Bingo 20!

By Dr. D.B. Mathews

Success breeds success. Proven popular in a variety of larger sizes, it now takes form in .20. Features interlocking light ply fuse construction.

So there are *Big Bingos* and .60 *Bingos* and *Bingo 40s,* so why on earth would anyone add yet another *Bingo* to the series? Simply because the things all seem to fly well, are so simple to build, look neat, and have earned the respect of thousands of builders and fliers all over the world. Besides, if anything works this well why not develop it in all sorts of sizes?

My interest in developing a .20 size *Bingo* was stimulated by observing George Sauer, a member of my flying group, fly a thin wing section *Quickee 500* design using an O.S. .20 four cycle. This neat model flies very well and is remarkably aerobatic using what most would consider inadequate power. This led me to wonder just exactly why we tend to think 350 square inch wing area when designing models for .20 to .30 engine sizes?

My development of the *Bingo 20* leads me to conclude that powerplants in this size range are vastly more powerful than commonly credited, and that many of the models designed just a few years ago for these engine sizes are now grossly overpowered. Surprising, isn't it?

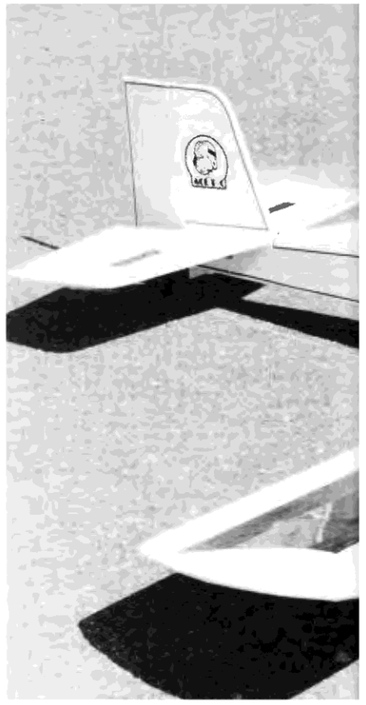
To spare you the effort of thumbing back to the flight report to find out if this *Bingo 20* is worth building, let's start right out with it now. These have to be the simplest tail draggers to take off ever. The *Bingo* series tend to come up on the mains as power is added until they just sort of take off by themselves. This is likely attributable to the landing gear placement.

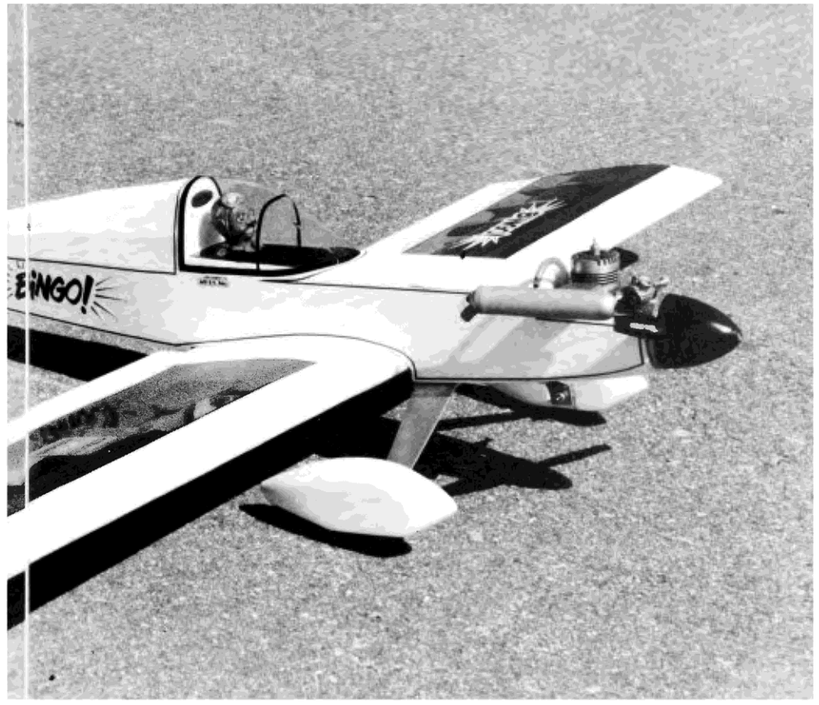
Aerobatics are clean, with absolutely no nasty traits. Snap rolls, upright or inverted, are just a matter of full everything with instant return to level after neutralizing the sticks. Spins, power on or off, inside or outside, are just like the snaps. Axial rolls are a bit slower than some of the thick sectioned hot rod designs, but comparable with most *Stik* types.

This roll rate makes for beautiful Cuban Eights. Inside and outside loops are almost identical which contribute to neat horizontal eights. Vertical eights are possible with careful speed management, but one must also be careful to slow down on the downhill legs as the *Bingo 20* is a very clean design and accelerates rapidly.

