



MONARCH

.05

Since the very beginning of R/C flight, the one type of design that has continually appeared in model publications and on hobby shop shelves has been the R/C trainer. There have been numerous approaches to trainer design over the years, but at the present time trainers can be roughly divided into two categories. One is the 3 to 4 channel trainer using a .19 to .60 size engine for power. The other is the 2 channel, .049 powered trainer. There are many excellent kits and designs which fall into the first category, but there are several significant drawbacks to this type of design where the beginner is

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he should do.**

By Lee Renaud

concerned. The most obvious is the higher initial cost for both engine and radio. The structure and construction of the larger trainers, while they appear basic to an experienced modeler, can also be quite confusing to the novice looking at his first set of plans. For the beginner, the 1/2A sized trainer is an attractive alternative because of the lower initial cost and simpler construction.

Designed specifically for the new Cox Dragonfly .049 engine, the Monarch .05 offers the advantages of low cost, simple, rugged construction and excellent flight characteristics for the beginner. By using a 1/2A engine

and an inexpensive two channel radio, a person interested in R/C can "get his feet wet" at a much lower cost than he can with a larger engine and a full house radio. The first-time pilot has enough jitters to deal with when he first gets ready to fly his new creation without also worrying about putting two month's rent into the ground as well.

The Monarch's structure is based heavily on that of the successful Olympic 650 sailplane, with both the wing and tail surfaces being identical. The three-piece wing employs a one-piece center section with spruce spars and leading edge which is virtually indestructible, while the plug-in tips serve to make transportation easy (even in small cars). The tail is a straightforward anti-warp structure with separate control surfaces for simplicity. The fuselage is a simple slab sided box which utilizes 1/8" air-ply sides and floor for strength and light weight. The structure has proven to be strong enough to survive poor landings and to be easily repairable in the event of a crash.

The Monarch has an unusually large amount of wing area for a 1/2A airplane. This wing area allows the Monarch to have a very light wing loading. The light loading allows the Monarch to fly at extremely slow speeds, which gives the beginner a definite advantage. One of the most difficult tasks facing the novice is developing the reflexes necessary to fly R/C airplanes. A slow flying airplane gives the beginner more time to realize what the airplane is doing, think about what he should do, and give the proper control input. The use of polyhedral in the wing design makes the model smooth turning and very stable. The large tail surfaces also contribute to the Monarch's stability and make it a very easy handling and forgiving airplane.

Pre-Construction Notes:

To build the airplane you will need a flat work surface at least 11" wide and 48" long, into which you can push pins. A sheet of Celotex, or similar composition board material, works well. Whatever you use, be sure that it is straight and unwarped.

CONSTRUCTION

A few simple tools will also be needed. These include a model knife and/or a supply of single edge razor blades, a razor saw, pliers, a small hammer and a hand drill and drills. You will also need hardwood sanding blocks and assorted grades of sandpaper, a small block or razor plane, a supply of straight or tee-pins and masking tape.

The types of adhesives used are a matter of personal choice, but we don't

recommend normal model airplane cement. For general construction, we suggest the use of aliphatic resin glue such as Wilhold or Titebond. Slow drying epoxy such as Hobbypoxy II or Sig will be required and 5-minute epoxy will be useful. We built the prototypes with Jet and feel that the time and weight saved is worth the extra cost. Be sure to follow the

MONARCH 05 Designed By: Lee Renaud

TYPE AIRCRAFT

1/2A-Trainer

WINGSPAN

72 Inches

WING CHORD

9 Inches (Avg.)

TOTAL WING AREA

650 Sq. In.

WING LOCATION

High Wing

AIRFOIL

Flat Bottom

WING PLANFORM

Constant Chord Center

Double Taper Tips

DIHEDRAL, EACH TIP

4 7/8 Inches

O.A. FUSELAGE LENGTH

40 Inches

RADIO COMPARTMENT SIZE

(L) 10" x (W) 2" x (H) 2 1/2"

STABILIZER SPAN

24 Inches

STABILIZER CHORD (incl. elev.)

5 1/4 Inches (Avg.)

STABILIZER AREA

126 Sq. In.

STAB AIRFOIL SECTION

Flat

STABILIZER LOCATION

Top of Fuselage

VERTICAL FIN HEIGHT

8 Inches

VERTICAL FIN WIDTH (incl. rudder)

6" (Avg.)

REC. ENGINE SIZE

Cox Dragonfly .049

FUEL TANK SIZE

Cox Dragonfly Lg. Tank

LANDING GEAR

Conventional

REC. NO. OF CHANNELS

2-3

CONTROL FUNCTIONS

Rud., Elev., Opt. Throttle

BASIC MATERIALS USED IN CONSTRUCTION

Fuselage	Balsa, Ply & Hardwood
Wing	Balsa & Hardwood
Empennage	Balsa
Wt. Ready To Fly	28-32 Oz.
Wing Loading	6.6

warnings on the bottle and check that all joints fit tightly.

Be sure to cover the plans with Handi-Wrap or similar material before starting construction so that the structure does not become glued to the plans.

Stabilizer:

(1) Cut the stab trailing edge from 3/16" x 1/4" balsa and pin in place over

the plans. Be sure that the trailing edge is straight from tip to tip when viewed from above.

(2) Cut the leading edge pieces from 3/16" x 1/4" balsa and use aliphatic resin glue to laminate the 1/16" x 3/16" spruce doublers in place. Allow 5 minutes for the glue to set-up, then trim the ends for the center joint and pin the leading edge in place.

(3) Cut the leading edge brace from 3/16" x 1/2" stock and cut to fit tightly against the leading edges. Work carefully to ensure that the joint is tight and glue brace in place. Install the 1/16" x 3/16" x 3" spruce trailing edge reinforcement.

(4) Cut the 3/16" x 1/2" center ribs to length and glue in place. Be sure that the ribs are properly aligned and are spaced 3/16" apart for the rudder root rib. Use a piece of 3/16" thick stock to check the spacing.

(5) Cut the stab tips from 3/16" x 3/4" stock and fit snugly between leading and trailing edges. Apply glue to joints and pin tips in position.

