



Prototype By Geoff Watkinson

# S - T E E

By Lee Renaud

**A Half-A powered, shoulder wing version of the popular Q-Tee, designed for sport flying.**

## INTRODUCTION

The S-Tee is a shoulder wing version of the popular Q-Tee design published in the January 1976 issue of RCM. The general airframe is almost identical to that of the Q-Tee which means that construction is very simple and rugged. The shoulder wing layout provides a larger equipment compartment, making 3-channel operation feasible.

The S-Tee is an intermediate model which offers a step-up in performance over the Q-Tee. The Cox Medallion .049 with throttle plus a one or two ounce tank permits easy "touch and go's" as well as providing extended engine runs. The model is so simple that we encourage you to try modifying the design if you want more aerobatic performance. We have built models with the dihedral reduced to 50% of that on the plans, using rudder control as well as straight wing versions with 5/8" wide strip ailerons cut from the trailing edge. Both flew well, but are not recommended for the beginner.

If you have read this far and think that the S-Tee is the model to introduce you to the sport of R/C, send to RCM for a copy of the full size plans of the S-Tee (see page 187 for plan ordering instructions). Then visit your local friendly

hobby shop with a copy of the materials list and select everything you need. While you are waiting for the full size plans, study the photos, instructions, and magazine plan to completely familiarize yourself with the building sequence. This will pay off later when you start to build.

Note that in addition to the materials required to build the S-Tee, you will need a few tools, supply items and a work surface. For this size airplane we recommend an inexpensive 24" x 36" wood drafting board as an ideal work surface. It is flat and true, easy to push pins into, and can be easily picked up and stored if you are working with limited space. Alternately a sheet of Celotex or similar material makes a good surface.

You should have a model knife and/or single edge razor blades, a razor saw, metal straight-edge, pliers, small hammer, and a hand drill available. A few hardwood sanding blocks, assorted grades of sandpaper, straight or tee-pins and masking tape will also be required. The type of adhesives used are largely a matter of personal choice. Wilhold Aliphatic, Titebond, and similar glues are excellent for general construction. Hobby epoxy Formula 4 or Devcon

5-Minute Epoxy are recommended for the fuselage former/side joints, and the wing center joint. We used Hot Stuff entirely to build our own prototypes as we feel the time and weight saved is well worth the additional expense. Just be sure to follow the warnings on the bottle and make sure all joints fit tightly.

When the plans arrive, we suggest that you cut out all parts required to build the airframe. Bend the landing gear to the pattern shown on the plan. To cut the wing ribs, we suggest making two templates of 1/16" ply and pinning eighteen 3/32" x 7/8" x 7/8" balsa rectangles between the ply templates. The resultant sandwich can be shaped to contour, notched, then separated to provide the ribs. We find that preparing a personalized kit in this manner reduces overall assembly time and gets the model completed quickly.

## CONSTRUCTION

The construction sequence described, progresses from the most simple steps through more complex building requirements. If this is your first model, we suggest you follow the sequence shown. The advanced modeler will, of course, ignore all instructions anyway.

To reduce overall building time, we suggest that you skip forward to the next step while the glue is drying. Just work carefully and be sure you understand all construction steps before cutting. Cut the plans apart if this is more convenient. Cover the plans with Handiwrap, or similar wrap, to prevent gluing the wood parts to the plan.

#### Tail Surfaces:

(1) The rudder is cut from a strip of 1/8" x 1 3/8" x 17 7/8" balsa. Lay the strip against the plan and mark the correct length. Check carefully, then cut. (The balance of this strip is used for the elevator.) Now, lay the rudder over the plan and cut or file a notch in the leading edge, to clear the elevator tie. Round off the corners then round all edges and sand smooth.

(2) The fin is made from a piece of 1/8" x 3" x 3 7/8" balsa. Sand both edges square and straight, align over plan and cut off the top front corner, using the cut line to line up your straight-edge. The triangle which you cut off is now butt glued to the front of the fin. When the glue is thoroughly dry, sand the outline smooth, and round the leading edge and top. Be careful not to round the bottom edge, where it fits between the stab center ribs.

(3) Use the plan to locate the holes in the rudder for the control horn. Mark the holes and use a 3/32" diameter drill, checking carefully that the holes in the rudder line up with the holes which are molded in the horn base and nut plate. Locate the hinge positions from the plans and use a #11 X-Acto knife blade (or similar) to cut a 1/2" long slot in the front edge of the rudder. Work very carefully and be sure the slot is exactly on the center of the wood. Run the blade back and forth in the slot and trial fit the hinges until the tab is fully inserted in the rudder and the crease is lined up with the edge of the rudder. Align the fin and rudder and mark the hinge positions on the fin. Cut slits in the fin trailing edge and fit the hinges. With the surfaces pushed together, check that the rudder swings freely and moves at least 30° each side of center. Check that all edges line up and final sand all over. Lay these parts aside until later.

(4) Lay the elevator stock in place over the plans and trim to final length. Cut a 1/8" deep notch in the leading edge, so that the 1/8" diameter dowel tie fits snugly. Be sure the edge of the dowel is aligned with the front of the elevator and glue the dowel in place. Pin the elevator in place over the plans and mark the cut-out which provides rudder clearance. **Don't** cut this section out yet.

