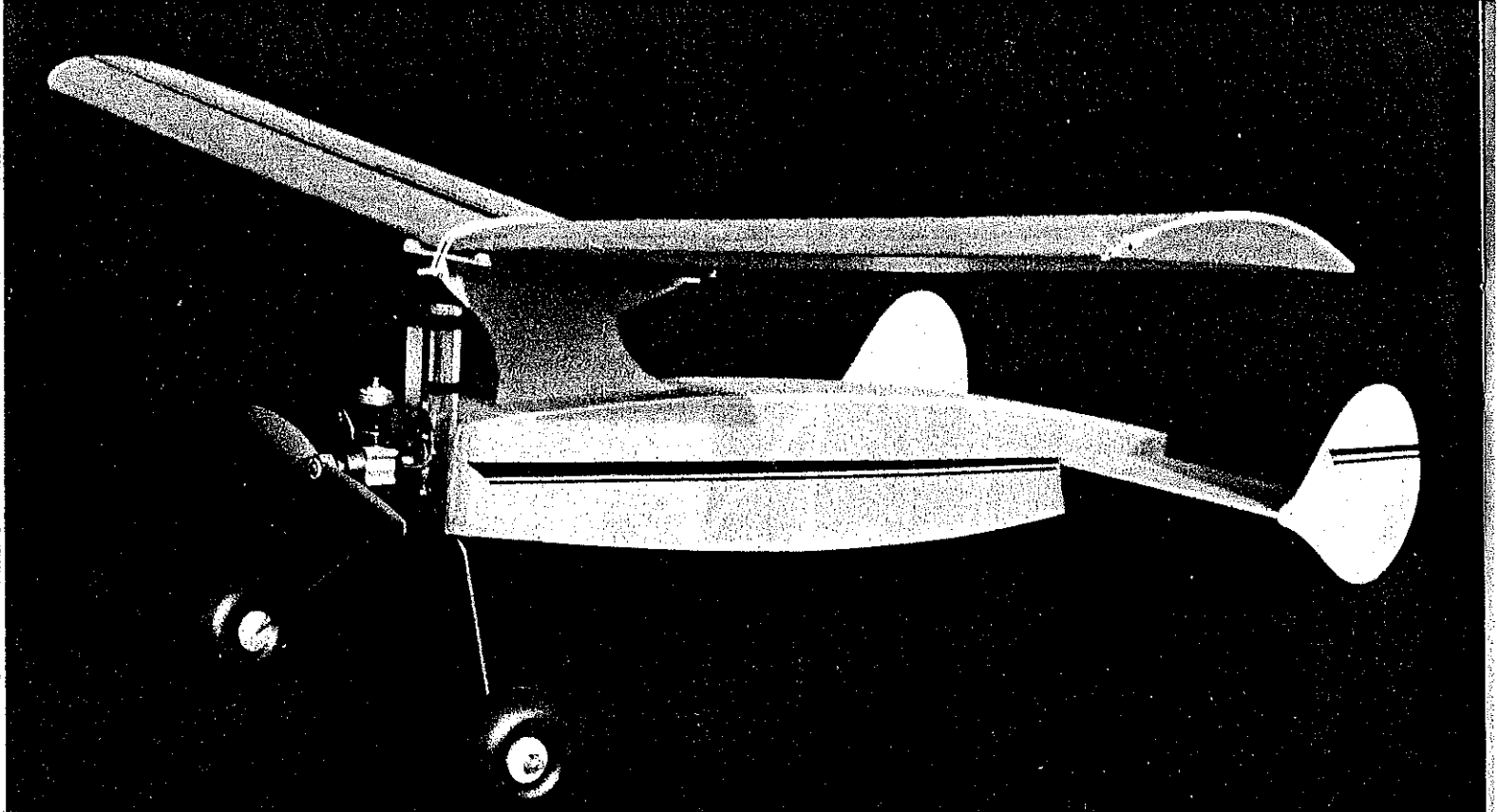


■ Paul F. Denson

Want to try your luck at RC? Start small with this trusty stick-and-tissue job. Once you have it aloft and flying, you're ready to build a bigger bird, add a radio, and really carve some air!

