WACO AIRPLANES AGC-8

By Fred Reese

To our knowledge, this Waco AGC-8 is a first time presentation of this aircraft in a model publication. Drawn to a scale of 1¼" = 1', this .10 to .25 powered aircraft is a must for the scale builder.

WACO AGC-8
Designed By: Fred Reese

TYPE AIRCRAFT
Sport Scale 1¼" = 1'
WINGSPAN
44" Upper
29" Lower
WING CHORD
7" Upper
4¾" Lower
TOTAL WING AREA
408 Sq. In.
WING LOCATION
Cabin Biplane
AIRFOIL
Flat Bottom
WING PLANFORM
Constant Chord

DIHEDRAL, EACH TIP
"1¼" Upper
3/4" Lower
O.A. FUSELAGE LENGTH
29 Inches
RADIO COMPARTMENT SIZE
(L)7½" x (W)3¾" x (H)5"
STABILIZER SPAN
14¾ Inches
STABILIZER CHORD (incl. elev.)
5" (Avg.)
STABILIZER AREA
74 Sq. In.
STAB AIRFOIL SECTION
Symmetrical
STABILIZER LOCATION
Mid-Fuselage
VERTICAL FIN HEIGHT
4½ Inches

VERTICAL FIN WIDTH (incl. rudder)
4½" (Avg.)
REC. ENGINE SIZE
.10-.25
FUEL TANK SIZE
4 Oz.
LANDING GEAR
Conventional
REC. NO. OF CHANNELS
4
CONTROL FUNCTIONS
Rud., Elev., Throt., Ail.

BASIC MATERIALS USED IN CONSTRUCTION
Fuselage ..... Balsa & Ply
Wing ..... Balsa & Ply
Empennage ..... Balsa
Wt. Ready To Fly ..... 40 Oz.
Wing Loading ..... 14 Oz./Sq. Ft.

The classic Waco cabins of the thirties epitomize an era of luxurious biplane aircraft. This sport scale model of the handsome AGC-8 is designed for .10 to .25 engines.

The Waco cabin biplanes originated in 1931, and were developed until 1940 culminating in the E series; the SRE being the most famous. After the war, a new W series was started and one was built, but development costs and a slumping post war market ended the project and Waco closed its doors in 1947.

The Waco cabin biplanes were conceived with goals of low cost, good small field performance, and ability to carry four passengers in comfort. The original design goals were exceeded and the 1931 QDC went into production. Thirty-seven QDC's were sold in 1931 along with 149 open cockpit airplanes; an outstanding success for a time when many companies were failing. 1932 to 1934 brought improvements to the model C along with more power and better performance. The 1932 models were the OEC and the UEC, UIC in 1933, and CJC and YKC in 1934. In 1935, Waco announced a new custom cabin series, the YOC, UOC and CUC. These were all new airplanes with features that made them outstanding four place luxury airplanes. The older YKC, UKC and CJC became the YKC-S, UKC-S and CJC-S to designate them as the standard cabin series. The 1936 C-6 Waco custom cabins were further refined with a new landing gear, cowl, and a larger fuselage. Depending on the engine chosen, the models were ZQC-6, AQC-6, EQC-6 or DQC-6 and the standard cabin model was YKS-6. 1937 brought a new longer fuselage and a wider landing gear for the C-7 models designated DGC-7, EGC-7 and ZGC-7. The standard cabin models for 1937 were the YKS-7, VKS-7 and UKS-7.

The 1938 Custom Cabin or C-8 model is the subject of this article and the last of the custom cabin series. The C-8 models had a 12" longer fuselage than the 1937 models and had better appointments and performance. At the same time a new model N went into production with tricycle landing gear using the C-8 airframe. Yes Martha, you could build the AVN-8 from these plans if you wanted.

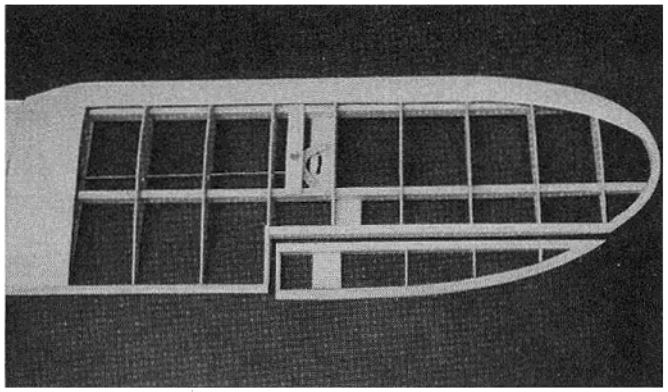
In 1939 and 1940, Waco produced the all new E series with a more streamlined fuselage and veneer covered wings. They were the SRE, ARE and HRE. Then the country was at war and Waco turned to making trainers and assault gliders. During the war many of the custom cabins were turned into military transports.

The Waco AGC-8 was powered with the Jacobs L-6 engine rated at 300 hp. Cruising speed was 149 mph and a range of 600 miles. In 1938, the AGC-8 sold for $10,495 at the factory. The ZGC-8 used the 285 hp Jacobs and sold for $9,895. The EGC-8 used the 320 hp Wright engine and sold for $12,860. Meanwhile, the Beech D-17S Staggerwing could cruise at 202 mph and had a range of 800 miles but cost $18,870, almost twice as much as the Waco and the Waco could carry the same load.

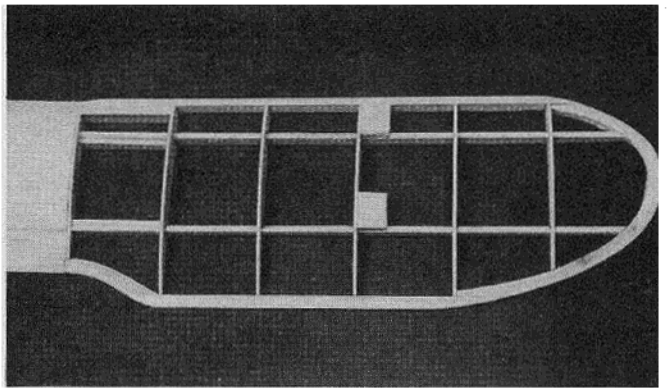
This model is the brainchild of Dick Kidd and Dick Tichenor, who sent me a drawing of this airplane with a note in the corner saying what a nice model it would make. Gosh, what could I say, especially since I, too, thought it would make a great model, so I set to work.

