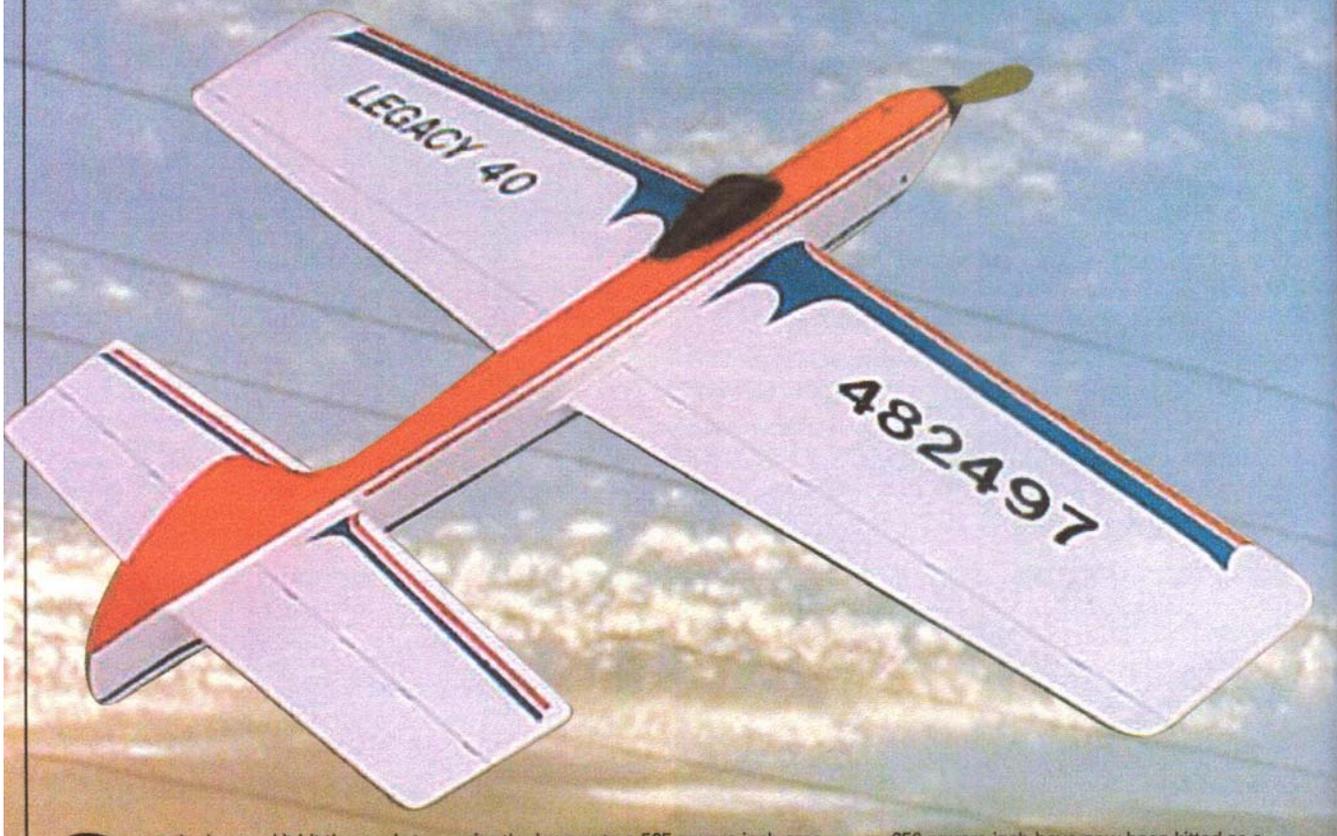


LEGACY 40 *Part I*

Allen W. Brickhaus and friends offer a highly effective reduced-scale version of his popular Brodak stunter



Once the Legacy kit hit the market in the US, John and Buzz Brodak of Brodak Manufacturing, Inc., were pleasantly surprised with the interest in the model and kit.

John usually produces 200 units per kit-run and he is now in his third set of kits. Humbly, only the George Aldrich '52 Nobler has outsold the modern full-sized Legacy in kit sales for the Brodak family. Watt Moore, a friend of mine, began a discussion one evening concerning a smaller version of the Legacy and one powered by an easily available .36 to .46 motor which would seem to fit the needs of the local and national stunt community.