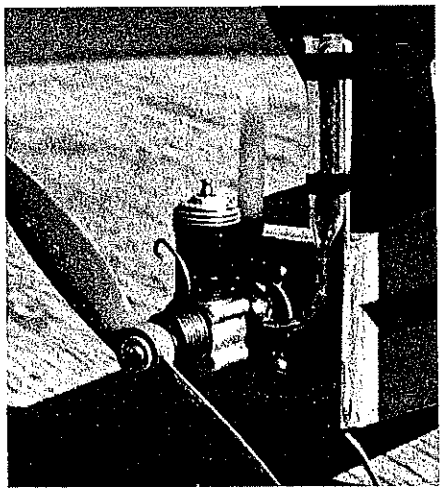
BDF-1, a replica of the earlier Half Pint, was originally meant to be a single-channel RC plane, but it proved unsuitable for the radios available in the 1940s. Name comes from our workshop, known for years as the Balsa Dust Factory.

BDF-1

TWENTY YEARS ago I wrote an article on how to build a little plane called the Quarter Pint. If you were to look closely at that plane, you'd notice that the BDF-1 is strikingly similar. Why build it again? For the thrill of it all!

The Quarter Pint was originally intended for the novice or Junior modeler, but anyone who wants to add a little fun to his humdrum RC existence will get a kick out of it. Juniors who want to start out in model aviation by becoming involved in RC might find this project particularly appealing. One of the most sensible ways to get into RC is by starting with a stick-and-tissue model, one that has stood the test of time and one you're sure will fly. After you build one and can get it to fly regularly, then all you have to do is build it larger, add an RC unit and guide it around the sky.

So here's the Quarter Pint again—given new life as the BDF-1—much better, because its design profits from 20 years' or so experience with Gliders, Old-Timers, Electrics and sport fliers. The 1964 issue of the *American Modeler Annual*, a concise history book chock-full of ideas for sport Free Flight, carried a picture of Lou Garami's Half Pint. It was somewhat larger than the BDF-1. In 1940 Lou commented on its size: "It was so small it could be carried to the flying site in a shopping bag, so the aeromodelist would be spared the embarrassment and explanations on the way to the field. Jeers from the neighborhood kids, truck drivers and dogs will cease when you tuck your Half Pint under your arm and set out for the field."



