

TIPORARE

Mfg. by W-K Hobbies
19 N. Main Street
Centerville, OH 45659

BUILDING INSTRUCTIONS

by

Bill Elliott & Dick Hanson

The TIPORARE is a high competition radio-controlled pattern aircraft, designed for both the experienced flyer and the beginner in pattern competition. Because of this, considerable detail is covered in these instructions that may be familiar techniques to the seasoned modeler.

1. Lightly sand the wing cores and vacuum thoroughly. If retractable landing gear is to be installed, cut recesses in bottom of wing cores using the hot wire technique. Figure 1 illustrates how the cutting wire is bent and installed in a Weller-type soldering gun. Thin plywood templates should be used as a guide when cutting. Figure 2 gives dimensions for laying out the wheel wells and plywood gear mount as well as the spars. Use the set of dimensions that apply to the type gear you are using. **DO NOT JOIN THE WING CORES AT THIS TIME!**



Fig. 1

$\frac{1}{4}$ " x $2\frac{1}{2}$ " x 4" plywood, 2 pcs.

$\frac{1}{4}$ " x $\frac{1}{2}$ " x 12" balsa, 4 pcs.
Inset into wing.

$2\frac{1}{2}$ " dia. wheel cutouts.

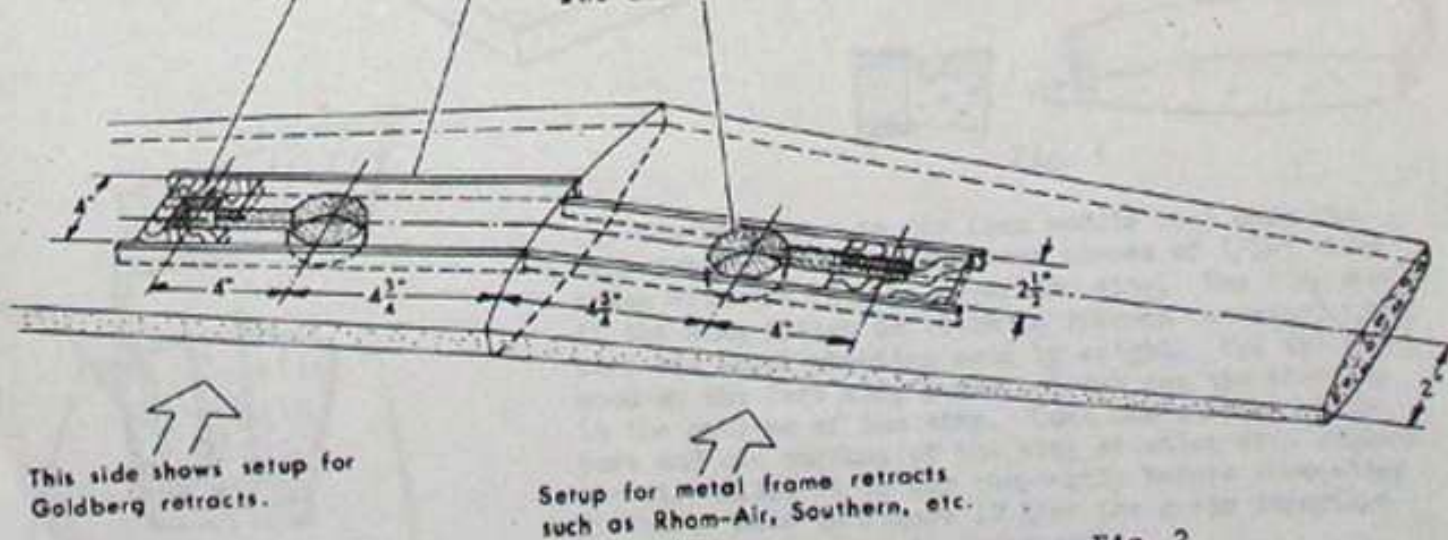


Fig. 2

RETRACTABLE LANDING GEAR INSTALLATION IN WING

7. Refer to figure 6 for this step. Lay three 1/4" dia. wood dowels on the top of the wing core as shown. These are to prevent the cement on the sheeting and core from coming into contact before you are ready. Lay a strip of 5-minute epoxy along the trailing edge of the wing. This next step calls for teamwork between two people. While one person holds the wing core perfectly flat on the work surface, the other person applies the sheeting to the core, starting at the trailing edge. As the sheeting is being worked forward, the dowels are removed one by one to allow the surfaces to come into contact. Remember that constant pressure to hold the cores flat must be applied during this operation.
8. Apply sheeting to the other side of the wing in this same manner.
9. Lay the wing half back into its foam saddle and replace it on the work surface. Using your long sanding block, being careful to keep the cutting edge vertical, sand the sheeting even with the edges of the wing core.
10. Epoxy the 3/8" x 1" x 36" balsa leading edge in place and shape as in figure 7.



Fig. 7

11. Build the other wing half as in steps 3 through 10.
12. Examine the wing halves carefully. If constructed per instructions, they should be perfectly straight. If somehow, a gremlin has crept in and they are warped, they can be corrected at this stage fairly easily.

