MA Construction Series - Build a Messerschmitt Bf 109



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Photos by the author

Construction Article

When introduced in 1935, Willy Messerschmitt's Bf 109 was nothing short of revolutionary. Luftwaffe pilots were initially wary of the high wing loading, the side-hinged canopy, and the narrow track of the
landing gear.

Some of their fears were well founded. For instance, the landing gear arrangement that greatly simplified manufacturing and maintenance also contributed to thousands of accidents. But after pilots such as Ernst Udet embraced the little hot rod, the Bf 109 began shattering speed and agility records at the great prewar air meets of Europe.

By 1945, the Bf 109 was the preferred mount of many of the Luftwaffe's top aces, including the highest-scoring ace of all time—Erich Hartmann, with 352 victories. Repeatedly upgraded, the 109 was in continuous production throughout the war. Nearly 34,000 were completed, including license-built models in Spain and Czechoslovakia—more than any other fighter in history. Incredibly, the last operational mission for the Bf 109 was in 1967 in the same Spanish skies where it first saw combat in the 1930s.

The early variants of the 109, from the "V" prototypes through the Bf 109E or Emil, can be distinguished from the later marks by their square wingtips. The earlier variants also tended to be aerodynamically cleaner, as various bumps and bulges were added from the Gustav onward to accommodate the heavier weapons that they carried. Many builders prefer the battle-hardened Gustav, but I find the earlier variants sleeker and more appealing.

If the clean lines and historical significance of the Bf 109 aren't enough of an attraction, there are also myriad paint schemes for consideration. These range from the aircraft of the Condor Legion in Spain, to those that battled over France and Britain, and to the aircraft stationed in North Africa. If front-line schemes don't turn your crank, there were several colorful, polished, prewar racers that are bound to turn heads at the field.

The Plans

Several years ago, I designed a park flyer model of the early Bf 109 with a 30-inch wingspan. The design was in the Free Flight style—stick-and-tissue-type construction with lightweight electronics. To keep things simple and lightweight, this little Messerschmitt was a belly lander without any landing gear.

This 30-inch 109 flew so well that I scaled up the design to a 45-inch wingspan. The enlarged version retains the same structure, but with some upgrades. Because the heavier 45-inch model would be more prone to damage on a belly landing (that big chin scoop is dying to eat up some dirt), the wing was redesigned to include accommodations for servoless retracts.

The bigger plans are introduced here as a free download from Model Aviation's website. Like the 30-inch Bf 109, the 45-inch version is available as a short kit with a plastic canopy and front cowl. The kit includes parts to build the larger chin scoop of the A through D models.

The 45-inch plans also include outlines for the chin and underwing scoops of the Emil, should the builder choose to model this variant. For builders who prefer to cut by hand, the parts' outlines are included as a second sheet to the plans.

The construction of the 45-inch Bf 109 will be the subject of this three-part series. We'll get through most of the framework in this article and move on to the internals in the next installment.

