

# Grumman Mohawk

■ Here is an unusual scale model with an unusual color scheme. Proportions for an authentic copy are excellent, with a long tail moment and general "clean" overall shape. The variety of contrasting colors is enough to pop the eyes of any judge at a flying scale meet.

Care has been exercised to stay within the "exact scale" area, with but two exceptions. One is the tail section, which is thinned for lightness and easy construction. The other deviation from scale is a simplified "greenhouse" up front. True scale here would mean carving large canopy forms and heat-forming the puffed compound-curved sections for all areas but the windshield, which is flat. Since a great many potential builders falter and quit when it comes to any "blown" style canopy, a somewhat simplified version is shown on the plans. Any celluloid of .020" to .035" thickness will do the job.

It is best to start with the wing of this particular design. Cut the required ribs, then the spar. It will be possible to cut a one-piece spar from a piece of  $\frac{1}{8}$ " x 3" x 36" stock, but a spliced one will do as well, since the strength in this wing is in its covering and system of sub-spars. After cutting out a plywood spar brace, carefully attach it to the spar and allow to dry thoroughly. You can cut out formers or tail parts in the meanwhile.

Once the rib positions have been marked on the spar, the center section can be assembled over the plan. A very slight crack is all that is needed in the  $\frac{1}{8}$ " x 3/16" sub-spars where the dihedral starts. Now before sheeting is applied, mount the bellcrank. For the lead-outs to come through the wing in the required manner, mount the bellcrank platform exactly as shown in the side view. The rear part of the bell-crank mount is just about vertically centered on the rib where it touches the spar (or recessed 3/32" below the top edge of the spar). Do not mount the bellcrank yet. The short leading edge section used in the center section should be  $\frac{1}{4}$ " x 5/16" medium balsa. Bevel the top edge so that the 1/16" sheet covering will go on smoothly.

When the sheeting is completed on the center section and the cement has had time to dry, remove any pins still holding the center section to the workbench. Now we tilt the wing assembly over to one side until the spar is flat on the plan and workbench. Pin the spar down and slide the various ribs into place and cement.

If you are working on the left (or "port") wing panel, be sure you have the lead-out holes cut into the W1, W2 and W3 ribs as shown. Also note that space will be left behind the spar where the landing gear strut later will be. Just slip a 3/32" shim in there and pin it in place if loose (but don't cement). Taper the leading edge as indicated and cement in place. Now sheet in the whole panel.

It will be found that small sections of 1/6" sheet will do very well in covering, but the butt-joints must be neat, or else do it in strips that go from the root to tip in one piece. Be sure that the sheeting extends beyond the rear tips of the spars. Neatly trim the trailing edge section of the sheeting as per plans. In other words, the sheeting should overlap a bit over  $\frac{1}{4}$ " at the W1 ribs tapering to a 7/16" overlap at the tips. This overlap later is bevelled to take the bottom sheeting. About those sub-spars. Firm  $\frac{1}{8}$ " x 3/16" stock, about 18" long does the job. No need for these beyond rib W4, as the spar and sheeting make the tip area more than strong enough.

Once the cement has dried on the wing panel that was assembled, the wing assembly is rocked over to the other tip and that panel is assembled in a manner similar to the first. Allow sufficient time for the cement to dry well before removing the wing from the workbench.

The main landing gear is bent per the dotted lines shown in the front view—3/32" steel wire does the job; all of the bends are radiused generously to retain strength. Sharp bends, as made in a vise with the aid of a sledge-hammer, have a tendency to crystallize the metal, with a crack (or even a complete break) as a reward for one's hurry. As long as the tread is even close to that indicated, and as long as the axles aren't cockeyed, the job is okay. Before attempting to install the main landing gear strut, note from the side view that the strut bends slightly backwards about halfway down to the axle. Once this bend is made, the strut is fastened to the rear face of the spar brace. Any strong joint will do, "J" bolts are about the best, next-best being fine wire "sewing" through the spar assembly. This requires many small pre-drilled holes, which is no trouble if you have a small high-speed electric hand-drill and #50 or 1/32" drill bits. But the attachment of the main struts must be strong.

Do not forget to add the small "L" struts aft of the main struts to brace the strut against collapse in a really hard landing. The small leg of the "L" is wrapped and soldered to the strut before cementing the large leg of the "L" to the underside of W2. Sewing it on with thread or using a bit of crinoline or cloth will help hold it to the rib firmly. Fibreglas and resin would be best, if you have any. If not, lots of cement!

The bellcrank is mounted now, with lead-out wires to follow either now or when the cowlings are on. Better do it now. If any holes are required for slipping the bellcrank into place, they may be cut out of the sheeting near the bellcrank mount. One or two holes, up to 1" x 2" in size, will not affect wing strength. Note that ample clearance is afforded the bellcrank by cutting away portions of sub-spars as shaded in on the wing plan.