A. If leading edge is warped down at tip (or trailing edge is up at tip), slit sheeting on bottom of wing as in figure 8.

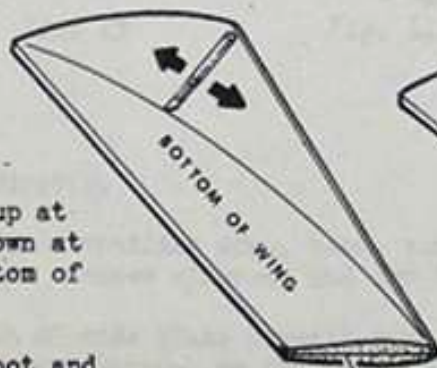


Fig. 8

B. If leading edge is warped up at tip (or trailing edge is down at tip), slit sheeting on bottom of wing as in figure 9.

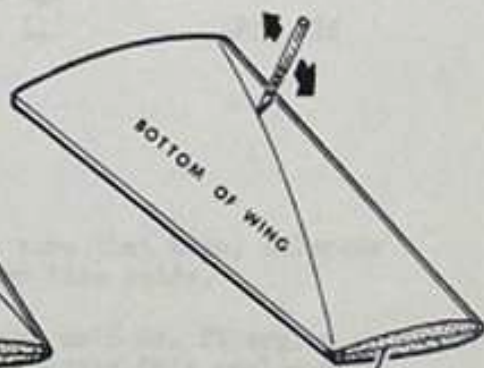


Fig. 9

C. Draw a centerline on the root and tip airfoil. Block and weight wing on your work surface and check with a spirit level until both centerlines are level. Figure 10 illustrates this procedure. When you are satisfied that the wing is straight, squeegee 5-minute epoxy into the slit and let it cure.

DRAW CENTERLINE AT ROOT AND TIP.

13. Block up wing tip for proper dihedral as in figure 11 and sand wing roots to match. Join wing halves using 5-minute epoxy.

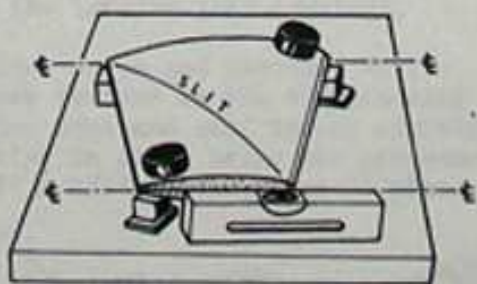


Fig. 10

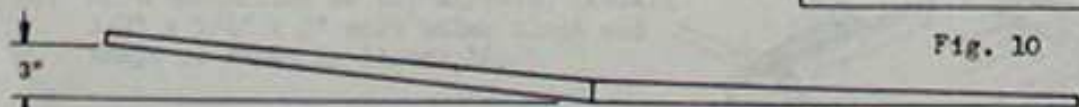


Fig. 11

2. If fixed gear is planned, cut recess for a $1/2" \times 1" \times 6"$ hardwood block into foam wing core. Locate so that main gear leg emerges from wing at same location as retractable gear pivot point. Glue block in place, using slow-drying epoxy.

3. To build the wing, a completely flat work surface is required. Remember that a warp of $1/64"$ built into the wing will cause undesirable flight characteristics. Select one of the wing cores and lay it in its foam saddle on the work surface with $1/2"$ of the trailing edge overhanging. Using shims under the saddle and weights on the core, align the trailing edge until it is perfectly straight. This is illustrated in figure 3.

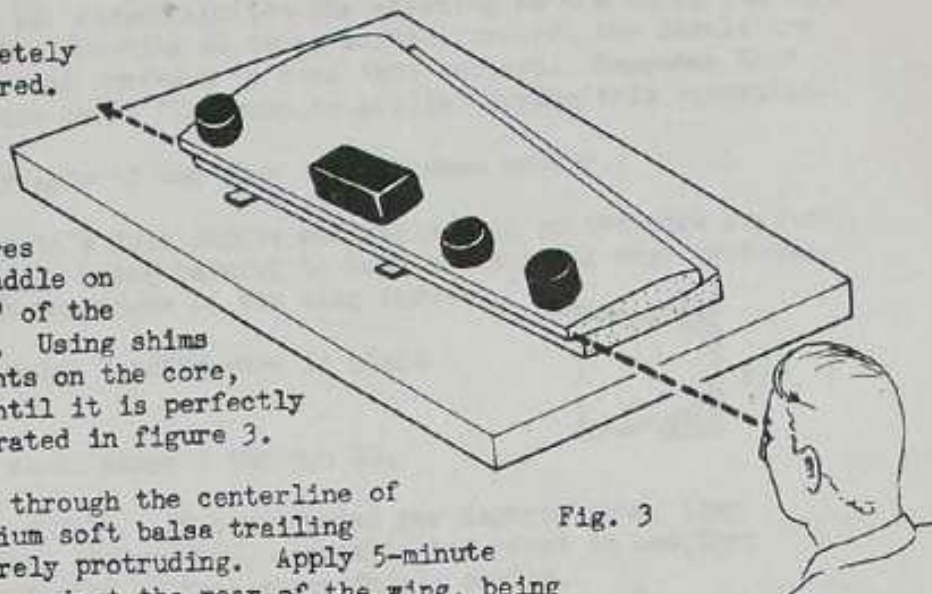


Fig. 3

4. Insert a number of T-pins through the centerline of the $1/4" \times 1/2" \times 36"$ medium soft balsa trailing edge with their points barely protruding. Apply 5-minute epoxy and place the balsa against the rear of the wing, being careful not to disturb the aligned surface. Push the T-pins through into the foam to hold the balsa in place as in figure 4. Do not use Hot Stuff in contact with foam as it will disintegrate the foam.

