

# The Predator

By BILL TURNER . . . This easy-handling, high-performance two-meter sailplane features a rugged airframe from conventional building materials. It uses a JC-14 undercambered airfoil. Pre-cut foam wings are available.

• The Predator sailplane is designed to be a competitive, high-performance two-meter ship. The design is conventional in appearance, with careful attention paid to minimizing aerodynamic drag and improving efficiency. Construction employs conventional model materials and techniques, with structural design optimized to provide a rugged airframe. The shoulder-mounted wing position allows for wing fillets to help in reducing drag. It also allows for a two-piece wing, which makes for easy transportation.

The heart of any sailplane design is the wing. The Predator wing is cut from two-pound density blue foam and features a JC-14 airfoil, which is one of a series of airfoils developed by Jack Chambers, of Laguna Beach, California. The airfoil has a 7.8% thickness, a fairly sharp leading edge with substantial Phillips Entry; the forward section being semi-symmetrical and the aft part of the section being undercambered. This airfoil provides good lift and penetration and a very broad speed range. I believe the JC-14 airfoil is

one of the best sections currently available for fun flying or contest competition. The wing plan form is double-tapered, with polyhedral, which provides for quick turn response.

The empennage design is simple, using a built-up structure for lightness and easy shaping. The horizontal surfaces are tapered in thickness from root to tip to minimize weight and to improve structural efficiency.

The Predator incorporates landing spoilers for glide path control. They are very effective in reducing lift and increasing sink rate, and I suggest you build your Predator with them.

The Predator is a very easy handling ship, with no adverse characteristics. The general performance is excellent, with a very wide speed range and responsive controls. One of the things that will impress you is its ability to cover large areas of sky with minimum altitude loss. Tow characteristics are good, both on 12-volt winch launches or with a heavy-duty hoist. The Predator design will provide you

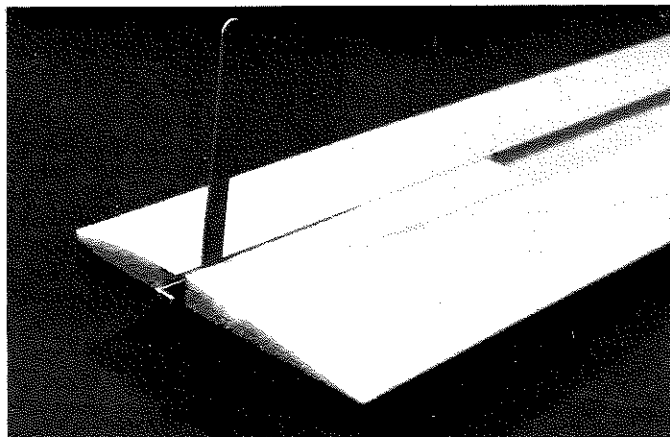
with many hours of enjoyable flying and can put you at the top of the class in competition.

## SPECIFICATIONS

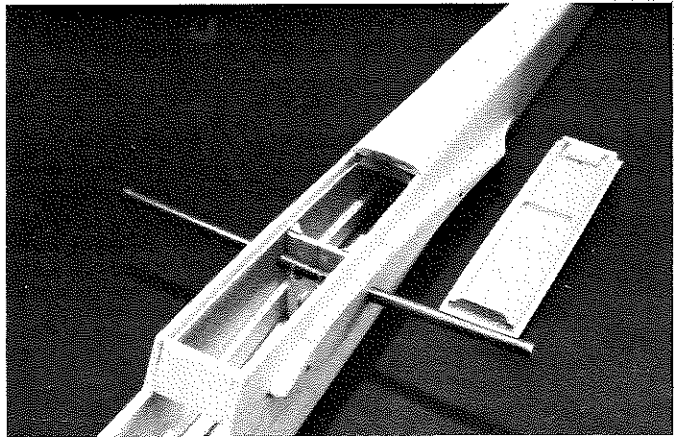
Wing Span . . . . . 78-1/2"  
 Total Wing area . . . . . 549 sq. in.  
 Airfoil . . . . . JC-14 undercambered  
 O.A. Fuselage Length . . . . . 40-1/2"  
 No. of Channels . . . . . 3  
 Control Functions . . . Red, Elev., and Spoilers  
 Wt. Ready to Fly . . . . . 38-40 oz.  
 Wing Loading . . . 10 - 10.5 oz./sq. ft.