(6) Cut the stab ribs from 3/32" x 3/16" strip starting from the center. Be sure that the end cuts are angled to fit tightly against the leading and trailing edges and that the ribs fit snugly. When all ribs have been fitted, glue them in place. Allow the stabilizer assembly to dry thoroughly before removing from the plan.

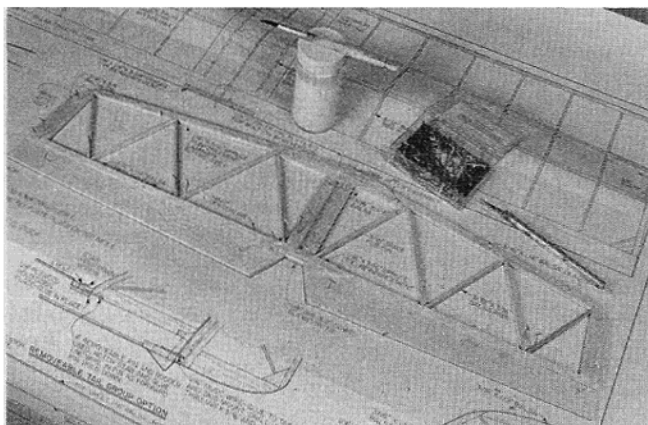
Elevator:

(1) Notch the leading edge of the elevators for the 1/8" dowel tie. Align the elevators behind the stabilizer trailing edge and check that the tie is flush with the elevator. Pin elevators in place and epoxy the dowel in position. Be sure to let the epoxy cure completely before removing from plan.

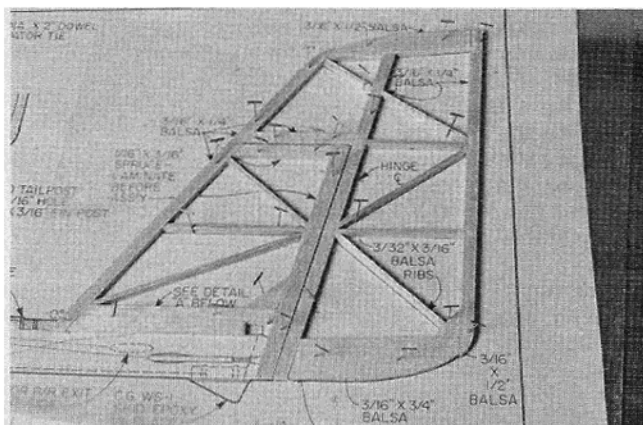
(2) Use a small plane to bevel the leading edge of the elevator to the Vee-shape shown on the plan. Be sure that the Vee is centered on the edge and is the same angle on both sides. Use a sanding block to finish the edge being careful not to sand a curve in the leading edges. Check fit the elevator against the stab trailing edge to be sure that the edges fit tightly without gaps.

Horizontal Tail Assembly:

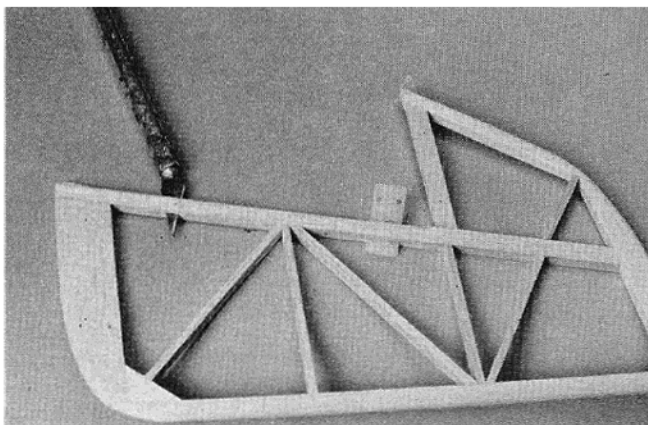
(1) Position the stabilizer over the plan and mark the locations of the hinges on the trailing edge. Also mark the hinge locations on the elevator leading edge. Mark the centerline and cut slits in the stab and elevator to receive the hinges. This can be done with an X-Acto knife and No. 11 blade, but we suggest that the hinge slotting kit, Cat. No. HSK-1, from Carl Goldberg Models will make this step



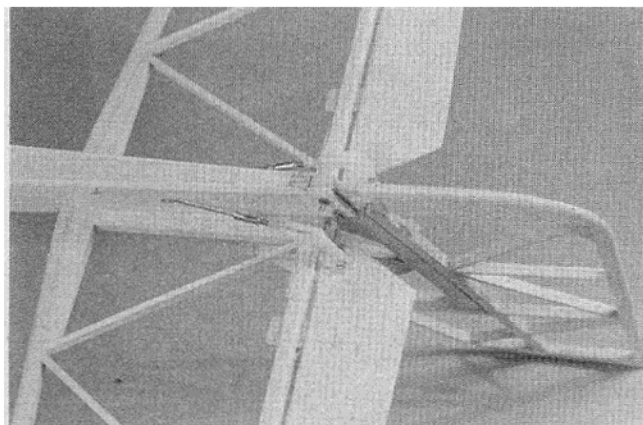
Fully assembled stab and elevator. Note 3/16" space for fin.



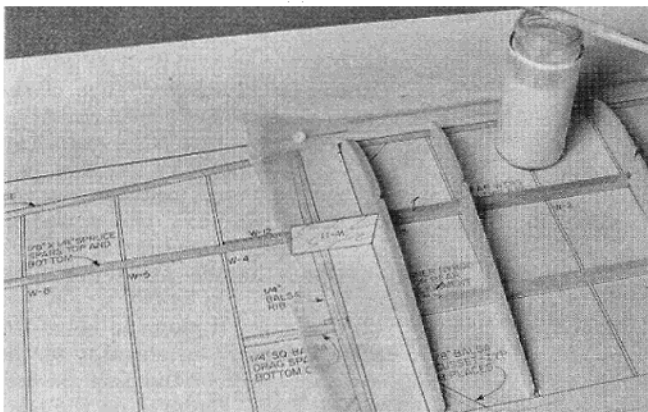
Completed fin and rudder assembly. Be sure to leave 1/16" space between top of fin and rudder.