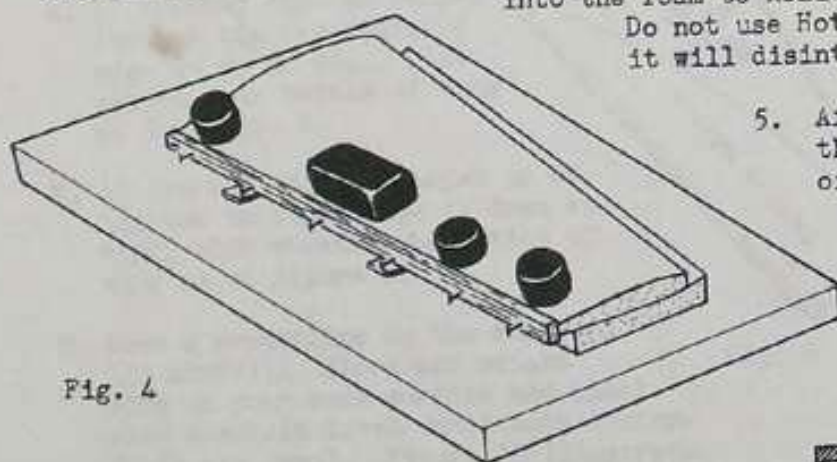


Fig. 4

5. After the epoxy has cured, shape the trailing edge to the contour of the airfoil with a razor plane and sanding block. See figure 5. NOTE: Always use 80 - 150 grit fresh sandpaper on a block 12" to 18" long for all wing shaping.

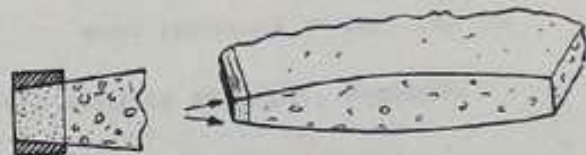


Fig. 5

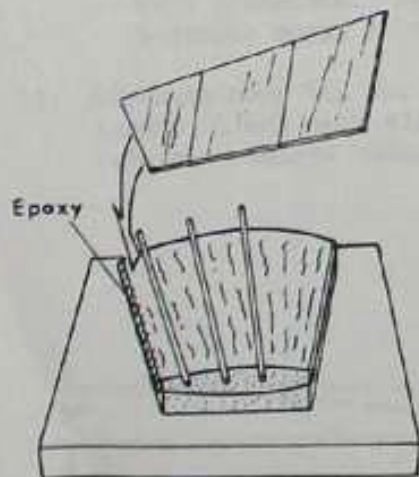


Fig. 6

6. Lay the wing core in the foam saddle back onto the work surface. Glue sufficient pieces of $1/16"$ thick balsa with Hot Stuff to cover the wing. Use firm wood if the wing finish is to be an iron-on covering. Be sure and match sheeting wood by weight. Use the heavy wood on the left wing panel. Rough cut the sheeting to the outline of the wing. Coat one surface of the core and one surface of the wing sheeting with contact cement. Allow it to dry thoroughly before proceeding further. Note in figure 17 that the grain direction of the wing sheeting is important.

14. Refer to wing assembly construction drawing (figure 17) and install aileron actuating assemblies. Fabricate ailerons from two $1/4"$ x $1-1/4"$ x $20"$ triangular balsa laminated together. Refer to dimensions given in figure 17 and mark where aileron joins the wing. Cut slots for aileron hinges exactly on centerline of trailing edge. Cut matching slots in ailerons and trial fit, but DO NOT glue in place.
15. If you have not already drawn a centerline on the tip airfoil, do so now. Take a piece of soft balsa, $3/4"$ x $2"$ x $10"$ and also draw a centerline on it. See figure 12. Match centerlines and glue tip block in place as in figure 13. Glue fixed portion of outer trailing edge in place, lining up on tip block centerline. (Figure 14). Sand wingtip block to shape, being careful to taper into centerline (figure 15). Use full scale outline on template drawing to determine wingtip plan shape.