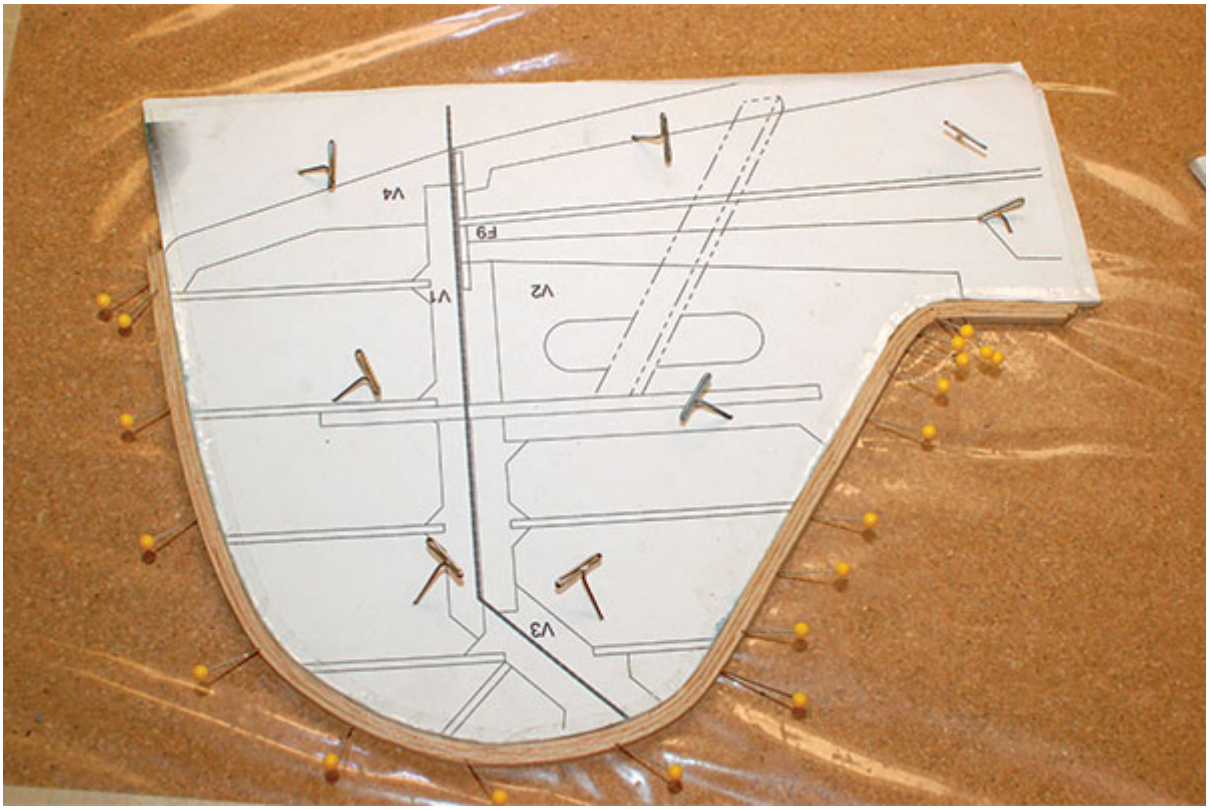
Construction

The design of this model and the techniques used to build it are very similar to the Miles M.20 that was covered in detail in last year's "Construction Series." This series will continue in the same fashion. I'll spend more time on general balsa-building techniques than the traditional step-by-step build instruction format.

For techniques already discussed in detail, I'll refer the reader to a "Construction Series" article when appropriate. These articles can be found on the Model Aviation website.

Tail Group

The tail of the Messerschmitt builds up exactly the same as the Miles M.20. The process begins by soaking 1/16 x 3/16 balsa strips in water overnight. After the balsa is flexible, the strips are stretched around a form to create the outlines of the tail parts.

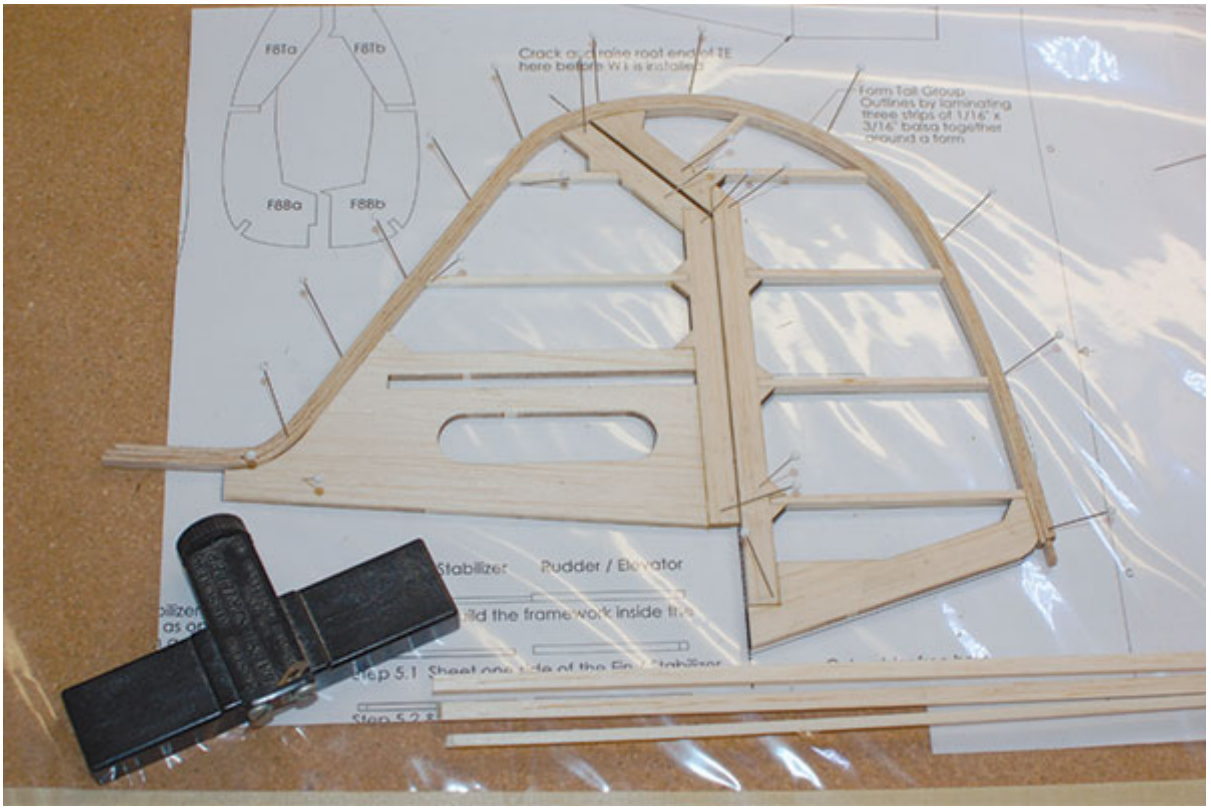


Tail group outlines were created by laminating softened balsa strips around a foam-board form.