(5) Cut the trailing edge to exact length from a strip of 3/16" x 1/4" x 36" balsa and pin in position tightly against the elevator. Cut one tip and center rib from 3/16" x 11/16" x 11 7/8" strip, and use these as patterns to cut a second set. Be careful that all edges are straight

and square for tight glue joints. If you are using aliphatic or similar glues, we suggest that you pre-glue the end grain of these parts. This is easily accomplished by applying a coat of glue and letting it dry for 10-15 minutes before applying the final coat of glue. It is also wise to trial fit the parts before using any glue and to correct any mistakes before continuing. Pin the end ribs in

3/16" x 36" strip. Fit these snugly in place, working from the center toward the tip, and being careful not to force the leading or trailing edges out of position. Pre-glue all joints, then glue in place. This completes the elevator assembly and we suggest that you leave this pinned in place at least 8 hours before removing from the work surface.

(7) Install the hinges following the same procedure used on the fin and rudder. Remove the hinges and sand the elevator, rounding all edges. Now carefully cut out the Vee shaped section being careful not to cut into the elevator tie. Round the leading edge and tips then use a sanding block to sand the top and bottom surfaces smooth. Be sure that all ribs are flush with the leading and trailing edges as any high or low parts will show up as flaws when you cover the model. Check the fit of the fin in the space between the center ribs and that the elevator tie does not hit the rudder in full throw positions. Correct any problems now, before covering. This completes the construction of the tail surfaces and now you are ready to tackle the wing.

#### Wing Assembly:

(1) Separate the stacked ribs and trim 1/16" from the top surface of the six center section ribs (W-1 and W-2) to allow for the top surface sheeting. Pre-glue the leading and trailing edge of all ribs.

(2) Use a small square or straight-edge to cut four pieces 1-5/16" wide and four pieces 3 1/8" wide from the 1/16" x 3" x 18" sheet. Be sure that the 1-5/16" wide pieces are all exactly the same width. Cut four gussets from the 1/8" x 1/2" x 3" strip following the method shown on the plan, so that the grain runs diagonally to provide maximum strength.

(3) Smooth the plans out flat and tape them tightly to your work surface, then cover wing area with a piece of Handiwrap. Note that the wing is built flat in one piece then cut apart at the center joint after assembly is completed. Now pin the trailing edge in place over the plans, using enough pins to hold it flat and secure. Slip the tip W-3 ribs over the spar and pin the tip ribs in final position gluing them to the trailing edge and spar. Be sure the tip ribs are square with the work surface. Next, install the (2) W-2 ribs butting tightly against the trailing edge. Be sure the lower surface of all ribs are tight against the work surface and that the spar is properly aligned.

(4) Install the two W-1 ribs at the center of the wing being very careful that they are properly aligned. Be sure to leave a 1/16" to 3/32" space between these ribs so that there is clearance for your knife or saw blade when you cut the wing apart. You may now proceed to install all the W-3 ribs in both panels, gluing them to the spar and trailing edge. Place a drop of glue on the leading edge

### S-TEE

Designed By: Lee Renaud

#### TYPE AIRCRAFT

1/2A Sport

#### WINGSPAN

36 Inches

#### WING CHORD

7 Inches

#### TOTAL WING AREA

250 Square Inches

#### WING LOCATION

Shoulder Wing

#### AIRFOIL

Flat Bottom

#### WING PLANFORM

Constant Chord

#### DIHEDRAL, EACH TIP

1 3/4 Inches

#### O.A. FUSELAGE LENGTH

27 Inches

#### RADIO COMPARTMENT AREA

(L) 9 1/2" X (W) 1 3/4" X (H) 2"

#### STABILIZER SPAN

12 3/4 Inches

#### STABILIZER CHORD (incl. elev.)

4 1/2" (Avg.)

#### STABILIZER AREA

56 Square Inches

#### STAB AIRFOIL SECTION

Flat

#### STABILIZER LOCATION

Top of Fuselage

#### VERTICAL FIN HEIGHT

3 3/8 Inches

#### VERTICAL FIN WIDTH (incl. rudder)

4 1/4" (Avg.)

#### REC. ENGINE SIZE

Cox .049-.051

#### FUEL TANK SIZE

Cox Engine Tank

#### LANDING GEAR

Conventional

#### REC. NO. OF CHANNELS

2 - (3)

#### CONTROL FUNCTIONS

Rud., Elev., & (Throt.)

#### BASIC MATERIALS USED IN CONSTRUCTION

Fuselage ..... Balsa, Ply & Hardwood

Wing ..... Balsa & Hardwood

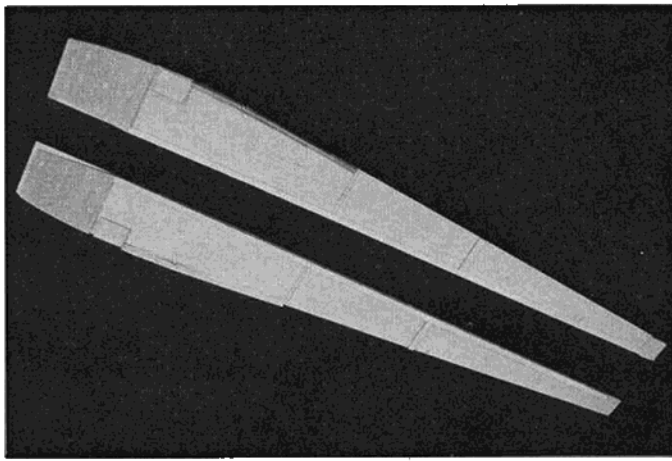
Empennage ..... Balsa

Weight Ready-To-Fly ..... 16-20 Ozs.