## CONSTRUCTION

*Editor's note: The author/designer of the Predator, Bill Turner, has written extremely detailed, numbered, step-by-step instructions for those who wish to build the model. To include these instructions as part of this article would consume much more editorial space than we can spare. Consequently, the following information is a summary of the construction methods used to complete the model as recommended by Turner. The complete step-by-step instructions will, however, be in-*



Filing the notch for ply shear webs. Use common emery board.



Wing rod is held in place by J-bolts. Note blocked-in wing fairing.

cluded with each set of full-size plans and article reprint, available through our Full-Size Plans Service. Also, as further noted in the section on wing construction, Model Builder has arranged for a source of foam wing cores, prepared especially for those who wish to build the Predator.

#### WING

Construction of the foam cored wing panels is explained in the 28 step-by-step instructions which come with the full-size plans. For those who may not be equipped to produce their own cores, or do not have another source available, cores for the Predator may be obtained directly from Superwings.

Superwings Ltd., 422 Wentworth Ave., Battle Creek, MI 49015. (See ad in this issue). Lee Murray, who laser-cuts the airfoil patterns for Superwings, will make the rib patterns for the Predator, and Superwings will cut the four panels, including the spar slots. The price per core set is \$22.50, plus \$5.00 for shipping and handling. If you need further info from Superwings, call 616-965-5293, and talk with Wayne Custer.

After installation of spars, shear webs, spoilers and mechanisms, joiner tubes, etc., the wings are covered with 1/16 sheet balsa, and the exterior leading and trailing edges are installed. Be sure to install sheeting while cores are in core beds, in order to maintain proper panel alignments.

#### STABILATOR

The all-moving "flying stab," or "stabilator" is fabricated from balsa, as explained in the 12 detailed building instructions. Brass and aluminum joiner tubes are installed during construction in order to maintain proper alignment.

#### VERTICAL FIN

There are 14 detailed instruction steps to follow in constructing the vertical fin, which also supports and contains the control hook-up for the stabilator. Basically, it is a 1/16 sheet balsa covered framework. Stabilator must be built first in order that it can be used to properly align the pivot tubing and drive fitting.

#### RUDDER

Construction of the rudder is quite simple and needs no special instructions to complete.

#### FUSELAGE

Contrary to most modern competition-oriented sailplanes, Predator's fuselage is built up of balsa and ply, rather than fiberglass, although it is highly recommended that the finished structure be covered with 3/4-ounce glass cloth and finishing resin.

Again, construction is detailed in 36 step-by-step building instructions. The fuselage comes last in the order of things, as alignment of wing, fin, and stab depend on having these surfaces finished and ready to use when installing wing rods, control cables, etc.

Super Monokote is recommended for covering of wing panels and tail surfaces.

#### RADIO INSTALLATION AND SPOILER RIGGING

Although radio installation usually varies according to each individual builder, the basic steps have been outlined, followed by step-by-step instructions for completing and rigging the spoiler linkage for proper operation.

##### Radio Installation and Final Assembly:

- 1) Install the servo rails and mount the servos in the fuselage.
- 2) Mount the rudder control horn to the rudder.
- 3) Install the rudder hinges and glue in place, making sure it swings freely.
- 4) Solder a threaded coupler onto the rudder end of the rudder cable and screw on a clevis. Slide the cable into the fuselage and snap the clevis to the horn.
- 5) Assemble the stabilator to the fin.
- 6) Center the rudder and stabilator servos, then trim the ends off the cables as necessary to allow the threaded couplers and clevises to be installed. Solder the couplers onto the cables and attach the clevises to the servo arms.
- 7) Install the battery pack, receiver, and switch. Check the control action and adjust linkages to obtain the control movements shown on the plans.
- 8) Install the wing tip tail skid to the bottom of the fuselage.
- 9) Assemble the completed model and add weight to the nose of the model until the airplane balances as shown on the plans. Trim the airplane slightly nose heavy for the first few flights, then move the C.G. back as you become accustomed to the airplane's flying characteristics.

##### Spoiler Rigging:

- 1) Drop the spoiler blade into the spoiler bay and center so the gap is even all around. Apply the full length 3M clear tape hinge. Zap the 3/32 O.D. aluminum tube horn in place.
- 2) Apply the 1/4 oz. stick-on spoiler return weight.
- 3) Assemble the Du-Bro ball links to the servo arm.