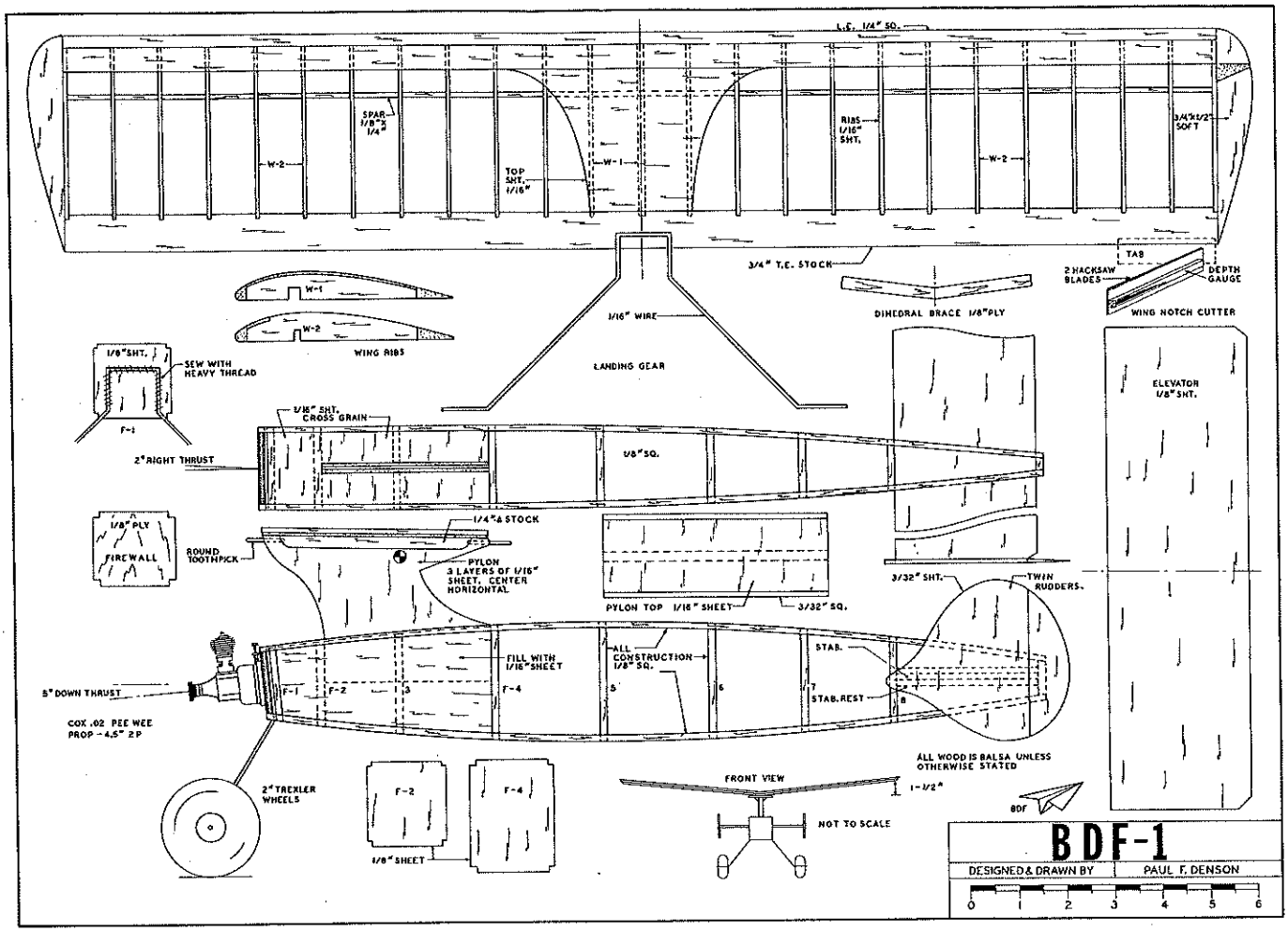
To hold the fuel tank to the upright, two rings of heat shrink tubing were stretched over the top of the tank, then adhered with a MonoKote heat gun.

BDF-1 was intended to be a replica, not a Scale model, of the Half Pint, and was planned as a single-channel RC plane. But it was too small to accommodate the radios that were available in the forties, so it was developed as a Free Flight model.

We started out with the side view of the Half Pint. Later we found a construction article in a 1940 issue of *Air Trails*, from which we took the above quote. We made the fuselage of our plane square rather than diamond-shaped—even this early in the concept we hoped to make the plan workable for Junior modelers.

The original model had a single wheel. We changed it to two in order to provide more protection for the engine and front of the plane. The wing is built up; the empennage is of sheet balsa.

We used a 1cc syringe to fill the fuel tank of the original Quarter Pint, started the engine, and heaved the plane into the blue sky. It flew for about 30 to 50 ft.; then as it gained speed and lift, it climbed up and into



a loop. At the top it rolled out ever so gracefully and continued circling in a right-hand direction until the fuel ran out. At this point the rudders took over, and the plane circled left and floated gently to the ground.

Recalling those magical flights so indelibly impressed on our memory, we knew we had to build another—if only to send it aloft and catch it, as we had in days past, before it landed.

