMBLY: Assemble the plane and check for alignment. If the wings are a loose fit on the tongue, simply build up the tongue with layers of tissue. The wings are held on only by friction between the tongue and the inside of the tongue box. Place small shims on the side of the stabilizer platform should the stabilizer not line up with the wing when viewed from the front. Also add the small keys to the stabilizer. Remove all warps, if any, by steaming. Be sure that there is a warp in the right wing panel as shown on the front view.

Make up the motor at this time and lube it with a 50/50 mixture of green soap and glycerin. We use 12 strands of ¼" Pirelli 34" long. The equivalent in T-56 being 15 strands of ¼", we reduce to 3/16" and make up a 20-strand motor 34" long. These motors will take 24 turns per inch or 816 turns maximum after break-in. To break a motor in wind it 25%, 40%, 60%, 80%, and then 90% of the maximum winds allowing a rest period when exceeding 50% winds. If you don't the motor will tear apart fast. Also, we have found that after three flights wound to maximum turns the motor is finished. Because of this, carry a couple spares when flying at a contest and switch motors between flights.

FLYING: Install the motor in the plane and adjust the wood screw on the noseblock so that the prop will stop with approximately 30 to 40 turn left in the motor. Then, balance the plane and add weight to the nose or tail if needed.

Test glide the plane now and strive for a fairly fast, flat glide with a circle of about 75-100 ft. diameter to the right. Probably the only adjustment needed is to offset the trim tab to the right about ½". Correct any stalling tendency by shimming up the leading edge of the stabilizer and shim up the trailing edge should you encounter a diving tendency. Once you are satisfied with the glide start powered flight with about 75-100 hand winds.

Increase the winds each flight and carefully observe the flight pattern. The plane should climb in right-hand circles. If the plane stalls, add downthrust until it is corrected. If you have already added 1/16" downthrust and the plane still stalls, then add some right thrust. Our model needed 1/32" downthrust and 1/32" right thrust. If your plane turns too tightly to the right a little left thrust is in order. As you approach maximum turns your plane will leap out of your hand and go into a steep right-hand spiral, which gradually opens up as the power diminishes and the plane makes its transition into the glide circle.

Keep checking the glide as sometimes a stalling tendency won't show up until the plane has been gliding for some time. Correct this by tightening the glide circle or shimming the leading edge of the stabilizer. This will affect your power adjustments slightly so make a few low powered test flights before opening her up again. Remember to use only the rudder for glide turn and thrust adjustments for power turn. Take your time when adjusting and think before making that next adjustment. Make several flights on each adjustment to be sure that it is the one you want.