LEAD PHOTO BY BILL NORTHROP, ALL OTHERS BY BILL BENNETT

Australian Jeff Tracy and his CAP 20L in the ready box on first day of the Las Vegas Tournament of Champions, 1978. Model was one of largest entered, second only to Prettner's winning Dalotel. Quadra powered original. Reduction-drive units can also do the job.

CAP 20L

By JEFF TRACY and GARRY REUSCH

This large scale model offers a rare combination of beauty, aerobatic ability, and flight realism. For 1.5 to 2.4 engines or reduction units.

• *"The rules of the recent Tournament of Champions required the competitors to fly a large stand-off scale airplane. Most of the models were outstanding, but the one that attracted me the most was Jeff Tracy's CAP 20. It was not only a beautiful model, but the size and flight characteristics were perfect for the new contest format.*

"After a close look at the model and seeing how well it flew, I decided that there must be some way for a Las Vegas slicker like myself to con a Kangaroo rancher like Jeff into donating his airplane to the cause . . . me! My approach was uncomplicated; I simply kept telling Jeff how great the airplane was and how much I would like to have one. This much admiration plus several cases of Michelob was just too much for Jeff, and, being the good friend that he is, he finally gave in with the statement, 'Okay, mate, after the contest it's all yours.' After that, each time he flew the plane, I crossed my fingers and prayed a lot . . . especially when he was doing a rolling circle.

"I have been flying the model for the last four months and I can honestly say that I have never owned an airplane that I enjoyed as much as I do the CAP 20. It will do everything that a pattern airplane can do, and does it at a much slower speed and in half the airspace. It does beautiful snaps at a speed that makes it easy to stop with the wings level and the airplane still on heading. Several top American fliers, namely Joe Bridi, Don Lowe, and Don Weitz, have flown the CAP 20 and all of them loved the plane and felt very comfortable flying it. It is very rare to find a taildragger model that is so easy to fly that everyone who has flown it, including myself, has had no problems with takeoffs and landings. In fact, with the help of a gentle breeze, it lands so slowly that it almost seems to hover with absolutely no tendency to tip stall. What more can I say? It's a great airplane . . . do yourself a favor . . . build one!" William G. Bennett.

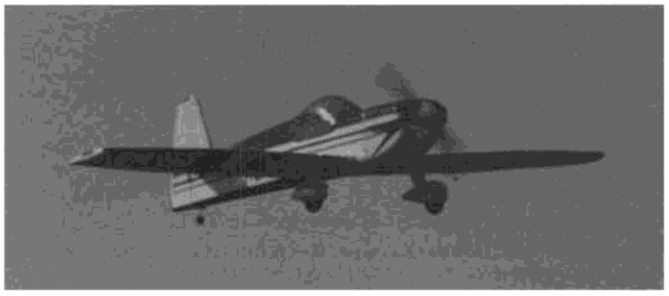
Not a bad buy for two cases of Michelob! New owner of Jeff's T.O.C. CAP 20L, Bill Bennett (left) during an informal flying session at the North Las Vegas field, several months later.

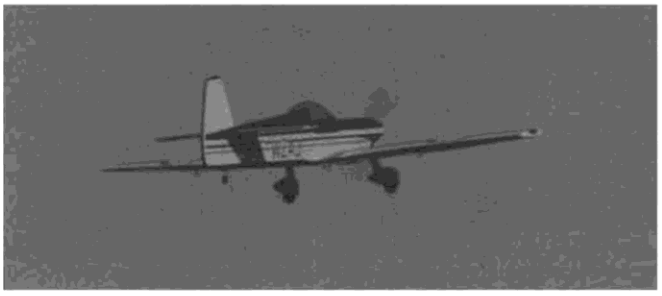
FOREWORD BY JEFF TRACY

This model of the CAP 20L was designed specifically for the 1978 Tournament of Champions held in Las Vegas, Nevada, and has resulted in a truly outstanding aircraft. No credit is taken for the overall design, as it is basically true to scale . . . the only deviations are in the wing section and a minor change to the fuselage width. The project was started with the idea of achieving a model that would be highly aerobatic and perform in a realistic manner with a low flight speed, a la the full-size prototype. To this end, the size of about 1220 sq. in. was arrived at and the Quadra engine chosen as power.