I looked over the myriad classic stunters that I grew up with in Stunt. Most of the best known and best flying .35 to .40-powered models were sized in the 560 to 570 square inch range. We made the decision to down-

size the Legacy to a 565 square inch area. Watt reduced the original plans to the desired size and then went to work re-drawing the main outline with correct wood sizes and dimensions. Drafts were sent to me and I noted any changes to be made. Those changes were minor. I presented the idea to Watt and Crist Rigotti, so that each of them could build the proposed stunter in their respective locale and evaluate the performance, based upon their individual meteorological and prevailing atmospheric conditions. Watt lives in Rock Hill, South Carolina, and Crist in Marion, Iowa.

Watt's choice of power was an O.S. Max 40FP, while Crist selected a Stuka Stunt Works-tuned O.S. Max .35. Needless to say, both powerplants have more than adequately served each flyer's needs. The design seems to have run the gamut as the heritage

began with a Genesis .35 wing won in 1976 in a Chicago area contest. The Buccaneer series was born and continued through six derivations until both a 740 and a 746 version were kitted by Custom Models of Arlington, Texas. Both the .40 variant of a 575 square inch size and the .46 model of a 650 square inch have now been kitted as a laser-cut pair by Ultra Hobby Products. An upscaled Buccaneer transitioned into the Scepter of 670 squares powered by either an O.S. Max .40VF or a Randy Smith PA .40. Both of these power plants were piped versions.

The Scepter then was translated into the Mr. Brickhaus's Opus which was published in the June 2002 issue of Aviation Modeller International/Aero Modeller. John Miller helped with the design parameters of the then following Legacy as kitted by Brodak Manufacturing, Inc., and reviewed by Peter Jackson in the September 2002 issue of AMI/AM. I must thank Watt Moore for doing his wonderful CAD work on the plans for the Legacy 40. My friend Crist Rigotti now takes the podium for the rest of this article and he will detail the construction format for the Legacy 40.

Step 1.

Laminate wing trailing edge (TE) using straight 8# wood and hard 1/32" (0.8mm) balsa to form the hinge slots. I use a long ruler to be sure they are straight. For the tailplane (stab), laminate the TE in a like manner to the wing. Laminate the tailplane leading edge (LE), tips and center section. I added a 1/32" (0.8mm) ply doubler to the inside of the tailplane TE about 12" (305mm) long for added strength. Now is a good time to make the flap and elevator horn boxes. Use 1/8" (3mm) square spruce with 1/16" (1.5mm) basswood tops and bottoms. Glue the fin together.

Step 2.

Pin the tailplane (stab) TE over the plans, carefully lining up the hinge slots. Add the LE, tips, and the center section. Carefully fit and glue in the ribs. Here is a hint to help when you are covering the tailplane with a heat shrink film. Before gluing in the ribs, cut a 3/32" (2mm) hole in each rib to allow the hot air to escape through the hinge slots when covering the stab. Cut out the elevators and glue in the horn boxes.

Step 3.

Place the wing plan on a smooth flat surface and cover with waxed paper. Pin the lower spars in place using shims to lift the spar 1/8" at Rib number 13. Use Rib number 1, Rib number 13, TE, and LE to locate the alignment blocks. I used some 1.5" X 1" (35 X 25mm) Popular that I

screwed to the top of my workbench. I used a 0.5" (12mm) shim at the center section and a 5/8" (16mm) shim at Rib number 13. I then added a 9/16" (14.25mm) shim halfway along the spar for added support.

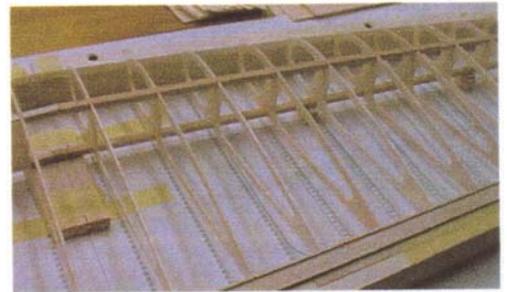
Place some 1/32" (0.8mm) ply pieces into the hinge slots to support the TE on the alignment blocks. Starting with Rib number 1 place ribs on the lower spar. Space the ribs over the plans and using the ribs as a guide, glue on the TE 1/16" x 7/16" (1.5 x 11mm) spacers to the TE. Place all the ribs in position then add the 1/4" (6.5mm) square LE and upper spars. Glue into position. Add vertical grain shear webs. Be sure to notch them for the bellcrank. Sand the small bevel in the TE then add the TE sheeting. Carefully fit and glue on the LE sheeting. Add the center section sheeting at this time.

