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Wingspan: 70 inches
Length: 70 inches
Wing area: 1,032 square inches
Wing loading: 20 oz/ft^2
Flying weight: 9 to 10 pounds
Power: Power 60 electric motor

There are some full-scale aircraft that simply *look* menacing, even while on the ground. I think the Dornier Do 335 Pfeil is one of those aircraft. First flown in October 1943, Dornier utilized its knowledge of multiengine aircraft to create a twin that had its engines on the centerline of the fuselage versus on the wing, resulting in a much more streamlined design. This feature was—and still is—uncommon for multiengine designs.

Other unconventional features were that it was one of the first aircraft to utilize an ejection seat, and there were explosive devices on the rear propeller to help protect the pilot during a bailout.

The aircraft was massive for a single-seat design. Its wingspan was 45 feet and it was more than 16 feet tall. Offensive weapons included two 20 mm cannons, and it could also carry an internal bombload. Fortunately for the Allies, technical delays prevented the Pfeil (Arrow) from reaching mass production and its full potential.

The Model

Similar to some of my previous designs (the Bearcat and I-16 Rata), the 335 is designed with scale outlines but features a stick-and-tissue Free Flight stringer look. The result is an accurate-looking model of the full-scale aircraft but with a lower wing loading for gentler flying.

The model features CAD-designed interlocking parts and is built using plywood, light plywood, basswood, and balsa. To help simplify operation, the model can be built powered with only the front motor (tractor) or with both the front and rear motors. The front motor uses a Power 60 motor, 80- to 90-amp ESC, 16 × 8 three-blade propeller, and a 5,000 mAh 6S LiPo battery. This combination offers good flight performance; however, a modeler can add the second motor if he or she wants a twin.

The plans are available as a free digital download from *Model Aviation* online. Should you choose not to cut the parts yourself, Manzano Laser Works sells the parts in a short kit, including an available canopy from Park Flyer Plastics.

The spinners are modified versions of Paul Kohlmann’s M.20 design. These and the nose gear file can be found on Thingiverse and can be 3D printed (see "Sources"). Construction details will cover the main points of building the model and are excerpts from the construction manual. The full manual is available for download on Manzano’s website.

Horizontal Stabilizer

The first item to build is the horizontal stabilizer. On the full-scale aircraft, it had a slight amount of dihedral. The model replicates this, so it needs to be built in halves. The main spar is a lamination of balsa and plywood. These are glued together, as are the tips and the leading edges (LEs). Using the ribs as a guide, bevel the LEs to match the rough contour of the ribs (this will be fine-shaped later).

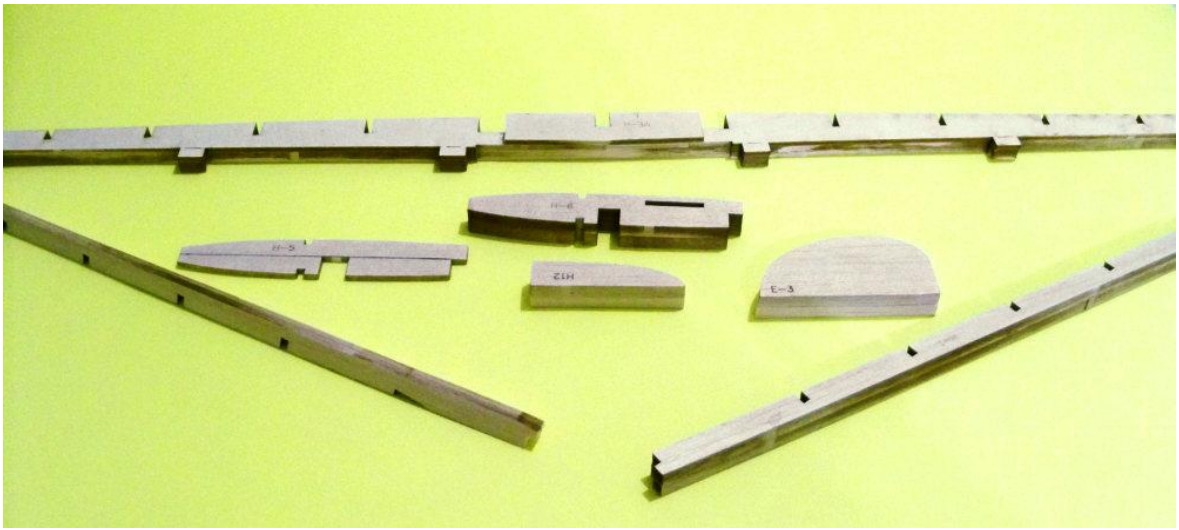
Scrap 1/32-inch balsa shims are cut and glued to the elevator LE then this is tacked in place against the horizontal stabilizer's trailing edge (TE). Dry-fit the ribs in place, minding the tabs for the elevator mounting plate. When you are satisfied, glue them in place.

