



="GUSSETS"=

By BRAD SHEPHERD . . . The author's idea of a "could be" scale model is this sporty mid-wing aerobatic ship. The model lends itself well to slight changes in shapes and colors, to suit individual tastes.

- Have you ever dreamed of building your own personal flying machine?

As a youngster, I used to spend many Saturdays at our local grass strip airport. Mom would fix me a sandwich, and I would walk about three miles along the bayfront to get to the field where I'd spend time wiping oil off the Airknocker C-3, the Waco, and the Piper. For this I would get a hop in one of the planes. It was the late 30's, and most folks were still pretty poor, our family included. This was my way to be around airplanes and get an occasional flight. Airplanes have been a part of my life ever since those early days, in the form of building and designing rubber, F.F.,

H.L.G., control line, and finally R/C models. However, I have always had this vague dream of building my own full-size aircraft.

Six years in the air arm of the Navy, marriage to a beautiful woman, raising four children with the attendant expenses, and now I find myself well into the middle years, with not enough money to build a real one but still having the dream, so an R/C version will have to be enough for the present.

There are some who say I'm in a rut. 'Tis possible, but that's one of the varieties of the aging process and it does get pretty comfortable. Sir Geoffrey (DeHavilland) was known to say, "If it looks right, it'll fly right." Anyhow, I'm walking in

good company, as George Owl's success will attest to, and this is the way I would do it if I were ever able to build that dream.

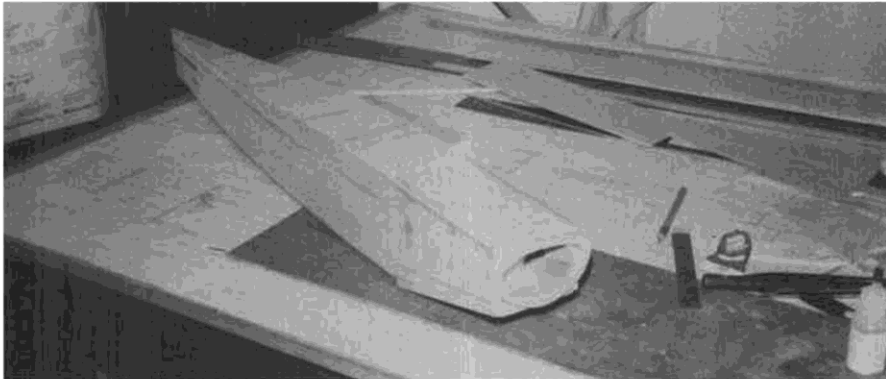
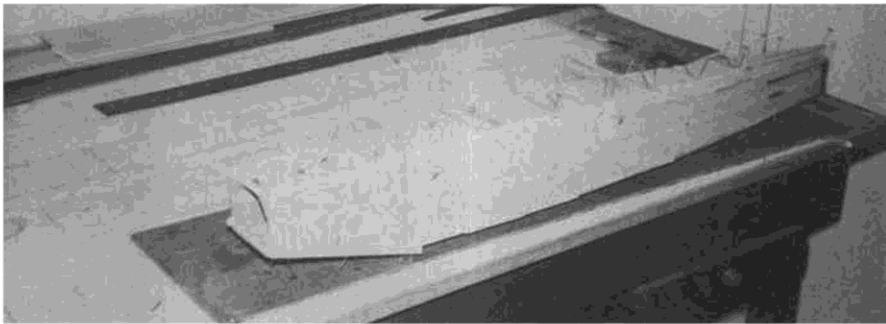
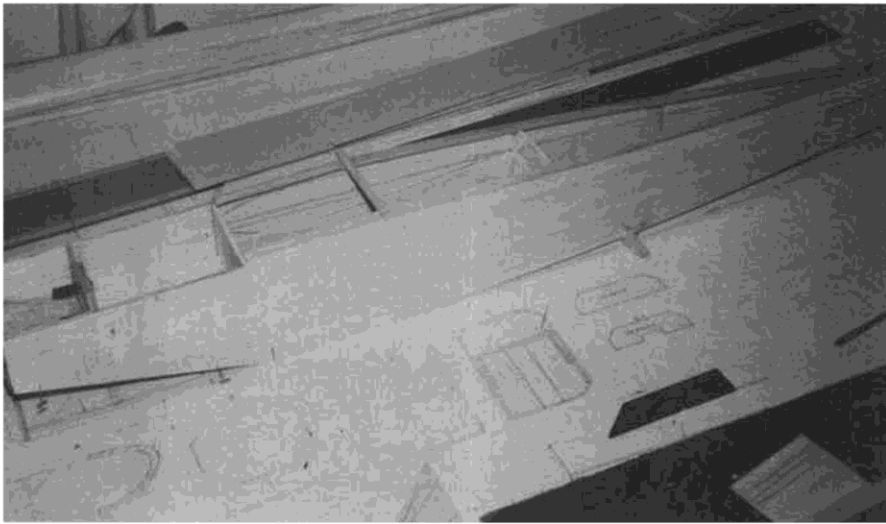
The wing would be full cantilever with two tapered spruce spars, generous amounts of ply sheeting to take about five G's, and the remainder would be capped, covered and doped. The fuselage would be semi-monocoque, a welded tube box back to the trailing edge of the wing, have formers, and be covered with aluminum. The rear of the fuselage would be monocoque, ala George Myers' "Little Toot". The stabilizer and fin would be welded tube with ply sheeting. The elevators and rudder would be made from light welded tubing, then