Step 4.

Flip the wing over and add TE sheeting. Don't forget to sand the small bevel in the TE. Add the LE sheeting. Install the bellcrank with lead-outs. I use 1/4" (6.5mm) ball-links on my pushrods and have the bellcrank ball link bolted to the bellcrank at this time. We'll screw in the flap pushrod after we glue the wing to the fuselage. Add the center section sheeting with a cutout for the flap pushrod. Add the cap strips and wing tips.

I laminated my wing tips to form an adjustable lead out. I start out with a 1/8" (3mm) sheet notched for the movement of the adjustable lead-outs. Then, add the 1/8" (3mm) ply top and bottom reinforcements. Glue in the rest of the tip outline with 1/8" (3mm) balsa.

Glue this assembly to the wing. Add top and bottom LE blocks then sand to shape. Add 1/16" (1.5mm) sheeting top and bottom. I sand a small bevel in the outline first before adding the 1/16" (1.5mm) sheet. Don't forget the weight box and the adjustable lead-out guide. Sand wing smooth and fill any small dents. Cut out the flaps and glue in the horn boxes



The basic wing structure, framed up, with ribs in place and spars added. Note the spacers under the lower spar to permit the tapered wing to be assembled in one piece over the building board.



Here, the balsa spar webs between the ribs have been added. Grain should be vertical.



The wing, now fully sheeted and with wing tips and rib cap-strips added to complete the structure, ready for covering.



The shape of the wing tips on the finished wing.

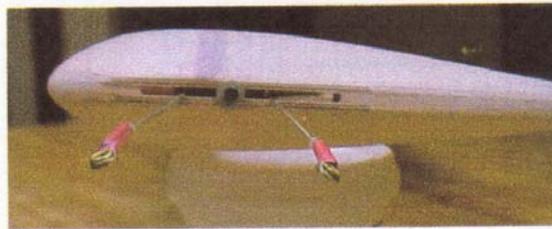
Step 5.

Carefully bend the flap and elevator horns to shape. Place the flap horn in position on the wing TE and slip both flaps onto the horns. Now transfer the hinge locations from the TE to the flaps. Slot the flaps for the hinges. I use Klett brand if I wish to make my surfaces removable. I'll use Dubro hinges if they will be permanently installed. Sand the flaps to shape, then sand in the hinge "pockets".

Dry assemble the wing and flaps and check for proper fit and alignment. Bend the flap horn to align the flaps. Remove the flaps. Repeat the same procedure for the elevators. I add three wraps of silkspan to the top and bottom of the wing for strength. The first is 9" (230mm) diameter and centered over the wing. The second and third are 6" (150mm) and 3" (75mm) diameter, also centered over the bellcrank post. I use un-thinned Nitrate dope for this. After several coats, I sand and feather the edges. Do your final sanding on the wing, flaps, stab, fins, and elevators now.



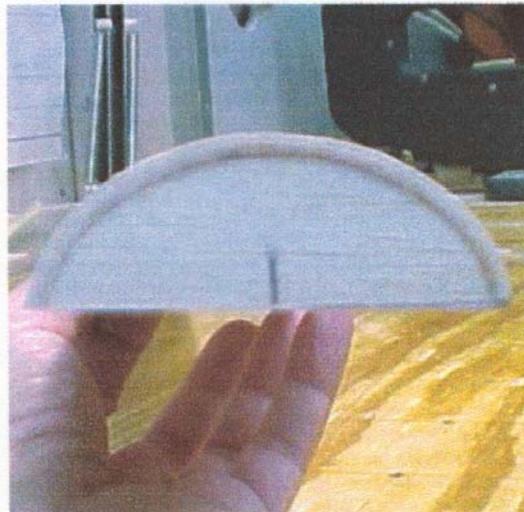
Slots in the wing trailing edge allow the flaps to be removable. Text covers the technique used.