Dick said to make it simple and light for a .10. It is not as simple as I would like, but it is light and it is scale in outline. With the cost of everything skyrocketing, the stick structure reduces the cost and the weight. The model could be built using slab sides, if desired, using the shaded outline for the sides. The tail group could also be cut from sheet balsa, but be careful, the model has a long tail moment and heavier construction could necessitate the larger engine and possibly ballast in the nose. Mine balanced as shown on the plan with the equipment installed as shown. Weight, ready to fly is only 2½ pounds.

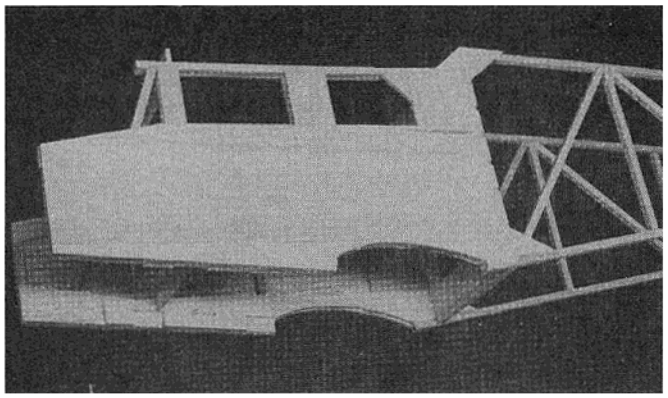
The engine I used is a ten year old O.S. Max .15 that has a lot of time on it. With an 8/4 prop, I was surprised by the performance. The .15 is plenty of power and a .10 would be more than adequate as the Waco will happily putt-putt around at just a notch above idle. Rudder response is good, but if you build it for rudder steering, increase the dihedral by 5/8" and 3/8" for a smoother roll response. Aileron response is gentle, even with large throws, but it will still do nice rolls. The top wing has 1/16" positive



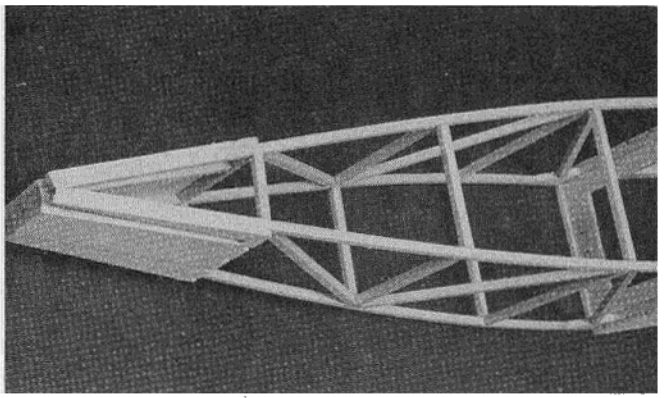
Upper right wing panel with bellcrank installed. Aileron to be hinged.



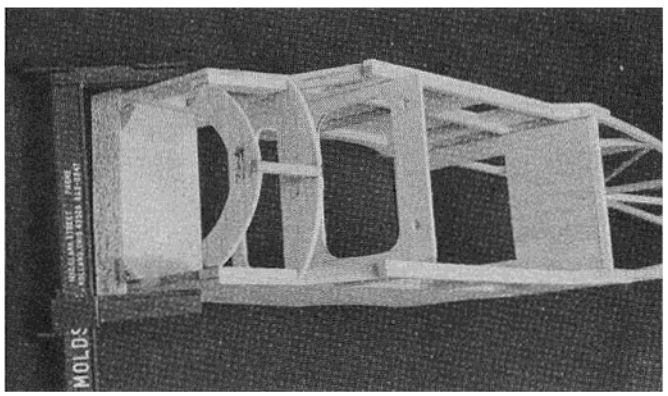
Lower right wing panel — note 1/8" ply strut attachment points.



Fuselage sides joined at front by F-4 and F-5. Note F-6 L.G. support.



Align the fuselage, pull tail together and glue. Add cross pieces.



F-2, F-3, bottom block with 1/2" triangle stock added.

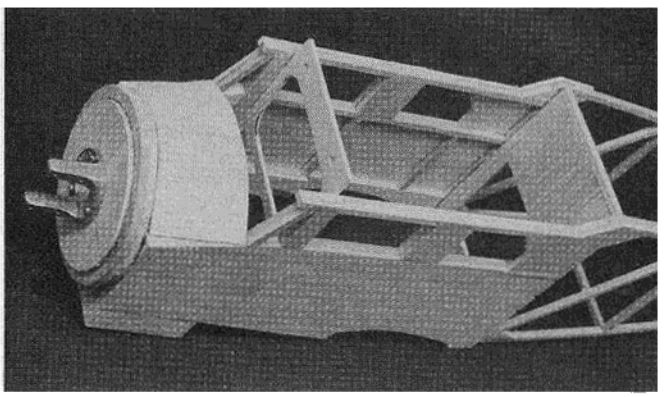
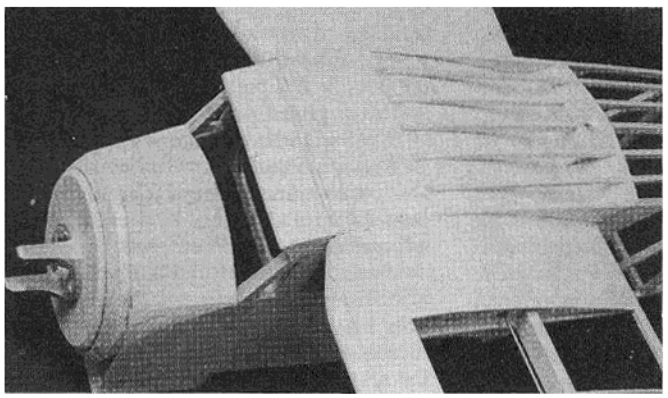
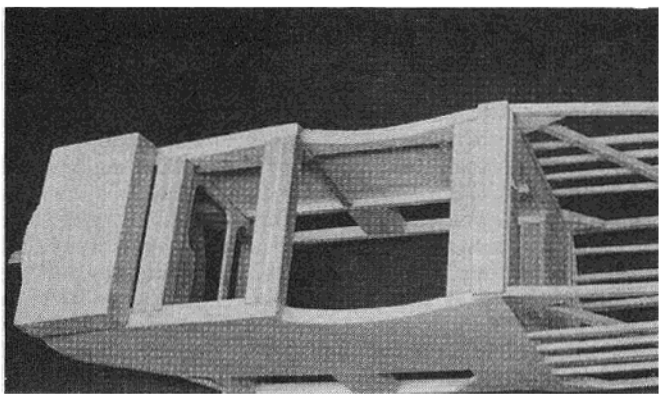


