*EDITOR'S PREFACE*

*The model publications and almost every kit manufacturer in the industy have been designing trainers since R/C flying began in the early 1950's. These models have been created in all shapes and sizes, and a few have endured through the years when they have proven to be truly successful beginner's models. The rest have passed into obscurity.*

*Designing a good trainer is a difficult task, more difficult in our judgement than the design of a good flying Scale or Pattern aircraft. It is not easy for an experienced flier to recapture the lack of knowledge and shaky knees that preceeded his first efforts. To analyze the problems facing the novice; to develop solutions to these problems; then to verify the solutions by a rigorous testing program, demands the highest level of design ability and insight. Rarely does a talented designer take a clean sheet of paper and create a truly unique model aircraft specifically tailored for the R/C Novice.*

*There are many excellent trainers available today. Most of these are for .19 to .60 sized engines, and many require 3 or 4 channel radio equipment. This type of model will handle heavy wind better than a smaller airplane and they are very popular today. They do, however, offer significant drawbacks to the prospective R/C pilot. The most obvious one is the initial investment in materials, engines and accessories and radio equipment. Not so obvious, is the additional skill level required to build many of these models, particularly those which require sheeted and cap stripped wings, carving and shaping blocks and other construction techniques the experienced builder takes for granted. Most important is the fact that the more popular trainers require the assistance of a skilled flier to trim out the aircraft and provide flight instruction. This is great if such assistance is available, but what about the guy who lives in the boon docks and has to get it all together by himself?*

*The Q-Tee, designed by good friend Lee Renaud, offers an alternative method of starting in R/C. This is a unique approach by an outstanding model designer and uses a carefully thought-out systems engineering concept. By using a low cost, easy starting engine which is available in every hobby shop and most work benches around the country as the basis for the Q-Tee, he has achieved a minimum cost way for the novice to try R/C flying. So simple that it's obviously a breakthrough in attracting newcomers to our hobby – yet no one else has approached the problem in this unique manner.*

*To most of us who have been involved with R/C flying for a number of years 1/2A R/C is associated with racing or small pattern ships. The Q-Tee is a very different breed of cat. As radios continue to shrink in size and weight and the pressure of urban sprawl makes large flying areas more difficult to find, we believe more and more fliers will be attracted by the advantages of this type of model.*

*The Q-Tee offers the stability and slow speed required for the beginner who has not yet mastered the sticks. Set up as a trainer it will putt-putt around until the tank runs out, then glide flat until you touch down. With the advanced set-up it can bore holes in the sky, fly inverted, perform all rudder/elevator stunts, yet still give you a glide many sailplanes would envy.*

*No matter what your skill level, we suggest that you read Lee's article. Perhaps you might enjoy a fun-fly ship you can keep in the trunk of your car until the next good day. Even if not, you can teach your own or the neighbor's, kids how to fly an R/C model. If there are no kids around the Q-Tee is still great for wives or girlfriends. Build one!*

*Don Dewey*

# Q-TEE

**BY LEE RENAUD**

The Q-Tee is an R/C power model designed for the novice builder and flier. The design was approached with the following objectives in mind:

1) Simple rugged construction so that someone with no previous building experience could easily duplicate the model.

2) An inexpensive systems approach which would minimize the investment for the person who wants to try R/C flying but has limited funds.

3) A model which could be easily transported to the flying field, even on a bicycle, with all support paraphenalia minimized.

4) A model which could be flown in a restricted space, such as a local schoolyard, parking lot, or field. It must be easily hand launched by the flier, without an assistant.

5) Smooth, stable flight characteristics for hands-off flying with the ability to return to level flight without constant control for the beginners. In addition, an intermediate flight envelope for stuntability as more skill is gained.

These goals are not easily accomplished and much thought, drawing board time, and test flying took place before the design was finalized. All design is a compromise, and

sport/trainer type models offer a most difficult challenge. So that you may better understand how the Q-Tee evolved we will explain this process in some detail.

Goals 2, 3, and 4 established that the best approach would be a 2 channel .049 powered model. Although there are many kits and previously published plans available for this type model, most use the Cox Tee-Dee series engines and are fast flying and highly maneuverable. This model was designed around the Cox Reed Valve engines, specifically the Golden Bee or Black Widow. These engines are inexpensive, readily available, start easily and have an excellent muffler available. They use small props and very little fuel and an important bonus is the built-in starter spring. The only field items required are a can of fuel and starting battery, with a spare glo-head, wrenches and screwdriver as deluxe additions. Cox even sells those items either separately, or in a neat plastic case, Part No. 990. Please don't use the more expensive and higher power Cox Medallion or Tee-Dee series engines, you just don't need the higher performance.

