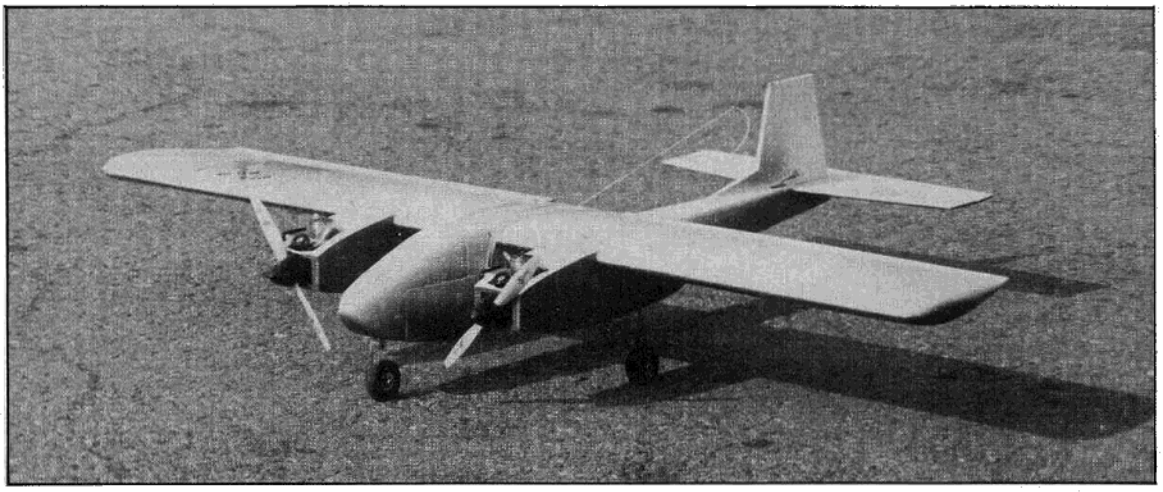
RCM TWIN TRAINER



The RCM Twin Trainer by Brendan K. Wong is designed as a twin engine trainer for two .40's. You'll find this design takes the trouble out of twin engine flying.

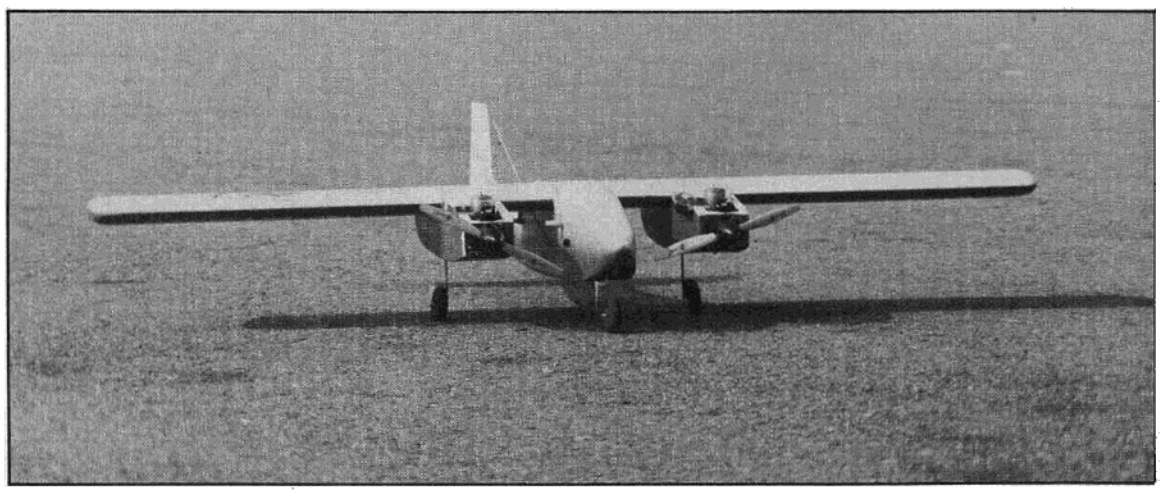
How many of you have wanted a twin but couldn't afford the cost of "practicing" on a Stand-off Scale B-25? This is a problem many would-be multi flyers face. I don't know of any company that kits a true twin engine trainer. This plane will fill that void.

