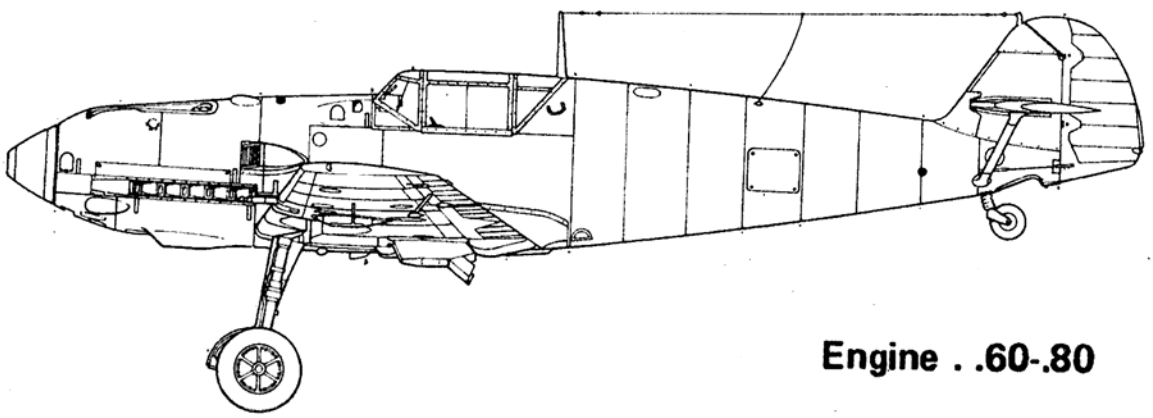
# ME 109E
# MESSERSCHMITT



Engine . .60-.80

# BUILDING PROCEDURES

ROYAL
PRODUCTS CORP.

# INTRODUCTION

Thanks for having purchased a Royal Products kit. We think you'll have fun building and flying it.

Built "box stock", the model will be competitive in Sport Scale contests. Or if you choose to expend a little more effort, your Royal model can be the starting point for a "museum scale" miniature aircraft. In any event, you'll have a model that looks like the "real thing"--a model to be really proud of.

In case you're contest-minded, we've included a 3-view on the drawings and a few references, here in the construction sequence booklet. Check the references for color and markings information, plus other data you'll need for your "scale presentation". One of the best sources for scale information may be found among the PLASTIC kits at the hobby shop. Even if you intend to build your Royal kit for "Sunday flying", the scale detail molded into the average plastic model surpasses most modelers' ability to duplicate in R/C. And, the instruction sheet in most plastic kits will provide drawings, color data and, often, photographs.

It's a good idea, before you actually begin construction of your Royal kit, to spend some time studying the drawings. It'll help, as you study, to locate the various parts: formers, ribs, shaped blocks and hardware items in the kit box. With a felt-tipped pen, identify the major components of the model (Like: number the wing ribs as you remove them from the die-cut sheets of balsa). This'll help prevent construction errors later on. While you're at it, read through our suggested construction sequence a couple of times. If you're like most of us R/C modellers, you'll "build the model in your head" before ever picking up a hobby knife or glue tube.

If you're an advanced model builder, you may wish to modify the kit by adding retracts, flaps or other operational features. If you do, pre-plan their installation. Sketch your changes on the plans and then note WHEN your modifications should be made within the construction sequence. It's easier, for example, to install hardwood bearers for a set of retracts BEFORE completely sheeting a wing. And--don't forget! As you plan your model's revisions, do consider the WEIGHT of the finished aircraft! Light ALWAYS flies better than heavy!

Certainly, there are a number of things you should have at hand before beginning construction of your Royal kit. An appropriate engine, the radio you intend to install, a propeller spinner (if one's required), a set of proper-sized wheels, a set of retracts (if you intend to install a retractable landing gear) and some push rods of your choice should be readily available as you proceed through the construction sequence. Choose your other

ACCESSORIES CAREFULLY (LIKE: A FUEL TANK) TO BE SURE THEY'RE COMPATIBLE WITH YOUR ROYAL MODEL --AND THAT THERE'S ADEQUATE SPACE FOR THEIR INSTALLATION. SINCE OUR DRAWINGS ARE FULL-SIZED, IT'S EASY TO "FIT" THE NECESSARY ITEMS TO THE MODEL.

SO--TAKE YOUR TIME, PLAN AHEAD AND YOU'LL HAVE A SCALE R/C MODEL THAT'LL LOOK GOOD AND FLY BETTER!

BEFORE WE GET TO THE BUSINESS OF "GLUING A TO B", WE'LL DISCUSS THE AIRPLANE AFTER WHICH YOUR ROYAL KIT WAS MODELLED, AND PROVIDE A FEW SCALE REFERENCES.

## THE MESSERSCHMITT BF 109-E3 "EMIL"

THE "EMIL", NAMED FOR THE "E" IN ITS DESIGNATION, WAS THE FIRST MAJOR PRODUCTION VERSION OF THE MESSERSCHMITT 109 FIGHTER. OUR MODEL REPRESENTS THE "3" MODIFICATION, BUILT BETWEEN EARLY 1939 AND MAY, 1940. TOGETHER WITH ITS SUCCESSOR (THE E4, WHICH FEATURES A MODIFIED, MORE ANGULAR WINDSHIELD AND COCKPIT CANOPY) THE "EMIL" FORMED THE BULK OF THE LUFTWAFFE'S SINGLE-ENGINED FIGHTER FORCE DURING THE BATTLE OF BRITAIN.

WHEN TESTED AGAINST ITS BRITISH CONTEMPORARIES (THE SPITFIRE AND HURRICANE), THE 109 WAS FOUND TO HAVE COMPARABLE PERFORMANCE. ALTHOUGH IT COULDN'T TURN QUITE AS TIGHTLY AS THE ENGLISH FIGHTERS, IT COULD GIVE A GOOD ACCOUNT OF ITSELF IN COMBAT WHEN IT WAS FLOWN BY A DETERMINED PILOT.

### SPECIFICATIONS:

| | | |
|---|---|---|
| ENGINE | DAIMLER-BENZ DB 601AA, V-12, 1,175 HP AT TAKEOFF | |
| ARMAMENT | TWO 20MM WING-MOUNTED CANNONS<br>ONE 20MM CANNON, ENGINE-MOUNTED, FIRING THROUGH THE SPINNER<br>TWO 7.9MM FUSELAGE-MOUNTED MACHINE GUNS | |
| DIMENSIONS | WING SPAN | 32 FT. 4½" |
| | LENGTH | 28 FT. 4½" |
| | HEIGHT | 12 FT. .05" |
| | WING AREA | 174 SQ. FT. |
| PERFORMANCE | MAXIMUM SPEED: | 357 MPH AT 14,560 |
| | MAX. CRUISE : | 300 MPH AT 13,120 |
| | NORMAL CRUISE : | 202 MPH |
| | STALL SPEEDS | 75 MPH, CLEAN |
| | | 61 MPH, WITH FLAPS EXTENDED |
| | SVC. CEILING : | 34,450 FT. |

### REFERENCES:


1. MESSERSCHMITT "O-NINE" GALLERY BY THOMAS H. HITCHCOCK, MONOGRAM AVIATION BOOKS, 1973

2. AUGSBURG EAGLE BY WILLIAM GREEN, MACDONALD, LONDON, 1971

3. THE MESSERSCHMITT 109, A FAMOUS GERMAN FIGHTER, BY NOWARRA AND OTHERS, HARLEYFORD, PUBLISHED IN THE U.S. BY AERO PUBLISHERS, INC., 1963

4. WARPLANES OF THE THIRD REICH, BY WILLIAM GREEN, MACDONALD, LONDON, 1970

# FUSELAGE

A VARIETY OF CONSTRUCTIONAL TECHNIQUES ARE FOUND IN THE BF 109 FUSELAGE. THE BASIC STRUCTURE CONSISTS OF SLAB SIDES AND PLYWOOD FORMERS. LATER ON IN THE CONSTRUCTION SEQUENCE YOU'LL BE CALLED ON TO PLANK THE FORMERS AND FORM A FEW BALSA BLOCKS. WORK SLOWLY AND KEEP THE FUSELAGE ALIGNED.

1. LOCATE AND MARK THE KIT PIECES DESIGNATED "F" ON THE DRAWINGS.

2. PLACE FUSELAGE SIDES, F-16, OVER THE PLANS AND GLUE TOGETHER. NOTE THEY APPEAR "BENT" AFT OF FORMER F-5.

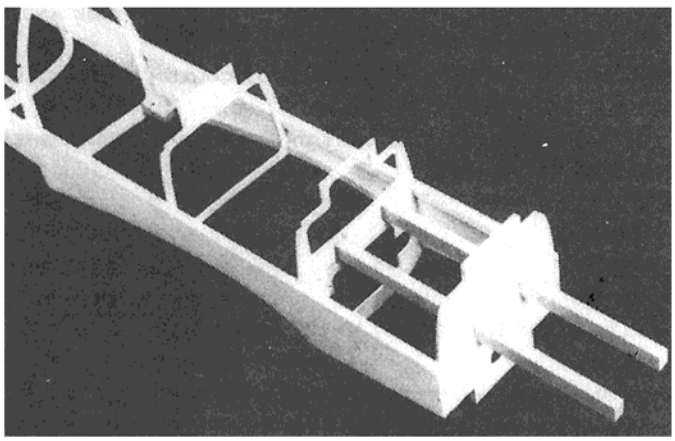
3. GLUE F-12'S, PLYWOOD DOUBLERS, TO FUSELAGE SIDES. MAKE A LEFT AND RIGHT SIDE!