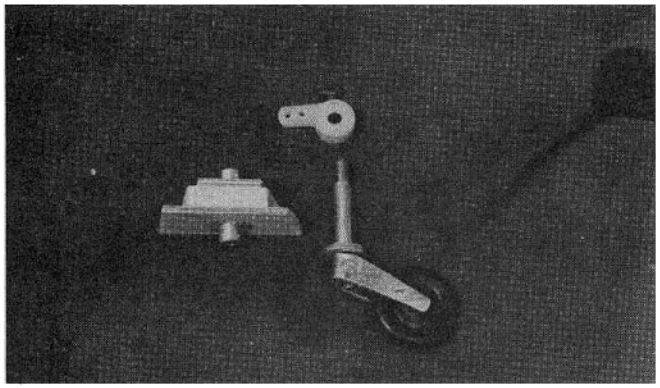
Photo shows 1/16" sheeting, with F-1 and F-1A glued in place.



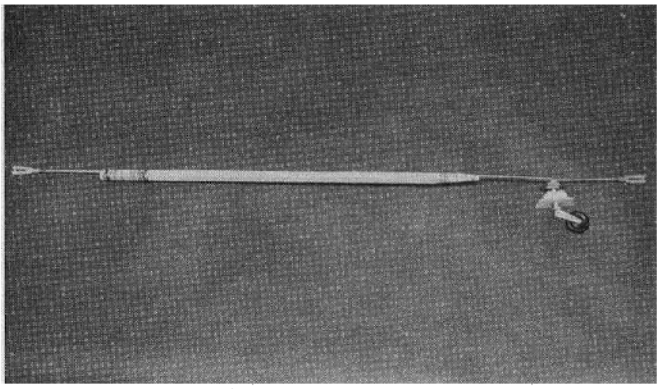
Top wing in place with stringers attached. Wing drilled for 1/4-20 nylon flat head bolt.



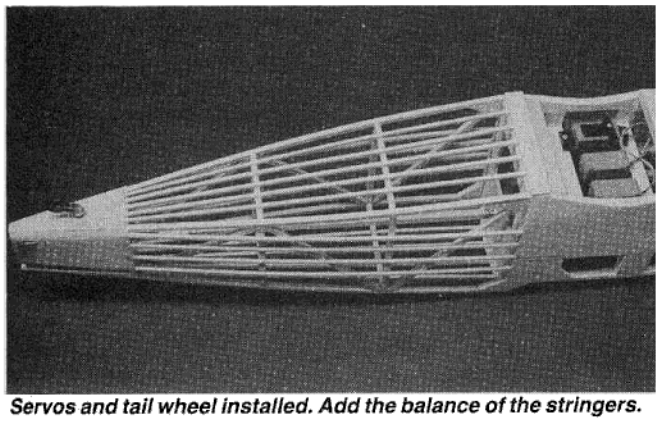
Landing gear blocks epoxied in place.



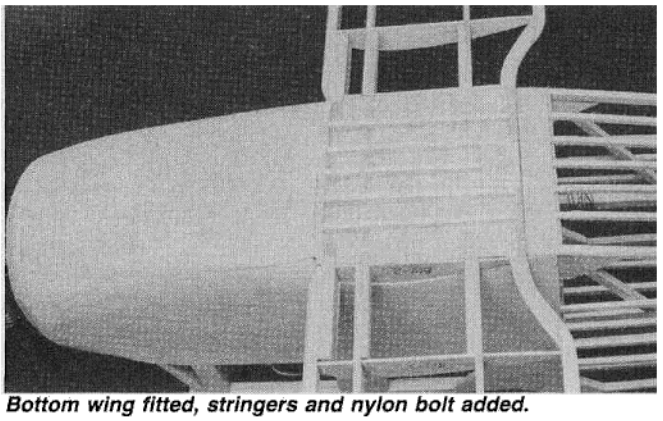
Details of tail wheel assembly.



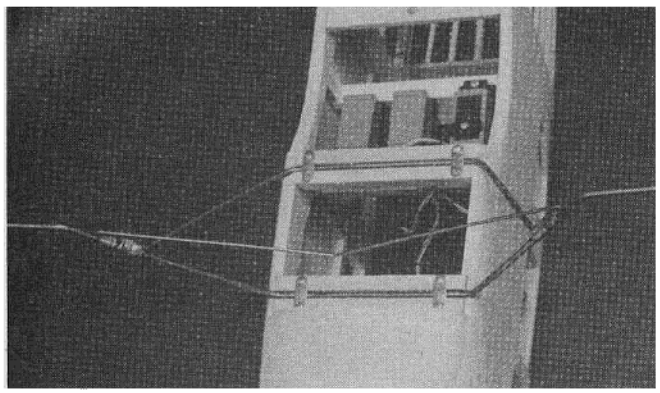
Rudder and tail wheel pushrod. Note clevis at both ends.



