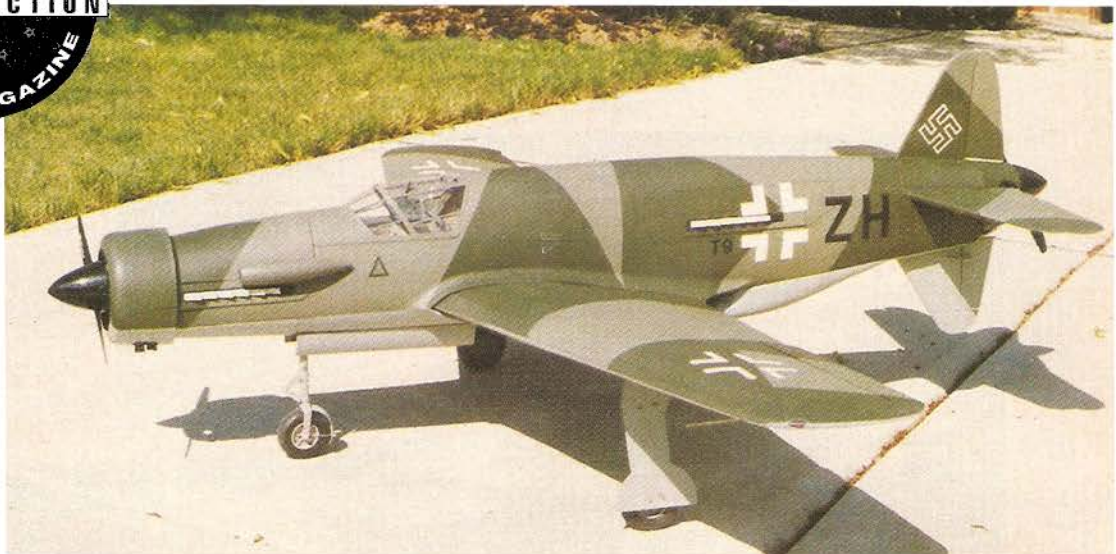


by
AL
MASTERS



3RD
PLACE
DESIGN
CONTEST

Dornier-335

TANDEM

IT WAS IN May '62, as I perused a pile of aviation magazines, that I read about a little-known WW II German aircraft. The article described a unique twin-engine aircraft with engines mounted in a push/pull configuration; it was reportedly the fastest propeller-driven aircraft developed during the war. The war ended before the many versions of this spectacular fighter/bomber could be made operational. It was the Dornier-335 Arrow.



Test pilot Ray Doan (holding the transmitter) and I pose with the Dornier-335 after another successful flying session.

PHOTOS BY AL MASTERS

ENGINE

What an R/C scale model it would make! I addressed a letter to Dornier-Werke in Friedrichshafen, Germany, requesting scale draw-

ings and information that would enable me to design an R/C scale model of the Do-335. In hopes that my inquiry would cross the desk of a sympathetic reader, or even a



With both engines singing and the gear neatly tucked into place, the Arrow streaks by.

ings and information that would enable me to design an R/C scale model of the Do-335. In hopes that my inquiry would cross the desk of a sympathetic reader, or even a

fellow modeler. I enclosed pictures of my French Caudron C460 Racer. (The $\frac{1}{4}$ -scale Caudron weighed $8\frac{1}{2}$ pounds, carried an Orbit 10 radio and had picked up trophies in national competition.) It was like fishing—nothing to do but wait!

It was an exciting moment when, after after three long weeks, I received a large envelope from Germany! Inside were scale three-view drawings, fuselage sections, air-

foils and data on wing washout. To top it off, black and white photos of the Do-335 were included. Bingo!

The photos were of the "V3," the third prototype aircraft, which was devoid of the armament and landing lights that were included on later versions. A close study of the photos with a magnifying glass revealed that the swastikas had been removed by postwar German censors.

Powered by two K&B* 45s and sporting handmade electric retracts, my 70-inch, $\frac{1}{8}$ -scale Do-335 flew that year. Since I built that model,

"ARROW"

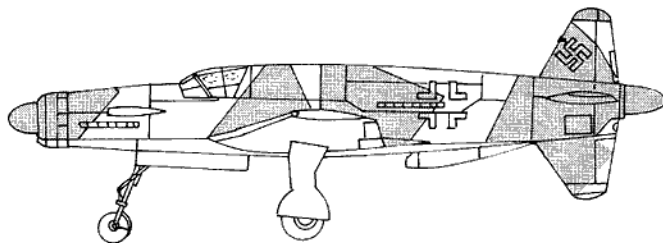
The model requires some degree of construction expertise, but it has been designed for builder/fliers who would like to scratch-build a unique, twin-engine scale model that doesn't have the inherent problems associated with twins.

excellent, scale, three-view drawings have been published, as have detailed booklets covering the many modifications of the full-scale aircraft. (For those who are interested, documentation sources are listed at the end of this article.)

The abundant fin and rudder area provides excellent rudder response, but the cuneiform tail section does have some negative attributes! The full-scale Do-335 was equipped with a rugged, hydraulic, shock-absorbing tail-bumper system, and the whole lower fin and rudder could be jettisoned with explosive bolts if a gear-up landing was anticipated. Should the pilot elect to eject, explosive bolts could also be called upon to separate the aft propeller from the airplane, thereby saving the pilot from passing through the propeller.

