



RCM X-Pert prototypes No. 4 and No. 5. One of the author's X-Pert's rests alongside Marshall Robilio's blue and white version. S.T. .46 in latter makes it a good open pylon contender! Ektachrome by H. L. Stroup.

# THE RCM X-PERT

THE THIRD AND FINAL CONSTRUCTION PHASE OF THE RCM FLIGHT TRAINING COURSE PRESENTS THE LOGICAL CONCLUSION TO THE SERIES . . . THE COMPETITION AIRCRAFT.

BY H. L. STROUP

Wanna' put your tank in a tiger? This is it! Yet, with a mild .35 engine it becomes a very well behaved "pussycat" performing class A and B maneuvers easily and smoothly. For the brute power maneuvers in the Class C pattern it needs a .40.

The RCM X-PERT was developed for two specific reasons:

1. For those who have followed the RCM Flight Training Program, from the Basic Trainer through the Advanced Trainer, the X-PERT is the next natural step to a truly high performance but easily handled aircraft. You may use the same wing, stab, and fin that you have on your Advanced Trainer.
2. It has long been my conviction that precision pattern aerobatics could be performed with a smaller aircraft than has been generally used. The new, miniature proportional systems help make this feasible, and the steadily rising costs of balsa and fuel make it highly desirable! I do not believe, however, that the "ultra" small designs recently appearing in several of the magazines are capable of performing smooth pattern maneuvers. They are rather "jumpy" or must get their "grooviness" from excessive speed because of the low Reynolds numbers involved. The RCM X-PERT with over 500 square inches seems about as small as we can get and still expect smooth responsiveness.

The .40 powered X-PERT is capable of performing FAI and Class C maneuvers with smoothness and precision. It will snap roll or spin in either direction but has no snap rolling tendencies at the bottom of outside loops or if slowed up too much in a landing approach. In fact, if the weight is kept at 4½ pounds or less it can be "dragged in" for slow nose high, main gear landings. The blunt airfoil very effectively slows it down when the power is reduced as well as helping to reduce excessive speed build-up in "nose down" maneuvers.

The X-PERT is tolerant of CG location. It has been flown with a CG location variation of 25% to nearly 50% of chord requiring elevator trim adjustment only. It is NOT however, tolerant of errors in decalage! Prototype No. 1 was flown with 3 degrees positive wing incidence and the ailerons were virtually "blanked out." So, make very, VERY sure the wing and stab are at 0 - 0 degrees.

Inverted flying upwind is nearly "hands off," the rolls are axial, and it is soft on elevator when properly trimmed.

In short, we have found no bad habits with the X-PERT. Maneuvers may be performed slowly, close in, and low, but it has plenty of power to pull straight up for vertical maneuvers. I must insert a word of caution at this point... **It is not a beginner's airplane!** The RCM Basic Trainer and Advanced Trainer are for the beginner. The X-PERT is not hard to fly, nor is it temperamental, but it is a fully aerobatic and highly responsive aircraft.

The fuselage inside diameter is 3 inches so that the older style servos may be mounted crosswise. The battery/tank compartment will accommodate up to a 10 ounce tank but there is not enough space for the older style 7 cell battery packs. The nose block could be hollowed out and/or a lower balsa block could be added to look like an air scoop to fit in one of the larger battery packs.

The fuselage was designed around equipment installation with the lowest drag exterior configuration I could devise. When you think about it, a fuselage has no real aerodynamic purpose. It does have two very practical functions:

1. To hold the wing, tail sections, and power source at correct relative angles and distances.
2. To provide a "housing" for the radio and tank.

The fuselage was not made "deep" in order to execute the knife edge maneuver. Since a Class C ship is expected to execute a total of 30 maneuvers, designing a fuselage configuration suited to one maneuver at the expense of several others doesn't seem practical. Successful designs are the best possible set of compromises.

If you have looked at the plans you probably noticed 1/4 inch fuselage sides. Before you decide I have lost my mind, let me explain: A .60 powered, 6½ pound model called the Cotton Picker was built this way nearly two years ago. It was never crashed but suffered two severe ground collisions (with other planes, not the ground). The sides did not split and have shown no signs of weakening - so it IS strong enough. X-PERT No. 1 was built with 3/32" inch sides, doublers forward and braces aft. Total unpainted weight with the stab was 14½ ounces. The second prototype was built in the way

shown and, in the same stage of completion, weighted 10½ OUNCES - so, it IS light. The thick sides also provide a wider wing and stab saddle and allow for more extreme contouring of the top and sides. There are NO doublers used at any point in the entire aircraft. This saves time and weight.