For something far out, try a "Wichita tumble". Start with a 1½ inside snap roll, then, at its apex, immediately jam in full down elevator. If the speed and timing are correct, the model will start tumbling horizontally. Sort of a horizontal Lomcevac, and lots of fun to watch.

Landing the *Bingo 20* requires a bit more skill than the earlier *4–20*. The latter has the landing gear located with the axles just behind the wing leading edge. For construction simplicity and to avoid placing the landing gear in the wing, I chose to move the axle line forward onto the fuselage, a technique commonly used on jumbo gas powered type sport models.





This requires that a slightly different landing approach technique be used. The model must be slowed down farther out in the pattern (it will fly remarkably slow without any tendency to snap, so don't worry) and setting it down on the wheels with less flare on touchdown. In other words make wheel landings!

The worst that will happen should you miss and end up in a three point attitude is an extra bounce or two. Lovely landings can be done if the speed is bled off farther out and minimum up elevator is used on touchdown.

I don't mean to imply the *Bingo 20* is at all difficult to land, rather I am trying to gently tell you the usual "bang the nose gear quickly" sloppy landings we all see won't work here. You will have to learn to actually land a model airplane.

The thing is flat dabbed gorgeous when it is wheel landed, rolls down the runway tail up, then slowly settles onto its tail wheel. A little practice will make the flier proud, as a matter of fact this whole project will make him proud!

So what we have here really, is a compact sized *Bingo* that builds and flies very much like its larger sisters. This seems to prove a simple to build, soundly designed model will fly well in darn near any size.

Now to the nuts and bolts

Though at first glance this design may look a bit flimsy, it actually is light and very strong. One must realize light ply and spruce are many times stronger than equivalent sizes of balsa. Under *no* circumstance should balsa be substituted for the hard woods in this design without *grossly increasing* their sizes!

Hardware items are standard and should be available at any well-stocked hobby shop. Personal preferences can certainly be substituted. Many of the specialized items such as the landing gear and pants, are available directly from ACE R/C, Box 511, Higginsville, MO 64037.

Read and study the text and drawings carefully to avoid any confusion. Cut out a kit of parts by transferring the shapes to the appropriate wood by placing carbon paper under the drawings and over the wood. Use of a good straight edge is mandatory. All holes and cut outs should be made at the time of the parts fabrication.

A simple jig saw (such as a Dremel, etc.) is helpful in building this or any other scratch project, a good knife will work, however. Cut outs can be made easily by drilling ¼-inch holes in the ply, threading the saw blade into the hole and re-attaching the blade. Tabs and slots can be cut using a sharp modeling knife.

This model is very easy to construct and keep in good alignment. Use a smooth flat building surface and follow sound principles of construction. A straight building job results in a straight flying model. The prototypes were constructed almost entirely with medium and thin cyanoacrylate adhesives.

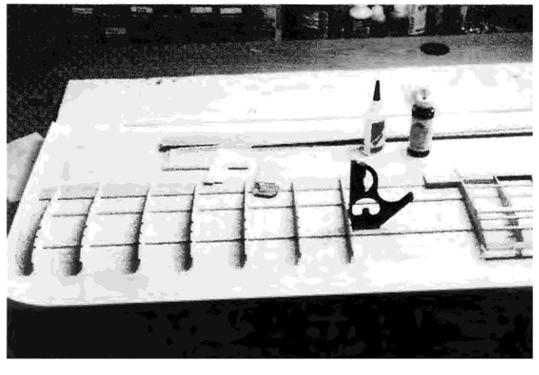
Wing

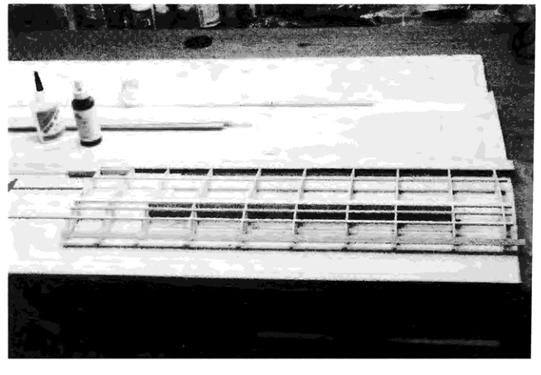
Since the wing will be needed early in the fuselage construction sequences, I prefer to build it first.

Stack cut the ribs using a master plywood or metal template as a guide. Notice that *two* rib patterns are needed. Carefully cut out each spar notch, as the spars must fit snugly for medium CyA to work properly. For improved adhesion on the spruce parts, sand the surfaces to remove residual oils that tend to come to the surface after milling.

