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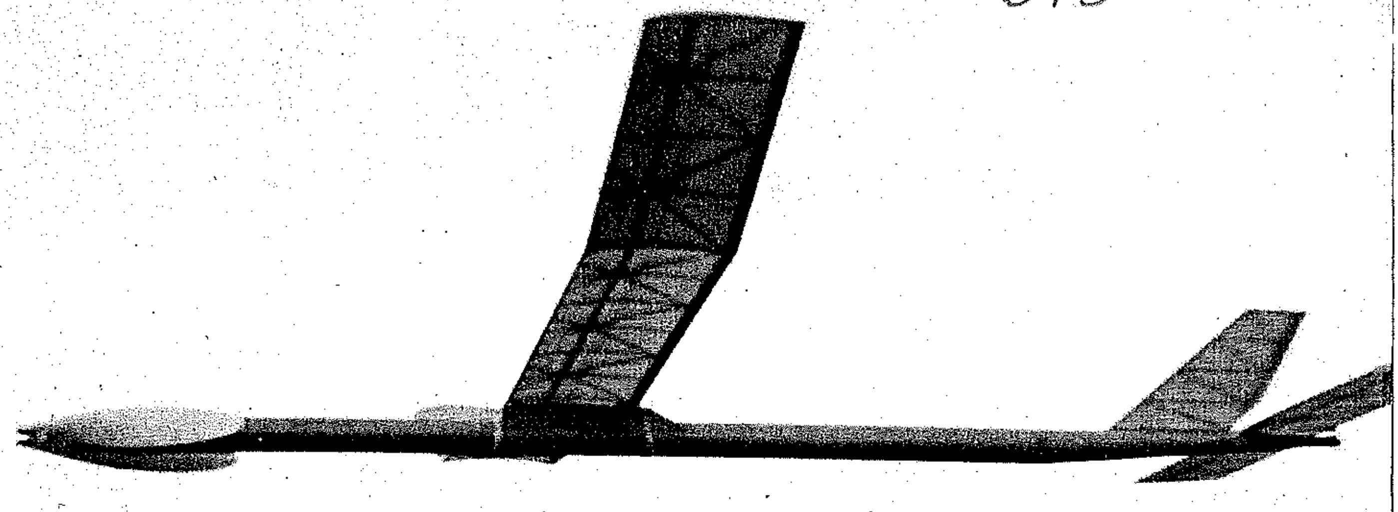


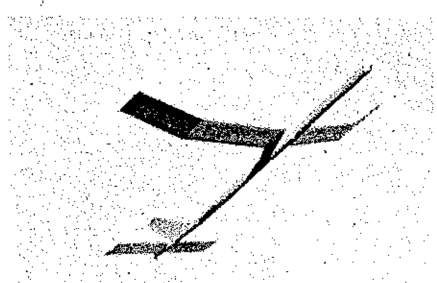
TUBESTAKE OMT

This design was around and doing well when the category it was flown in was known as Unlimited Rubber. This latest version for Mulvihill Rubber finds itself frequently in the winner's circle. ■Design by Jim O'Reilly ■Text and Photos by Larry Kruse

WHETHER YOU'RE BETTING money, marbles, or chalk, blood lines count if you're looking for a winner. Jim O'Reilly's Tubestake OMT can trace its lineage back more than a decade to what was then a Category II "Unlimited" design literally flown by the entire O'Reilly family.

The design evolved from the original 245 sq. in. Tubestake published in *Flying Models* in 1975 through a geodetic 300 sq. in. version with improved torsional strength (in a 1979 *Flying Models*) to the model presented here. The TS OMT has increased wingspan, warp-resistant Union Jack construction, and a new carved prop featuring less blade area but improved blade angle distribution.

The plane now carries 250 sq. in. of wing area aloft with a nominal airframe weight of 4.22 oz., powered by strands of 1/4-in. rubber from FAI Model Supplies. High placings in Nationals competition in the late 1970s, right on up to the present, point to the design's continued refinement and success.