The first prototype of the model followed scaling up of the 20:1 three-

Flight shot of the full-scale CAP 20L, reproduced from company brochure. Ship derives its shapely fuselage and distinctive wing planform from the French Emeraude lightplane. Jeff's model represents a 200-hp Lycoming powered version.





Jeff's CAP 20L in a fly-by at Las Vegas. Ship is an exceptionally smooth, stable flier, yet performs the snap maneuvers without difficulty. Sharp leading edge at outer end of wing panels, as detailed on plans, helps to stall the tips.

view plans we had acquired from the factory in France. This model was constructed entirely from foam, with the exception of the fin, rudder, and ailerons, which were built up. Due to our inexperience with this size of model and to our choice of covering material and the size of construction materials used, this first model weighed 21 pounds plus when completed. We were very disappointed with this result, but the aircraft did in fact fly, and performed well enough to indicate we were on the right path, even if the model was basically unsatisfactory as designed.

The real problem was how to cut 5 or 6 pounds off the weight of the aircraft and still maintain the required strength in the airframe to withstand the flying loads required. The problems were overcome by going to a fiberglass fuselage and redesigning the construction of the wing. These methods are clearly shown in the plans. Flight tests of the two models using the glass fuselage indicated that we really did have an outstanding aircraft. Although a change of pace for a long-time pattern flier, this aircraft is indeed capable of performing *all* the maneuvers in a very realistic manner and has proven to be a real joy to fly.

We intend to build at least two more and will experiment with different powerplants and prop sizes to see if we can further enhance the already good performance (incidentally, we found the best prop for the Quadra and this aircraft to be a Zinger 18x8).

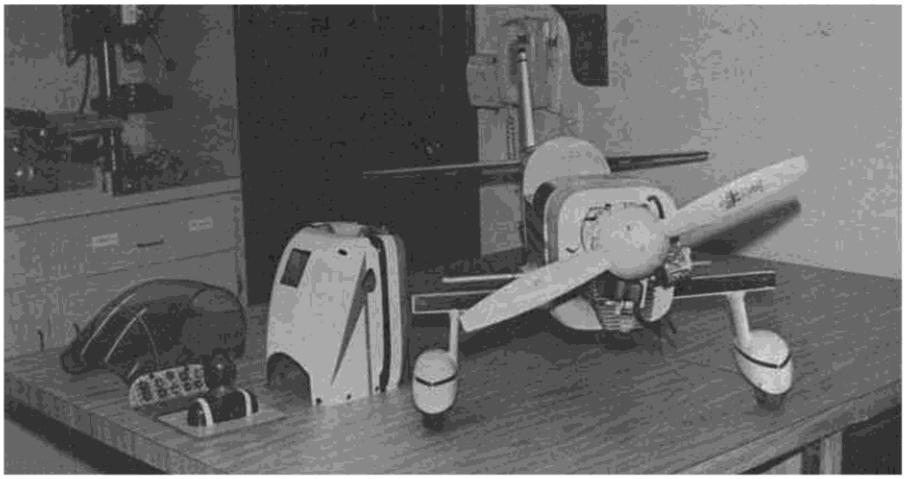
The glass parts and the full kit should be available from Bridi Hobby Enterprises by the time you read this.

This project has been a most rewarding one, and we are proud to be able to share it with you. Please let us know if you have any questions or problems with this model by writing to Jeff Tracy, P.O. Box 911, Shepparton, Victoria, Australia 3630.

