

# F.W. 190

## BUILDING INSTRUCTIONS

Your choice and purchase of this kit indicates that you are a modeler with discerning tastes. Very likely you have much above-average modeling skills. Certainly, you are willing to spend time to create a model of museum quality *yet* which has outstanding flying ability for those with the necessary piloting skill. These things being so, you are going to enjoy this F.W. 190!

No kit model ever gets built precisely "according to plans." This is because there are no absolutes in model design. Very likely, you will make small modifications here or there to suit your own sense of what's right, and in these areas perhaps your ideas are better than mine.

I would suggest that you consider the addition of some carbon in strategic locations. This will *considerably* add to the strength while adding negligible weight. Carbon is, however, quite costly and therefore is no material to be wasting. Carbon laminates are available from Bob Violett Models, 1373 Citrus Rd., Winter Springs, FL 32708. Send for his leaflet.

Among the places you could add carbon to this model to good effect: a 1/2" wide piece of .007 thick laminate top and bottom of the four main wing spars, entire length. A similar strip, 1/4" wide, to the top and bottom faces of the 1/4" sq. fuselage crutch side-members, entire length. Strips also 1/4" wide and .007 thick glued chordwise on the inside of the wing sheeting, between ribs, will significantly reduce the possibility of skin splits. Similar strips glued to the fuselage formers opposing the wood grain direction will greatly increase their strength. You will find other places too; go with your hunches.

One caution though. Stick to the *sequence* of assembly given here - it works.

### STABILIZER

1. Mark positions of ribs on 1/4 sq. spar. Slide ribs into place but *don't glue*.
2. Cut tapered T.E. from 1/4 x 3/4 strip. Mark positions of ribs and glue all ribs to T.E., carefully centering each rib.
3. Slide S-8 into place; don't glue. Cut L.E.'s from 1/4 x 5/16, glue to ribs and S-8, *then* glue S-8 to ribs.
4. Glue rib/spar joints now. Make elevator horn and all G-10 hinges. Cut slots in T.E. for hinges.
5. Slide two center hinges onto elevator horn, slide hinges into stab., center everything perfectly from rear view, and glue hinges to stab. Assemble outer hinges onto their wires, slip in, center, and glue.
6. Cut slots in 1/16 sheet elevator cores for the horn and the outer wires. Glue cores to wires and horn. Don't get any glue in the hinges!
7. Cut 4 pcs. of 5/16 sheet to size for elevators. Press one of the sheets onto one of the elevator cores to get an "impression" from the horn and hinges. Relieve the 5/16 piece till it can laid flat onto the core. Glue this piece to core, bottom surface.
8. Repeat procedure for the 5/16 part for the bottom of the other elevator core. Do *not* relieve and glue top pieces yet.

Begin to shape the elevator top pieces to airfoil section *and* thickness-taper. Since the stab. will later have 1/16 skins, tack-glue scrap 1/16 sheet to the T.E. to simulate this depth while shaping the elevators.

9. When both elevators are about right, round off the L.E. of the elevators. You should now be able to move the elevators from about 20° of "down" to a full 90° of "up."
10. Using similar procedures as before, prepare, attach, and shape the top 5/16 pieces. Aim to get about 20° to 25° of movement both up and down.
11. The stab. can now be skinned. Make sure you have the required T.E. overhang that forms the elevator shroud. Add and shape the tip blocks.

(Since lightness at the tail end is important, let's mention that our stab., at this point, weighed 140 grams (4.9 oz.) If yours is lighter, good. If it is significantly heavier, consider lightening-out the solid elevators.)