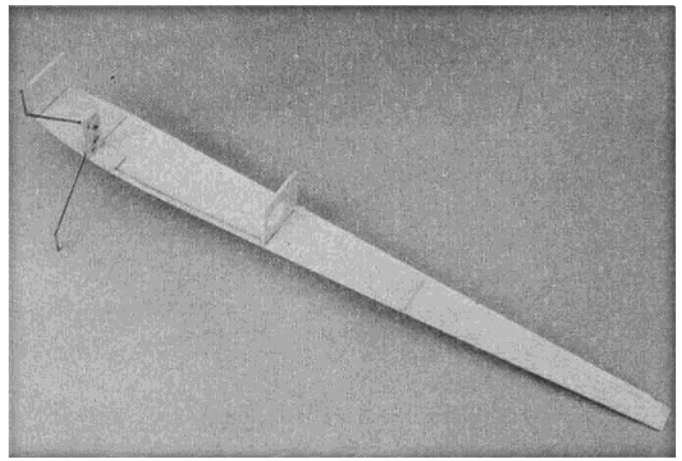
Wing Loading ..... 9.24-11.56 Oz/Sq. Ft.

place, gluing them to the stab trailing edge. Also pin and glue the center ribs in position, using the fin as a gauge to space the ribs apart. Cut the leading edge pieces from the 3/16" x 1/4" strip, and fit the center joints so that both pieces butt tightly together, then pre-glue this joint. Apply glue and pin the leading edges in place.

(6) Cut the truss ribs from a 3/32" x



**Completed fuselage sides ready to be joined.**



**Formers Installed to right fuselage side - use small triangle or square to align properly.**

of all ribs and press the pre-shaped leading edge against the ribs. Use pins to force the leading edge tightly against the ribs and to hold it firmly against the plans. Try not to pin through the wood unless absolutely necessary as this may weaken the structure or split the leading edge. Check once more that the leading and trailing edges, spar, and all ribs are tightly against the work surface.

(5) Trim two pieces of the 1-5/16" wide sheet to fit snugly between the leading edge and spar (save the cut-offs). Glue these to the center W-1 rib leading edge and spar, pinning the sheet tightly to the work surface. Next, glue the 1-5/16" x 3" pieces in place behind the spar and trim the cut-offs to fit between these pieces and the trailing edge. Now glue the W-1 rib against the edge of the bottom sheet and to the L.E. spar and T.E.

(6) Install the tip rib gussets, trimming to fit if necessary, so that the gussets are tight against the ribs and leading and trailing edges. Install the top center sheet starting at the trailing edge working toward the leading edge. Be sure the joint is centered over the gap between the W-1 ribs. Trim sheet for a good tight joint, and use pins and/or masking tape

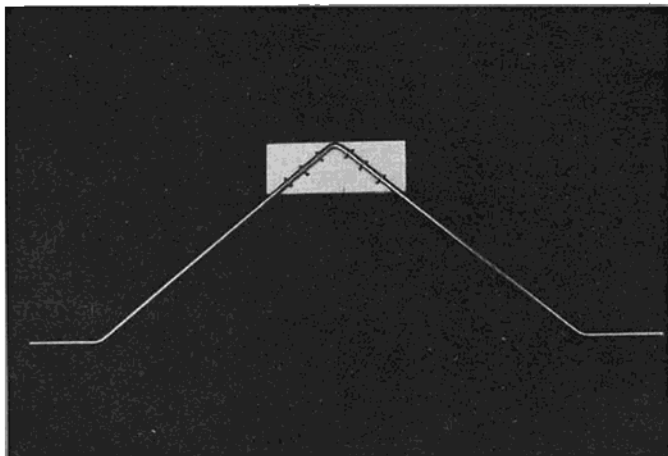
to hold in place. If the wood is hard to hold down, dampen the outer surface with a rag or sponge moistened with water before bending downward. This completes the basic wing assembly and the wing should remain pinned to the board at least 8 hours to avoid possible warps. (You can begin working on the fuselage while the wing is drying.)

(7) Remove the wing from the work surface, carefully removing all pins or tape. If the pins are hard to remove, grasp with pliers and rotate the pin slightly to break loose any glue, then pull straight out. Use a flat sanding block at least 3" wide by 9" long, made of pine or plywood stock, with #180 or #220 sandpaper glued in place to sand the wing lower surface from tip to tip. Be careful to keep the airfoil section flat and not to change the rib shape. Cut away any excess blobs of glue as you progress. Cut the tips from 1/8" x 1 3/8" x 7 1/2" balsa as shown on the plan. Trim any excess material which protrudes beyond the tip rib and glue the tips in place aligning the bottom edge with the lower wing surface. When dry, cut off the excess material to match the top rib contour.

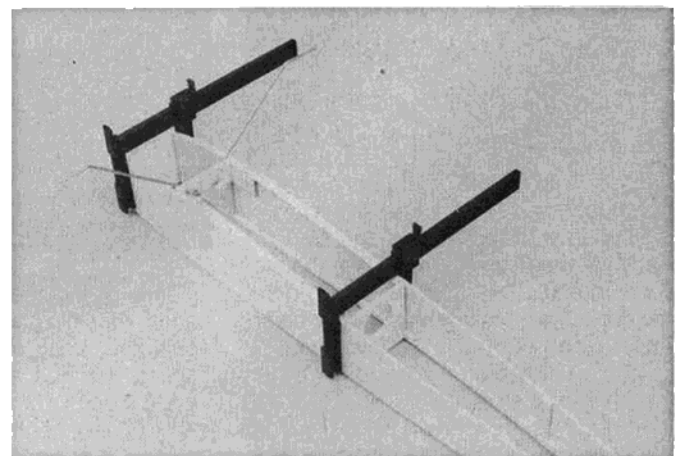
(8) Use a small razor plane or your knife to carve the leading edge to the

shape shown on the side view. Work slowly with the grain of the wood and reverse the direction of cut if the wood tends to splinter. Remove material from the corners and carve and sand the leading edge to a nicely rounded shape. Be very careful to maintain the shape along the whole span of the wing and avoid shaping to a point. This is very important as the wrong shape, or different shapes on the right and left panel will cause serious problems when you fly the model. Now you can sand the top surface of the wing, using extra care not to change the contour of the ribs. Just blend the leading and trailing edge joints, and the tips and center sheet.