4. MARK ALL FORMER (BULKHEAD) POSITIONS ON THE FUSELAGE SIDES.

5. GLUE TWO F-2'S TOGETHER TO FORM THE FIREWALL. EXAMINE FORMERS F-2 AND F-3 CAREFULLY AND MARK THEM. WHEN F-2 AND F-3 ARE PROPERLY MOUNTED (LATER) TO THE FUSELAGE SIDES THEY WILL PRODUCE RIGHT THRUST IN THE ENGINE MOUNTS.

6. BEGIN FORMING THE FUSELAGE BY GLUING FORMERS F-2, F-3 AND F-4 IN PLACE BETWEEN THE FUSELAGE SIDES. MAKE SURE THE PLYWOOD DOUBLERS ARE INSIDE.

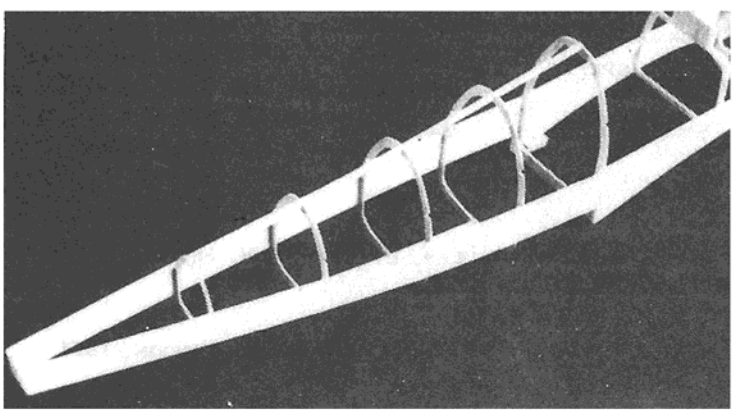
7. SLIDE ENGINE MOUNTS (EM) IN PLACE--CHECK FOR THE PROPER RIGHT THRUST (LOOKING DOWN ON THE MOUNTS) AND EPOXY THEM IN PLACE.



8. EPOXY THE THREADED HARDWOOD WING BLOCKS TO THE FUSELAGE SIDES.

9. GLUE F-5 IN PLACE. WHEN IT'S DRY, PULL THE REAR ENDS OF THE FUSELAGE SIDES TOGETHER AND GLUE--WITH F-11 BETWEEN THEM. CHECK CONSTANTLY FOR FUSELAGE ALIGNMENT.

10. ADD FORMERS F-6, F-7, F-8 AND F-9. KEEP THE FUSELAGE STRAIGHT!



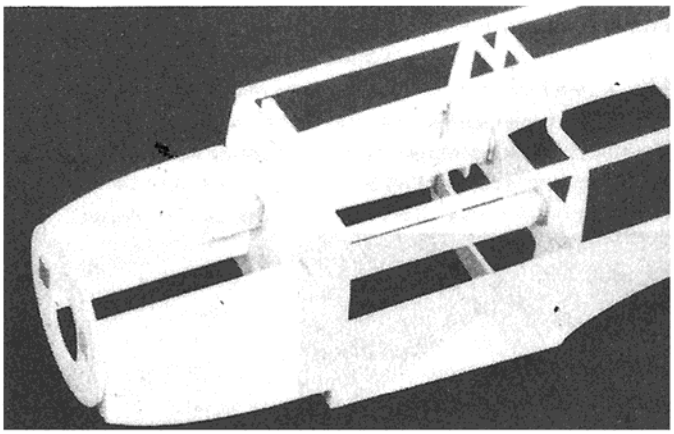
11. GLUE THE 3/16TH SQUARE BALSA STRINGERS IN PLACE, BETWEEN FORMERS F-5 AND F-9, TOP AND BOTTOM.

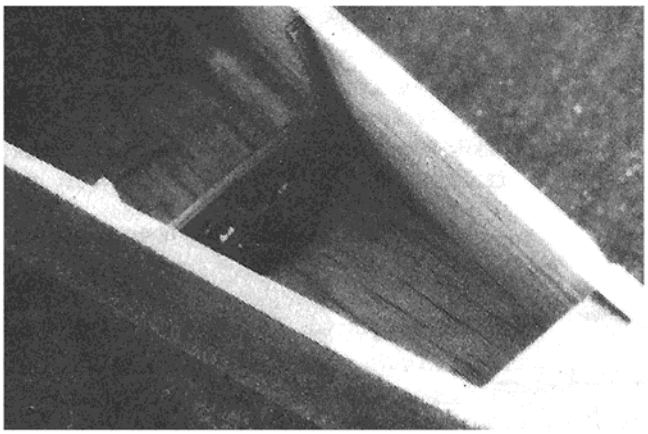
12. Drill the necessary holes in F-10 for the tailwheel assembly. Mount the tailwheel temporarily in place to check the fit and then remove it until we've planked the rear of the fuselage. Epoxy the mounting nuts in place (or use blind nuts) to facilitate re-mounting of the tailwheel. Glue F-10 into place.

13. Glue the long 3/16th square balsa stringers from former F-2 to F-8. These stringers run along the base of the cockpit canopy.

14. Fit F-17's in place and glue. Note these balsa blocks are right and left-handed.

15. Place--don't glue--F-1 in position on the front of the fuselage. Fit the engine--with the propeller and spinner attached--to the engine mounts. Drill the engine mount bolt holes and install blind nuts. Note that the engine mounts <u>beneath</u> the engine bearers (it's inverted). Jiggle F-1 until it centers on the spinner back-plate and then glue it into position. Remove the engine after locating the holes on F-2 for the throttle push rod and the fuel line. Drill appropriate holes at the location marked.





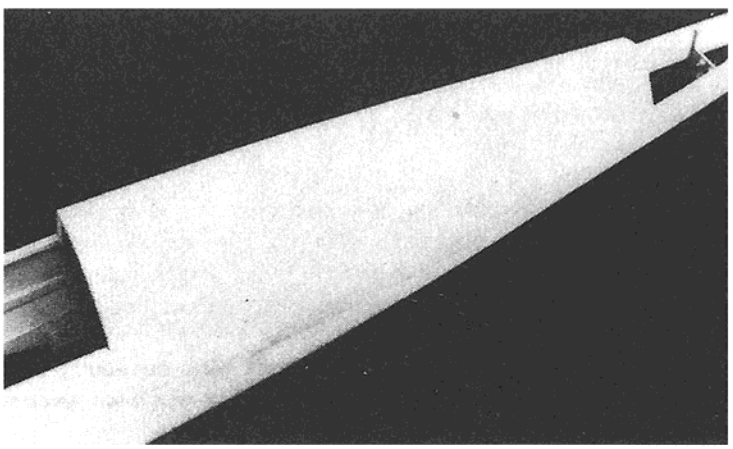
16. Glue F-20 in place as shown on the plans. Note that the aft end of F-20 overhangs F-4 by a tad over 1/4".

17. Re-glue all formers and stringers at this point. It'll strengthen the structure at little increase in weight.

18. Using a sanding block, sand the stringers to conform to the formers. We're going to sheet the fuselage now and we want it to fit with a minimum of bumps or gaps.

19. Cut and fit the 1/8" sheet balsa sheeting that runs from F-2 to F-9, above F-16 and even with the 3/16th square stringer beneath the cockpit. Brush some water on the <u>outside</u> of this sheeting if it doesn't bend easily. Slow and easy does it--because we don't want to pull the fuselage out of line! Give the glue plenty of time to dry before proceeding.

20. Plank the upper rear fuselage (between F-5 and F-9) with balsa strips cut from 1/8" planking. Add strips to the fuselage sides, alternately, to retain alignment.



21. Glue F-25 and F-26 together. While they're drying, glue F-14 and F-15 in place, using F-24's as spacers.

22. Bevel the front edge of F-25/F-26 and glue in place. Glue the lower, plywood portion of F-14 in place.

23. Plank the lower, rear portion of the fuselage between F-6 and F-9 with 3/8" balsa strips.

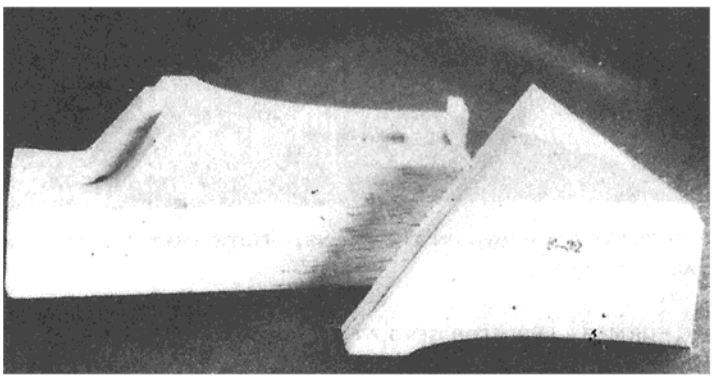
24. Glue F-33's and F-34 in place. Tack-glue F-35 in place--we'll have to remove it later to install the tailwheel assembly.