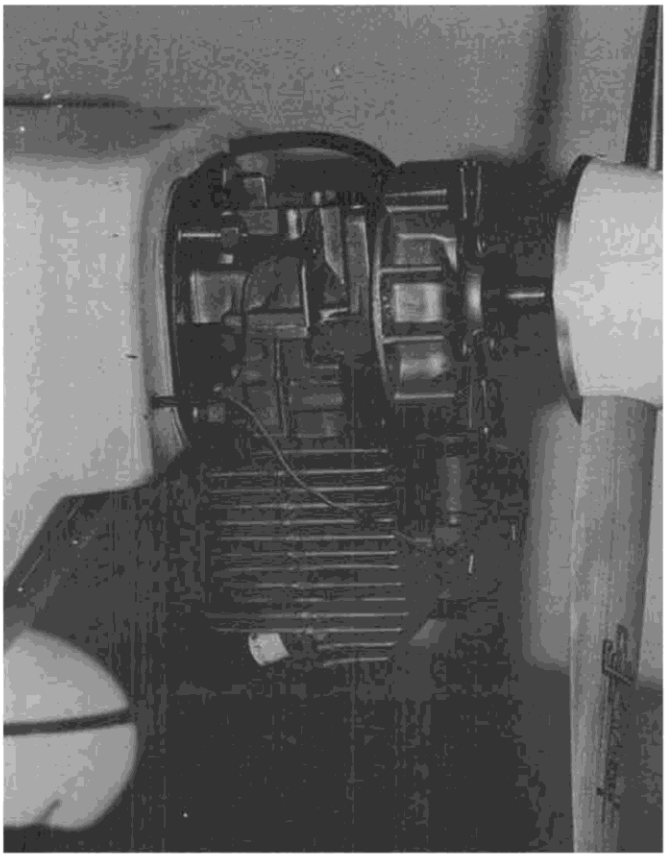
FULL SCALE NOTES

C.A.A.R.P. (Cooperative des Ateliers Aeronautiques de la Region Parisienne) took over production of the Scintex-Aviation Super Emeraude in 1965, which helps explain the similarity of the CAP 20 to the pleasing lines of that French light aircraft. Prior to the CAP 20, the company built a prototype C.P. 100 side-by-side, two-seat aerobatic version of the Emeraude.

The CAP 20 (CAP might be the 1st, 3rd, and last letters of the full C.A.A.R.P. name) series began with a single-seat version of the CAP 10, first flown in 1969. The CAP-20L ("leger", or "light") is a lightweight version of the CAP-20, totaling 1322 pounds at takeoff. The span is 24 ft., 4-1/2 in., and a maximum cruising speed of 168 mph is available with the 200-hp Lycoming. The latter version is the scale subject chosen by co-designers Garry Reusch and Jeff Tracy to meet the requirements of the 1978 Las



The combination wing beam and landing gear mount takes all flight and landing loads. It's eight laminations of 1/8 spruce laid up with epoxy. Canopy is molded plexiglass.



Quadra mounted correctly . . solid! So-called shock-mounting allows it to move, causing vibration. Minor engine mods explained in text.

Best results have been with Zinger 18 x 8 prop. Note aft aluminum tube wing dowel, for assuring proper wing alignment.

Vegas Tournament of Champions.

GENERAL BUILDING NOTES

The tendency in quarter scale and larger model airplanes is to overbuild. Unfortunately, this produces overweight airplanes with marginal performance. Every effort has been made to produce a lightweight yet sturdy airframe.

Selection of balsa is very important. Excessive glue and finishing materials add greatly to the weight and compound balance problems.

Accuracy is very important. The foam "gloves" (the blocks that are left over when cutting out a foam core) are used when sheeting the surfaces and therefore must be as accurate as the cores themselves. Skinning of the foam surfaces is done with a thin epoxy adhesive rather than conventional water or latex-based contact cements. Besides being lighter, the epoxy is stronger and more stable. To prevent excessive epoxy from seeping into the cores, coat all foam surfaces with shellac just prior to covering.

WING

For transport reasons, the wing consists of 3 separate pieces: left panel, right panel, and center section.

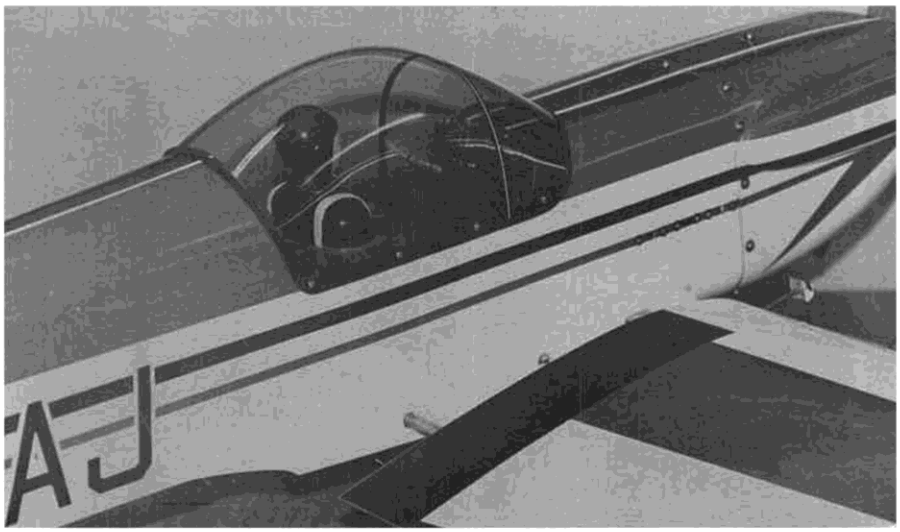
Two separate cores are required per wing panel. The elliptical planform is formed by the ailerons and the curved leading edge. The combination of a straight-tapered outboard panel and an elliptical leading edge when shaped, automatically create a perfect sharp-nosed snap strip on the outboard third of the wing. The center section and inboard wing panels are of constant chord and section, having a rounded leading edge profile throughout.