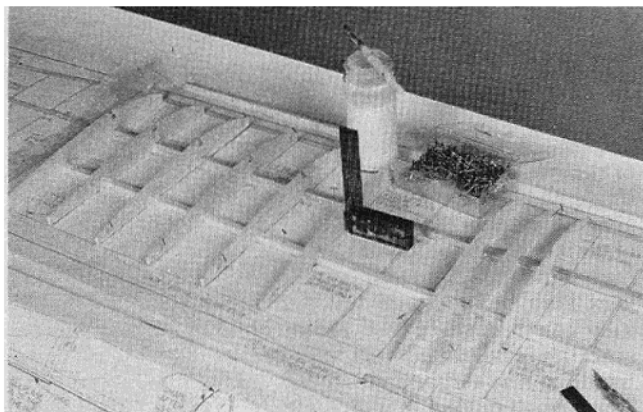
Slotting rudder for hinges. Be careful to cut the slots straight and on the centerline of the surface.



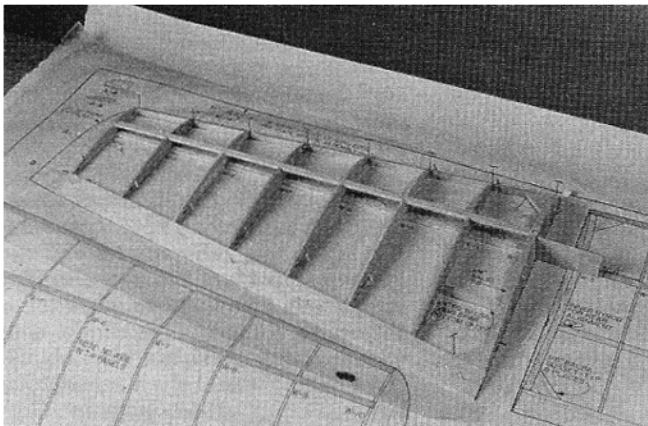
Detail of tail group with hinges and control horns temporarily installed ready to be covered.



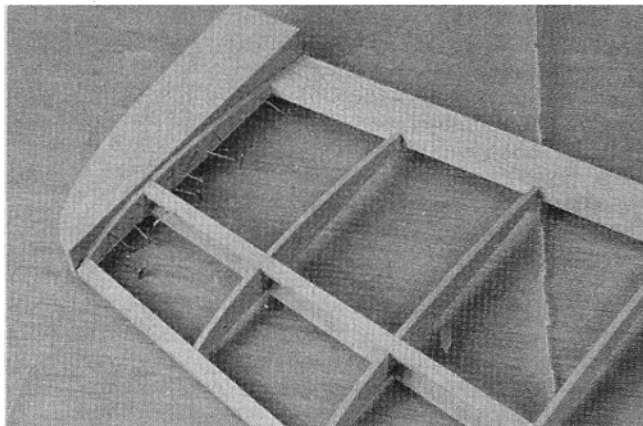
Using the W-11 plywood web to angle the W-3 rib. Make sure the top of the rib is tilting in toward the center of the panel.



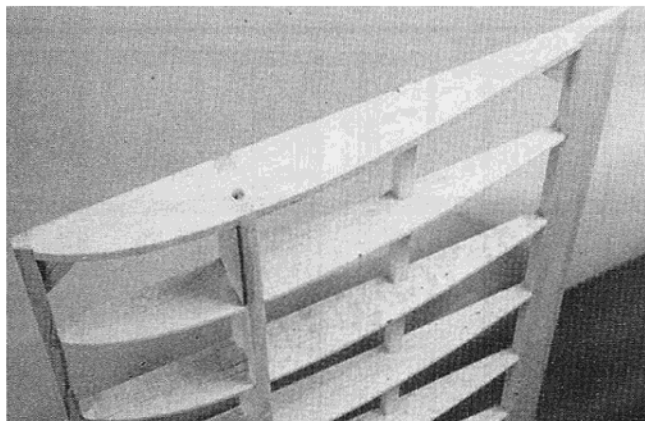
Installing the W-2 ribs in the center panel. Note how square is used to align the ribs.



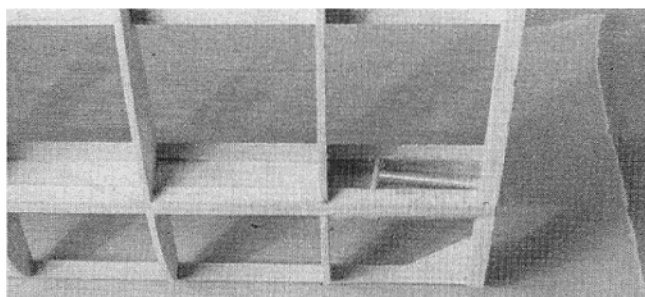
Basic wing tip panel assembly. Note how W-11 ply web is used to angle W-3 rib.



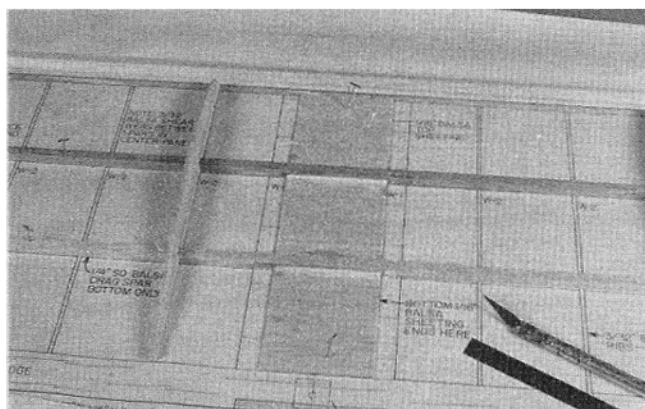
Wing tip block pinned in place after trimming spars and leading and trailing edges flush with W-10 rib.