Complete the lamination by gluing three layers, one against the other. After the outlines have completely cured, they can be removed from the forms. Although they appear fragile, these laminations are strong and lightweight.

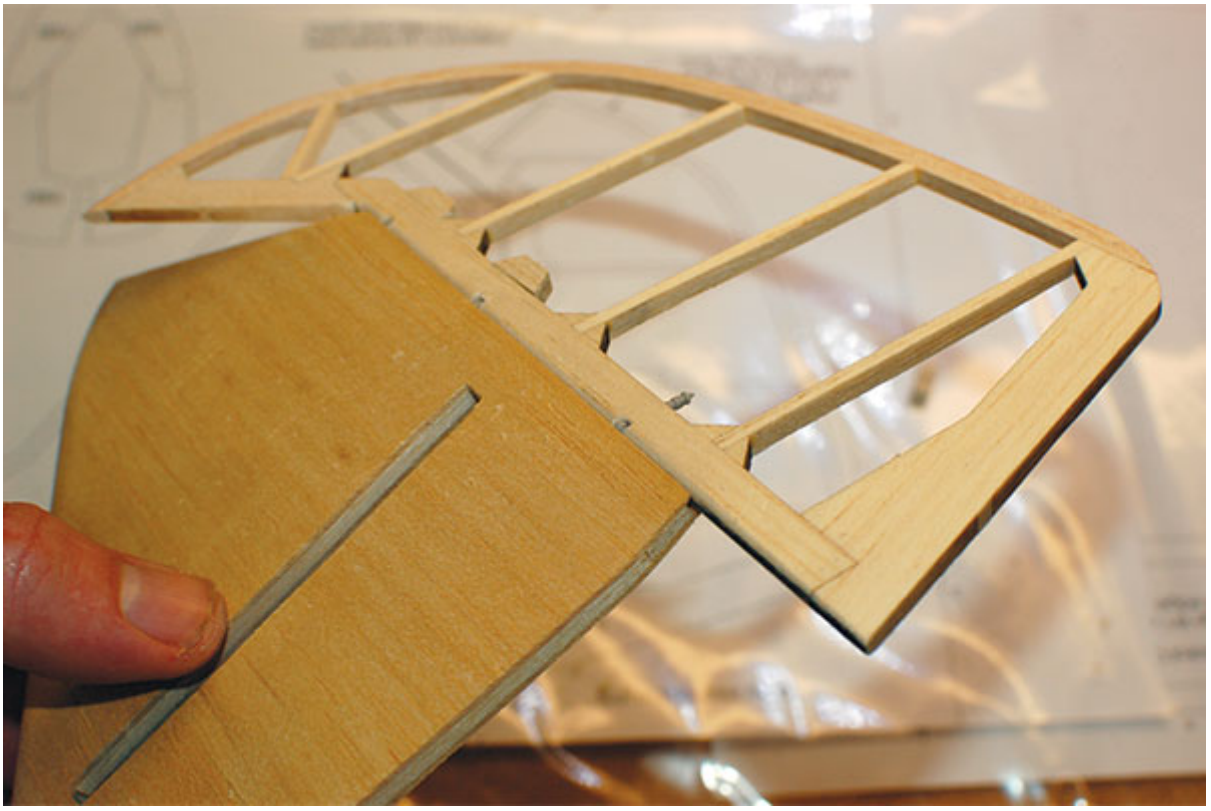
Assemble the tail parts from the kit over the plans and then fit the cured outlines into place. Cut strips of 3/32 balsa for the bracing that goes between the short kit parts and the laminated outlines.

The rudder and elevators are built-up from 3/16 balsa, while the fin and stabilizer are built from 1/8 balsa. Sheeting the thinner stock on the fin and stabilizer with 1/32 balsa will build these parts up to 3/16. The rudder and elevators will be left as open structures. This procedure does a good job of replicating the construction of the full-scale 109, which used fabric-covered control surfaces on an otherwise aluminum-sheeted structure.



Strip stock for bracing the framework was cut from the kit's sheet wood with a balsa stripping tool.

For hinging models of this size, I've become a fan of Robart hinge points. One reason for this is that the hinge pivot point can be moved back into the leading edge of the control surface. This allows a builder to minimize the gap between the fixed and movable surfaces in the same way that is typically done on full-scale aircraft.



The offset hinge point and a little extra sheeting on the fin hide the rudder gap.

