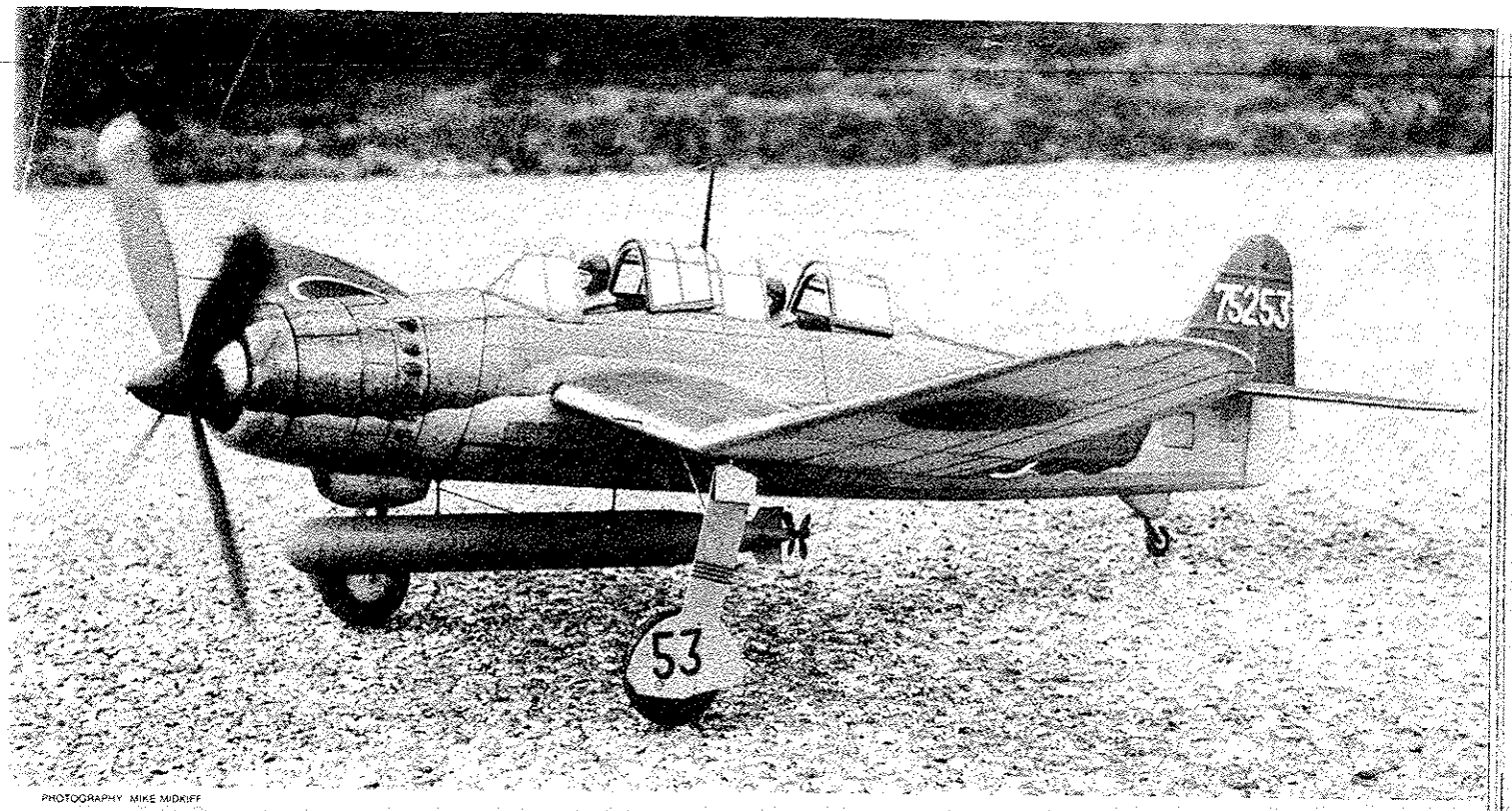


PHOTOGRAPHY MIKE MIDKIFF

Long overlooked by modelers attempting Japanese WW II subjects, the Aichi B7A2 *Grace* presents some pleasing lines matched by good flying qualities.