25. Glue F-22's and F-13 in place, on the bottom of the fuselage, forward of the wing cut out. Glue F-23 to them.

26. Assemble cowling parts C-1, C-2, C-3 and two C-4's. The C-4's are tack-glued to the F-17's--the rest of the cowling can be glued permanently (it'll be removable later for access to the engine!).

27. Glue blocks F-18 and F-19 in place as well as blocks F-21.

28. Since the lower portion of the fin is really a part of the aft fuselage, it's assembled at this time. Glue two parts F-29 to F-27 (lower fin leading edge) and to F-28. Note that the notch in F-28goes forward and its back is flush with the rear of F-29. Glue the lower fin in place, aft of F-9, and to the top of F-16.

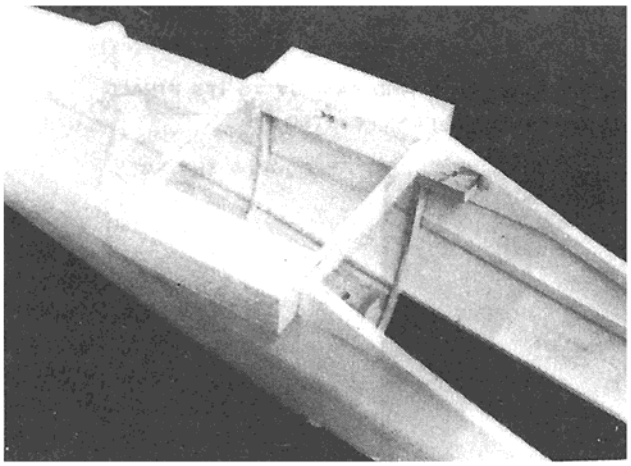


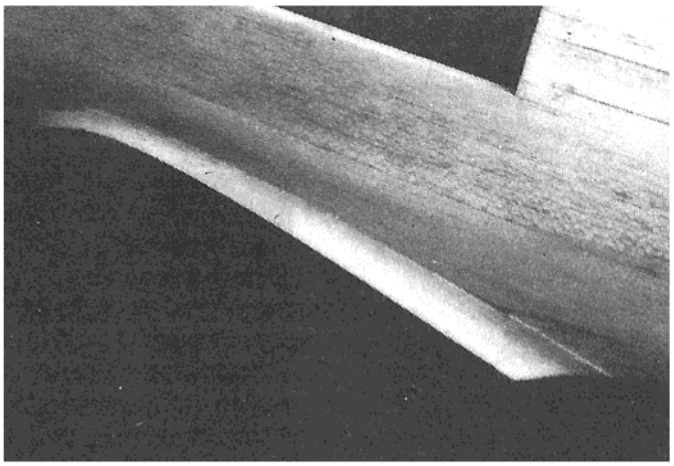
29. 'Tis SANDING TIME! There's not a draftsman alive who can draw the subtle, streamline shapes you're about to produce. He'd be limited to two dimensions and you're going to create a three-dimensional balsa and plywood structure. Use a new, sharp long-bladed knife to remove the corners of the balsa blocks. If you're so inclined, use a razor-plane to follow-up the knife. "Play" the balsa's grain--carve <u>with</u> the grain and avoid chipping or gouging. It helps a lot if you refer to photographs of the "real airplane" as you shape the fuselage. When the blocks look like they're at about the same degree of "roughness" as the planked portions of the fuselage, put the knife away and pick up your sanding blocks. Within reason, start out with the heavier grits--which will establish the basic shapes. Graduate to finer and finer papers as the fuselage begins to "shape up". Pay particular attention to the cowling area, because there are rounded places and flat places to be formed. And, form the fin's leading edge carefully. Flow it into the fuselage.

30. "Pop" F-35 loose, install the tailwheel (and, if you're building a steerable tailwheel, the tailwheel push rod--it'll go to the rudder servo) and re-glue F-35 in place permanently.

31. Position the <u>trimmed</u> cockpit canopy in place atop the fuselage and mark the rearward-slanting portion of the cockpit. Remove the canopy and trim the fuselage away, just forward of the line you drew. "Face" the trimmed area with a bit of 1/8" sheet balsa and sand it to conform to the fuselage contour.

32. Glue wing filets, parts F-36 and F-37 above the wing cut-out, on each side of the fuselage. Don't try to form them now--we'll do it when we have the completed wing in place.





33. Fit radiator, F-38 in place. By wrapping a bit of fine sandpaper under the formed F-22, F-23 area and working F-38 back and forth, you'll probably get a good fit. Glue F-38 in place, and sand it to shape. Might find you'll need a bit of wood filler to fair the radiator into the nose of the model.

34. Now's the time to detail the nose of the Messerschmitt. If you're going to fiberglass the fuselage, now might be the time. Use a light cloth and--easy on the resin. Add F-41 and the 5/16" dia. aluminum exhaust pipes*; F-39 (the carb air intake--after bevelling its front edge and trimming it to streamlined shape); F-40 (the "bumps" that cover the breeches of the fuselage-mounted machine guns); and groove F-20/F-21 for the guns' blast tubes. Gun muzzles can be simulated with bits of brass tubing or birch dowels.

35. "Pop" the C-assembly loose, reinstall the engine and carve the interior of the cowling to clear the cylinder, the push rod, the fuel line and the carb. Install the lower front cowling using your favorite method. It can be "pinned" with dowels for alignment and held in place with everything from rubber bands (ugh!) to Dzus fasteners. Make sure you have access to the glow plug and the needle valve!

36. You may have "sanded through" F-18 in forming the nose contours. Back up the hole with a bit of scrap balsa--and make sure you sand the nose to "flow" into the spinner.

37. Of course, it's a matter of preference, but now's a good time to install the fuel tank and the radio. The fuel tank--and, possibly the battery pack--goes between F-2 and F-3. Depending on your radio, the receiver and servos may be installed between F-3 and F-4. Elevator and rudder pushrods can be cut to their approximate final length and pushrod holes cut in the aft fuselage.

38. Put the fuselage aside--where it can't acquire "hangar rash" and let's get on with the tail surfaces.

## RUDDER

1. After identifying and marking the parts that make up the BF 109's rudder, draw a vertical line fore and aft on R-1. Mark the positions for the rudder ribs on the aft side of R-1. Locate and mark the centers on each of the rudder ribs.

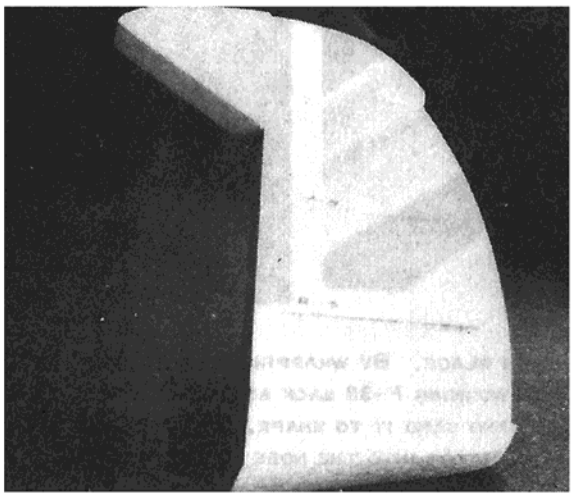
2. <u>With R-1 resting on its leading edge</u>, glue rudder ribs perpendicular to its rear edge. Use a small triangle to make sure each rib is "square" to the spar (R-1) and align each rib with the vertical center-line you drew in 1. Remember, we will sheet the rudder with 1/16" balsa.

3. Sheet one side of the rudder and when dry, bevel trailing edge to accept opposite sheeting. Use the ribs as a guide.

4. Sheet other side of the assembly. Bevel sheeting before you glue in place so that the trailing edge sheets fit together. Shape R-1's leading edge as shown in fuse top view--from bottom of R-8 to base of rudder.

5. Glue R-6, R-7 and R-8 in place.

6. Put rudder aside for the moment. We'll hinge it to the fin and sand it to its final shape after the stab is glued in place and the upper fin is constructed.



## STABILIZER/ELEVATOR

1. Identify and mark the stab parts. Draw centerlines on the front and rear sides of the spar as well as the locations of the stab ribs on the <u>front</u> of the spar, S-1. Draw centerlines on the rear edge of each stab rib.

2. <u>With S-1 resting on its trailing edge,</u> glue the stabilizer ribs, S-5 through S-10 in place after you've glued S-4 to the forward center of S-1. Use the small right triangle to get the ribs square with the spar--and align the ribs with the spar's centerline.

