

# TBM-3U

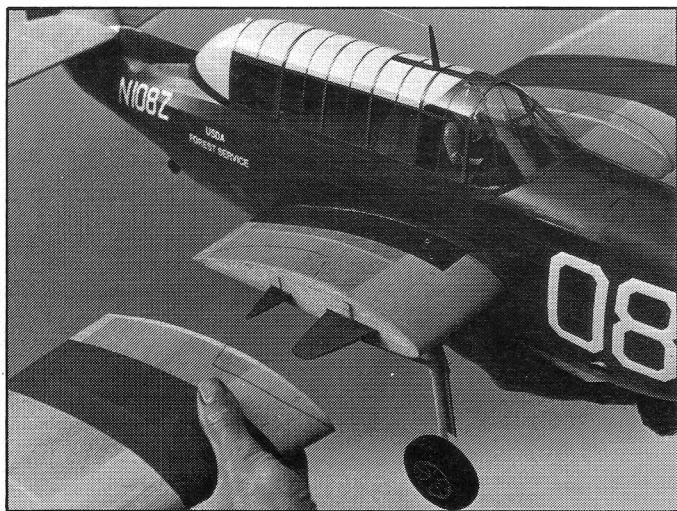
## AERIAL TANKER

This 3/4-inch Jumbo Scale for rubber power has a lot of character; should satisfy anyone's urge for something different.

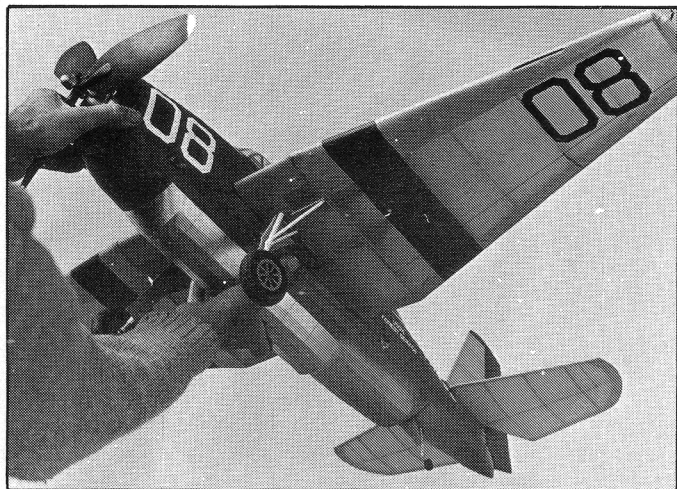
By Bill Noonan **Scanning by Hlsat**

### TBM-3U

**TYPE:** FF Jumbo Rubber Scale  
**WINGSPAN:** 40 1/2 inches  
**WING AREA:** 275 square inches  
**LENGTH:** 30 1/2 inches



Plug-in wing feature for transportation and protection.



The Aerial Tanker's underwing is its most distinctive angle.

• A lot of factors come into play when one is contemplating a subject for rubber scale. Is it well proportioned so as to have a reasonable chance to fly well? Does it have character and color? Is it unusual? We think that the TBM aerial tanker conversion pretty well answers these questions.

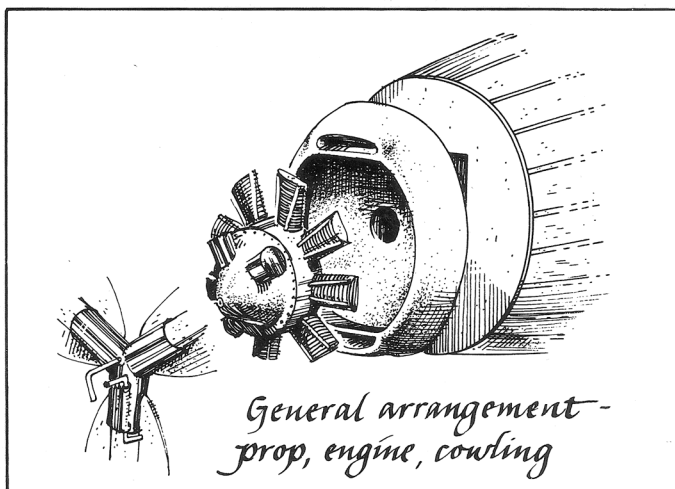
The design was originated by Grumman in the late 1930s to meet the Navy's demand for a torpedo bomber to replace the aging Douglas TBDs, which were rapidly becoming outmoded. Designated the TBF-1, the new weapon made its first flight in August 1941; the second prototype flew 13 days after Pearl Harbor.