Top: In its glide path the Tubestake is practically level with the horizon. Properly trimmed, the model will make one complete glide circle every 20 to 25 seconds. It has good airspeed *and* a very low sink rate. Above: Jim O'Reilly sends the Tubestake aloft on another flight. It has a steep spiral climb to the right. When the prop folds, it goes into a right glide turn without a bobble.

Fuselage construction. The Tubestake OMT, like its predecessors, employs a rolled sheet balsa motor tube. Use an adequately wide unspliced sheet of 1/16 balsa if possible, cut precisely to 4 x 36 in—with all edges vertical and all corners square.

Coat one side of the fuselage blank with three or four heavy coats of full-strength clear dope. After the dope dries, wet the opposite side of the blank with water. It will immediately begin to curl and then can be wrapped around a form (such as a piece of pipe or an old fluorescent light tube) and taped in place until it dries.

After the blank is completely dry (at least 24 hours), remove it from the form and carefully squeeze the edges together to a cylindrical shape. Beginning at one end of the blank and moving to the other, use Super Jet to glue the seam. The best technique is to squeeze an inch or so of the seam together at a time, apply Super Jet sparingly, let it set up, and then move to the next inch. Go at it slowly, and you will be rewarded with a nearly perfect cylinder. Should it be slightly out of round, the ply reinforcing rings and the nose plug will help round it out nicely. Form the two 1/32 ply rings in the same manner as the motor tube, and insert them as shown on the plans.

The motor tube should then be covered with a single layer of fiberglass cloth (.60 to .75 oz. per sq. yard) overlapped by about a half inch. Sand the tube carefully to remove all bumps and excessive resin, and cover the fiberglass with a layer of tissue for the sake of appearance.

The tail boom blank is wrapped around a

tapered form in the same manner as the motor tube blank, and the seam is similarly glued. After the boom is formed, it can be covered with a single layer of tissue. Predope the boom prior to covering. Attach the tissue with dope along one edge, wrap it around the boom, and attach the other edge. Dope down a strip approximately ½-in. wide at either end of the boom, and water-shrink it. After the tissue dries, stick it down all over by brushing on thinner to soak through and soften the dope underneath. Add a couple coats of dope for good measure.

Construct the wing mount as shown on the plans. It can be custom-fitted to the fuselage by wrapping a strip of fine sandpaper around the motor tube and sanding away. The tube becomes sort of a rasp to round out the bottom of the wing mount. When the fit is perfect, cover the mount with tissue, dope it, and set it aside until later.

Flying surfaces. Stack-saw the ribs for both the wing and stabilizer from the required thicknesses of wood. Pin down the leading edge (LE) and trailing edge (TE) of the wing, packing up the front of the TE to conform to the undercamber of the airfoil. Glue in only the non-diagonal ribs and the upper spar cap at this time. Omit the ribs at the dihedral and polyhedral joints and the turbulator stringers for now. Remove the wing from the building board, and add the lower spar cap.

Re-pin the wing panels, being careful to shim in the needed 3/16-in. washout in each wing tip. Install all diagonal ribs except those immediately adjacent to the dihedral and polyhedral joints. These, along with the top stringers, should be glued in place after the dihedral and polyhedral joints are locked in at their respective angles.