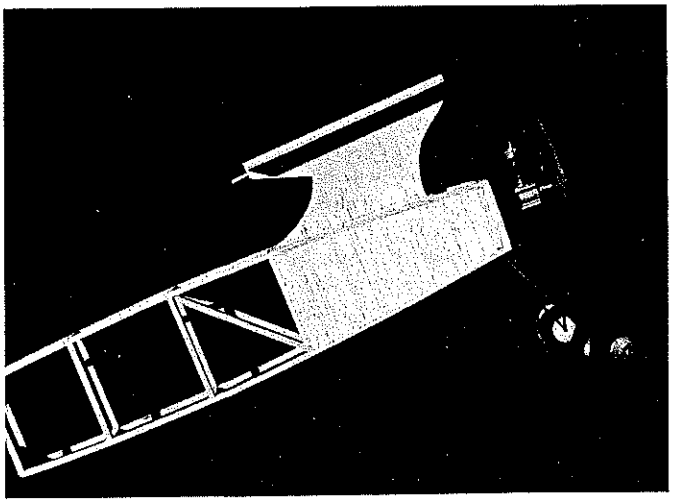
Construction. We suggest that you start by kitting the plane. Look over the parts list, visit your local hobby shop and stock up on everything you do not already have around your workshop.

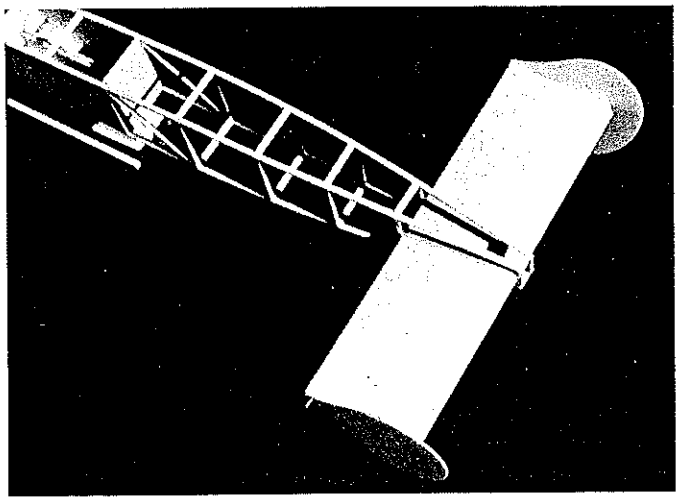
Fuselage. Build the right fuselage side. Pin the 1/16 fuselage side filler to the plans, and add all longerons and crosspieces. Build the left side in the same manner. Prop the fuselage filler up 1/16 in. above the plans, then finish the construction with 1/8-in.-sq. balsa.

Pin the right side back to the plans, and glue formers F3 and F4 in place, ensuring that they are perpendicular to the side. We use UFO Thick and Thin from Satellite City, and this really shortens the wait for adhesives to set up. A spray of Kick-It cuts the wait to zero. Glue the left side in place atop the two formers.

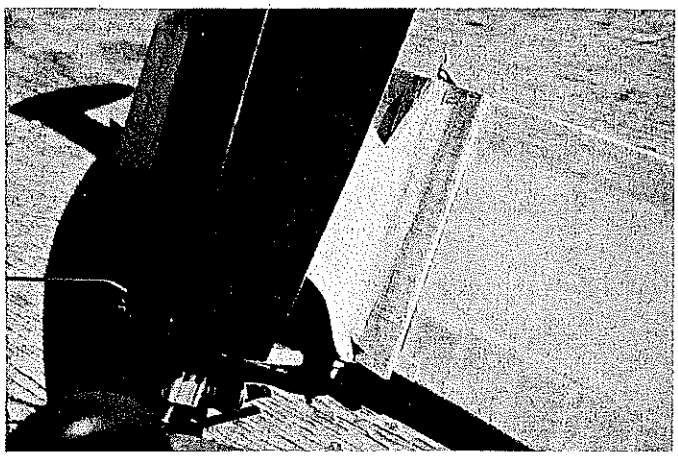
Sew the landing gear to former F1 as indicated on the plans. Check the location of the blind mounting nuts which will secure the engine to the firewall, and make sure the landing gear doesn't interfere with them.