Before proceeding further, the wing beam and its U-boxes must be constructed. The beam acts as both landing gear and wing mount. As such, it is designed to withstand flight and landing loads. The beam is fabricated by laminating 8 sheets of 1/8 spruce with a slow-curing epoxy glue. Machine to dimensions on plan view.

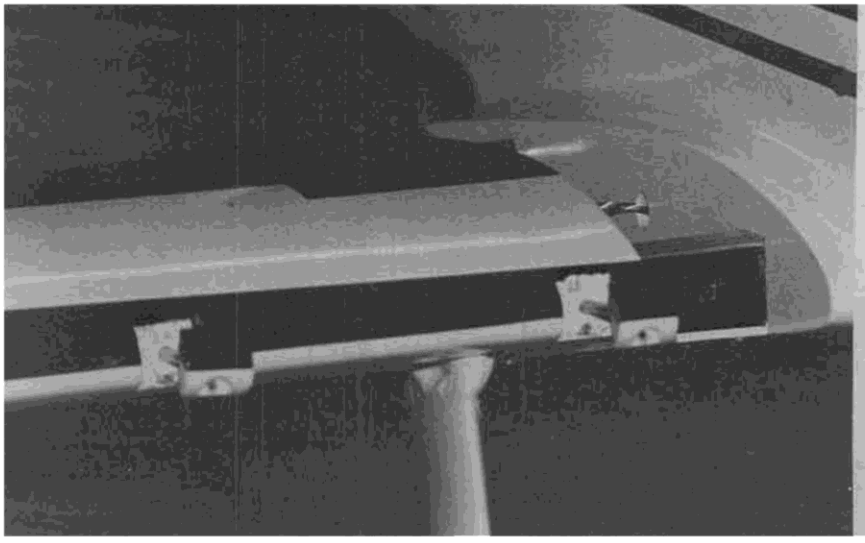
The next step is to build the beam U-boxes. These are designed to telescope onto the beam, encasing it very snugly around the top and sides. The sides and tops of the U-boxes are built of 1/8 spruce and inner faces lined with 1/16 ply.

Cut all 5 foam wing cores per templates and plan view. Butt join the inboard and outboard wing panel cores. Remove foam from inboard core and install the 3/16-inch full-depth balsa false trailing edge. Epoxy 1/16 ply W-2 in position. Add 1/16 balsa wingtip plates and 1/8 balsa aileron root plates. Epoxy 1/16 full-depth ply plates in position for pin tubes near roots of wing panels.

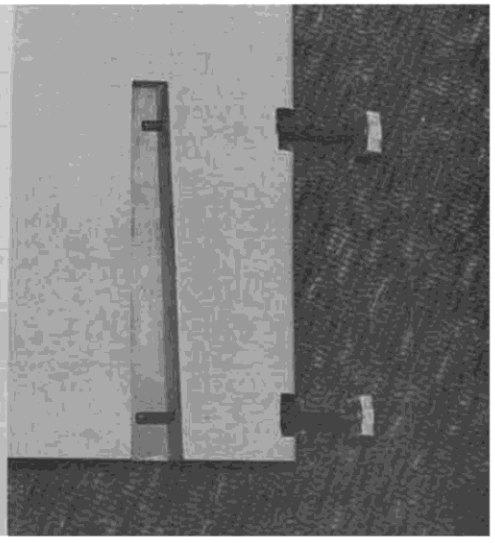
Place the wing panels in their top gloves on a hinged board set at 3-1/2° total anhedral. Space the panels 8-1/8 inches apart on chordline to allow for the center section and two W-1's. Slip



Canopy and cowl are held in place with sheet metal screws through grommetted holes. Canopy and cockpit "floor" remove for access to radio compartment.



Locking pins slide through holes in wing beam to keep everything together when assembled. Finish is acrylic laquer over dope/tissue.