### WING

1. Pin down the bottom 1/4 x 1/2 mainspar over the *left* wing plan. A small piece must be added to the tip, as the spar is a little over 36" long. Glue one of the W-12 ply pieces to the front face at the root end of the spar.
2. Make up the front half of Rib W-1 from 5 parts: 2 W-1 F's, 2 W-1 A's, and the 1/4 dowel (you could use 1/4 carbon rod instead if you like). This assembly is glued to the front face of W-12. This rib must bisect the dihedral angle viewed from the front.
3. Glue rear W-12 to spar, followed by the rear half of Rib W-1 (2 pieces W-1 R).
4. Cut "support jig" (see note on plan) and pin in place over left wing plan. Glue ply doublers W5A, W6A to ribs W-5 and 6 respectively. Make sure you have the doublers on the correct side of the ribs. Now *pin* (no glue) all ribs to the mainspar. Also pin ribs to jig. Assemble (but again, don't glue) the L.G. rails into place.
5. From 1/4 x 1 cut the wing trailing edge (see plan) then glue to ribs 7 thru 11. Glue 1/4 sq. rear upper spar into ribs 1 thru 7.
6. Glue L.E. to all ribs 1 thru 11. Now glue lower spar/rib joints. Add upper mainspar and all 1/16 sheet mainspar webs. Add W-13 and glue L.G. rails to ribs 5 and 6.
7. Remove wing from plan. Glue lower *right* mainspar to W-12's. Place assembly down over right wing plan (support left wing with block while right wing is built). Repeat steps 4 thru 7 to build right wing to same stage as left wing.
8. Lift entire wing from plan. Add bottom rear spars and all rear-spar webs to both wings.
9. It is time now to begin the process of installing all mechanisms into the skeleton wing so far made. Proceed in this order: ail. bellcranks, servo rails, servos, ail. pushrod, switches, flap bellcranks. Test-drive all mechanisms and ensure smooth, backlash-free movement.
10. Install air-line conduits and air lines. Drill and tap L.G. rails for 6-32 screws to hold retract units in place. Note that no nuts are used here.
11. If the flaps are to be included (they are optional) build and install these at this time. Thin ply (1/64) could be used, but .010 G-10 sheet is far superior - this is available from us.
12. The wing bottom is now skinned completely with 3/32 sheet. Cover right over the L.G. units. They will be made removable later.
13. Install aileron hinges cut from supplied 1/16 G-10 sheet. Install hinge wire, ensuring it is a perfectly straight line thru all hinges. Glue aileron bottom skin to this wire, cutting recesses for clearance around the hinges. Glue aileron L.E. block to bottom skin.
14. As we did with the stabilizer when shaping the elevators to their tapered depth, it is now necessary to temporarily tack-glue a strip of 3/32 sheet on top of the wing trailing-edge piece to represent the thickness of the upper wing skin. With this strip in place, shape the aileron L.E. block to depth. Also cut away the front to the required angle. Lastly, add small scrap scabs and shape to triangles to become aileron ribs, and sheet the top surface of the ailerons.
15. Install aileron horns, hook up to their bellcranks and test-drive the ailerons. About 1/2" to 5/8" up and down movement is OK.
16. Taking the wings one at a time, hold down over the bench with weights. Support the wing under the second spar so that it has a 3° twist (washout) and skin the upper surface completely with 3/32 sheet. Add the tip blocks, shape, and fit the tip-shroud piece (see sketch).

### FUSELAGE

Before we get into a blow-by-blow on the fuselage, please note the following: due to a design change made to alleviate a cowling problem, some of the diecut parts need to be altered slightly:

F-26 Trim length very slightly to match the plans.

F-27, 28 and C-3 Same instruction.

C-2 Paste corrected shape (shown on plans) onto existing diecut C-2 and revise the shape.

Okay, with that taken care of, let's start.