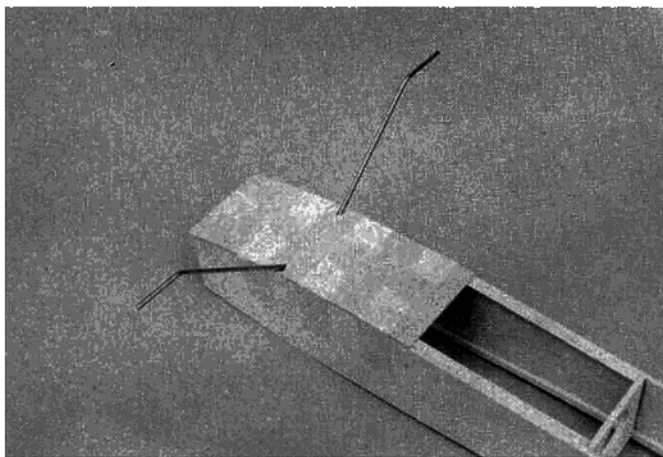
(9) Cut the wing apart at the center, working from both upper and lower surfaces. Be careful not to cut into the center W-1 ribs. A razor saw or hacksaw with a fine tooth blade is the easiest way. But you can do it with a knife. When the cut is complete, trim and block sand the excess spar, L.E. and T.E. material flush with the ribs. Check that the joint is square and that the ribs meet tightly. Trim the trailing edge on one panel to the contour shown on the plans, back to the 3/16" strip. Use this as a pattern to trim the second panel so that both panels



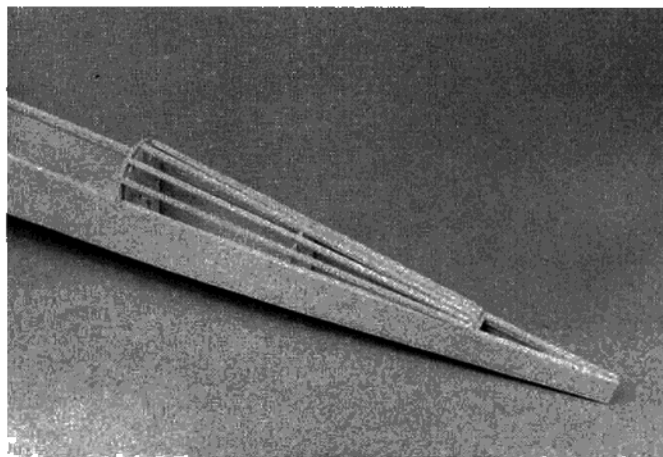
**Landing gear wired to F-2. Epoxy securely.**



**Using model clamps to hold securely, join two sides.**



**Ply bottom in place and secured with masking tape. Notch ply for landing gear.**



**Rear of fuselage completed with formers F-5A, 5B & 6 in place and stringers installed.**

match.

(10) Epoxy the 3/16" x 3/4" tapered stock to the end of one panel carefully aligning the lower edge. When dry, carve the wedge to match the end of the panel. Place this panel flat on your work surface (use Handiwrap underneath the joint) and butt the second panel against it. Block up the second panel so that the tip is raised 3 1/2" above the work surface and check the fit of the joint. If a gap exists, sand the face of the wedge until the gap is eliminated. Weight the first panel with magazines or similar so it won't shift around and apply epoxy to the end of the second panel. Join the panels, using pins, tape and/or weights to hold securely; check that the tip rib is 3 1/2" above the surface and let dry thoroughly. Don't move the wing until you are sure that the epoxy is completely cured!

(11) Sand the joint smooth and use Duco or similar cement to secure one end of a strip of 3/4" wide by 14" long nylon tape to the bottom trailing edge. Then raise the tape out of the way and apply a heavy bead of cement to the bottom joint. Pull the tape tight and squeeze down onto the cement. Use your fingers to rub the tape down firmly

in place, allowing the cement to ooze through the pores of the tape. Add more glue, if necessary, to cover any dry spots and let dry a few minutes. Now apply cement to the top surface and pull the tape tightly around the leading edge, across the top and down around the trailing edge, rubbing down as you go. When dry, trim off excess tape and rub in 2-3 additional coats to further strengthen the joint, rubbing the cement into the tape and adjacent balsa. Don't omit this step as the wing's strength depends on the tape and cement reinforcement! Sand the wing all over and it is ready to cover.

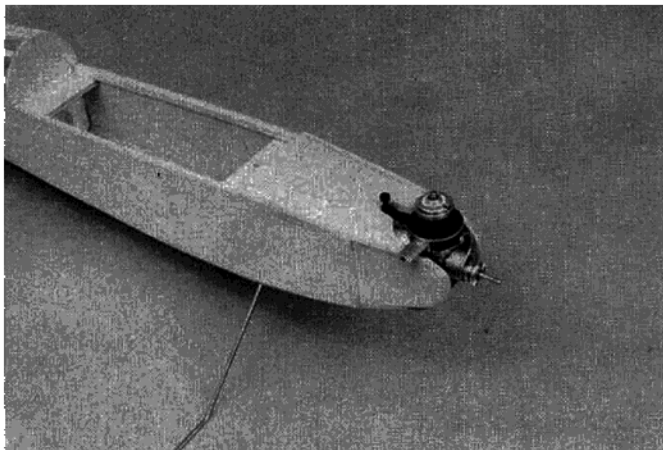
#### **Fuselage Assembly:**

(1) Pin the right fuselage side to the plan. Mark the location of formers F-2, F-5 and the aft cross pieces. Glue the nose doubler in place using the firewall (F-1) as a spacer at the front. Cut the tail post from T.E. stock and glue to the side. Cut a longeron (3/32" x 3/16" balsa) to length and glue in place between the doubler and the tail post. Cut the stiffener and glue to the side. Cut the 3/32" gear brace, glue in place using F-2 as a spacer. Cut and glue the 3/16" triangle stock between the gear brace and location for F-5.