On a competition control line aerobatic machine like this, it is important that the line lead-outs can be adjusted to trim for peak performance.

Step 6.

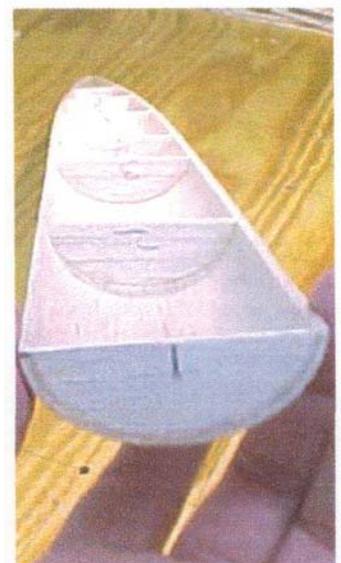
I cover the wing with Monokote. I run the Monokote over the fuselage line about 3/8" (10mm). Cover the stab in the same manner as the wing. Add the trim, too. Cover each flap and elevator in two pieces top and bottom. Slit the Monokote along the sides of the hinge "pockets" and, using a trim tool, seal the Monokote into the "pocket." Using a sharp blade, cut away the Monokote from the hinge slot. Finish the edges with Lusterkote paint. This last step can be done after the hinges are installed IF you are making the flaps removable.



These two views are of the fuselage top decking. Every effort must be made to minimize the weight of the finished airframe—hence the adoption of the construction style used.



The basic fuselage, with the two sides married to the formers.



Step 7

Carefully cut out the fuselage sides. I make the cut-outs for the wing large enough for the wing to pass through. Glue in 1/8" (3mm) dia. aluminum tubing where the cowl retainer bolts will be and sand flush with both sides of the sheet. Glue the ply doublers using 30-minute epoxy on a flat surface. Weight this assembly down while drying.

When set, cut away the ply doublers from the wing cut out and sand the ply to match the fuselage sides. Mark the locations of the formers and the wing center-line on the inside of each side. I then drill a 1/16" (1.5mm) hole in the fuselage sides just aft of the flap TE on the wing centerline. I use this hole as a guide when adjusting the flap pushrod for "neutral". Glue in 1/8" (3mm) I.D. (internal diameter) aluminum tubing where the filler and uniflow vent lines will go into the fuselage.