The elevator TE is made from 1/8 × 1/2-inch medium balsa cut to length and slides into the slot at the rear of the ribs. With one side completed, the assembly is unpinned and the other half is built.

A 1/8-inch square basswood stringer is added, and the center section is sheeted with 1/16-inch balsa. The elevators are then cut free and the shims are removed.

The horizontal stabilizer and elevator LEs are rounded and contoured, and the tips are added and shaped. There is a slot between H-2 and the stringer where the sheeting is removed (top and bottom). A former (VP-1) will go in this spot later.

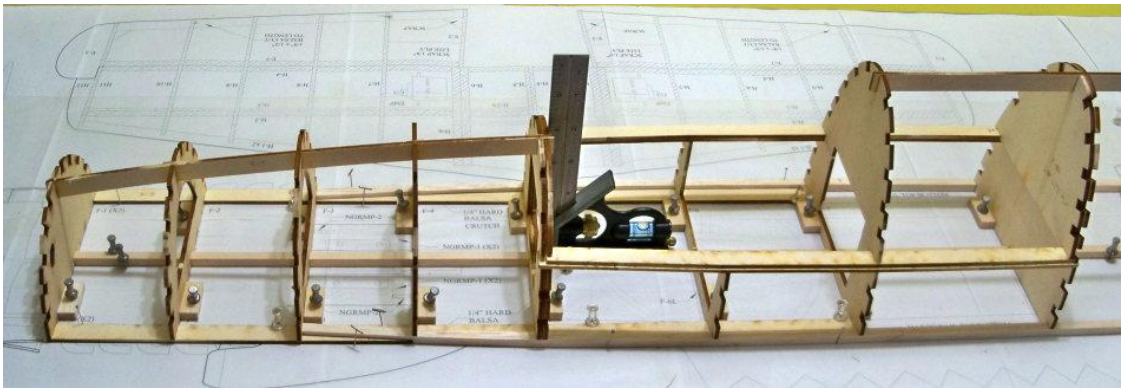
After the construction of the horizontal stabilizer is complete, the assembly is sanded and covered. Nitrate and silkspan dope and tissue were used on the prototype. If you are covering with film, lightly sand/scuff the film surface (for paint adhesion) before application.

	The main subassemblies of the horizontal stabilizer. The LE was beveled before gluing it in place.
	The horizontal stabilizer is completed and ready to cover. Here you can see the slot cut in the sheeting for VP-1.

Fuselage—Top Half

The fuselage top half is next and built over the fuselage top view plans. Several longitudinal stringers make up the crutch. The center stringer (and the rear and center split stringers) are made from 1/4-inch square basswood, and the outer stringers are 1/4-inch square balsa. They slide into a slot in part K-5.

Pin these stringers in place over the plans along with the K-5s. Note how the center stringer splits and becomes two at former F-13. Cut the 1/2 × 1/4-inch crosspieces (dashed lines on the plans) and add these either fore or a of the formers then glue the outer stringers to the K-5s. Find parts F-5U/F-5A and F-8U/F8A and orientate them according to the plans, adding 1/32-inch balsa shims between them.

	The upper formers and crutch can be seen here. The hatch sub-formers have 1/32-inch balsa shims on them to allow for spacing.
	All of the 1/4-inch square stringers for the top half have been added. The horizontal stabilizer was covered and glued in place before building the vertical.

Next, add formers F-1BU and F-8U to F-16U, K-1, and K-2, the hatch rail bottom, and the horizontal mounting plates. When you're satisfied with the fit, glue them in place. Add 1/8-inch balsa cross-grained pieces between the formers and the outer longerons according to the plans, from F-2U to F-13U. This will act as a floor for the battery and will strengthen the structure.

Add the hatch rail top at this time, making sure not to glue it to the bottom, then set the horizontal stabilizer and F-16A in place on the horizontal mounting plates. Ensure the alignment before gluing in place.