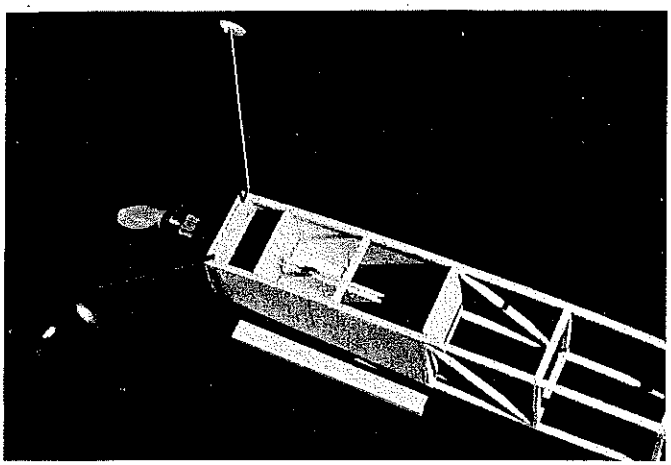
Remove the fuselage from the plans, insert former F1, and glue it in place. Drill the firewall for four blind mounting nuts.



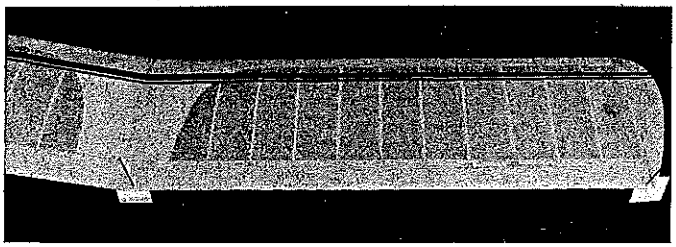


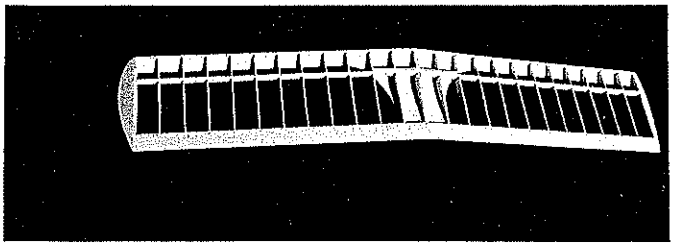
The fuselage side sheeting is built in during construction of each side. The pylon is made of three layers of 1/16 sheeting. The two outside layers are vertical, while the inside layer is horizontal. The stabilizer slides in between the two tail longerons with the twin rudders added after the stab is glued in place. To give the empennage extra strength run a glue bead top and bottom on the stabilizer at the fuselage and fin.





The wing mount is glued to the top of the pylon and then braced with ¼-in. triangular stock. In the blue version a piece of 3/32 stock was needed under the leading edge for added incidence. The pylon is cemented between the second and fourth formers. There is no F3. The landing gear is sewn with heavy thread to F2 and then glued between F2 and the firewall.





After spraying with water or painting with dope, mount the wing on blocks and pin it to the workbench so that air may circulate freely as it dries. Blocks under the leading edge do not show. Note that the bottom view of the wing shows that the center sheeting is on the top only. The dihedral doubler is made from ⅛-in. sheeting.

These should be worked into the back side of the firewall. Add a drop of UFO to hold them in place. Add the firewall to the fuselage.

Level the fuselage by inserting a block under the firewall, then pin the fuselage to the plan top view. Bring the tail end together by squeezing it between two food cans from the pantry in such a way that the rims of the cans are touching the longeron lines on the plans. Insert and glue the crosspieces top and bottom at the tail end of the fuselage. Insert all cross braces, top and bottom, along the whole fuselage.

Fill the bottom area between F1 and F2 with 1/16 sheet balsa. Cut three pylon sections from 1/16 sheet balsa. Be sure to check the plans for appropriate direction of the wood grain on each piece. Laminate these pieces using UFO Thick. UFO Thick and Kick-It work great for laminating sheet balsa. Put the glue on one piece, spray the associated piece with Kick-It, and carefully place them together; the UFO will bond instantly.