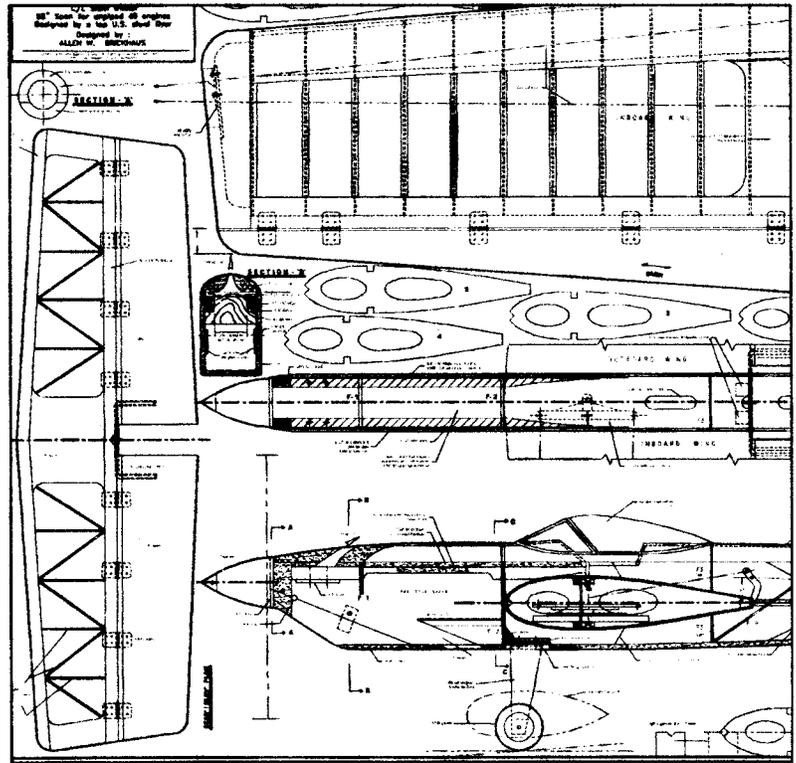
Step 8

Cut the maple motor mounts to size, being sure to undercut them in the tank area. This undercut allows the tank to be shimmed to a proper height for the correct engine run. Assemble the engine crutch by pinning down two pieces of 1/4" (6.5mm) square spruce, about 16 inches (405mm) long, over the top view of the plans along the outer edge of the motor mounts. Don't forget the waxed paper. Be sure that these are parallel. Then pin down another 1/4" (6.5mm) square spruce, about 3" (75mm) long, along the front of the motor mounts.

Place both motor mounts with the flat top surface on the bench, and measure the hard 1/4" (6.5mm) cross-grain balsa that is used between the mounts. Carefully cut this out and trial fit. When satisfied, epoxy in place between the mounts. Be sure to wipe away any excess glue and weight the mounts down so the entire assembly is flat. Be sure

to double check that the front of both mounts are against the forward spruce piece.

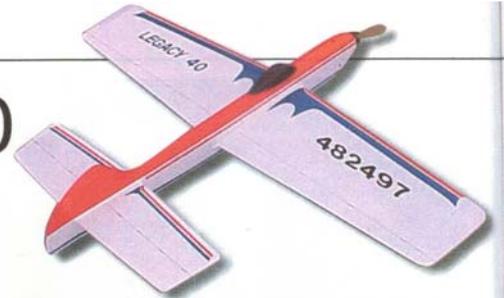
Cut out formers F-1, F-2, and F-3 making them the same width as the engine crutch. You can check this by placing them in between the spruce jig used for the engine crutch. When the crutch is dry, drill for the engine mounting hardware. I use 4-40 threaded brass inserts. Follow the manufacturer's instructions. I use a drop of medium CA glue on them before I screw them into the maple mount. Glue in formers F-1 and F-2 and the 3/16" (5mm) balsa top using 30-minute epoxy. Again, make sure this assembly is flat and use a small triangle to get the formers 90 degrees to the mounts and that the former sides are parallel. ■



C/L Aerobatics

Legacy 40

Allen W. Brickhaus and friends offer a highly effective reduced-scale version of his popular Brodak stunter. Part 2.



Step 9

Cut out formers F-4, F-5, and F-6 to the width shown on the plans, but make them taller for now. Don't forget the pushrod holes! I assemble my fuselage sides using a fuselage jig. This isn't necessary, but does make the process easier to get a properly aligned fuselage. On the plans, I make some triangle cutouts along the centerline between every other former, and in front of the spinner and behind the tailpost. Using these cutouts as a guide, tape the plans down along the centerline of your jig. Just tape over the triangle cutouts to hold the plans in place.

Tape waxed paper over the plans. Place a piece of the 1/4 inch square spruce over the plans where the front of the fuselage sides are to be

located to act as a “stop.”

Assemble the fuselage upside down in the jig. Place the crutch assembly, F-3, and the fuselage sides in the jig. Using the jig, locate the fuselage over the top view and tighten down the jig pieces. When satisfied, loosen one side of the jig only and add 30 minute epoxy to both sides of the crutch assembly and place back into the jig making sure that the assembly is flat along the “top” of the fuselage for the proper alignment. Tighten down the jig pieces. Wipe away any excess glue. Glue in former F-3 with CA and let dry overnight.

Add the rest of the vertical formers working your way to the tail then glue the tail-post together. Add the diagonal formers aft of F-4. We will add the forward diagonal former after we install the wing. Trim the excess length off the formers and sand smooth. Remove the fuselage from the jig. Glue in the balsa nose block and trim to fit the hatch line and the top of the fuselage sides.

Install the tail wheel mount. Add the bottom sheeting aft of F-4. I make a hatch in the bottom sheeting aft of the tail wheel to the tail post. I use this hatch to adjust the elevator pushrod and to add tail weight if needed. Add the bottom sheeting from F-2 forward. Tack glue on the bottom sheeting between F-2 to F-4.