About a year ago, I decided to get into radio control. I knew absolutely nothing about R/C, but had done some control-line flying, so I didn't exactly start from the bottom. A friend was already into R/C, so we met at the flying field a number of times. After a month of data gathering, I set down my plan.

Due to the cost of balsa, gas and engines, I stayed with .40 powered aircraft. Step One called for a .40 powered trainer. I also needed a radio set and an engine. A Bridi RCM 40 with a K & B .40 and a 5 channel Futaba set turned out to be a great combination. A Sig Kougar was my second trainer (Step Two). Both planes are great, and I'd recommend this combo to any newcomer. Step Three would be a twin trainer. Because there weren't any kits or plans available, I decided to modify my RCM 40 for twin power. Borrowing two .25's, I built two engine nacelles and tacked them on the wing, covered up the old engine compartment and tried it. After one flight, I decided to do it right and start from scratch. Because this would be a trainer, a second twin would most likely follow. For this reason, this trainer would use engines in the range of what most of us can afford — .25 to .40. Prototype II used extended engine nacelles to get the weight up front and reduce the possibility of building tail heavy as in Prototype I. Another modification was an extension of the wing to 62". You'll notice some other minor changes in the plans but, other than that, it's really an RCM trainer. Model I of Prototype II weighed 5.75 lbs. with two K & B .40's. Since I wasn't exactly sure how this thing would fly, finish was minimum. I used Fas-Cal plastic iron-on covering with basic black overall.

Since I had made the trim flights on my Kougar, I decided to trim out my twin myself. I had no trouble with my Kougar and hoped this twin would be as easy. After adjusting the throttles, I finally got the engines to run about the same. By the way, I don't use counter-rotating engines. I made some high speed taxi runs to adjust the nose gear, then topped off the tanks to prepare for my first flight.

Both engines were adjusted for a strong four cycle at wide open throttle (W.O.T.). With both engines W.O.T., this thing goes like hell, so make sure it goes straight without much steering. There



isn't much time to practice your steering skills. With both engines humming, it took just a bit of up and it was flying. There was no tendency to roll to the left and, in fact, was so easy to take-off, it felt like it was already trimmed. I took it up high and trimmed for straight and level flight. It needed a bit of aileron trim and some down trim. Turns in either direction using aileron-elevator or rudder-elevator were done without any trouble. The flight to this point was great, so I decided to try a landing approach to feel it out before I ran out of gas and had to make a landing without any idea of how it would handle. As it turned out, I didn't have to make more than one approach! Everything felt so good, I brought it in the first time around.

Flight One was a complete success! In other flights, it has shown me that it could do just about anything. Loops can be as big as you want them to be, inverted flight is just as easy as right-side-up, and it'll fly straight up for as long as you like. In other words, I really think it's a great plane! There is one thing I would not do and that is spins. I'm worried about the wing falling off. Those rubber bands aren't the greatest way of attaching the wing, but you have to show the troops that it is a trainer, right?

I've had a number of flights where one engine has died, but haven't tried to continue the flight on one engine. If one engine does die, do not continue to fly with the other engine in W.O.T. I'm sure it will not fly. Cut back on the throttle first. One of these days, I'll take it way up and let one engine die and give it a try.

The plans shown here, Prototype III, have some improvements over Model I of Prototype II. These improvements were to strengthen the nacelles and wing saddle section, and to move the main landing gear to the nacelles.

I hope this article proves that not only experts can try something different. If you are a decent builder and flyer, there is no reason why you cannot build and fly this twin. It's a cheap way to learn the basics. If someone tells you you're crazy, ask him if he has tried one. If he hasn't, play deaf. If he has, get as much information out of him as possible, and try not to duplicate his mistakes. Please feel free to contact me about any problems. My address is 3504 Garnet Street, Torrance, California 90503. I would like to thank Bridi Hobby Enterprises for allowing me to use the RCM 40 Trainer plans as a basis for my twin.