- 4) Cut a piece of dial cord approximately 20-inches long. Make a loop on one end of the cord just large enough to slip over the ball link and secure the knot with Zap.
- 5) Feed dial cord through tubing starting at the root end of the wing. Slip the cord through the spoiler horn.
- 6) Assemble the wing to the fuselage and feed the looped end of the cord through the hole in the fuselage wing fairing.
- 7) Slip the loop over the ball link on the servo arm. Make spoiler throw adjustment at spoiler horn, secure cord to the spoiler horn with toothpick peg.
- 8) Repeat the process for the other wing and make sure both blades extend equally, about 80 degrees. Cut off excess cord.

#### BILL OF MATERIALS

For those who like to accumulate all the materials required before beginning construction of a model, a bill of materials has been prepared. Even if, like most of us, you just start to dig in with materials you have on hand, and then shop for stuff as the need arises, checking the list could reveal some essential items that you may have to send away for to obtain, and you could avoid lengthy delays during construction if you order them at the very beginning.

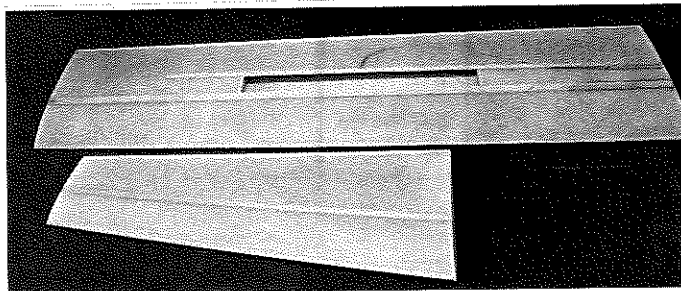
#### FLYING

The Predator is a very clean and responsive aircraft. Be careful not to over-control on your first flights and make all commands smoothly until you have become accustomed to the control response.

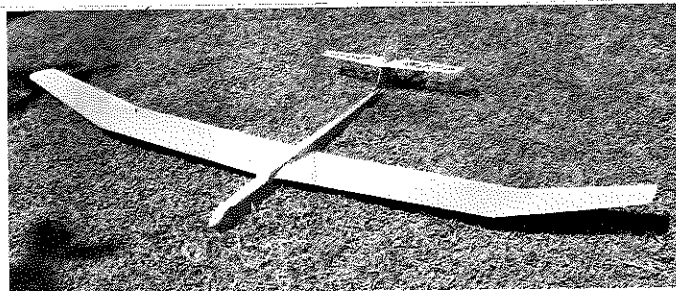
Once you are familiar with the flying characteristics of the Predator, you can fly around on the verge of a stall without a problem, but dropping the nose slightly and allowing the speed to increase will improve the L/D and you will be amazed at the large amounts of sky you can cover looking for that elusive thermal.

On your first few landings, practice slowing the Predator on the down wind leg. When you turn onto final, use the spoilers to adjust your glide path and the stabilator to keep the nose up. If you don't keep the nose up, you will come in too hot and chances are you will slide through the landing circle.

All of the test ships have flown well on their initial flights, so you should experience the thrill of flying this ship on your very first launch. Good luck to you and your Predator on your first flight and many flights thereafter.



Foam wing core ready for 1/16 sheeting.



The Predator, ready for covering and painting.

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### CONSTRUCTION

#### Wing:

Build all four wing panels at the same time. When the spars are glued into the form cores, the cores must be placed into the core beds with wax paper between the core and the core bed, on a flat surface and weighted down and allowed to dry. This will prevent the cores from warping.

- 1) Make four 1/16" thick plywood shear webs.
- 2) Place the 3/8" upper and lower spars (DO NOT GLUE) in the inboard cores. Using an X-ACTO razor saw with part of the back removed, cut through the core for a length of 3", using the spars as a guide. Now use a fingernail emery board file and file the notch for the ply shear webs, again using the spars as a guide. Remove the spars and remove the 3" piece of foam where wing carrier tube will be glued in at a later time.
- 3) Fit the 1/16" ply shear webs to the cores making sure they are flush with the top, bottom, and end of core. When satisfied with the fit, glue the shear webs to the cores with 5-minute epoxy.
- 4) Cut the bottom 3/8" spars 1/4" longer than the cores. Glue the bottom spar to the core with Titebond allowing the spar to extend 1/8" beyond the ends of the core. Allow to dry (in the core bed).
- 5) Use Titebond to glue the 1/8" x 3/16" balsa subleading and and subtrailing edges to core. The best method for this is to place the wing core in the beds leaving the wing core extending up from the beds about 1/2". Apply Titebond (I prefer Titebond because it sands easier than epoxy) to the core edge and secure the balsa stock to the core with masking tape, and allow to dry.
- 6) Sand the balsa subleading and trailing edges to the core shape. To prevent gouging of the foam core when sanding, put a strip of 1" wide masking tape the full length of the core about 1/8" from the subleading or trailing edge stock. Remove the tape after sanding.
- 7) Notch the root end of the wing core and epoxy in 1/8" thick ply rubber band hook plates.