The war imposed accelerated production demands, and General Motors, temporarily out of the passenger car business, was to become Eastern Aircraft and shared in the manufacture of the "Avenger," as it was to be known. The Eastern-produced aircraft were designated TBMs, and differed from the Grumman only in small details. A total of 5,173 TBF-TBM aircraft of various models were built.

The Avenger distinguished itself in combat in both the Atlantic and the Pacific. Not sleek, it nevertheless was a robust and



Stunning in its colorful paint scheme, TBM-3U performs well.



The addition of about 10% household ammonia to the water seems to make it easier to bend the wood without it breaking. Rinse the soaked pieces in running water before applying white glue between laminations (the glue will roll up into funny little balls if you don't).

Draw the first piece of  $\frac{1}{16}$ " square around the cardboard form, pinning it temporarily. Follow up with the other two courses, using pins as necessary around the perimeter to hold all three courses in compression against the form. Scarf the ends of the balsa where they meet. Try to avoid having the ends meet in the same proximity on the three courses. Follow this procedure on all formers except number 10, which is cut from sheet. Leave the layups to dry overnight.

Mark off stringer locations on former number 4. Do not notch. When everything is dry, unpin the cardboard forms, with the formers still attached.

You will now need the "skewer." This is a temporary alignment jig that allows you to slip the forms and formers in their correct sequence and alignment prior to applying the stringers. The skewer may be made of straight-grained wood about  $1\frac{1}{4}$ " x  $\frac{1}{4}$ " and 5" longer than the fuselage. Taper the skewer about  $\frac{1}{4}$ " to make removal easier. Before slipping the formers in place,

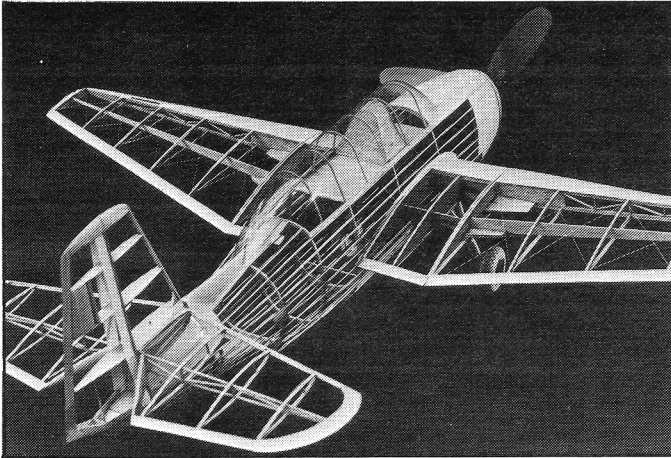
mark the stations from the reference on the side view of the model on the plans. Number each station.

Slip on the formers (still on the cardboard forms) in the correct sequence. They should fit snugly on the skewer, but not tightly. Make any adjustments necessary to assure correct alignment. Former number 10 pins to the end of the skewer.

Lay straight-grained  $\frac{1}{16}$ " square balsa stringers along the former edges, using the marks on former 4 as the basic reference. For each left-hand stringer, apply a corresponding right-hand one. Cyanoacrylate glue works to good advantage in this operation. Sight down the fuselage every once in a while to check stringer fidelity; they should be straight and parallel. Three top stringers pass through the cockpit area between formers 4 and 7. Remove these after all stringers are in place. A  $\frac{1}{8}$ " x  $\frac{1}{16}$ " doubler is cemented in place on top of the beltline stringers that separate the cockpit glazing from the sheet metal.

Carefully remove the skewer from the fuselage by withdrawing it through former 1. Reach into the framework and poke out the cardboard forms. If you waxed them adequately, they should drop out easily, sliding between the stringers. If you didn't wax the forms, well . . .