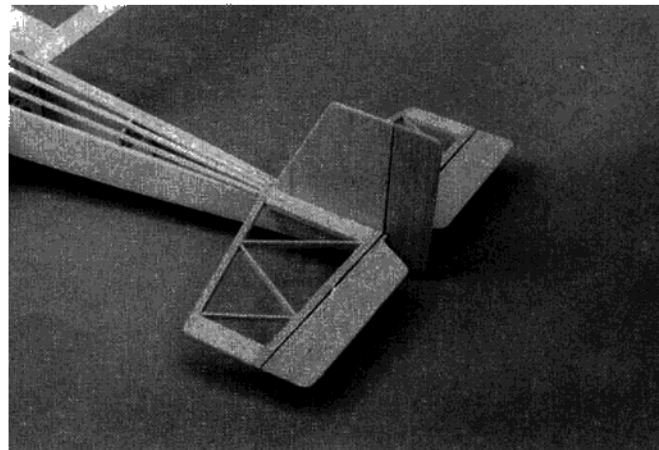
(2) After the glue has dried, remove the right side from the plan. Pin or tape the left fuselage side piece to the **outside** of this assembly. Now build up the left side, making sure that all the parts fit in exactly the same place as the right side.

(3) Using the plan as a template, mark the location of the 12 wire binding holes in former F-2. Drill the holes with a 1/32" diameter drill. Align the former and the gear over the plan and tack glue the gear in place with epoxy. Be careful not to plug any holes. Cut six pieces of soft wire about 1" long and bend to hairpin shape. Push a wire through 2 holes and twist together on the back side of the former. Twist the wire until it is firmly snugged down around the gear. After all six tie wires are in place, trim off the excess wire. Apply epoxy liberally around the landing gear and over the twisted wire on the back of the former. Check the gear alignment again and let the epoxy cure thoroughly. Mark and drill the firewall (F-1) for the engine mounting screws. A No. 55 drill is best, but a 1/16" diameter drill will do as a substitute.

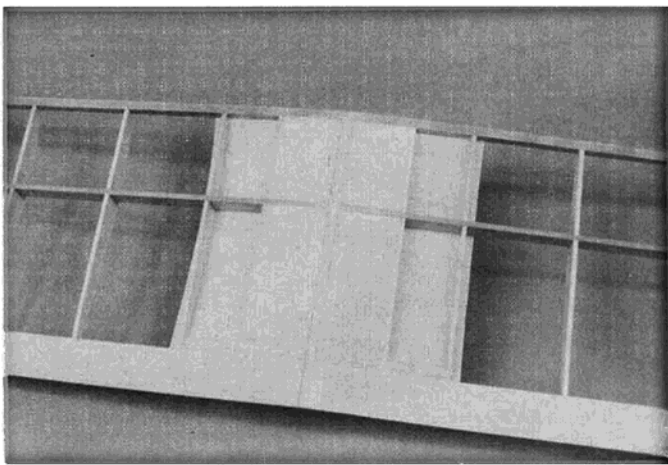
(4) Apply a bead of epoxy to one edge of F-1 and position on the right side assembly so the face of the former is flush



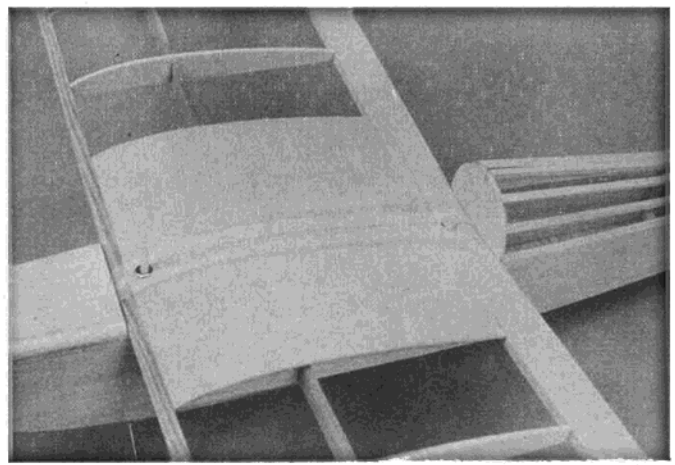
**Engine installed and nose blocks glued in place and sanded to shape.**



**Tail group completed and pinned in place to check alignment.**



**Bottom view of wing center section after two panels are joined. Center wrapped with 3/4" nylon tape.**



**Completed wing mated to fuselage. Holes drilled for grommets and nylon screws.**

with the edge of the side and that the bottom edge is aligned (make sure you don't glue it in upside down — check mounting holes). Use a square or triangle to insure perpendicularity. Hold in place till epoxy dries. Next epoxy F-2 in place. Note that you may have to notch the doubler to clear the landing gear wire. After F-2 has set, attach F-5. Check the location of the pushrod holes to make sure you don't glue former backwards. Check perpendicular alignment of all three formers as the epoxy cures.

(5) Lay the left side over the assembly and check the alignment of the parts. Correct any misalignment before proceeding. Apply epoxy to the edge of the formers and attach the left side. Weight the assembly until the glue sets.