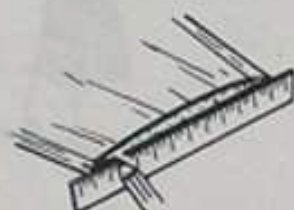


Fig. 12

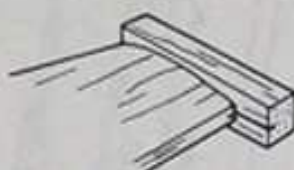


Fig. 13



Fig. 14



Fig. 15

16. Repeat procedure for other wingtip.
17. Complete center portion of fixed trailing edge, being sure that tips, ailerons and trailing edge are aligned. Remove ailerons and lay them aside.
18. Wrap wing center section with 2" wide glass drywall tape or 6 oz. fiberglass cloth and squeegee 5-minute epoxy through to the wood. After this application has cured, wrap the center section with 6" wide 4 oz. fiberglass cloth and squeegee slow-drying epoxy through to the wood. Lay strips of toilet paper onto the wet epoxy to absorb the excess. Do not allow the toilet paper to remain on the epoxied area. Remove and discard.
19. After the wing center section has cured, if you are using retracts, take a Dremel tool and remove the balsa sheeting from the landing gear openings.
20. Lay aside the wing and lightly sand the stabilizer cores and vacuum. Weight and align the stab in the foam saddle on the work surface as you did the wing in step 3. Attach the $1/4"$ x $3/8"$ balsa trailing edge and sand to the airfoil contour as in figure 5. Glue $1/16"$ balsa sheeting in place using the procedure described in steps 4 through 11. Epoxy the $3/8"$ x $1/2"$ leading edge in place, and shape as in figure 7.
21. Mark centerline on tip airfoil, install $1/2"$ x $3/4"$ x $5"$ soft balsa block and shape as shown in figure 16.