Aichi B7A2 "Grace"

By Mike Midkiff

Try a refreshing change of pace from the "commonplace" Zero. A little know Japanese WW II torpedo bomber for F/F rubber.

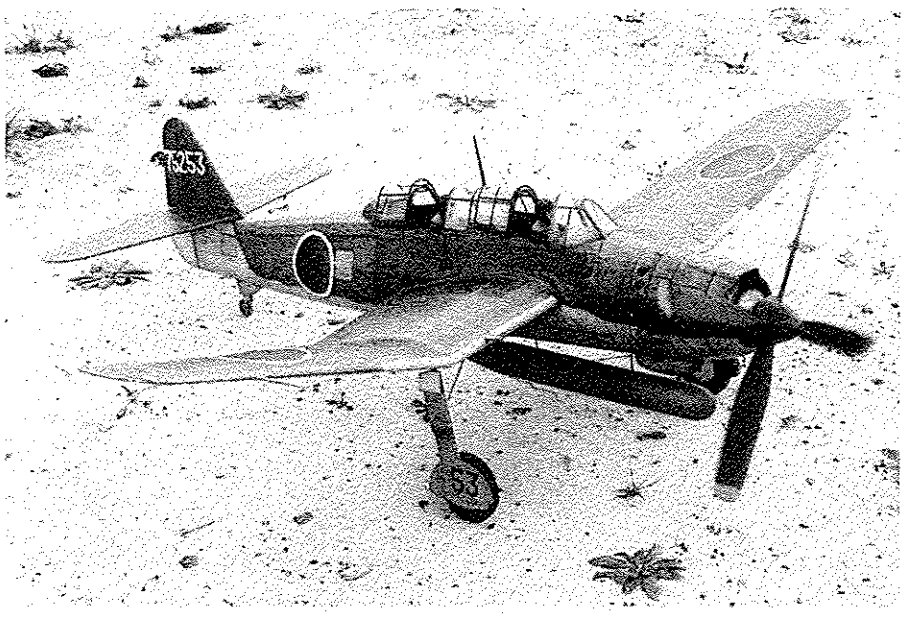
"Hey look at that neat *Zero*." This is typical of the comments at the local flying field when I would take *Grace* from the car. Each time I would hear this, it would remind me of my intent in designing and building this obscure Japanese aircraft. Japanese WW II aircraft have become largely stereotyped: If it's Japanese, it's a *Zero*. Using data supplied by Bill Caldwell and Lin Reichel, *Grace* emerged from the drafting board and into the sky with flying qualities similar to a coup d'hiver. Believe me there are other nifty looking and flying Japanese planes than the ubiquitous *Zero*.

Aichi's B7A2 was designed to meet the need for a fast, load carrying, attack aircraft. Quite large by previous Japanese standards, *Grace* was intended to complement Japan's second generation of super carriers. Problems with engine development, an earthquake which partially destroyed Aichi's production facility and ever increasing B-29 attacks, hindered production so much that only approximately 115 aircraft were produced by war's end. Had this not been the case, this nimble, fine performing, attack aircraft would have been a real thorn in the U. S. Navy's side. The B7A2 *Ryusei (Shooting Star)*—allied code named *Grace*—was a superb attack aircraft. *Grace* could tote a 2200 pound full size torpedo externally or 1760 pounds of bombs in the bomb bay. After delivery *Grace* could move out at the respectable rate of 360 MPH. Near the war's end, with Japan's carrier force essentially nonexistent, *Grace* contributed to Japan's home island's defense and was listed on the rosters of the 601st, 752nd and Yokosuka N.A.G.