(6) Using the plan as a template, cut 4 cross pieces from 3/16" x 1/4" stock (one forward, two aft and one stab cross piece). Place Handiwrap over the top view of the plan. Pin the front, top aft and stab cross pieces to the plan. Apply epoxy to the ends of these pieces and to the side of the fuselage tail post. Lay the fuselage, upside down, over the plan. Pin the fuselage so it rests against the cross pieces. Tape the tail together and

pin the fuselage to the plan. Make sure the fuselage conforms to shape on the plan. Epoxy the bottom aft cross piece in place.

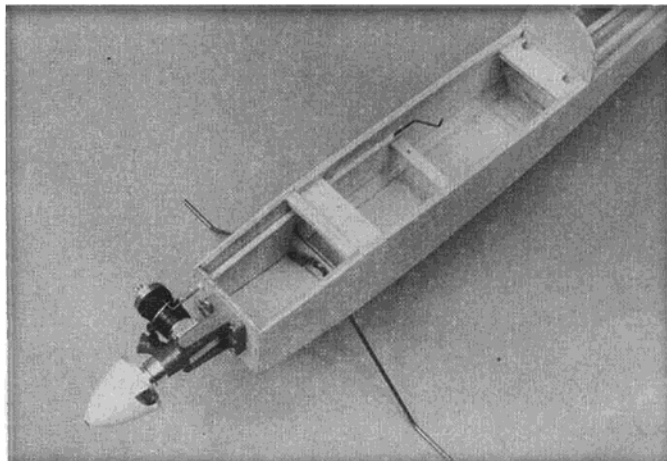
(7) Notch the plywood floor to clear the landing gear. Epoxy the floor in place using weights or masking tape to hold it in position. Complete the bottom sheeting with pieces cut from the 1/16" x 3" x 12" sheet. Note that the grain of the bottom sheets runs across the fuselage. Allow the assembly to dry thoroughly.

(8) Remove the pins and lift the assembly from the plan. The pushrods shown are telescoping nylon tubes, which transfer the motion of the servo output arms to the control surface. This type of pushrod is lightweight, very easy to install, operates smoothly, and we highly recommend their use. Note that the outer tube is firmly fixed at former F-5 and the side exit point. The inner tube slides back and forth inside this outer tube. Cut or file the slots under the stab for the outer pushrod tubing. Before installing the pushrods, place your radio equipment in the fuselage and make sure that the servo rotation will result in proper control surface movement. The elevator pushrod is pulled forward for down, and pushed back for up elevator.

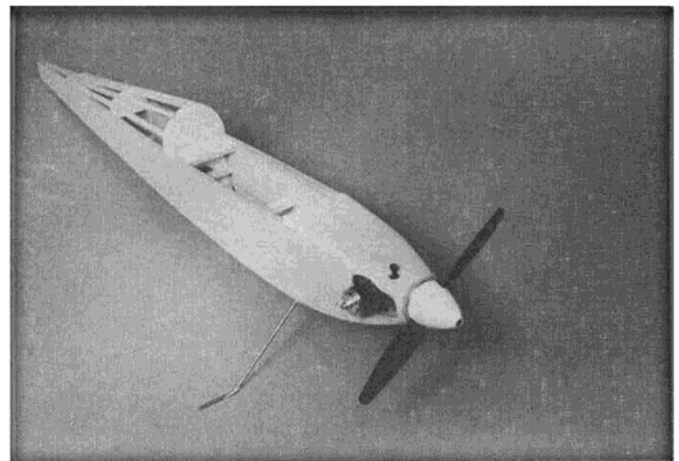
The rudder pushrod is pulled forward for right and pushed back for left rudder. Now remove the outer tube and use coarse sandpaper to scuff the surface which contacts F-5 and the sides for better glue adhesion. Reinstall the tubes in the fuselage and use Hot Stuff or epoxy to glue the tubes in place.

(9) Check that you can insert and remove the battery pack through the space between former F-2 and the top cross piece, correcting any problems before continuing. We suggest that you line the sides, front, and bottom of the battery compartment with soft 1/4" thick foam or equivalent. Contact cement works well to secure these pads in place and this should be done before adding the top forward sheet. Install the 3/16" x 5/16" spruce servo rails across the fuselage. Make sure your servos will line up properly with the pushrods.

(10) Glue formers F-5A and F-5B together as indicated on the plan. Glue this assembly to the top of former F-5. Check perpendicular alignment as the glue dries. Glue former F-6 on top of the aft cross piece and cut and glue a 1/8" square piece of balsa atop the stab cross piece. Now attach the 1/8" square



**3 channel version showing throttled Tee Dee installation. Note cut-outs in rear wing mount for access to servo tray screws.**



**Completed fuselage for 3 channel version.**

stringers in the following sequence: First, glue the top stringer in place, centering it on the fuselage. Next, attach the two outside stringers, warping them slightly along their length so they conform to the curve of the formers and are flat on the fuselage at the stab cross piece. Finally, glue the two intermediate stringers in place, centering them between the top and outside stringers. Epoxy formers F-3 and F-4 in place beneath the side longerons.

(11) Trim the fuselage sides to match the angle at the top of the nose doublers. Cut the cowling parts from 3/16" balsa sheet. Cut out the top nose sheet according to the plan template and glue to the front fuselage. Cut the nose side sheets and glue to the firewall and the top sheet. Leave enough material outside the fuselage sides to allow sanding to a smooth contour shape. Cut and glue the nose bottom sheet in place. Note that the grain on this part runs crosswise to the fuselage.

(12) After the glue has thoroughly dried, carve the nose sheets to finished shape. Block sand until a smooth, even contour is achieved. The pushrod tubing that exits from the rear of the fuselage is trimmed flush and sanded smooth. Lightly sand the remainder of the fuselage and slightly round all corners.