Brad is justly proud of his little bird. Model looks something like his "Doublor" design, kitted by Sig.



If you build Gussets, build two and put one away. If Brad ever gets around to building the real one, you'll have a scale model!



Fuselage construction sequence. Top: basic fuselage frame. Middle: top and bottom sheeting in place. Bottom: ready for shaping. Note that the balsa nose ring and cheek cowl have been added. Generous use of triangle stock in corners makes for well-rounded edges.

loops are no sweat if the “muscle” up front is putting out, knife-edge with the .23 is possible if it is started from a split-S upwind and really gets honkin. The airplane is a lot of fun and gives lots of flying pleasure, and it’s easy on the budget. It looks like something that might be seen at Oshkosh. So, if you have a .23 or .35 lying around idle, like taildraggers, enjoy building and sport flying, then look through your balsa pile, pick up your “Uber Skiver”, and start cutting.

I used Sig building materials all the way through, with the exception of some of the accessories. The 1/8 Lite-Ply is just that; light, easy to cut, and quite a bit stronger than balsa. The trailing edge was designed around Sig’s t.e. stock, which has a 90° angle on the thick side. If some other trailing edge stock is used, take this into account when cutting the ribs and building the wing. The landing gear blank was cut down with a hacksaw and finished up with a file, to give a more scale-like appearance. The tailwheel rudder drive assembly is easy to fabricate, using the isometric sketch on the plans. The 1/16-inch wheel collar is used as a spacer. Epoxy a piece of inner Nyrod in the rudder for wear-ability. The arm is cut from K&S 1/4 inch brass strip.

Start the wing by cutting root and tip rib templates from ply or aluminum, and stacking eight pieces of 3/32 balsa between them. Pin or bolt this assembly together, then carve and sand the balsa to conform to the patterns. Make a right and left hand set. The ribs won’t come out perfect, but it is the quickest, easiest way to cut ribs for a tapered wing, if the taper is moderate. Use a piece of straight-grained 1/8 medium balsa to lay out the spars, then cut them out. I have used this method of wing construction (full depth spar, 1/8 cap, 1/16 webbing on trailing edge sheeting) for tapered wing models up to .40 size, and have found it to be very strong, light, and rigid.

When the spars and ribs have been cut out, pin a piece of 1/4 square balsa on the line shown in the wing plan. Pin the 1/8 x 1/4 spar cap to the plans, making the splice about halfway out on one of the panels. Glue and pin the 1/8 sheet spar to the rear edge of this cap. Check-fit each rib before gluing, and trim where necessary. Take ribs 4 and 5 from each stack, mark where the aileron bellcrank plate will be located, and trim 1/16 of an inch from the bottom of each rib at this location to accept the plate. Glue the ribs in place, pinning them to the spar and the 1/4 sq. “jig”. While they are drying, cut two pieces of

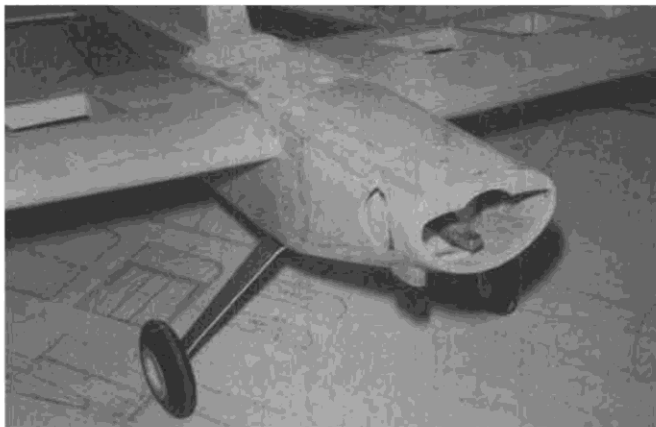
fabric covered.