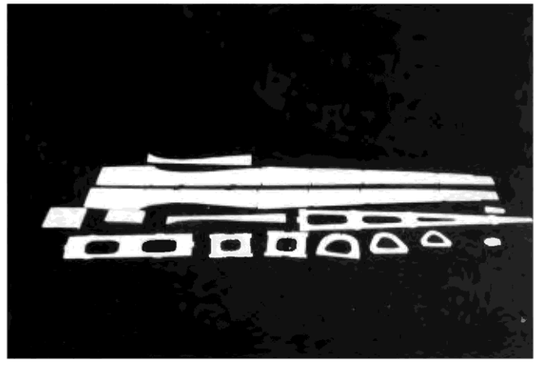
The wing panels are mirror images of one another and are built flat on the board from the front spar rearward. Obviously, the building surface must be perfectly flat as the wing will match any warps of the building board. Wing construction is from the bottom up. Pin the sheet trailing edge and center section sheet over the plans. Position the bottom spars and then the ribs. Use a small 90 degree triangle or a House of Balsa "Upright" to keep the ribs square. Fit the hardwood trailing edge filler and adhere it to the bottom center section trailing edge sheet.

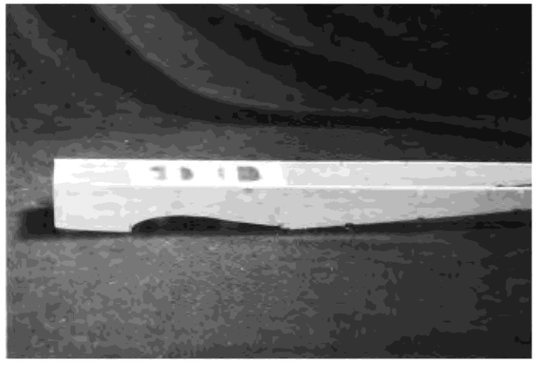
Add the top trailing edge sheeting and





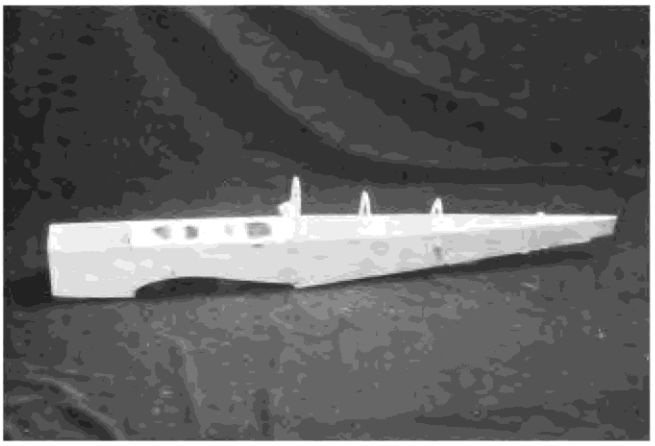
While gluing the ribs to the bottom spars and bottom trailing edge, use a square or triangle to keep the ribs perpendicular **(above left)**. Once the ribs are in place, start adding the top spars, leading edge and tope trailing edge sheet **(above right)**. Note the shear webbing and the filler blocks in the center trailing edge.

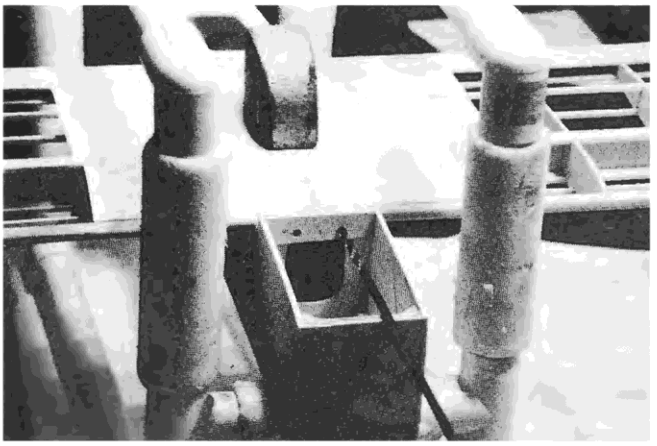




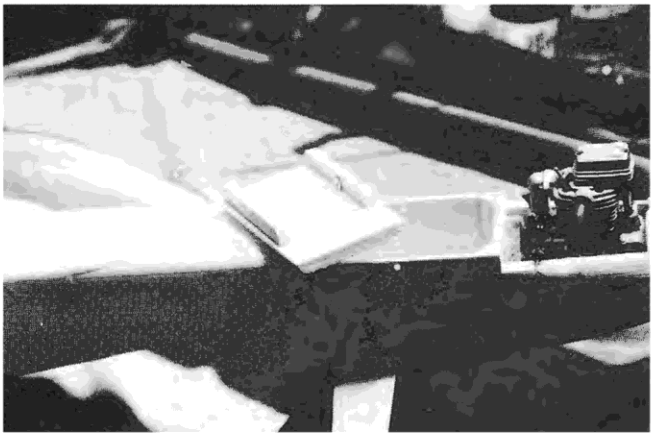
No doubt, there's extra effort in making the pieces for the interlocking tab fuselage **(above left)**, but the advantage is a much more easy to assemble structure that really doesn't require building over plans. Start the fuselage **(above right)** with the firewall, sides, and cockpit floor taped together be fore gluing.