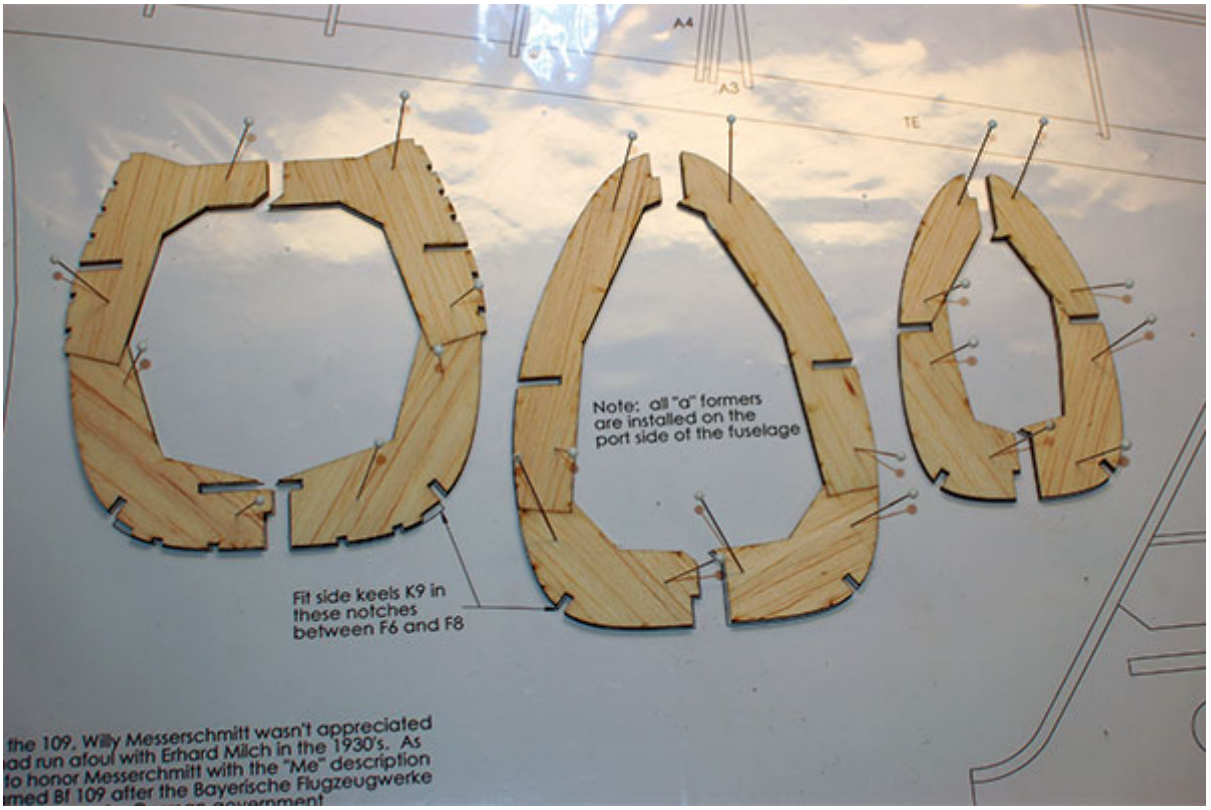


Now that the tail group is shaped and hinged, it can be set aside until it is time for covering.

Fuselage

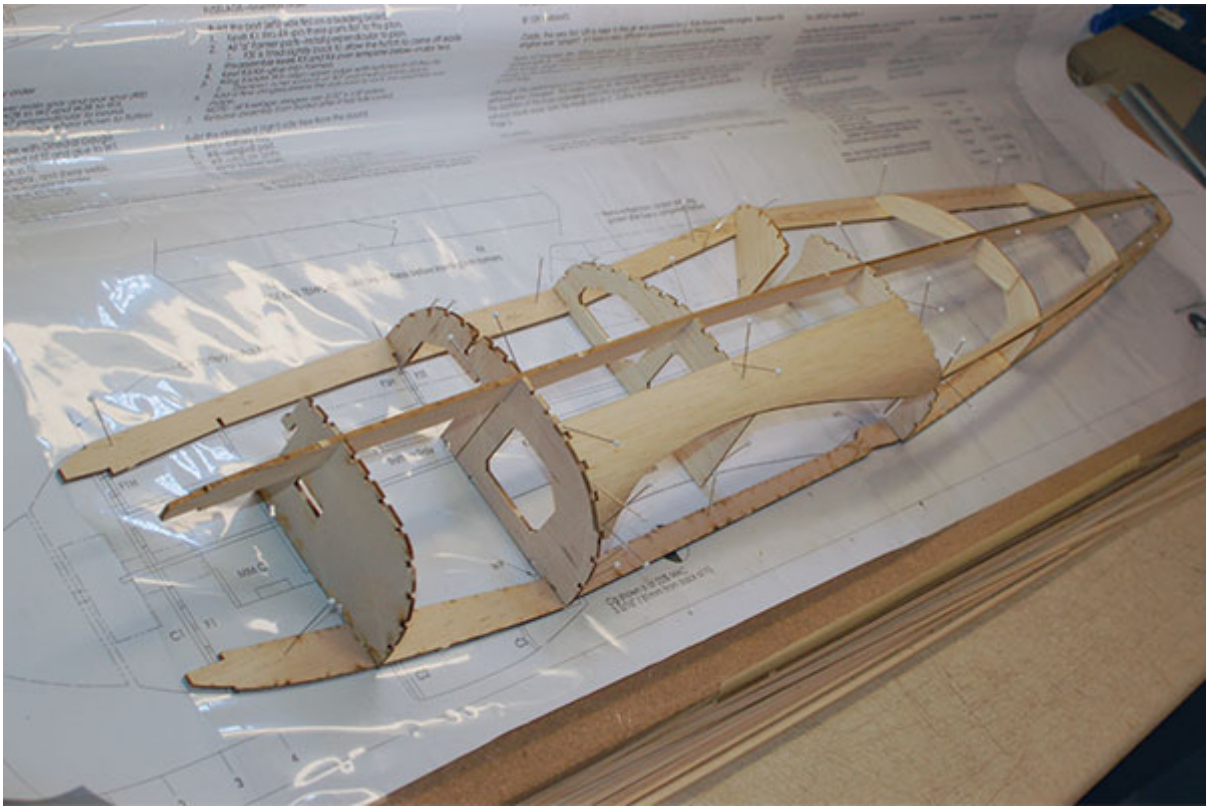
The fuselage construction begins by building the left side over the plans. Get started by preassembling formers F6 through F8, and the two side keels K5 and K6 over the plans.