As of this writing, I've built and flown four 1/10-scale renditions. We were putting model number three through "gear-down" flight tests when it had a midair! Tom Krasin's Corostar-40 came in at two o'clock and passed under the Dornier, ripping off its main gear

units and much of its lower wing skin. The Corostar spun in. The 335, with both engines still operating, was 12 ounces lighter and still flying! Ray Doan, who was piloting the 335, commented that



the plane had become a "floater" as he made a "nose-wheel-only" runway landing! (The landing cleaned off the lower fin!) A team search of the field adjacent to the runway recovered both Spring Air* main gear units, which had fallen free after impact.

The model requires some degree of construction expertise, but it has been designed for builder/fliers who would like to scratch-build a unique, twin-engine scale model that doesn't have the inherent problems associated with twins. An additional benefit is that you can fit this 56-inch-span model into a medium-size station wagon without having to dismantle it!

CONSTRUCTION

Study both plan sheets and note that the bulkheads and ribs have been arranged near the sheet edges to make tracing them onto templates or construction material easy. Weight-saving construction aft of the center of gravity (CG) is of major importance when building this model. Use light 4- to 6-

pound balsa throughout; only the main wing spars are of medium-hard balsa. Lightning holes should be made where shown. The plans also include some building suggestions, but experienced builders may want to use their own methods.

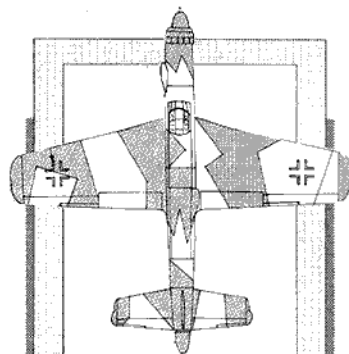
This 1/10-scale model was designed and flight-tested using two engines of equal size so that the plane would stay airborne if either engine failed. You'll need nose ballast, so always pick the heaviest engine for the tractor spot to reduce ballast requirements. The scale high thrust line in front will allow some engines to be inverted inside the cowl. A 40-size engine up front will add no additional weight. My four models use O.S.* Max 25FP

engines. The available space for the 6-ounce fuel tank is fixed by design and must be taken into consideration if a larger fuel-burner is placed up front!

I installed standard Spring Air retracts on all my models, and I used the heavy-duty unit for the shock-mounted nose wheel.

FUSELAGE

Trace and cut out the parts. Bulkhead halves can be nested to save material. One-



DORNIER-335 (V3)

TYPE:

Scale Twin WWII German Fighter

SCALE:

1/10

WINGSPAN:

56 inches

LENGTH:

56 inches

WING AREA:

600 square inches

POWER:

O.S. Max 25 (2)

FUEL CAPACITY:

12 ounces (2 6-ounce tanks)

GROSS WEIGHT:

8.75 pounds

WING LOADING:

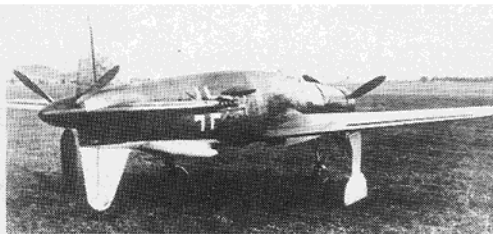
33.6 ounces per square foot

RADIO:

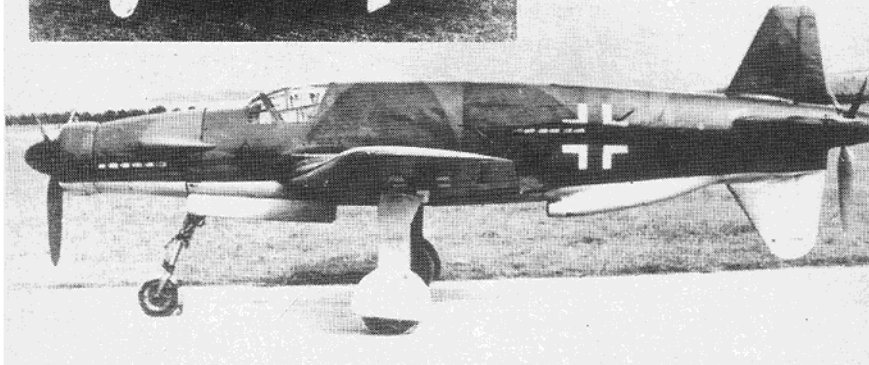
5 to 6 channels (rudder, elevators, ailerons, throttles, retracts, optional flaps).

CONSTRUCTION:

built-up wood



In 1962, I received photos of the third prototype aircraft (V3). Postwar censors eliminated the swastikas.



piece bulkheads are less work, but they result in considerable material waste. The bulkheads are rather flimsy to work with, but the final structure will prove quite rugged. The plywood parts are one-piece and cut apart where indicated. Make fuselage part F10 and wing part W1 at the same time, and match-drill the holes for the two 1/4-inch wing dowels in them.