Let's get to the construction.

CONSTRUCTION NOTES

Most builders will agree, making a kit before starting actual construction is the best way of scratch-building. I like to identify each part with removable labels. Please read over each section before starting, and be certain you understand what you will be doing before you actually do it!

ABOUT THE AUTHOR

Brendan K.M. Wong is 26 years old and holds a Bachelor of Science in Mechanical Engineering from Northrop Institute of Technology. He is employed at Aerojet Ordnance and Manufacturing as a Mechanical Engineer. Born in Hawaii, Mr. Wong has had recent experience in design and development of carburetor calibrations for 1976/77 vehicles; design and development of advanced single venturi staged carburetor; cold weather and high altitude emissions and driveablity studies; hot fuel handling study and fuel system integrity designs to meet Federal docket; emissions calibrations, fuel economy, driveablity, etc.

RCM TWIN TRAINER

Designed By: Brendon Wong

TYPE AIRCRAFT
Twin Engine Sport Trainer
WINGSPAN
62 Inches
WING CHORD
10¾ Inches
TOTAL WING AREA
666 Square Inches
WING LOCATION
High Wing
AIRFOIL
Symmetrical
WING PLANFORM
Constant Chord
DIHEDRAL, EACH TIP
(Flat Wing)
O.A. FUSELAGE LENGTH
45 Inches
RADIO COMPARTMENT AREA
(L) 15" X (W) 3" X (H) 3"
STABILIZER SPAN
22½ Inches
STABILIZER CHORD (incl. elev.)
5⅛" (Avg.)
STABILIZER AREA
107 Square Inches
STAB AIRFOIL SECTION
Flat
STABILIZER LOCATION
Top of Fuselage
VERTICAL FIN HEIGHT
6½ Inches
VERTICAL FIN WIDTH (incl. rudder)
5¾" (Avg.)
REC. ENGINE SIZE
.25-.40 Cu. In.
FUEL TANK SIZE
4-8 Ounces
LANDING GEAR
Tricycle
REC. NO. OF CHANNELS
4
CONTROL FUNCTIONS
Rud., Elev., Ail. & Throt.

BASIC MATERIALS USED IN CONSTRUCTION

Fuselage	Balsa, & Ply
Wing	Balsa & Ply
Empennage	Balsa
Wt. Ready-To-Fly	92-104 Oz.
Wing Loading	19.9-22.5 Oz/Sq. Ft.

Horizontal Stab and Elevator: Cut the rear section of the horizontal stab and elevator from the 1/4" x 4" x 36" balsa sheet. The front stab portion should be cut from one of the 1/4" x 3" x 36" sheet. Join the stab pieces together using Zap. Install the plywood elevator horn plate. Sand the stab and elevator to shape.

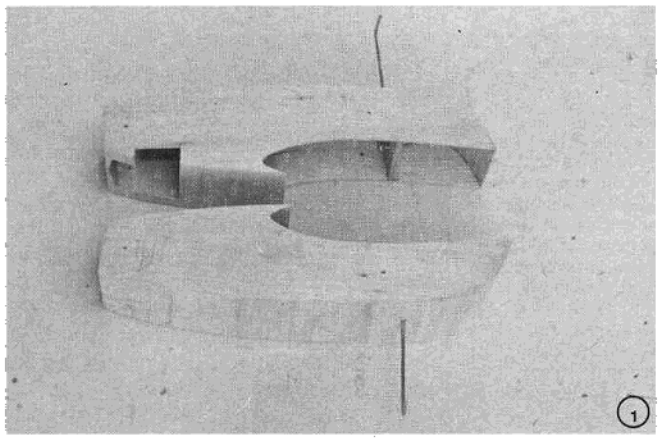
Vertical Stab, Dorsal Fin and Rudder: Cut the vertical stab and rudder from the remaining piece of 1/4" x 4" x 36" balsa sheet. The dorsal fin can be cut from any piece of 1/4" sheet remaining. Glue the plywood rudder horn plate in place. Don't glue the dorsal fin to the vertical stab.