- 8) Cut lower spar notches in 1/8" sheet balsa core caps and glue to cores with Titebond. Allow to dry and sand to core shape, and cut in upper spar notches.
- 9) Glue in the spoiler blade framework.
- 10) Drill .030" dia. hole in the balsa root cap, notch the spoiler frame and epoxy in the .030" dia. plastic tubing for the spoiler dial cord.
- 11) Use a sharpened piece of 1/4" I.D. brass tube to bore a hole in the balsa core root caps for the wing carrier tube.
- 12) Cut a piece 1/4" I.D. brass tubing 7" long and plug the ends with balsa wood to prevent epoxy from getting in. Sand the tube with 100 grit paper and wipe clean with acetone or thinner.
- 13) Place the cores with the lower beds end to end of a flat surface, slip the 1/4" I.D. brass wing carrier tube into both cores. Fill the cavity around the carrier tube with 30 min epoxy. Smear Titebond on the 3/8" top main spars and install in the cores. Glue in the 3/32" spoiler spars with Titebond. Wipe off any excess glue. Cover the cores with a strip of wax paper and the top core beds and weight down, allow to dry overnight. Cut through the brass tubing and file flush to core roots.
- 14) Use Titebond to glue in the lower and upper spars in the tip panels, place in the core beds and allow to dry. Glue on the subleading and trailing edges, allow to dry and sand to shape. Notch the balsa core caps for the spars and glue to the foam core. When dry, sand to the airfoil shape.
- 15) Lightly sand the foam cores with a 220 grit sanding block.
- 16) Prepare 1/16" thick balsa sheeting, and cut to the wing plan shape allowing 1/8" overhang all the way around the core.
- 17) Use a vacuum cleaner for removing all sanding dust from the cores and the sheeting.
- 18) Apply the 1/16" sheeting to the foam core. The method I prefer is as follows. Place the core top side up in the core bed on a flat surface. Apply 2" wide (3M brand No. 465) adhesive transfer tape to the foam core, being careful not to apply any tape to the balsa subleading and trailing edges and balsa core caps, then apply a tight coating of 5 min. epoxy to all balsa core edges. Carefully align the sheeting

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- to the trailing edge and rub the sheeting down toward the leading edge.
- 19) Use a sanding block with 100 grit paper and carefully sand the sheeting overhang flush with the core edges.
  - 20) Turn the core over and place it in the upper core bed, sheet it and sand it using the same method.
  - 21) Sheet the remaining cores.
  - 22) Trim the wing sheeting from the spoiler blade slot and glue in the spoiler blade stops. Cut a piece of 1" trailing edge stock to fit into the spoiler slot, and glue the 1/32" ply doubler to the bottom of the spoiler blade. Shape the top of the blade to the airfoil shape.
  - 23) Use Titebond to glue on the 1/8" x 1/4" spruce leading edge, hold in place with masking tape. When the glue is dry remove the tape and draw a center line down the length of the spruce leading edge. Shape the leading edge using a razor plane and sanding block, to diameter of a round toothpick.
  - 24) Place a piece of balsa shim stock 1/16" thick x 3/8" wide the full length of a wing panel on a flat surface and cover with wax paper, position the sub trailing edge of the wing panel over the shim stock leaving half of the shim exposed. Position the 1-1/2" trailing edge stock over the exposed shim and glue to the wing panel using Zap CA. Use a razor plane and sanding block to remove the excess trailing edge stock thickness from the top of the wing. Do the remaining wing panels by the same method.
  - 25) Taper trim the trailing edge stock on the outer wing panels to 1" width at the tip.
  - 26) Place the inner wing panel on a flat surface and block up the outer panel for the proper polyhedral angle and sand for a good fit. Butt glue the outer panel to the inner panel with 5 min. epoxy.
  - 27) Zap CA the tip blocks to the wings and sand to shape.
  - 28) Make four root caps from 1/16" ply and glue one on each wing root. (Don't forget to make the holes for the rubber band hook and spoiler cable.) Save the two remaining caps for the wing fairings on the fuselage.