Pin the crutch over the wax-paper-protected plan, and glue the aft fuel-tank support in place. Epoxy F20 to the aft tank support and epoxy the two 1/16-inch ply braces in place. Proceed with the

DORNIER 335

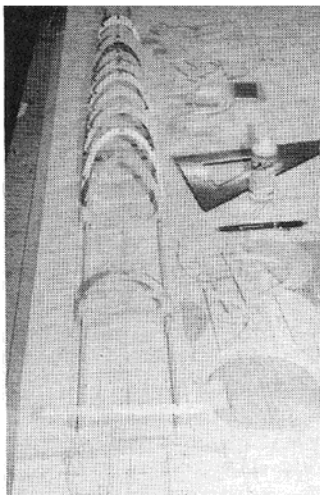
bulkhead placement, taking care to insert scraps of 1/16-inch balsa in the crutch area to provide the slot for inserting the 1/16-inch ply wing saddle beam later. Avoid gluing the small scraps to the crutch and the bulkheads because the scraps must be removed later.

Fit the backbone and the stringers to give the assembly rigidity, and add the top sheeting from F9 to F19. When you add the sheeting to the top of the fuselage, soak sections of sheeting in an ammonia-and-water solution, and bend them over the backbone, but don't glue them! Hold each piece in place with masking tape, and when it has dried, trim it and glue in place. This method will result in a very nice fuselage line without the usual sanding problem in this area. Don't remove the structure from the building board yet!

CANOPY

The canopy can be framed up while the upper fuselage is still on the crutch. Cut the plywood frames and use wax-paper glue barriers as you clamp F4C to F4 and the 3/32-inch ply rear canopy frame to F9. Wax paper should also be placed under the two 3/16x1/2-inch balsa canopy-base pieces. Canopy frames are cut out of 3/32-inch ply and tack-glued with CA. Reglue with epoxy when the frame-up looks right. Provide for the canopy hold-downs. Attach 3/32-inch pre-formed sheet balsa to the front of the canopy, and remove the unit from the fuselage.

If desired, canopy blisters can be made. Cut a teardrop-shape hole in the center of a piece of 1/4x8-inch-square plywood. Take a piece of



Protect the plan with wax paper, and begin by gluing upper bulkheads to the crutch.

.015-inch-thick butyrate sheet that's 5 inches square, and center it over the cutout. With masking tape, tape all four edges down. Heat the butyrate in an oven or with a heat gun until it sags, and force a teardrop-shape wooden plug into the butyrate and through the cutout. A vacuum cleaner can also be used to draw the soft butyrate through the cutout. Make the two side pieces with the blisters that allow space for the rearview mirrors.

Silver MonoKote* can be used for the mirrors; they add a nice scale touch! Paint the ply frames (color 82), before attaching the butyrate sections with RC-56 glue. I placed pre-

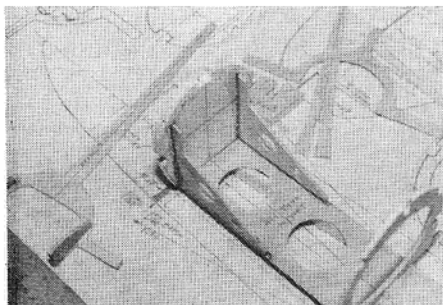
colored automotive striping tape (color 82) over the seams.

TAIL GROUP

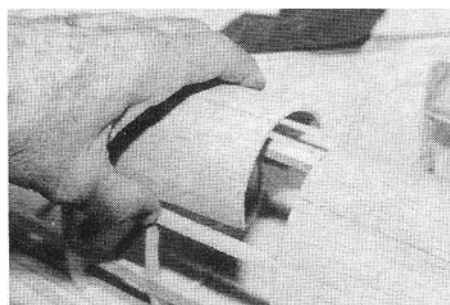
While the upper fuselage is still on the building board, make the stabilizer and upper fin of light 1/4-inch balsa sheet. Fit 19A, 19B, 19R and S1 to the stabilizer and upper fin. Use wax paper as a glue barrier as you construct the removable tail section in place. Trim the pre-formed 3/32-inch balsa sheet to fit over 19A and 19R, and allow it to overhang F20. Remove the tail unit and inlay the two 1/8-inch ply pieces, assembled with the 4-40 blind nuts, so that they're almost flush with the underside of the stab. The two 3/32-inch ply mating fuselage pieces will be epoxied in place later after careful fitting to the fuselage. Epoxy the pre-drilled 1/8-inch ply torque-rod bearing to F20.

RETURN TO THE FUSELAGE

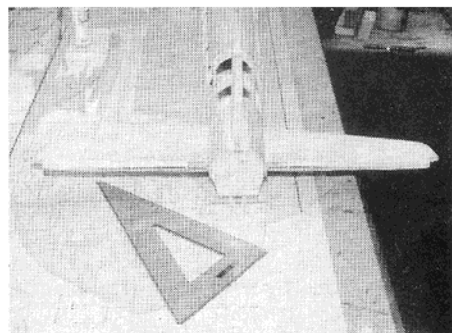
Remove the upper fuselage from the building board, and fit the two wing-saddle beams in the



Aft tank support and the two-ply braces have been epoxied in place over the crutch. Use epoxy sparingly in the aft section to avoid excess weight.