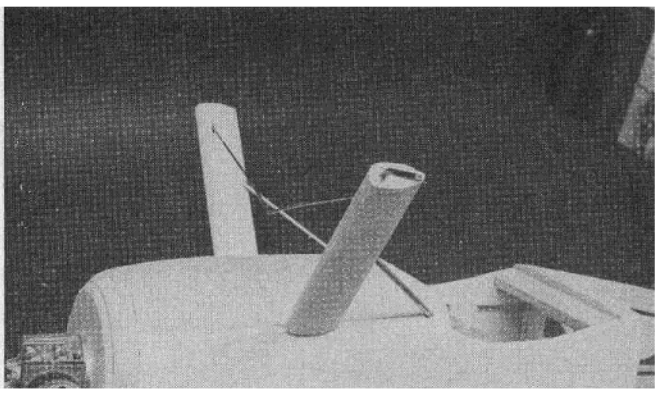
Servos and tail wheel installed. Add the balance of the stringers.



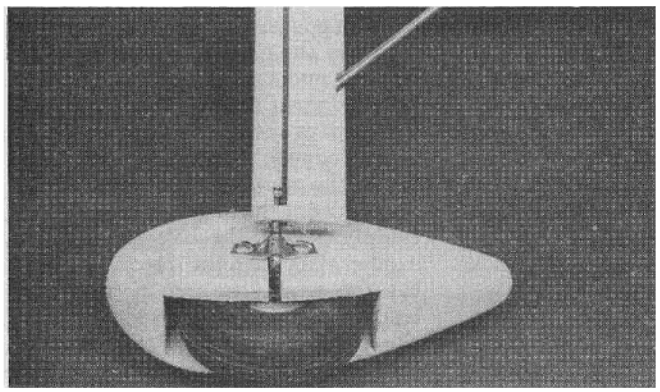
Bottom wing fitted, stringers and nylon bolt added.



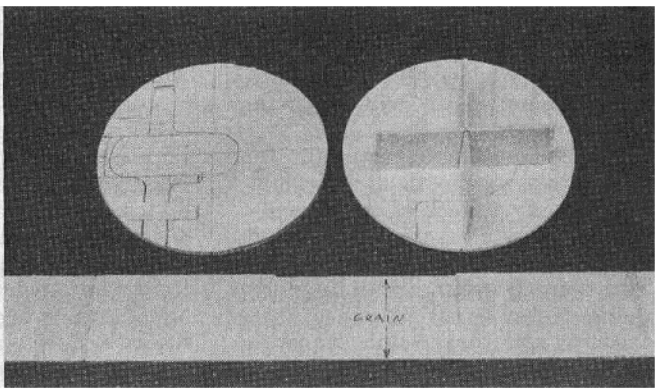
Remove cover block and install landing gear. Held in place with Du-Bro metal L/G straps.



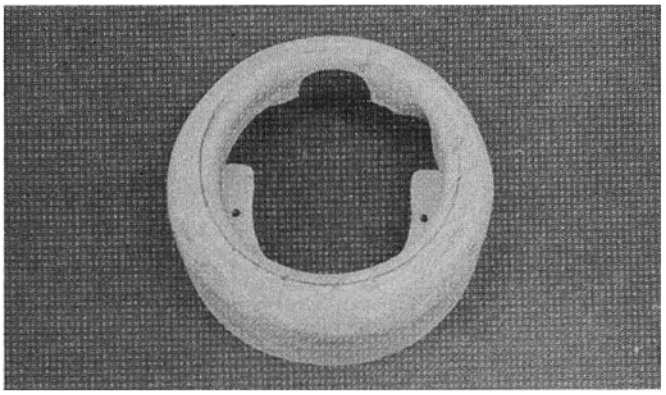
Cover block reinstalled and balsa fairings added to gear legs.



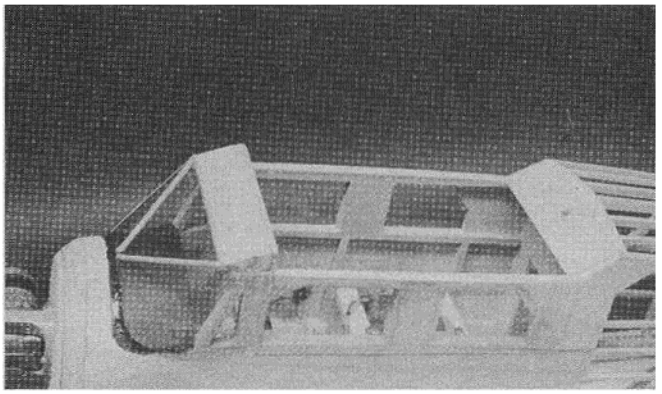
Close up detail of wheel pants and their mounting plate.



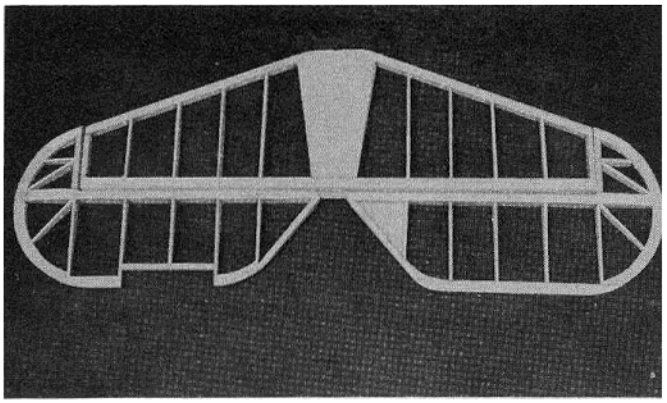
Basic parts for building up balsa cowl.