To minimize radio equipment cost only rudder and elevator control was considered. The smaller engines don't throttle very well anyway and the power on/power off speed ratio is not high. Ailerons were not considered as they require more skill to install and align. We consider the 2-3 channel brick style radios as most suitable for the beginner as they simplify installation and make it very easy to fly several different models with one radio system. Take a look at the systems offered by Cannon, Kraft, or EK and pick the one you like best — they all work well. Of course any conventional airborne systems using small servos will also work well. There are many such radios available, several of which offer optional 225 mah battery packs, an easy way to save 2 ounces of flying weight.

Previous experience with 1/2A powered models indicated that a target flying weight of 18-20 ounces was suitable for a muffled

Golden Bee engine. The desired flight characteristics, particularly slow flying speed dictated a wing loading of 10-11 ounces/sq. ft. This meant a wing area of 250 sq. in. would be about right. To conserve wood and covering material, a span of 36 inches was selected, and a constant chord layout adopted.

With the power plant, radio system and wing planform determined the next step was to finalize the overall layout. The parasol wing position was chosen to provide a high center of lift. Combined with positive wing incidence and a generous horizontal empennage, this layout ensures good longitudinal stability and a nose-up tendency under power. A large amount of down thrust is used to prevent excessive climbing under power. Generous dihedral is used to ensure adequate spiral stability. A two wheel gear was chosen since easy ground handling was not a consideration. With major airframe elements determined the overall lines could now be finalized. The final configuration is reminiscent of home-built aircraft popular in the thirties, and many current EAA home-built designs. We think that the lines are visually appealing and appropriate to the flying characteristics of the model. Everyone who has seen the prototypes agree, and almost all have said, "That's a real cutie." Now you know why we selected the name **Q-Tee.**

The secret of successful flying of all model airplanes is a lightweight accurately aligned airframe. This is particularly important in the smaller size models as a weight increase of only 2-3 ounces will make power flight marginal and the increased flying speed makes control more difficult for the inexperienced pilot. For those reasons we carefully considered the structure of the Q-Tee and tried several variants before selecting the materials and construction shown on the plans. The resultant airframe is very easy to build and very crash resistant. Most important, it is simple to assemble accurately and requires no special tools or jigs. Additionally, repairs are very easy and the structure is rigid enough so that any of the currently available film coverings can be used. Please don't "beef-up" the structure as it is not necessary and flight performance will be degraded.

If you have read this far and think that the Q-Tee is the model to introduce you to the sport of R/C Aircraft, send off to RCM for a copy of the full size plans of the Q-TEE and Volume 1 of the Flight Training Course. (See special offer on page 166 of this issue.) 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 Q-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. They are 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. Hobbypoxy Formula 4 or Devcon 5-minute epoxy are recommended for the cabane structure and 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.

**Q-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**
Parasol Wing
**AIRFOIL**
Flat Bottom
**WING PLANFORM**
Constant Chord
**DIHEDRAL, Each Tip**
1¾ Inches
**O.A. FUSELAGE LENGTH**
27 Inches
**RADIO COMPARTMENT AREA**
(L) 7½" X (W) 1¾" X (H) 2"
**STABILIZER SPAN**
12¾ Inches
**STABILIZER CHORD (incl. elev.)**
4½ Inches (Avg.)
**STABILIZER AREA**
56 Square Inches
**STAB AIRFOIL SECTION**
Flat
**STABILIZER LOCATION**
Top of Fuselage
**VERTICAL FIN HEIGHT**
3⅝ Inches
**VERTICAL FIN WIDTH (incl. rudder)**
4¼ Inches (Average)
**REC. ENGINE SIZE**
Cox .049-.051
**FUEL TANK SIZE**
Cox Engine Tank
**LANDING GEAR**
Conventional
**REC. NO. OF CHANNELS**
Two
**CONTROL FUNCTIONS**
Rudder and Elevator
**BASIC MATERIALS USED IN CONSTRUCTION**
Fuselage ..... Balsa, Ply & Hardwood
Wing ..... Balsa and Hardwood
Empennage ..... Balsa
**Weight Ready-To-Fly** ..... 16-20 Ozs.
**Wing Loading** ..... 9.24-11.56 Oz./Sq. Ft.

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 18 3/32" x 7/8" x 7⅛" 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 matter 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, to prevent gluing the wood parts to the plan.