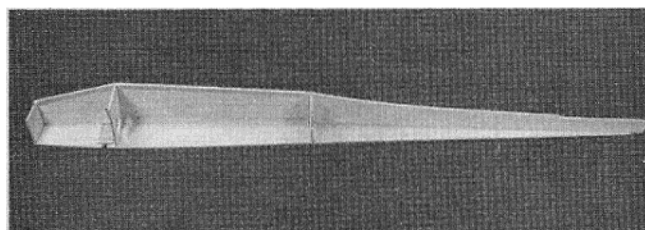
3/16" hole for wing joiner tube drilled in W-3 rib.



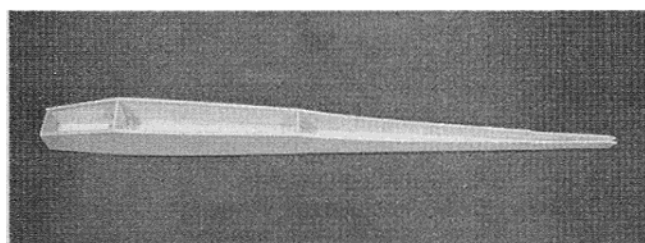
Installation of wing joiner tube. Note how panel is left standing on leading edge while epoxy sets.



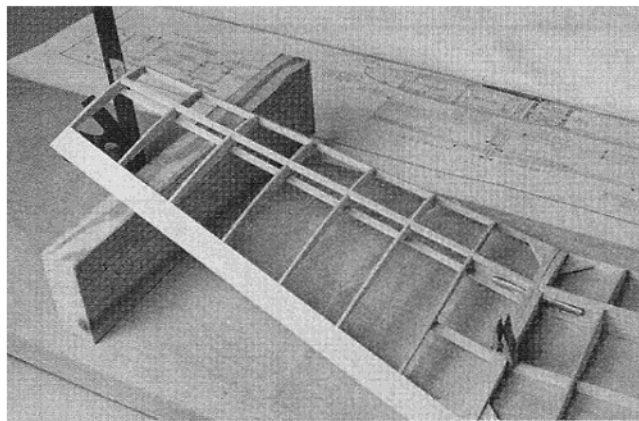
1/16" balsa bottom sheet cut to fit between spars, leading edge, and trailing edge. Note where sheeting ends.



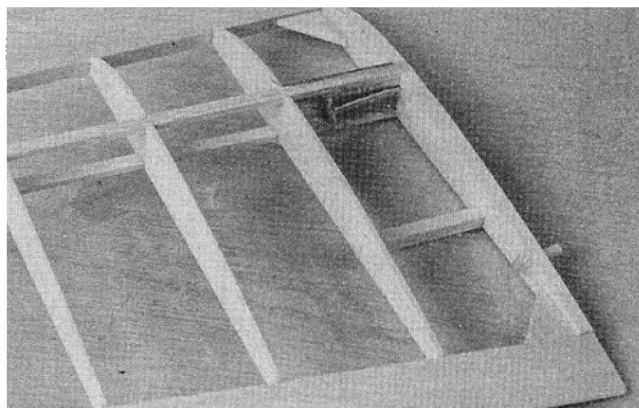
Basic fuselage assembly with left side removed to show internal detail. Structure is simple but very rugged.



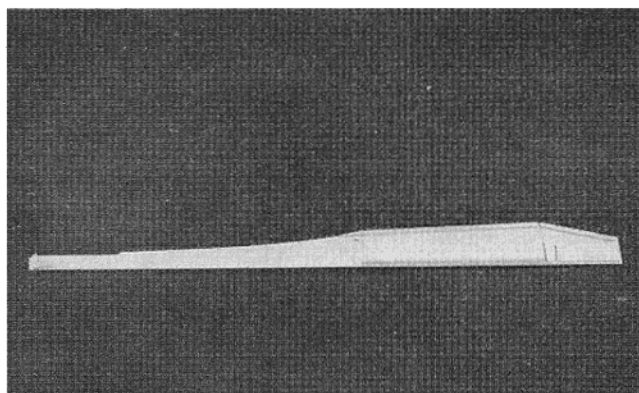
Basic fuselage assembly ready for installation of pushrods and top sheeting.



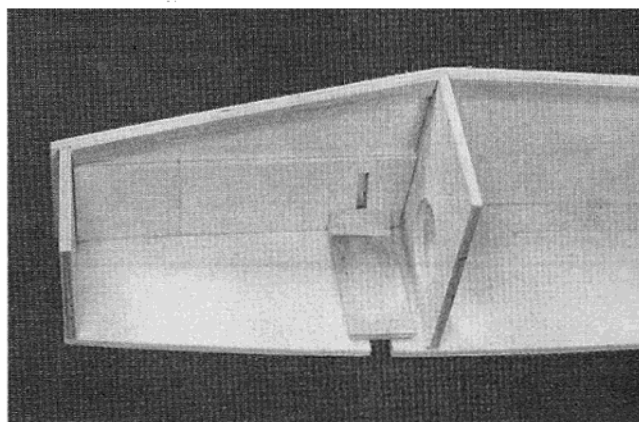
Tip panel blocked up for joiner tube installation. Tube is tack glued with small dabs of epoxy at this stage.



Tip panel detail showing completed installation of joiner tube and 3/16" alignment dowel.



Left fuselage side assembly showing installation of nose doubler, stringers, and triangle stock. Note that tail skid mount and tailpost are on left side only.



Detail of forward fuselage. Note how right thrust is built in. Right side will be trimmed flush with F-1 when assembly is complete.

easier and is well worth purchasing.

(2) Cut the individual hinges from the molded tree and fold them back and forth a few times to break-in the hinges. Slip the hinges into the elevator until the hinge line is flush with the leading edge, and then push the hinges into the stab slots until the two surfaces touch. Work the elevator up and down to be sure the hinges work smoothly without binding. Correct any problems by moving the hinges or enlarging the slots. When you are satisfied that the alignment is correct, use Hot Stuff or 5-minute epoxy, to secure the hinges in the stabilizer. Work the elevator up and down while the adhesive is drying to avoid gluing the surfaces together. When dry, cut off the excess hinge stock on the stabilizer side. Leave the elevator in place, but do not glue hinges yet.