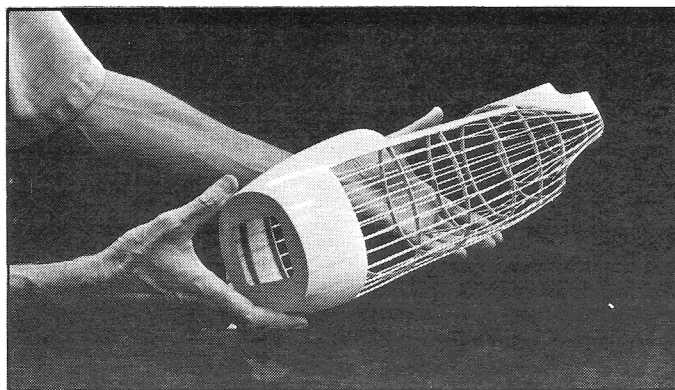




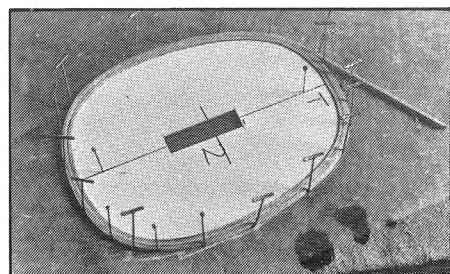
There is nothing quite as beautiful as well-designed framework.



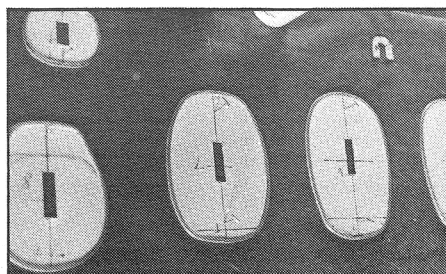
Structure is light and strong; ship convertible to small R/C.



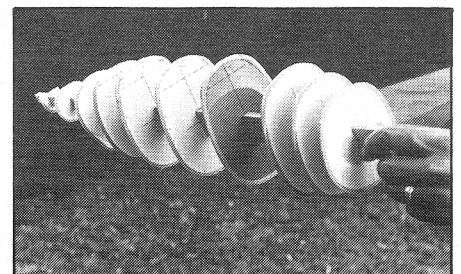
Framework after skewer and cardboard forms removed.



Method for laying up fuselage formers is shown in this view; note slots for skewer.



Formers are simply cardboard rimmed with balsa strips in the fashion shown.



Skewer is the foundation for fuselage construction; formers and skewer don't fly.

reliable airplane. It served in various military capacities until the mid-1950s; some U.S. Marine squadrons operated TBM-3Es (radar version) in Korea. Ironically, the Japanese, who bore the brunt of the Avenger's firepower during WW II, were supplied with TBMs as part of their Maritime Self-Defense Force in 1955. These were TBM-3S-2s, for anti-submarine work. How strange to see such a familiar silhouette bearing the rising sun insignia!

But the venerable TBM had still another, albeit less conspicuous, role. It was "beat into a plowshare" and, rather than being used to destroy, was pressed into service to save lives and property. In 1956 the U.S. Forestry Service purchased eight TBMs from Navy surplus and modified the torpedo bay to accommodate 600-gallon liquid fire retardant tanks. This was the start of a long and successful war on forest fires. Soon private entrepreneurs formed companies to deal with fighting forest fires with airplanes, and TBMs became the backbone of their fleets. Sixty-six Avengers were still on register in 1969, in the service of fire fighting.

Our model reproduces a TBM-3U, a surplus Navy utility version. The full-size aircraft was given the registration number of N-108-Z, and performed water-drop tests out of Edwards AFB between July and September of 1961, making 23 flights to evaluate flight techniques. Test reports indicate that procedures used in dropping a 600-gallon chemical solution were distinctly different from those for dropping a 1500-pound torpedo. But that's another story in itself. The tests did conclude that the TBM was suited for the task, but that methodology had to be altered to lessen risk. N-108-Z went on to prove itself in actual application. Just what its final fate was, however, is lost in the archives.

Our model, 3/4" scale, easily qualifies for Jumbo rubber scale events. With minor modifications, it would make an excellent R/C subject, as the corpulent fuselage offers plenty of space for receiver and servos. It is not a beginner's model. But for those who like a challenge, and something out of the ordinary, it provides a very rewarding subject. The color scheme alone—blue fuselage, yellow wings and tail, and red rudder—is enough to win over those looking for an attention-getter.

**FUSELAGE CONSTRUCTION.** To achieve the greatest strength-to-weight ratio, it's necessary to build the fuselage in a rather unorthodox way.

Trace nine former patterns, shown on the plans, on 1/16" (or thicker) cardboard. Cut these carefully, maintaining the symmetry of the forms. Cut the "skewer" slot in each. We will explain its use later. Former number 10, shown actual size on the plans, is cut from 1/16" sheet balsa. Wax the edges of the cardboard forms liberally with a candle or child's crayon. This will facilitate removal of laminated formers later. Pin the forms to the workbench over plastic wrap or waxed paper. Leave at least 5" of work space around each.