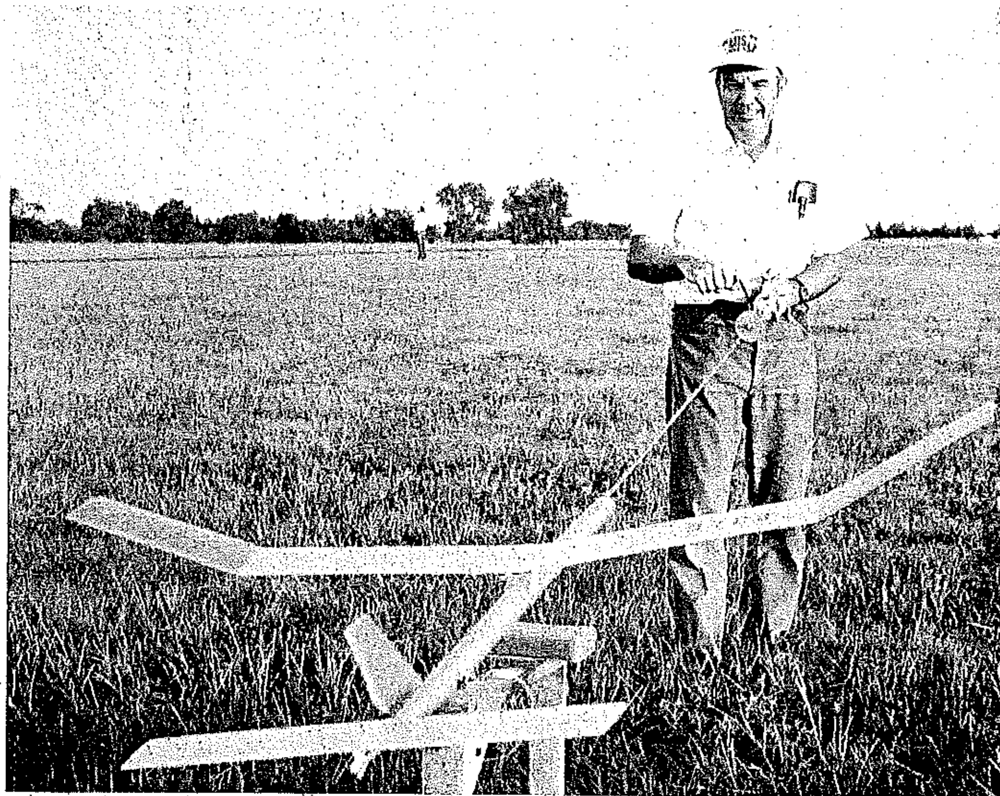
While the dihedral view is shown on the plan as per tradition, the dihedral and polyhedral gussets actually set the needed angles without all of the usual propping up and measuring. The three gussets, cut according to the plan, are slipped between the spars. At the center joint, it will be necessary to cut out the rib sections between the spar caps to allow passage of the ⅛-in. ply gusset. Each joint should be test-fitted and trimmed as needed until everything fits as close to perfect as possible.

Shear webs of vertical-grain ⅛-in. balsa should be set in between the spar caps of the main (center) panels. Outboard of each polyhedral gusset, a single 1/16-in. vertical shear web will add sufficient flex resistance to the tip panels.

The stabilizer is built essentially the same as the wing and in the same sequential steps—except without dihedral and without the shear webs. The fin construction is self-explanatory.

When completed, all of the flying surfaces should be carefully sanded and prepared for covering. Japanese tissue is the preferred covering material. If tissue with strong shrinking tendencies (such as from Peck-Polymers) is used, be very careful in the shrinking process—particularly with the fin and stabilizer. The best shrinking results can be had by using rubbing alcohol (isopropyl) misted onto the surfaces with an atomizer (rather than water). As a precautionary measure, it is well to wait until the fin is glued to the tail boom before the fin covering is shrunk.

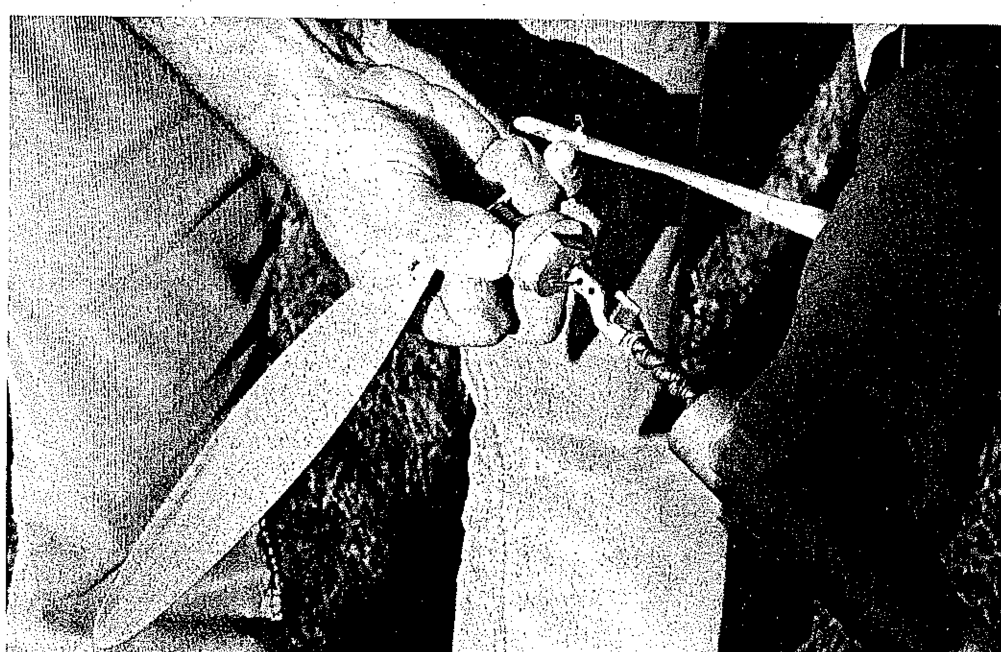
After the fin is glued in place, install the 1/16 ply stab platform, aligning it in relation to the fin. Even though the stab will require some tilt for the glide circle, you're probably better off to line up the stab mount perpendicular to the fin; pack up the stab as needed later in the flight trimming process.