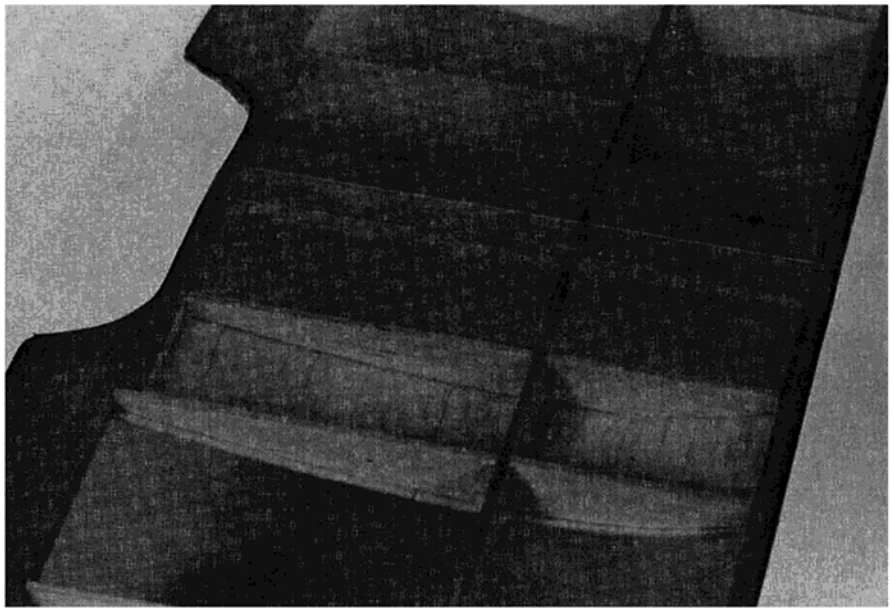
**Tail Surfaces:**

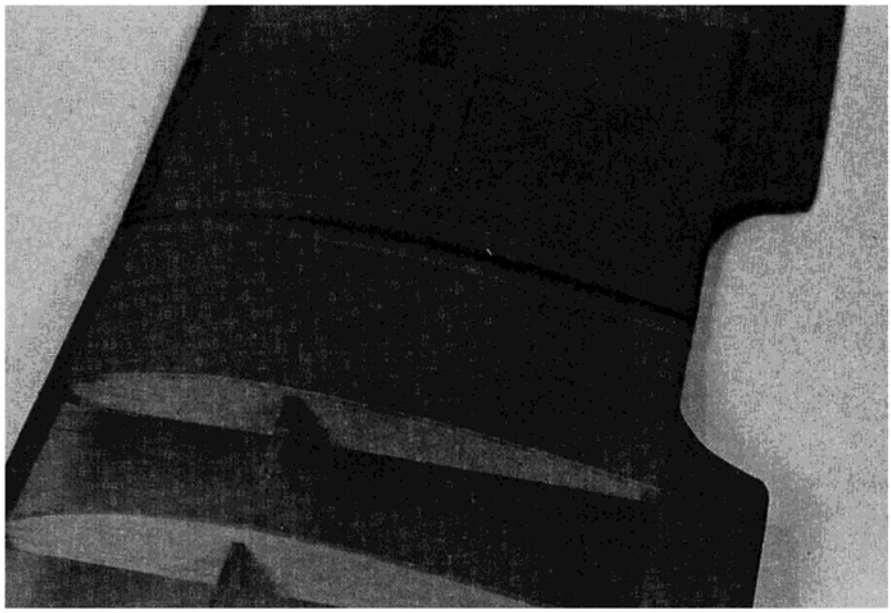
1) The rudder is cut from a strip of 1/8" x 1⅜" x 17⅞" balsa. Lay the strip against the plan and mark the correct length. Check carefully then cut. (The balance of this strip is used for the elevator.)