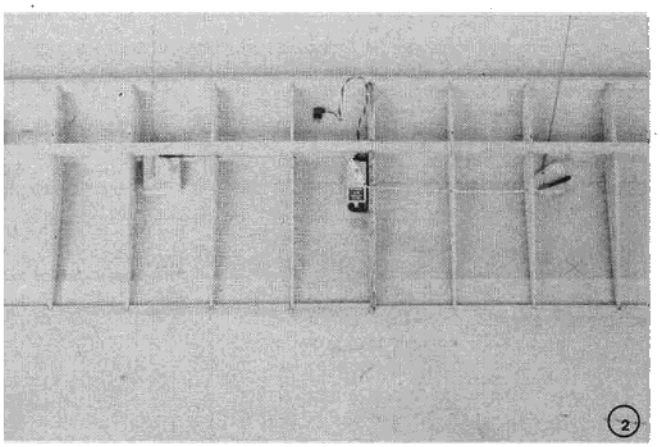
Fuselage: Cut all fuselage parts out. Cut the fuselage top block from the 3/16" x 4" x 36" balsa sheet. Also cut B-2 and B-3 from this sheet. The fuselage sides are cut from the 1/8" x 4" x 36" balsa sheet, one sheet per side. The aft section will have to be joined.

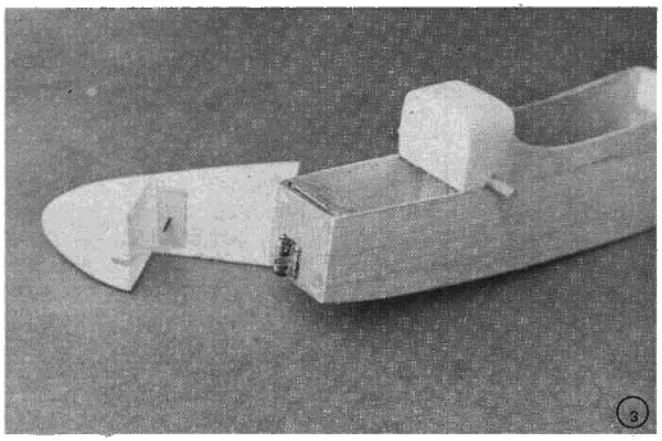
Draw a centerline down B-1, B-2, B-3, the top fuselage block, and the horizontal stab. Place the top fuselage block, with the centerline showing, on your building board. Glue the 1/4" x 3/16" stringers in place (allowing a 1/8" recess to accept the fuselage sides) on the fuselage block. Glue the 3/16" x 1/4" x 2" cross brace in place as shown in the plans. Glue B-3 in place. Also use a triangle or square to make certain B-3 is perpendicular to the fuselage block.

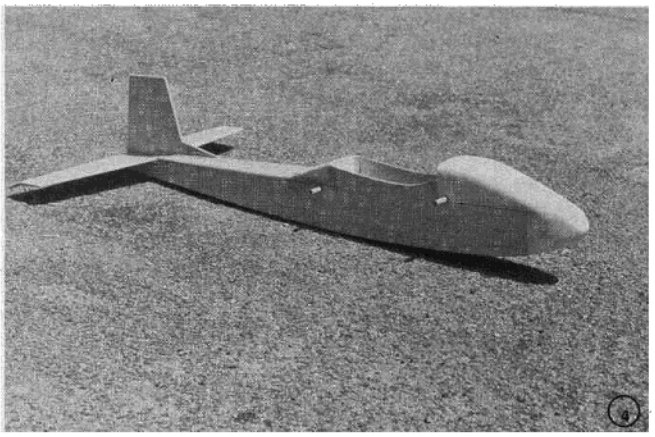
Using the completed fuselage top block, mark the positions of B-3 and the vertical brace on each fuselage side, making certain your marks are perpendicular to the top fuselage block. Lay both fuselage sides down on your building board with the innerside up. Place the 1/32" ply wing saddle-fuselage doubler in position and mark the position of B-2; also mark the position of B-1. Glue the 1/32" plywood doublers and the vertical braces to each fuselage side. Using one fuselage side, Zap B-2 in place using a triangle or square to make certain it is 90° to the fuselage side. Place this fuselage side upside down on your building board and Zap the other fuselage side to B-2. Pull the rear portion of the fuselage together and pin using a 3/8" piece of balsa as a spacer. Remove the fuselage assembly temporarily to place the fuselage top block in position over your plans. Put glue on the stringers and B-3. Place the fuselage side assembly on the fuselage top block. Make certain the fuselage sides are perpendicular to your building board by shimming the fuselage sides apart where necessary. Use Zap to "pin" in position. Zap B-1 in position while holding the fuselage sides tightly against its edges. Allow to dry.