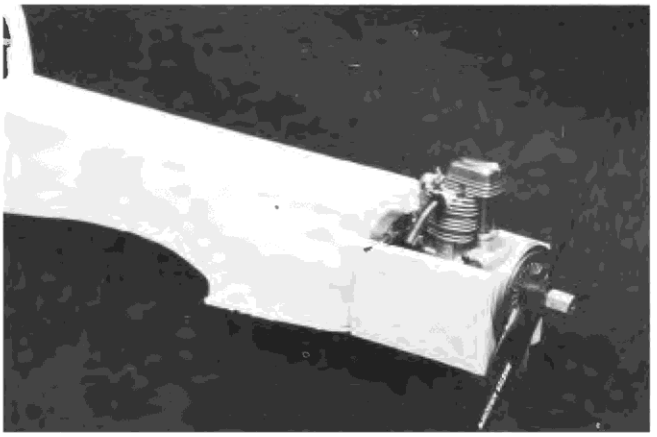
Bingo 20!





The rest of the fuselage formers and rear bottom piece are then added and taped **(above left)** be fore gluing. With the wing aligned to the fuselage, in its saddle **(above right)**, the holes are drilled for the 3/16 wing dowels, before the lite ply floor is added. A convenient way to secure the hatch and make access easy **(below left)**. Put in some rails and "T" nuts. With the engine in place **(below right)**, the cowl side and the spinner sheets are added, then shaped.





Ready to dress 'er up! At this point the canopy is only taped on. It will be glued on after the model is covered.

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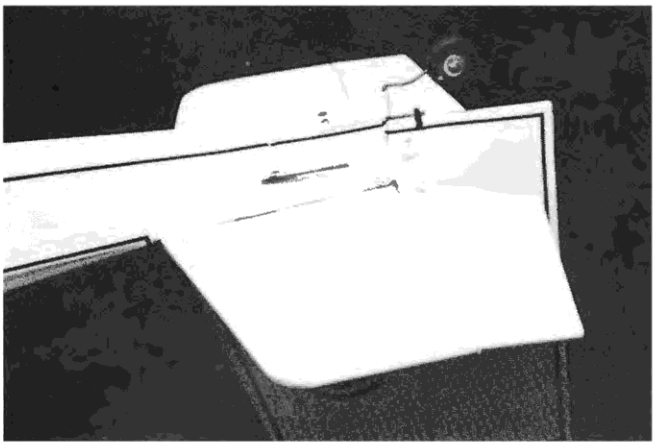
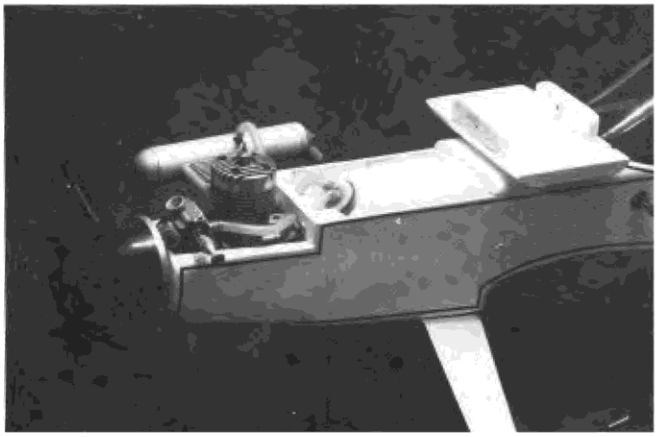
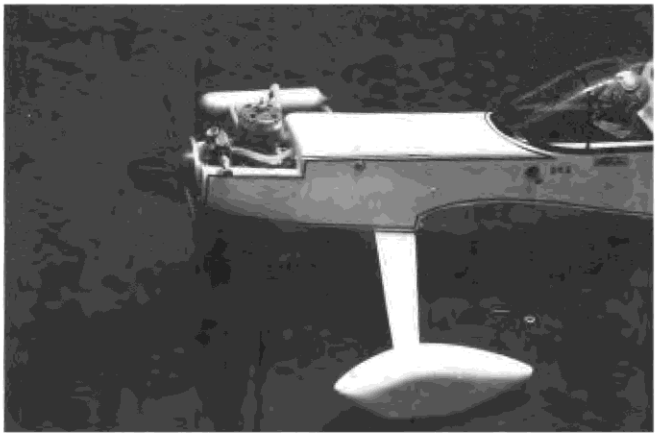