1. First separate the plan view of the body from the rest of the print. Tape this view down onto a FLAT board. Check that no "wave" has occurred by making sure the marked centerline is a true, *straight* line. Cover the print with waxed paper and proceed to build the fuselage crutch from 1/4 sq. balsa. Choose the hardest pieces for the front members, using the lightest pieces at the tail end. Glue parts F21, 22 & 23 to the crutch.
2. While the crutch sets up, prepare the formers. Glue all "left" and "right" halves together. From the plans, mark and drill pushrod holes in all formers requiring these. On F7 and F8 mark positions of servo rails and glue rails in place (complete width of formers).
3. Remove crutch from plan. Turn upside-down. Glue F-7, 8, and 10 to the crutch. Now cut about a dozen pieces of scrap balsa stripwood (of any size) to about 4 1/4" long. **Note:** The exact length of these strips is not critical – what is important is that they all be exactly the same length as *each other*. These strips are going to serve as a support-jig to hold the crutch about 4 1/4" above the building surface while construction continues.
4. Glue the support-jigs to the bottom face of the crutch side-members *sticking straight up*. Space them at roughly equal intervals along the crutch and glue them in the spaces between formers, not right where a former occurs.  
Turn the assembly right-side-up. You now have the crutch supported up in mid-air by the jig "stilts." Center carefully over the plan view. When all is exactly right, *glue* the bottoms of the jigs to the bench to prevent movement.
5. Slip F-19 into place behind its cross-member, check for true upright, and glue. Follow this with F-18, F-16 (note: NOT F-17 yet), F-15, F-14 and F-13. In some cases it may be helpful to extend the crutch-notch in the formers inward slightly to allow them to slip in easily.
6. Glue top piece F-31 to F-13-16. Glue front edge halfway onto F-13 to allow a lip for F-30 later. Also note that the curve in F-31 goes at the rear end. Now fit F-17, glueing to crutch and F-31. Note forward lean-angle. Add F-32, then draw center-lines on F-31/32 as a future reference. Notice that these parts are somewhat wider than needed; they will be trimmed later.
7. F-12 goes in next. You'll have to loosen the cross-member from one side of the crutch temporarily in order to get F-12 in place. Next, F-11 (same story). Next, F-9. Make and angle-template for F-9 to be sure of the right lean-back. Glue F-6.
8. Mark the positions of F-1 thru 6 on the motor-mounts. Glue F-29 between mounts. Glue F-1 in place. Glue F-28's each side of mounts, then F-24's. Add F-27, completing the battery-box. **Note:** Plywood very often warps badly. You'll need to be careful during this entire step to ensure accuracy. Use several squared-up lines drawn on the parts and "pull" the parts into straight assembly while glueing. I suggest using Green Label Zap along with the Kicker to "tack" the assembly together first, only completing the glue joints properly once it is established that the entire assembly is true.
9. Slide F-4 into place and glue. Then F4-A, F-3, F-2 and F-5. Next F-24's and F-25. Before the front-end assembly is attached to the fuselage and is thus handy to work on, it's a good time to mount the throttle servo (in the right F-28). Also, make up the service panel, cut a hole in the left F-28 and screw in place. Cut holes in F-4 to pass wires, air line etc. through.
10. We are now going to join the nose subassembly to the fuselage structure. Cut 4 more strips 4 1/4" long as used before. Tack-glue these strips to F-4, and F-2, one each side *under* the crutch-notch in the formers. These jigs will support the front end at the same height-above-bench as the rest of the body. Slide the assembly in from the front until the motor mounts enter the holes in F-6. Now align the front of F-1 exactly over the fuselage centerline. When correct, glue the bottom of the jigs to the plan. Run glue around the motor mount/F-6 joints. Bring the crutch side-members in and glue into notches in F-2, 3, 4 and 5.
11. Assemble F-30 from the 4 diecut pieces. (The part was too long to be cut in one piece each side of the center joint, so the small pieces join onto the rear end.) Glue the completed F-30 to the fuselage.
12. Engine time. Lay the engine in place on the mounts. Measure the front of the prop driver (rear of spinner) as being 1 3/16" to 7/8" ahead of the front face of F-1 and mark the mounting screws locations. Drill holes for screws. Insert draw-nuts or blind nuts under mounts and use bolts to draw into place. Screw engine to mounts. Fit muffler to engine. We used an S.T. 2500 engine for which a perfect muffler is the Tatone JT-STB. This has two exit tubes facing down. Cut away the starboard F-28 to allow down pipe(s) to clear. To get these down pipes clear of the motor mounts, we needed a 5/16" to 3/8" thick spacer between the engine exhaust stack and the muffler. For setup purposes you can make this of balsa, replacing it with a metal part later. The silicone pipes are now tied to the down-tubes to complete the muffler installation. Make, assemble, and test the throttle pushrod to the servo. When correct, remove engine & servo.
13. Cut and glue the three pieces of 1/16" sheet each side which form the exhaust duct of the full-scale airplane. See sketch on plans.
14. Our next project is the cowling. Using Bulldog-type clamps, hold S-3 side pieces on top of F-28's, spacing can be checked by sliding C-1 between them front & rear. While clipped, drill thru C-3 and F-28 together, one near the front and one near the rear of each C-3. Use a 3/16 or 1/4 drill. These holes are for short locating dowels glued into C-3's, engaging in holes thru F-28's for 1/4" or so of depth. Enlarge holes in F-28's with a file very slightly *just* until dowels will slide in easily but not rattle about. Using clamps again to hold C-3's in place, glue C-1 and C-2 to C-3's, forming the basic cowl structure. Trim glass cowl to the rear mark only, then glue cowl to ply parts. Use Flex-Zap for this joint. The cowl will overhang at the sides and front. Trim to fit exactly, then beef-up the joints inside the cowl with milled fiberglass or chopped-matt mixed with polyester resin to make a paste. Do *not* use epoxy glue, it will not hold well onto the glass cowl.
15. Make up the elevator pushrod and insert thru holes in right halves of formers. Relieve crutch crossbrace at F-14 to suit. We need a free sliding action, so sand away any tight areas. Now insert the conduit for the TW steering wires and glue at each former. Insert rudder cable, cutting hole thru F-32. Glue to each former. Allow enough length dangling at the rear end to run up into the fin. Refer to sideview on plans.
16. Lay the stabilizer in place on the fuselage. Tack-glue it to F-18. Make a pair of same-length scrap strips to fit under the stab. out at the tips to hold it truly horizontal. Check that stab. is true also in plan view, then glue to F-19. Make tacked joint at F-18 firm. Hook the pushrod to the elevator horn.
17. Glue the vertical-fin trailing edge F-20 (2 laminations 1/8 sheet) onto the crutch. **Note** that it is not truly perpendicular to the crutch in the sideview but leans backward *very slightly*. Make an angle template to glue in temporarily to hold F-20 at the correct angle while the fin is boned up. Also, make sure F-20 is truly up-right from the front (or rear) view.
18. Cut the top block (2 x 2 3/4 x 16) to sideview and glue on top of F-31 and 32, centered carefully.
19. Locate the fin L.E. block (7/8 x 2 1/4 x 8) and cut to side view shape. Glue to the top block. Check that sweepback angle is as per plans (try V-5 rib; if it fits between L.E. and F-20, all is well).
20. Shape and tap the maple block for the TW retraction cylinder. Glue block to V-1, screw cylinder in place, connect air lines to cylinder. These will need to be long enough to reach F-4. Glue V-1 in place, also glue a small scrap of balsa bridging the space between V-1 and the stab. Now glue in the rest of the fin ribs, inserting the rudder-drive bellcrank as you go. Some of the holes in the ribs will need to be enlarged for good clearances. Insert the rudder-drive cable, assemble Swingee

