RCM 15-500 Front Rotor .40: The New Breed of Club Racer

Clean, honest, and fast, the RCM 15-500 is tailored to the emerging class of very simple sport or club racers using front rotor .40 engines. A one weekend project by Larry Maynard.

● The 15-500 is an outgrowth of a series of similar designs dating from 1969 all of which have been easy to build and fun to fly. This latest version is tailored to the emerging class of very simple sport or club racers using front rotor .40 engines. With a wing just over 15 percent thickness and 500 square inches of area it meets all requirements under AMA sport racing rules while retaining the honest characteristics of a fine Sunday flier. With a smaller engine, i.e., a .19 to .35 it becomes as docile as all but the very basic trainers.

The prototype was designed, engineered, and fully framed up over a weekend in which I also attended the B.I.R.D.S. annual Pattern contest. Insofar as practical the design has been tailored to standard material sizes and a materials list is provided to permit the builder to survey his supplies and scrap bin for necessary purchases. The structure has more than adequate strength so that any desired finishing technique may be used. For basic construction I strongly recommend using regular model cement in other than high stress areas in order to keep the weight at a minimum. At the same time the builder is cautioned to spend the few extra minutes it takes to double-glue each joint. For attaching the wing sheeting it is a very simple matter to put the glue on the mating structure, lay the sheet on to transfer the glue, and then set it aside for a few minutes before re-gluing and pinning it in place. This method substantially increases joint strength and will save several ounces in airframe weight which can be the difference between winning and losing in a closely matched contest. A foam wing was also considered but fell by the wayside from weight considerations.

The construction notes have been layed out for minimum building time, so let's get with it.

CONSTRUCTION

Cut the fuselage sides from matched 3/16" x 4" x 36" balsa to the outline shown making sure to cut for the 2 degrees downthrust and the stabilizer inset. Draw lines on the inside of the fuselage sides to locate F3 and F4, and cement the ¼" x 1/8" stiffeners in place. Epoxy the trailing edge stock, firewall gussets, and wing nut blocks to the sides as indicated and set these assemblies aside to dry. Cut out F1, F2, F3, F4, and F5, and drill pilot holes in F1 for your motor mount, throttle control, and fuel lines. These are set aside for now.

Cut out and shape the horizontal stabilizer and, while you're at it, do the elevator, fins, and rudder, too. Since it will be a while before you can proceed with the fuselage assembly you might as well go grab a snack or a brew while contemplating the wing structure.

RCM 15-500 PROPOSED RULES

WING
- Area ≥ 500 square inches
- Thickness ≥ 15% of chord
- Planform: Constant chord and thickness from the centerline to 24 inches on each side. Wing tips may be any shape or kind as long as the owner can prove that the total wing area is equal to or greater than 500 square inches.
- Airfoil: Airfoil section and construction are up to the builder.

TAIL
- Area of the horizontal stabilizer and elevator must be no less than 90 square inches when projected on a horizontal surface. Vertical fin and rudder may be any size depending on stability requirements.

FUSELAGE
- Fuselage to have a rectangular cross section nose to tail. The maximum width and height of the rectangular cross section must be at least 2-15/16 inches and 3¾ inches respectively with the wing removed. These dimensions need not occur at the same cross section. A maximum radius at the edges of 3/8 inch is permissible. No wing fillets are permitted and only structural filleting of the tail will be allowed. No engine cowling may be used. Addition of a pilot's canopy to the above requirements shall not be cause for disqualification.

ENGINE
- Front rotor 0.40 cubic inch or less, standard production engine generally available in local hobby shops. Full idle must be demonstrated; however, zero motion on a smooth runway is not required. Idle will be considered adequate when aircraft lands under power and taxies back to pit (or pit area) under full control.

PROPELLER
- A wooden, commercial 10 inch diameter, 6 inch pitch propeller shall be used. One blade may be modified for balance purposes only.

LANDING GEAR
- Landing gear shall be fixed, non-retracting and may be either taildragger or tricycle configuration in the usual sense. Ground steering shall be provided and demonstrated at the request of the C.D. or by the taxi maneuver after landing. Main wheels shall have a minimum diameter of 2¼".