Stabilator:

- 1) Cut the 1/4" sheet balsa root pieces to shape, grain running spanwise.
- 2) Cut the 1/8" x 1/4" spruce spar and the 1/4" x 3/8" balsa leading edge to length. Glue the spar to the leading edge with Zap. Zap the spar assembly to the balsa root piece.
- 3) Cut the tip from 1/4" x 3/8" balsa stock and Zap to the spar assembly.
- 4) Cut the 1/2" trailing edge stock to length and Zap to the tip and root.
- 5) Cut the 1/4" sheet gussets to shape and Zap in place.
- 6) Cut the stab ribs from 1/8" x 1/4" balsa. Be sure all end cuts are angled to fit tightly against the spar and trailing edge and Zap in place.
- 7) Use a razor saw to cut the slots in the root pieces to accept the joiner tubes. Make the slots a snug fit.
- 8) Cut 1/8" O.D. brass joiner tube to 4" length and the 3/32" O.D. aluminum tube to 3" length. Plug the ends of the tubes with balsa to prevent epoxy from getting inside the tubes. Sand the tubes with coarse sandpaper and clean the tubes with acetone or thinner.
- 9) Lay the stabs on a flat surface with a 1" separation between the roots. Now press the brass and aluminum joiner tubes into the stab slots, aligning them in the center of the stab thickness. Fill the slots flush with 5 min. epoxy. When dry, turn the stabs over and fill the slots on this side with 5 min. epoxy and allow to dry.
- 10) Use razor saw to cut through both of the joiner tubes close to one of the stab root edges. Cut off the extending aluminum joiner tube from the other stub. DO NOT cut off brass joiner tube. The brass tube is used for the stabilator pivot bearing surface and will be cut to length when fitted to the vertical fin.
- 11) File the aluminum and one brass joiner tube ends flush with the stab roots. Remove the burr from the inside of the tubes with an X-ACTO knife.
- 12) Use a sanding block and shape the stabilator to the airfoil on the plan. The stab should taper spanwise in thickness from 1/4" at the root to 1/8" at the tip. The leading edge should be about 1/8" in diameter. The trailing edge should be square and sharp and about 1/16" thick.

Vertical Fin:

- 1) Cut the 1/8" thick balsa frame pieces to size. Make sure all joints fit tight and Zap together.
- 2) Make the pivot support from 1/8" thick ply. Locate and drill a 5/32" dia. hole for the stabilator bearing tube. Glue to the fin frame with Zap.
- 3) Make two pieces of fin sheeting from 1/16" thick balsa with the grain running vertically.
- 4) Glue the sheeting to one side of the fin frame with Titebond and allow to dry. Use a sharpened 1/8" I.D. brass tube to make the pivot hole in the sheeting. Make the slot in the sheeting to allow for stabilator movement, make sure the spacing is correct.
- 5) Make the stabilator drive fitting according to the plan and solder to the control cable. Insert the cable into the plastic cable tubing.
- 6) Locate the drive control cable to the fin and notch the balsa frame as required to allow the control cable to lay flat on the sheeting. Make sure the cable moves smoothly and ~~the~~ Zap in place.
- 7) Glue the sheeting on and core drill the pivot hole and make the slot for stabilator movement.
- 8) Cut a piece of 1/8" I.D. brass tubing about 1" long, sand the tube with coarse sandpaper and clean with acetone or thinner. Insert the brass tube through the pivot hole in the fin. DO NOT glue.
- 9) Cut two stabilator music wire joiner rods, one is 3/32" dia. x 3-3/4" long and the second one is 1/16" dia. x 2-3/4" long.
- 10) Assemble the stabilator to the fin by inserting the 1/16" dia. joiner rod through the hole in the stabilator drive fitting. Engage the stab half with the brass tube extending from it through the pivot tube and the 1/16" joiner rod. Insert the 3/32" joiner rod through the fin and into the stab, slide the second half of the stab onto the joiner rods.
- 11) Carefully align the stabilator perpendicular to the fin. When alignment is correct, Zap glue the 1/8" I.D. bearing tube to the fin and remove the stabs.
- 12) Make two stab fillets from 1/4" x 1/4" x 3" balsa, core drill the stab bearing holes, slide the fillets over the bearing tube. Align for 0° incidence and Zap to the fin. Cut the slots through the fillets to allow for stabilator movement.