Cut about a dozen pieces of 1/16" square straight-grained balsa about 18" long and soak these in hot water for about a half hour.

Fill in between the stringers in the nose (cowl) area with soft  $\frac{1}{16}$ " sheet balsa. This applies also to the area immediately in front of the cockpit. Finish off by sanding to correct fuselage shape.

Cut the dorsal fin from medium-soft  $\frac{3}{16}$ " sheet balsa. This part forms a support for the  $\frac{1}{32}$ " sheet "saddle" on which the stabilizer sits, held in place with rubber bands. Be sure the saddle conforms to the bottom airfoil shape of the stab. Cement the dorsal fin in place and add the  $\frac{1}{32}$ " sheet fillets on either side. This is a tricky fillet, and requires a little fiddling around to get a good fit. It's a good idea to make a cardstock pattern to test the fit, before cutting balsa. Soak the  $\frac{1}{32}$ " fillets in hot water prior to cementing them in place. It will be necessary to hold them with clamps or clothespins while the glue dries. It also may be necessary to use some fillet putty to complete the job, but try to use it sparingly, as it adds weight, something we are trying to avoid. Add the tail cone of soft block balsa. Add stiff paper leading and trailing portions of the chemical bay, on the underside of the fuselage. What was formerly a gun position is carved balsa block.

The cowl is built up of three pieces of medium  $\frac{1}{4}$ " sheet balsa, the grain of each running at  $90^\circ$  to the other. Simulate engine cylinders (9) by wrapping the thread around balsa dowel. These are cut into half-round parts and painted black. Cut the crankcase portion from hard balsa block. Drill a thrust bushing hole to accept  $\frac{1}{16}$ " i.d. brass tubing; the hole should incorporate about 2 degrees of right off-thrust, and about the same down-thrust. Cement the crankcase/cylinder assembly to a hard balsa backplate, which in turn is cemented to the last ring lamination of the cowl. Add the two magneto covers, pushrods, and ignition harness. The crankcase is painted gray.

The nose section of the fuselage is reinforced by cementing a  $\frac{1}{64}$ " ply facing over former number 1. This should have a square aperture cut in it to receive the balsa indexing plug that is cemented to the rear of the motor section.

The overturn structure, immediately behind the pilot's cockpit, is made from two  $\frac{1}{16}$ " sheet formers (4A) covered with  $\frac{1}{32}$ " sheet. Cut a hole in the top to accept the antenna mast.

The forward and aft portions of the greenhouse are vacuum-formed .015" acetate, drawn over a pine form. The center part of the greenhouse is regular acetate bent over the laminated frames. The top of the canopy and the teardrop aft section are opaque white. Canopy frames are made of laminated basswood.

The wing center-section is built integrally with the fuselage. Prepare the front and rear spar joiners from the patterns shown on the plans. Cut away stringers where the two spars pass through the fuselage. At this point it will facilitate things if you bend the main landing gear struts from .045" wire and epoxy them to the front of the front spar joiner. This is one continuous piece of wire that passes through the fuselage along with the spar.

Glue the spar joiners in place. The back one cements to the front of former number 5; the front one will have to be temporarily supported until leading and trailing edges and ribs are cemented in place. Be sure to incorporate positive incidence as shown. Fabricate wing "tongues" and cement these in place. Add  $\frac{1}{32}$ " x  $\frac{3}{32}$ " capstrips top and bottom. Cement in a short piece of hard  $\frac{1}{8}$ " x  $\frac{1}{4}$ " balsa between the spars for the landing gear brace to cement to. Add the  $\frac{1}{32}$ " sheet filler pieces between the stringers, following the airfoil contour at the wing root. These provide a surface for tissue to attach to when you cover the fuselage.

The landing gear legs are brought up to scale appearance with plastic soda straws, slit and slipped over the wire. It will be necessary to plug the ends with scrap balsa dowels. The "collars" shown at two places on the strut tubing may be made of heat-shrink tubing, slightly larger than the straws. Apply heat with a small soldering

You may want to incorporate a free-wheeling prop hook to finish the nose assembly. The bulb-like hub nose is just that—a rubber bulb cut from an old eyedropper and painted silver.

**WING CONSTRUCTION.** The wing panel construction is simple, but results in a very light, strong unit.

The leading edge is actually a closed, tapered tube, built around the built-up truss spar on which the rib noses have been cemented.