Now pin the vertical keel parts K1 through K4 to the plans. Join these parts together by gluing in the left half of each of the formers F2 through F9. Note that the top half of F3 is tilted backward. This will make it easier to remove the battery hatch later.



There are a few parts that need preassembly before the real fuselage construction can begin.

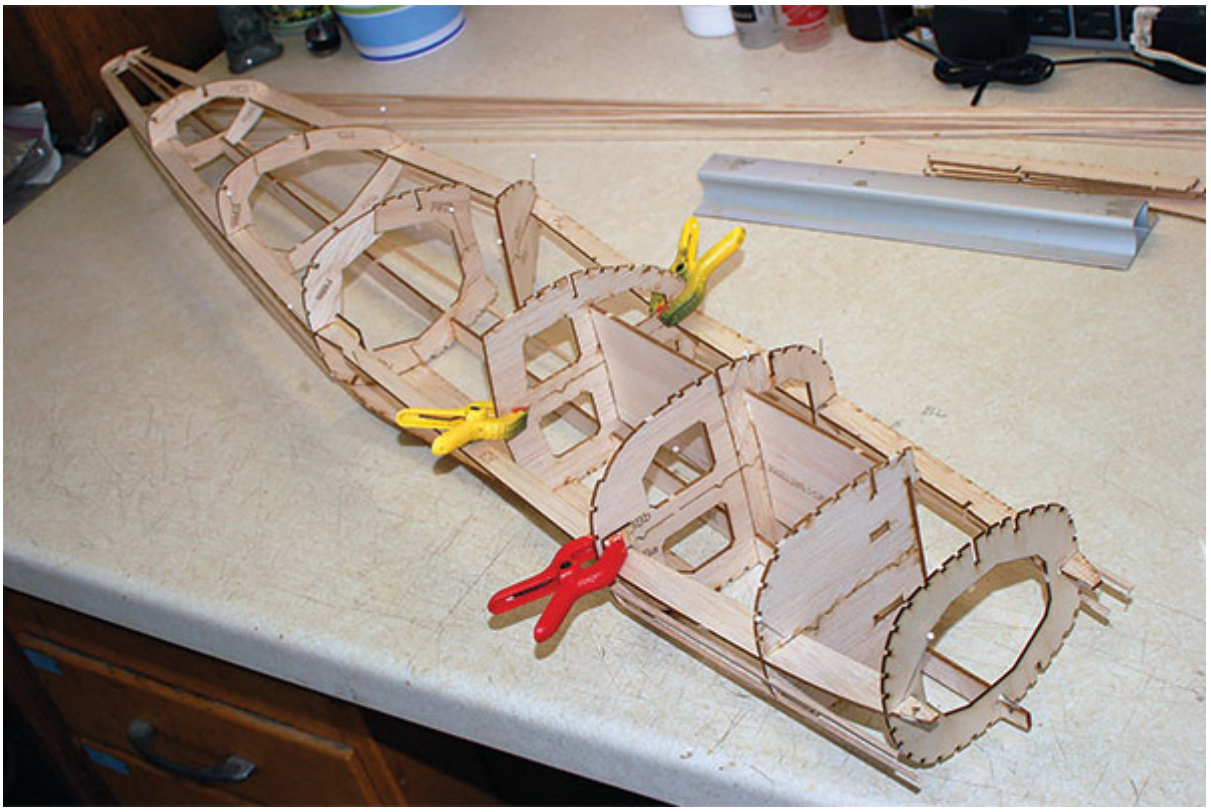
Tie all of the formers together with the preassembled side keel K5/6. Now install the wing saddle. Dampen the outer side of the saddle with a little water and it will begin to curl. Glue it to formers F3, F4, and F6. Add a few stringers to stiffen the fuselage assembly and then let it cure completely before removing it from the board.