Remember not to loop the ends of the lead-out wires (okay at bellcrank end), as cowl parts slip onto these wires and small lengths of tubing for reinforcement have to be added to cowl. Approximate placement in side view. Tip guide not added until cowl are in place.

Now the fuselage can be started. Part of the wing bottom must be sheeted in order that the wing may be handled in ensuing construction. When all of the center section and even half the rest is done, we'll proceed.

With the utmost care, mount the top and bottom halves of formers 4 and 5, taking care to center them. These parts are marked F4T, F5T, F4B and F5B. Now the side keels are slipped over the wing panels toward the wing root. You will find that the landing gear struts will be in the way. Merely make a small cut where required at a slight diagonal angle to get the side keel past the L.G. strut. Even cutting a section out of the side keel is okay, but replace it as accurately as you can once the side keel is past the L.G. strut. A small doubler on the inboard face of the side keel where the cut was made will reinforce it as good as new. Some sanding will be necessary to get the side keels to fit the center section. Once fit is obtained, cement only to the formers. Work back toward the tail and up toward the nose, cementing the formers in place as you go. For the side keels to fit flat against all the formers, it will be necessary to dampen the outboard faces of the side keels so that they curl slightly to follow former contours.

After all the formers are in place, sight along the fuselage from the rear to check alignment. The top of the fuselage is straight, and can be used as a reference line as marked on the plans. Pin a strip of scrap balsa along the tops of the formers to check this. If slight relocation or sanding is required, do it now. Once you are happy with the overall line-up, put on the second coat of cement where formers touch side keels and where side keel meets wing sheeting.

## "MOHAWK" BILL OF MATERIAL

Four pieces  $\frac{1}{8}$ " x 3" x 36" med. balsa for ribs, spars, and formers; (8) 1/16" x 2" x 36" med. soft balsa for wing covering; (50) 3/32" x  $\frac{1}{4}$ " x 36" DR (40)  $\frac{1}{8}$ " x  $\frac{3}{8}$ " x 36" soft balsa for fuselage planking; (1) 3/16" x 3" x 36" balsa for cowl sides; (5)  $\frac{1}{4}$ " x 3" x 36" med. balsa for cowl sides, tip rudders, etc.; (2)  $\frac{3}{8}$ " x 3" x 36" med. balsa for stab, rudder; (1) nose block 3 1/2" x 3 1/2" x 4" med. balsa; (2)  $\frac{3}{8}$ " x 1" x 5 1/4" med. balsa wing tips; (2) 1" x 2 1/2" x 5" med. balsa for top cowl blocks; (4)  $\frac{3}{8}$ " x 1/2" x 5" hardwood strips for engine bearers; (1) 1/4" plywood, 6" x 12" for spar brace and L.G. mounting reinforcement; (2)  $\frac{1}{8}$ " x  $\frac{1}{4}$ " x 36" hard balsa wing short spars; (2) 3/32" dia. steel wire, 36" long, for L.G. struts and push-rod; (1) .020" x 6" x 12" celluloid for windshield; (1) 1 1/2" or 1 3/4" dia. nose wheel; (2) 1 7/8" dia. main wheels; (2) tanks, approx. 1" x 1 1/2" x 2"; (2) Black "Wondur-Cal" sheets for scale wing walks, etc.

The following amounts of any "fuel-proof" dope are required: 8 oz. balsa fillercoat; 8 oz. white; 4 oz. red and silver; 1 oz. black.

Planking is best accomplished with narrow strips,  $\frac{1}{4}$ " or  $\frac{3}{8}$ " widths are best, and if you have any stock slightly over 3/32" thick, that's fine. You can afford to be a little sloppy. But remember, the neater the splicing and butt-joining of adjacent strips, the less sanding needed later. Work at an easy pace, and do not forget to work on alternate sides. If you plank one whole side, ignoring the other, you are very likely to warp the whole shebang out of line.

Add the nose-wheel strut before all the planking is on, ditto for the push-rod. The middle push-rod hole on the bell-crank is recommended for smooth flying (we assume you'll leave the looping and wing-overs to the "stunt" ships). The bend in the tail end of the push-rod can be deferred until the tail assembly is attached. If you have a power jig-saw, pre-cut the nose block as to side and top-view contours before cementing it in place. Once the cement is dry, carve and sand to shape. Hollowing is not necessary, and do not use very hard balsa, as there is a lot of whittling to do and you'll be hacking forever with rock-hard balsa.

