

By
Fred
Reese

Our intrepid, prolific designer of things that occasionally fly, is back with an "easy to build," "easy to fly" .40 size sport biplane that will provide you with several seasons of flying pleasure.

Double Trouble is a sport biplane for Sunday flying that features high performance and simple construction for .40 sized engines.

Over the years, most of the biplanes that I built were light, low powered, gentle flying machines and, though, I still enjoy flying slowly, now I prefer a design with more capabilities. I rarely fly in pattern competition but during a Sunday flying session, if I feel like trying a four point roll or knife edge flight, it is more fun to be flying a model that is capable of these maneuvers. Double Trouble is a biplane that is capable of these maneuvers and of any others you might think of.

With ailerons on each wing, the rolls are truly axial and smooth like a single winged pattern airplane. The model flies smoothly and remains docile at low speed and is very easy to land. Think about it: This is a biplane without struts that has pattern performance, tricycle landing gear and really is easy to build.

The wing span may appear too short at first glance, but the combined wing area is 548 square inches, which results in a wing loading of only 16.8 ounces per square foot. Double Trouble only weighs four pounds ready to fly. This is the third

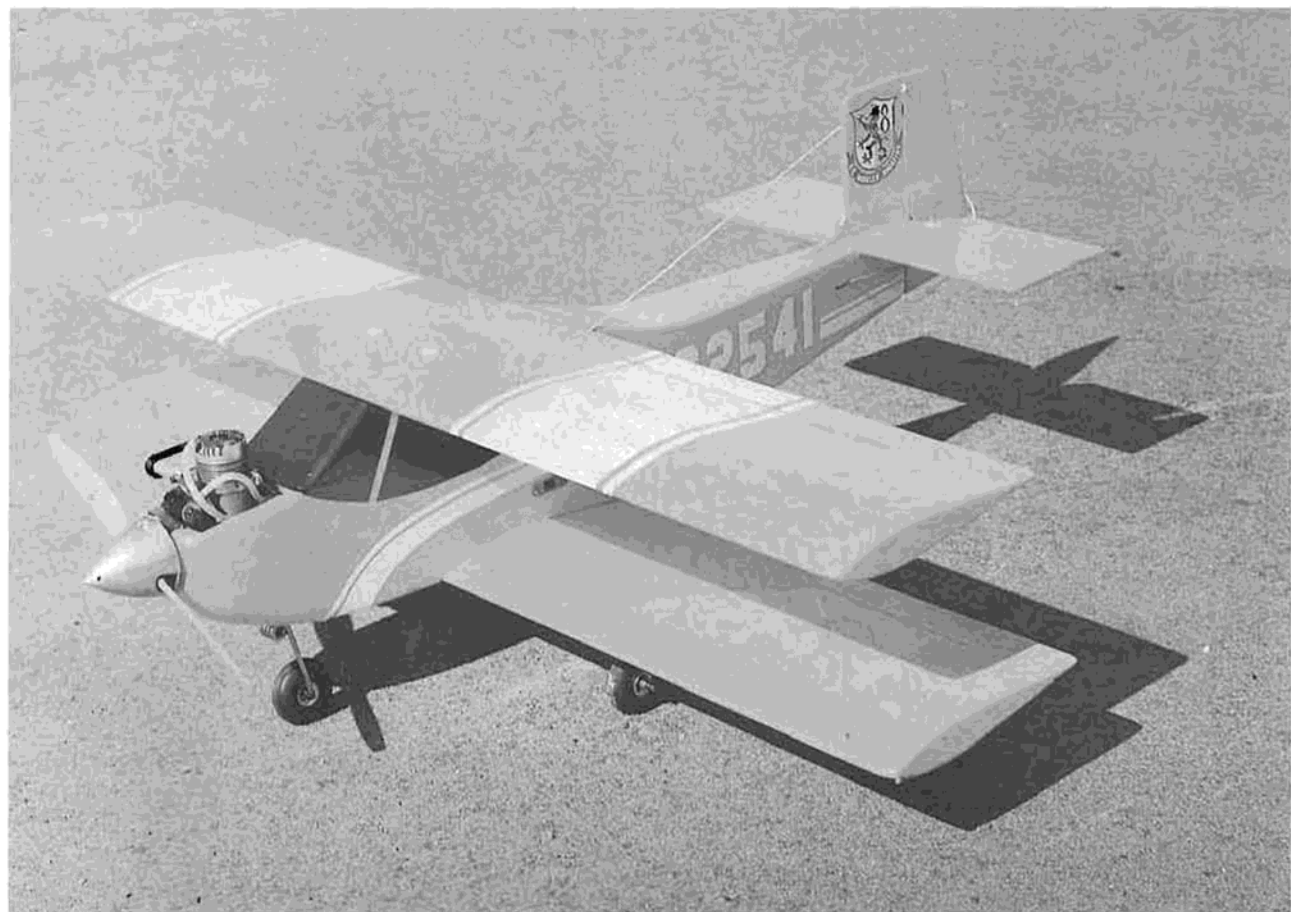
.40 powered biplane I have built of this size and it seems to be just right since mufflers, fixed landing gear and frontal area drag take their toll of the available power. The result is an airplane that is not super fast, but has the power to pull up through "top hat-like" maneuvers, yet does not build up excessive speed coming downhill. I mentioned that I rarely fly in pattern contests, however, I did fly the Double Trouble at a local Sport Biplane Pattern Event hosted by the R/C BEES in Riverside, California, and placed Second simply because the airplane could do all of the maneuvers easily and I got points for every maneuver on each flight.