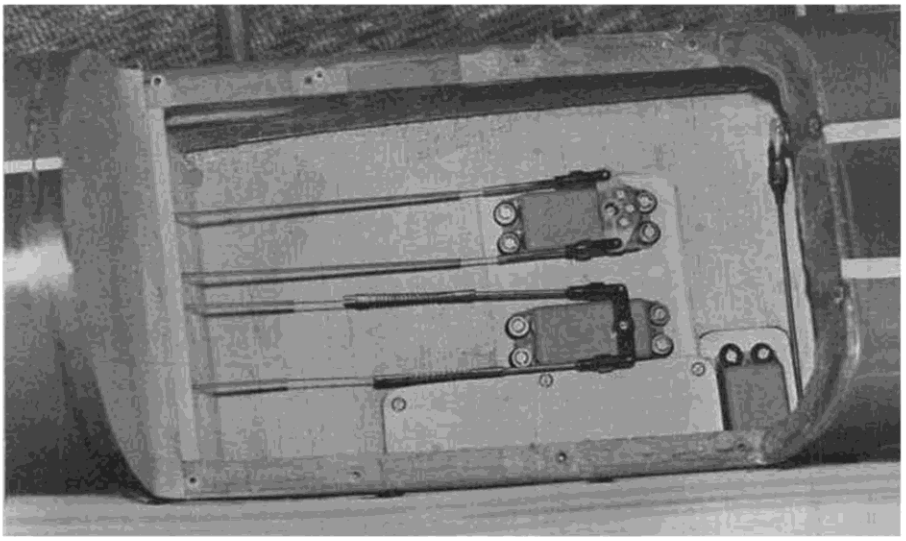


U-shaped box in bottom of wing panel fits over wing beam. Locking pins go through the whole thing to keep it together.

the U-boxes over the beam and carefully cut out foam to house the boxes in the wing, using W-2 as a guide chordwise, making sure to keep wing panels in alignment with each other in all aspects. using a slow-cure epoxy, install the wing U-boxes with the beam still in place for alignment. Trim off sections of the U-box which are protruding below the camber of the wing. Top and bottom spruce spars and spruce fill around the box are recessed into the foam.

Again, fit the beam into the wing panels and replace wing on anhedral board. Using a long drill bit of the same outside diameter as the 1/8-inch I.D. aluminum and brass wing pin tubes, drill through the 1/16 ply front tube bearer, U-box, beam, and rear tube bearer. Aim to pass through the beam slightly above the center of the beam's leading edge. Slip the aluminum tube into the hole before continuing. Repeat procedure for next hole and other wing panel. Remove the aluminum tubes and beam after drilling all holes. Epoxy the full-length aluminum tubes in the wing panels. After curing, remove the portion of the tube crossing the U-box. The beam holes themselves are bushed with 1/8-inch I.D. brass tubing.

Make up the wing pins of 1/8-inch diameter music wire per plan and check fit. They should be very snug.



Remember when radios were big enough to *need* all this space? Note weight saving control cables to tail surfaces, in place of usual push rods.

Aileron servo bays must be cut into the bottoms of the wing panels. Line the bays with 1/16 balsa and use 1/8 ply rails to mount the servo tray. Inset hardwood blocks for rear wing tube on bottoms of both panels. Sand cores in preparation for sheeting.

Make a rear view template of the false trailing edge of the wing where it forms the aileron bay, marking definite top and bottom. Set this template aside for aileron jig construction.

Using the foam gloves, cover wing panels with full-length 1/16 balsa sheets.