(13) The wing is attached to the fuselage with two nylon screws. Mark the screw center lines on the wing. Position the wing on the fuselage, making sure it is centered. Drill a 3/32" diameter hole through the wing and former F-4. Remove the wing and enlarge the hole in the wing to 5/32" diameter, then tap a 6-32 thread through F-3. Re-attach the wing using one of the 6-32 nylon screws. Note that the rear mounting screw will have to be cut off to 9/16" to clear the pushrod. Trammel the wing so it is perpendicular to the fuselage and drill a 3/32" diameter hole through the forward portion of the wing and former F-3. Remove the wing, enlarge the hole in the wing to 5/32" diameter and tap the threads into F-3. Re-mount the wing, check alignment and correct any misalignment before continuing.

### **Sanding:**

Sanding is intended to smooth the surfaces of the wood so that the finished model will look better. Any defect will not

be hidden by the final finish, but will show up more visibly. The care and patience spent now will reward you with pride when you show your model to your friends and provide you with the self-satisfaction of doing an outstanding job.

The difference between a good looking or poor model is usually sandpaper and there are no substitutes. One hour with a sanding block now will provide satisfaction for the life of the model.

We suggest that the following tools and materials will make this work easier and provide better results:

A small block plane such as Sears No. 37057 is great for shaping the leading edges and hardwood parts. In addition, a razor plane is excellent for shaping balsa.

Several different sanding blocks, covered with different grades of paper, will give true, flat surfaces. Emery boards are also helpful for tight corners or stubborn spots.

Use the better grades of sandpaper such as Aluminum Oxide or Silicon Carbide open coat. Garnet paper is also satisfactory, but the more common grades of flint paper wear out so quickly that their low cost is offset by the inconvenience and wasted time. Check the shelves of your local hardware store or automotive supply outlet if you can't find these materials elsewhere. We recommend that you use No. 120 for rough sanding, switching to No. 220, then to No. 320 or No. 400 for final sanding. One sheet of each grade is more than enough to complete this model. Use long strokes and blend the surfaces smoothly. A little water or saliva on dents may raise the wood fibers enough to eliminate the need for filler in most cases. Bad dents or cracks should be filled and sanded smooth.

Re-sand all surfaces with worn No. 320 or No. 400 paper by hand and you are ready to cover and finish your model.

### **Covering and Finishing:**

Every modeler usually develops his favorite methods of covering and finishing models. Many times, however, a great deal of weight is added to the model trying to get a super finish. This is bad for any model. For a small airplane, disastrous! Whichever method you choose, keep it light!

We strongly recommend that the entire model be covered in Super MonoKote or Solarfilm. We know of no other

way to get a slick, good looking surface with minimum weight build-up. You can use silkspan and dope if you prefer, but be careful to avoid warps.

If you do use one of the plastic film materials, we suggest that you apply a protective coat of fuel-proof paint to the inner surfaces of the cowl and firewall, plus the wing supports and cabane uprights. We used clear Hobby epoxy, brushed on for the prototypes, as this gives a varnished wood appearance. You might also use polyurethane varnish or any fuel-proof dope, either clear or colored. We definitely feel that these surfaces should be painted, as the covering with film is very difficult and time consuming, and the wood will become oil-soaked very quickly if left unprotected. This painting should be completed before starting to cover.

Remember that you have to see the model clearly while in flight, to be able to control it properly. Use high visibility colors such as orange, red or yellow for the flying surfaces. The fuselage can be the same or a contrasting color. A longitudinal trim stripe on the top or bottom surface of the wing will help orient the model when it's far out. A few areas of chrome MonoKote or Mylar trim will give excellent visibility on sunny days. The transparent colors are very effective and look good with this type of structure. It's your choice and a good opportunity to express your individuality.

The wing is covered in 4 separate pieces, and the stabilizer with 2 pieces. Follow the instructions provided by the supplier if you use Super MonoKote or similar material. Be careful when shrinking the material to avoid warping or distorting the structure. Be sure to adhere the covering to the ribs on both the top and bottom surfaces for greater strength.

We suggest that you cover the vertical and horizontal tail surfaces separately, and then remove the material locally to assemble. We also find it easier to cover the tail surfaces before installing the hinges.

### **Final Assembly:**

After all parts are finished to your satisfaction, and you have checked all the flying surfaces for twists or warps, and removed any present (except the wing tip washout noted on the plans for the trainer), you are ready to start final assembly.

(1) Remove a narrow strip of covering material to uncover the slot in the top of the stabilizer where the fin mounts. Also, remove the covering from the base of the fin, so that there is wood to wood contact between the fin and the stab center ribs. Epoxy the fin into the stab,

checking that it is properly seated and perpendicular to the stab. Use your square or triangle and check while the epoxy is curing. Use thinner, acetone or alcohol to remove any excess epoxy.

(2) Install the hinges into the stabilizer, using a pin or No. 11 X-Acto blade, to force epoxy down into the slot. Be sure that the molded crease in the hinges are lined up exactly with the stab trailing edge, and remove any excess epoxy that oozes out before it cures. Allow to dry thoroughly, then install the elevator, being very careful to ensure free action and to remove any excess epoxy. Next, install the hinges in the fin first, then add the rudder, once again checking that the surfaces move freely.