The optional bubble canopy would be removable for those warm, lazy summer days, when you just want to go up and enjoy the sky.

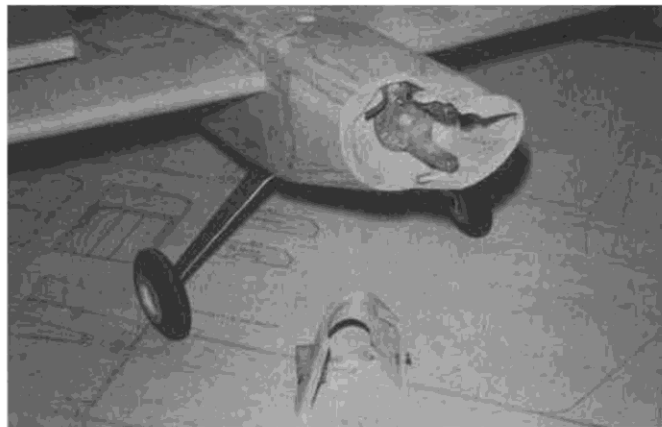
A good 85 hp engine out of a wreck (cheaper that way) would be enough, or, if you’re so inclined, stuff some more horses (150 should do it) under the cowl, beef up the tail feathers, and mix it up with the big boys.

The ST .23 in the prototype gives pretty good scale-like flying, but a .35 would give more vertical capability and be about what a 150 would be like in the big one. I had a few ideas I wanted to try on this model and they worked out okay. If you make any changes, let me know how it turned out for you.

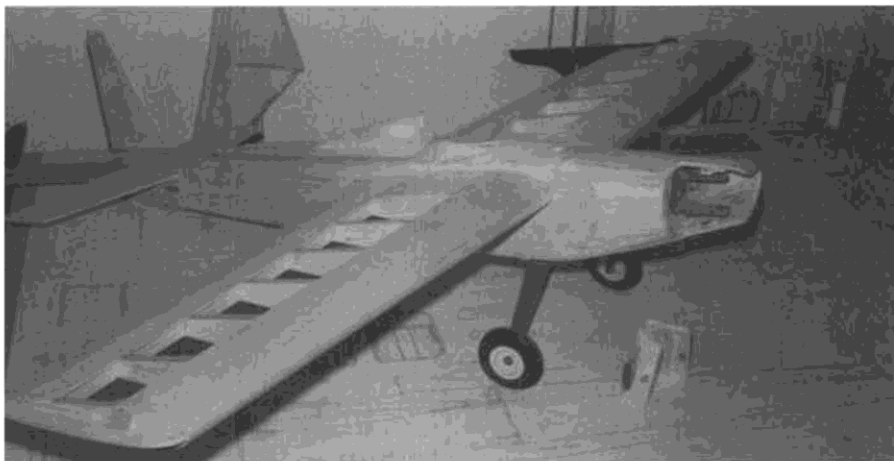
I “lucked out” this time . . . the only adjustment I made was to add a tad more aileron throw for better roll rate after the test flight. Takeoffs are a real joy for a taildragger “nut” . . . just a smidgen of right rudder as power is applied, the tail comes up and it rolls right along. When you figure it’s going fast enough, touch up elevator and jam right aileron (just like Art Scholl). I get my “jol-lies” this way, as long as my Kraft keeps working. Almost everything has been done with it . . . inverted spins have to be worked at, snaps are good, spins to the right are positive and recovery is good (tried one to the left and almost swept up the little pieces!), inverted flight is positive and solid, four-point rolls are easy, Cuban Eights and square



This is how the nose looks after shaping. Air outlet through the left cheek cowl is barely visible.



Cowling removed. Note the plywood tabs that hold the cowl in place.



"Gussets" ready for finishing. The 1/64 ply exhaust extension in the removable cowl is plainly visible. Brad used Monokote on the wing, Sig Supercoat dope on everything else.

1/16 sheet 24 inches long by 1-5/8 inches wide, and glue the 1/8 x 3/8 trailing edge spars to the edge of each sheet. When dry, glue the sheet to the ribs, butting the spar against the rear edge of the ribs, and pin in place to dry. Glue reinforcement scrap in place inside the sheet joint at the center section.