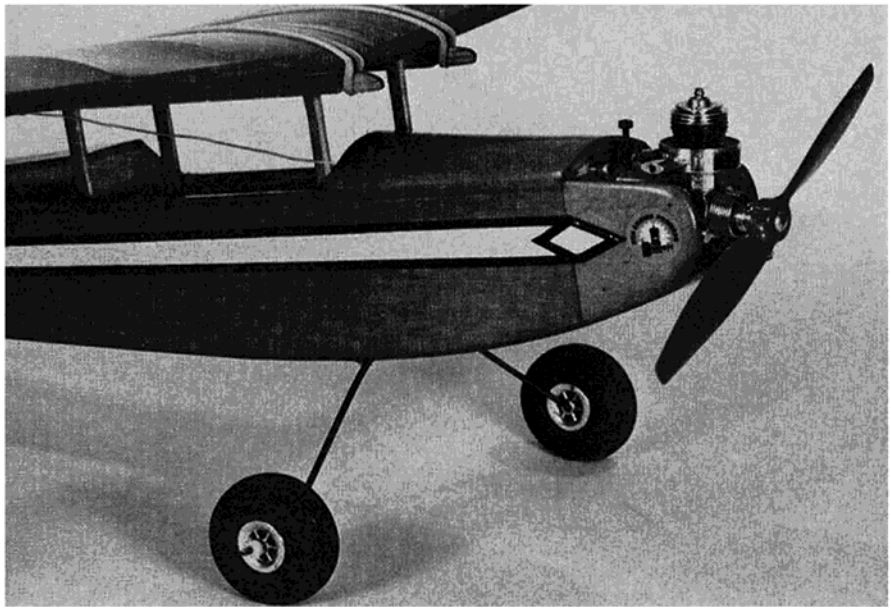
Now, lay the rudder over the plan and cut or file a notch in the leading edge, to clear the elevator tie. Round off the corners then round all edges and sand smooth.

2) The rudder is made from a piece of 1/8" x 3" x 3⅞" 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 rudder. 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







***The top photo shows the underside of the wing center section. Center photo is a view of the upper surface of the center section. Photo above shows Cox .049 and Cox muffler.***

rudder and the crease is lined up with edge of the rudder.

Align the fin and rudder and mark the hinge positions on the fin. Cut slits in fin trailing edge and fit 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 the 3/16'' x 11/16'' x 11⅞'' 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 together, before using any glue and to correct any mistakes before continuing. Pin the end ribs in place, gluing them to the stab trailing edge. Also pin and glue the center ribs in position, using the rudder 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 joint 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 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 rudder 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. Trim 1/4" from the trailing edge of 4 of these ribs (W-1) to allow clearance for the 3/16" x 1/4" balsa trailing edge strip which fits between the W-2 ribs. Pre-glue the leading and trailing edge of all ribs.

2) Use a small square or straight-edge to cut 4 pieces 1-5/16" wide and 4 pieces 3⅛" 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 4 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 the 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 complete. Now pin the trailing edge in place over the plans, using enough pins to hold it flat and secure. Cut the 3/16" x 1/4" strip to fit between the W-2 ribs and glue it to the trailing edge. 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 ends of the center strip and 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"-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 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 strip. 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

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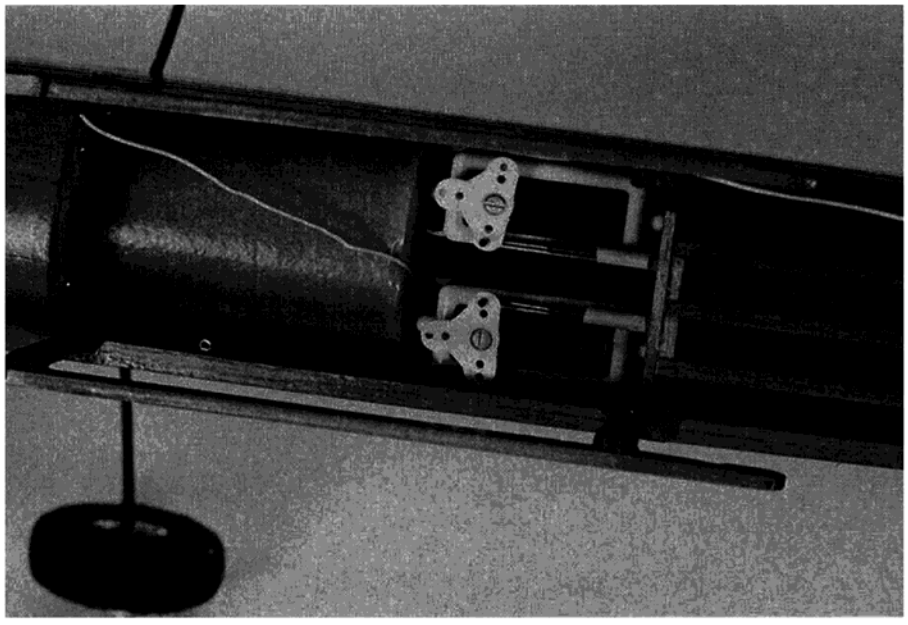
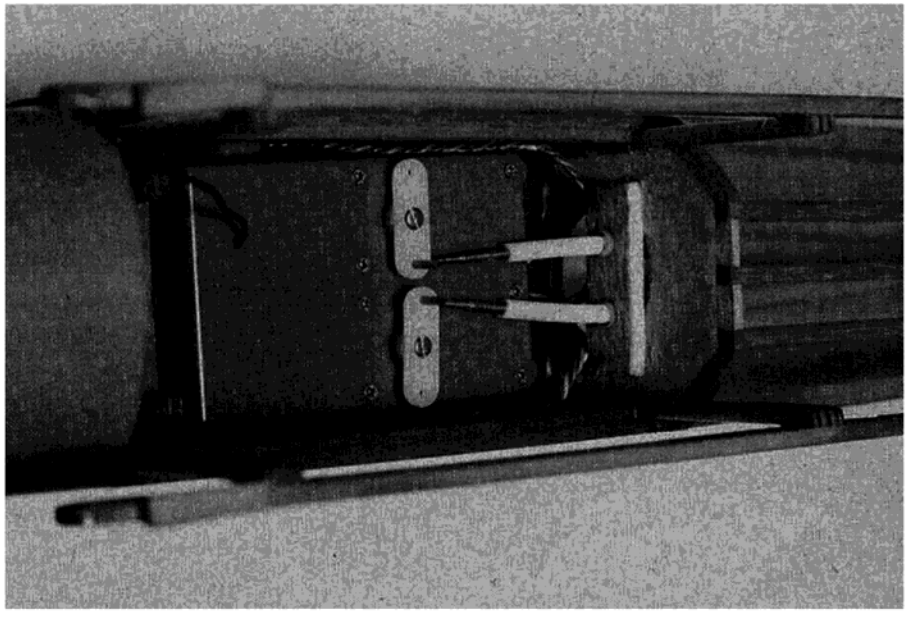