- 13) File the brass bearing tube flush to the fillets and remove the burr from the inside of the tube.
- 14) Cut the brass tube extending from stab so that it is flush with the fillet when assembled to the fin.

Rudder:

- 1) Cut the balsa pieces for the rudder. Make sure all joints fit tight and Zap together.
- 2) Cut the hinge slots in the rudder and the fin.
- 3) Use a sanding block to sand the rudder to shape. Round the leading edge, the trailing edge should be square and sharp and about 1/16" thick. Taper the edges of the fin to match the thickness of the rudder.

Fuselage:

- 1) Cut to shape fuselage formers F1, F2, F3, and F5 from 1/8" thick popular lite ply. Make former F4 from 1/8" 5 ply aircraft plywood and former F6 from 1/16" aircraft plywood.
- 2) Make two fuselage sides from 1/8" thick sheet balsa. Locate and core bore 1/4" dia. wing rod hole in both fuse sides.
- 3) Make two 1/32" thick ply fuselage doublers.
- 4) Align the right fuselage side over the plan and carefully mark the location of the formers. Transfer these locations to the left fuselage side.
- 5) Use Zap to glue the 1/4" triangle corner stock to the fuse sides (one left and one right side).
- 6) Glue the 1/32" ply doubler to the fuse sides with slow cure Zap or 5 min. epoxy. With a piece of sharpened brass tube transfer punch the 1/4" wing rod hole through the doublers.
- 7) Glue formers F4 and F5 to the right fuselage side. Use a square to align them perpendicular to the fuse side.
- 8) Slip a piece of 1/4" dia. music wire through the wing rod holes of both fuselage sides and place the fuselage upside down over plan. Align the rod and the fuselage sides to the plan. Use 5 min. epoxy to glue formers F4 and F5 to the left fuselage side. Make sure the alignment is correct.
- 9) Place a piece of 1/8 x 3/8 balsa shim stock between the fuselage sides at the aft end. Taper trim the 1/4 triangle stock until the sides can be pulled up tight against the 1/8 x 3/8 shim stock.