3. Install and glue S-3 between ribs S-6 and in the slots in the leading edges of ribs S-5.

4. Glue stab leading edges, S-2 in place.

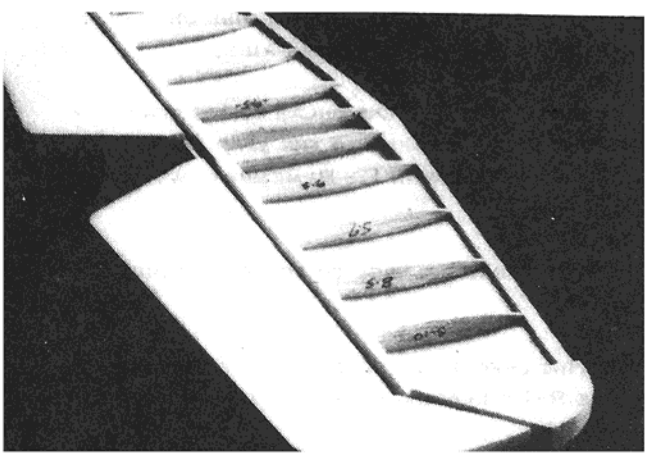
5. Sand the stabilizer/elevator assembly to the streamlined cross-section shown on the side view drawing.

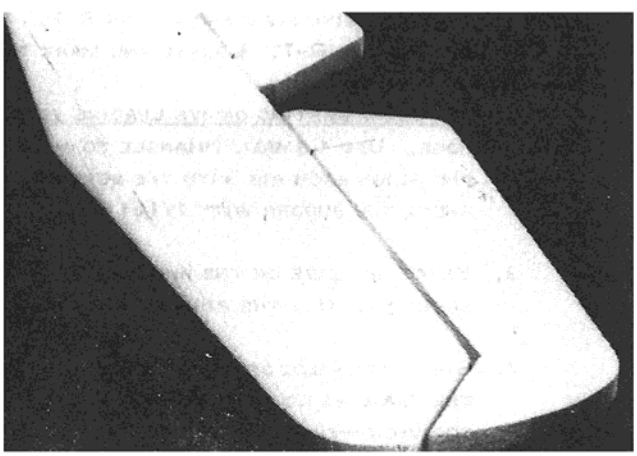
6. Sheet the stabilizer with 1/16" balsa and sand to airfoil shape. Mark the fore/aft stab centerline on the stab, perpendicular to the stab spar. Don't forget to bevel the trailing edge of the sheeting for a good glue joint.

7. Glue S-11's in place. Sand to shape

8. Glue S-13's to S-12's.

9. Hinge the elevators to stabilizer, but do not glue until after plane is completed. Insert the elevator--connecting U-shaped music wire joiner. Do not epoxy the wire in place yet, as this should be done upon completion of aircraft.





## ASSEMBLING THE STABILIZER/ELEVATOR TO FUSE

THIS BIT OF CONSTRUCTION IS A TAD DIFFICULT--BECAUSE WE HAVE TO MAKE SURE OF THE STAB'S ALIGNMENT IN THREE DEMINSIONS. THERE ARE A LOT OF WAYS TO DOING IT--YOU MAY KNOW OF A BETTER WAY. IN ANY EVENT, TAKE YOUR TIME AND FIT THINGS PROPERLY BEFORE REACHING FOR THE GLUE.

1. THE STABILIZER MUST, IF YOU'RE LOOKING AT IT FROM THE FRONT OR THE REAR OF THE MODEL, BE SQUARE WITH THE FIN AND MAINTAIN A $1^{\circ}$ POSITIVE INCIDENCE ANGLE.

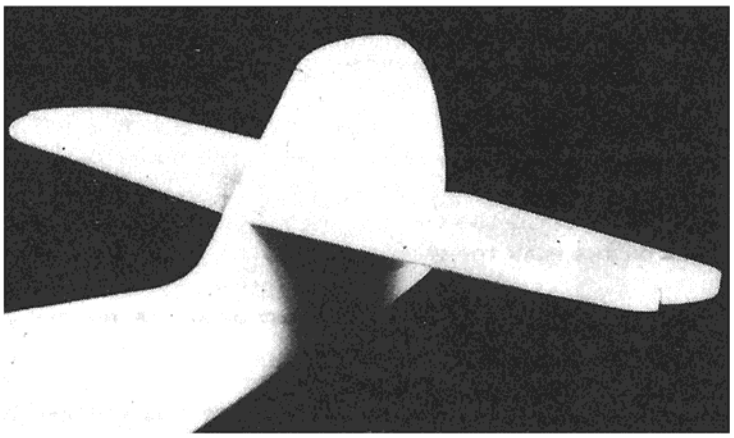
2. WITH A COUPLE OF RUBBER BANDS, LASH A COUPLE LENGTHS OF WOOD ACROSS THE WING SADDLE. THIS IS TO GIVE YOU A "LINE" SO THAT THE STAB WILL BE PARALLEL TO THE WING.

3. BLOCK UP THE FUSELAGE ON THE WORK BENCH SO THAT THE BITS OF WOOD YOU'VE BANDED ARE AT EQUAL HEIGHTS FROM THE BENCH SURFACE. MAKE SURE THAT THE FIN PORTION OF THE AFT FUSELAGE IS STRAIGHT UP AND DOWN (PERPENDICULAR TO THE WORK BENCH). SANDBAGS, HUNKS OF LEAD, GLUE TUBES, DOPE BOTTLES--ANYTHING CAN BE USED TO IMMOBILIZE THE FUSELAGE ON THE WORKBENCH. JUST MAKE SURE THAT THE FUSELAGE ISN'T FREE TO FLOP AROUND.

4. CAREFULLY, FIT THE STABILIZER TO THE AIRFOIL-SHAPED CUT-OUT IN THE TOP OF THE F-29'S. IT MIGHT BE A GOOD IDEA IF YOU REMOVED THE ELEVATOR FOR THIS FITTING PROCESS. WHEN THE STAB FITS THE FUSELAGE EXACTLY, AT $1^{\circ}$ OF POSITIVE INCIDENCE, EPOXY IT IN PLACE WITH SLOW-SETTING EPOXY. TRIPLE-CHECK EVERYTHING--AND THEN GO AWAY FROM THE MODEL FOR AT LEAST THREE HOURS!

5. BACK ALREADY? IF THE EPOXY HAS WELL AND TRULY SET, FIND S-14 STABILIZER STRUTS. CUT THEM TO LENGTH AND SAND 'EM TO A STREAMLINED CROSS-SECTION. IF YOU REGULARLY FLY FROM GRASS, YOU MIGHT CONSIDER ELIMINATING THE STAB STRUTS. IF YOU ARE GOING TO USE THEM, DON'T GLUE THEM IN PLACE UNTIL YOU'RE READY FOR FINISH PAINTING.

6. YOU CAN RE-HINGE THE ELEVATORS NOW. CUT A NOTCH FOR THE CONNECTING MUSIC WIRE IF THERE'S NOT ENOUGH CLEARANCE IN F-28.



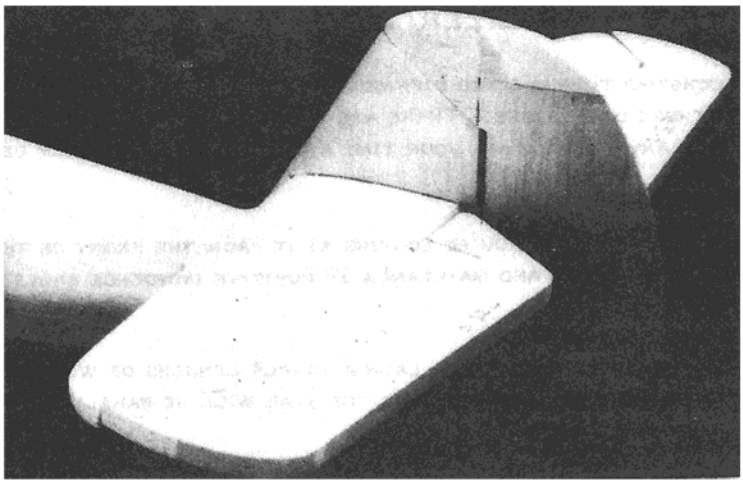
## COMPLETING THE FIN

1. GLUE AN F-32 TO EITHER SIDE OF BOTH F-30 AND F-31--AND LET THE ASSEMBLY DRY.

2. CAREFULLY TRIM THE BOTTOM OF THE F-32'S TO FIT THE TOP SURFACE OF THE STABILIZER. WHEN IT'S RIGHT, THE FIN'S LEADING EDGE WILL BE A STRAIGHT LINE AS WILL THE REAR EDGE. THE TOP HALF OF THE FIN'S SPAR WILL LINE UP WITH THE BOTTOM HALF. WHEN IT DOES, GLUE THE TOP HALF OF THE FIN IN PLACE.

3. HINGE THE COMPLETED RUDDER TO THE FIN.

4. SAND THE FIN AND THE RUDDER TO THE STREAMLINE SHAPE SHOWN IN THE TOP VIEW DRAWING.



## WING CONSTRUCTION USING A WING JIG

As you will notice, the wing ribs of the BF 109E are semi-symmetrical. Building the wing on a flat board, therefore, is rather difficult--if it is to be constructed without warps. We heartily recommend that the two wing panels (right and left) be constructed on a WING JIG. Several good jigs are available, and we suggest you check with your local hobby dealer to determine which is best suited to your needs.