Now that the keels, formers, and saddle are in place, it's time to add a few stringers.

The right side of the fuselage is built free of the building board. Begin by gluing the battery tray, wing pin plate (WP), and wing bolt pad (WB) to the left side assembly. Now glue the right half of each former to its left-side counterpart. Small spring clamps are handy for pinching the former halves together so that they are parallel to one another.

Add the side keel K5/6, the wing saddle, and a couple of stringers. Now it's time to move on to the battery hatch.



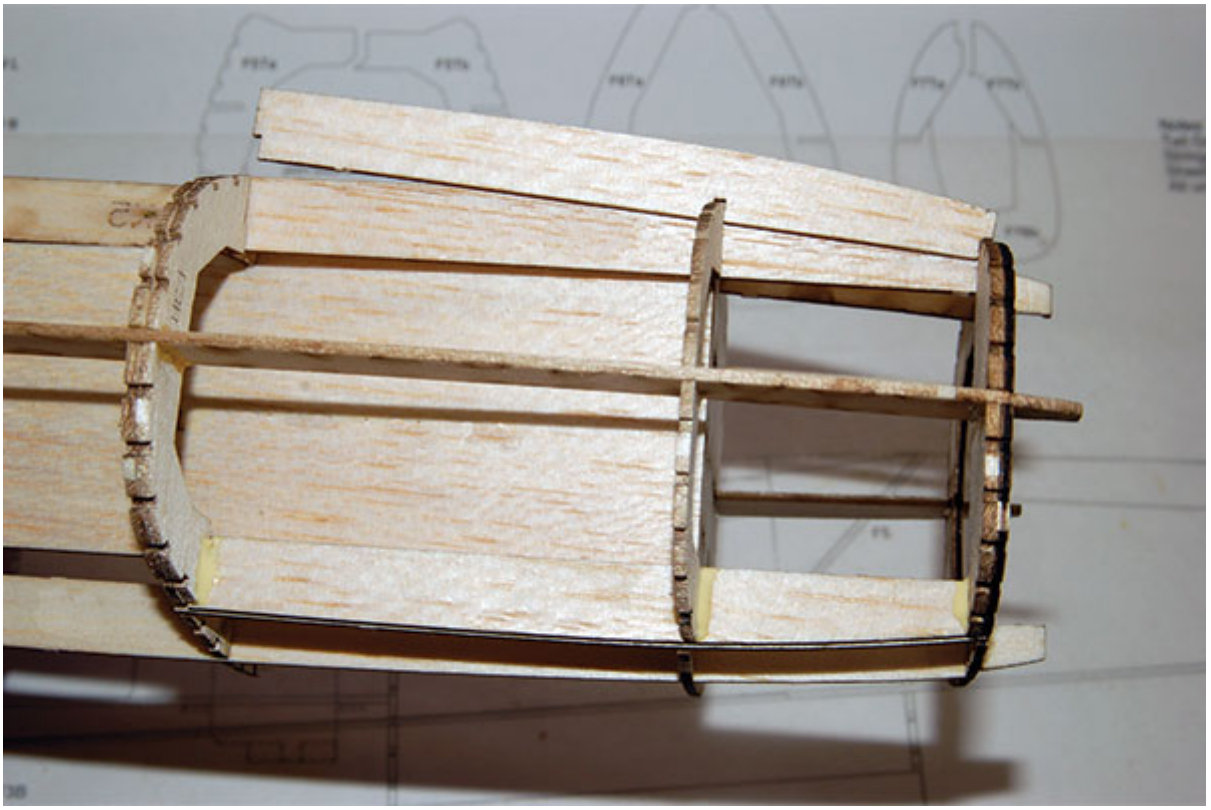
Clamps hold the right side formers parallel to the left halves.