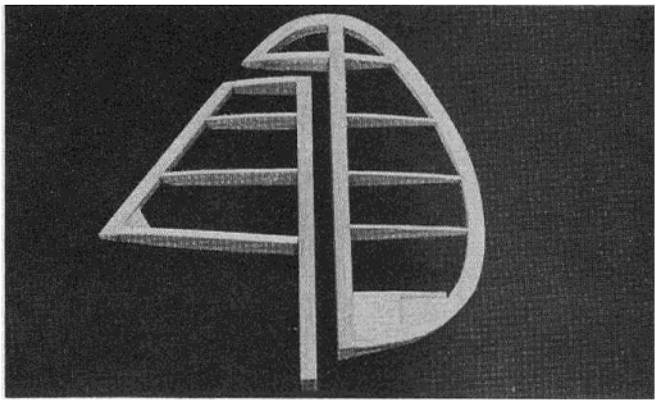
Completed cowl with necessary cut-outs. Cowl has been covered with fiberglass cloth and resin.



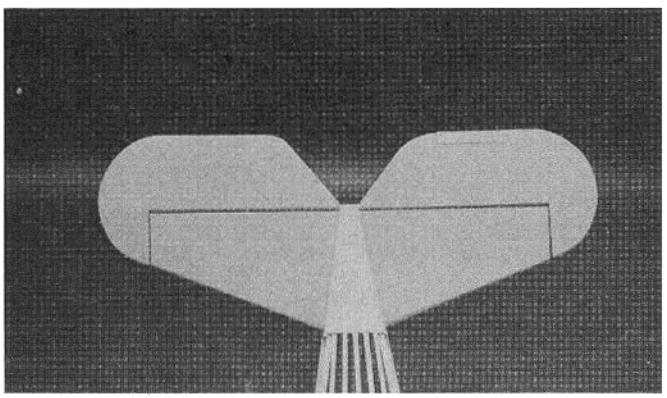
Do your inside painting at this stage. Cement windows in place.



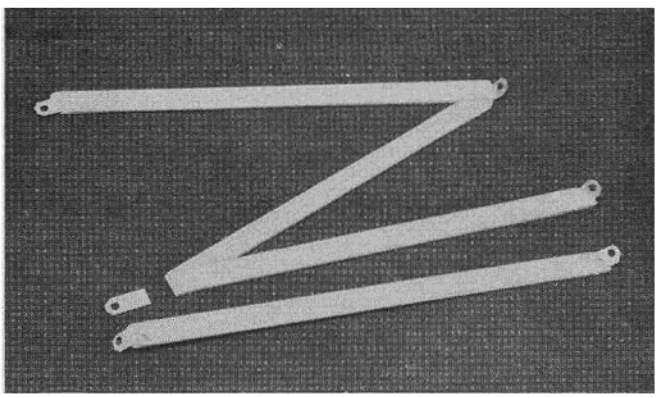
Stab and elevator shown completed. Note the trim tab.



Completed rudder and fin just needs final sanding.



Stab covered, hinged and installed.



1/8" x 3/8" balsa wing struts. Note beverage can aluminum tabs.

incidence which you should probably remove if you use an engine larger than a .15. I added the incidence to improve slow speed flying with the smaller engines.

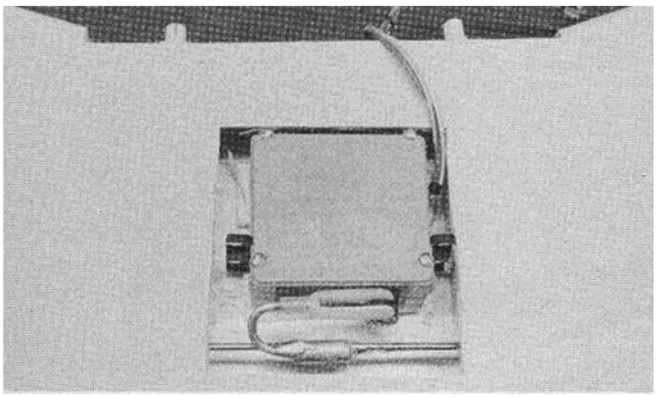
Ground handling is very good. The takeoff run is smooth and straight, needing only a touch of rudder and a little up trim to get it off the ground. The takoff run is only about fifty feet from smooth ground. Landings are slow and easy as the Waco just floats on down and three-points smoothly onto the ground.

Information for this model and the Waco history came from: Waco Publications, "The Versatile Cabin Series," by Ray Brandly, available direct at 700 Hill Ave., Hamilton, Ohio 45015, for $13.95, and "US Civil Aircraft," Vol 7, from Aero Publishers.

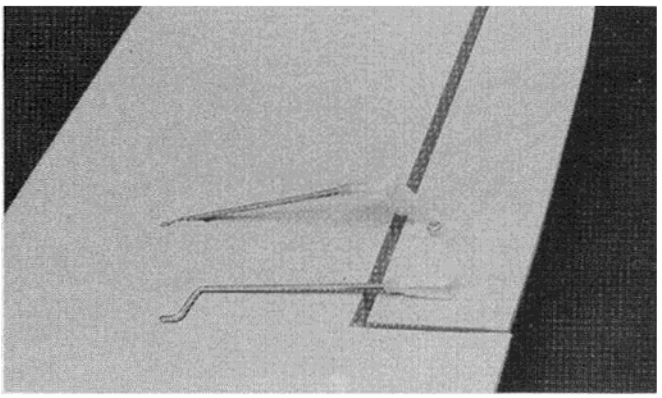
CONSTRUCTION

For ease in handling, cut the plan into three sections on the dotted cut lines. I used Hot Stuff and Super T for all construction except for where I call out epoxy. Use Sig's lite ply for all 1/8" plywood except the firewall F-1, as it is lighter and easier to cut.