CONSTRUCTION

Fuselage: Make a pair of fuselage sides from 1/8" x 3" x 36" balsa sheets as one piece runs full length down the middle with a 2" section added to form the top of the cabin and upper wing saddle and a 1 1/2" section is added to complete the bottom outline and lower wing saddle. Glue the 1/4" balsa nose doublers onto the fuselage sides. Use contact cement to bond the 1/32" plywood doublers to the fuselage sides aft of the nose doublers. Cut the plywood doublers from

DOUBLE





TROUBLE

6" x 12" sheets. Also glue the two 1/8" x 1/2" rear fuselage stiffener strips onto the fuselage sides. Cut the firewall from 1/4" or 3/8" plywood and, before gluing in place, bolt the aluminum motor mount in place and install the blind mounting nuts in the firewall. Also mount the Goldberg steerable nosewheel unit and drill a hole through the firewall behind the outer hole in the control arm for the steering linkage. Place the engine on the mount and drill the firewall for the fuel lines and throttle linkage. Epoxy the firewall to one of the fuselage sides up against the 1/4" nose doubler using a square to align the firewall. Cut the #3 bulkhead from 1/8" x 3" balsa and cut a hole for the pushrods. Glue bulkhead #3 to the same fuselage side. Note that the bulkhead is glued on to the plywood doubler from top to bottom. Epoxy the other fuselage side to the firewall and bulkhead.

Glue the 1/2" triangle stock to the fuselage sides behind the firewall along the top & bottom edges. Cut a 3-5/16" x 4 1/2" piece of 1/8" plywood and epoxy it in place behind the firewall to form the bottom of the fuselage. Glue the 1/8" x 3" x 3-5/16" balsa forward

windshield in place above and behind the firewall. Pull the fuselage sides together at the tail and glue together. Add the top and bottom rear fuselage sheeting of 1/8" balsa with the grain running crosswise. Glue the lower chin block and 1/2" triangle in place and then sand off the excess wood flush with the front ends of the fuselage sides with a sanding block. Temporarily bolt the engine in place with a prop and spinner installed. Slip the #1 balsa nose block in place behind the spinner, if possible, and either add or shorten the fuselage sides until there is a 1/32"-1/16" gap behind the spinner. Glue the nose block in place and mark the outline of the spinner on the nose block as a guide while shaping the front end. Remove the engine and shape and sand the front of the fuselage. The cowl shape can be simply rounded off to give a Cessna look or a larger spinner could be used and the entire cowl streamlined into the spinner. Round all the edges of the fuselage except the wing and stabilizer saddles with a sanding block and sand the entire fuselage smooth with #220 sandpaper.