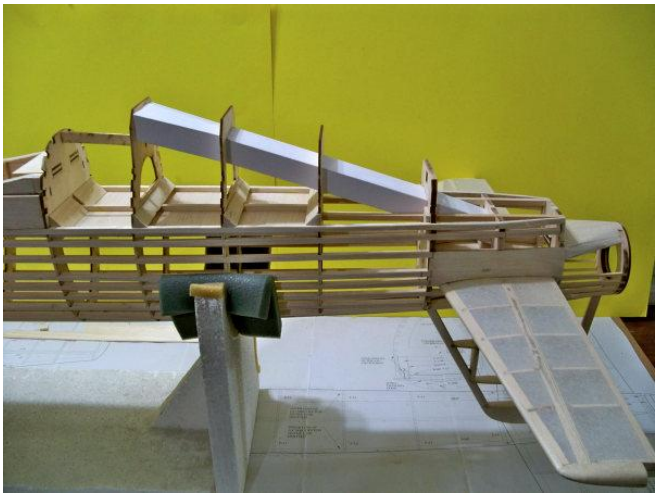
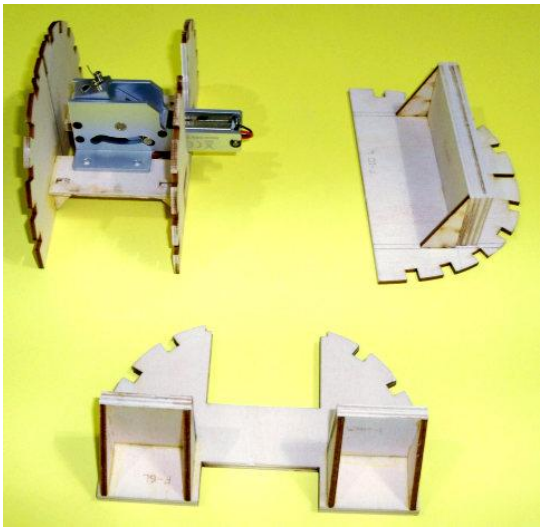
Slide the top vertical LE into F-14U and VP-1 into the slot cut in the horizontal stabilizer, making sure the rib notches are on the same side as F-16U. Test-fit the V parts and rear mounting plates and glue them in place when you are satisfied with the fit.

The rudder TE was made from 1/8 × 1/2-inch balsa cut to length. Slide it into a slot at the rear of the ribs. Test-fit then glue F-17, F-18, and F-19 in place as shown on the plans.

Starting at the top, add 1/4-inch square stringers from medium-grade 1/4-inch balsa, alternating to each side as you go down the fuselage. Add the 1/8-inch square basswood stringers on F-16U and F-18. Fill it in with 1/8-inch balsa under the hatch rails and the nose section according to the plans. Cut the rudder free and round the LE. Sand the top fuselage to remove any rough spots and unpin it from the board, setting it upside down in a stand.

Fuselage—Bottom Half

Former F-6L, the wing mounting plates, and the nose gear mounting plate subassemblies are glued together. The forward wing mounting plate (WMP-1) is separated in the middle to allow for the nose gear retraction. The wing mounting plate assemblies tab into F-6L and F-10L and have triangular support parts. The nose gear mounting plates tab into F-3L and F-4L. Test-fit the retract at this time.

	
The bottom of the fuselage is where the center-line stringer is bifurcated to allow for the air ducting.	The templates for the cardstock ducting are on the plans.
	
The belly scoop sides and bottom are made from 1/8-inch balsa, and the edges were sanded to match the formers. Quarter panels of 1/4-inch balsa were added and contoured.	This shows the bottom former subassemblies. The nose gear is fitted and mounted at this time.

The bottom (L) formers are added now, as is the cardstock ducting (see the plans). The wing saddles are added next—first A then the additional Bs. The bottom and sides of the belly scoop are from 1/8-inch balsa sheet. Cut and sand the edges to match the angle in the former then add a sheet of 1/4-inch balsa for the quarter-panel trim to match the outline.