1. Identify and mark each of the pre-cut wing ribs in the kit. Following the instructions for your wing jig, drill the appropriate jig rod holes in each rib (it's best if the rods fall fore and aft of the main wing spar).

2. Add the wing ribs (from W-1A through W-12) to the jig, adjusting the rib spacing, as shown on the plans. If your jig will hold the entire wing at one time, build both panels at the same time. Otherwise, build one panel (right and left!) as we now indicate.

3. With the ribs properly aligned, glue the 1/8x3/16" hardwood main wing spars and spar doublers into the notches on top and bottom of the ribs per wing detail view.

4. Glue wing rib ply doublers (W-18 and W-19) to ribs W-2 and W-3 respectively. The notches in W-18 and W-19 go "down".

5. Glue the 3/32" sheet balsa shear webs between the top and bottom spars at the locations noted on the plan top view of the wing.

6. Glue W-15, the leading edge, to the front of all of the ribs, making sure that it is aligned with all of them.

7. Glue the aileron bellcrank hardwood braces to ribs W-8 and W-9. Epoxy the aileron bellcrank mount (W-17) in place, after you've installed the bellcrank beneath it.

8. Sheet the top of the wing with the 3/32" balsa sheeting. Note that the sheeting overlaps the leading edge (W-15) and extends beyond the aft end of each rib about 3/8" Trim the aft-most sheeting strip to locate the trailing edge of the wing panel properly.

9. Let the entire wing panel(s) dry--at least overnight!

10. Remove the wing panel(s) from the wing jig. We're now going to work from the BOTTOM of the wing.

11. Chamfer the wing's trailing edge--so that when we add the bottom sheeting (later!) the trailing edge will taper to an almost-knife edge. Use a knife with a sharp blade and/or a sanding block to get a smooth chamfer.

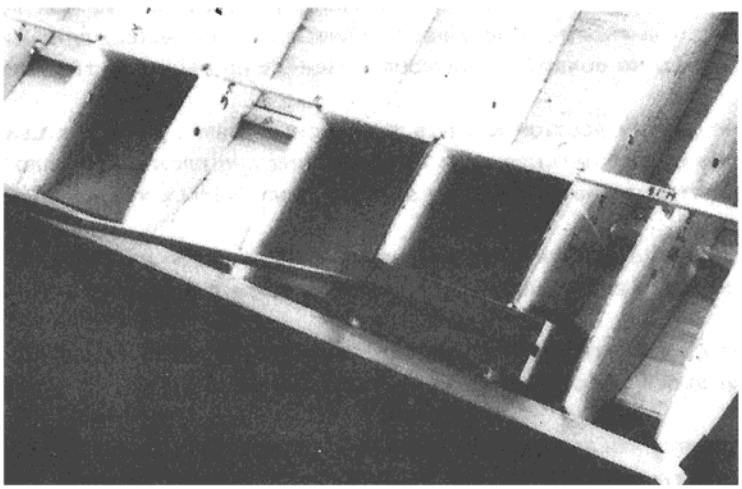
12. Carefully cut ribs W-9 through W-12 up to top sheeting, so that aileron spars and aileron wing spar may be glued into place after the wing is completely sheeted. Remove all of rib W-9 aft of the aileron spars and glue ply aileron rib W-23 in its place. Add two aileron ribs W-22 at the inboard end of aileron on either side of the to-be-cut line. Note the measurements you had to make to locate the aileron dimensions, because when you cut the ailerons away from the wing structure, when the lower wing sheeting is in place, you're going to have to relocate the aileron hinge line! Use of pin holes punched through the sheeting is a big help here.

13. Glue the 3/16" square balsa aileron hinge doublers fore and aft of the aileron spars, as shown on the plans. Locate them at the top of the spars, after sanding them to conform to the airfoil shape. Since everything's upside-down at this point, make sure you glue the hinge doublers to the spars <u>and</u> the top sheeting.

14. Remove the aft end of rib W-1B and epoxy W-34 in place.

15. Clear slots, fore and aft of the main spar, for the plywood wing joiners W-13, and epoxy them in place. Do the same at the leading edge and epoxy W-14 to W-15.

16. Carefully trim ribs W-2 and W-3 to remove the balsa in the area where there's a rectangular notch in the plywood doublers. The landing gear mounting blocks (W-20 and W-21) will fit between these two ribs. It's a good idea to fit the bent landing gear wires into the mounting blocks <u>before</u> gluing them together or to the wing structure. With everything lined up, pre-install the landing gear retaining straps. Remove the wire from the hardwood blocks and epoxy the blocks into position in the wing. If you intend to use retracts, install them at this time (see special retract installation instructions on the plans).

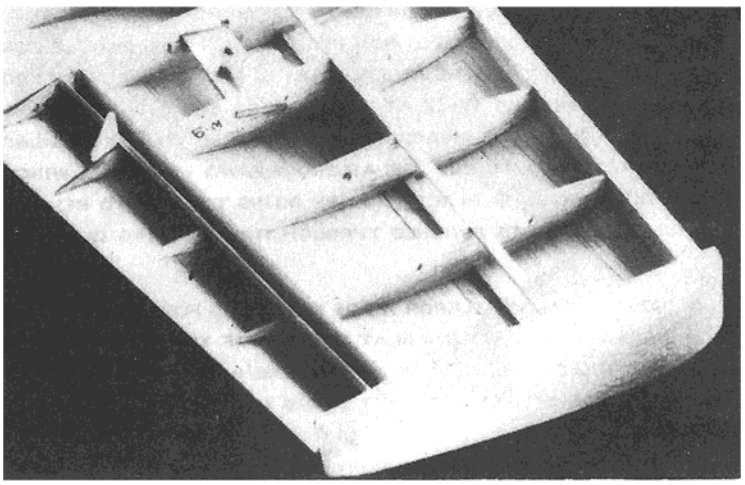


17. Install the aileron horn, to W-23, as shown on the drawings. Align the aileron bellcrank with the inner arm parallel to rib W-8 and install the aileron pushrod.

18. Install the servo-to-aileron bellcrank pushrod. Each intervening rib will have to be drilled to accept this rod--so keep things aligned.

19. Sheet the bottom of the wing. Remember to chamfer the bottom sheeting where it'll meet the top sheeting at the trailing edge. You'll have to cut clearance slots for the aileron pushrod and the aileron horn. Properly done, the wing's trailing edge will be about 1/16 of an inch thick for its entire length.

20. Using the measurements you recorded in Step #12, cut the ailerons away from the wing structure. Note that the ends of the ailerons are perpendicular to the trailing edge! Taper the leading edge of the aileron to conform to the "AA" cross-section and remember to allow for the thickness of the W-24 aileron and wing spars when measuring and making your cut. Glue wing and aileron spars in place. Shape aileron spar as shown on "AA" cross-section on plans. Then, hinge the aileron to the wing; do not glue hinges in place yet.



21. With the aileron in place, glue the wing tip--W-25--in place. Sand the tip to conform to the airfoil but wait until the wing is completely assembled before rounding it to its finished shape.

22. If you've built only one panel, repeat steps 2 through 21 above. MAKE SURE THAT YOU'RE MAKING THE "OTHER HALF" OF THE WING! The model won't fly very well with two left-hand wing panels!

23. With both wing panels in hand, epoxy 'em together. Note that W-14 and both W-13's fit into the "other panel and that ribs W-1A are epoxied together. A bit of sanding, particularly of the inboard ends of the wing sheeting, may be necessary to get a good fit. Note that the proper wing dihedral angle ($8^{o}$ per panel) will raise <u>each panel</u> 4" above the building board. Take your time--avoid twisting the wing.

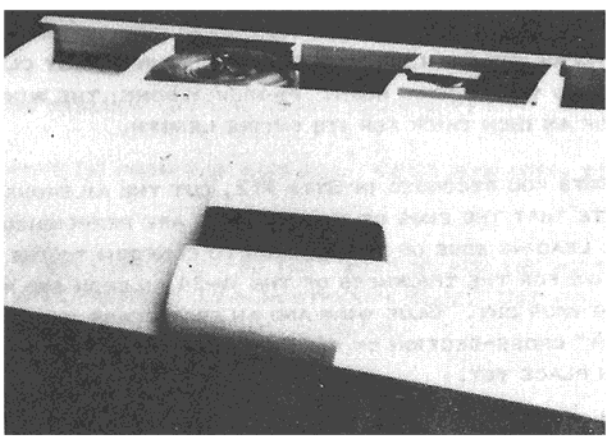
24. When the wing center section joint is thoroughly "dry", trim the leading and trailing edges as shown by the hatched area on the plans and epoxy W-29 and W-30 in place. This is a good time to notch the top sheeting and install the aileron servo.

25. Reinforce the wing's center-section with a 2-3" strip of fiberglass. Apply the "glass" with either epoxy or resin, centering it on the center line.