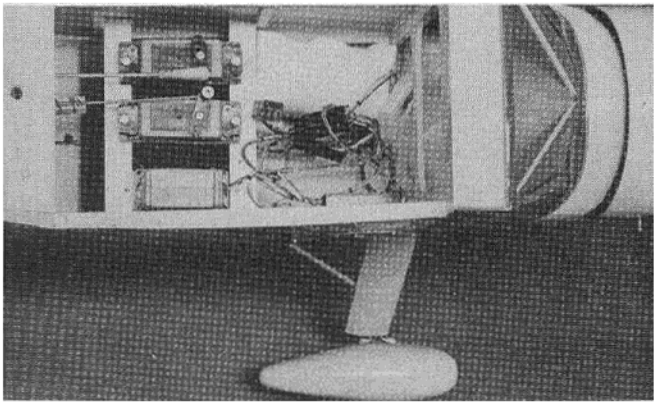
Build the wings first and then the fuselage. Both wings are built flat on the plan in three sections and then joined with epoxy, overlapping the spars at the junctions. Build the outer wing panels by gluing the ribs onto the spars and then add the leading and trailing edges. The wing tips must be raised at the tips and centered on the leading and trailing edges. The 1/8" plywood strut mount plates are glued to the spars and the ribs flush with the bottom edge in the top wing and on the top of the spars in the bottom wing. Scraps of 1/8" balsa are glued on top of the plywood in the bottom wing and sanded even with the top of the rib. In the top wing, the gap between the leading edge and the spar between ribs TW-2 and TW-3 is left open until the wing panels are joined. The center wing panels are sheeted top and bottom with 1/16" balsa. Join the wing panels with epoxy and add the top 1/16" sheeting to the leading edge of



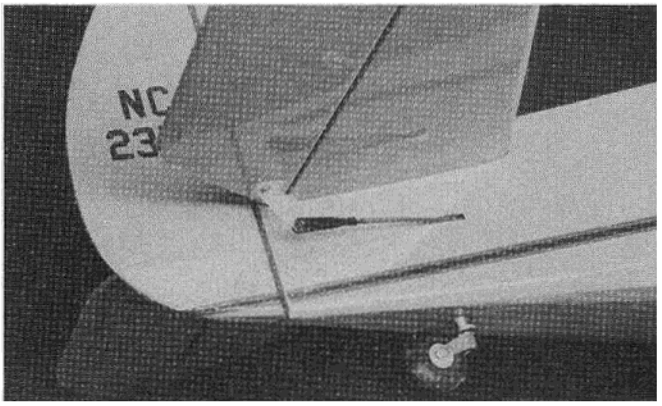
Aileron servo installation in top wing.



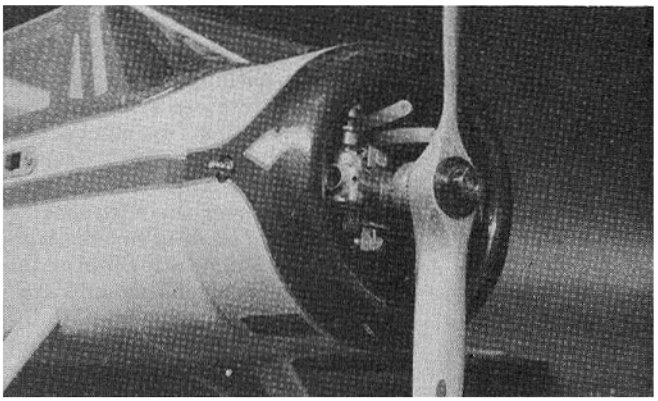
Goldberg's 1/16" aileron pushrods are connected to bellcranks through slot.



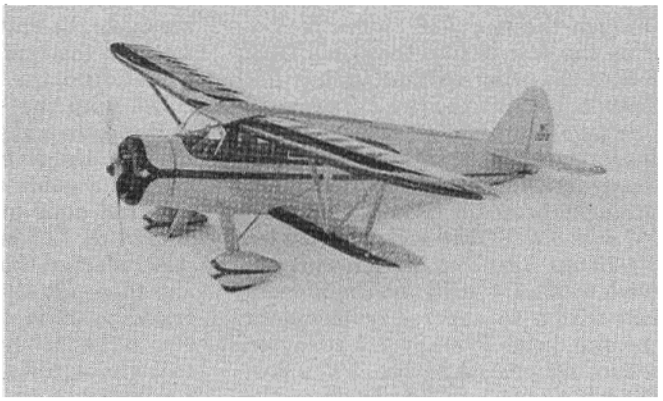
Ample room for radio installation throttle servo inverted for better alignment.



Finished tail group showing pushrod and tail wheel.



View of completed aircraft showing side mounted O.S. .15. Note glow just protrudes outside cowl.



Completed beauty rests in snow covered runway. Needs skis to be at home.

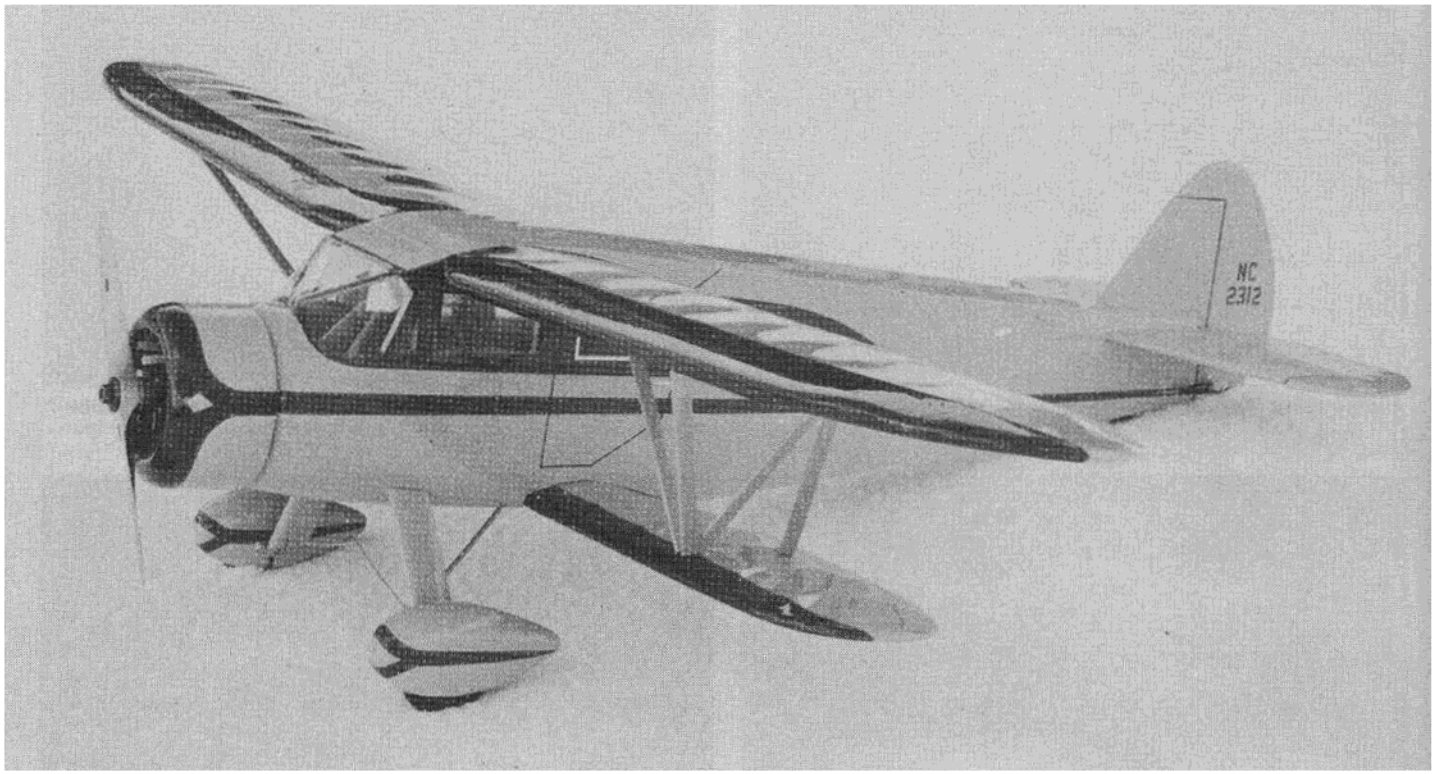
the top wing. Build the ailerons separately and pin them in place while you shape the wing tips. Add the aileron linkage and bellcranks in the top wing.