General construction notes

Both the landing gear and torpedo are plug-in which gives the option of flying with or without either. Also this enables the model to be flown in A.M.A. contests which require the landing gear for R.O.G. or removed for hand launch flights typical of F.A.C. contests. The lightest balsa wood is used throughout the structure except hard fuselage longerons and inboard wing spars. Basswood is used for the wing support "I" beams and canopy frames. The engine cowl is built separately from the fuselage and attached after covering. Lastly, the stab and rudder are constructed with a symmetrical airfoil.

Fuselage. Construct the fuselage from a basic box framework of 3/32 square. Use hard 3/32 for the four longerons and medium light for the uprights and cross pieces. Add all of the quarter section formers and F-10 at the rear of the framework. Wrap the cowl between F-3-1 and F-4 with 1/16 sheet; also add the instrument panel and wrap with 1/16 sheet between F-4 and the instrument panel. Carefully cut out two identical wing mount openings from 1/16 sheet and glue in place to F-4, F-5, F-6, F-7. Glue two stab supports made from 1/16 sheet between F-9 and F-10 to the top longerons. Laminate the five canopy frames three A's, one B, and one C from two pieces each of 1/32 × 3/32 bass wood over a balsa form. Trim each to fit at exactly the right height and equal length sides and glue to the top of the longerons. After all five are in place, fill in the area between each with 1/16 sheet. This sheeting adds strength and support to the canopy frames and provides a good celluloid and tissue attachment area. Cut out the 1/32 ply windshield frame and glue in place by cutting through the top sheeting for the bottom ends to stick through. Make sure the windshield frame is centered and at the appropriate slant. Cut



The fuselage, which has an elliptical shape, is basically built from a box framework to which sub-formers are added. Each wing has two panels, built separately, and then joined at the appropriate "gull" angle.

out the two small windshield-to-canopy joining pieces, notch these, and glue in place. Finally glue two 1/16 squares vertically between the windshield and the front canopy frame. Cut out eight F-11 upright doublers from 1/32 basswood and glue in place as shown in the side view and section view through the wing mount. Cut out two F-12's and two F-13's and glue to the F-11's as shown. Note that these four pieces are in line with the leading and trailing edges of the wing and their parts fit and joining must be done with care. This structure makes up the "I" beam which spreads the wing stress through the fuselage structure. Build the engine cowl separate from the fuselage structure. Cut out F-2-1 and F-3, notch out and join with the four 3/32 × 1/4 stringers, align carefully before the glue sets. Wrap this with soft 3/32 sheet balsa and add the front F-1 and F-2 engine cowl rings and carefully sand to shape. Control the front radius by using a card radius template and sanding to match. Fill in with balsa, where required, and sand to shape the carburetor air scoop on top of the engine cowl. Carve and hollow out the rear canopy cone shaped form. Don't attach this to the fuselage framework until covering is completed. Set aside the fuselage components for tissue covering.

Wings. The wing panels are constructed in the general manner except that the inboard and outboard panels of each wing are built separately and joined at the appropriate "inverted gull" angle. Cut out the 1/8 sheet wing tip pieces, leading and trailing edge parts and pin directly over the plan onto your building board. Cut out all of the ribs and notch out for the various spars. Glue in place all of the ribs except the four 3/32 sheet ribs which are set at the "inverted gull" angle. Don't assemble the spars yet. After these four panels are dry, unpin the two outboard panels and glue against the inboard panels with each tip raised 3 1/2 inch. After each wing assembly is dry, remove from the building board and add all of the top and bottom spars. Don't forget to extend the main spar 1/2 inch beyond the root rib. Glue in place all of the various gussets, dihedral braces and landing gear mounting parts. Carefully shape the leading and trailing edges and blend into the rib contours. Set aside for covering.