26. Sand the wing so that the entire surface is smooth. Round and finish the wing tips. Use a sanding block here, to avoid any hills and valleys in the wing.

27. If it's your desire, "glass" the assembled wing with a light fiberglass cloth and resin. Easy on the resin!

28. Glue the underwing radiator assemblies (W-26, 27 and 28) to the bottom of both panels, as shown on wing top view. Sand the radiators to the cross-sections shown. Add the wing cannon "bumps" (W-32) to wing bottom and sand 'em to fair smoothly into the wing surface. Drill the leading edges for the wing cannons--but don't glue them in place yet. They might break off as you handle the wing.



29. DON'T DRILL THE WING FOR THE FORWARD HOLD-DOWN DOWELS OR THE WING HOLD-DOWN BOLTS UNTIL YOU'RE READY TO FIT THE WING TO THE FUSELAGE. YOU CAN GLUE W-31 TO THE BOTTOM OF THE WING, BUT WAIT UNTIL THE WING AND FUSELAGE ARE MATED TO SAND IT TO SHAPE.

## WING CONSTRUCTION WITHOUT JIG

1. TRIM W-1 LOWER SPAR TO PROPER LENGTH AND PIN IN PLACE OVER PLAN.
2. ADD SPAR DOUBLER.
3. PIN W-3 TO W-12 IN PLACE, ADD TOP SPAR AND DOUBLER. NO GLUE YET.
4. PIN LE W-15 IN PLACE.
5. SIGHT ALONG TE OF RIBS TO INSURE THAT THEY ARE STRAIGHT.
6. INSTALL AND GLUE 3/32" SHEAR WEBS IN PLACE. GLUE ALL RIBS AND SPARS AND LE IN PLACE. REPEAT FOR OTHER WING HALF.
7. THIS ASSEMBLY WILL NOW ALLOW YOU TO UNPIN THE WING FROM THE PLANS.
8. TRIM RIBS W-1A, W-1B AND W-2, AS NECESSARY FOR FIT OF W-13, W-14 AND W-34.
9. TRIAL FIT WING HALVES TOGETHER WITH W-13, W-14 AND W-34 IN PLACE. MAKE SURE YOU HAVE NO WARPS AND THAT DIHEDRAL IS CORRECT. WHEN SATISFIED, GLUE ALL PARTS IN PLACE.
10. GLUE W-17'S IN PLACE. ADD SCRAP HARDWOOD.
11. GLUE W-18, 19, 20 AND 21 IN PLACE.
12. SAND WING ASSEMBLY TO GET RID OF ANY KNOBS, BUMPS, ETC. THAT WOULD PRECLUDE A GOOD SHEETING JOB.
13. REFER TO JIG INSTRUCTIONS FOR SHEETING AND FINAL CONSTRUCTION. A NOTE OF CAUTION, WHEN SHEETING THE WING IN YOUR HAND--USE SOFT BALSA AND WET IT ON THE OUTSIDE, SO THAT IT WILL WRAP AROUND THE LE. WORK FROM THE LE AFT AND DO AN UPPER AND LOWER SURFACE TOGETHER. WATCH FOR ANY TWISTS OR WARPS--THEY CAN BE REMOVED AS YOU SHEET.

## ASSEMBLING THE WING TO THE FUSELAGE

THIS IS, AGAIN, ONE OF THE CRITICAL ASSEMBLY STEPS FOR YOUR BF 109. GOOD WING MOUNTING AND ALIGNMENT, LIKE THAT OF THE STABILIZER, WILL RESULT IN A GOOD FLYING MODEL. SLOPPILY DONE --YOU'RE ASKING FOR PROBLEMS! SO, TAKE YOUR TIME AND MAKE SURE THE WING IS NOT ONLY ALIGNED PROPERLY, BUT THAT IT FITS THE WING SADDLE WELL.

1. TEST FIT THE WING TO THE FUSELAGE. GROSS MISMATCHES WILL BE READILY APPARENT. A BIT OF JUDICIOUS TRIMMING OF THE WING SADDLE (THE BOTTOM OF F-16 AND F-36'S AND F-37'S) WITH A MODELING KNIFE WILL NARROW THE BIGGER GAPS. GENTLE TOUCHES WITH A SANDING BLOCK WILL REDUCE IT STILL FURTHER.

2. Drill the assembled wing at the locations shown on the wing drawing and insert two 1/4" forward wing holding dowels. Square 'em up to the wing spars and the airfoil's side view and epoxy them in place.

3. With the fuselage inverted, slip the wing partially in place and mark F-3 where the wing dowels will be inserted. Drill F-3 for wing dowels. Unless you're a bloody genius or a jeweler on a busman's holiday, the wing dowels won't fit the holes in F-3 exactly the first time you press the wing forward. There are a couple of solutions to this dilemma. The first is to ream out the holes in F-3 until the wing fits. This is bad news! Better enlarge the holes until the wing fits and then epoxy a couple of bits of plywood with 1/4" holes drilled in them--to the <u>front</u> side of F-3. Before the epoxy sets, do two things. First, make sure the wing is perpendicular to the fuselage center line, has $1\frac{1}{2}^{o}$ positive incidence and is parellel to the stab. Second, be ready to <u>tape</u> the wing in place. Use masking tape--and hold the wing in alignment. Use a <u>lot</u> of tape--it's cheap!

4. When the front edge of the wing is fixed in place, drill <u>down</u> through the threaded hardwood wing bolt blocks. Use a drill that's small enough that it doesn't cut into the blocks' threads. Remove the tape, and the wing from the fuselage. Carefully enlarge the wing bolt holes (a round, rat-tail file works well) until the wing bolts (nylon) just fit. If you're inclined, saturate the bolt holes and the balsa area surrounding them, top and bottom, with cyanoacrylate glue (Hot Stuff, etc.) Re-file the holes and sand the wing sheeting--you'll have a stable, solid bolt hole and bolt head bearing area!

5. Bolt the wing in place and begin snugging up the nylon bolts. Re-check the wing's alignment in all three planes--and achieve the final wing-wing saddle fit. When it pleases you, loosen the wing and tad and slip in a couple of pieces of typewriter paper (between wing and saddle).

6. Tighten the wing bolts again and form the wing filets. It's easiest if you begin the forming process by using a concave wood carving chisel. Watch the grain (of parts F-36, F-37) and groove the filets. They can be taken to the final cross-section, using sandpaper wrapped around dowels. Note that the filet is "continued" by F-25 and F-26--and is "blended" through them. Reference to wing filet photos will help immeasurably in this process!

7. If you nick or gouge or otherwise goof up the wing filet, cover the wing's center-section with some plastic (food) wrap and smooth things out with wood filler (micro-balloons and resin, etc.).

## DETAILS, DETAILS!

At this point in the construction sequence, we're going to turn you loose on your own. There are a number of things that will probably be common to most model builders--like: installing the landing gear legs. But we're not sure that you haven't gone the retract route. Of course, the canopy will have to be glued in place--but maybe you want to build in a bunch of cockpit detail first. Certainly, if you intend to enter your BF 109 in scale contest, you've got to build, paint and install a "pilot".

There's the rest of the radio installation to complete the pushrods to finish. And you may want to install the wing "cannons" and the scale radio antenna at the rear of the canopy. The ends of the stabilizer strut have to be filetted after they're glued in place and the plywood landing gear strut covers attached to gear legs. Certainly, you'll fill the gap at the wing's center section by gluing F-31 in place and sanding it to conform to the shape of the forward fuselage.

Before you get to the "finishing" process, it's a good idea to make a list of details that need to be completed before painting the model. Check 'em off as you complete them!

# RETRACT INSTALLATION

The Messerschmitt engineers didn't do us R/C modelers a favor when they designed the 109's retractable landing gear. Come to think of it, they didn't do Luftwaffe fighter pilots a lot of good, either. The landing gear on the "real 109" was a weak point in the design--gear legs often collapsed on landing. The narrow gear tread made the "Emil" a "ground loop looking for some place to happen"!

The gear on the 109 was mounted to a truss-like structure that was part of the airplane's fuselage frame. The gear legs splayed out 17° and were thrust forward when extended. They were swept-back 17° in the retracted position. We superimposed the scale gear on our drawings and came away with one very definite conclusion--NO WAY! Scaling everything drives the wheel right through the lower wing spar. That's no place for a 2" hole!

If we attempted to duplicate the scale gear tread, we'd end up with a model that would land like a bicycle! So, for the retract installation, we decided to increase the tread, cut the outward splay in half and align the struts with the main wing spar, when the gear's "up". Our final concession to practicality (over scale accuracy) was to shave the diameter of the landing wheels--from 3¼", which is scale for the fixed gear version of the model, to 3" for the model with retracts.

Our retract installation drawing shows Royal mechanisms. If you intend to use other types of retracts, draw them in place to see how they'll fit. The retracts are installed at the same point in the wing's construction sequence as the fixed gear.

1. Carefully cut 4 pieces of spruce or maple mount stock, 3/16"x1/2" to fit between ribs W-2 and W-3. There should be a good, friction-fit between the ribs.