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- 10) Place the fuselage top side up over the plan and clamp the aft fuselage sides together, with the 1/8 x 3/8 shim between them. The shim must not extend above the sides. When satisfied the fuse tail boom is aligned straight, glue in former F6. Then glue on the 1/8" thick balsa top sheeting. Use slow cure Zap. DO NOT glue in the shim stock.
- 11) Remove the clamp and the shim stock.
- 12) With the fuselage still aligned over the plan, Zap glue in former F1.
- 13) Slip formers F2 and F3 between the fuse sides and Zap in place.
- 14) Fit 1/4 triangle stock to aft side of former F4 and Zap in place. Open up the holes through the 1/4 triangle stock for the control cables.
- 15) Fit 1/4 triangle stock to aft side of formers F1 and F2. Zap in place.
- 16) Glue the fuselage 3/8 thick balsa bottom block in place.
- 17) Cut a notch through the top sheeting to fit vertical fin tail post.
- 18) Locate and make a hole through the top sheeting for the stabilator control cable.
- 19) Trial fit the vertical fin to the fuselage by feeding the stabilator control cable through the hole in the top sheeting and through the holes in formers F6, F5, and F4. When satisfied with the fit and alignment, use 5 min. epoxy to glue the tail post to the fuselage sides and the fin bottom to the top sheeting.
- 20) Zap the 1/8" thick sheet balsa curved forward fin piece in place.
- 21) Make an angled hole through the right fuselage side for the rudder control cable. Install the plastic cable housing through the hole in the fuse side and the formers holes. Leave 2" of the housing extending out of the fuse side.
- 22) Glue in the balsa filler block in the aft section of the fuselage at the tail post.
- 23) Zap the control cable housings to the fuselage sides and the formers. Zap the 2" length of control housing to the outside of the fuselage.
- 24) Glue the bottom cross grain sheeting to the fuse with slow cure Zap.
- 25) Glue on the pine nose block with 5 min. epoxy.
- 26) Glue on the 1/16" ply canopy hold-down plate with Zap.
- 27) Zap glue the 1/4" thick balsa block aft of the top hatch. Taper the block thickness to match the 1/8" top sheeting.
- 28) Make the top hatch frame and glue the 1/4" thick sheeting to the frame.
- 29) Make the canopy tray for the vacuum formed canopy or use a solid balsa block for the canopy.
- 30) Drill the 1/8" dia. hole for the hold-down dowel through F-3 and the forward frame of the top hatch. Sharpen one end of the hatch hold-down dowel and slightly round the other end. Insert the rounded end into the hole in F-3 and carefully slide the canopy tray into place, driving the pointed end of the dowel into the aft part of the canopy tray. Remove the canopy tray and drill a hole at the punch mark. Glue the dowel in the tray.
- 31) Cut a piece of 1/4" dia. music wire 8" long. De-burr the ends. Bend the rod in the center for the 3° of dihedral angle. The easiest way to bend the rod is to clamp half the rod in a vice, put a wooden block against the rod extending from the vice, and hit the block with a hammer.
- 32) Slip the 1/4 wing rod through the holes in the fuselage and center the rod to the fuselage. Use a long drill to drill the two holes through F4 for the J-Bolts. Open up the hooked end of the J-Bolts so they fit the 1/4" dia. rod. Install the J-Bolts in F4, but do not tighten the nuts yet. Assemble the stabilator to the vertical fin. Set the fuselage on a flat surface so the stabilator is perfectly horizontal. Now align the wing rod by making measurements from the flat surface to the end of the wing rod on each side and by sighting down the fuselage from stabilator to the wing rod. When satisfied with the alignment, tighten the J-Bolts, then recheck the alignment.
- 33) Assemble the 1/16" ply wing fairing cap to the wing with wax paper between the wing and the cap. Hold in place with the wing locating pins. Slip the wing onto the wing rod and align the wing for 2½° of up incidence. Fit three small balsa filler blocks, one at the leading edge, center, and trailing edge between the wing fairing cap and the fuselage side and zap in place. Remove the wing from the wing rod. Do the remaining wing fairing cap by the same method. Make sure both wings have the same incidence or you will have a built in turn. When satisfied with the alignment, fill in the remaining gaps between the fairing caps and the fuselage with balsa blocks.

Fair in the fairing using a filler putty. (The filler I prefer is a mixture of white glue thinned 50% with water and phenolic micro-balloons mixed in, to a thick consistency.) When the fairings are dry, sand to shape.

34) Make the holes through the fairing for the spoiler cords and the wing rubber band attachment.

35) Cut a slot in the fuselage bottom sheeting to fit the tow hook track. Install the 1/8" ply tow hook mounting plates and the 4-40 blind nuts.

36) The fuselage is now ready for final shaping and sanding. Make the fuselage contours as smooth and streamlined as possible, using coarse (80 grit) sandpaper. Use progressively finer grades to smooth the entire fuselage prior to finishing.

#### Covering and Finishing:

I suggest you use Super Monokote to cover the wing panels and empennage.

The entire fuselage should be covered with lightweight (3/4 oz.) glass cloth and finishing resin. It is not all that difficult and adds strength and durability to the fuselage. Then paint with K&B Super Poxy.

#### Radio Installation and Final Assembly:

1) Install the servo rails and mount the servos in the fuselage.

2) Mount the rudder control horn to the rudder.

3) Install the rudder hinges and glue in place, making sure it swings freely.

4) Solder a threaded coupler onto the rudder end of the rudder cable and screw on a clevis. Slide the cable into the fuselage and snap the clevis to the horn.

5) Assemble the stabilator to the fin.

6) Center the rudder and stabilator servos, then trim the ends off the cables as necessary to allow the threaded couplers and clevises to be installed. Solder the couplers onto the cables and attach the clevises to the servo arms.

7) Install the battery pack, receiver, and switch. Check the control action and adjust linkages to obtain the control movements shown on the plans.

8) Install the wing tip tail skid to the bottom of the fuselage.

9) Assemble the completed model and add weight to the nose of the model until the airplane balances as shown on the plans. Trim the airplane

slightly nose heavy for the first few flights, then move the C.G. back as you become accustomed to the airplane's flying characteristics.