Step 10

Mount the engine and place the ply nose ring in between the spinner and balsa nose block. Line up the nose ring to the spinner and tack glue in place. Remove the spinner and engine. Finish gluing in the ply nose ring. Fabricate the cowl.

If you plan to use a carved top block, then trace the outline of the top block and cut out. Tack glue in place. Carve, sand, and hollow as required. I personally use a molded skin top block. I carve the top block 3/32 small then mold 3/32” (2mm) balsa over it. I trim it to size and add the formers. Carve and sand the nose area to shape. Remove the bottom sheeting that was tack glued between F-2 & F-4.

Step 11

Make two marks the same distance from the center of the wing out towards the tips on the TE. These will be used to align the wing when gluing it to the fuselage. Turn the fuselage upside down and place on a flat surface. Slide the wing into the fuselage and measure from each fuselage side so that the marks are equal on both sides of the wing. Insert a pin into the wing on the INSIDE of each fuselage side near the TE. This will keep the wing centered in the fuselage.

Now, stick a T-pin in the tail post and, using a fabric tape measure, measure to the marks on the TE of the wing. Make this distance equal. When satisfied, push in two pins near the LE to secure the wing. Make a mark on the outside of each fuselage side on both top and bottom of the wing. Remove the pins and slide out the wing. I cut 3/8 triangles in the Monokote from the lines just drawn spaced 1” (25mm) apart to give a good glue joint. Cut a small notch in the TE cutout in the fuselage side about 1/2” (12.5mm) long by 5/32” (4mm). Place the flap horn into this notch and slide the wing into position. Insert the pins in their holes and then slide the flap horn tabs into the TE.

Block up the tips so that they are equal and insert small shims in a few places along the wing/fuselage joint on both the top and bottom of the wing. The wing should not be applying any pressure to the fuselage. If it does, sand the fuselage cut out till the wing sits right. Carefully check to be sure that the wing is centered in the fuselage and that the wing is centered in the fuselage and that the marks are the same distance to the tail post. Take your time and then tack glue the wing in place with medium CA. Add shims to the rest of the cutout. Recheck everything, then secure the shims with thin CA.

Force 30 minute epoxy into the joint with your finger. Wipe away any excess glue and keep the “filleting” to a minimum. Epoxy glue in both bellcrank plywood reinforcements. Reinforce the wing center section by applying 2 oz.

fiberglass cloth and epoxy. Run the fiberglass cloth at least 3/8” (10mm) up the fuse sides. I use toilet paper to blot out the excess epoxy. When finished, you should not see any shiny spots, which are “puddles” of epoxy. Cut away the FG from the pushrod hole.

Step 12

Install the flap pushrod. If you have trouble threading the pushrod into the bellcrank ball link, cut a 3/4” (19mm) hole in the sheeting so you can use needle nose pliers to hold the ball link. Make up the elevator pushrod. Place the stab into the fuse and carefully measure at the TE to center the stab in the fuselage. Pin in place like we did the wing. Sight along the top of the wing surface to be sure the stab is aligned with the wing. I do this from the nose looking aft. Sand the fuselage sides if necessary.

Using a ruler, set the tailplane (stab) TE parallel to the wing TE. Take your time and get this right. When satisfied, pin the tailplane LE in place and scribe a line on the outside of the fuselage sides. Remove the stab and cut away the Monokote between the marks. Attach the elevator pushrod to the elevator horn and place the stab in the fuselage. Again, carefully align the stab with the top of and the TE of the wing. Tack glue in place with thin CA.

Re-check this alignment. It is very important that you get this right. Take your time. When satisfied, permanently glue the stab in place.

Continue on for the remainder of this article and more pictures of the Legacy 40 under construction.



Step 13

Centre the bellcrank by clamping the lead-outs at the wing tips. Temporarily install the flaps and adjust the flap pushrod to center the flaps using the 1/16" (1.5mm) hole previously drilled in the fuselage sides as a guide. Bolt the flap pushrod to the flap horn. After centering the flaps, adjust the elevator pushrod to center the elevators and bolt to the flap horn. Remove the flaps and elevators. Glue in the landing gear mounts and the diagonal former F-7.