Cut the fin, rudder, and stabilizer from 3/16" x 3" balsa and the elevators from

3/16" x 2" balsa sheet. Join the two elevator halves with a 4" length of 1/4" dowel epoxied into the 1/4" notches in the elevators. Epoxy the fin and stabilizer to the top of the fuselage.

Wings: Make a 1/16" plywood master wing rib to match the #1 rib outline on the plan and cut out 30 ribs from 1/16" or 3/32" sheet balsa using a sharp X-Acto knife. From the 30 ribs, select eight and cut out notches for the landing gear block to make the #2 ribs. Cut out four 1/16" plywood half-ribs using the same rib template to make the #3 rib doublers.

The landing gear block is 3/8" x 3/4" x 12" with a 1/8" wide by 1/8" deep slot for the landing gear wires. Make the gear block from pine or hardwood or it can be laminated from 1/8" plywood. From 3/4" square pine or hardwood, cut four 5/8" spacer blocks for the lower wing and two 15/16" spacer blocks for the top wing. These spacer blocks are placed where the wing mounting bolts and landing gear pass through the wing and will be drilled through in a later sequence. The two wings are the same except for the two extra ribs in the center and the landing gear mount in the lower wing. I will describe the construction for the lower

wing with the additional structure only.

Lay some Saran Wrap or waxed paper over the plan and pin down a 36" length of 1/4" square in the spar location on the plan and a second piece of 1/4" square which will act as a building spacer, in the area marked for the 3/8" square along the back edge of the ribs. Glue the #3 plywood doublers to the #2 ribs. Glue all of the ribs in place on the 1/4" square spar with the landing gear notches up. Pin and glue the 3/8" square trailing edge to the ribs and pin down to the 1/4" square balsa spacer on the plan. Be sure to center the back edge of the ribs along the 3/8" square to leave a 1/16" edge top and bottom for the cap strips. Glue the top 1/4" square spar in place. Glue the 3/8" square leading edge onto the forward ends of the ribs, again leaving a 1/16" edge above and below the ends for the ribs for the wing sheeting. Glue down the 1/16" x 3" x 36" leading edge sheet using pins to hold things in place while the glue dries. It would also be helpful to fit some scrap blocks under the leading edge to give some added support to the wing structure while applying the sheeting and cap strips. Fit and glue in place the 6" center section sheeting aft of the spar. Glue 1/16" x 1/4" cap strips over the remainder of the ribs. When dry, remove all of the pins and remove the partially built wing from the plan. It is easier to make the cut-out for the landing gear block and install it now before the top sheeting is in place. With a pin or the point of an X-Acto knife, push through the sheeting to locate the landing gear notches in the ribs, then cut away the 3/4" x 12" strip of 1/16" sheeting over the notches. Epoxy the landing gear block into the wing flush with the sheeting. The notch is on the outside. Turn the wing over and pin down to the plan, shimming as before for support and to insure straight wings. Epoxy the four 3/4" square by 5/8" pine spacers in place on top of the gear block and up against the top spar and a rib or rib doubler, as shown on the plan. The top edge of these spacer blocks should be flush with the top of the spar as they should make contact with the top sheeting. Glue the top 1/16" x 3" x 36" leading edge sheeting in place. Add the 6" wide center sheeting and the cap strips on the top. When dry, remove from the plan and build the top wing using the same procedures but omit the rib doublers and gear mounting. In the top wing, use 3/4" square pine spacers 15/16" long between the sheeting and against the spars for the top wing mounting bolt supports. The wing tips are simply end caps of 3/16" or 1/4" sheet balsa glued onto the outboard ribs and then sanded to match the airfoil.