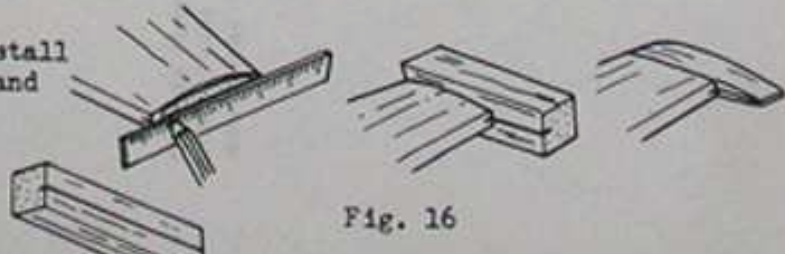


Fig. 16

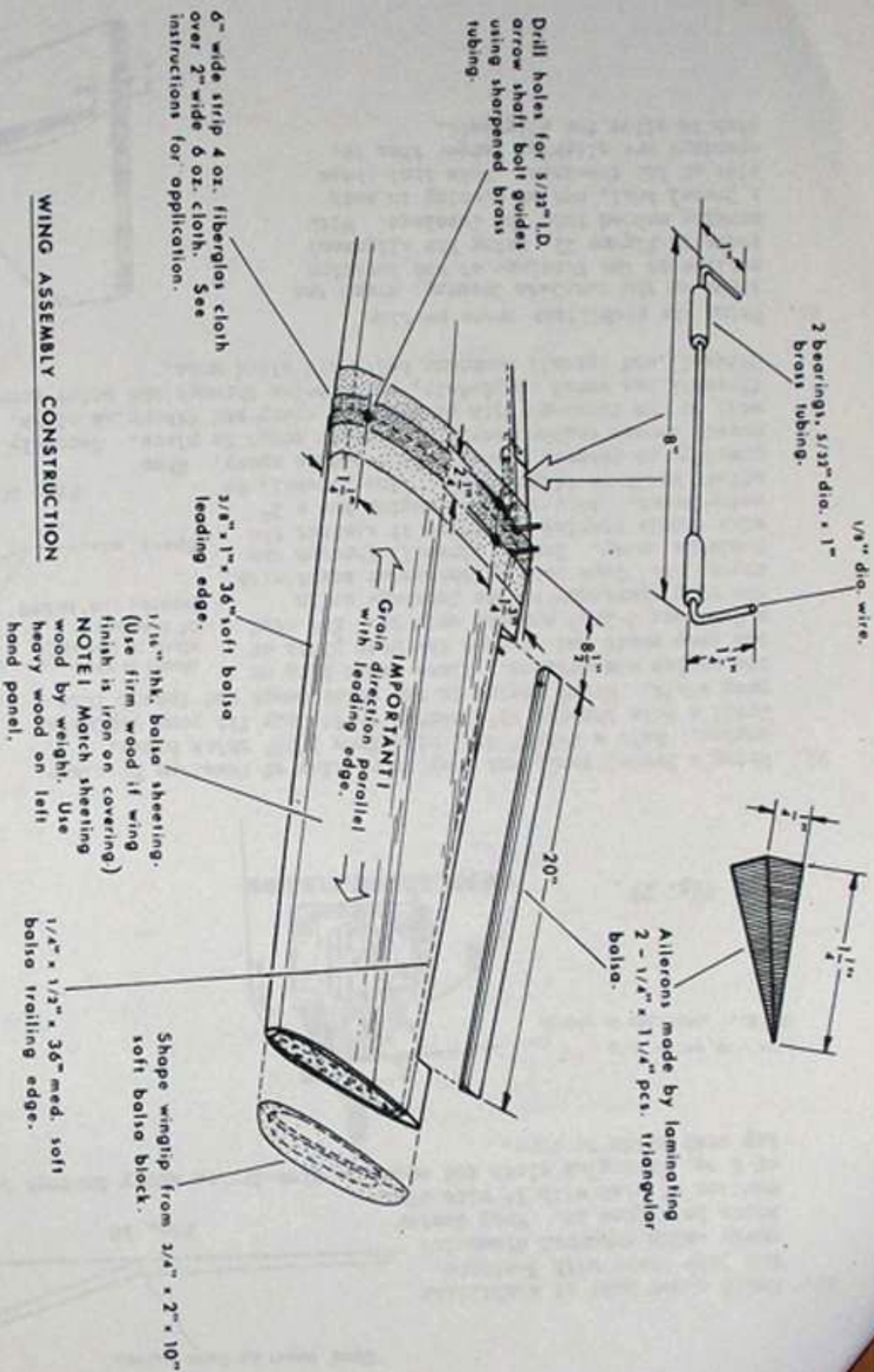


Figure 17

22. Build other half of stabilizer and join stabs with 5-minute epoxy using anhedral dimension shown in figure 18. Wrap center section of stab with 1" wide strip of 6 oz. fiberglass cloth and squeegee slow-drying epoxy through to wood. Lay stab aside to cure.

Sand bevel on both halves.



Fig. 18

1/16" thk. balsa ring.
Hot Stuf sparingly in place.

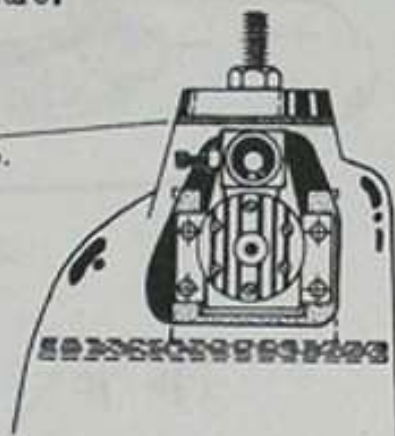


Fig. 19

23. Using a Dremel tool, cut away front side of fuselage to clear engine. Make a 2-1/4" dia. ring from 1/16" thick balsa. Drill a hole through it's center to tightly fit your engine's prop shaft. Mount engine in the motor mount and insert into the engine compartment. Place balsa ring on the prop shaft and tighten the rear plate of a Goldberg 2-1/4" spinner onto it. Hot Stuf the ring sparingly to the fuselage as in figure 19. Coat rear of the motor mount with 5-minute epoxy. Insert firewall through the wing saddle opening and press it against the motor mount. Note that the engine has a 2° offset built in (figure 20). Glue firewall to fuselage at several places with 5-minute epoxy. When cured, remove engine leaving the motor mount in place. Securely glue the firewall to the fuselage with slow-drying epoxy and fiberglass cloth. When the firewall has cured completely, drill holes through the motor mount into the firewall and install mounting bolts and blind nuts.

Mount is very close to left side of fuselage. (approx. 1/16" to 1/8")

Epoxy mix.

TOP VIEW
FUSELAGE



Fig. 20

24. Using the stabilizer cross section shown on the template drawing, trace the outline on the fuselage at the location shown in figure 21, using the alignment marking molded into the fuselage. With a Dremel tool, cut an opening in each side of the fuselage. Note that these openings are slightly larger than the stab to allow for alignment.