Select tangent-cut (A-grain)  $\frac{1}{32}$ " balsa, we have used with good results for some time. The three-part hub is from  $\frac{3}{8}$ " diameter brass tubing, cut and soldered. Drill the center to accept the  $\frac{1}{16}$ " i.d. brass bushing for the prop shaft. The blades are made by cutting two pieces of  $\frac{1}{64}$ " plywood in the shape shown on the front view of the plans, and laying the cemented pieces over a wooden pitch block. I have about three of these blocks handy for laying up blades anywhere from 3" to 7" in length. These blocks provide a helical twist, which typically starts off at the hub end at about  $70^\circ$  (measured from a flat reference surface) and winds up at about  $10^\circ$  at the tip; the midpoint of the blade should be about  $45^\circ$ . A slight crown is carved into the block to provide undercamber in the finished blade. Bind the cemented blade to the block with old rubber motor and allow it to dry overnight. Make three identical blades in this manner.

Sand to airfoil contour. Cut 2" pieces of  $\frac{3}{8}$ " birch dowel and cut  $\frac{1}{32}$ " slots to receive the blades. After cementing in the blades, give the blades two coats of sanding sealer and paint them flat black, with yellow tips. Insert the blade dowels into the brass hub. Each blade should have its center set at about  $45^\circ$ . Drill small-diameter holes in each part of the hub that holds a blade; these allow insertion of a locking pin once the pitch is set.

This type of propeller has two major advantages, in my view. You can experiment with pitch change for optimum performance, and you can easily replace broken blades. While not as attractive as a well-carved prop, it is quite practical. You may

improve the efficiency of the blade by covering the back with light silk, attached at the edges only, water-shrunk and doped. This provides an airfoil not unlike a Clark Y.

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**WING CONSTRUCTION.** The wing panel construction is simple, but results in a very light, strong unit.

The leading edge is actually a closed, tapered tube, built around the built-up truss spar on which the rib noses have been cemented.

Select tangent-cut (A-grain)  $\frac{1}{32}$ " balsa, free of any graining peculiarities, to wrap around the rib noses. Cement the  $\frac{1}{32}$ " along the spar top, spray the convex (outer) side with water, and carefully draw the wood around the ribs, applying cyanoacrylate glue as you go. Finish the process by cementing the sheet along the spar bottom. Trim off excess.

The portions of the ribs behind the front spar may be made by laminating two pieces of  $\frac{1}{16}$ " square balsa around an airfoil form (much as was done with the formers), or slicing from  $\frac{1}{16}$ " sheet balsa. Note that end ribs (A) are cut entirely from hard  $\frac{1}{16}$ " sheet.

Lay the finished leading edge "tube" in place over the wing plan. Pin the lower component of the trailing edge in place. This is  $\frac{1}{32}$ " x  $\frac{1}{2}$ " balsa. Cement the  $\frac{1}{16}$ " x  $\frac{1}{8}$ " rib bottoms in place, the trailing edge portion coming to a point where it cements on top of the trailing edge. Cement the rib tops in place, being sure there is a smooth transition where the trailing part indexes with the angled part of the lower rib.

Carefully slip  $\frac{1}{16}$ " sheet tapered rear spar in place, starting at rib C (solid rib A is cemented in place later). You may have to make a few alterations to make the spar contact all ribs, but this is important, as it contributes to the structural integrity of the wing. Apply cyanoacrylate glue to all joints.

Build the "pockets" as shown to receive the tongues that protrude from the wing stubs. These provide a means of removing the wings, and also absorb shock in the event of contact with a fixed object (the ground?). Top and bottom parts are  $\frac{1}{64}$ " plywood; the separations are  $\frac{3}{16}$ " x  $\frac{1}{32}$ " balsa. Before making permanent installation in the wing panels, be sure the pockets fit properly on the tongues. Slip the pocket units in place in the slots provided in the root ends of the spars, and apply glue. Cement the balance of rib A in place, having slotted this to fit over the pocket ends. Finish the trailing edge by adding the top part  $\frac{1}{32}$ " x  $\frac{1}{2}$ " balsa, cemented along the entire seam. Cement  $\frac{1}{32}$ " x  $\frac{3}{32}$ " capstrips on all ribs, top and bottom; these about the sheet balsa at leading and trailing edges.