Pre-formed 3/32-inch balsa sheet is added over the backbone before removing the structure from the building board.

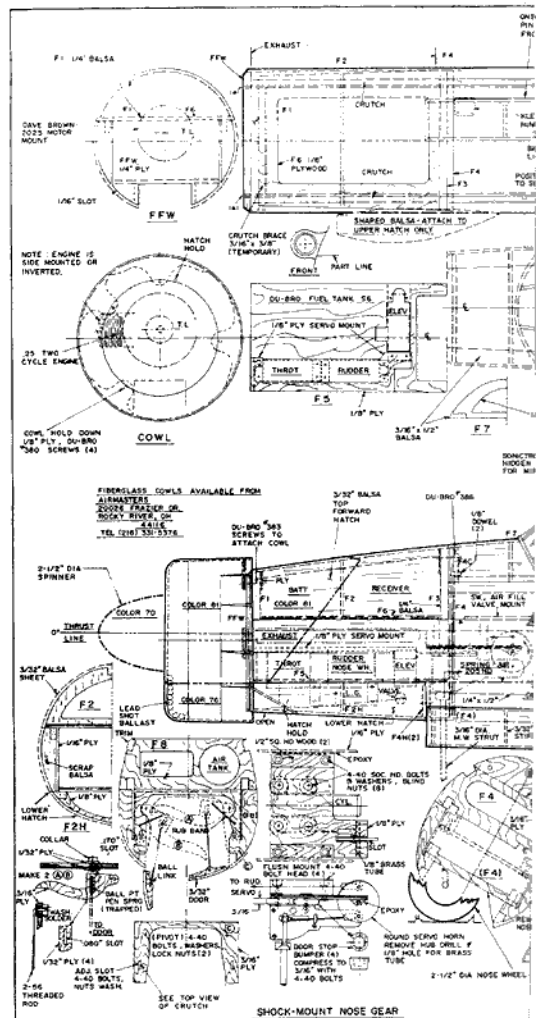


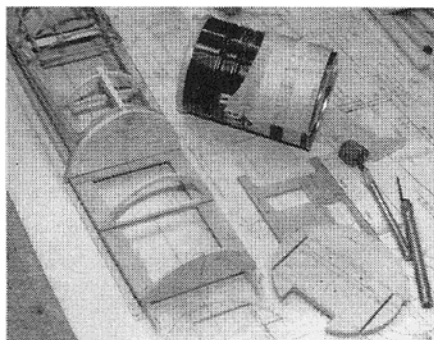
The removable tail section is constructed in place over the crutch. (For ease of construction, the empennage on my fourth model was changed to light-weight 1/4-inch balsa sheet.)

slots and alongside the crutch. Clamp and glue. Make up the front firewall (FFW), including the blind nuts for the motor mount. Fit FFW over the 1/16-inch ply beams, and make sure the assembly is at a right angle to the crutch. Epoxy the firewall in place. Glue in the lower bulkhead sections and add the aft stringers.

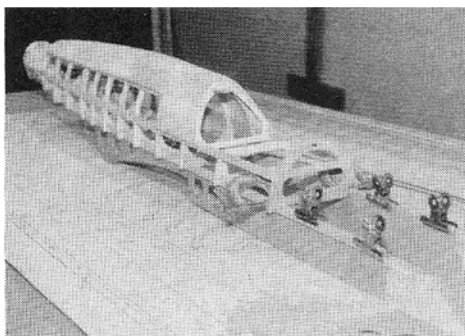
Lay out F5 and make cutouts to accept the servos to be used. Epoxy F5 in place. The servos are mounted on 1/8-inch ply (with supports), which is epoxied in place above F5.

The wing-saddle area and fillets are completed after the wing has been trial-fitted to the fuselage.

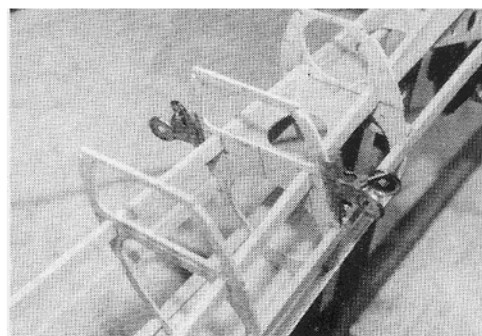




The upper hatch and canopy frame can also be built over the crutch. A coffee can was used to pre-form ammonia/water-soaked balsa sheet for the canopy front section.



The wing saddle beam (1/16-inch ply) is fitted into slots and clamped before gluing to the crutch.



Lower bulkhead sections are glued into place.

The nose-wheel doors are made of pre-formed 3/32-inch sheet balsa with ply stiffeners. A door-frame assembly can be made up with 1/4x1/2-inch medium-hard balsa and with temporary cross-braces. The doors and hinges are fitted in the frame and the cross-braces removed. The 1/4-inch music-wire hinge pin is pulled to remove the doors. The door-frame unit can then be glued in place. The ply door operators are installed as an assembly and can be easily taken out by removing the two 4-40 bolts that hold part C to F8.