Battery Hatch

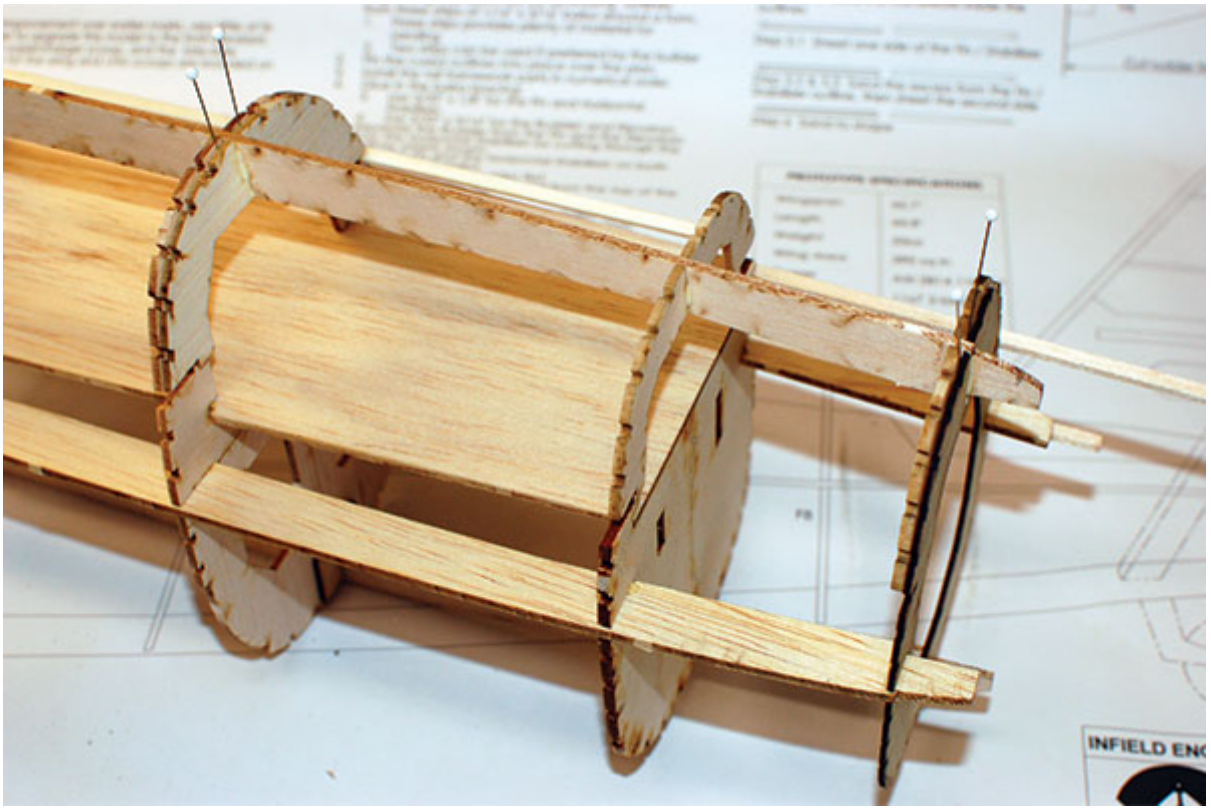
Construction to this point has been simple. Building a removable battery hatch isn't any more difficult, but it is important enough to deserve a section of its own. The following process applies to access hatches in many different models.

The parting line for the hatch is formed between doubled formers at each end of the hatch, and a pair of horizontal rails. The order in which the hatch parts are assembled is important. If the rails that form the lower parting face of the hatch are installed first, it will be almost impossible to get the hatch formers into their notches.

Glue the three hatch formers into their notches in the upper keel. Be careful not to glue the front and back hatch formers to their adjacent fuselage formers. Inserting pins between these parts as shown will prevent the formers from sticking and maintain an even parting line.



The rails that frame the edges of the hatch go in after the formers. Slide the bottoms in first, and then the top.



Hatch formers are glued only to the upper keel. Pins maintain a gap between the hatch and the fuselage formers.