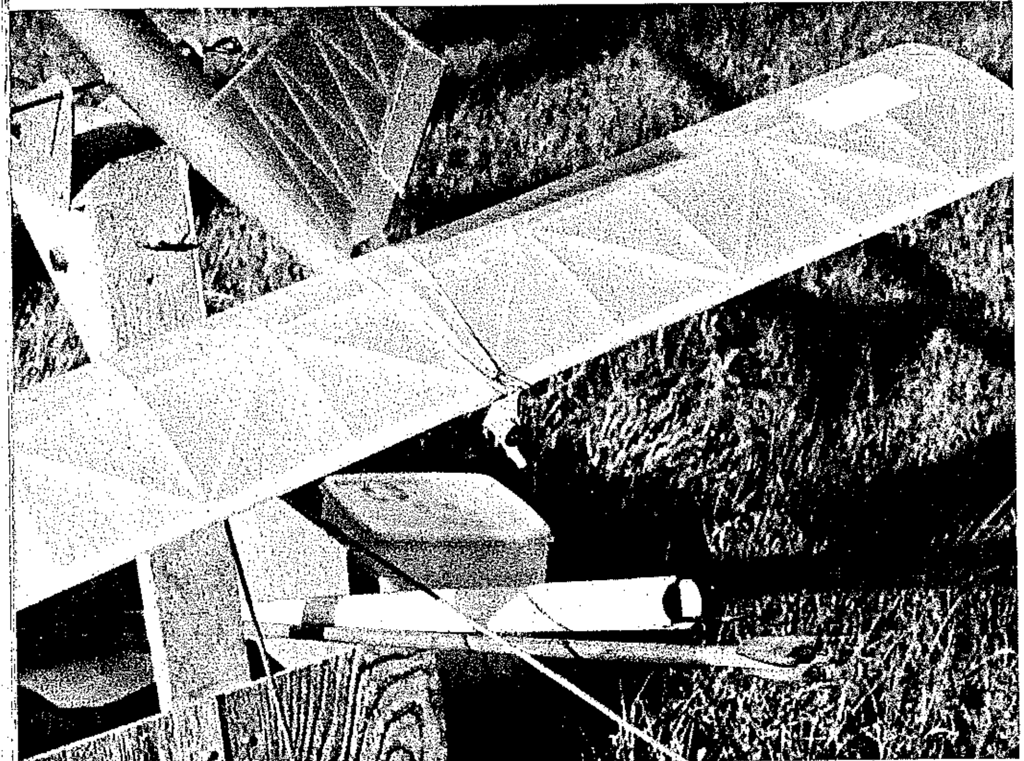
Jim begins cranking in the turns with his model held by a stooge. No winding tube or winding rod is used because the fiberglass-wrapped motor tube is strong enough to take a blown rubber motor without damage. It's handy to not have to bother with these contraptions.