The author used an ACE nylon tail wheel bracket, and locked the tail wire tiller arm to the bottom of the rudder for ground steering **(above left)**. Note the hole in the cockpit headrest **(above right)**. It stabilizes the air in the cockpit and keeps it from deforming. The 6-ounce tank fits neatly in the forward compartment **(below left)**. The battery goes underneath it. ACE #35 wheel pants dress up the aluminum gear **(below right)**. The engine is a K&B .20 Sportster.





spars followed by the leading edge and turbulator spars. Center ribs are angled using the ply sheer webs. No dihedral braces are used. I have followed this technique for many years on hundreds of models and have yet to have a center section fail. In crash situations the wings always break off outboard of the glass and epoxy!

All that is required to create a solid and accurate dihedral joint in these designs is to block up the panels tip against a flat table edge, sand in the angle, and join the panels with five-minute epoxy. This is exactly the same technique used in building hand launched gliders. The center section is then wrapped with glass cloth and epoxy.

Using pre-notched basswood trunnion blocks (wing gear mounts as used on trike aircraft), make a left and a right aileron torque rod assembly. Make sure the nylon tube is on the wire before bending it! Roughen the outside of the nylon with coarse sandpaper.

Apply a small drop of warmed Vaseline (use your MonoKote heat gun and the jar lid) to spread between the wire and the inside of the tubing. This helps prevent any adhesive that might seep into the barrel of the nylon hinge from locking the wire into the tube.

Hold the assembly against the trailing edge cap with masking tape, flow thick CyA on the joint. When cured, carve away the excess basswood and sand to match the contour of the trailing edge cap.

The ailerons are beveled at the hinge line and only slightly rounded at the trailing edge. This configuration seems to help prevent any potential high speed flutter. The hinge gap lines should be kept to an absolute minimum or even taped closed after covering.

Fuselage

Make a right fuselage side by tracing over the plans with carbon paper onto a sheet of light ply. Mark the bulkhead and slot locations at this time. Cut out the side then use it as a pattern for the opposite side and for the needed doubler.

Note that the ply is referred to as ⅛-inch when in reality light ply is a true 3mm in thickness. This is slightly less than ⅛ inch. The slots should fit snugly, therefore allow for this slight variance when cutting the fuselage slots.

Similarly, trace and develop the other parts, then trial fit everything before final assembly. Cement the doublers, firewall triangular stock braces, and the landing gear block in place using epoxy.

Do not neglect the necessary holes and cut outs in these parts.

Without gluing, fit the fuselage sides, F-2, F-3, the firewall, and the cockpit floor into the appropriate slots in the sides. The whole unit is self aligning, but double check with a square. Adjust by moving the masking tape as needed. When satisfied, flow medium CyA along all the joints.

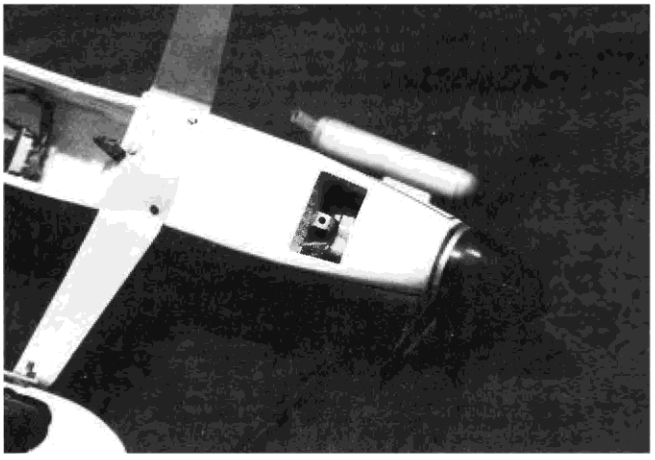
Fit the rear bottom section, and again adjust it as needed. Clamp the tail post together with clothes pins or clamps. Keep all edges aligned and square with masking tape. Repeat the gluing sequence. Add the turtle deck, formers, tail wheel mount, and spruce stringers.