Glue the leading edge to the front of the ribs. While this is drying, take some 1/8 Lite-Ply and cut out (2) of PR, (2) of aileron bellcrank plate, one each of WPL, WPT, and spar joiner. Glue the PR pieces to the inside of the root ribs. Use firm, medium A-grain balsa to sheet the leading edge . . . this type of grain curls easily across the width. Use a straightedge and trim one edge square. Do not sheet the center area between the root ribs yet. Pin the sheet against the l.e., between the tip and root ribs, and mark the sheet where it lays against the rear edge of the 1/8 spar. Use a straightedge to trim the sheet, and glue it in place. Repeat the procedure for the other panel.

The center section sheet behind the spar can be done in one-piece sheets. Glue the 1/8 ply spar joiner in place, along with the aileron

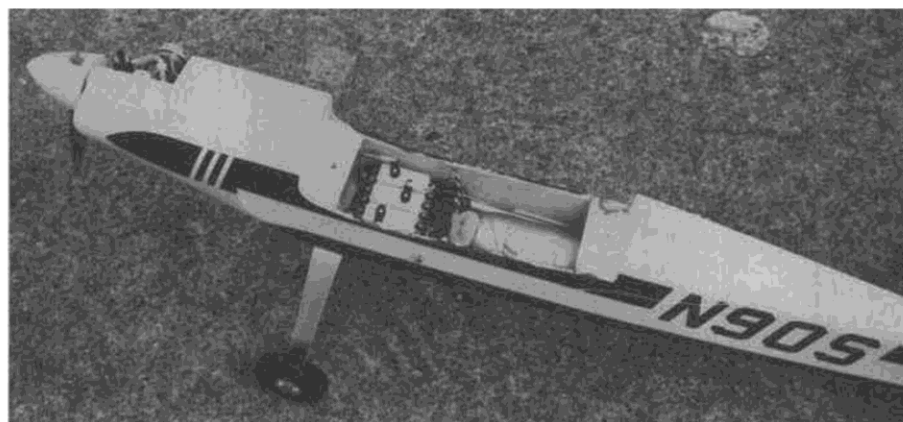
bellcrank plates. Remember, the aileron plates are flush with the leading edge sheet, and project 1/16 of an inch above the ribs at the rear to allow a 1/16 balsa cap strip to fit. Cap strip the ribs and allow the wing to dry.

Now is a good time to cut out the tail surfaces; use light to medium quarter-grain wood. Make the elevator joiner from coat hanger wire; it's about 3/32 of an inch in dia., bends easier than music wire, and is strong enough for this application.

Lay the two elevator halves against the rear edge of the stabilizer and pin them to the workbench. Lay the joiner on the elevators and mark where the holes are to be drilled, then drill the holes and rout out a groove for the joiner. Lay Saran Wrap or poly sheet on the bench, position the elevator halves against the stabilizer, and pin them down firmly. Mix up some Kwik-Set epoxy and smear it on the wire, inserting it into the holes and groove on the elevator halves.

Remove the wing from the plans, turn it over, and pin it down at the root ribs and 1/4 sq. jig. Shim each tip 7/16 of an inch at the spar and 13/16 of an inch at the trailing edge. Pin this down firmly so the leading edge sheet will not twist the wing when it is glued on. Trim one edge of each trailing edge sheet with a straightedge so that they butt against the 1/8 x 3/8 trailing edge spar squarely, then glue in place. Glue 1/16 sheet reinforcements inside these sheets at the center section. Glue 1/16 balsa webbing between the trailing edge sheets, making sure the wing is pinned down solidly and the trailing edge is straight, or a warp will be glued into the wing. Epoxy the WPL ply plate to

Continued on page 117



Spacious fuselage makes for easy radio installation. Receiver antenna exits through a brass grommet in fuselage side and connects to fin. Neat, clean arrangement.

Gussets Continued from page 23

the PR pieces. Take two more 1/16 A-grain sheets of wood and check the fit against the leading edge; trim if necessary, mark the sheets as was done on the bottom sheeting, cut and glue into place. Glue a 1/16 sheet scrap under the center section joint.

Glue the cap strips in place and let the wing dry thoroughly. Using a long, straight block with 220 sandpaper, sand the wing smooth. Pin one panel down at the trailing edge over some poly sheet, fit the 3/8 x 1-1/2 trailing edge stock to the rear side of the 1/8 x 3/8 spar, sand where necessary for a good fit and glue in place. When this has dried, repeat the procedure on the other panel. When dry, remove the wing from the board and sand smooth. Glue WPT and hardwood block to trailing edges.