Build the fuselage sides on a soft pine board or a piece of celotex that you can stick pins into. Lay Saran Wrap or waxpaper over the fuselage side view on the building board. The basic fuselage side of 3/16" balsa is indicated on the plan by the dark shaded area. Build one side, remove the pins, lay another piece of Saran Wrap over the side and build the second side right over the first. Adjust the two 3/16" square pieces next to the servo rails for the width of your servos.

The fuselage entrance door is on the left side only so the right rear window is rectangular instead of angled at the rear. Glue on the 1/8" balsa outside doubler over the entire cabin area except the windows and over the tail area. The vertical grain doubler should overlap all of the top glue joints around the windows and the jog up behind the cabin. Glue the landing gear doublers, F-6 to each side. Glue on the top and bottom 3/16" sq. to bulkhead F-5 and glue to one of the fuselage sides. Keep the pushrod opening at the bottom. Glue F-4 in place to the fuselage side with the fuel tank cut out on the right side. Glue on the other fuselage side and pull the tail together and glue.

Check now to be sure the fuselage is straight and the bulkheads are square to the sides. Add the 3/16" sq. cross pieces in the tail area. Glue the 1/2" triangle stock to the sides ahead of F-6's. True up the bottom edge of the cabin with a large sanding block. Glue on the bottom front block even with the edge of the front gear block slot. Add F-2 and F-3 and the 3/16" joiner. Note that the front narrows slightly ahead of F-4 to the firewall. Add the 1/16" balsa over F-2 and F-3.

Mount the engine to F-1 and drill the holes for the fuel lines and the throttle pushrod. Make the two 3/16" balsa rings, F-1A and glue together



and glue them onto the firewall F-1. Glue the firewall assembly to the fuselage. Glue in the top wing mounting plate, F-7. Fit the top wing to the fuselage and drill the holes in the wing for the mounting dowels through the two 3/16" holes in F-4. Glue the dowels into the wing. Glue F-8 to the wing so that it lays flat against F-7. Add the two F-9 pieces to line up with the 3/16" sides. Glue in the screw mount block and the 1/8" sq. top stringers over the wing. Drill down through the screw mount block and F-7 with a 3/16" drill and follow with a 1/4-20 tap. Ream out the screw mount block with a 1/4" drill and chamfer the hole with a 45° tapered reamer to fit the flat head Prather 1/4-20 nylon mounting bolt. Add the 1/2" x 3/4" windshield block to F-4 and shape the top front of the fuselage. Epoxy in the two slotted landing gear blocks, F-10 and the 1/8" balsa piece behind F-10.

Make the scale-like steerable tailwheel from brass tube and brass sheet, or you can use a Goldberg nylon tailwheel bracket at the rudder hinge line. The tailwheel location, as shown on the plan, is too far forward for scale but the linkage wouldn't fit further aft. Neither is scale but the built-up unit looks better to me.

Solder the 1/8" wire into the 1/8" I.D. brass tube which gives you a firm end to clamp to while you solder on the washer and wheel yoke. Drill the ends of the yoke for the 1/16" brass tube axle. Assemble with the wheel, solder quickly, and cut off the excess ends of the axle. Cut down a 1/8" Goldberg steering arm and drill two new 1/16" holes as shown on the plan. Assemble the 1/16" plywood and 3/16" balsa sandwich for the tailwheel mount and drill a 3/16" hole for the brass tube bushing. Glue the 5/32" I.D. brass tube bushing into the sandwich and assemble the unit and tighten the set screw in the arm.

Make up the 1/16" pushrod and clevis from the steering arm to the control horn and the pushrod from the servo to the steering arm using the plan as a guide for the lengths. The pushrod ends at the steering arm should be "Z" bends. Assemble the pushrods and the tailwheel unit and slip them into the fuselage with the rudder pushrod sticking out through a slot in the 1/8" side doubler. Glue the tailwheel unit in place and the remainder of the 1/16" balsa covering the bottom rear. Install the servo rails and servos. Glue on all of the 1/8" fuselage stringers.