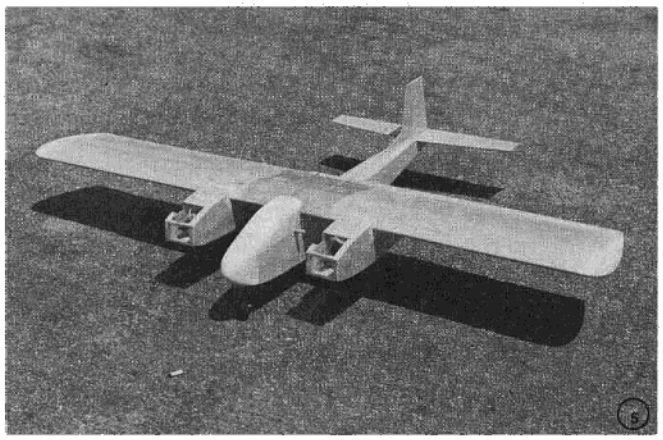
Use the 1/16" ply and balsa, cross

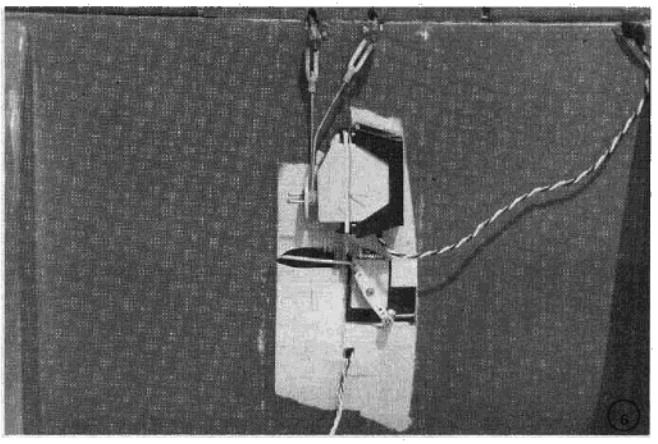


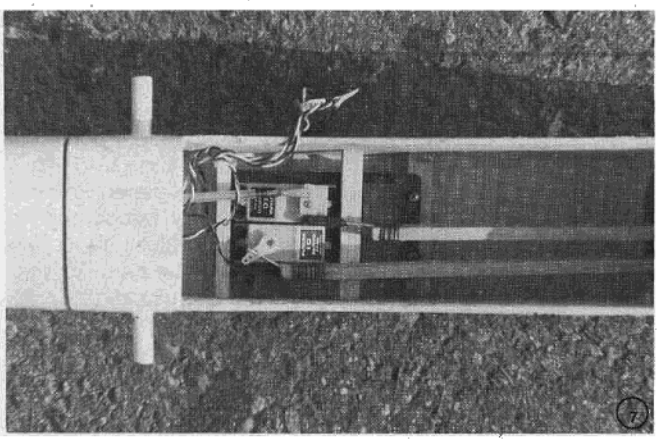


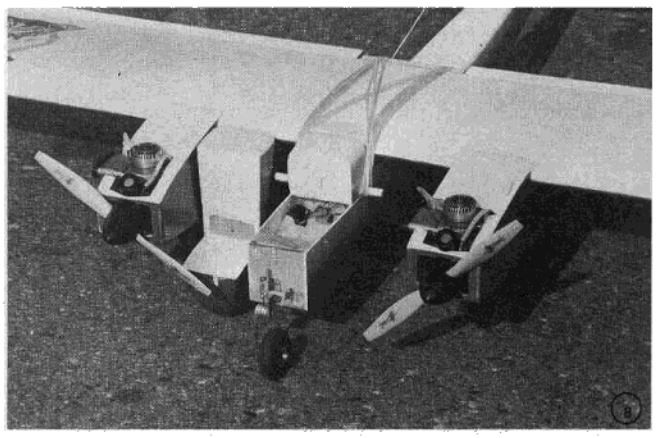












(1) Framed up engine nacelles ready for installation on wing. (2) Bottom view of wing center section showing throttle servo & linkage. (3) Forward fuselage section showing removable foam nose block. (4) Completed fuselage ready for covering. (5) Completed twin ready for final covering & equipment installation. (6) Completed wing with throttle & aileron servos installed. (7) Rudder & elevator servos installed showing ample room for even the largest of equipment. (8) Nose block removed giving good access to receiver & battery pack. This allows easy adjustment to nose wheel tiller arm.

grain, to plank the bottom of the fuselage.

Glue the rear cabin block up against the rear edge of the wing saddle ply and balsa parts. Use the 1/4" tri-stock to strengthen the joints between the block, saddle, fuselage sides and B-3. "Tack" the front cabin and nose blocks in position. Cut and sand the blocks to shape. Glue the cabin block to the nose block. The forward section will become removable to adjust the steering gear and allow access to the "baggage" compartment. Remove the front cabin-nose unit and hollow out. Also make provisions for mounting. If foam is used, cover with 2 oz. glass cloth Hobbypoxy II.

Glue the horizontal and vertical stab in place making certain that they are perpendicular to each other. Also glue the dorsal fin in position. Don't forget the tri-stock strengtheners at the base of the vertical stab and the horizontal stab-fuselage joint. Sand the fuselage, vertical and horizontal stabs, elevator and rudder. The rudder and elevator can be hinged now or after finishing. Lock the hinges within the balsa. I use straight pins, cut to length, and Zapped in place.