#### Spoiler Rigging:

1) Drop the spoiler blade into the spoiler bay and center so the gap is even all around. Apply the full length 3M clear tape hinge. Zap the 3/32" O.D. aluminum tube horn in place.

2) Apply the 1/4 oz. stick-on spoiler return weight.

3) Assemble the Du-Bro ball links to the servo arm.

4) Cut a piece of dial cord approximately 20" long. Make a loop on one end of the cord just large enough to slip over the ball link and secure the knot with Zap.

5) Feed dial cord through tubing starting at the root end of the wing. Slip the cord through the spoiler horn.

6) Assemble the wing to the fuselage and feed the looped end of the cord through the hole in the fuselage wing fairing.

7) Slip the loop over the ball link on the servo arm. Make spoiler throw adjustment at spoiler horn, secure cord to the spoiler horn with toothpick peg.

8) Repeat the process for the other wing and make sure both blades extend equally, about 80 degrees. Cut off excess cord.

Bill of Materials

1 ea	1/8" x 4" x 48"	Balsa Sheet - Fuse Sides
2 ea	1/8" x 2" x 36"	Balsa Sheet - Fuse Top & Bottom - Core Caps - Canopy Tray - Rudder Bottom
1 ea	1/4" x 2" x 20"	Balsa Sheet - Stab Roots - Fuse Top Hatch
1 ea	3/8" x 2" x 10"	Balsa Block - Fuse Bottom
11 ea	1/16" x 4" x 30"	Balsa Sheet - Wing - Vert Fin
6 ea	1/8" x 3/16" x 36"	Balsa - Subleading and Trailing Edges
1 ea	1/4" x 3/8" x 36"	Balsa - Stab Leading edge and Tip Block
1 ea	1/8" x 3/8" x 36"	Balsa - Vert Fin and Rudder Framing
3 ea	1/8" x 1/4" x 36"	Balsa - Rudder Ribs
1 ea	1/8" x 1/8" x 15"	Tri Stock - Balsa - Fuse Longerons
5 ea	1/4" x 36"	Trailing Edge - Balsa - Wing
3 ea	1-1/2" x 36"	Trailing Edge - Spoiler Blades
1 ea	1" x 20"	Trailing Edge - Balsa - Stab and Rudder
1 ea	1/2" x 36"	Balsa Block - Tip Blocks
1 ea	3/8" x 1" x 10"	Ply - F4 - Two Hook Mounting Plate - Stab Pivot Support
1 ea	1/8" x 6" x 4"	Lite Ply - F1 - F2 - F3 - F5
1 ea	1/16" x 6" x 10"	Ply - F6 - Shear Webs - Wing Root Caps
1 ea	1/32" x 6" x 20"	Ply - Fuse Doublers - Spoiler Blade Doublers
4 ea	1/8" x 3/8" x 36"	Spruce - Wing Spars
4 ea	1/8" x 1/4" x 36"	Spruce - Stab Spar - Wing Leading Edge
3 ea	3/32" x 1/4" x 36"	Spruce - Wing Spars - Spoiler Spars
1 ea	2" x 2" x 2"	Pine - Nose Block
1 ea	1/4" I.D. x 7"	Brass Tube - Wing Joiner
1 ea	1/8" O.D. x 4"	Brass Tube - Stab Joiner
1 ea	1/8" I.D. x 2"	Brass Tube - Stab Pivot
1 ea	3/32" O.D. x 3/4"	Brass Tube - Stab Drive Fitting
1 ea	3/32" O.D. x 4"	Aluminum Tube - Stab Joiner
1 ea	1/4" dia. x 8"	Music Wire - Wing Joiner Rod
1 ea	3/32" dia. x 4"	Music Wire - Stab Joiner
1 ea	1/16" dia. x 3"	Music Wire - Stab Joiner
2 ea	.058" dia. x 36"	Sullivan Cable - Control Cables
1 ea	.030" dia. x 36"	Sullivan Cable - Spoiler Control Tube
1 ea	.024" dia. x 40"	Dial Cord - Spoiler Control
1 ea		Small Horn - Rudder Control
2 ea		Du-Bro Ball Link - Spoiler Control
2 ea	6-32 x 1"	J-Bolt - Wing Joiner Rod Mount
2 ea	1" wide	M-3 #465 Adhesive Transfer Tape - Wing Sheeting
1 ea		Prather Products Phenolic Micro - Ballons - Wing Fills
1 ea		Airtronics Adjustable Tow Hook