pushrod. Test the assembly. Feed the TW air lines thru holes in formers cut to suit them. Leave front of air lines dangling at the wing opening for the time being. Note: When glueing the Swingee (not supplied - hobby store item) the hinge-line *must* line up with the rudder hinge-line.

21. Glue F-33 and 34 together and add in correct location on F-30. If you plan to install cockpit detail, cut away the section of F-30 from the rear of F-30 to the front of F-9.
22. Cut two strips of  $\frac{1}{8}$  sheet to  $\frac{1}{2}$ " wide and glue to formers F-4 to F-13 with its top edge level with the upper face of F-30. Also glue this strip to F-30 and the top rear block. This strip acts as a bridge, giving stability and strength to the fuselage structure until the rest of the side sheeting is attached later.
23. With the entire cockpit area now exposed and easy to work on, this is the time to add the cockpit detail. (Note for detail freaks: this is also the time to add any other internal details.)
24. Make and assemble the rudder onto the Swingee in the fin. Test movement; a whole lot of angle is not vital. If you have  $20^\circ$  or so each way, all is well. Join  $\frac{1}{16}$  panels to sheet the fin. When fin is sheeted add the tip block and shape L.E.
25. The sides of the fuselage from the crutch up can now be sheeted. Join enough  $\frac{1}{8}$  sheet together to allow the whole side skin to be cut to shape and glued on as one piece. Before

actually glueing, check the "loft" of the bulkheads to be sure that the sheet will lay smoothly. Do this with a straight edge. Sand away at any formers that appear "proud." In particular, F-9, being at an angle, has some extra width to allow the precise final shape needed to be sanded in. When both sides are sheeted, carve the top block to shape, then remove the body from the jigs.

26. With the fuselage supported upside-down on the bench, add the lower rear corner strips. Install elevator, rudder & TW steering servos. Test these functions.
27. Join sheets to make bottom from F-10 to rear and glue in place.
28. At this time the rest of the sides below the crutch, cowl blocks etc. can be added.
29. With the entire model now basically completed, no difficulties can now be encountered by doing things "out of sequence." Therefore, proceed from here in your own chosen order, fitting wing to fuselage, adding under-duct to wing (see sketch on plan) and other details such as wing fillets, ETC rack if desired, and so on.

Reference at this time to the enclosed Finishing Booklet will give you some good ideas regarding making wing fillets, landing-gear doors, etc.