Nacelles: Epoxy the 1/16" ply doublers to the nacelle sides. Decide what engine-motor mount combination you will use and make certain the prop-spinner will be in the proper position — outside of the nacelle! Mark each N-1a, drill and install the blind nuts. Install the motor mounts temporarily. Mark the insides of the nacelles for positions of N-1, N-1a, N-2, N3A and N-3. J-bolt the main landing gear struts to each N-3. Epoxy N-1, N-1a, N-2, N3A and N-3 to one nacelle side making certain each is perpendicular to the side. When set, epoxy the other side to the assembly. Glue the nacelle bottom planking in place. Drill N-1a for the fuel line, vent line, etc. Plank the top portion of the nacelle. After dry, cut out a section to install your engine. Trial fit your engine, prop and spinner. Mark the location of your engine mount holes. Also trial fit your mufflers and modify the nacelles to fit. Drill and tap the motor mounts. Sand the nacelles to the final shape. Fuelproof the engine compartment and tank compartment with resin. Install the gas tanks and motor mounts.

Wing: This is the most difficult part of this building sequence. If you read it over a couple of times before actually starting, it'll be a lot clearer. I suggest you use a wing jig. If you can't buy one, make one using 1/4" rod and some spacer blocks. Make certain the blocks are the correct height. I'm assuming you will be using one. (Note: The rib template shows alignment tabs for those builders who prefer to use a flat building board for the wing assembly.)