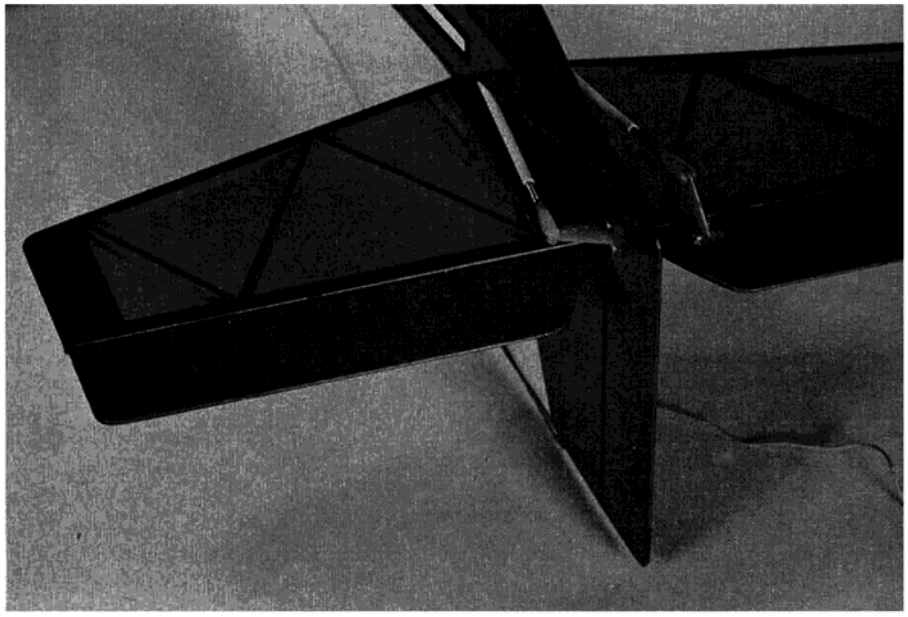
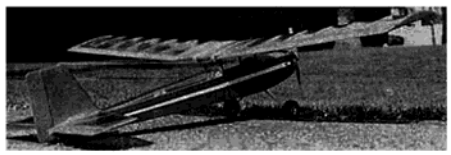


***Photo at top shows a typical two servo installation. Foam wrapped receiver in front. Center photo shows a typical two-channel brick installed. Photo above is a view of the tail surfaces and pushrod connections.***



## Q-TEE

.....edge. 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. It is easiest to hold the wing in your hand or lap and to sand one section at a time, working along the span. Sand slowly and carefully to be sure all joints are flush. Cut away any excess blobs of glue as you progress. Cut the tips from 1/8" x 1⅜" x 7⅛" 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" x 1/4" strip. Use this as a pattern to trim the second panel so that both panels match.