Carving the prop. The propeller is the very soul of the TS OMT, incorporating Eugene Larrabee's ideas on blade angle and area distribution but with less total blade area. The intent is to improve overall propeller efficiency. Although the idea of carving and assembling a prop is a weighty one for the average modeler, it can be handled quite methodically with the following sequence.

Blades. Saw two identical blanks from the same ¾-in. medium balsa stock so that their weight and density are as close to identical as possible. Mark the edges of the blanks as indicated with the dimensions shown on the plan, measuring carefully



Nose plug is pulled out to display the prop shaft and sheet aluminum winding hook. Note the small rubberband just behind the winding hook which keeps all 12 motor strands together.



Dethermalizer setup is very simple and reliable. It uses just one hook for both the popping up and holding down. The aluminum snuffer tube is flared for easy insertion of the fuse.

back from the surface you have selected as the front face of each blank. Draw a smooth curved line through the series of points as shown on the small isometric view on the plan, and carve away the back side of each blank down to the line you have drawn. Carve in the slight undercamber shown, and sand the back of the blade to the final contour. The front face of the blade can now be carved to the airfoil section on the plan. Final-sand each blade in preparation for doping. Use enough coats of dope to cause the blades to have a definite sheen.

Hub and shaft. The hub and shaft wires are bent from 1/16 music wire. Omit the final 90° bend in the prop shaft until after it is inserted into the 1/16-in. I.D. FAI shaft bushing, thrust washer, and tension spring. Bend the wire hub as closely as possible to the pattern on the plan. Twist in freehanded the torsional "droop" in the hub ends as per the end view.

Jig. Construct the prop jig as detailed on the plan. It is all glued together except for the two jig blocks at the hinge area which are interchangeable. One is for drilling the hinge hole in the blades; the other is for checking the hub angle.

The jig blocks are made from a single piece of 1 x 2-in. pine or fir drilled with a 3/32 bit set precisely at 15°. Once drilled, the block can be sawed apart carefully along the 74.1° line. The 3/32 guide hole in the blocks will be bushed as needed by a removable piece of K&S 3/32-in. O.D. brass tubing.

As shown on the jig fixture drawing, the two blade support blocks are both chamfered so that only the knife edge of each block touches the blade. The block cut at 34.75° and located at section A-A is chamfered on one edge. The block located at the hinge area should be chamfered on both edges so that it touches the blade only along the center of the block.

Drilling the hinge angle. Place the blade on the prop jig with the drill block screwed into place. Using the 3/32-in. guide hole, pass the drill bit from the back side of the jig block through the blade. Insert a 7/16-in. piece of 3/32-in. O.D. aluminum tubing into the hole drilled in the blade. Place the 3/32-in. O.D. brass tubing in the guide hole of the jig block, and run a 1/16-in. piece of music wire through it and the aluminum tube in the prop blade. Work everything around until the blade lies flat on the prop jig with the aluminum tubing in position. Carefully apply a single drop of cyanoacrylate (CyA) to the aluminum tubing to lock it in place.

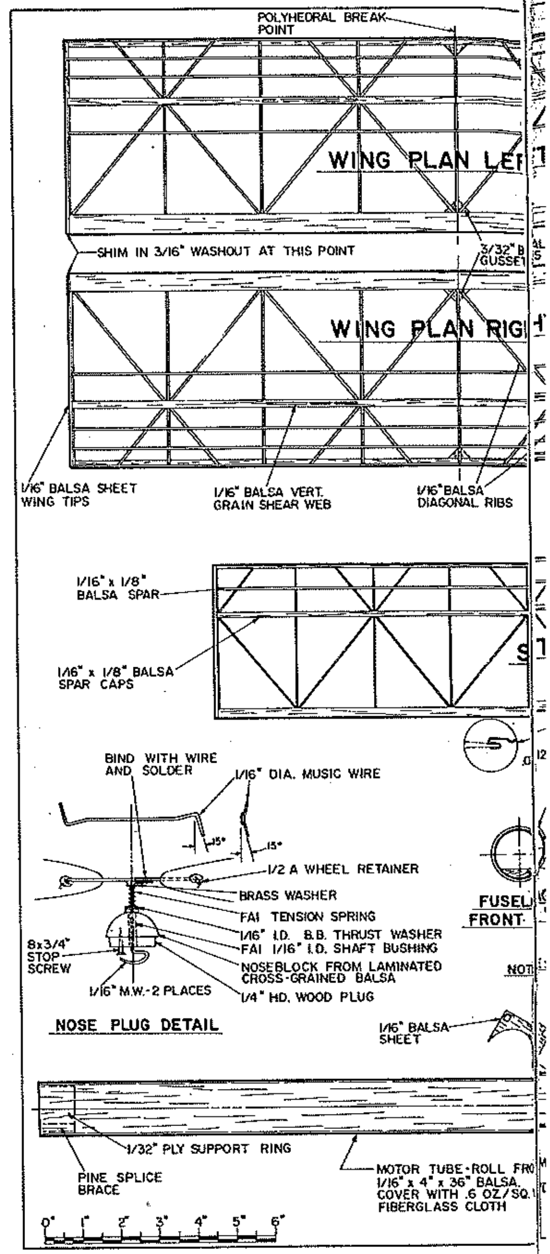
Gently remove the blade assembly from the jig, and build up a fillet of baking soda around each end of the hinge tube. Soak the area with CyA. The CyA will make the baking soda rock hard and be an excellent support surface for the aluminum tube hinge bushing.