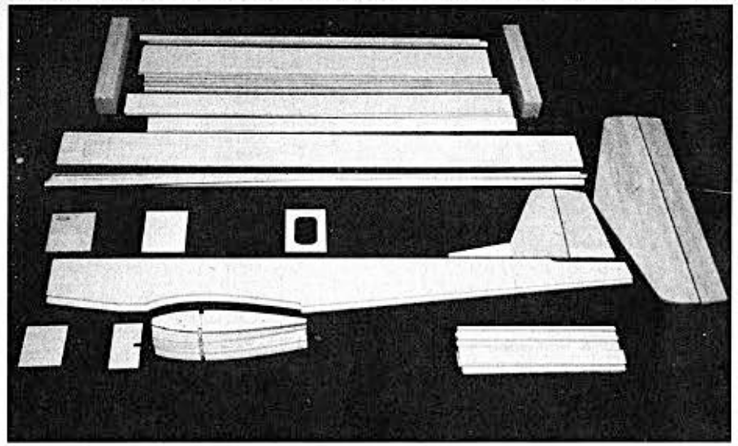
FUEL
- Fuel shall be a standard commercial mix and will be provided by the contest management.

The race course and conduct are to follow Formula I rules and procedures.

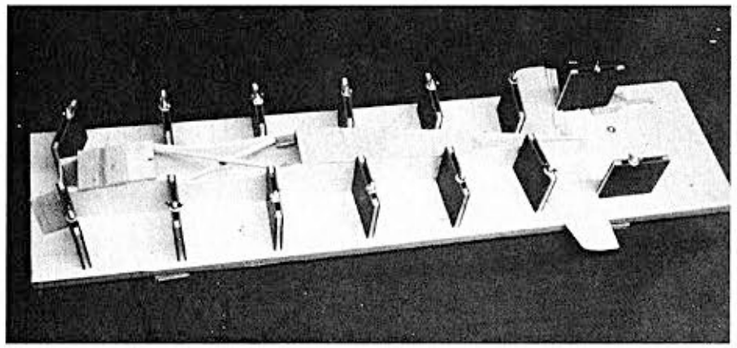
Properly fortified now, cut 20 ribs from 3/32" sheet and one from ¼". Cut the spars, leading edge strip, trailing edge, and the wing sheeting to approximate size as shown and cement the 1/16" x 3/16" trailing edge strips to the trailing edge sheeting. (A tracing of the wing on shelf paper can be used if you would rather build the whole wing at one time.) Add the ¼" diameter wing hold-down dowel to the center ¼" thick rib and add 1/16" sheet vertical grained webs to each side. Pin the lower spars over the plan on an absolutely flat work surface and locate the ½" thick jig block parallel to them at the location shown. Using model cement, glue all but the center ¼" rib in place. Use a small square or triangle to assure accuracy. Bevel the 3/32" strip leading edge and add it and the trailing edge sheeting with its attached 1/16" x 3/16" strip using the double-gluing method. Add the upper leading edge sheeting and the upper 1/16" x 3/16" capstrips.

By this time the assembled parts for the fuselage and tail feathers should be dry. To assemble the parts, pin the stabilizer to a flat work board on the plan top view. Fit and glue the tail end of the fuselage sides together and then glue them to the stabilizer. Immediately insert F4 making sure that the top of the fuselage sides lies flat on the work surface. Next, get some 8-10 inch lengths of 2" x 4" (house construction type) and, using weights or clamps to hold them in place, bring the fuselage sides in to meet the B3 bulkhead. (To really make this simple use an RCM Fuselage Jig – see the February 1972 issue.) Dampen the fuselage sides in the area of F4 to make it easier to form the sides. Add ¼" x 1/8" cross members to the existing stiffeners and add short triangular pieces between the fuselage and stabilizer as structural fillets if desired, then install the tail wheel bracket. Note that the tail wheel bracket has to line up with the back of the vertical fin if it is to be controlled by the rudder. Draw the nose together and epoxy F2 and F5 (the landing gear block) in place. Add the lower front nose sheeting and add temporary "X" bracing of scrap in the wing cutout area to assure fuselage alignment when the assembly is removed from the work surface. Add the bottom 1/16th sheeting cross-grain.

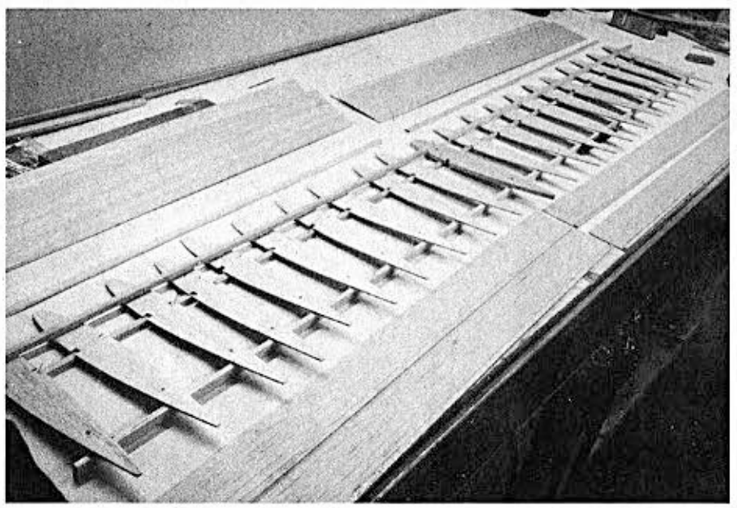
The wing structure has set up pretty well by this time so remove it from the work surface, turn it over, and pin it back in place. Now, add the lower leading and trailing edge sheeting using the double-glue method and add the capstrips to the ribs. Since both the wing and fuselage assemblies should be left overnight to assure