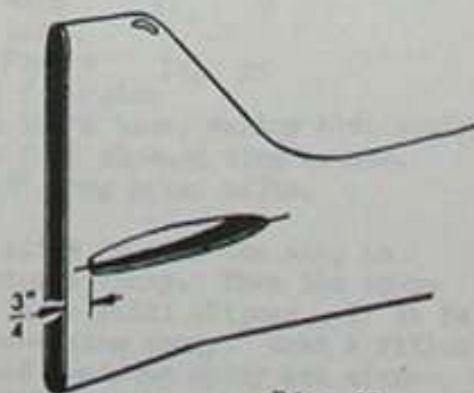


Fig. 21

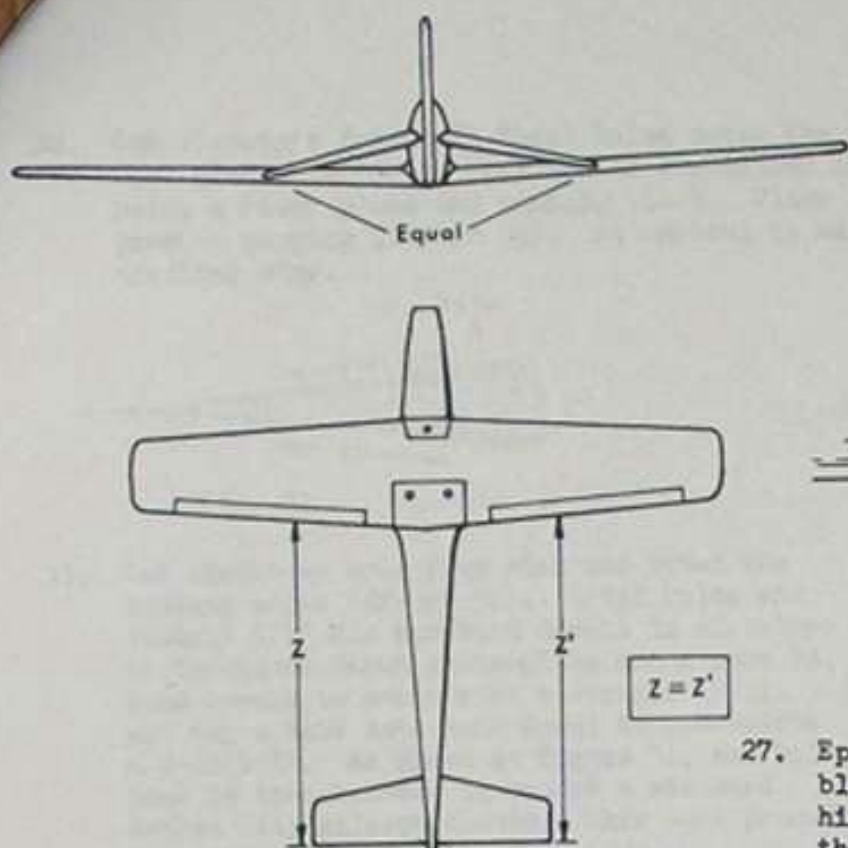


Fig. 26

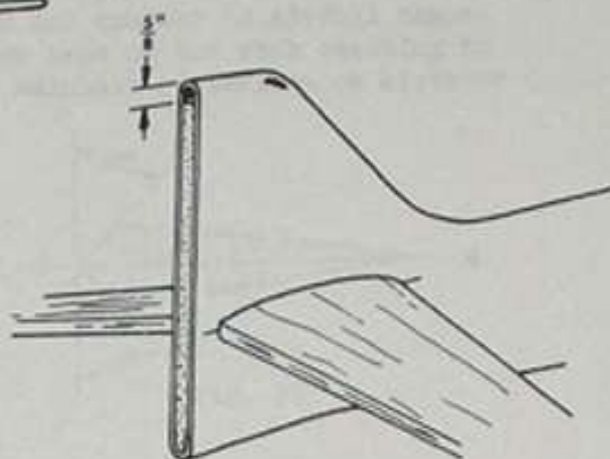


Fig. 27

27. Epoxy a 3/8" x 3/8" medium hard balsa block into the opening at the rudder hinge line, leaving a 5/8" opening at the top for the fin tip (figure 27).

28. Construct the rudder as shown in figure 28 from 1/16" thick balsa and 3/8" square balsa blocks, using the outline on the template drawing as a guide. Bevel the leading edge (figure 29), being careful to locate the centerline. When the rudder is completed, drill a hole and add a 1/2" dia. hardwood dowel at the location shown on the template. Sand the dowel to contour it with the rudder. The purpose of this dowel is explained in step 31.



Fig. 28

29. Draw a centerline on the fin hinge line and cut slots for the rudder hinges. Cut matching slots in the rudder. Attach but DO NOT GLUE the rudder to the fin. Sparingly Hot Stuf a 1/4" square balsa piece to each side of the fin to align the rudder in the neutral position. Construct the fin tip by laminating 1/8" thick plywood to 1/2" thick hard balsa and carve to fit inside the fin as shown in figure 30. Glue securely in place and shape fin tip to contour shown on template drawing. Leave rudder and 1/4" sq. pieces temporarily installed to help protect the fin tip during subsequent construction.