The upper hatch is made in place with F6 (1/8-inch ply), which is the hatch base. The

hatch also uses formers F1, F2 and F3, which give form to the 3/32-inch pre-formed balsa-sheet covering. The lower hatch hides the retract-gear servo and is made in a similar manner.

Lay in the Nyrod sheaths for the 1/16-inch music-wire control rods and throttle cable to the aft engine.

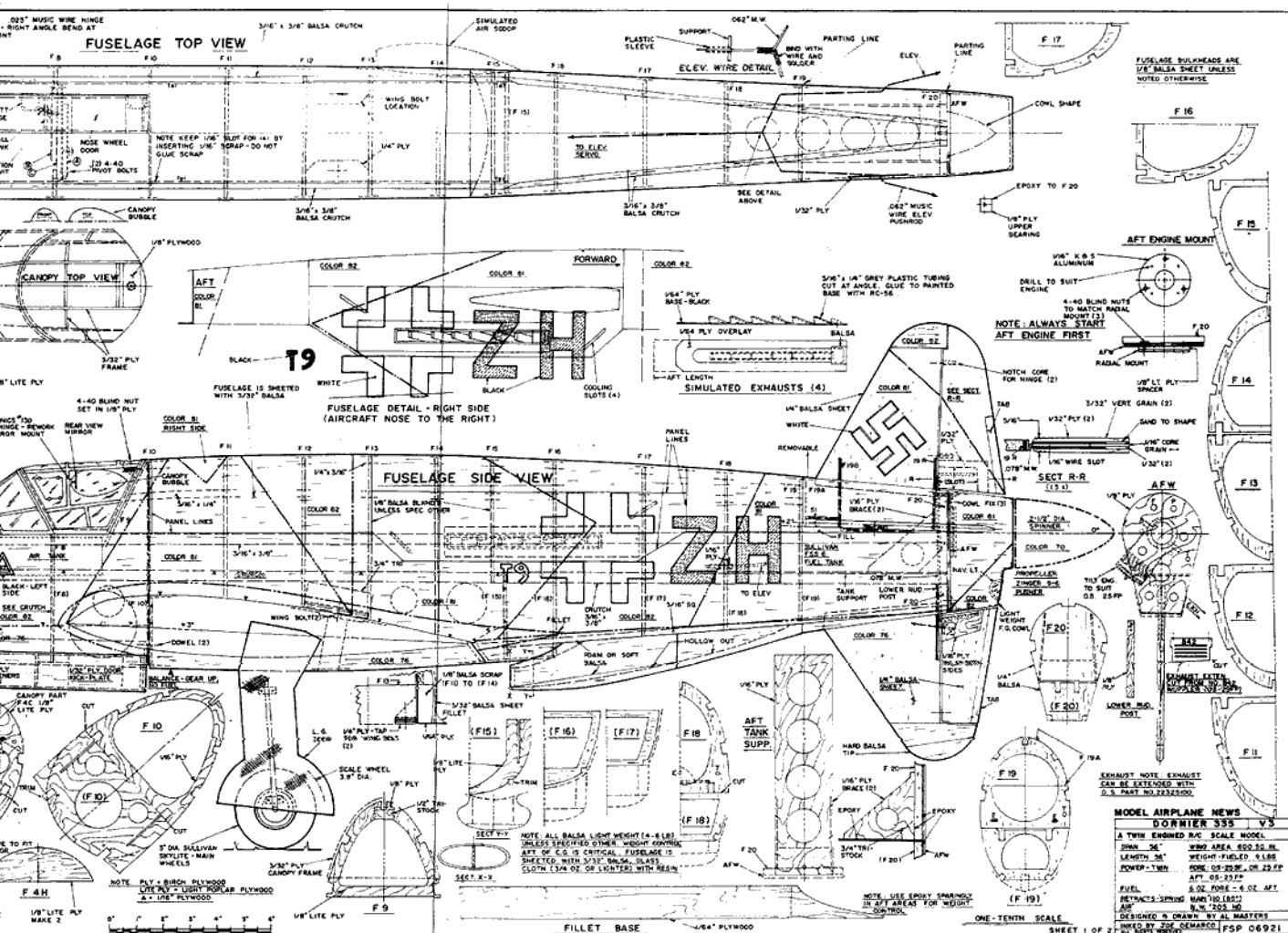
The aft radiator section can be made up as a separate piece and epoxied into place after painting.

WING

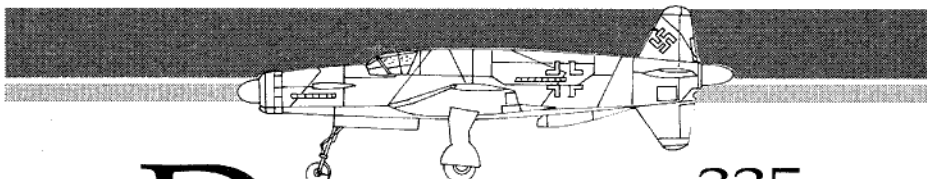
Trace and cut out a set of ribs, noting the

construction tabs and material specified. Trace full-length ribs from leading edge to trailing edge, making sure to include all lines showing where to cut the rib off to make the flap and aileron ribs. (Flaps are optional.) Finish-sand the ribs in pairs. Add the 1/16-inch ply doublers to ribs 4 and 5, taking care to make a "right" and "left" set! Make the ply dihedral braces. (Note: wing part W1 and fuselage part F10 should be match-drilled for the two 1/4-inch wing dowels before either part is attached.)