Remove the fuselage from the plans, and insert the pylon between formers F2 and F4. This step is one of the most important in the construction of the whole plane. The incidence of the wing is determined by the proper location of the pylon. Mark the centerline on the top of both formers. Measure on the plans from the top of each former to the top of the pylon. These measurements must be duplicated on the plane. Glue the pylon in place.

Add the wing platform atop the pylon, and brace it with ¼-in. triangular stock. We whittled our own from short pieces of ¼-in.-sq. balsa. Add the 3/32-sq. strips, which act as dihedral fillers. Drill holes, and add the wing hold-down dowels (which are nothing but round toothpicks).

Using 1/16 sheet balsa, fill the area between the pylon and the longeron on each side; then fill between the pylon and former F1.

Wing. Using two pieces of hacksaw blade taped together, cut the notches in the trailing edge stock. You can tape a gauge into the blades to limit the depth of the cut (see drawing on plans).

We built the wing in one piece and cut it in half later. Place waxed paper or plastic wrap over your plans, and pin the trailing edge stock in place. Using ribs as spacers, pin the center spar in place. Add all ribs except the two center W1s, and glue. Add and glue the leading edge spar. When the glue has set, cut the wing into two halves.

Remove all the pins that are holding one half to the workbench, and prop that tip end up three inches. Check the fit between the spars. No doubt a bit of sanding will be necessary. Using the edge of the workbench as a guide, sand a bevel in one wing half. Check for fit, then glue the two halves together. When the glue has set, remove the wing from the plans, insert the dihedral brace, and glue securely to the side of the center spar.

The wing tips can be made from very soft triangular stock, or you can whittle them from soft sheet balsa. Add the 1/16 center sheeting. A little notch must be cut in the first W2 wing ribs to accommodate the sheeting.

Assembly. Very carefully sand the whole plane. We use 2 x 9 x ¼-in. ply blocks (the width of sheets of sandpaper), to which we glue various grades of sandpaper.

The next step seems to bamboozle most builders. Cover the plane with tissue. It's not as tough as you may think. Go over the whole plane with thick dope. Use it just as it comes out of the bottle. Apply three coats, allowing drying time in between.

Let's start with the bottom of the wing. Tear the corner of a sheet of tissue to see in which direction it tears easily. This is called the spanwise direction. The length of the wing, fuselage and elevator should be covered spanwise.

Cut a piece of tissue about ½ in. larger on all sides than the area to be covered. Ready a small brush and your bottle of dope thinner. Lay the tissue on the bottom of the wing, and run a line of thinner across the tissue where it touches the centerline of the wing. Using a fingertip, rub the tissue; the dope will come up through the paper and will dry almost instantly. Once it's dry, you can stretch the paper spanwise and attach it in the same way at the tip of the wing. Again, as the dope dries stretch the paper over the bottom of the wing tip. If necessary add more thinner, then stretch and rub the paper down with a fingertip.

Use the same maneuver for the leading and trailing edge spars, pulling the paper tight as you go. Allow the whole thing to dry while you're working on the other wing half. When it's finished, use a sharp single-edge razor blade to trim the paper back to

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but settling for second. Phil and his Granderdog were the undoing of several other big-time competitors including Michael Willcox and the Vacaville Money Meet winner, Steve Stewart.

With over $15,000 (a pickup-truck bedful) in stereo prizes, it's no wonder that so many people are drawn to this classic among Combat meets. As usual, the organization was very good, the site roomy, well prepared—and, above all, safe. There was only one scary moment when a cutaway model hit a pitman in the leg. Luckily, the foam wing rather than the engine did the hitting.

A circle marshal was used throughout the meet to ensure that pilots stayed in the circle and close together during line tangles, with a DQ for anyone sawing lines or otherwise making things difficult. The processing was commendably tight; lines were checked for diameter, length and condition (not the case, unfortunately, at many meets). The emphasis on safety made a difference and probably provides more benefit than all the written rules in the world could.