(3) Use a sanding block to blend the stabilizer and elevator tip shape into a smooth continuous curve. Lay the assembly flat on your bench and block sand the surface of the stabilizer until all joints are smooth and flush. Turn over and sand the other surface. Now sand a slight taper into the elevators and stab trailing edge so that they blend together. Be careful to keep the trailing edge of the elevator 3/32" thick or it will be easily warped when covering.

(4) Use a plane; or knife, to carve the stabilizer leading edge and tips round. Finish shaping with the sanding block blending the tip contours and then round the elevator trailing edge. Final sand with fine paper and separate the stabilizer and elevator. Mark the location of the elevator control horn holes and use a 3/32" diameter drill to drill through the elevator. This completes the assembly of the horizontal tail surface which is now ready for covering.

Fin:

(1) Cut a piece of 3/16" x 1/2" balsa as shown in detail "A" to form the fin root rib, then pin the root rib in place. Cut the fin trailing edge and spruce doubler to length and laminate together. Note that these pieces extend to the fuselage bottom surface. Pin the trailing edge in place, then glue the root rib against it and pin in place.

(2) Cut the fin leading edge to length from 3/16" x 1/4" stock, apply glue to the forward end of the root rib, then pin leading edge in place. Cut and fit the 3/16" x 1/4" tip rib and glue in place. Cut the gusset from 3/16" x 1/2" strip with the grain direction as shown for maximum strength and glue against the root rib and fin trailing edge. Cut and fit the 3/32" x 3/16" ribs and glue. Leave the fin pinned in place over the plan until the rudder has been assembled.

Rudder:

(1) Cut the 3/16" x 1/4" rudder outline pieces to length and pin the center vertical spar in place against the fin trailing edge. Pin the trailing edge and leading edge in place then cut the 3/16" x 1/4" rib and glue in place, allowing a gap between this rib and the fin tip rib. Cut the tip ribs from 3/16" x 3/4" stock and glue in position. Be sure that the rudder vertical spar butts tightly against the bottom of the rudder tip.

(2) Cut the corner gussets from 3/16" x 1/2" strip and glue in place. Cut and fit the 3/32" x 3/16" ribs, then glue these in place. Allow to dry completely before removing from board.

(3) Bevel the leading edge of the rudder to a Vee-shape from the bottom of the 3/16" x 1/4" rib to the lower end. Work carefully and finish up with a sanding block. Check that the edge is straight and fits tightly against the fin trailing edge.

Vertical Tail Assembly:

(1) Position the fin over the plan and mark the hinge locations on the trailing edge, then mark the rudder leading edge. Cut slits and install the hinges as you did for the horizontal tail.

(2) Sand all surfaces and round the leading and trailing edge of the assembly. Round the tip and rudder base but do not round the two 3/16" x 1/4" ribs. Check the hinge action and locate and drill the holes for the control horn. Check the fit of the fin between the stab center ribs, sanding the fin if the fit is too tight. The vertical tail surfaces are now complete and ready to cover.

Wing Center Panel:

(1) Pin the 1/4" x 1" tapered trailing edge in place over the plan, using a pin every second rib to hold it securely.

(2) Unpin the stack of W-2 ribs and use 2-3 ribs as spacers to locate the bottom spars. Press the rib aft end tightly against the trailing edge and pin through the 1/4" x 1/4" balsa rear spar to hold it in place. Secure the spruce forward spar with pins placed straddle fashion. Don't pin through the spruce it will weaken the spar and may split the wood.

(3) Install the outermost W-2 rib, then glue one of the 3/32" balsa shear webs to the inboard side of the rib and to the lower spar. Glue the next W-2 rib to the inboard edge of the shear web, allowing the shear web to determine the rib spacing. Proceed this way — rib, shear web, rib, shear web, until all of the W-2 ribs are installed. Try to apply the glue neatly and remove any excess with a balsa sliver. This will avoid large blobs on the lower surface which are hard to sand off later. Check that the ribs are straight from the leading to trailing

edge and are square with the work surface.

(4) Apply glue to the forward edge of the W-2 ribs and press the leading edge tightly against the ribs, using pins to hold it in place. Angle the pins backward to hold the leading edge, but don't pin through the strip.

(5) Cut 3 pieces of 1/16" x 3" x 2 1/2" sheet from 36" stock. Trim these pieces to fit snugly between the spars and the spars and the leading and trailing edges at the center of the panel, with the grain running span-wise. Mark the location of the W-1 ribs on the spars, leading and trailing edge and install the sheet making certain that it is down tight against the work surface, pinning in place as required. Glue the three W-1 ribs in place over the sheeting.

(6) Sharpen one end of the 3/16" x 3-3/32" long brass tubing and use this as a drill to cut a 3/16" diameter hole in the four W-3 ribs. Be sure that the hole is directly in line with the forward edge of the main spar notches and that the top edge of the hole just touches the bottom of the top spar notch. Now cut the 3/16" diameter hole for the 3/16" diameter rear alignment dowel. Drill the W-3 ribs in sets so that the holes will line up exactly when the completed wing is assembled. Glue the W-3 ribs in place using one of the W-11 ply shear webs as a gauge to tilt the ribs for the proper tip dihedral angle. Check to be sure the ribs are not bowed or twisted.

(7) Apply glue to all rib notches and install the 1/4" x 1/4" spruce top spar. Be sure that the top surface of the spar is flush with the top surface of the ribs. Epoxy the W-11 ply web in place using clamps to hold it tightly against the top and bottom spar.

Tip Panels:

(1) Cut a 36" length of 1/4" x 1" tapered T.E. stock into two 18" lengths then cut the inboard ends at an angle to fit against the center panel. Pin the trailing edge in place with the inboard edge protruding slightly beyond the joint line. Use W-3 and W-10 ribs to locate the 1/8" x 1/4" spruce spar and straddle pin the spar in place. Glue all the tip ribs, except W-3, in place. Make sure that they are square to the work surface.