10) Epoxy the 3/16" x ¾" 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 3½" 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 3½" 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 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 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 finished wing's strength depends on the tape and cement reinforcement!** Sand the wing all over and it is ready to cover.

**Fuselage Assembly:**

1) Cut two sets of cabane uprights and wing supports from a strip of 1/8" x 1/4" x 30" fir, using the plans as a guide. Pin the right side in place over the plan and epoxy the forward and aft uprights to the side, removing any excess epoxy from the surfaces where F-2 and F-3 fit. When these joints are completely dry, epoxy the wing support under the uprights using extra care that the support is exactly aligned with the plan. Add the 3/16" x 3/4" tapered tailpost and the 3/32" x 3/4" lower nose doubler using F-2 as a spacer to locate the doubler. Cut two sets of 3/32" x 3/16" top stiffeners to the lengths shown by the arrows and glue in place aligning them with the top edge of the sides. Note that the rear stiffener is one piece from aft of F-3 to the tailpost, and that 1/8" gaps are allowed so that F-1, F-2, and F-3 rest directly against the side. Add the 3/32" x 3/16" vertical stiffener and 3/16" triangular reinforcement between uprights and allow to dry thoroughly before removing from the work surface.

2) Pin or tape the left side to the **outside** of this assembly so that both sides are perfectly aligned, with their outside faces together. Epoxy the cabane uprights in place aligning them exactly with the ones installed on the right side. When dry, install the wing support using tape to align it with the right one. Install the lower doubler, top stiffeners, and vertical stiffener. Check that both sides are identical. When the glue has dried shape the wing support ends and trim the lower doublers flush with the side outline. Separate sides and pin the right side to your work surface locating it so that the landing gear hangs over the edge. Be careful not to snag the gear during the next step.

3) Before proceeding further with assembly of your Q-Tee, the fuselage formers should be checked against the radio you plan to use and modified accordingly. Former F-2 requires a cut-out to provide clearance for the battery pack. For maximum strength this cut-out should be as small as possible. The cut-out shown on the plans will accommodate any of the current small battery packs and was used on the prototype models. In any event do not enlarge the cut-out downward as the landing gear support will be weakened. Use the outline on the plan to locate the 12 holes required for mounting the gear and use a 1/32" diameter drill or sharpened 1/32" diameter music wire to drill these holes. Align the former and landing gear over view A-A, and use a few drops of epoxy to tack the gear to F-2, being careful not to plug the holes. Cut six pieces of soft wire about 1" long and bend into hairpin shape. Push a wire through two holes from the gear face and twist together tightly on the aft side of F-2. Use pliers to snug the wire firmly against the gear and the plywood. When all six pieces are installed, trim off the excess wire and apply epoxy liberally around the landing gear, and on the aft side over the twists. Check the gear alignment again and let the epoxy cure thoroughly.

Former F-1 should be marked and drilled for the engine mounting screws, using the plans as a template. A No. 55 diameter drill is best, but you can use a 1/16" diameter drill or sharpened music wire for those holes.

If you have larger size radio equipment it may be necessary to cut out Former F-3 to gain enough room for your receiver. Check this before installing the former! You will also have to drill (2) 3/16" diameter holes for the pushrods in Former F-3, and these must be located to suit the radio you intend to use. Now that you have all the formers ready, let's finish the fuselage.

4) Apply a bead of epoxy to one edge of Former F-1 and position on the right side so that the face of the former is flush with the edge of the side and the bottom edge is aligned. Use a square or triangle to check that the former is perpendicular to the side and hold in place until dry. Repeat this process with formers F-2 (you may have to notch the lower doubler to clear the gear) and F-3 epoxying them to the cabane uprights as well as the fuselage side. Check alignment as the epoxy cures. Allow to dry completely. 5) Place the left side assembly over the formers and check that all formers fit tightly against the side. Hold in place and use a square to check that the rear edges where the stab mounts are aligned. Correct any misalignment, apply epoxy to the edges of the formers and re-install the side. Weight or hold in place until the epoxy cures. Remove pins from the right side and remove from work surface.

6) Remove any lumps of glue or epoxy on the bottom edges of the side assembly and use your sanding block to smooth the edges between F-1 and F-3. Position the 1/16" ply bottom sheet and mark the location of the landing gear. You will have to file or cut a 3/32" wide notch about 3/16" deep from each edge to clear the wire. Be sure that the floor contacts the bottom edge of F-2 but try to avoid making the notches too large. When you're satisfied with the fit, epoxy the floor into position using strips of masking tape to hold in place tightly against the sides.