Lay the fuselage sides out on 3/32 sheet balsa using a ballpoint pen and straightedge, but do not cut them out. All the lines on the sides, except the root rib, are straight. Locate and draw the thrust-line. All other measurements and lines are made from this reference point. Locate formers C and D on the sides and, using a 90° triangle, mark their locations on the fuselage sides. Locate, but do not cut out the openings for the wing.

Locate and draw the cutouts for the stabilizer. Lay out and cut two each of the doublers D-1 and D-2, from 3/32 sheet. Glue D-1 into place on the sides. Use a scrap piece of 1/8 balsa between D-1 and D-2, when gluing D-2 in place; this is to allow for former C. Glue the 3/8 triangle stock to each side, as shown on the isometric view, and also the 3/32 x 1/2 under the stab and on the fuselage side between the wing and stab. Lay out all the ply parts, and cut them to shape. Note that the firewall and landing gear plate are hard 3-ply or 5-ply birch. The heavy lines on the section drawings are the outlines of the formers.

Cut the sides out around the outside edges of the triangles and doublers, cut the slot for the stabilizer, but do not cut out the wing opening yet. The fuselage section over the wing, between formers C and D, is removable, but it is not cut loose until the fuselage has been shaped.

Lay poly sheet over the fuselage top-view on the plan. Pin landing gear plate LP in place squarely over the plan. Pin a piece of 3/8 sq. scrap, about 4 inches long, over the top view, 3 inches behind former D location. Pin each side over the plans, butting them against the LP plate, and pinning them down to the

3/8 sq. scrap. Slip former C into the slot between D-1 and D-2, and pin it to the sides. Check the squareness of the fuselage by setting a 90° triangle against the sides and bench top. Shift the sides or former to get everything square, then use the Hot Stuff, Zap, etc. to glue LP and former C in place. Glue two B formers together with Kwik-Set epoxy, then lay out the thrustline and center line on the front of B. I used a Tatone long .19 mount in the prototype. Take whatever mount you are going to use, and center it over the center line and thrust-line, then mark the mounting bolt holes. Drill the mounting holes in the plywood, and use bolts and blind nuts to hold the engine mount. (I use bolts with a short piece of wire soldered to the head slot, to keep them from turning. The bolts are epoxied to the back of the firewall. The mount is held to the firewall by double nuts; this makes a fuel-proof arrangement and will not vibrate loose.) Slip the firewall into the slots, check for squareness, wrap the fuselage front sides with masking tape, and use a hot glue to fasten the firewall to the sides. Install former D and press it against the rear edges of doublers D-2, pull the sides together at the rear, and hold with two clothespins. Check to see that the joint is over the center line at the rear; if it is, glue the sides together. Check former D to see that it is against doublers D-2, then glue it in place. Go over each former and LP with epoxy glue. Pin and tack-glue a temporary brace across the top of the fuselage at the cockpit, to keep it square.

Using a Zona saw, make a cut on the sides down to the wing center line, directly in front of former D and directly behind former C. Slip some poly sheet into these slots, then glue formers C-1 and D-1 in place. Cut FT from 3/32 sheet, and glue it to the fuselage, lining the fin slot up with the centerline mark on the firewall. Glue the 3/32 top sheets in place. Cut the 3/8 sheet over the wing to length, butting it against the sides at the cockpit location, line it up with former C, and glue in place.

Glue the 1/8 tank floor sheet in place, fit the tank and tubing in place, then glue the 3/4-inch triangle pieces to the sides and firewall. Stuff some foam around the sides and top of the tank. Cut and fit the top 3/8 sheet, then glue it in place. When it is dry, unpin the assembly from the plans and plug the fuel tank lines to keep sawdust out of the tank.

Cut the pushrod slots in the fuselage sides. If you use Golden-n-rods,

as I did, epoxy the outer tubes in place now. Sheet the bottom from LP to the tail, glue the 3/4-inch triangles in place in the nose, and glue the bottom 3/8 sheet in place. Sand the front end square, using a large sanding block. Draw the center line and thrust-line on former A, and glue in place. Glue the cheek cowl to the sides, and also the 3/8 front cowl sheet.