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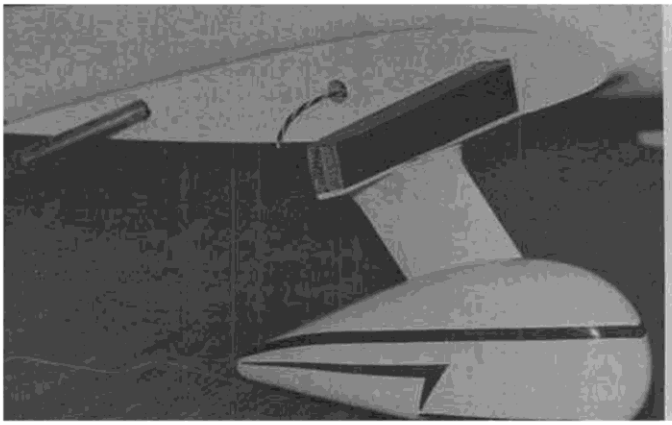
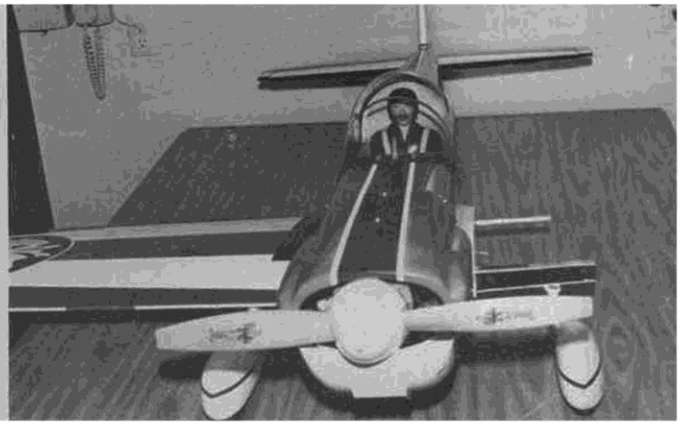


Sturdy laminated beam that takes most of flight and landing loads. Aileron connector protrudes from wing root.



Another view of partially assembled CAP 20L. Wing and horizontal stabilizer are sheet balsa epoxied over foam cores.

Add and shape 3/8-inch balsa leading edge and ply/balsa snap strip. Add the 1/4 x 1/2 balsa trailing edge.

Epoxy W-1 in position on the wing panels. The aileron servo lead slot is formed with a hot steel or aluminum tube melting the foam core.

Set up wing cores on anhedral board with beam and wing pins in position. Fit rear wing tubes into wing panels, using center section tube to align. Drill and tap for 4-40 machine screws through hardwood block, wing panel, and center section tubes.

The center section is next. Tack glue center section W-1 ribs to completed wing panel W-1 ribs. Cut the 1-3/4° dihedral angle on each side of the center section core. Make slot for rear aluminum joiner tube. Hot-wire cut behind full-depth spruce spar and fit this section of foam core neatly between wing panels. Glue full-depth 1/8 spruce to beam and core, checking for alignment. Add soft balsa fill and hardwood blocks above beam. Add foam leading edge ahead of beam and epoxy W-3 ply ribs in position.

Shape bottom of beam flush with foam core on center section and flush with 1/16 sheeting on wing panels. Cut slots for landing gear struts and drill a 7/32-inch hole in beam at the root. Recess the 1/8 ply landing gear strap mounts into the beam.

Remove beam and center section from wing and, using foam gloves, sheet with 1/16 balsa. Add balsa and spruce trailing edge and balsa leading edge. Make tank recess and line with 1/16 balsa.

Epoxy W-1 in place with wing assembled to ensure snug fit between center section and wing panels. Burn aileron servo lead slot. Make cutouts for 1/8 ply servo trays and compartment for receiver in upper surface of center section. Kraft KPS-15II servos were used throughout in the prototype models.

AILERONS

The ailerons are built in upper and lower halves on a simple jig.

Cut a top view profile of the aileron from a flat piece of 3/4-inch ply. Using the template obtained from the wing false trailing edge, make a 1/8 ply pattern. Mark a hingeline on the approximate chordline on both sides of the pattern. Using small nails, tack the 1/8 ply pattern to the leading edge of the aileron profile, lining the hingeline up on the top edge of the 3/4 ply with aileron root and tip matching.

Lay a sheet of wax paper over the jig. Pin the 1/4-inch balsa leading edge snugly against the 1/8 ply. Pin the curved 3/16 balsa trailing edge piece to rear of profile jig. Glue the 1/4-inch balsa tip rib to leading and trailing edges. On top halves only, 1/16 ply horn mounts extend from under the 1/8 balsa inboard rib to underneath the 1/4-inch balsa aileron root rib. Add 1/8 balsa ribs between.

Using a razor plane and sanding block, remove material protruding above top of 1/8 ply leading edge pattern and feather into nothing at the trailing edge. While still in the jig, sheet with 1/16 balsa. You now have one-half of an aileron.

Because of the semi-symmetrical wing section, the 1/8 ply leading edge pattern will have to be moved after each half aileron is built, as no two are the same. This is accomplished by removing the nails holding the 1/8 ply leading edge pattern, inverting the 3/4-inch profile, and retacking the pattern on the leading edge of the profile, this time exposing the bottom half of the leading edge pattern. This will form the bottom half of the aileron.