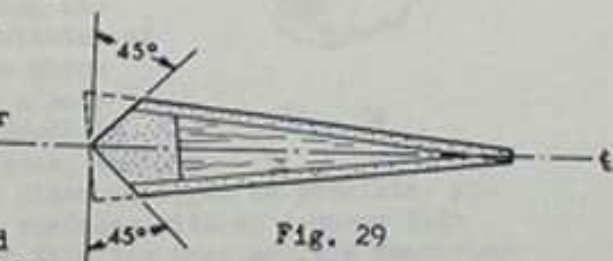


Fig. 29

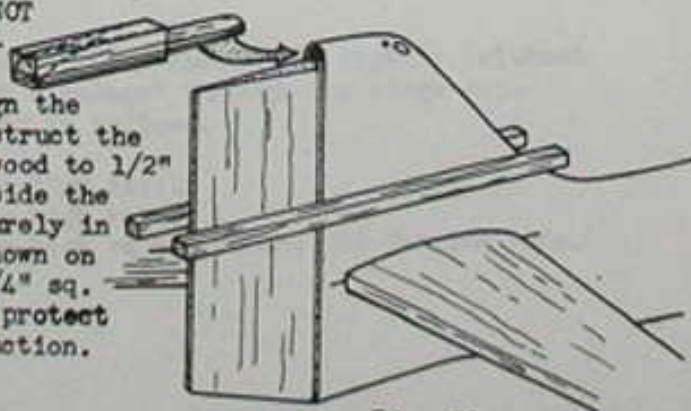


Fig. 30

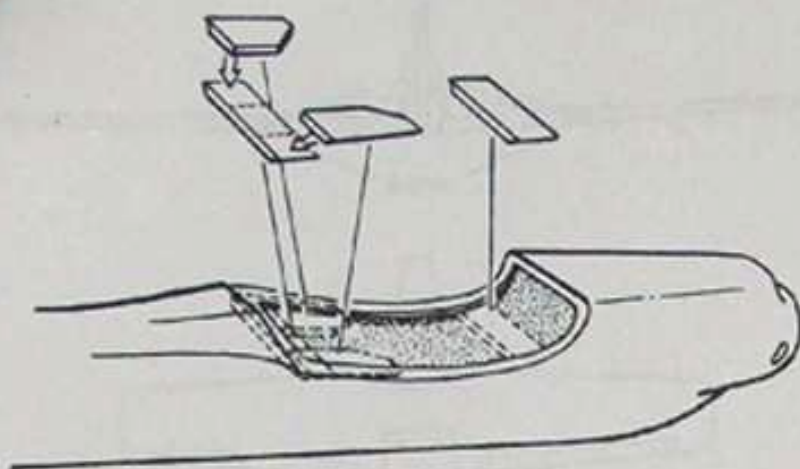


Fig. 22

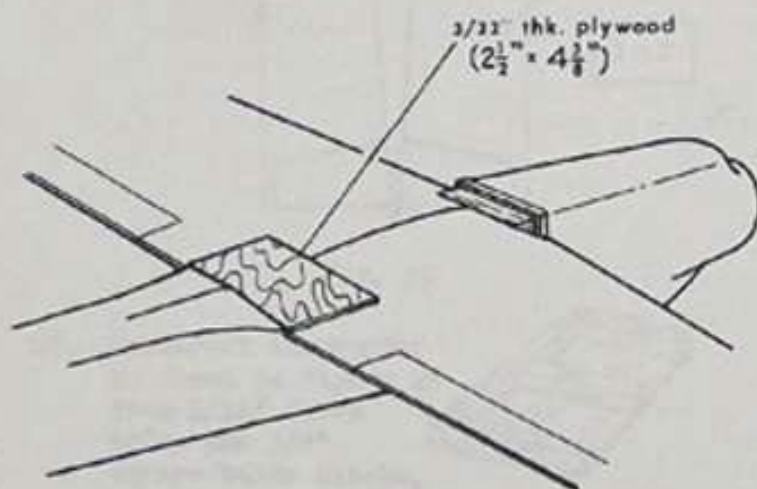


Fig. 24

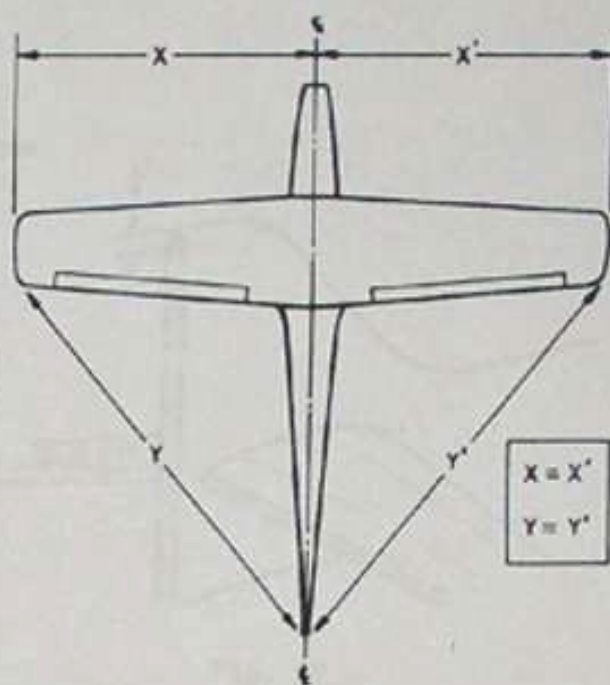


Fig. 23

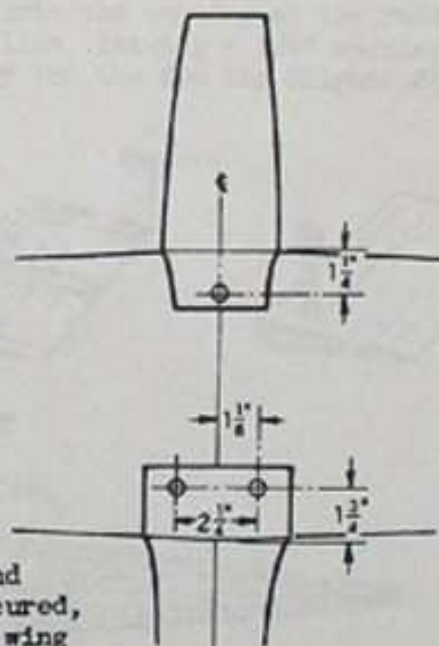


Fig. 25

25. Glue the plywood wing mounting blocks in place with slow-drying epoxy as indicated in figure 22. Lay wing into fuselage saddle and align as in figure 23. Glue fuselage fairings onto wing as in figure 24. Using a mixture of 5-minute epoxy and micro-balloons, build up the front fairing. When cured, sand to contour with fuselage. Check alignment of wing again, then drill holes for 5/32" I.D. arrow shaft bolt guides through wing using sharpened brass tubing. Figure 25 gives location dimensions. Cut bolt guides from fiberglass arrow shafts and epoxy in place. Check alignment a third time, making absolutely sure that it is correct. Drill through bolt guides into plywood wing mounts, tap holes and bolt wing to fuselage using 1/4-20 x 2" long nylon bolts.
26. Slide the stabilizer into the fuselage opening and align it with the wing as shown in figure 26. Spot glue it in place with 5-minute epoxy. When the epoxy has cured, check the stab again to be certain that it is still aligned. If it is, glue securely in place inside the fuselage with slow-drying epoxy. Make a fillet to fair the stab into the fuselage using a mixture of 5-minute epoxy and micro-balloons, working fairly quickly and smoothing the fillet with your finger dipped in water.

30. Cut elevators from 1/2" thick balsa using the template on the template drawing. Spot glue them to the rear of the stabilizer and contour to airfoil shape, using a razor plane and sanding block. Place tape on the stab sheeting to prevent gouging (figure 31). Be careful to maintain centerline on elevator trailing edge.

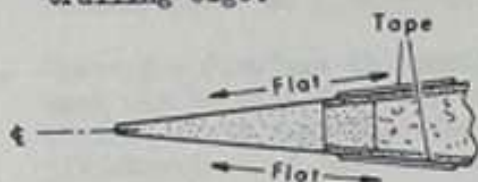


Fig. 31

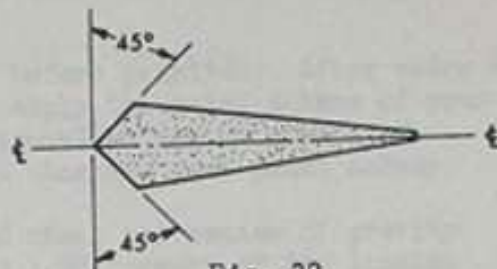


Fig. 32

31. Cut elevators away from stab and bevel the leading edges (figure 32). Drill holes and install 1/2" dia hardwood dowels in elevators at locations shown on template and figure 33. Sand dowels to contour of elevator. Drill and tap a hole into each dowel to accommodate a 4-40 bolt. As shown in figure 34, the bolt head is then removed to accept a standard Rocket City aileron clevis. This same procedure is used on the rudder.



Fig. 33

32. Hinge, but DO NOT GLUE the elevators to the stab. You may remove the 1/4" square balsa pieces from the fin at this time.