I chose to mount the aileron servo in the bottom wing although it could be in the top wing if desired. Make a pair of strip aileron linkages from two 5" lengths of 3/32" piano wire and two 2 1/2" lengths

of 3/32" I.D. brass or aluminum tubing. Bend 1 1/2" arms 90° upward on each wire to connect to the servo, then slip the tubing over the long ends of the wires and make 90° bends 1/2" from the outboard ends to plug into the balsa ailerons. Be sure to make a right and left side. Cut a 6" length of tapered trailing edge stock from each of the two 36" lengths required. Cut a slot along the forward edge of the 6" length of trailing

apart, on the top center for the servo connecting arms of the linkage, then epoxy the tubing of the linkage into the slot in the trailing edge. The ends of the tubing should be even with the end of the wood. Epoxy the 6" center sections onto the wings. Cut the remaining trailing edge stock into four 15" lengths and glue a scrap of 1/4" sheet onto one end of each aileron to match the wing tip blocks. Cut, fit, and round the leading edge, and put an identifying mark on the inboard end of each aileron so that, after covering, each aileron can be matched, hinged and installed where it was fitted. Shape the leading edges of the wings and finish sand the entire wings with #220 paper and a balsa sanding block to remove any bumps or ridges. The 3/8" square back edge of the wing must be tapered slightly to match the forward edge of the ailerons. Bend the main landing gear from 1/8" piano wire. Drill a 1/8" hole through the gear block and into the pine spacer blocks deep enough to take the ends of the gear wires on each side of the lower wing. The holes should be 2 3/4" from the ends of the landing gear block. Trial fit the gear wires into the slots and adjust if necessary. After covering, the gear wires are held in place with metal straps and screws such as Du-Bro GS-25.

The next step is to mount the wings. Adjust the wing saddles so that the wings seat completely against the sides of the fuselage by placing a strip of sandpaper between the wing and fuselage and sanding the sides while maintaining slight pressure with the wing. The saddles may also need slight adjusting side to side so that both wings and stab are all parallel when viewed from the front. Epoxy and screw the four 1/2" square maple wing mounting blocks into the fuselage. Make centerline marks on the top and bottom of the fuselage and at the leading and trailing edges of the wings for the wing alignment. Using rubber bands, masking tape, and pins, firmly mount the wings into position. Check the wing alignment visually and by measuring from the wing tips to the tail on each side. Also measure the distance between the wings at the tips. Make any necessary adjustments, then add enough pins to keep the wings from shifting while drilling for the mounting bolts. The mounting holes should be 2 3/4" from the leading edge and 2 1/2" apart to align with the spacer blocks in the wings and the mounting blocks in the fuselage. Drill straight down through the wings and hardwood blocks in the fuselage with a 3/16" drill for each of the four mounting bolts. Remove the wings and enlarge the two holes in each wing with a 1/4" drill. Turn a 1/4"-20 tap down through the 3/16" holes in the hardwood blocks in the fuselage. Mount the wings using 1/4"-20 x 2" round head nylon bolts and re-check the wing alignment.