Select two 1/4-inch-square medium-hard balsa spars and glue them to W2 to make up a full-span lower spar. Cover the plan with pro-



ORDER THE FULL-SIZE PLANS...PAGE 90



DORNIER 335

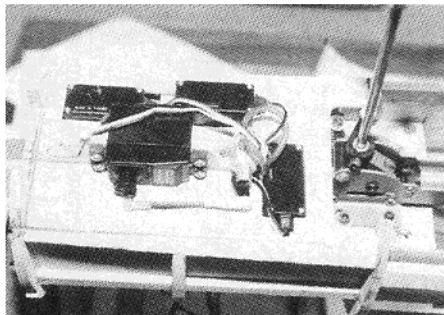
protective film and proceed. Secure half the lower spar to the plan with pins or weights, and support the other half to hold it off the building board. Position the ribs on the spar, cutting each rib off to make the flap or aileron rib as you go. Rib 1 is slanted from perpendicular. When setting ribs 6, 7, 8 and 9, provide for the tip washout by supporting rib 9 as indicated on the plan.

Add the tapered aileron sub-spar and sub-leading edge. The $\frac{3}{16} \times \frac{1}{4}$ -inch spars can be slipped into place. Add the $\frac{1}{8}$ -inch sheet-balsa tips and tip frames. The $\frac{1}{4}$ -inch-square medium-hard balsa upper spar is placed, and any missed joints get a final shot of CA.

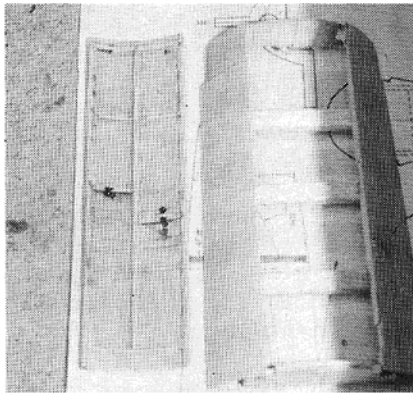
Remove the panel from the building board, and proceed with the other half of the wing in the same manner. W3 is now glued in place to support the aft center section, and rib parts 1A (a doubler) and 1B (a center-section filler rib) are added behind W3. W1 is fitted in place and tri-stock supports are added. Shear webbing is now added out to rib 6.

The upper wing skins are made of lightly sanded $\frac{1}{16}$ -inch sheet balsa. Attach the two upper skins, adding the filler support at the center section. The wing can now be completed by working from the underside. Add bellcranks, control rods, retract mounts, air lines, aileron hinge supports, etc. Add the bottom wing skin, but don't open the wheel wells.

The fiberglass main-gear doors are made up before the wheel-well/strut openings are cut through the lower wing skins. Use masking



The lower front hatch hides the retract servo and valve. The underside of F5 is shown with the three servo cutouts.



The nose wheel door frame is made with temporary cross-braces and pre-formed $\frac{3}{32}$ -inch balsa sheet. The nose-wheel doors were made as one piece, then sawed apart.

tape around its outside edges to put a piece of MonoKote over one lower wing panel. There's no need to remove the plastic backing on the MonoKote. Proceed to lay up 6-ounce glass-cloth/resin over the MonoKote for an area large enough to overlap the wheel/strut cover. When the cloth/resin has cured, it can be peeled off (the MonoKote acts as a parting agent). The MonoKote can be used on the other wing panel.

Trace and cut out the gear/strut covers. The wheel and strut wells are now open, and the fiberglass wheel covers will fit nicely to the wing contour.

Where the wing trailing edge fits the fuselage is a section that will have to be completed by fitting the wing to the fuse-

lage and blending the formers and sheet balsa for a satisfactory fit.

Open the access holes to install the flap hinges. The $\frac{3}{4}$ -inch balsa tri-stock leading edge and stall-breaker inboard leading edge are added, shaped and sanded to blend with the wing skins.

Flaps and ailerons are trial-fitted but not attached until after painting.

FINAL ASSEMBLY/FINISHING

Apply $\frac{3}{4}$ -ounce (or lighter) glass cloth/resin or your preferred paintable covering material. Mask off and spray the camouflage pattern. Rudders, elevators, ailerons, flaps and gear doors are all painted before assembly.