Return the blade to the prop jig for a final angle check. The blade should lie easily on the pitch blocks with the 1/16 music wire in place again.

Repeat the process with the other blade, and you're almost home free.

Checking the hub angle. Bend the prop shaft at 90° and solder it to the wire hub, first wrapping it with soft copper wire for reinforcement. Try to locate the shaft as close to the center of the hub as possible, and eyeball the "droop" angles to make sure they, too, are equal in relation to the prop shaft.

Replace the prop blade drilling block on the prop jig with the block used for checking the wire hub angle. Slip the 3/32-in. brass



bushing into the guide hole and the end of the hub wire into the end of the brass bushing. Both drooped ends of the hub wire should be at the correct angle as indicated by the following simultaneous readings:

A. The middle portion of the hub wire should be parallel to the blade centerline as shown on the prop jig baseboard.

B. The prop shaft should be perpendicular to the baseboard, both from the side view and the end view. Use a triangle to check. Tweak the shaft wire and the hub wire as needed to get perfect alignment.

Complete the nose assembly by laminating the nose block from cross-grained sheet balsa. Trim the spruce or basswood plug so that it fits snugly into the ply reinforcing ring. Note that the nose plug has a section removed and glued to the fuselage proper as an indexing key. The 1/4-in. O.D. hard aluminum rear motor anchor tube, the dethermalizer (DT) snuffer tube, the lower DT anchor dowel, and 1/8-in. sheet aluminum winding hook are the last items to be