(2) Cut the tip drag spar from 1/4" x 1/4" x 6" balsa and pin in place, using the notch in W-3 to locate the spar. Install the W-3 rib, using one of the W-11 ply shear webs as a gauge to tilt the rib for the proper tip dihedral angle.

(3) Apply glue to the front edge of all ribs and install the tip leading edge, with the inboard edge protruding slightly beyond the joint line. Apply glue to all spar notches and install the top 1/8" x 1/4" spruce spar. Be sure that the spar is flush with the top surface of all ribs.

(4) Cut the tip spar filler from 1/8" x 1/4" x 6" spruce and glue it to the upper tip spar as shown in the tip joiner detail on the plan. Epoxy the W-11 ply shear web in place on the forward side of the spars. Be sure that the web fits tightly against both spars and the W-3 rib.

(5) Trim the spars, leading edge and trailing edge flush with the W-10 tip rib. Glue the tip block in place with 5-minute epoxy. Carve the block flush with the top surface of W-10, then shape it to the cross sections shown on the plan.

Tip Dihedral Joint and Final Wing Assembly

(1) Trim the spars, leading edge and trailing edge flush with the W-3 ribs at either end of the center panel. Prop up the panel so that the bottom surface of one W-3 rib is 4 7/8" above the work surface. Use a coarse sanding block to sand the spars and the leading and trailing edges flush with the W-3 rib, using the method of fitting hand launch glider dihedral joints. Sand only until the spars and leading and trailing edges are flush; be very careful not to change the dihedral angle of the rib or round off the edges of the rib.

(2) Trim the excess from the spars, leading and trailing edges at the inboard end of the tip panel. Prop up the panel so that the bottom surface of the W-10 rib is raised 2-7/16" above the work surface and sand the spars and leading and trailing edges flush in the same manner as the center panel. Again be very careful not to change the dihedral angle or round off the edges of the rib. At this point check the fit between the center panel and tip panel; there should be a good tight fit along the entire joint line between the W-3 ribs, and the tip and center spars should be in a straight line, with no forward or rearward sweep. Correct any problems with careful sanding until you have achieved a good fit before going on.

(3) Cut one of the 3/16" O.D. x 3-3/32" long brass tubes in half so that you have two pieces of equal length. Plug one end of each of the tubes with scrap balsa to keep epoxy from running inside the tubes. Sand the outside of the tubes with coarse sandpaper and then clean the tubes with thinner or acetone to ensure a good bond.

(4) Push one of the tubes through the hole in W-3 in the center panel, and pin the center panel to the building board. Push the second brass tube through the hole in the W-3 rib in the tip panel. Slip the 5/32" wire joiner into the tube in the center panel and slide the tip panel onto the joiner, being careful that the ends of the brass tubes remain flush with the outer surfaces of the W-3 ribs. Prop up the tip so that the bottom surface of the tip rib is 4 7/8" above the working surface.

(5) Check that the brass tubes are snug against the ply webs. If they aren't use a small rat-tail file to open the holes in W-3 slightly so that the tubes will fit tightly against the webs. Check the fit between the tip and center panel one final time to ensure there are not any gaps or misalignment. Look at the tubes and make sure they are equally spaced between the spars as shown in the tip joiner detail on the plans, and when satisfied with the alignment, spot epoxy the tubes in place with 5-minute epoxy, being extremely careful not to epoxy the joiner inside the brass tubes.

(6) When the epoxy is completely cured, re-check alignment and correct any problems before continuing, then separate the panels and remove the joiner. Mix a batch of slow drying epoxy. Hold the center panel with the leading edge down and build up a generous fillet of epoxy between the brass tube and the W-11 ply web. It isn't necessary to fill the cavity between the spars, but make sure the entire tube is covered and that the tube is well-bonded to the ply web. Epoxy the tip joiner tube in the same manner, then stand both the center and tip panels on their leading edges until the epoxy sets.

(7) When the epoxy has cured, use the 5/32" joiner to rejoin the tip and center panels. Clamp the two panels together so that the trailing edges are aligned, and check to see that the holes for the 3/16" alignment dowel line up. If they don't, use a small rat-tail file to open the hole in the tip panel until the holes do line up. Round the ends of the alignment dowel slightly, then push it through both W-3 ribs. Check to make sure the trailing edges are still aligned, then epoxy the alignment dowel into the tip panel only. Be very careful not to epoxy the dowel into the center panel or glue the two panels together. When the epoxy has set, remove the tip panel and repeat steps 1-7 for the other tip dihedral joint.

(8) Cut 3 pieces of 1/16" x 3" x 3 1/2" long sheet and cut to fit the top center section with the grain running span-wise. Use masking tape or pins to hold the sheet in position until dry. Notch the center section of the wing to accept the 1/8" x 1/4" x 3 1/2" spruce reinforcement and use 5-minute epoxy to glue it in place. When the epoxy has cured use a razor plane to taper the reinforcement to match the trailing edge. Don't omit the reinforcement as it prevents the wing hold-down bands from crushing the trailing edge.

(9) Use contact or rubber cement to bond a piece of No. 120 or No. 180 sandpaper to a hardwood block at least 3" wide by 11" long. Be sure that the sandpaper is tight against the surface of the block as, otherwise, you will sand hollows into the flat bottom surface of the wing. Now block sand

the entire lower surface keeping the block in contact with the leading and trailing edges at all times. Be sure that all seams and joints are flush and smooth as any high or low spots will show as flaws when you cover. Hold the block at 10°-20° angle to avoid breaking the ribs while sanding. When you are satisfied with the bottom, sand the top contour being very careful not to change the shape of the ribs. Be sure that all ribs are flush with the leading and trailing edges. Use your fingertips to check the surface by touch if you can't tell by looking at the joints.

(10) Use a small plane, or sharp knife, to carve the leading edge to contour. If the spruce tends to split, reverse the direction of carving. Try to get the shape shown on the plan and be sure that the contour is the same on all three panels. Finish off with the sanding block working carefully. Resand the entire wing with No. 220 or No. 240 sandpaper on your block. Assemble the completed wing and check the span-wise balance. Add weight to the light tip, if necessary, until the wing balances on the center rib. The wing is now complete and ready to cover.