Fit the bottom wing to the fuselage. The 1/8" wing dowels key into two holes drilled in the rear landing gear block. Add the bottom 1/8" x 1/4" stringers to the wing and the 1/8" sheet screw block. Drill and tap for the 1/4-20 Prather nylon bolt the same as on top. The holes for the nylon bolts should be drilled perpendicular to the outside surface so the head of the bolt is flush with the finished surface. Lightly glue the bottom block over the gear blocks and carve and sand to shape. Finish shaping the rest of the front so that it rounds off smoothly at the firewall. Now remove the shaped block over the gear blocks and make the landing gear. Bend the wire landing gear parts and screw them in place using the Du-Bro gear straps. Bind the gear wires together above the axles with copper wire and solder. Re-fit the bottom block and glue back in place. Finish shaping the fuselage with a sanding block. The 1/8" side doublers should taper from the stringers to nothing at the top and bottom of the fuselage sides.

Make the landing gear strut covers with a 1/8" slot for the 1/8" wire and sand to shape. Separate the sandwich and glue back over the wire landing gear. Later the strut is covered with the base color MonoKote. Build up the wheel pants from balsa and 1/8" plywood and carve to shape. With the wheel collars on the axles and the pant in place, solder on the brass retainer plates. The pant is held on with two #4 x 1/4" SM screws through the brass plate into the 1/8" plywood side.

Cut C-3 through along the shaded line except for a couple of 1/8" spots to hold it together. Make an egg crate "X" from the two cowl jig pieces and lightly glue the "X" between C-2 and C-3. Make a strip of 1/16" balsa 1¾" x 13½" with the grain crosswise. Wrap the 1/16" balsa around the cowl form with the edge even with C-2. Glue the cowl rings, C-1 together, staggering the joints and glue to the cowl. Shape the cowl front in a 3/4" radius edge. Wrap the completed cowl with 6 oz. glass cloth and either polyester or epoxy resin. Sand and fill and trim the back edge to match the plan. Cut out the shaded area of C-3 and break out the cowl jig pieces. Fit

the cowl to clear the engine, muffler, needle valve, and glow plug, and then cut the cooling duct over the cylinder head. Resin the inside of the cowl and reinforce C-3 to the outside 1/16" balsa and glass with little scraps of glass cloth. Cut off the Du-Bro Mini Muffl-aire II even with the edge of the cowl. I did not cut a hole in the cowl to adjust the needle valve, rather, I set the needle originally with the cowl off. Later the needle can be adjusted if needed between runs with the cowl on.

Paint the inside of the cabin gray and the instrument panel and cover flat black. Epoxy the windows in place.

The stabilizer and rudder have a symmetrical airfoil. The stabilizer uses a 1/4" square leading edge and 1/8" trailing edge and tips which must be centered, relative to the 3/8" spar. All ribs for the stab are 1/16" or 1/8" x 3/8" balsa which are sanded to airfoil shape after the structure is completed. Pin the spar to the plan. Place 1/16" shims under the leading edge and glue in all of the ribs. Pin down the elevator spar to the plan. Separate the halves after sanding. Place 1/8" shims under the tip and trailing edge and glue in the ribs. Pin the elevator and stabilizer together and sand to airfoil shape. Separate the elevator halves and rejoin with a 3" length of 3/16" dowel. Cover the stabilizer and elevator and hinge together. Glue the stabilizer into the fuselage.

Build the rudder the same as the elevator by shimming the edges to center them on the spar, and then sand to shape. Glue the fin onto the fuselage and cover the rest of the airplane.

The iron-on covering should cover to the edge of the windows. MonoKote trim is applied over the windows cut to the outside trim shape. Use the light shaded area on the plan as a guide. To cut away the trim over the windows, point a flashlight or reading light into the cabin area and the windows will be perfectly outlined. Trim away the covering with a razor blade. Give the glassed area of the cowl a coat of Balsarite and cover with MonoKote up to the curve in the front. The front of the cowl and the wing leading edge trim is painted on using Pactra's Formula U spray paint to match the trim color. Midnight Blue Formula U does not exactly match the Insignia Blue MonoKote trim but it is the closest match I could find. The paint is slightly darker than the trim. The red trim and paint are very close.

The numbers on the wings are cut from blue trim and applied onto red MonoKote trim which is then cut to give a 1/16" red edge to the numbers. You can make a one piece transfer of all the numbers. Tape down two strips of masking tape sticky side up. Apply the numbers to the tape in order and evenly spaced with the protective back still on. Apply three strips of Scotch Tape over the row of numbers. Carefully lift the Scotch Tape and it will pick up the numbers from the protective back and can now be applied to the wing. The Scotch Tape will peel off of the numbers.

Apply Goldberg 1/16" red color stripe around all of the other trim patterns. NC 2312 has a fancier trim than most Waco's while the others did not have the inset diamond on the cowl and wheel pants.

The wing struts are made of 1/8" x 3/8" balsa covered with MonoKote. The screw tabs are cut from an aluminum beverage can and glued into razor saw slots cut in the ends. The struts are held in place by #4 x 3/8" SM screws into the 1/8" plywood pieces in the wings.

The aileron pushrods and servo clevis rod are joined with a piece of 5/32" I.D. brass tube & soldered. The servo is mounted with foam servo mounting tape. Be sure to seal the wood before mounting the servo with dope or varnish or the servo may loosen in time. The ailerons are connected to the bellcranks with Goldberg 1/16" aileron pushrods bent to match the plan. The pushrods can be slipped into the hole in the bellcrank, through the slot after covering. Mount the control horns with #2 SM screws or use the screws supplied after shortening, by screwing them into 1/16" holes with a drop of Hot Stuff. Install the rest of the radio, switch and charging plug. Adjust all control surfaces to move 1/2", in each direction.

The Waco turned out to be more of a project than I originally thought, but I feel the results are worth it. The real Waco is a handsome airplane and to do less would be a disservice. The model can be further enhanced with additional details such as running lights, baggage door, pivot tube, pilot, etc. The model was designed for sport flying, rather than competition, and since I plan to be flying mine for a long time, I left off those details that add weight or can easily be broken off.

I hope you enjoy your Waco as much as I do mine and can recall some of the nostalgia from an era that will not be seen again. □

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