The "floor" in the nose section of the fuselage is optional, but is at scale position, for those who go all the way on cockpit interior detail. Not much is known at present as to interior detail, this being a new design. However, it is assumed that a radar hood and screen takes up more than  $\frac{1}{3}$  of the instrument panel, on the right side. Martin-Baker ejection seats are fitted (2). Standard instrument cluster forward of pilot (left seat) with throttles and other handle-type controls on a pedestal in center of cockpit. Overhead instruments in "eyebrow" fashion are forward of both seats, with an overhead console strip between the seats. Dual stick controls at both positions, with fire extinguisher clipped to back of cockpit behind pilot's left shoulder.

Cockpit canopy construction is by the cut-and-try method. Between photos and what is indicated on the plans, we can cut the various sections to shape and cement them in place. Almost any thickness near  $\frac{1}{32}$ " will do for canopy covering, but windshields will look best if of thicker stock. Any Lucite or celluloid up to  $\frac{1}{16}$ " will be best for the windshield. If interior detailing is not attempted, paint cockpit interior dull black or dark gray.

Cowlings can be assembled in any manner desired, as long as the assembly is neat and accurate. The various cowl rings can be assembled first, working back towards the rear. Engine bearers can be added after part "D" is in place. Take care in fitting parts H6 and H7, as you do not want two left-handed cowlings. Due to the taper of the wing, the openings in the cowl vary, plus the fact that the starboard (right) cowling is toed-out as per exact scale. Thus, if the left engine conks out prematurely, the "out-thrust" helps to maintain line tension. For a similar reason, NO out-thrust is incorporated in the left cowling, as the thrust would pull inwards toward the flyer, slackening the lines, resulting in loss of control.

The rear portions of the cowlings can be assembled first, if desired. But accuracy must be maintained. Be sure to pin both cowlings in place, marking their positions for a visual checkout, before cementing in place permanently. A little sanding or trimming may be needed here or there, but will be minor.

Tail surfaces are simple. If scale dihedral is employed in the stabilizer, twin elevator horns must be fitted. They can be actuated by a common "L" bend in the end of the push-rod, or a forked end fashioned to the push-rod. The former

method is recommended. The large throw of the horn is desirable, as it cuts down elevator action. If a flat stabilizer should be chosen, simplicity will be the keynote, as an elevator horn of orthodox type can be fitted. A spar could be incorporated into the elevators ( $\frac{3}{8}$ " sq.) and the elevator horn fastened to it in the conventional manner.

Now for the paint job. A primer, or sanding-sealer coat is needed to seal in the balsa pores. Or should we say several coats? It depends on the finish you desire. Two coats would be about the minimum, 4 coats more than enough. Fuselage is white, with dull black anti-glare panel forward of windshield. Bright red under that. Red stripe aft of cockpit to denote prop danger zone.

National insignia appears each side of fuselage midway between stabilizer and wing. The word "ARMY" aft of that, each side. Tail surfaces are mostly red, with silver leading edges. White panel lower part of outboard rudders for "U.S.ARMY" and serial number below. "76463" in block letters there. This lettering and numbering only on outboard faces of rudders. Cowls and wings mostly white. Black spinners and anti-glare panels inboard faces of cowls. Red wing tips, black lettering as noted. Black wing-walks near cowls, ditto exhaust ovals, and small corner of leading edges at tips. Underside of wings similar to top, except for no exhaust markings or wing-walks. Top of lettering toward leading edge, same as on top surface, but lettering on opposite wing panel. National insignia on alternate panels also. (Top of left wing, bottom of right wing).

Leading edge slot area is all silver. Since the slot begins at different chord positions, top and bottom, we note that the color separation lines vary. Wider band of silver on top surface. Control surfaces can be indicated with strips of black tissue, put on with a draftsman's ruling pen, or scribed in without any coloring. We prefer the ruling pen method, using diluted black dope that was well shaken up to remain quite opaque when ruled on.

If the scale antenna mast is fitted, remember that it sports a two-tone paint job. Leading edge is red, aft section is white. Antenna system is optional, and if it isn't too clear to you, check the photos of the real ship for details. Scale prop blades are silver, with red tips.

If you build your "Mohawk" to exact scale and are questioned as to its scale by a judge at a contest, remember that it is  $\frac{7}{8}$ " to the foot. At this ratio, the 42 foot span of the original comes down to  $36\frac{3}{8}$ ". The 41 foot length scales down to a  $35\frac{7}{8}$ " length.

For those super-scale bugs, the real ship is entered through side panels that hinge upward and outward. Top sections of canopy just over the hinged sections both slide aft on roller tracks. These remain in place in a bail-out, as the ejection seats propel the occupants right through the plexiglas canopy at any altitude safely. Remember, the pilot's head and face are protected by a strong "curtain" that zips down over him before ejection. Manual egress is virtually impossible for bailout purposes, due to proximity of prop arcs and number of rudders one would have to clear safely.