Finish the wing with the addition of soft balsa block tips, cut and sanded to contour. Note the wash-out on the side view of the plans. This is very important, so be sure to check panels carefully during construction and covering. The transition of the airfoil from flat-bottom at the root to a more symmetrical shape at the tip should make wash-out almost automatic. Although we have omitted showing the bracing thread on the plans for reasons of clarity, you may want to incorporate this feature, and it may be made of unwaxed silk dental floss. It contributes a lot to the rigidity of the panel and probably weighs less than a gram. Add hooks on the underside of the wing to allow rubber-band retainers to hold the panels snugly against the wing stubs. Add the pitot tube, carved from hardwood, to the port wing tip.

**TAIL SURFACES.** The stabilizer spar is built up of  $\frac{1}{16}$ " square balsa just like the main wing spar. The "ribs" are actually pieces of straight-grained  $\frac{1}{20}$ " x  $\frac{3}{32}$ " balsa bent over the spar into a symmetrical section, cemented to leading and trailing edges. It isn't as difficult as it sounds, but care must be exercised when bending to avoid snapping the balsa. It is necessary to slip in  $\frac{1}{16}$ " square upright pieces here and there to maintain a nice, streamlined section. Center-section ribs are cut from  $\frac{1}{16}$ " sheet balsa. These are covered with  $\frac{1}{32}$ " sheet balsa, top and bottom. Tips are cut from soft  $\frac{3}{16}$ " sheet balsa, faired and sanded to conform to the airfoil. In order to conserve weight, we made the angled root portions of the "elevators," adjacent to the rudder, by bending  $\frac{1}{32}$ " sheet into sort of a hollow half-cone (see typical cross-section on plans). You may prefer to make these parts from sheet balsa.

The rudder utilizes  $\frac{1}{16}$ " sheet ribs bracketed by two pieces of  $\frac{3}{32}$ " square balsa coming to an apex to form the spar. A solid balsa tip, sanded to airfoil section, finishes off the top. The entire unit is quite thick in cross-section, as you can see. We used the wrapped  $\frac{1}{32}$ " sheet technique to complete the bottom. Spraying the convex side with water assists in forming the bend. Add a tab as shown; this can be cut free if needed during the test period.

The rudder/fin unit is cemented to the stabilizer, the tail becoming a removable component. It is held in place with rubber bands, stretched between hooks in the fuselage and stab underside. These hold the stabilizer snugly against the "saddle" provided on the fuselage. Incidence change is easily made during the test period by insertion of balsa shims.

**FINISHING.** The fuselage of N-108-Z is dark blue. The wings, stabilizer and fin are chrome yellow. The wings have insignia red bands running chordwise as shown on the plans. The rudder is also red. The top of the greenhouse has a white-painted "sunshade," terminating at the teardrop after end.

The fuselage of our model was covered with white tissue (Peck-Polymers), given two coats of diluted and plasticized clear nitrate dope, then sprayed with sign-writer's transparent lacquer. The stuff we used was "Lacryl," which may be diluted considerably (3 to 1) yet still retains good, intense color and pigmentation. The wings were covered with pre-war (!) Japanese tissue from John Oldenkamp's secret supply. This may *sound* exciting, but I find very little difference between it and the stuff currently available, except that it has very good color intensity.

The numerals and lettering on our model were made from hand-lettered and typeset copy converted to pressure-sensitive transfers by a 3-M process called "i.n.t.," and available through better-

stocked graphic arts supply houses. It's not cheap, so you may be satisfied by just using conventional methods of cutting white bond paper, or black tissue, in the case of the wing numerals.

The ailerons, elevator separation, wing-fold breaks, wheel-well outlines, and cowling separations are made with ink lines or  $\frac{1}{64}$ " flat-black chart tape.

**FLYING.** Eight strands of  $\frac{1}{4}$ " Sig rubber 40' long was used to power our model. The use of a protective winding tube is advised if you intend to pack in maximum turns.

Tests should be conducted over nice soft grass, if you have access to such a luxury. We had to do a little thrust adjustment (down), and add about an ounce of lead to the nose, to achieve acceptable performance. The first couple of flights utilized about 100 to 200 turns, sufficient to observe the model's behavior. It is quite stable once the balance and thrust are correctly established.

We originally incorporated scale dihedral, but increased it after about six flights. The model, with the relatively low aspect ratio wing, and short tail moment, is sensitive to wind gusts. The increased dihedral, as shown on the plans, gives an additional margin of safety.

The TBM Aerial Tanker is an interesting project, and results in a model with a lot of character. The general configuration makes it a rugged airplane, able to take a lot of punishment. Good luck! ■