2. Fit these retract mechanism mounts to the retracts. Note that the rear mount will have to be trimmed to clear the spring coil of retract leg and the bolt head on the inboard end of the retract. The front mount will be trimmed to clear a bolt head and the pivot.

3. Press the mounts between W-2 and W-3 after cutting a gear leg slot (about 3/8" wide and 1/2" deep) in W-3 and a 2-1/4" wheel well in W-4.

4. Insert the retract, with the mounting flanges below the wood mounts, with the inboard side of the retract 1/16" outboard of W-2. Tack the retract to its mounts with a drop of cyanoacrylate glue (Hot Stuff, etc.).

5. Add a Royal's adjustable axle to the end of the retract's leg, and position a 3" wheel on it. With the gear extended, make sure that the wheel tracks fore and aft (with a slight bit of toe-in). Retract the gear leg and trim rib W-4 to clear the wheel when the gear leg is parallel to the main wing spar.

6. You can "jiggle" the retract and its mount so that, when the wheel is retracted, its "plane" parallels the lower surface of the wing. When it does, epoxy the mounts to ribs W-2 and W-3. After the epoxy sets, install some bits of 1/8" plywood (from the die-cut sheets) to reinforce the retract mounts where they "meet" the ribs. Of course, you'll have to cut a wheel well out of the lower wing planking.

# THE FINISH WORK

THE CONSTRUCTION PHASE CONCLUDED WITH THE REMAINING PARTS BEING STUCK ONE TO ANOTHER AND/OR "SHAPE" SANDED. THIS PILE OF PARTS WHICH MAY RESEMBLE AN AIRPLANE DEPENDING ON ARRANGEMENT MUST NOW BE FINISHED TO SATISFY THE GOAL.

ONE OF THE KEYS TO A GOOD FINISH IS SAND, SAND, SAND, DUST IT OFF AND SAND ONCE MORE. REMEMBER THAT, AS IT'S IMPORTANT. THE FIRST SANDING IS DONE WITH ROUGHER OPEN COAT SAND PAPER (I PREFER ALUMINUM OXIDE OR GARNET PAPER) 280-320 RANGE. I GLUE MINE TO 1"X4"X12" BLOCKS WITH SPRAY CONTACT ADHESIVE OR "STICKY BACK" BY SCOTCH. IT'S BEST TO SAND ALL COMPONENTS PRIOR TO FINAL ASSEMBLY AND IS ALSO MUCH EASIER. THE NEXT SAND IS DONE WITH 320-400 GRIT PAPER. AFTER THIS STEP TAKE A GOOD REST, THEN COME BACK AND SAND UNTIL TIRED AGAIN. NOW WIPE THE PLANE DOWN WITH A CLEAN SOFT RAG AND CHECK IT FOR SEAMS, LOW SPOTS, AND SYMMETRY. THEN SAND ONCE MORE WITH THE 400 GRIT.

IF YOU PLAN TO "MONOKOTE" YOUR EYEBALL SCALE, IT IS DONE AT THIS STAGE ON BARE WOOD AND IN ACCORDANCE WITH THE DIRECTIONS FURNISHED WITH THE "MONOKOTE". AFTER IT'S ALL MONOKOTED, GO TO THE FINAL ASSEMBLY STEP.

IF YOU PLAN AN ULTIMATE SCALE JOB FINISH YOU MUST PAINT IT 'CAUSE NO REAL AIRPLANES ARE MONOKOTED. (TOO BAD, THOUGH!) YOU MUST DECIDE WHAT TYPE HINGES YOU WILL USE NOW BECAUSE IT MAKES A DIFFERENCE. IF YOU ARE GOING TO USE HINGES WITH REMOVABLE HINGE PINS, THEN INSTALL ALL HINGES AND CONTROL RODS, LINKAGE, RADIO GEAR, (ACCORDING TO MANUFACTURERS INSTRUCTIONS) ETC., AT THIS TIME. THEN DISMANTLE IT AND COVER IT INDIVIDUALLY. IF YOU ARE TO USE "HIDDEN" HINGES (LIKE THE NO GLUE MOLDED NYLON ONES) THEN COVER ALL THE SEPARATE PIECES AND THEN ASSEMBLE THEM.

TO PREPARE THE MODEL FOR COVERING, YOU DOPE THE BALSA WITH AT LEAST A 50/50 DOPE-THINNER MIXTURE. AFTER EACH COAT SAND LIGHTLY AND CONTINUE UNTIL NO "FUZZ" OCCURS AFTER DOPING. (USUALLY 3 OR 4 COATS). NOW COVER WITH THE MATERIAL OF YOUR CHOICE (FOR INSTANCE, SILK, SILRON, NYLON ETC.) CHECK THE GRAIN (LOOK AT A CORNER OF THE MATERIAL TO DISCOVER THE GRAIN IS PARALLEL TO THE HEAVIEST OR MOST DENSE THREADS WHICHEVER THE CASE). THE GRAIN MUST GO LENGTHWISE ON EACH PIECE.

TO APPLY THE COVERING, CUT IT OVERSIZE, HOLD IN PLACE AND SPRAY WITH A FINE FINE MIST WATER SPRAYER CAREFULLY WORKING OUT ALL THE WRINKLES AND DOPE IT WHILE STILL WET WITH THE BRUSH NEARLY PARALLEL TO THE SURFACE AND LIGHTLY, LIGHTLY STROKING IT. IF DONE WHILE WET, THE DOPE WILL "FLOAT" ON THE DAMP SURFACE AND DRY "WHITE OR CLOUDY" BUT WILL REQUIRE FAR FEWER COATS AND THE CLOUDY LOOK WILL DISAPPEAR AFTER THE 2ND OR 3RD COAT.

CAREFULLY TRIM (WITH A DOUBLE EDGE RAZOR BLADE) AND SAND THE "ROUGH" AREAS BUT BE CAREFUL NOT TO "CUT" OR "SAND" OUT THE FIBERS OVER A "HIGH" PLACE LIKE A RIB.

WHEN SURFACE REMAINS SMOOTH AFTER A COAT OF DOPE (3RD OR 4TH COAT) IT'S TIME TO THIN THE MIXTURE AND ADD TALC OR CORNSTARCH FOR FILLER "BODY". SAND AFTER EACH COAT

UNTIL DESIRED SMOOTHNESS IS ACHEIVED. THEN ASSEMBLE THE PARTS AND SPRAY PAINT THE FINAL COLORS TO SUIT. JUST REMEMBER ALOT OF PLANES MODELED ARE GLOSSY WHEN THE PROTOTYPE WAS NOT. THIS MISTAKE COSTS POINTS. AS I MENTIONED EARLIER, I WON'T PRESUME TO ADVISE ON ACHIEVING THE "ULTIMATE SCALE" FINISH, BUT IF IN DOUBT, THERE ARE VOLUMES WRITTEN ON THE SUBJECT. THERE MAY EVEN BE A "SCALE NUT" IN YOUR AREA WHO CAN HELP. DON'T FORGET THE PLASTIC MODELER WHO KNOWS FINISHES. REMEMBER ALSO, THE PLASTIC MODEL IS AN EXCELLENT SOURCE OF SCALE DETAIL AS WELL.

## BALANCE AND FLIGHT

THERE BEFORE YOU, IS THE RESULT OF THESE MANY EFFORTS. ALL OF THE WORK IS DONE, YOU SAY. NAY, SAY I. ALL OF WHAT IS DONE, ANYONE COULD DO. WHAT LIES AHEAD IS IMPORTANT FOR IT MAKES AN ALMIGHTY DIFFERENCE.

THIS PHASE BEGINS WITH THE MODEL READY FOR FLIGHT AND ENDS WITH A SUCCESSFUL LANDING. BEGIN WITH THE AIRPLANE ASSEMBLED AS IF TO FLY. SET IT ON A SMOOTH SURFACE WITH A PLAIN UNBROKEN BACKGROUND AND GO AROUND BEHIND THE CRAFT AND "EYEBALL" IT. VERY CAREFULLY CHECK TO SEE THAT THE RUDDER AND VERTICAL FIN ARE PERFECTLY ALIGNED. IN THE CASE OF TWIN RUDDERS, MEASURE THEM ACCURATELY. IS THE HORIZONTAL STABILIZER PARALLEL TO THE WING? ARE THERE ANY WARPS IN ANY OF THE FLYING SURFACES? IS THE FUSELAGE STRAIGHT? IF THE ANSWER IS YES TO ALL THESE QUESTIONS, YOU ARE IN GREAT SHAPE. IF NOT, ADJUST IT SO IT IS. YOU KNOW WHAT MUST BE DONE TO ALIGN SURFACES BUT WAIT AWHILE TO DO THAT WHILE WE CONSIDER WARPS.

WARPS ARE CROOKED OR "BENT" SURFACES. THEY CAUSE MOST ACCIDENTS. IT ISN'T NECESSARY AS THEY CAN BE FIXED. ON ANY WOOD AIRPLANE WHICH HAS BEEN DOPED OR PAINTED WITH ANY OF SEVERAL DIFFERENT PAINTS THE PROBLEM IS TO SOFTEN THE PAINT AND TWIST THE SURFACE OPPOSITE THE WARP, THEN LET IT HARDEN AGAIN.