All wood parts for the RCM 15-500 cut out and ready to assemble.



Fuselage assembly in the RCM Fuselage Jig.



RCM 15-500 wing layout using the 3/16" x 1/2" leading edge cap as the wing jig block. The 1/16" x 3/16" T.E. strips are pre-glued to the T.E. sheeting.

complete setting up of the adhesives you might as well set the whole works aside, return to the refrigerator for sustenance, watch the late news, and go to bed.

When both wing halves are complete, carefully sand the 2 degree dihedral angle at the center section. Epoxy the ¼" center rib in one wing half so that half of it is exposed. Clean off any excess epoxy on the exposed surfaces and allow it to set up. Sand the leading edge flat and then add the 3/16" x 1/2" leading edge cap to both halves and spot glue the wing tips in place. After this has cured, put epoxy on the mating surfaces of the ¼" rib and slide the two wing halves together so that each wing half has 1/2 of the center rib keying it in place. Even if you use 5 minute epoxy for this, give it an hour or so to set up completely. After this is set-up, finish shaping the leading edge and the wing tips then remove the tips, hollow them out, and re-cement them in place permanently. Add the center section sheeting and the 1/16th plywood stiffener for the wing hold-down bolts and fiberglass the center section as shown. Add the strip aileron horns after fiberglassing. When everything has set up give the wing a final sanding, cut out the center rib and sheeting for the aileron servo and cover with your favorite material.

Now that the wing is essentially complete let's finish up the fuselage and tail assembly. Remove these parts from the board and pin the top sheeting in place. Draw trim lines for the sheeting and locate the slot for the vertical fin. Remove the top and trim it to outline. Cut the slot for the fin and finish trim the portion of the top that fits over the stabilizer. Install your control guides and rods in place before adding the fuselage top. Epoxy the F1 firewall to F2.

Separate the hatch from the fuselage top and add its stiffeners. Carefully cement (double) the fuselage top in place and allow it to dry completely. Do not add the vertical fin until it and the fuselage are otherwise complete and the tailwheel is installed. The bend for tailwheel control should be made before the fin is installed. The control surfaces can now be sanded and finished as desired, the hinges added, and the ailerons installed to the wing.

By the time this operation is complete the fuselage should be ready for final shaping. With the hatch in place sand the fuselage edges, fairing them