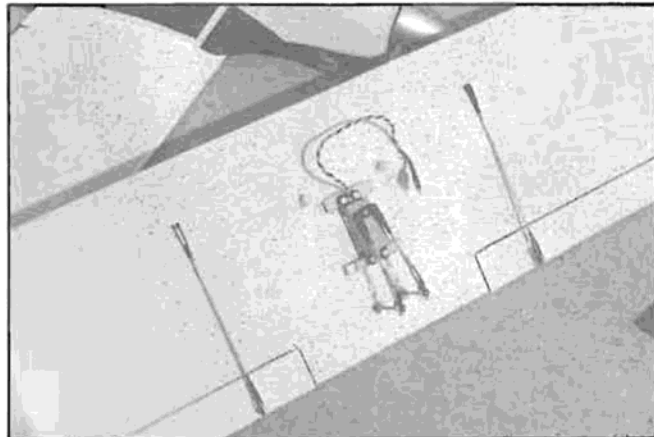
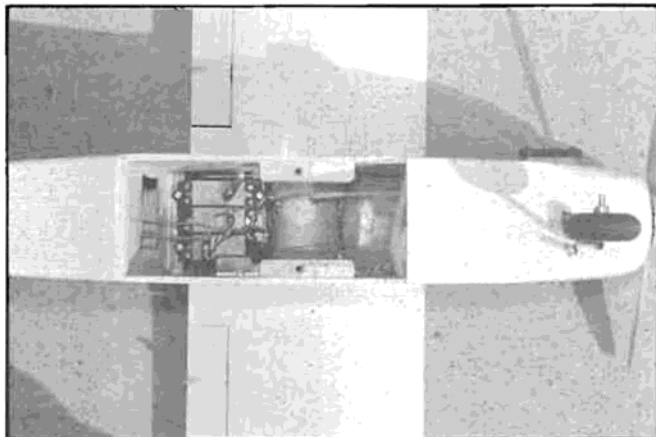
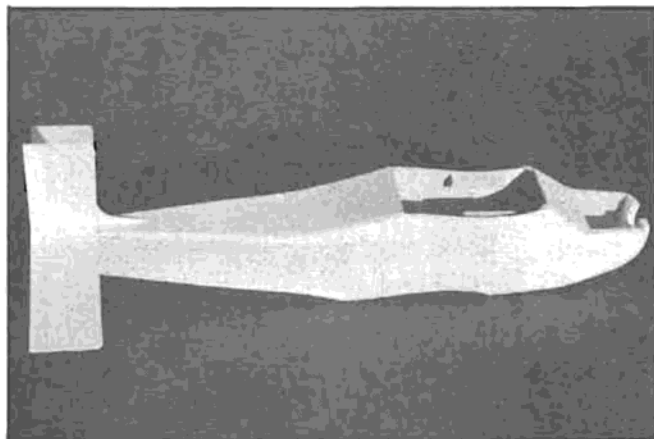
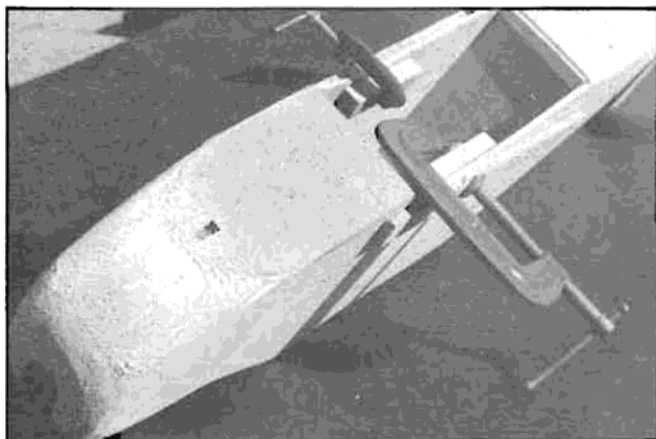
text to page 161

DOUBLE TROUBLE

Designed By: Fred Reese

TYPE AIRCRAFT	Sport Biplane
WINGSPAN	36 1/2 Inches
WING CHORD	7 1/2 Inches
TOTAL WING AREA	548 Square Inches
WING LOCATION	Biplane
AIRFOIL	Symmetrical
WING PLANFORM	Constant Chord
DIHEDRAL, EACH TIP	None
O.A. FUSELAGE LENGTH	36 Inches incl. Spinner
RADIO COMPARTMENT AREA	(L) 10" X (W) 3" X (H) 4"
STABILIZER SPAN	14 Inches
STABILIZER CHORD (incl. elev.)	5" (Avg.)
STABILIZER AREA	67 Sq. In.
STAB AIRFOIL SECTION	Flat
STABILIZER LOCATION	Top of Fuselage
VERTICAL FIN HEIGHT	4 1/2 Inches
VERTICAL FIN WIDTH (incl. rudder)	5 3/4 Inches
REC. ENGINE SIZE	.40
FUEL TANK SIZE	8 Ounce
LANDING GEAR	Tricycle
REC. NO. OF CHANNELS	4
CONTROL FUNCTIONS	Rud., Elev., Ail., & Throt.
BASIC MATERIALS USED IN CONSTRUCTION	
Fuselage	Balsa, Ply., & Hardwood
Wing	Balsa & Hardwood
Empennage	Balsa
Wt. Ready-To-Fly	64 Oz.
Wing Loading	16.8 Oz./Sq. Ft.