Stabilizer and rudder. The structure of the tail surface is a little unconventional in that it results in a scale thickness, symmetrical airfoil. Even though a slight weight penalty is accrued, the resultant warp resistance more than makes up for the added weight. Start construction of both by cutting out all of the 1/8 sheet tip pieces and the spars R-1 and R-2 from 3/32 sheet. The rudder has two spars in order for the fin and rudder to be built separately. Pin the spars in place over the plan view. Now using 3/32 shim stock, pin leading and trailing edges in place and then shim and glue all of the 1/8 sheet tip pieces. Cut to length 1/16 × 5/16 balsa strips and glue in place where each rib is located. Note the 1/8 slot on the stab center line: the fin tongues fit into this at assembly. Add all other miscellaneous pieces and gussets. When these structures are dry, remove from the building board. Shape these surfaces as shown in the appropriate cross sections.

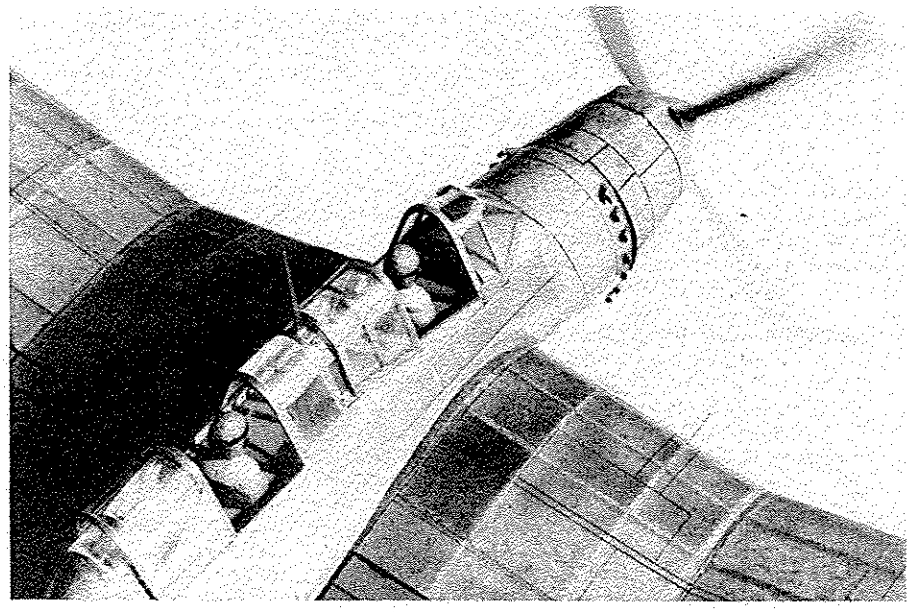
Covering

Decide whether the color scheme of the model will be done using colored tissue or air brushing. *Grace* appeared in prototype form with an overall aluminum finish set off by a black cowl and anti-glare area ahead of the windshield. The more common color scheme was dark green upper surfaces, light grey lower surfaces, and yellow wing leading edge.

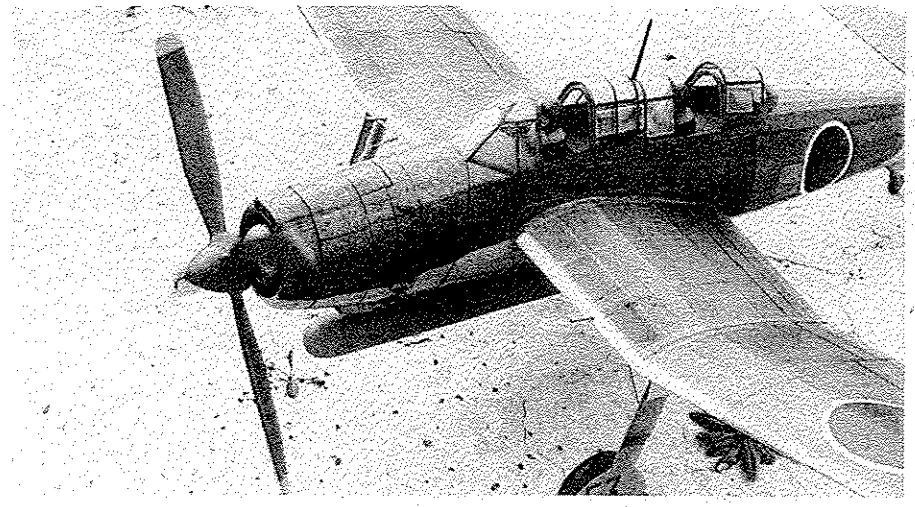
If you are going to spray paint with an air brush, cover the model entirely in white tissue. I chose to cover mine in appropriate colored tissue. From here on, this is what I'll highlight:

Carefully sand all of the various structures and dope all areas of all the structures which come in contact with tissue. Apply a total of three coats of full strength dope with light sanding between to eliminate the raised "fuzz". Really take your time as any blooper in the structure is magnified ten times when the tissue is shrunk and doped.

Cover the bottoms of both wings, the stab and the fuselage in white or light grey tissue. Slightly dampen the tissue, apply to the structure and flow thinner thru the tissue around the outline of the part you are covering. The tissue on the fuselage bottom should wrap around to the stringer beyond the color separation line. Trim off all excess tissue and apply the green tissue in the same manner to the top surface of the wings and stab. Also cover both sides of the rudder in green tissue. Refer to print and familiarize yourself with the color separation "ripple". Lay down two pieces of green tissue large enough to cover the entire side and cut this ripple in the bottom of these two pieces of tissue. Carefully apply each piece to the fuselage side, line up the color separation, and dope in place. This technique produces a rather neat looking color separation. Finish covering the top of the fuselage and the engine cowl. Make sure the color separation on the fuselage matches the same on the cowl. Also cover the rear canopy cone. Water shrink the tissue on the various frames and after satisfactory shrinkage, dope the wings and fuselage with four coats



The canopy requires a bit of work since it's difficult to vacuum form it in one piece. Mike found that building the canopy over laminated forms solved the problem. The front windshield's built from four pieces.



Following common Japanese color scheme practice, Mike, using appropriate colored tissue, finished the *Grace* with dark olive green upper surfaces, light grey lower surfaces, and yellow leading edges.

of 60/40 strength Sig Lite-cote. Dope the stab and rudder with three coats of the same. Trim off any excess small amounts of tissue and prepare all components for assembly.

Canopy

One of the most attractive features of Japanese WW II aircraft is the long "green house" which is so characteristic of their style. Unfortunately they don't lend themselves to economical vacuum forming. The solution I have found is to build up the canopy over laminated canopy forms. If done carefully, it really looks great. Use either Hot Stuff™ or R/C-56 glue to attach the celluloid to the frames. Start with the windshield area since it is the most difficult. Place an oversize celluloid piece over each area to be covered and lightly mark where to cut the celluloid with a fine point felt pen and allow a full overlap of the celluloid over each frame. The windshield area should be done with four individual pieces of celluloid. Now working from the rear forward, individually wrap and glue five separate canopies, the one ahead overlapping the one right behind.

Simulated canopy framing can be done in a number of ways: various widths of tissue strips with "snot tape" or spray glue on the back side, chart pack colored layout tape or even the complete canopy frame pattern cut out from typing paper, painted and spray glued in place. Make your choice, whichever is less painful.

Assembly

Check the fit of the wing panels into their respective openings. In the fuselage make whatever minor adjustments are necessary and then liberally glue the panels in place, in particular the spar stubs against F-5. Ensure correct incidence, dihedral, and distance from the front alignment. Both wings must be identical. Carefully align and glue the engine cowl in place and also the rear canopy cone. Tack glue the fin to the rudder and the stab to the tongues on the fin. Align these surfaces square. Now carefully fit and tack glue this whole assembly to the rear of the fuselage. Carve out the tail wheel fairing from soft 1/4 balsa and glue to the bottom center stringer. Bend up a 1/32 wire fork, install a wheel and Hot Stuff the fork into the fairing.