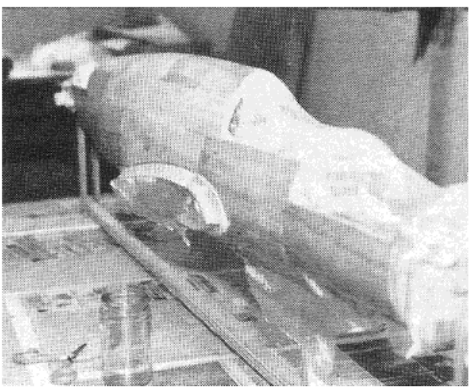
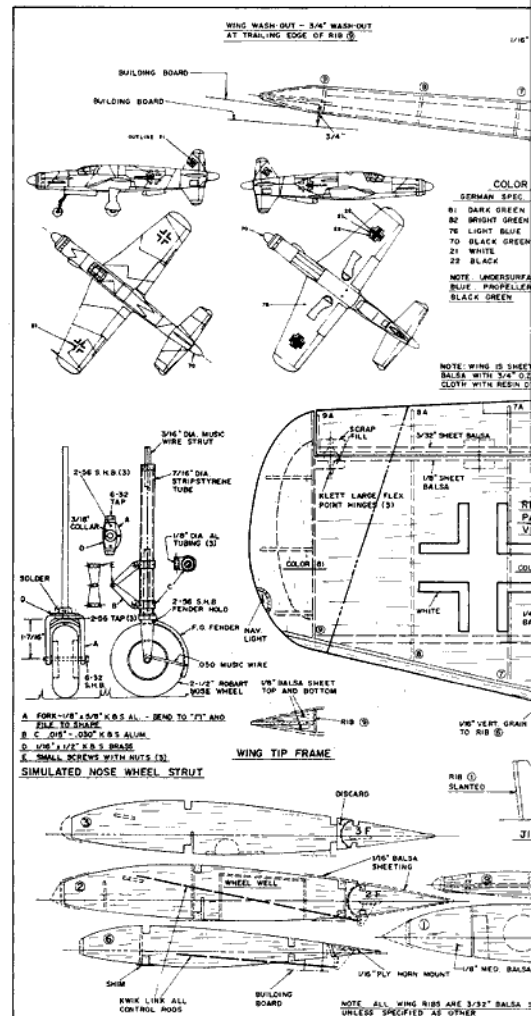
Add details, i.e., exhausts, carb intakes, numerals and insignias. A marking pen can be used for panel lines. Coat the whole model with flat clear to enhance the colors.

FLYING

The pusher propeller should be the lightweight Zinger* 9x6 in conjunction with a standard Carl Goldberg Models* spinner. (The plans show a scale, longer spinner that can be made of foam for static display.)

Attach a heavier Master Airscrew* 9x6, a Higley Heavy Hub and a standard Carl Goldberg spinner to the tractor engine.

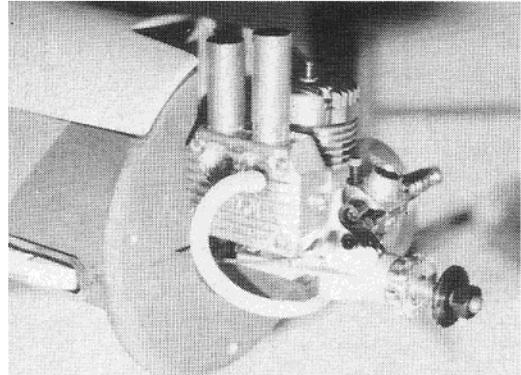
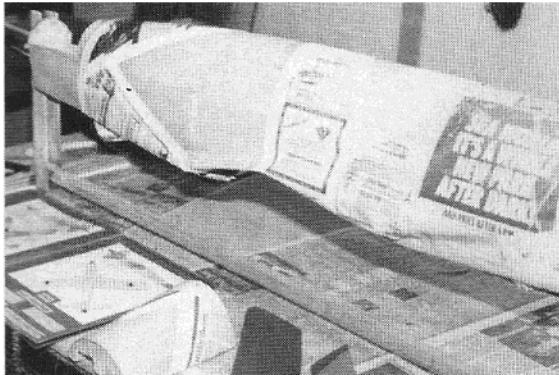
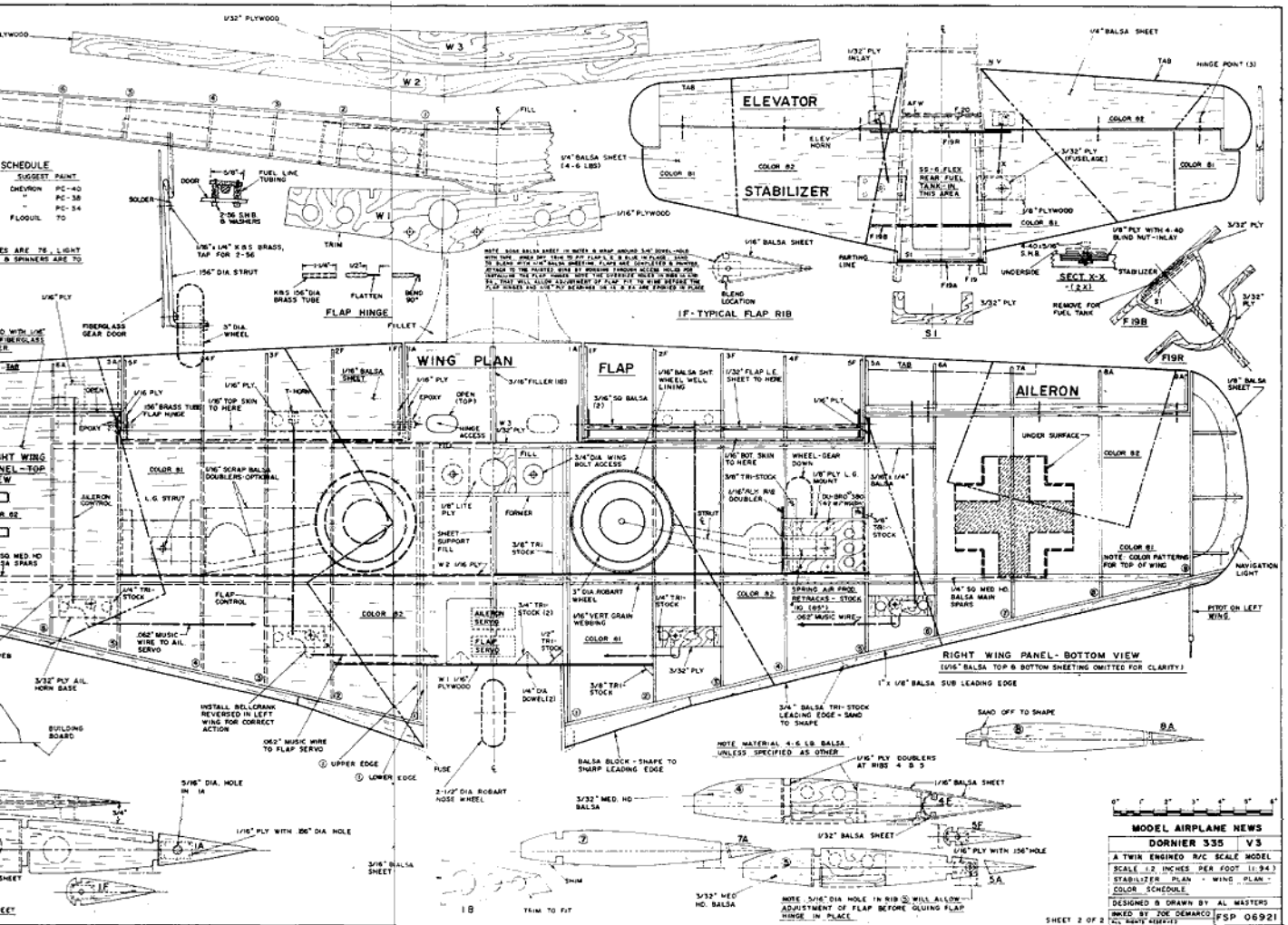
Add shot ballast to the inside of the front cowl to establish the correct CG without fuel.