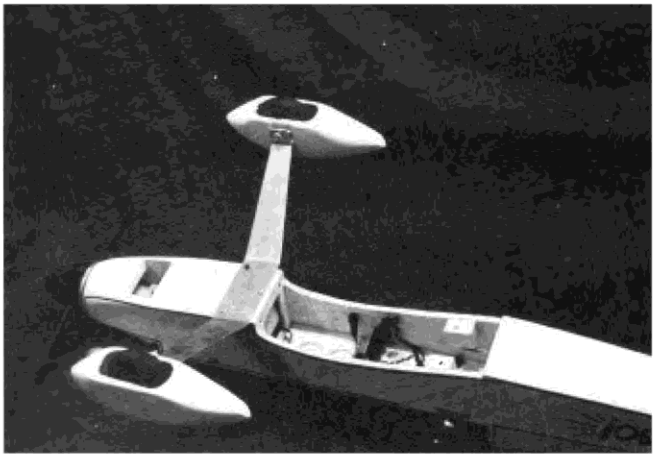
The firewall should have been previously drilled to place the engine thrust line as drawn. Install 4–40 blind nuts and bolts and drill the appropriate holes for the fuel lines and throttle pushrod. Do not install the front bottom sheet just yet; it will provide access to the wing hold down dowel holes and the hatch hold downs later on.

Wing to fuselage mating

Mark a centerline onto the bottom of F-2 and F-3. Measure out 1 7/16 inch from the center line of the wing, marking this on the bottom of the wing. Place the wing into the saddle flush with F-2, centered on the mark. Repeat for F-3 making sure the wing center matches the fuselage center.

Weight the wing down in the saddle to stabilize it, then place a pin into the exact center of the tail post. Use a length of string to square the line in the left/right plane. The distance from one tip must be exactly the same as the distance to the opposite identical point.





That large rectangular hole in the chine block **(above left)** is just a large drain hole to let all the glop in the engine compartment drain. Be sure to fuel proof the compartment. With the battery up front, there's ample room and depth in the radio compartment **(above right)** to put the receiver and three servos.

When everything is just right, place a 6-inch drill bit through the holes in F-2 and drill through the wing and ply shear web. Remove the wing.

Round one end of the 3/16-inch dowel and sharpen the other in a pencil sharpener. Push the sharpened end into the holes in the leading edge, inserting it all the way into the ply web (leave about 3/8 inch protruding).

Return the wing to the fuselage and recheck the fit. If necessary, file out the hole in the leading edge until the wing seats cleanly into the fuselage saddles. Remove again, mix epoxy and work it into the wing hold down holes with a scrap of wire, then insert the dowels. Return the wing to the fuselage and recheck while the epoxy cures.

Remove the wing again and epoxy the hardwood wing hold down blocks to the fuselage sides with their tops flush with the wing saddle. Return the wing and mark the proper location of the bolt holes onto the wing. Re-check the alignment using the tail post string. Drill down in to the blocks following a slight rearward angle. Remove the wing and tap the block holes 10–32. Enlarge the wing holes to 3/16 inch. Use nylon washers with the nylon bolts to spread the forces over a wider area.

Complete the wing by adding the tips, the glass center section reinforcements, and giving everything a careful sanding.

The wing depends on its covering for some of its torsional strength and rigidity. I *strongly* advise against the use of low heat, softer covering materials. Use MonoKote, Oracover, or Ultracote!

Fuselage completion

Glue the 3/8 inch top block on to the cockpit floor but not to the hatch area. Carve and sand to a rounded contour and final sand. Using a razor saw cut loose the tank hatch.

Sand the sawn edges and return the hatch to the fuselage, holding it in place with masking tape. Reaching up through the uncovered bottom, attach two hardwood blocks to the hatch with CyA. Drill 1/8 inch through the light ply sides and into the blocks. Place 4–40 blind nuts into the block holes, then some bolts, and tighten. Remove the hatch and reinforce the blind nuts and blocks with additional CyA.

Using cross grained light ply, close off the tank hatch area bottom. Epoxy the landing gear block inside the light ply.

Install the engine and spinner. Protect the edges of the spinner while carving and sanding by wrapping it with tape.

Rough cut the nose blocks to outline and establish a block sanded bevel, front and back, so that the outside edge of the nose block meets the mid-line of the spinner about evenly and is flush with the firewall end. Adjust the front to clear the spinner back plate by approximately 1/8 inch. Mark the bottom block to fit inside the side blocks by running a pencil along the juncture. This block should be level with the bottom center of the spinner.

Mark the outline of the spinner, then remove the engine and sand the blocks to rough shape. Remount the engine and final sand the cowl to a pleasant contour. I don't use ply faces on the cowl/spinner joint, but if you wish, it is easily enough done. Obviously, length and shape of the nose blocks is a function of the exact length and type of engine being used.