Detailing notes

- The oil cooler is carved from light balsa, hollowed out, and covered in grey tissue before assembly to the model.
- Engine exhaust stubs are made from bent 3/16 O.D. tubing. Holes for these are made by using a sharp end of 3/16 tubing to pierce the 1/16 sheet. Hot Stuff each exhaust stub in place and paint a rust red color.
- All of the insignia are masked off and sprayed using an air brush; where a white surround is used, spray paint the entire white disc first and then lay on the mask for the red centered over the white.
- Use a fine tip "Sharpie" or "Pilot" marking pen to define the flap, aileron, elevator separation and any other panel lines needed to suit your taste.
- Make 20mm wing mounted guns and pitot tube from aluminum tubing, drill holes, and glue in place.
- The torpedo is built using a paper tube wrapped around a 1 inch dowel and balsa plugs, which are carved and hollowed out, for the front and rear. Fins and props are from card. Install two pieces of 1/32 I.D. tubing and glue into the bottom center of the fuselage. 1/32 attachment wire struts are glued to the "seam" area of the paper tube torpedo.
- Landing gear is bent from 1/16 wire and soldered together. Use lengths of fuel line to give each leg some depth, also wrap with tape strips to give that hydraulic cylinder look. L. G. covers are cut from 1/64 ply and rubber cemented to the L. G. leg. Check the plug-in gear sockets in the wing and make minute bends in the wire to align one with the other.
- Wheels are turned from soft balsa on a 1/4 inch diameter stub dowel, after turning in a hand drill. Cut off the excess dowel and drill for the axle.

Flying

Before you even get to the flying field there are a couple of things that are a must. Check the decalage between the wing and stab. The simplest method for this is to set the wing bottoms on two parallels set on a large flat table. Now measure the stab leading edge to the table and compare this with the stab trailing edge to the table. The trailing edge of the stab must be 1/8 to 3/16 higher than the leading edge. Then make up a rubber motor and install in the model. Braid the motor to remove any excess slack. Now check the location of the center of gravity. Add ballast if necessary to the inside of the cowl to bring the C. G. in line with the main spar.

This model is so stable that it can fly either a right or left power pattern. But be careful that a right hand power pattern does not tighten up into a right power descent. Start low powered flights at about 200 turns and set the thrust line to approximately 4° down and 2° right. Launch the model straight out and observe carefully. Add power gradually to each successive flight, about 50 more turns to each, and make thrust changes if necessary to achieve a shallow, straight out climb. At this point don't fiddle with wing tabs, warps or rudder settings. Of course this assumes that wings and empennage are aligned, using thrust adjustments only, the model should climb out in a gradual right or left circling pattern with no hint of a stall or "gallop". If a slight amount of stall occurs during the power pattern this may be cured by tightening the climbing turn a small amount with side thrust. However, if the turn is smaller than a 100 foot diameter circle it may be safer to add more down thrust. By now the model should be reaching reasonable altitude at which time observe the power cruise and glide. Set up the cruise and glide in the same direction as the power pattern. Offset the rudder in the direction required but add opposite side thrust if the rudder movement is more than 1/16 inch, otherwise the power pattern will change. Now, with the model reasonably trimmed, install a fresh motor and wind to near max winds. Observe carefully the complete flight pattern. The model should climb out and cruise, all the while gaining altitude, and settle into a circling glide turning in the same direction as the climb. Above all, eliminate any stalling condition; this wastes power and robs you of altitude. Remember: Under power, if changes are needed, change the thrust line setting. Glide changes are made with the rudder with corresponding opposite thrust line change. When properly trimmed this model will fly like a Wakefield, no kidding.