To build ailerons for the other wing panel, repeat the above process using the opposite side of the 1/8 ply leading edge pattern.

Prior to joining aileron halves, file slots for hinges on top and bottom halves. Bevel the leading edge. Fit control horns in upper halves with small screws. Slot lower halves to facilitate control horns.

Ailerons are now joined and temporarily hinged. Add hollowed balsa wingtip blocks. The spruce trailing edge is added to the wing and ailerons in one piece. Before cutting ailerons free, block sand entire wing including aileron to achieve a smooth, faired surface.

FIN

The fin is of built-up balsa "egg crate" construction, using formers F-4 and F-5 as end templates for shaping with a razor plane and sanding block. Sheet the framework with 1/16 balsa. Add leading edge of 1/4-inch balsa and 1/2-inch balsa tailpost. Shape leading edge and fin portion of tailpost.

STAB AND ELEVATORS

Cut foam cores per templates and plan view. Butt join cores at center section. Remove foam to glue in stab trailing edge and elevator leading edge. Add 1/16 balsa tip plates on stab and elevators. Fit balsa stab joiners. Using the foam gloves, sheet all surfaces with 1/16 balsa using one-piece full-span sheets. Add the 1/4-inch balsa trailing edge to elevators and add the 3/32 balsa root plates. Bevel the leading edge of elevators. Add block balsa tips and spruce trailing edges. Hinge surfaces and fit elevator drive assembly, relieving surfaces as required for free movement.

FUSELAGE

Install 1/2-inch ply firewall F-1 and all 1/8 ply cowl and canopy screw fastening plates with epoxy. Make up tailwheel assembly and install hardwood bearing block.

Fit cowl in position with tape and drill fastening holes. Remove cooling and access areas as shown on the plan view.

Mount Quadra engine inverted. It will be necessary to remove several head fins and the rear section of the crankshaft.

Fit canopy to fuselage. Drill fastening holes with a drill bit designed for use on plastics.

Remove outboard 1/4 inch of fiberglass wing fillets and clean out the inner flange with a file. The center section slips snugly through this opening and out the other side. Place wing panels on center section to align to fuselage from top and rear views. File fillets as required to obtain correct alignment. Tack glue center section to fuselage and remove wing panels. Turn fuselage on its side and glue center section to fuselage by letting epoxy pool into fillet inside fuselage. After curing, rotate fuselage and repeat on other side. It will be necessary to add microballoon filler to the exterior to return the wing fillet to its original shape.

The stab cutout is made in the fuselage and the elevator driver is placed in position with overlength cables attached. It will be necessary to slot the fuselage aft of the driver bearings to allow the stab to slip into its cutout. Replacing the wing panels, align the stab to wing and fuselage and check for correct incidence. Epoxy in place and fillet with microballoons.

File fin area flat on top and rear of fuselage. Epoxy fin in place using wing, stab, and fuselage centerline for alignment. Shape lower tailpost to match fuselage. Make a template of the tailpost trailing edge. Fillet base of fin with microballoons.

RUDDER

The rudder is constructed on the same type of jig as the ailerons. Because it is perfectly symmetrical, the jig only need be altered once. Use the tailpost template and side view of rudder for the jig.

After both halves are made, slot for hinges and 1/16 ply horn mounts. Bevel surfaces prior to joining. Join halves and add balsa tip and spruce trailing edge. Temporarily hinge rudder and block sand fin and rudder to achieve a smooth, faired surface. Remove rudder and glue horns in position.

EQUIPMENT INSTALLATION

Mount all servos on rubber grommets, and receiver and battery pack in foam rubber. Magneto shorting switch, airborne pack switch, and charging jack should also be mounted on grommets. Foam formers F-2 and F-3 are fitted and installed with silicon rubber. Fuel tank must be assembled with neoprene rubber tubing.

SPATS

Spats are added after the aircraft is assembled and all systems are installed. This is required to determine the position of the landing gear strut at rest. Epoxy the fiberglass spat to the strut. Add 1/4-inch balsa fairings on either side of the strut with silicon rubber. Fillet with microballoons.

FINISHING

All balsa surfaces are sealed with tissue and dope. Prime and spot-fill all balsa and fiberglass surfaces with an acrylic primer. Color coats are now applied using acrylic lacquer. This is a very lightweight method of finishing and is not affected by gasoline. •