Fuselage Sub-Assembly

(1) Pin the 1/8" air-ply right fuselage side in place over the side view of the fuselage with the best face against the work surface. Using the reference marks on the plans, draw the former locations on the side. Using the side internal detail cut two sets of spruce stiffeners. Glue all of the stiffeners in place using F-2 as a spacer between the two stiffeners. Trim 1/8" from the rear edge of one of the 1/8" air-ply nose doublers, and install the doubler with the rear edge aligned with the mark for F-2 and 1/8" from the bottom edge. Cut the lower 1/4" triangle stock to length and glue in place 1/8" from the bottom edge.

(2) Pin the left ply fuselage side in place and assemble as per Step 1. Note: do not trim 1/8" from the nose doubler. The left side doubler is installed with the rear edge aligned with the forward face of F-2. The difference in the sides is to ensure the model will have built-in right thrust. Install the 3/16" x 1/4" balsa tail post and skid mount on the left side, recessed 1/4" from the aft end of the side, and 3/32" from the bottom of the side. Allow both sides to dry thoroughly before removing from the work surface, then cut the slots for the pushrod exits.

(3) Pin the 1/8" air-ply forward floor and floor in place over the top view, using the two landing gear wires to space them 1/4" apart. Make sure that the front edge of the forward floor is angled to give right thrust. Use 5-minute epoxy or aliphatic to install the 1/8" birch ply gear mount. Join the 3/32" balsa aft bottom to the floor

assembly. Pin the aft bottom to hold it firmly against the work surface. Use the alignment guides on the plan to accurately draw lines across the bottom to locate the formers.

(4) Install formers F-2 and F-3 with 5-minute epoxy or Jet. Use a small square or triangle to be sure that the formers are perpendicular to the bottom and check that the edges of the bottom and the formers are aligned. Glue the 1/4" triangle stock reinforcement behind F-3. Let this assembly dry completely before proceeding.

(5) Using the template on the plans, lay out and drill the holes in F-1 for the engine mounting blind nuts. Install the blind nuts and secure each of them with a small dab of epoxy, being extremely careful not to get any epoxy in the threads of the nut.

Fuselage Assembly:

(1) Remove both sides from the work surface and apply glue to the face of the 3/16" x 1/4" tailpost on the left side assembly. Align the aft end and bottom edge of the sides carefully and join the sides at the tailpost. Pin through the sides or use a small clamp to hold this joint secure.

(2) Lower the sides over the bottom assembly pinned to the work surface and check that the sides fit properly. Correct any problems before continuing. Now you are ready to glue the sides to the bottom, thus ensuring a perfectly aligned fuselage. Because of the length of the joint involved, the choice of adhesive for this step is very important, and we recommend only slow drying epoxy or alpha cyanoacrylate adhesives.

Method A: Slow-Dry Epoxy: Mix a generous supply of epoxy so that you don't run out in the middle of this step. Apply epoxy to the edges of F-2 and F-3. Apply epoxy to the bottom face of the 1/4" triangle stock and to the inside face of each side along the lower 1/8" from the edge. Separate the sides at the nose and drop into place outside the bottom assembly using the alignment marks for fore and aft position. Be sure that the sides are properly aligned and pin the section between F-3 and the tailpost tightly against the 3/32" balsa bottom. Apply masking tape across the top of the former F-3 to clamp the sides tightly against the former edges. Next, pin and tape the sides against the ply forward floor and the edges of F-2. Apply epoxy to the side and bottom edges, and the outermost 1/8" along the sides on the rear of F-1 and install between the sides. Make sure that the former is tight against the sides and floor, and that the rear face of the former is snug against the nose doublers. When satisfied with the alignment of F-1, use clamps or masking tape to hold everything securely in place while the glue sets.

Method B: Alpha-Cyanoacrylate

Adhesive: Position the sides over the bottom using the side alignment marks for fore and aft location. Apply glue from the inside of the fuselage starting at the tailpost first on one seam and then on the other. Do 4" to 6" at a time and hold the sides firmly in place until the glue sets. This technique relies on capillary action to wick the adhesive into the joint so be sure to use enough adhesive. Hold the sides against F-3 and run a bead along the side-former joints. Pull the sides together and apply adhesive from the inside, gluing the side/floor and former joints as you move forward. Install F-1 in the same manner as outlined in Method A, using either epoxy or Super Jet.

(3) When the basic fuselage assembly is dry, use a sanding block with coarse paper to sand the sides and bottom flush with F-1.

(4) If the radio you are using does not have servo reversing switches, check the direction of servo travel and make sure that the servo movement drives the pushrods in the proper direction. An up elevator command must push the pushrod back. Right rudder must push the pushrod back. If this action is not correct, try crossing the pushrods in the aft fuselage. If that doesn't work you will need a reverse rotation servo or you will have to relocate the front end of the pushrod to attach at the center of the fuselage. If you have not yet purchased your radio we suggest that you do not route the pushrods through former F-3 until you are sure that the action will be correct.

(5) Roughen one end of both outer pushrod tubes with coarse sandpaper and insert the other end through the fuselage slots near the tail. Fish the tubes through F-3 until approximately 1/2" protrudes outside the sides. Insert the inner tubing and check that they slide smoothly then glue the outer tubes in place with Hot Stuff or 5-minute epoxy, being careful to avoid getting any glue inside the tubing. Be sure that both ends of the outer tubing are secured. Remove the inner tubes and trim the aft end of the tubes flush with the fuselage sides.

(6) Install the 1/16" x 1/4" spruce stab leading edge stop using care not to distort the sides. Cut the cross-grain top sheet to size from 1/16" x 3" balsa sheet. Remove any pins between the sides in the aft bottom and install the top sheet. Install the 1/16" x 1/4" spruce trailing edge stop, aligning the forward edge with the front side of former F-3. Let this dry completely and remove the fuselage from the work surface. Trim the top sheet flush with the sides and sand the rear portion of the fuselage.