(3) Hold the tail group in place on the top rear of the fuselage and use masking tape or pins to secure it temporarily to the fuselage. Use a strip of masking tape across the bottom of the rudder and aft fuselage to ensure that they are properly aligned. Visually check that the fin is aligned with the fuselage center line, using the top stringers as a sighting guide. Check this very carefully, as a misaligned fin will cause turning tendencies while flying. When you are satisfied with the alignment, use the point of a pin held tightly against the fuselage sides to mark the bottom of the stabilizer leading and trailing edges where they meet the sides. Remove the stab and cut away the covering material from the bottom of the stab, using the pin holes as a guide. Remove any covering material from the fuselage sides and top stiffeners where the stab mounts. Coat these areas with epoxy and re-position stab in place, securing with pins. Check alignment carefully and let dry completely before handling the fuselage.

(4) Bend the tail skid from a bobby-pin (or use 1/32" diameter music wire). Drill a small hole vertically into the tail post and cut away the covering material under the skid. Epoxy the skid in place. Push the wheels over the axle ends and screw on the small spring retainers to hold the wheels in place.

(5) The next step is to mount the engine on the firewall. We highly recommend that you use the muffler called out on the plans, particularly if you plan to fly near houses or buildings. This muffler causes very little loss in power, is light and effective, and is easy to install following the instructions provided with the unit. Use four No. 2 x 3/8" long sheet metal screws to fasten the engine to the firewall. Slip a No. 2 flat washer between the firewall and mounting flange in the upper right hand corner (see plans) to provide a little right and down thrust for the first flights. Be sure to tighten all four screws snugly, but don't overtighten, as the holes in the firewall will strip.

(6) Thread the No. 2-56 x 1 studs into the end of the inner pushrods at least 3/16". Use pliers if you can't turn the stud with your fingers. If you have access to a

No. 2-56 tap, we suggest pre-tapping the pushrods and clevis to make assembly easier, but it is not necessary. Install the clevis on the other end of the stud and position the clevis so that approximately 1/8" of the stud protrudes into the slot in the clevis. Insert inner pushrod into outer tube from the rear until it comes through in the servo compartment. Spread clevis with a small screwdriver and insert pin through outer hole in control horn. Now mount control horns, lining up holes for the clevis with the hinge line. Hold in place with your fingers and use a nail or toothpick to punch through the film covering over the mounting holes. Assemble horns to the surface using the No. 2-56 x 5/16" long screws and the small square piece attached to the horn as a nut. (Cut horn and nut plate with razor blade or knife before assembly.) Check control action for binding and you are ready to install the radio equipment.

(7) Using the template provided on the plan, cut out the cockpit back and sides. Cut strips of MonoKote from the wing in the area where these parts attach. Glue the cockpit back to the wing. Sand the cockpit sides to conform to the contour of F-5A. Bevel the top and bottom edges as indicated and glue in place. Use small pieces of MonoKote to cover these parts, slightly overlapping the MonoKote on the wing. Cut the windshield from the acetate sheet using the plan template as a guide. Cut a paper pattern to match the contour of the windshield bottom as shown on the top view of the plan. Place this pattern on the wing and carefully cut away a thin strip of MonoKote where the windshield will attach. Place the windshield on the wing, wrap around and pin to the cockpit sides. Carefully apply a bead of fast setting adhesive to the windshield base. Make sure it is firmly glued to the wing and cockpit sides, then remove pins. Apply a thin strip of MonoKote around the windshield base to hide the joint. Attach a narrow piece of tape to the back edge of the windshield to represent a metal frame. The strip of foam tape is used to seal the radio compartment. Cut the tape into two 7" long pieces. Peel the backing material away and press the tape onto the top of the fuselage sides.

#### Radio Installation:

If you use a different radio system than shown on the plan, you will have to locate the equipment to suit; be sure to follow the manufacturer's instructions. Plan the installation carefully so that you don't have to keep moving things around, and check the balance before finalizing locations. Fasten the servo and switch into the tray and screw the tray to the servo rails. Wrap the battery pack and receiver in foam and install in the forward compartment. At this time,

we suggest that you connect all cables, install antenna leadout and run antenna rearward along the outside of the fuselage.

Secure the free end of the antenna with a rubber band or tape, letting any excess length trail behind the model.

Make up the two servo links, bending as required with pliers. Thread into inner pushrod at least 10 turns, align with servo arm and make final bend. Install through hole in arm, press on retainer and check neutral position. Adjust if necessary by screwing the clevis in or out. You should now check the balance point of the completed model by supporting the wing on your fingertips near the center. The model should balance in a level attitude about 1/8" forward of the main spar for the first flights. Slide the battery pack back and forth if necessary to balance the model. Be sure that it is firmly secured so that it will not shift around during flight or landing. If the model still won't balance properly, then you must add weight to the nose or tail to obtain good flights. It is far better to add an ounce of lead to the nose, than to try to fly a tail heavy model, which will be very difficult to handle for the inexperienced pilot.

#### Pre-Flight:

At this point, you are ready to make the pre-flight checks before going flying. A few minutes spent now, will give you more confidence and help to eliminate any problems at the field.

(1) Inspect the model carefully. Wiggle the tail surfaces to make sure the joints are secure. Check that the radio equipment is securely mounted.

(2) Check that the surfaces are not twisted or warped. Correct any warps with low heat or steam on the surface, while you twist in the opposite direction.

(3) Mount the wing. Make sure the rear attachment screw does not interfere with the pushrod movement.

(4) Check the balance point. Add or remove weight from the nose until it's correct.

(5) Check the radio operation. Try all the control positions and make sure the controls move in the proper direction. Check that the surfaces are at neutral position when the transmitter trims are at neutral. Adjust clevises, if required.

(6) Check your batteries, both in the transmitter and airplane. If you are using dry batteries, be sure they are fresh; if Ni-Cads, that they are fully charged. Remember that more radio failures occur from defective or improperly charged batteries than any other causes. Don't be a statistic!

Now let's go flying!

**Editing By Hisat.  
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