Now glue on the bottom sheeting. Glue on the top block by first applying a little water to the top block and along the top of the fuselage sides. Then apply the glue to the top block. I use PICA Gluit because it sands so smoothly. The water helps the wood swell slightly, giving a nice tight glue joint. Use masking tape to hold the top block in place. Sand the entire fuselage smooth and get it ready for finishing. I make up Kraft paper "sleeves" to cover the wing and stab. Make these slightly longer than needed because we will tape these down and remove them several times during finishing. The tape has a tendency to tear the paper away as we removed it from the wing or stab.

Fuelproof the engine bay and tank compart-

Step 14

I use a dope and Silkspan or 2/10 carbon fibre finish on the fuselage and fin. I'll outline my process using 2/10 carbon fibre veil. A silkspan finish is very similar.

I start with brushing on two coats of un-cut clear Nitrate dope on the bare wood. Sand lightly with 400 grit sandpaper to reduce the grain and smooth the surface. Starting with the bottom, cut out the carbon fiber slightly oversize by about 1/2" (12.5mm). Place on the fuselage and brush slightly thinned Nitrate dope through the carbon fiber. Go very easy with the brushing so you don't disturb the fibers. Apply two more coats of Nitrate dope.

When dry, trim the edges by sanding along the corner of the fuselage sides. Using the plans as a guide cut out two pieces of carbon fiber for the sides. Carefully cut out for the wing and stab. Make these about 1/2" (12.5mm) oversize too. Apply to each side as we did with the bottom, but roll the lower edge over onto the bottom with your brush and let it overlap on the bottom. Don't try to trim the carbon fibre, just dope it down. This takes some patience, so go slowly.

Cut out the top piece about 1/2" (12.5mm)

oversize and apply as we did with the other pieces. Cover the fin in a like manner using one piece for each side. Don't forget the cowl and hatch. Sand lightly with 320 grit. Apply several more coats of Nitrate dope. Sand lightly and feather the edges. Trim and sand the canopy to the fuse top.

Attach a piece of 180 grit sandpaper to the fuse top with masking tape and sand the canopy to match. Don't push down too hard or you'll "deform" the canopy and it won't fit very well. I cut a 1/2" (19mm) hole in the top block where the canopy will go, to ventilate the canopy. I usually do not add cockpits or pilots and just dope over the outside of the canopy. Glue on the fin using epoxy and the canopy using Pacer 560. Make sure the fin is 90 degrees to the stab.

Step 15

Add the fillets now. I use SIG Epoxolite. Apply some fine line tape about 1/8" (3mm) from the fuselage sides on the wing. Mix and apply with a small stick. I form the fillets using a 1/4" (6.5mm) steel ball bearing glued to a 3/16" (4.5mm) dowel. When the fillet has set a little, form the fillet using the ball bearing tool and alcohol.

Remove the tape and using a single edged razor blade, scrape away the excess Epoxolite starting near the fillet and scraping away from it. Use a paper towel soaked in alcohol to clean the wing and fuselage sides. Do this for the wing, stab, canopy and fin. I use a 1/8" (3mm) ball bearing for the fin. When dry, sand the fillets lightly to remove the "shine". Apply two coats of thinned Nitrate dope to the fillets.

Put the sleeves back on the wing and stab. Switch to Butyrate dope from now on. Apply two coats of filler and sand smooth. The carbon fibre turns a light gray when sanded and is an excellent indicator when you have sanded the filler down to the surface of the carbon fiber. Don't be afraid to use the filler on the fillets too. I have never had them pull up yet. The filler really gets the fillets smooth.

When happy, spray on another coat or two of thinned clear to help seal the filler coats. Go easy or you'll "burn" down to the Nitrate and you'll have a mess. Sand lightly and spray on two coats of the grey base coat. Sand smooth using the color of the carbon fiber as an indicator. Another nice part about using carbon fiber is that it is grey and the base coat could be very thin and light. Because I spray the colour on the outside of the canopy, go ahead and

sand it just like the rest of the fuselage. Remove the sleeves and re-tape just a little past the grey so that the colour will cover up the grey edge. My colours of choice are Red, White, and Blue.

spray the entire fuselage white. When dry, wet sand very lightly with 600 grit to help smooth the surface by getting rid of the bumps and fuzz. I then spray the red, then the blue, and finally the black canopy. I remove the fine line tape as soon as possible. If the doped edge "pulls" and doesn't "cut" clean, don't worry about it for now. After drying, I use a plastic credit card to scrape the edges of the paint. Go easy and take your time. Using 1000 grit, carefully wet sand the edges and the entire surface smooth.