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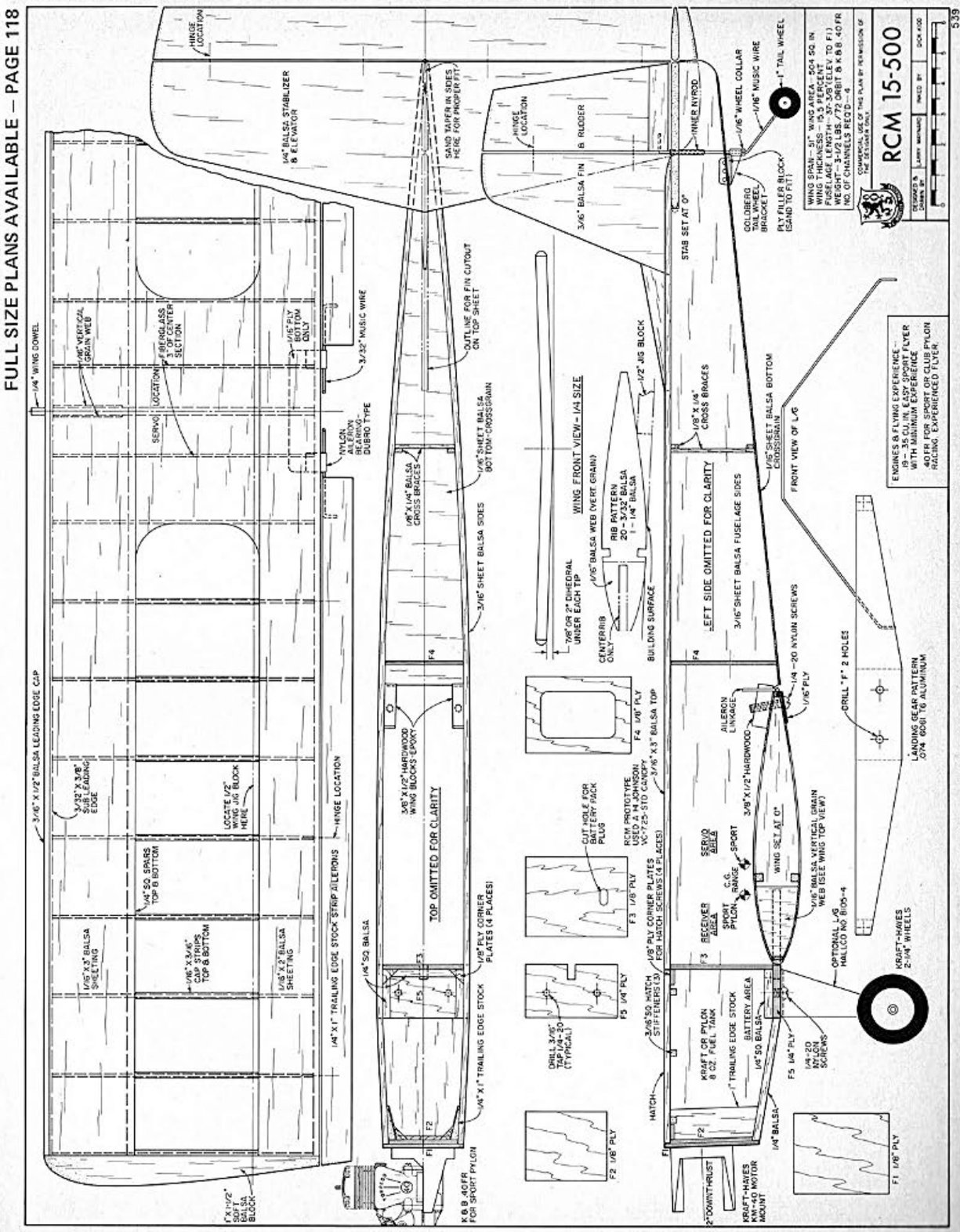
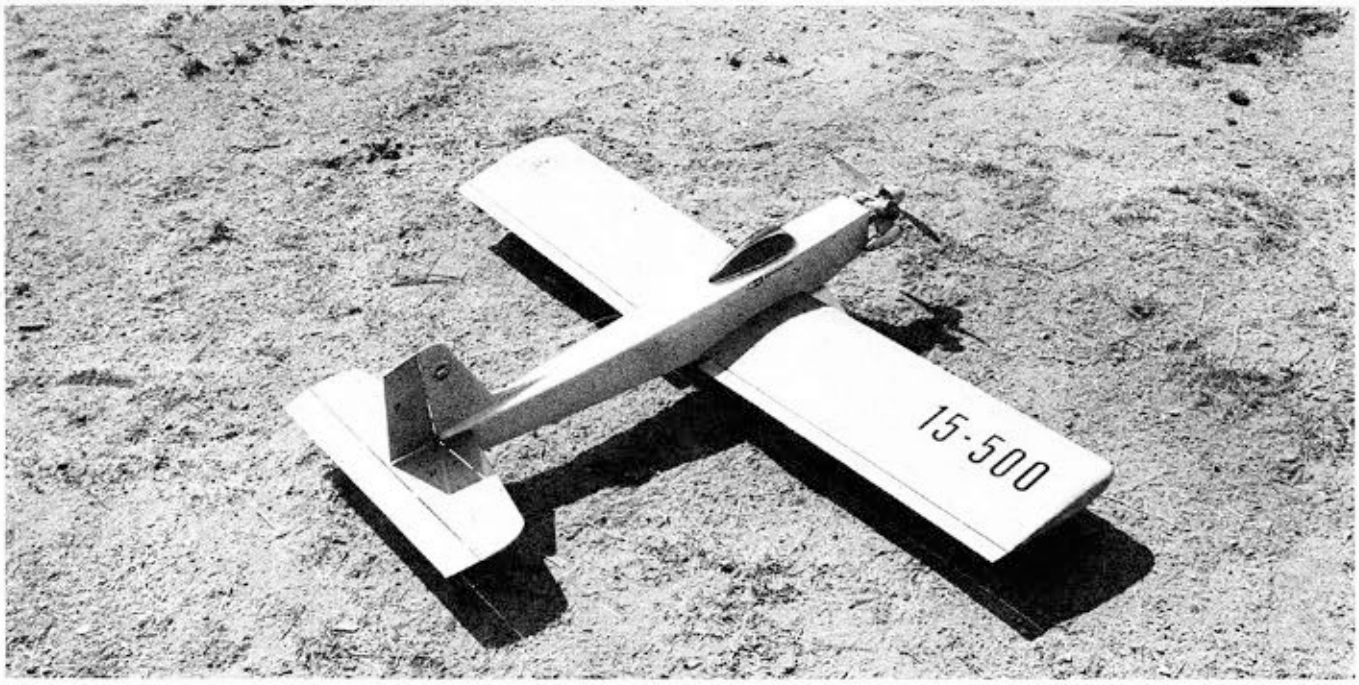
FULL SIZE PLANS AVAILABLE — PAGE 118