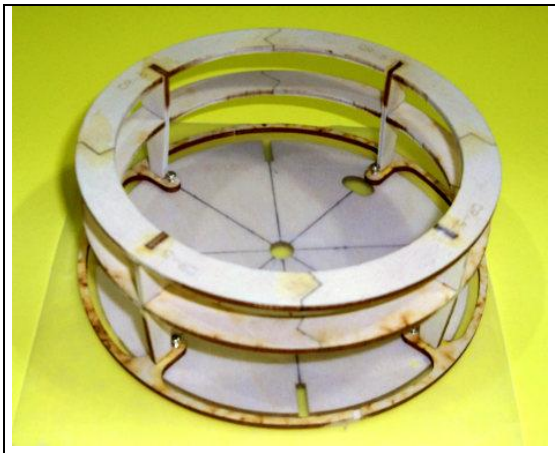
Glue the six laminates of F-11B (1/4-inch balsa) and one F-11A (1/8-inch light plywood) and sand to shape. The bottom vertical is made the same way as the top, so check that the rib notches on the formers are on the same side.

Add V-8B/C. Cardstock will enclose V-13 to V-8C. Add the remaining 1/4-inch balsa and 1/8-inch basswood stringers. Sand overall and fill in the sections as shown on the plans. The main firewall (F-1) is then added, along with the four FWs, and the motor is test-mounted.

Cowling

Make the four front cowling rings next, with each ring made from four pieces of 1/4-inch balsa (use the plans for reference). After the rings are made, they are stacked on top of one another. Make the two center rings from light plywood parts. The ribs (CR-7) are first added to the center rings. Slide them into the notches of the mounting ring (CR-6).

Sheeting is added (1/16-inch balsa) to the center section and to the outer section, making the cowling flaps. The front rings (laminates of 1/4-inch balsa) are added, and the assembly is sanded to shape.

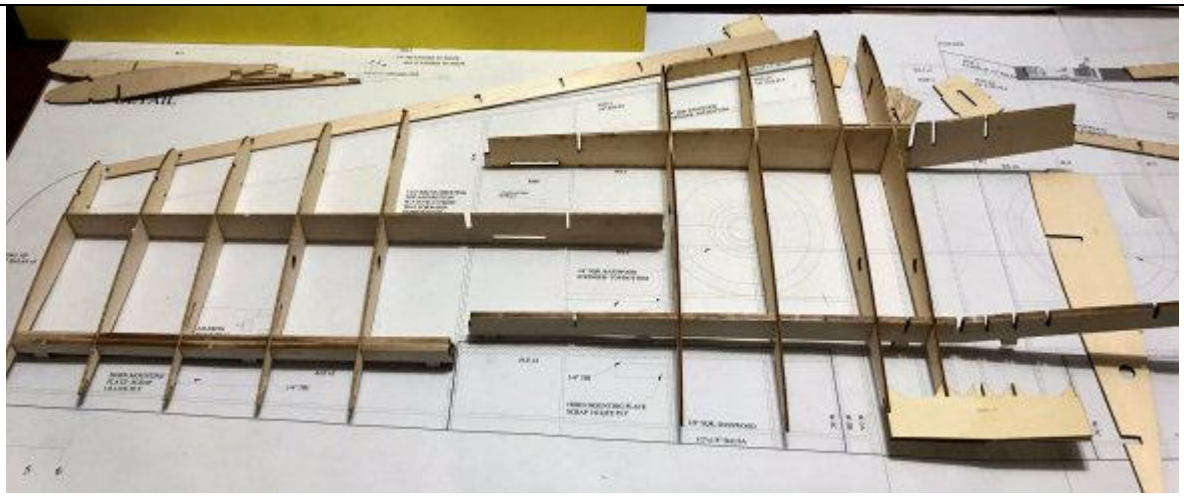


The center cowling rings and ribs have been added to the mounting ring.

Wing

The light plywood main wing spar is joined at the center section with WS-1A (forward of WS-1). The retract plates are from two layers of 1/8-inch plywood and notched into W-6 and W-7/8. Balsa shims (1/32 inch) were added between WS-4 and the aileron LE then tack-glued together. Repeat the process with WS-3 and the flap's LE. Plane down the top edges of these assemblies to match the rib contour.

Wing spar two is similar to the main spars on the Bearcat and Rata. The top portion is balsa with a basswood plank glued to the bottom for rigidity. Pin these assemblies over the plans.



The wing subassemblies have been created and pinned in place. The top edges of the rear spars were beveled to match the ribs before gluing them in place.

Starting at the root, add W-1 to W-5. The forward wing mounting plates (WMP-2) are split to allow space for the nose gear to retract. Review the plans and test-fit these parts before gluing and adding the light plywood wing LE. Slide spar WS-2 into place along with the rest of the ribs and retract mounting plate.