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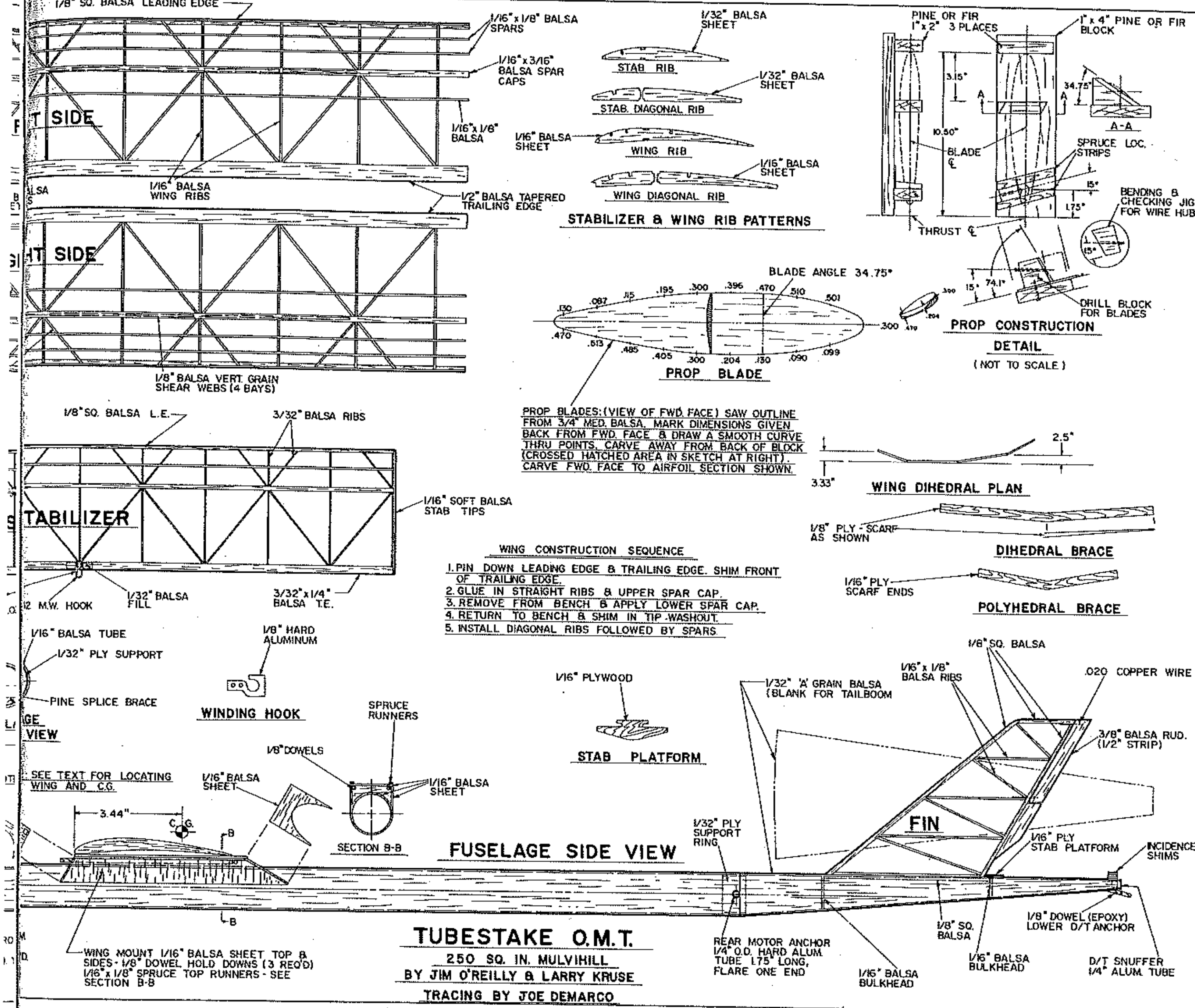

added or made ready for test flying.

Add braided fishing line turbulators to both the wing and the prop. The turbulator should be added atop the front stringer of the wing and approximately 10% aft of the leading edge of the prop. Both turbulators may be simply doped in place.

Flight trimming. Balance the plane, with the rubber motor installed, at the point shown, in relation to the wing chord, by sliding the wing mount fore and aft. When the correct balance has been achieved, the wing mount is glued in place. Pack up the stabilizer to approximate the incidence blocks shown on the plans. Set up the plane as follows for a flight pattern with a climb to the right and glide to the left:

1. Be sure the wing tip washout is equal on both panels. No other wing warps are required.
2. Tilt the left stab tip high as viewed from the rear. Start with the stab tilted approximately half as high as the left main wing panel. If the glide circle is