(7) Cut the forward hatch reinforcement from 1/16" x 1/4" spruce and install. Glue the

1/16" x 1/4" spruce aft reinforcement in place. Glue the reinforcement to the 1/4" x 1/2" balsa forward fairing, but don't install the fairing yet. Temporarily install the center panel of the wing on the fuselage tight against the trailing edge stop. Hold the hatch in place with a 1/64" space between the wing leading edge and the aft end of the hatch. Apply glue to the top of the nose block and forward top of the sides and install the fairing using the hatch as a spacer for proper location. Remove the hatch and wing. Glue the 1/4" x 1/4" hardwood hatch hold-down block to the forward face of F-2. Trim the 1/16" plywood forward hatch hold-down to fit snugly between the sides and glue to the bottom of the hatch.

(8) Drill the hole for the hatch eyelet and push the eyelet in place. Position the hatch on the fuselage and locate the hole in the hold-down block through the eyelet. Remove the hatch and drill a 1/16" or 5/64" diameter hole in the hold-down block. Locate and drill the 3/16" diameter holes for the wing hold-down dowels. Add the 1/4" triangle stock reinforcements between the sides and the landing gear mount.

(9) Carve and coarse sand the nose area and hatch as shown on the plans. Use a small plane or knife to round the bottom corners of the fuselage from F-3 forward, and a sanding block to round the hatch and aft fuselage corners. Check the cross sections shown on the plans and be careful not to round the aft fuselage too much as this will weaken the corner joints. Block sand the rest of the fuselage, filling any dents or joint gaps with vinyl spackling compound or Hobbyoxy Stuff.

(10) Place the completed fuselage flat on a large flat surface and pin the stab in place. Measure the distance from each stab tip to the work surface to check that the stab is parallel to the bottom of the fuselage. Correct any misalignment by trimming the high side of the fuselage. Next, assemble the wing and place it on the fuselage. Check that both polyhedral joints are the same distance from the surface. Correct any problems. Finally, slip the fin in place and use a square or triangle to check that it is perpendicular to the stabilizer. Stand back and admire the structure. Construction is complete and you are now ready to cover your Monarch .05.

Covering:

We suggest that you finish the model with one of the iron-on plastic film coverings, as they provide a good looking finish with minimum weight. For the wings and the tail group, we recommend that you use Super MonoKote because it provides more stiffness than similar products. This is important if you get the airplane

moving at high speed in a dive or during competition flying.

The fuselage can be finished with Solarfilm or one of the other low temperature films as stiffness is not a factor in this application. These films will cover the compound curves in the nose area more easily than MonoKote. There is no need to fiberglass the fuselage, as the structure is very strong and does not require additional reinforcement.

Use bright, high visibility colors such as orange, yellow, or red, so that you will be able to see the model when it is high above. Trim to suit your individual taste and add your AMA number.

Final Assembly:

(1) Remove any covering material from the fuselage stab-rest, bottom side of the stabilizer, and the top surface between the center ribs.

Remove the covering from the bottom of the fin and the fin trailing edge section that fits between the sides. Glue the fin into the stabilizer slot with 5-minute epoxy and lay the stab flat on your work surface with the fin trailing edge hanging over the edge. Check that the fin is perpendicular with the stab and let dry thoroughly.

(2) Install the elevator on the hinges and glue the hinges in place using Hot Stuff or 5-minute epoxy, then mount the control horn with No. 2-56 x 5/16" machine screws. Repeat for the rudder. Push a pin into the center of F-2 and tie a 4' length of cotton or rayon thread to the pin. Apply slow-drying epoxy to the surface of the stab-rest and in the notch in the aft end of the fuselage. Place the tail group in position, making sure that the fin trailing edge is seated against the tailpost and that the stab is firmly against the sides. Pull the thread tight and check the distance to one stab tip. Swing the thread to the other tip and compare the measurement. Adjust the position of the stab until both tips are equidistant from the towhook and pin the stab in place. Check alignment one more time and don't handle the fuselage until the epoxy is completely cured.

(3) Mount the engine to the firewall using four machine screws. Follow the instructions included with the engine for proper operation and break-in.

(4) Install your radio equipment, following the instructions provided by the manufacturer. Install the hardwood rails to suit your servos and wrap the battery and receiver in foam rubber for protection. Route the antenna through a hole in the side and down the side of the fuselage or insert a length of outer Nyrod tubing down the fuselage for an internal antenna installation. Thread the No. 2-56 studs into one end of the inner pushrod tube and then screw the clevis on to the stud. Slip the inner tubes through

the outer and attach the clevises to the rudder and elevator control horns. Cut off the excess tubing and thread the Nyrod adaptors into the forward end of the tubes, then bend to correct length and connect to the servo arms. Adjust the length of the pushrods so that the elevator and rudder are both in neutral position when the servos are neutralized. Check that the control surfaces move in the proper direction and that there is no binding. Correct any problems now!

(5) Drill two 3/32" diameter holes in the aft fuselage bottom and epoxy the tail skid in place. Use two nylon L.G. straps and four #2 sheet metal screws to install the 1/8" music wire landing gear. Install the wing hold-down dowels and glue in place to the sides and formers. Epoxy the hatch eyelet in place and install the hatch.

(6) Assemble the wing and mount it on the fuselage using eight No. 32 rubberbands. Support the model with your fingertips at the Center of Gravity shown on the plans, which is the rear edge of the main spar. Add weight to the nose until the fuselage bottom hangs level with the floor. If the wings do not remain nearly level, add weight to the light tip. A slight tilt is okay, but excessively out of balance wings will cause erratic turns. Be sure that any nose ballast is firmly secured and that it can't slip forward or backward.

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 on the surface, while you twist in the opposite direction.

(3) Mount the wing, using four No. 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 fuselage 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.

(6) Check your batteries, both in the transmitter and airplane. If you are using dry batteries, be sure they are fresh; if nicads, 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!

Flying:

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 controls move in 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. 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 wind. 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 2' 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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