The outer sub-LE is made from 1/8-inch balsa. The sub-ribs were added for the flap with the same shim process used to allow for movement later. The TE is a composite of 1/8-inch square basswood glued to a 1/2 × 1/8-inch balsa plank. Slide this into the notches in the TE of the ribs. Sheet the top of the wing with 1/16-inch balsa as shown on the plans. The rear wing mounting plate is added at this time.

The left wing panel parts are in place, and 1/16-inch balsa top sheeting has been added. After it dried, the wing was unpinned and blocked up to build the other half.

Unpin the completed half of the wing then elevate the wingtip to build the other half. Make WS-6A from scrap balsa (see the templates) and tack-glue in place then finish the other half the same as the first half.

With the wing removed from the board, cut the building tabs free and block in around the retracts and aileron mounting plate with scrap before adding the bottom sheeting. Add the 3/4-inch balsa triangle to the outer LE and contour it using the templates. The inner 1/4-inch balsa LE laminations are glued in place and sanded to shape. The wingtips are glued in place, planed, and sanded to shape.

Next, cut the ailerons/flaps free, round the LEs, and then hinge using Robart pinned hinges for the flaps and E/Z hinges for the ailerons. Test-fit the wing to the fuselage and ensure its alignment before drilling the mounting bolt holes (10-24 bolts were used). Threaded inserts are then screwed into the fuselage mounting plates.

Here you can see the forward belly pan details. The BP-2 has been added to the bottom of W-2.

Belly Pan

With the wing mounted in place, add the belly pan formers with 1/4-inch balsa triangle stock on each side. Add 1/4-inch square stringers from hard balsa or use BP-1 (see template). Add BP-2 according to the plans, blocking in around the wing mounting bolts with scrap.

Main Gear Struts and Doors

If you're not using commercial struts, you can make your own. The prototype main gear struts were made from 5/32-inch piano wire utilizing

5/32-inch axles. The gear doors were made from two cross laminations of 1/64-inch plywood

The doors were mounted in the retracted position with the excess length of the axle passing through the door. It is held in place with a 5/32-inch wheel collar. The door's midsection was secured with a 5/32-inch wheel collar (over the main strut). Refer to the plans for greater details and the parts used.

Dress up the strut with paper and plastic straws/tubes. The nose gear was also from 5/32-inch wire and made to look like the full-scale strut. A 3D-printable nose gear fork can be added to the nose gear strut.

The main gear door is made from cross laminations of 1/64-inch plywood. The door doubler is 1/4-inch balsa.

Final Details

Mount all of the servos in the wing, tail, and fuselage (including the steering servo) and test for the controls to be plus or minus 1/2 to 3/4 inch. Set the flaps for 30° and 45°. Du-Bro E/Z connectors and .062 wire are used to connect all of the control surfaces. The two side scoops are made from six laminates of 1/4-inch balsa with a plywood front ring. Exhausts (24) are made from two laminates of 1/4-inch balsa and a rear plywood ring. The hatch is cut free and mounted according to the builder's choice.

The canopy is then glued on with canopy-safe adhesive. Detail the cockpit to your liking. The prototype performed well with just the front motor; however, a smaller electric motor in the tail can be added (use the regular plywood F-20 for this version). The rear ESC can be routed in the cardstock ducting. Balance the model according to the plans.

The model can be covered/finished as the builder prefers. The prototype was covered with medium silkspan and nitrate dope. After covering, add the F-11 A/B/C assembly. Paint it to match the full-scale aircraft: Reichsluftfahrt Ministerium (RLM) paint designation 02 (gray) for the wheel wells, cowling insides, and wheel hubs; RLM 81 and 82 (brown-violet and light green) for the fuselage and wing top; and RLM 65 (light blue) for the bottom surfaces.

Commercial spinners can be used or more scale-like ones can be printed using the link in the "Sources." Additional details can be added according to the builder's preference.

The initial flighttests were made before painting. The color scheme of 102 has since been added.

Flying

Before the first flight, perform a range check, test the gear, and check that the controls are in the correct direction. Takeoffs are straightforward and eased by the tricycle gear. Climb out steadily. Retract the gear and trim as needed. The prototype flew well between 1/2 and 3/4 throttle. Rolls are smooth and stalls are straightforward. The nose drops and one wing might as well, but it does not snap and you can recover from this with power.

On approach, gently reduce power on the glide-slope before bringing the throttle to idle just before touchdown. The initial testing did not require using flaps. The model slows down nicely, and touchdowns are smooth.

Sources:

***Model Aviation* online**
www.ModelAviation.com

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