Fiberglass cloth ($\frac{3}{4}$ -ounce or lighter) being applied to the fuselage.

The aft fuel tank is piped up with the clunk forward. Always start the aft engine first to start the fuel burn-off in the aft tank, thereby allowing the CG to creep forward. With both engines at full bore, the two 25s put out the equivalent thrust of a 60. (Records show that the full-scale Do-335 had a higher single-engine speed when the front engine was shut down.) When checking the aft engine at full throttle for fuel draw, remember to hold the nose of the ship down, not up! It's wise to top off the fuel tanks if extensive run-ups have been made during the initial needle-valve tweaking!

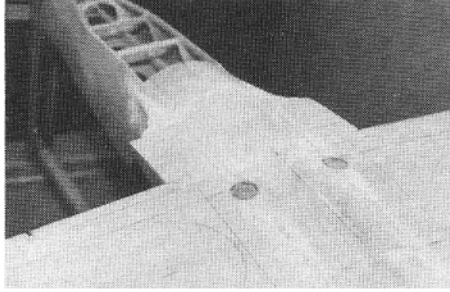
The long tricycle gear has considerable drag,



Camouflage paints are specified. The fuselage and upper front hatch have been masked off and are ready for color no. 81.

An inverted O.S.25FP fitted with a J'Tec manifold has been mounted in the tractor position.

so retract it as soon as possible after takeoff. If the aft engine stops early in the flight, land the plane as soon as possible. If fuel isn't being burned in the aft tank, the CG will shift to the rear as the front tank gets lighter!



The wing is fitted to the fuselage, and the underside center section of the wing is sheeted with 3/32-inch balsa sheet, which is blended with the fuselage. Wheel wells are opened after the fiberglass well covers have been made.

With both engines singing, the ship will put on a most spec-

tacular show, especially when the crowd calls for a low flyby! With its cuneiform tail section, it truly appears to be an "arrow" as it streaks by. If the pilot gets carried away with the thrill of it all and lets a tank run dry, there's no need for the frantic trim requirements that are usually associated with an

engine-out situation on a conventional multi-engine plane. Happy flying!

*Here are the addresses of the companies mentioned in this article:
K&B Mfg., 12152 Woodruff Ave., Downey, CA 90241.
Spring Air Products, 82 Parkhill Blvd., W. Melbourne, FL 32901.
O.S., distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.
MonoKote; distributed by Great Planes Model Distributors.
Zinger; distributed by J&Z Products, 25029 S. Vermont Ave., Harbor City, CA 90710.
Carl Goldberg Models Inc., 4734 W. Chicago Ave., Chicago, IL 60651.
Master Airscrew; distributed by Windsor Propeller Co., 3219 Monier Cir., Rancho Cordova, CA 95742.