When everything is dry, carefully rough-carve the fuselage to shape, according to the section drawings on the plans, then use rough sandpaper to finish shaping, and finish off with 220 grit. Using a sharp knife, cut along the line between C and D, at the center line of the root rib on each fuselage side, and remove the turtle deck. Trim the fuselage sides at the root rib until they are the same as doubler D-2. Epoxy the WP3 pieces to the sides, then epoxy WP2 and WP1 in place. Epoxy the hardwood block under the center of WP2. Glue WP4 into recesses and against former D. Glue WP6 pieces to each side and up against WP4, then glue WP5 under WP4.

Draw center line on formers C and D, and a center line on top of the wing. Place the wing in the fuselage, line up the center lines, and pin the wing firmly into the fuselage saddle. Measure from each tip to the tail post, and shift the wing until it is square. Drill holes down through all the ply plates and hardwood blocks at the leading and trailing edges, and tap the front and rear blocks with a 1/4-20 tap. Enlarge the holes in the wing leading edge plate and fuselage at former D to clear a nylon bolt, then bolt the wing in place.

Place some poly sheet at formers C and D and glue the fuselage turtle deck to the wing. Slip the stabilizer into its slot, measure back from the wing to get it square, and glue it to the fuselage. Glue the fin into the slot in FT, using 90° sheet balsa triangles to keep it square with the stabilizer. Cut the cockpit opening as shown on the side view. I used BT5 rocket body tubes for screw guides; sand holes in the rear bottom and front top of the fuselage to allow these to slide in, then glue in place. Cut through the headrest at former D with a Zona saw, and remove the wing.

Place the drilled landing gear in position over LP and drill the holes. I used 4-40 x 3/8 flat head screws and blind nuts to hold the gear in place. Bevel the holes in the gear to receive the flat head screw.

Cut a slot in the center of the rear fuselage, under the fin, to receive the aileron bearing that is used for

the tail wheel bracket. If you have not fabricated the assembly, do it now. I used low temperature silver solder to make the joint between the arm and the 3/32 tubing, and also to sweat the tubing to the 1/16 music wire. Trim enough of the fuselage away so the 1/16 wire lines up with the hinge lines; otherwise, there will be binding when operating the rudder servo. Epoxy the assembly to the fuselage. Place the rudder in position and mark where the tail wheel drive wire goes, then drill a hole and epoxy a short piece of inside Golden-n-rod to the rudder.

Using a ballpoint pen, lay out and cut out the ailerons. Bevel the leading edge of the aileron, removing about 1/16 of an inch of material, so the aileron will fit properly and be free to move. Cut the wing tips out and glue them to the center of the tip ribs, using scrap triangle stock to keep them square and solid. Draw center lines on top and bottom of the fuselage ahead of the firewall, and draw a line around the right side, from the top center line to the bottom center line, about 1/8 of an inch ahead of the firewall. Use a Zona saw to cut the cowl off.

I made the 1/4-inch cowls functional by cutting a 3/8-inch wide by 1-inch high hole in the left fuselage side, just ahead of the firewall, and gouging the cowls out to about 3/32 of an inch thick. Paint the inside of the cowls and fuselage sides with epoxy, then glue the cowls in place. Cut the removable cowl to fit the engine by starting with a small hole where the glow plug is, and keep cutting until there is about 1/8 of an inch of clearance around the head.

A ply tab is glued on top and bottom of the cowl, inside the 3/8 sheet. Drill holes in the cowl in the center of these tabs, and glue short pieces of dowel into the holes. Drill holes for 4-40 screws down through the dowels and tabs. Put blind nuts inside the tabs, and screw the cowl on tight. When drilling these holes, it is a good idea to tape the cowl tightly in place before drilling. I used 1/64 ply, wrapped around a form the same shape as the exhaust cut-out, to make an exhaust extension. The carb air scoop is made from two pieces of 3/8 sheet; glue one on the fuselage and one on the cowl, and sand to shape. Coat the entire engine compartment with epoxy.

Everyone has his own favorite finishing method. Mine was to paint the fuselage and tail feathers with clear dope, cover it all with light silkspan, and finish with Supercoat dope. The wing is Monokoted. The aileron link is bent as shown on the

plans, and is installed after the wing is finished. Don't forget to install the 1/16 music wire aileron pushrod before covering wing. I used a Du-Bro aileron connector and ball link at the servo. When bolting the wheels to the landing gear, give them a little camber and make sure each wheel toes in a few degrees. Restrict elevator movement to 1/4 inch up and down for test flights.

Gussets doesn't take long to build, the cost is moderate, it's fun to fly, and sure looks good taxiing out, taking off and flying. I hope you enjoy yours as much as I have mine.●