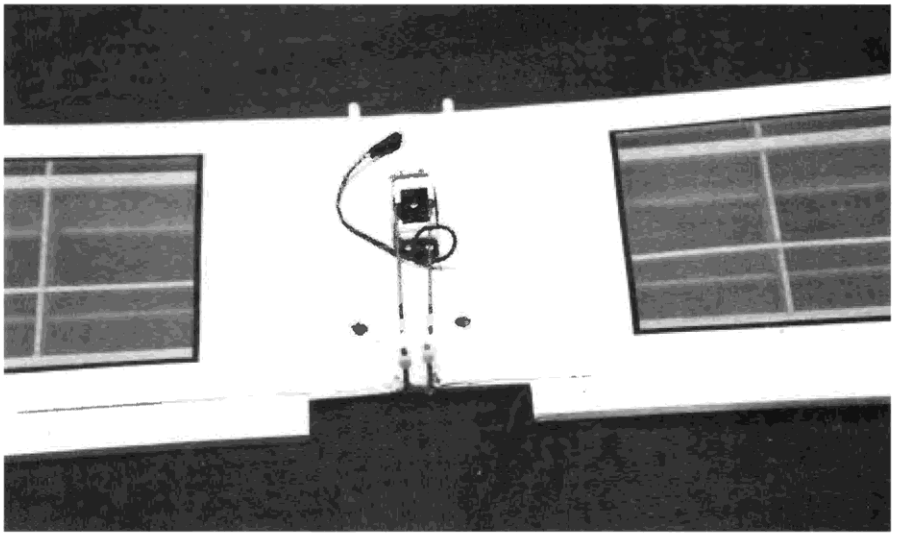
The landing gear is mounted with #4 × 1/2 inch sheet metal screws. Be *sure* they do *not* run into the wing hold down dowels; if they do, shorten them with a cut-off wheel or file.

Tail surfaces

These are all sheet and totally simple. Select medium density sheet balsa and join as required to make up the proper width. Join the elevator halves with a formed wire. Watch out that the wire doesn't induce a twist into the elevators. Hinges are the builders choice, but I highly recommend ACE Hot Hinges or similar. These are so easy to install if a "hinger" as illustrated in the photo is used. The only precaution is to be sure to adhere them with *thin* CyA, noting else!

Control hook-ups are easily done with a standard nylon rod in a rod. Cross them over about half way back in the fuselage and use an anti-flex brace in that area.

Easy and clean looking exits can be done by drilling the exit holes on an angle that matches the run of the rods. A 6-inch or even a 12-inch drill is perfect for this function. After the outer rod has been adhered to the



There isn't enough depth to the wing to allow the aileron servo to fit entirely inside the wing, so check how much it will intrude in the radio compartment space. Mount the servo just aft of the main spar.

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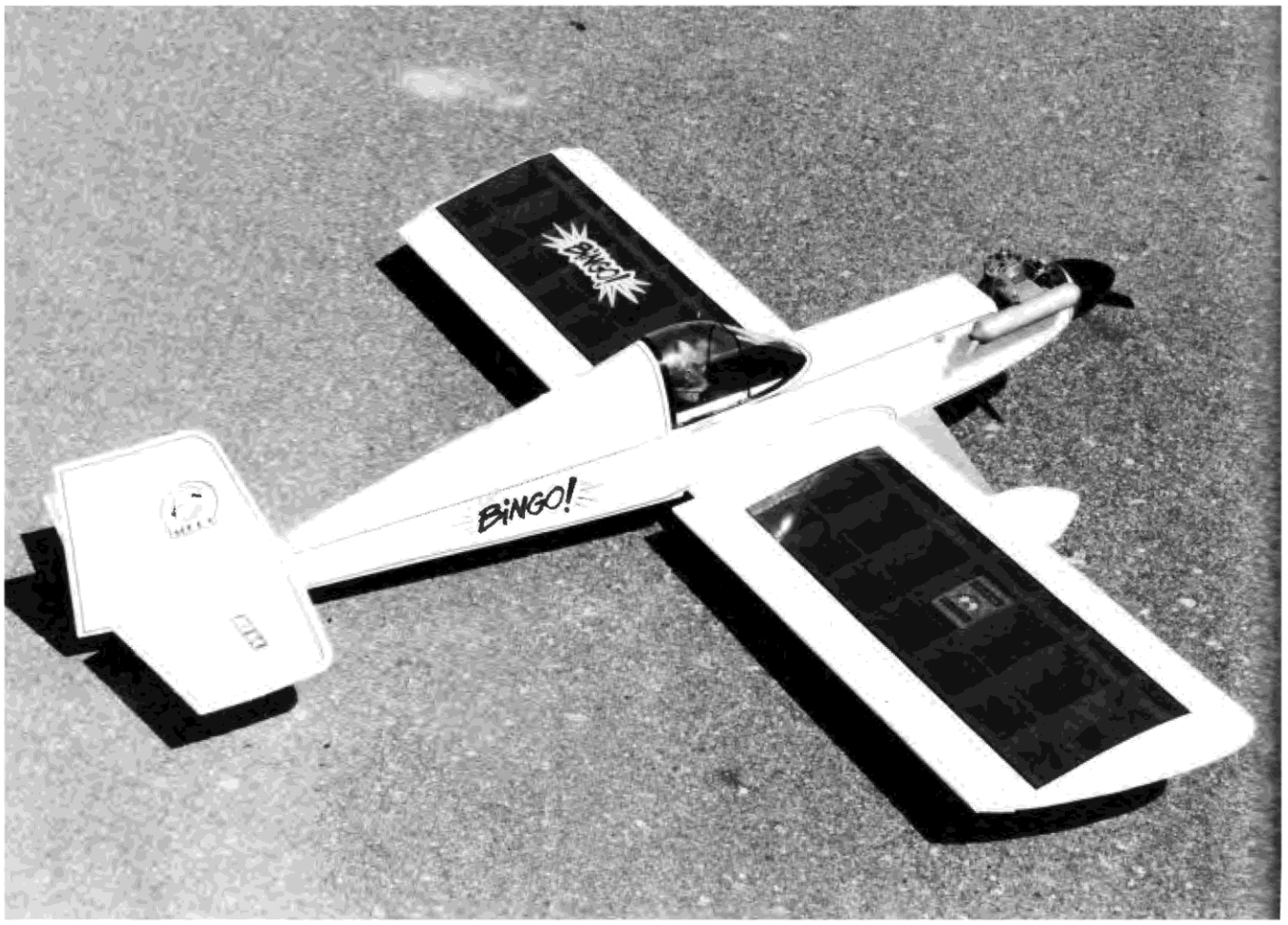