33. Glue in place the plywood fuel tank floor. Drill holes for fuel tubing. Install fuel tank. Reinstall the engine. Mount retractable landing gears and servo tray. Install all control linkages. Check for smooth and non-binding operation.



Fig. 34

34. Remove all equipment and control surfaces from the airframe and prepare for finishing. Sand exterior of the fuselage thoroughly. Fill and sand seam where necessary. Fill all surface blemishes with a body filler such as Snow White or Black Magic. Brush on two coats of Hobby Pox primer to wood surfaces, sanding well after each coat. In order to keep the plane as light as possible, you might want to consider finishing the flying surfaces with an iron-on film covering. We recommend Econocote because of its low heat sealing characteristics.
35. Permanently install the control surfaces. They should fit tightly (without binding) to insure minimal air flow or "leakage" through the hinge gap. Recommended control surface movement is as follows:

Ailerons - 3/8" total travel on high rate.
 Elevators - 3/4" total travel on high rate.
 Rudder - 3" total travel on high rate. Reduce 75% for low rate.

NOTE: If more than $1/8$ " of elevator "up" trim is required, shim trailing edge of wing down. Do not trim ailerons down or up more than $1/16$ ", because doing so will adversely affect the performance of the airplane. It is advisable to seal all hinge lines after painting the airplane with "Fas-cal", "Sticky-cote" or a very flexible tape.

36. Clean the fuselage thoroughly with thinner before painting. After using a tack rag to wipe down the entire airplane, apply the paint scheme of your choice. Note that included with these instructions are 10 sheets of illustrations of the TIPCRARE to be used in planning your paint scheme.
37. After painting, reinstall the equipment and check the center of gravity. We recommend that you start with it $3/8$ " to $1/2$ " forward of the landing gear centerline. You may then adjust it to your personal preference. Check lateral balance. Add weight to the wing tip to adjust.
38. FLYING INFORMATION: If you use a tuned pipe, sling it under the fuselage for best results with the anhedral stab. Lower or raise the pipe for trimming rudder pitch problems. Use a dual rate elevator and ailerons radio for best wide speed variation performance. Use the largest diameter and flattest pitch propeller that you feel is suitable to your engine. Try a $11-1/2$ " x 7 cut to $11-1/4$ " or a 12" x 6 cut to $11-1/2$ " to make the engine turn fast and run cool. The TIPCRARE flies best at moderate speed. Do not use soft props or thin hub propellers. They don't pull well and will occasionally come apart.
39. Clear a space on your mantle for additional trophies.