7) Place the fuselage over the top view so that the wing supports are resting on the plan and aligned with the sides. Pull the tail ends together and use a spring type clothespin or stationery clip to hold the sides together at the tailpost. Use a square or triangle to check that the tail joint is located directly above the position shown on the plans. Sight along the bottom of the fuselage to check for any twisting or a banana shape. Correct any misalignment by loosening the clamp and adjusting the side position. When satisfied, apply epoxy to the face of the tailpost and clamp the sides back together. Check alignment again. Cut two cross pieces from 3/16" x 1/4" stock and install between the sides at the location of the vertical stiffener. Slip a rubber band around the fuselage if required to hold the sides against the cross pieces. Cut the cross piece for the stab L.E. location, and glue in place. Be sure to position this cross piece so that it extends 1/8" in front of the stab. Use the stab as a gauge to check this. Cut former F-4 from 3/16" x 1/4" balsa stock using view B-B as a guide. Glue in place across the cross piece.

8) The pushrods shown are telescoping nylon tubes, which transfer the motion of the servo output arms to the control surfaces. 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-2 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. If necessary, you can cross the pushrods in the fuselage to help obtain the correct control surface action. Now, remove the outer tube and use coarse sandpaper to scuff the surface which contacts F-2 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 hole in Former F-2, 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. Use a moist sponge or rag to dampen one face of a piece of 3/32" x 3" x 3" balsa. The moisture will expand the wood fibers, causing the sheet to curl toward the dry side. Place this sheet over the top edges of Formers F-1 and F-2, and mark the rear edge to match the contour of Former F-2. Trim this edge until it lines up with F-2 and fits snugly against the forward cabane uprights. Now, mark and trim both edges that contact the sides. These edges should be carefully fitted and beveled until the sheet fits tightly along both sides and Former F-1 and F-2. When satisfied with the fit, glue the sheet in place using strips of masking tape to secure.

10)The aft fuselage sheeting is installed with the grain running across the fuselage, and is cut from a piece of 1/16" x 3" x 12" balsa. Lay the sheet across the bottom of the fuselage with the edge touching the ply bottom, and mark the sheet for the fuselage width. Glue this section in place using pins and/or masking tape to secure. Flop the sheet over so that the tapered edge matches the side curvature, mark, then cut and glue in place, butting tightly against the first piece. Use your fingers from inside the fuselage to help align the edges. Continue this process until the entire bottom is sheeted from the plywood back to the tail end. When dry, remove the tape and trim and sand flush with the sides.

(11) The top stringers are cut from a strip of 1/8" x 1/8" x 36" balsa. Cut the two long stringers 11¾" long, and the center stringer 6⅛" long and glue in place as shown on the top view and veiw B-B. Use the remaining stock to cut the fill-in pieces in front of the stab and on the face of Former F-3 after the stringers have thoroughly dried. Sand the stringers and filler pieces so that all joints blend smoothly. Trim all ends flush with the front side of F-3 and use the stab to check that the leading edge fits tightly against the 1/8" x 1/8" cross piece and that the trailing edge is aligned with the tailpost. Slip the fin and rudder in place and correct any misalignment now.

12) Trim and sand any surplus material from the front surface of F-1. Cut the cowl sides and bottom from 3/16" x 2" x 5⅞" balsa, taking note that the cowl bottom fits between the sides and the grain runs across the fuselage. Bevel the aft edge of the bottom so that it fits tightly against F-1 at the angle shown on the plans, and epoxy in place. Bevel the aft edge of the sides and epoxy to F-1 and the cowl bottom. When all cowl parts are dry, carve the bottom to match the side contour and carve and sand the side pieces to match the top view. Round all edges slightly and you are finished with the fuselage assembly.

## 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 #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 #120 for rough sanding, switching to #220, then to #320 or #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 #320 or #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 is disasterous. 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 Hobbypoxy, 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 to 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 #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 #2 x 3/8" long sheet metal screws to fasten the engine to the firewall. Slip a #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 #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 #2-56 tap, we suggest pre-tapping the pushrods and clevis to make assembly easier, but it is not necessary. Install clevis on the other end of the stud and position 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 #2-56 x 5/16" long screws and the small square piece attached to the horn as a nut. (Cut horn and nut plate apart with razor blade or knife before assembly.) Check control action for binding and you are ready to install the radio equipment. Since the airframe assembly is now complete, we suggest you mount the wing on the supports with a few #32 rubber bands and stand back and admire your handiwork. (We won't tell anyone if you run around the house holding the model raised in one hand and making funny noises.)