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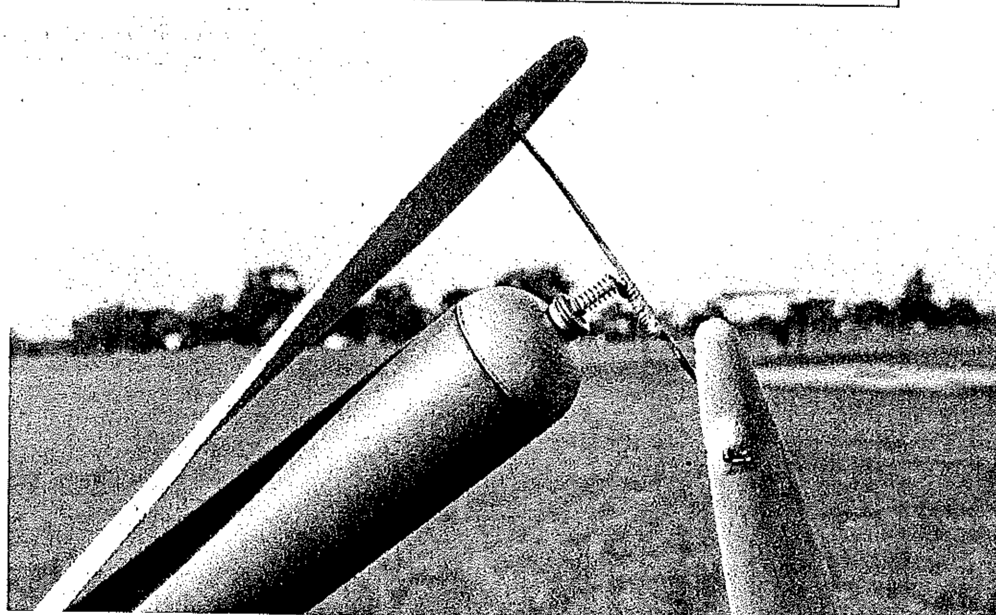

Detail of the prop mechanism shows the wire-wrapped solder joint between the prop shaft and wire hub. Note the baking soda/CyA fillet around the hinge tube of each prop blade and the removable wire keeper holding the blade on the hub. Plan and text detail these things.

Tubestake/O'Reilly

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too tight, reduce the tilt. If it is too open and wandering, increase the tilt by 1/32 in. at a time.

3. The rudder tab should be offset to the left as required to achieve a glide circle of about 20 to 25 sec. in calm air.

4. Offset the nose block approximately 2° to 3° with right thrust and 3° to 5° downthrust.

5. Key the wing and stab to maintain consistent trim.

Hand-glide the ship a few times to make sure it won't do anything ridiculous. Then begin powered flights—gently and incrementally. Start with enough winds in the motor for the plane to have power flight on its own—but not so many winds that a mishap will bring destruction. Lots of time spent building a plane demands lots of time and *practice* to get it flying well.

The desired flight path is a continuous vertical spiral to the right, accompanied by a decreasing climb angle as the motor torque lessens. By the time the prop folds, the plane should be leveled out and transition smoothly from the right-hand power pattern into the left-hand glide. Any wavering or discontinuity in the spiral climb to the right may indicate a need for a center of gravity (CG) change or a thrust change. Here are two problems that may occur:

Problem: The plane tries to start a wingover (in the best Control Line tradition) about eight to 10 seconds into a full-power flight.

Solution No. 1. If the wingover seems to be at a fairly constant speed, try reducing the right thrust just a bit.

Solution No. 2. If the plane slows down just before commencing the wingover, the CG may be too far aft. Try moving the wing ⅛ in., and fly it again. Recheck and readjust the glide if the wing is moved.

Problem. The plane shows a tendency to spiral in the glide when encountering strong thermal activity.

Solution. Reduce the rudder tab setting a bit to open up the glide turn.

The model flies on 2.8 oz. of ¼-in. FAI rubber made up into a 12-strand motor, giving an all up weight to the model of just over 7 oz. Below is a table of suggested component weights:

Wing	1.61 oz.
Fuselage	1.60 oz.
Prop assembly	.59 oz.
Stabilizer	.34 oz.
Winding hook	.08 oz.
Airframe weight	**4.22 oz.**
Rubber	2.80 oz.
Total weight	**7.02 oz.**

The model could be built lighter than these weights, but for a midday thermal rider, there's little incentive to do so. It is difficult enough to dethermalize from strong lift already. At the 1985 Ft. Worth Planesmen Labor Day Contest, the TS OMT had one worrisome flight during which it drifted around for about 6 min. with the tail popped up—and no apparent loss of altitude!

If you choose to build the TS OMT, Jim O'Reilly would be happy to correspond with you about the design. Address: Jim O'Reilly, 4760 N. Battin, Wichita, KS 67220. Given its long lineage of success in the hands of the O'Reilly clan, it is certainly a worthy ship to consider as your Mulvihill entry for the next contest season.