Kelly Crozier brought his fuel shutoff model to the Bladder Grabber for inspection. When the model is flying (on the lines) a weight in the wing tip pulls on a wire that holds a pinchoff open. If the model gets cut away, the weight will no longer be pulling against the trip wire, and a small rubberband will have sufficient force to do the job. It's similar to the swing weight valves used on AMA Slow Rats, in which centrifugal force opens the valve as the model gets up to speed.

Does it work? You betcha. Frank Boden reports in the *Airwaves* newsletter (British Columbia) that Kelly and friends tested it at a remote site. Using a measured quantity of fuel so they wouldn't lose the model if it didn't work, they cut the lines at the appropriate moment. The model veered to the outside of the circle and immediately quit and fell harmlessly back to earth. Kelly's design could be refined into a pretty compact unit that wouldn't add more than a few grams to the weight of the model. The dreaded Canadian contingent may have come through with a solution to the most glaring problem facing Fast Combat.

Also seen at the Bladder Grabber was an old friend, Rich Porter. The Northwest Terror was putting on demonstrations of his whip model, which you can picture as an unpowered Stunter on a string attached to a short pole. Great for kids, and some good exercise for adults.

Rich also had his .15-powered, 600-sq.-in. model in action. It features Combat-style construction for lightness, a tuned pipe, and a rising-rate control system. This system features very slow and insensitive control around neutral, with increasing rate as you crank in more Up or Down. The system really appeals to those of us who don't like to use a lot of handle movement but at the same time don't want touchy control near neutral. I've had to speed up the controls on all my models, because after three or four flights my wrist and arm lose just enough of the quickness necessary to miss the ground or an opponent.

Quick controls mean too much elevator movement unless stops are used. Until Rich brought out his special bellcrank, the only thing to do was to get used to not giving it full control. The answer to whether it works at 110 mph as well as at 50 mph will have to wait until next time, when a proper test can be done.

Who's hot? The latest issue of the MACA newsletter showed Alan Deveuve leading the points battle for champion with 60 points, followed by Tom Fluker with 46 and 1989 champion Paul Smith with 45. Alan has been using all of Mark Smith's products described above. His Fast model is on a par with the Hills Arrowplane, and he's planning to make an FAI version for the team trials.

Gary Frost commented in the newsletter that goes out to FAI competitors that we may have to adopt the European flying style if we want to win over there. I think Gary is probably right, and I love the wiggle-waggle style they use; but I can't say the same for the tactical line tangles and mid-airs. Remember the days of the "wrap and punch" artist in AMA Combat? I think we're all relieved that the running-around-the-circle style didn't catch on in the U.S.A. The Euros seem to have forgotten it, too.

BDF-1/Denson

Continued from page 78

balsa wood. Using a dope-filled brush, go over the edges of the paper to make sure everything is stuck down. A piece of fine sandpaper around the edges will remove the ragged bits of tissue and smooth down the dope.

Use the same process to cover the top of the wing. When the wing is fully covered you're ready to shrink the paper. Gather some straight pins and some pieces of soft balsa all of the same thickness. Using a spray bottle or mister, spray-wet the bottom of one half of the wing and pin it to your workbench. The small balsa pieces should

be used as spacers so the air can get under the wing.

Pinning the wing to the workbench while it dries will prevent warping. When it's dry, repeat the process for all four sides. When sealing the paper with diluted dope, you can dope both sides of the same wing half before you pin it to the workbench.

Cover the fuselage in a similar manner. Where there is balsa filler under the paper, apply thinner and smooth the paper with a fingertip. Where it is open, apply thinner around the edges only. The center will shrink when the water is added later.

Cover the whole empennage with tissue, wet with thinner, and rub the tissue until the dope comes through. We use sandpaper to remove the excess tissue around the edges. As you sand the edges, the tissue will part and fall off.

Give all surfaces of the plane two coats of dope diluted 1:1. Sand lightly between the coats with 400 wet or dry sandpaper. Trim the plane as you like. Ours is done with Super MonoKote Trim Sheet.