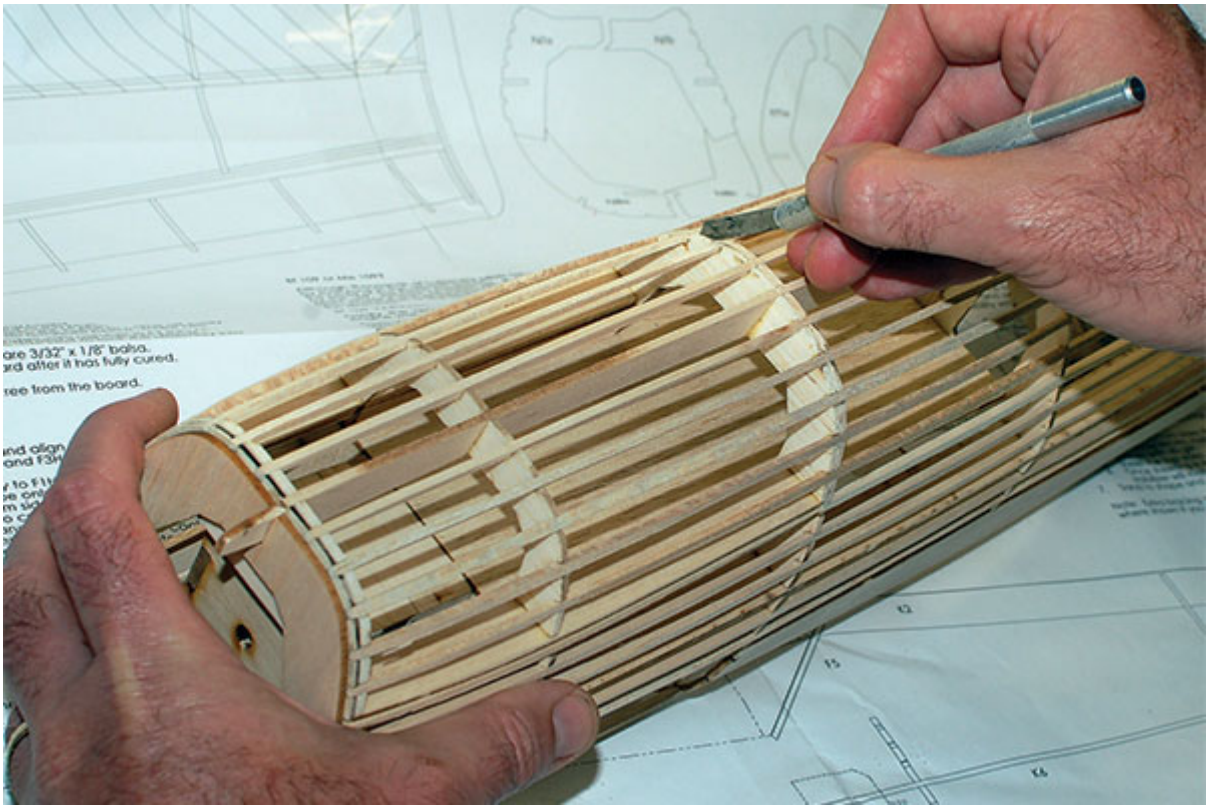
Now the hatch rails can go in. Slide the lower rails into place first and glue them to the notches in the fuselage formers. Now fit the upper rails, but glue them only to the hatch formers. Use a few pins in the former parting lines to create an even gap, and to keep the corners of the hatch from sticking to the fuselage opening. If done in this order, this should be a hassle-free operation. Strengthen the hatch by adding a fillet of glue to the corners of the hatch rails and formers.

Now the time has come to get to stringing! Remove the pins between the hatch formers and add the stringers, working from side to side. Keep a close eye out for warps as you go. Installing the stringers and using balsa infill to strengthen key areas are covered in depth in the “Construction Series” fuselage article

After all of the stringers are in place, sand the entire fuselage. Most of the stringers can stand slightly higher than their formers. This helps to minimize wrinkles later when the covering is pushed up by the formers. The stringers at the ends of the hatch must be sanded flush with the formers. If not, wrinkles will form when the covering is stretched at each of the high spots.

Now it’s time to cut the hatch free. By now, the completed and sanded fuselage should be a thing of beauty. Many builders are intimidated to take a knife or saw to their handiwork, but it must be done.

Carefully cut the upper keel and each stringer between the doubled formers at the front and back of the hatch. Take your time and be careful to cut only the stringers and not into the formers. If care was taken with the glue, the hatch should pop free without much trouble. If not, carefully cut through any excess glue and pry gently with a wide blade until the hatch can be removed.



Free the hatch by cutting between the doubled formers with a sharp blade or razor saw.

A combination of a pin in the front and magnets in the back is a nice way to hold the hatch in place. The pin will keep the front from lifting in flight while two pairs of rare-earth magnets, available from K&J Magnetics, allow the hatch to be snapped on and off. The pin can be a bit of

wire or dowel. Strong, but tiny, rare-earth magnets are available in many shapes and sizes at your hobby shop or online. Two pairs of 1/16 x 1/8-inch diameter magnets were used on the Bf 109 prototype.

With the hatch framework in place, drill a hole through the plywood front former and into the front of the hatch for the pin. Now drill holes through the hatch and fuselage rails for the magnets. Drilling guide holes in the rails before the stringers go in makes it easier to align the magnet holes later.

Use your choice of glue to hold the pin into place in the front of the hatch. I use epoxy on the magnets. A neat trick for this is to put a small piece of waxed paper between each pair of magnets. Coat the holes in the rails with epoxy. Now drop the magnets into place in the lower rails.



The front pin is in place and the rear magnets are ready for epoxy.

The waxed paper will keep the magnets from falling through and prevent the rails from sticking to one another. This method will also ensure that the polarity of the magnets is correct. Getting that backward is not cause for celebration.

Carefully fit the hatch into position. The upper magnets should slip into their holes in the hatch rails. Clamp the hatch into position and brush a little epoxy over the exposed faces of the magnets and the surrounding areas in the rails. After the epoxy is cured, the hatch should easily pop on and off.



Here's the fuselage with all of the stringers in place and the tail loosely fitted. Next on the punch list are wings and retracts.

In Closing

It's been great to hear from builders who downloaded the free Miles M.20 plans last year. So far, the only complaint has been from a few builders who found that the short kit parts didn't quite fit the plans because they had printed them at the wrong scale.

If you decide to download and print either of these plans, please make sure to print at 100% scale. You can double-check the scaling of the print by measuring the 4-inch rulers in the lower left corner of the plans.

See you next month when we frame up the Bf 109's wing and install the retracts.

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