## RADIO INSTALLATION

The plans show suggested locations for brick type radios, and can be followed exactly for EK Logictrol LRB radios. For different equipment 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. Most radio manufacturers caution against the use of foam mounting tape for radio installations because of equipment failures, due to excessive engine vibration. We agree with this for larger engine sizes, but have used foam tape for 1/2A R/C and sailplanes for several years without problems.

You can use mounting rails if you prefer, as long as they are well supported on the sides. Material for rails and supports is not included.

Attach tape to the servos first, then peel off protective wrapping and press firmly against the floor. Do not try to move the servo once it has been mounted in place without replacing the tape. At this time we suggest that you connect all cables, mount the switch, 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, using four #32 bands on each side. Align the wing so that both tips are the same distance from the nose, and equidistant from the center of the fuselage. To check, tie a length of thread to the tail skid and use it to measure the distance to one tip at the trailing edge. Mark with your fingers and swing to the opposite tip. Adjust wing position until length is the same. We suggest you mark the lower surface of the wing on both sides of the wing supports to provide line-up marks for quick checking of wing alignment.

☐ 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.

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 cause. Don't be a statistic!

**Now let's go flying!**

## FLYING YOUR Q-TEE

Pick a large, grassy field, without obstructions if possible, for your first flights, even if you have to travel to find such a site. Since you are going to hand-launch the model, you don't need a paved strip or similar runway. If you can find a nearby R/C club, or someone in the area who knows how to fly R/C proficiently, by all means seek help before going flying. We will assume that you are on your own, without experienced assistance.

Before going to the flying field, run the engine at home until you are able to start it and adjust the needle valve consistently. You should also be completely familiar with the operation of the transmitter sticks and trim levers, so that you can locate everything by touch without looking away from the model. A few evenings spent hangar flying in front of an old TV movie is time well spent. Check that the controls move in the proper direction, etc., before you go to the field.

Select a calm morning or evening when there is no more than a 5 mph breeze for the first flights. You will have enough trouble coping with the excitement and nervousness of your solo flights, without worrying about wind. Force yourself to wait for the right conditions!

Start the engine and adjust the needle valve until it's running smoothly. Point the nose straight up and make sure the engine doesn't quit. **Turn on the receiver and transmitter.** Develop the habit of operating the sticks and watching the control surfaces respond **before** releasing the model! Face directly into the breeze and release the model with the nose pointed directly at the horizon and the wings level. Don't throw the ship or just let it drop — just push it forward and let it fly out of your hand. She should fly out straight and level in a slight climb.

If there is a slight turning tendency, don't worry about correcting it now. If a tight turn develops, move the stick in the opposite direction to correct. The angle of climb is controlled with the elevator and trim movement should be sufficient. If the model is hanging on the prop with the nose high, reduce the climb by trimming in down elevator. Try to keep the model upwind and flying away from you by making large, gentle S-turns. Face in the direction the model is flying at all times, even if this means looking back over your shoulder. You will find that it is easy to fly when the model is going away from you but very confusing if it is coming toward you, as the turning motions are reversed. Remember that if you do get confused with the model flying toward, push the stick **toward** the way the model is turning to stop the turn. Let the model climb all the time until the fuel runs out. Usually, the engine will burp a few times and run with more power as it runs out of fuel. This may cause the climb angle to steepen, so be prepared to add down elevator to stop the zoom.

The model should now be gliding and flying slower than when the engine was running. Try adding a little up trim to slow the glide even further. Make sure that you keep the model upwind as it glides and start to think about landing. Continue to let the model lose altitude until it is down to 40 or 50 foot altitude.

You should now have the model lined up with your landing path, and heading into the wing. Avoid making any tight turns and let the model fly toward the ground. Don't worry where it's going to land, as long as you won't hit something. When you get within two feet of the ground, hold slight up elevator to flare the glide path and let the model land. Don't give any commands after it contacts the ground. Don't feed in too much up elevator on the flare out as it may stall the model. The object is to land on the wheels with minimum forward speed. If you just fly into the ground without flaring the model will bounce and the landing gear will probably need to be bent forward.

Now that you are back on the ground, pick up the model and turn off the radio. Take the wing off and inspect everything, including your radio installation, very carefully. Make sure the engine mounting screws are tight and wiggle the tail to make sure it's still attached to the fuselage. Put the wing back on, fill up the tank and you're on the way to another flight. Good Luck!

For more information on building and flying R/C model aircraft, we suggest you get a copy of *RCM Flight Training Course. – Volume I.* ☐

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