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into the previously finished portion over the stabilizer. Remove the temporary "X" bracing from the wing cutout and finish sand the whole assembly. Locate the wing in the saddle and drill and tap for the hold down bolts. The assembly can now be finished as desired and the vertical fin permanently affixed. Fuel-proof all exposed edges then install the rudder and elevators.

The landing gear is cut from .064" or .071" 6061 T6 aluminum or equivalent and bent to the shape shown. Axles used on the prototypes were Williams Bros., which were shortened to fit the Kraft-Hayes 2¼" streamlined wheels.

About all that's left now is to install your favorite radio and power plant and have a go at it.

I won't make any claims for zero-trim flying "off-the-board" since this is all a matter of the individual's care in building, the weight of the materials used, and a whole host of other factors. Suffice to say that the prototype is clean, honest, and fast. With a small (.19 – .35) light engine it is a real pussy cat to fly and could well be used as an interim trainer. It will do the complete AMA and FAI pattern.

See you at the races or just out for some fine Sunday flying . . . . □

BILL OF MATERIALS

FUSELAGE

QUANTITY	SIZE	MATERIAL	PURPOSE
2	3/16" x 4" x 36"	Balsa	Sides
1	1/8" x 1/4" x 36"	Balsa	Stiffeners
1	3/16" x 3" x 36"	Balsa	Top
1	1/8" x 3" x 8"	Birch Ply	F3, F4
1	1/8" x 3" x 6"	Birch Ply	F1, F2
1	1/4" x 2" x 3"	Birch Ply	F5
2	3/8" x 1/2" x 1½"	Hardwood	Wing Nut Blocks.

WING

3	3/32" x 3" x 36"	Balsa	Wing Ribs
1	1/4" x 1½" x 9"	Balsa	Center Rib
4	1/16" x 3" x 36"	Balsa	Leading Edge Sheet and Fuselage Bottom
4	1/16" x 2" x 36"	Balsa	Trailing Edge and Center Section Sheeting
1	1" x 1½" x 18"	Balsa	Wing Tips
4	1/4" x 1/4" x 36"	Balsa	Spars
2	3/32" x 3/8" x 36"	Balsa	Sub-Leading Edge
2	3/16" x 1/2" x 36"	Balsa	Leading Edge
7	1/16" x 3/16" x 36"	Balsa	Cap Strips and Trailing Edge
2	1/4" x 1" x 36"	Balsa	Trailing Edge Stock for Ailerons and Firewall Gussets
1	1/4" dia. x 3"	Birch Dowel	Wing Hold-Down
1	1/16" x 1" x 4"	Birch Ply	Doubler for Wing Bolts

EMPENNAGE

1		1/4" x 4" x 18"	Balsa	Stabilizer
1		1/4" x 2" x 18"	Balsa	Elevator
1	OR	3/16" x 3" x 18"	Balsa	Fin and Rudder
1		3/16" x 4" x 12"		

MISCELLANEOUS

2 Yards Covering Material
1 Strip Aileron Set
1 Set of 2¾" Wheels
1 Motor Mount
1 Fuel Tank (80Z Kraft-Hayes Fits Beautifully)
1 1" Tail Wheel
1 Tail Wheel Bracket
1/16th Music Wire
2 1/16th Wheel Collars
2 5/32" Wheel Collars
12 Hinges
4 1/4-20 Nylon Bolts
2 Control Horns
1 .071 x 1½" x 15 6061 T6 Aluminum (or equivalent) for Landing Gear
1 Pair 5/32" dia. Axles
Pushrod Material and Clevises
Fiberglass and Resin
Short Length (1-1½") of Inner NyRod