edge for the lower wing aileron linkage by first making two 45° angle cuts with an X-Acto blade, removing a wedge shaped strip of wood. The slot can now be easily enlarged with a piece of sandpaper wrapped around the edge of a piece of scrap 1/16" or 3/32" balsa sheet. The finished slot should be 1/8" wide and 1/8" deep to completely accept the 1/8" tubing around the aileron linkage. Cut two notches in the slot, 1"



TOP ROW, LEFT: 1/2" sq. maple wing mounting blocks being glued into the fuselage. Clamps hold things together until epoxy sets. TOP ROW, RIGHT: Fuselage assembly ready to cover. ABOVE: Lower wing removed to show radio installation and rear portion of 8 oz. tank. ABOVE, LEFT: Aileron servo installed in the lower wing. Clevis on the ends of the connecting rods allows quick and easy hook-up. RIGHT: Aileron connecting rods attached to plywood horns epoxied to the ailerons. Four ailerons allow this biplane to roll like a pattern ship. BELOW, LEFT: K & B .40 with Du-Bro muffler installed gives good power but not excessive speed. Wings mount with two nylon screws. BELOW RIGHT: Double Trouble coming at you. Trike gear and absence of cabanes or struts is simple and practical.



DOUBLE TROUBLE

from page 42/40

The pine spacers in the wings should allow the bolts to be tightened firmly without crushing the wings. Apply Hot Stuff to the balsa around the holes in the wings to make the surface harder (remove the bolts first).

The entire airplane can now be covered with Super MonoKote or your favorite covering material. I would suggest that the trim on the top of the airplane be different from the bottom for better visual reference in the sky.

Prepare and install the 8-oz. fuel tank so that the brass fuel lines pass through the firewall. The fuel tank can be positioned by gluing in balsa supports or it can just be supported with foam rubber as I do. Epoxy the two pine or hardwood servo rails across the fuselage with the rear rail up against the rear bulkhead then install the three servos, using the servo trays designed for your radio. Use 1/16" wire pushrods with Du-Bro TC-25 threaded couplers soldered onto the servo ends and threaded Kwik Link clevises to attach to the servos so that both the nosegear steering and throttle can be adjusted for throw. When installing the wire pushrods, slip scraps of NyRod over the wire to keep it from binding up in the foam packing. Make the 1/4" square balsa pushrods for the rudder and stabilizer using the plan as reference. The wire ends are bound to the wood shafts with thread and glue. Note that there are short 90° bends in the ends of the wire sticking into the wood shafts.

The aileron servo is mounted in the lower wing and connected to the aileron linkage by Kwik Links to Du-Bro #103 aileron horn set connectors. The upper and lower ailerons are connected to each other on each side about 2" from the sides of the fuselage. Small plywood tabs are epoxied onto each aileron and drilled with a 1/16" drill, or standard short control horns could be used. The two ailerons are then connected by an adjustable rod and clevis with a soldered clevis on the other end. The lower ailerons are then adjusted at the servo so that they are straight with the trailing edge. With both wings in place, the connecting links are then adjusted until the upper ailerons are even with the trailing edge. Check the ailerons at the tips as they all should be straight with the airfoil. With four ailerons and the short span, it does not take much movement of the ailerons for roll. 1/8"-3/16" in each direction for the ailerons should be sufficient. The rate can be adjusted by moving the #103 connectors up or down on the aileron linkage arms or by using different output holes on the servo. The elevator should move 1/2"-3/4" in each direction and the rudder should have maximum throw.

to page 167

DOUBLE TROUBLE

from page 161/40

Double Trouble has been a real pleasure for me and it is still flying after two years of Sunday flying, having survived numerous mishaps like running out of fuel and hitting a fence and other thumb-induced encounters with the ground. I hope you will enjoy your Double Trouble also.

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