Touch up any "sand throughs". Re-tape the sleeves a little further out from the white line for the clear coats. I'll spray the first several coats of clear by fogging them on, then the rest as usual. I'll spray extra coats on the fuselage nose, top of and in front of the fin. These are the "wear" areas and can use the extra dope. Typically, I'll spray on seven coats of clear dope. When spraying only the fuselage and not the entire model, the clear dope doesn't add much weight, so don't be shy. When dry, wet sand with 600, then 1000, then 1500 grit. Then rub out the dope using a white polishing compound. Apply two coats of wax and enjoy your finish.

Step 16

Add the flaps and elevators if they are to be permanently glued in place. Make up the tank. I use a 6-ounce Sullivan RST Flex tank plumbed for uniflow. Solder the uniflow vent to the clunk about 1/4" (6.5mm) inch in front of the pickup hole. Plumb the tank to allow the clunk to rest against the outboard side of the tank. I have the overflow tube against the top front of the tank. Leak check after assembling the tank.

Bend and install the 1/8" (3mm) copper filler and uniflow vent in the aluminum tubing previously glued in the fuselage side securing them with thin CA. I install the tank using small pieces of foam to wedge it in place. Install the engine, landing gear and tail wheel. Add the removable flaps and elevators. Start with 1 ounce (28.5 grams) of tip weight. Check the balance point and adjust the CG to your liking. My CG is located at the 23% mark. Seal the flap and elevator hinge lines using 3M Crystal Clear tape. ■

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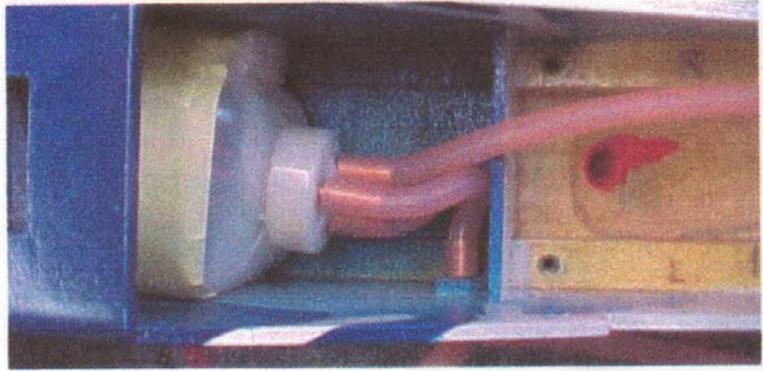
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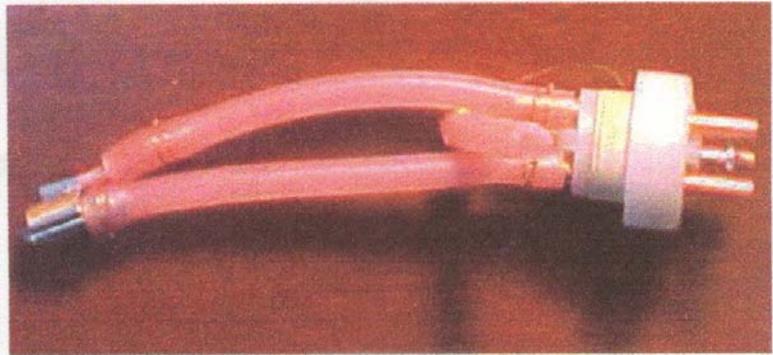
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Copies of the LEGACY 10 plan are available price £11.50. From AMI Plans & Parts Service, Model Activity Press Ltd., 3 High Street, Chesham, Bucks. HP5 1BG.



Clunk-type fuel tank installed behind the engine bay. Note filled pipe that exits the fuselage bottom of picture.



The plumbing that goes inside the fuel tank. Note the double fuel pick-up.