The large horizontal and vertical stabilizers used on the Basic Trainer are used on the X-PERT. As a matter of fact, they are identical.

The original, 15% airfoil has a rather blunt leading edge and reaches maximum camber further forward than most airfoils for two reasons:

1. It is easier to contact cement plywood veneer, balsa, or "tag board" skins around a blunt leading edge.
2. To slow the plane down when throttled back.

Various amounts of dihedral were tried from 2 degrees to 8 degrees, total. Conclusion: No advantage was found with the larger amount of dihedral. There is just enough used to prevent the wings from appearing to have negative dihedral. Aileron effectiveness, knife edge, point rolls, slow rolls, in fact, MOST maneuvers were easier with the reduced dihedral.

Three types of wing tips were used with total spans of 52 inches and 54 inches:

1. Cut off straight tips, no blocks
2. 1 inch rounded tip blocks
3. "Citron-type" spade tips.

Since there was no discernible difference in performance I used the 1 inch rounded tip blocks with a wing span of 54 inches. The soft balsa does absorb shock when a tip gets a little low on a landing. (We call this a 3 point landing, one wheel, one wing tip, and one prop blade.) All six of the X-PERTS built so far have had foam wings. I can't personally see too much advantage in the "built up" balsa type except for a very slight saving in weight. As the size of the wing increases, the weight savings probably becomes more pronounced. Arrangements have been made with Warner Industries to have the RCM X-PERT wing core available by the time this article is in print.

#### Construction Notes

As with the RCM Basic Trainer the X-PERT has no curved lines except for the nose section. After assembly the top and sides may be extremely rounded, but nearly all parts are cut with a straight edge. I believe this technique provides for easier and

more accurate construction. To speed up assembly, all parts can be cut out in advance, ready for "kit" type assembly. Devcon 5 minute epoxy can be used for maximum speed and strength.

### Fuselage

Cut the sides from 1/4" x 4" x 48" sheet to the OUTSIDE shape shown on the plans. Since this sheet is rather thick, make sure the cut is at exact right angles to the flat sides. A band saw or bench mounted Stanley variable speed sabre saw will do this job better than a blade. Pin the two sides together and make sure they are identical. Bore the holes for the wing hold-down dowels through BOTH sides while pinned together. Use a thin line ball point pen to mark the exact locations of F-1, F-2, and F-3 on both sides. Cut out the firewall, F-1 and the two bulkheads, F-2 and F-3. Pin one fuselage side to a flat surface and glue F-2 and F-3 in place at right angles to the side. Allow to dry thoroughly.

Cut the fuselage top from 3/8" sheet. Again, it is more accurate to use a band saw than a blade. Since the top block tends to "line up" the entire fuselage it is a good idea to draw a center line before cutting, then measure to opposite sides to make sure they are equi-distant. Cut the fuselage bottom from 1/8" sheet and match to the top where they are opposite each other. (From trailing edge of wing to leading edge of stab.)

Glue the other fuselage side to the two bulkheads. Make sure both sides "line up" accurately – one no higher on the bulkheads than the other.

Cut out and glue the 3/8" triangular longerons to the top block making sure the sides of both line up.

Glue the 3/16" longerons and 1/4" square cross braces to the bottom.

Insert the assembled top block BETWEEN the fuselage sides and make sure it fits. The top of the top block should be flush with the top of the fuselage sides from the stab leading edge cut out to a point just ahead of F-2. The top is later contoured to a rounded shape and lowered to the sides forward of F-2.

The following step is the only really hard part of building the whole model. Glue the top block in place using glue on each side from F-2 to F-3 ONLY. Clamp securely until dry. (The 1/4 inch stock resists bending.) Apply glue on both sides from F-3 to the end of the top block and firmly bend both sides against the top block. Hold firmly with pins and rubber bands. In

order to prevent side distortion the bottom should be glued in place before the top is dry. The forward section may now be drawn together and glued. I recommend epoxy for the firewall. Before the nose bottom is assembled and installed, coat the inside of the tank/battery compartment with epoxy and install blind nuts for the Tatone mount. Coat the inside of the nose bottom assembly with epoxy and glue in place. Glue in the 1/8" tail piece and the 3/4" tail block in place. Wipe the sweat from your brow, take a deep breath, and let the whole mess dry for about 24 hours.

Do not "round" the fuselage until the tail surfaces are mounted. The flat fuselage top makes an excellent reference point for accurate installation of the stab and fin.