This *Bingo 20* was covered in MonoKote, any similar covering like Ultracote or Oracover is acceptable. Don't, says the author, use low-heat coverings.

fuselage exit, sand it down smooth to match the side. A professional appearing exit will result.

I have been sort of fumbling about for years trying all sorts of tail wheel tillers, and think I have finally hit on one that works beautifully while being easy to install and very durable. It also allows for quick removal of the tail wheel, a real virtue when the model is being converted from wheels to floats.

I cut a 3/16 × 1¼-inch strip of surplus servo horn long enough to bury an inch or so into the rudders bottom. I then drill 1/16-inch diameter holes in several spots; these anchor the unit in the rudder while the ones that protrude are used for the tiller wire. CyA will adhere this unit very well and it all stands up just fine in daily use. Of course, the easiest way to install this rig is after the rudder is covered. Try it, you will like it.

Covering and finish

Individual builders have their own preferences in finishing and I am not about to state "the only way to do this is ..." I will, however, describe my pet technique and perhaps you will find something worth trying out.

The entire model should be coated with a thin coat of Balsarite; this seems to moisture proof the wood and prevent much of the wrinkling and creeping that can occur with environmental temperature changes. This coating should be thinned; the formula out of the can is, frankly, too thick for this use as supplied.

The fuselage is covered turtle deck first, and the overlaps trimmed even with the belt line. Side strips are cut from the roll with a straight edge to provide a smooth line over the turtle deck covering.

The rear and front bottoms are covered with their overlaps on top of the side overlaps. I heat and pull the material around to the nose block center lines. Interior portions of the nose and tank areas are given two coats of K&B Superpoxy clear, then the nose interior is finished with an appropriate color of the same paint.

Wheel pants can easily by spray can painted with Rustoleum if a suitable color is found.

The heat, pull, stretch and stick technique described in the film's packaging is also helpful when covering the wing tips.

The canopy is attached by cutting away a 1/16 inch strip of film, leaving a border of raw wood in the areas where it will be touched by the R/C 56 glue on the canopy edge. After the glue sets, this edge is trimmed with contrasting or matching trim tape. Leave the rear of the canopy open as this allows heated air to escape rather than expand the plastic.

When gluing the tail onto the fusela and the fin to the stab, clear the cover film at the joints. However, be very care not to "score" the wood with the knife this provides a natural fatigue/fract line.

Pre-flight & in the air

The balance point has considerable tude on the *Bingo 20*: forward of the mid of the main spar for safety, rearward increasing control sensitivity and wild aerobatics. Nominal surface deflections shown on the drawings; these are avera and will provide plenty of action for all the most jaded fliers.

The flight comments are at the beginn of this article! Fooled you didn't I?

This is another in the *Bingo* family dire ed at the "keep it in the car" flyer who enj models small enough to stick in the car head directly to the flying site after work, at lunch hour, or to the flier who c smallish designs that fly much "bigger" they are.

If you find this model attractive would like to build one, the *Bingo 20* is easily done scratchbuilt project. It wo also be an excellent first try for any of readers who have never before tackled a project.

She's a nimble, spirited and attract design, not at all difficult to enjoy!