THE PAINT CAN GENERALLY BE SOFTENED TWO WAYS. IT CAN BE HEATED OR DISSOLVED. TO HEAT IT, USE STEAM. IF A SMALL SURFACE IS THE PROBLEM, A TEAKETTLE OVER A STOVE DOES NICELY. IF A LARGE SURFACE IS WARPED, THE OUTLET BEHIND A STEAM CLEANING PLANT WILL DO THE JOB. YOU APPLY BOTH SIDES OF THE WARPED SURFACE TO THE STEAM UNTIL GOOD AND HOT, THEN HOLD OPPOSITE WARP, REMOVE FROM STEAM AND ALLOW TO COOL WELL. WAIT AWHILE, THEN CHECK AGAIN. DO THIS UNTIL THE WARP IS GONE.

TO DISSOLVE THE PAINT, USE MORE COATS OF PAINT OVER BOTH SIDES OF THE WARP. THIS DOESN'T WORK ON ALL PAINT, BUT HAS BEEN DONE SUCCESSFULLY WITH DOPE AND LACQUER. I HAVE ALSO SEEN GUYS FASTEN THE SURFACE DOWN IN PROPER POSITION AND PAINT AND PAINT UNTIL IT WILL STAY. THAT'S THE HARD WAY.

NOW THAT ALL THE WARPS ARE GONE, REASSEMBLE THE PLANE, PUT IT ON A TRUE FLAT SURFACE AND MEASURE THE DISTANCE FROM THAT SURFACE TO LEADING EDGE OF WING, THEN FROM THE SURFACE TO TRAILING EDGE OF WING AT SAME STATION (CHORD POINT) AND VERIFY THAT IT AGREES WITH THE INCIDENCE SHOWN ON THE PLANS. DO THE SAME FOR THE TAIL. IF IT DOESN'T AGREE, DO WHATEVER IS NECESSARY TO MAKE IT AGREE.

NEXT CHECK THE THRUST. FASTEN A STRING TO THE CENTERLINE OF THE PLANE BACK NEAR THE TAIL AND COMPARE THE DISTANCE TO EACH PROP TIP WITH THE PROP HORIZONTAL INSURING THAT THE OFFSET AGREES WITH THAT SHOWN ON THE PLANS. THEN VERTICAL FOR DOWNTHRUST.

Now, check the balance point to be sure it is exactly as shown on the plan. If not, add weight or relocate the radio in such a manner that it agrees with that shown.

Lastly, turn the radio on and operate all the surfaces one at a time to insure that they move in the proper direction, do not bind, do not interact with other controls and do run smoothly. When you have satisfied all these requirements, put the outfit on charge all night before you go fly.

When you get to the field, don't be afraid to ask an expert to fly your plane for you if you are a novice or if you haven't flown in awhile.

If you decide to fly it yourself, plan your flight from takeoff, through climb, turns, pattern, approach and landing with careful consideration given to wind direction, runway orientation, other traffic and relative position of the sun.

I have seen everything mentioned in this chapter cause a scale job to crash when not done properly, so if you will carefully tend each one of these points, your odds will be much much better. Don't you agree?

Good luck and happy landing!

## AIRCRAFT ALIGNMENT

This sheet is included as an addition to the normal instructions in hopes that you may benefit from the information it contains. The time it takes to accurately align an airplane is repayed many, many times by the superior performance of the aircraft.

All alignment information is included on the plans. Note that wing and stab angles, thrust angles, etc., appear near their component locations. Generally, the angles are referenced to a fuselage centerline which is also drawn on the plans.

Most angles are expressed in degrees of angular offset. Don't let this stop you from using them! The least expensive conversion method is to borrow an algebra book which has trigonometry sections. Use the formulas to convert the degrees to fractions of an inch of offset. The easiest method is to use a Robart incidence meter. This device is calibrated in degrees and allows direct readings of the incidence angles.

The first step in aligning the aircraft is to transfer the centerline to the fuse sides. Usually the centerline runs parallel to a major piece of the fuse such as the top edge of the side. Use a felt tip pen and draw a line parallel to the centerline above the wing saddle and below the stab saddle.

Next, mark the centerlines of the leading and trailing edges on the stab and wing. Make a template from the plans to transfer this location.

Place the fuse on the workbench and block up so that the centerline is parallel to the table top. Now place the stab in its saddle and trim and skim it until the leading and trailing edges are at the required different angles. Let's say the plans call for 1/16" positive incidence. That means the center of the leading edge is 1/16" higher (referenced to the top) than the center of the trailing edge. It makes no difference how far up the trailing edge is from the work surface--just make the leading edge 1/16" higher. The stab may have positive, negative, or no incidence depending on the design.

ALIGN THE WING THE SAME WAY. A METHOD TO USE, WHERE DOWELS ARE EMPLOYED ON THE LEADING EDGE, IS TO DRILL THE DOWEL HOLES IN THE BULKHEAD HIGHER THAN NECESSARY (TOWARD THE TOP OF THE FUSE IN A LOW WING DESIGN). NOW, WHEN THE WING IS PUT IN PLACE, THE TRAILING EDGE WILL STICK UP OFF THE WING SADDLE. USING A RAT TAIL FILE, ELONGATE THE HOLES DOWNWARD UNTIL THE WING IS AT THE CORRECT INCIDENCE. IF THERE IS A GAP ALONG THE WING SADDLE USE BALSA, PLY, OR FILLER TO CLOSE. IF YOU WANT TO USE WING SEATING TAPE, BE SURE TO MAKE ALL YOUR MEASUREMENTS WITH THE TAPE IN PLACE.

THE WING AND STAB MUST ALSO BE CHECKED TO BE SURE THEY HAVE THE SAME LENGTH EXTENDING OUT FROM THE FUSELAGE. USE A BALSA STICK OR YARDSTICK AND BE SURE THAT IF THE TOTAL WINGSPAN IS 70" THAT 35" MINUS 1 2 THE FUSE WIDTH, EXTEND ON EACH SIDE OF THE FUSELAGE.

NEXT, BE SURE THE WING AND STAB ARE NOT SKEWED ON THE FUSELAGE OR TO EACH OTHER. USE A PIECE OF NON-STRETCHABLE STRING AND TIE A LOOP IN ONE END. PIN THROUGH THE LOOP ATTACHING THE STRING IN THE EXACT CENTER OF THE FUSELAGE. FOR THE WING ATTACH NEAR THE TAIL. (NEAR NOSE FOR STAB) MEASURE OUT TO ONE TIP AND THEN GO TO THE OTHER TIP. IT MUST BE THE SAME DISTANCE. DO THIS FOR THE WING AND STAB.

THE LAST THING TO CHECK IS THAT THE WING AND STAB ARE NOT TILTED. CAREFULLY SIGHT FROM THE FRONT AND BE SURE THAT ONE TIP OF THE STAB DOES NOT DROOP LOWER THAN THE OTHER.

AS YOU CAN SEE, THESE 5 PARAMETERS MUST BE COMPLETED TAKING INTO ACCOUNT THE OTHER 4 AS ONE IS BEING WORKED UPON. USUALLY, WE ESTABLISH THE STAB INCIDENCE, EQUAL EXTENSION, SKEWNESS FIRST, AND THEN GLUE THE STAB IN POSITION WHILE SIGHTING FROM THE FRONT WITH A STRAIGHT ROD RESTING ON THE WING SADDLE.

THE LAST DIFFICULT AREA IS THE FIN AND RUDDER. BE SURE THE FIN IS PERPENDICULAR TO THE STAB. A LARGE RIGHT TRIANGLE IS NECESSARY FOR THIS STEP. ALSO, SIGHT CAREFULLY FROM THE FRONT TO BE SURE THAT THE FIN IS INLINE WITH THE TOP CENTERLINE. SIGHT FROM THE FRONT AND MAKE SURE YOU SEE THE SAME AMOUNT OF EACH SIDE OF THE FIN.

MOTOR OFFSET IS DIFFICULT TO MEASURE. IF THE ROBART GAUGE IS USED, IT IS EASY. INCASE YOU DON'T USE THE GAUGE, ABOUT THE BEST METHOD IS TO DRAW THE THRUST LINE ON THE NOSE OR NACELLE AND THEN EXTEND THIS LINE WITH A STICK. MEASURE FROM THE CRANKSHAFT TO THE STICK AND COMPARE WITH WHAT THE PLANS CALL FOR. REMEMBER THAT THRUST ANGLES MAY BE ALTERED WITH SKIMS OR OVERSIZE MOTOR MOUNT HOLES. WHEN YOU VERIFY THAT THE THRUST IS CORRECT, FILL THE UNNEEDED PART OF THE HOLE WITH EPOXY TO MAINTAIN STRENGTH.

WE ARE SURE THAT IF YOU TAKE THE TIME TO COMPLETE THE ABOVE STEPS YOU WILL HAVE MUCH MORE SATISFACTION FROM YOUR NEW MODEL.