### Wing

If you are using the wing from your advanced Trainer, take off the ailerons, reverse them, fill in the aileron hole in the bottom, install landing gear mounts and cut a new aileron hole in the top of the wing.

The foam wing is easy to cut if you have your own equipment for it. Cut 1/4" slots the full length of the core for the 1/4" square spars both top and bottom. These can best be cut with an X-Acto razor saw (small) with two or three layers of masking tape wrapped lengthwise around the blade to limit depth of cut to 1/4". Chip out foam with X-Acto knife, then rout out spar slot with a 3/16" square strip. This undersized strip will allow a tight fit of

the 1/4" spar when it is installed. Fit these spars in rather tight and use either epoxy or Titebond. White glue will sometimes form a "puddle" somewhere in the foam which will become trapped moisture after the wing skins are applied. Cement the 1/4" trailing edge in place to provide a good hinge base. Contact cement balsa or tag board (bristol board, poster board, cardboard?) on each wing half before they are joined. Autocon Marvelite is excellent for covering foam wings. We do not use a dihedral brace. Epoxy the two wing halves together (after sanding for correct dihedral). After the epoxy has dried, wrap the entire center section with a 4 inch wide piece of glass cloth impregnated and coated with epoxy. (Don't use resin.) Cut the tip blocks to shape and glue in place.

The ailerons are 1/4" x 1" trailing edge stock with the leading edge rounded. . . or, you may use the aileron stock available from Top Flite. I do NOT recommend flat, 1/4" stock without a tapered trailing edge for ailerons because the plane becomes too "jumpy" around neutral. The squared aileron corners move too quickly into the airstream and it becomes difficult to make small attitude corrections smoothly. A DuBro strip aileron assembly is used for the aileron linkages.

Top Flite hardwood landing gear blocks are used with one inch sawed off and epoxied above the "hole" end. Cut through the skin and into the foam to conform to the gear block

*(continued on page 85)*

**Herm Stroup with one of the many RCM X-Pert prototypes. Kraft Gold Medal radio.**



*(continued from page 31)*

placement and shape. Gouge out the foam to the correct depth. Use plenty of epoxy in the cavity and you will have a very secure gear mounting. Bend the 5/32" main gear wire to the dimensions shown on the plan.

After sanding the center section and the tip blocks the wing is ready for painting, installation of ailerons, and main gear wire. Use your favorite hinges but make sure there is no binding. We used Tatone hinges on the latest prototype and they were excellent, requiring no pinning. In fact, ALL SURFACES should be checked to make sure there is no unnecessary load placed on the servos.

#### **Tail Surfaces**

The stab may be constructed of

solid 1/4" stock but the "built up" version is easy and probably lighter. Make sure the top and bottom stab skins match, glue framing to the bottom side mounted on a flat surface, then glue top side, weight, and let dry. If you draw an accurate center line on the stab it will be easy to "line up" with the center line drawn on the top of the fuselage. The leading edge of the stab may be rounded after installation. The stab tips are drawn straight but the 1/8" x 1/2" bracing stock will allow rounding for a more pleasing appearance.

The fin and 3/16" fillets may be glued to the stab and top block on the center line already drawn.

After the tail surfaces have completely dried you may carve and sand the corners of the fuselage to an extremely rounded shape. This carving will also save about two ounces.

Finish the fuselage using the techniques described in the RCM Training Program. I prefer to install all my control surfaces before the LAST coat of color is applied.

#### **Equipment Installation**

The RCM Training Program covered this subject thoroughly but I will include just a few notes for this particular plane.

The Tatone combination engine mount and nose gear is so convenient that I wouldn't think of using anything else. If mounted with the thrust line shown on the plans the tank position will be right for positive fuel draw. You may drill two holes through the Tatone backplate and through the firewall for the fuel feed and vent tubes.

The radio gear should be mounted as close to the fuselage top as possible and you will probably have to bury your aileron servo in the wing for sufficient clearance. Everything WILL fit but there is no EXTRA space.

Aileron movement should be 5/16" up and 5/16" down. Elevator travel varies according to weight and CG but should be adjusted so there is just enough for positive spin entry. Rudder movement . . . "sock it to 'em baby," to get over the tops of the double stall turn, point rolls, knife edge, etc.

After installing everything, make sure you follow the Training Program article on proper alignment and trim, then it WILL fly "right off the board."

Best of luck and I hope you become truly expert with your RCM X-PERT.