We will build a half of the wing at a time. Mark spars L.E. and T.E. Notch the T.E. as indicated. Place the ribs on the 1/4" rods. Glue the top spar in position. Glue the L.E. in place making certain the ribs are centered on the L.E. Glue the T.E. in position. Cover the **top** of the wing with 1/16" balsa sheeting. Remove this half from the jig and build the other half. Remember to sheet the **top** surface of each half. When dry, place both halves on the jig with the sheeting (top surface) down. Glue the bottom spars in position and epoxy the halves together. Install your throttle servo tray. Use the 1/8" ply bellcrank mounts and balsa blocks of approximately 1/4" thickness to build your throttle bellcrank mounts. Trial fit them in the wing between ribs 3 and 4. Fit your throttle servo into your tray. Install your bellcranks temporarily. Connect the servo to your radio gear and set the throttle at the lowest throttle position (idle) with full **up** idle trim. Bend the 1/16" wires to fit between the servo arm and the bellcrank. Leave the pushrods in position. Mount the engines into the nacelles. Tape the nacelles onto the wing. Set both engine throttles at idle. Measure the distance between the engine throttle arm and the bellcrank output arm. Bend another pair of 1/16" rods to fit in these positions. Don't forget, the clevis end is at the engine. Remove the nacelles from the wing and the engines from the nacelles. Drill N-1a to allow the pushrod to pass through to the engine throttle arm. Place the pushrods in position with the R/C gear connected, and work the throttle through the total travel including trim. After you are certain everything is alright, reset the throttle to idle with full up trim. Again, install the engines into the nacelles. Guide the pushrods through the nacelles and tape each nacell onto the wing. Adjust the clevises to set both throttles at the idle position. Check your throttle movement with your transmitter. Use the clevis and engine throttle arm to adjust both engine throttles to function identically. Make absolutely certain that the throttle linkage assembly operates smoothly with no binding. Once we cover the wing, it won't be easy to get back into the wing. When satisfied with the movement, epoxy the bellcrank mount nut in place. The real trouble of adjusting the throttles are in the throttle arm radii, bellcrank arm radii, the servo arm radii, and the start of the engine-throttle arc.

Remove the nacelles from the wing. Don't forget to mark where each engine goes. If you are certain all is fine, cover the bottom of the wing with 1/16" balsa. When dry, trim off the excess and install the wing tip blocks. Tape over the throttle servo and sand the wing to shape. Epoxy the nacelles in position. Use glass cloth and resin to strengthen the wing mid-section. Cut and shape the ailerons from 5/16" balsa. Install the aileron horns. The ailerons can be hinged now, or after finishing. Install your aileron servo and pushrods.

Final Assembly: Install the 1/4" hardwood dowels into the body if you have not already done so. Mount all hardware: engines, spinners, props, nose gear and tires. Strap the wing onto the fuselage. Use your radio gear as ballast and find their correct positions within the body to get the proper C.G. position. Install all R/C gear. Make certain the wing is perpendicular to the vertical surface and parallel to the horizontal surfaces. Trim the rear cabin block for aileron clearance.

Finish: I used Fas-Cal iron-on film to cover the plane completely. It's cheap and easy to use. A Miller spray outfit was used to shoot the Perfect Paint. I like to use two primary colors as a basis for all my planes. It is also easier to fly when one top panel is "different" from the other side. Everyone uses symmetrical paint schemes; be different!

BASIC MATERIAL LIST

Ply
1 ea. — 1/4" x 6" x 12"
5 ea. — 1/16" x 6" x 12"
1 ea. — 1/8" x 6" x 12"
2 ea. — 1/32" x 6" x 12"

Balsa
12 ea. — 1/16" x 4" x 36" Sheeting
2 ea. — 3/32" x 4" x 36" Sheeting
4 ea. — 1/8" x 4" x 36" Sheeting
1 ea. — 1/4" x 4" x 36" Sheeting
2 ea. — 1/4" x 3" x 36" Sheeting
1 ea. — 3/16" x 4" x 36" Sheeting
6 ea. — 1/4" x 1/4" x 36" Tri-Stock
6 ea. — 3/8" x 3/8" x 36" Strip
4 ea. — 3/16" x 1/4" x 36" Strip

Foam or Balsa Blocks
2 ea. Wingtip blocks — 2" x 1" x 11"
1 ea. Rear cabin block — 1.5" x 3" x 4"
1 ea. Nose block — 3" x 3" x 3"
1 ea. Forward cabin block — 2.5" x 3.5" x 9"

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