Slide the stabilizer between the two longerons at the tail end of the fuselage, and glue it in place. Glue a vertical fin on each end of the stabilizer. We run a glue bead top and bottom on the stabilizer where it meets the fuselage and at the juxtaposition of stab and fin. This gives the whole empennage extra strength.

The firewall is designed to give the downthrust necessary; you'll have to add side thrust. As you bolt the engine to the firewall, place a couple of washers between the back of the engine and the firewall on the left side as viewed by an imaginary pilot.

Drill a hole in the fuel tank. The location of this hole is very important. It must pass between the two bolts which hold the backplate and tank to the crankcase (see photo). Our tank has a hole on the other side, too. It's evidence that we failed to locate the hole properly on our first try. Of course once you drill one hole in the tank, it won't hurt to drill two, so if you don't get it positioned exactly on the first crack, you've got another try coming. If you ever want to use the engine with the tank, you'll need to get a new one; but they're not too expensive.

We acquired a foot of ⅛-in. fuel tubing and a medicine dropper from our hobby shop. Using a propane torch in the manner of a chemist, we heated the glass tubing and stretched a new end around which the ⅛-in. plastic tubing would fit. This shortened the medicine dropper, which we tied to a strip of hardwood fastened to the firewall. When we made the plane all yellow, we used little strips of heat shrink tubing to hold the dropper to the riser. The picture is pretty much self-explanatory and the process is much easier to see than to explain on the plans.

Fill the medicine dropper tank with fuel, then extract a bit into a syringe, prime the engine, wind up the spring, and off it goes. Watch the fuel level, and at the bottom string, launch the plane. The time of launch is a determination you must make for yourself, and after a few launches you will have

it down pat. The picture shows the prop positioned correctly. We turned the prop backwards for the first few launches to slow down the plane in order to get it trimmed properly. Later we turned the prop around.

Flying. Do not under any circumstances launch the BDF-1 with a full tank of fuel. An engine run of that length will put the plane out of sight overhead. First check the center-of-gravity. It should be as marked on the plans (about two-thirds of the wing chord).

A few test flights will be necessary. On a windless day, find a flat, soft location such as a football or baseball field. Hold the plane over your head, and walk fast or run until the plane wants to lift out of your hand. Launch it forward and level, then stop and watch. If it floats straight out, drops slowly to the ground and rolls to a stop, it is perfect. If it dives a bit or stalls, changes in the wing incidence are necessary.

We cut strips of 1/16 sheet balsa, crack them to match the dihedral, and place them between either the front or back of the wing and the wing saddle. If the plane dives, place them under the forward edge. If it stalls, put a spacer under the trailing edge of the wing.

If there's a breeze, launch the plane into it. Otherwise launch straight out. As the plane picks up speed it will gain lift and start to climb. At the same time the right thrust will pull it to the right. The plane will climb back toward you in a right spiral and should top out after the second turn. The engine should quit, so that the plane loses speed and the rudders take over. The plane will figure-eight into a left spiral and float downward.

On a perfect flight, just turn around, reach up, and the plane will be in your hand. We did this once three times in a row, and that was a thrill we've remembered after all these years.

We're not Free Flight experts. Most of our time is spent with RC. So when we had a bit of difficulty on the initial flights, we weren't immediately sure how to correct it.

The problem was this. The plane started off, climbed a bit, and when it got up to speed the right thrust put it into a steep right bank from which it did not recover. We tried to fix it by cranking in a goodly amount of left rudder, but that put the BDF-1 into a left death-spiral.

A bunch of broken props later, we came upon the magic formula. Notice on the plans that there is a tab on the right wing tip. This tab, made of cardboard or light aluminum, will keep the plane from doing a right spiral. Just bend the tab down a bit to correct the maneuver. We now understand that washin will accomplish the same thing. We give a tiny bit of left trim to the left rudder and leave the right one alone. Make changes in tiny increments until the plane flies as it should. How we wish we'd had a Free Flight expert available to tell us all this.

In some ways the BDF-1 is the same old plane we built years ago; in some ways, at least for us RCers, it's not. The return to stick-and-tissue is new, flying Free Flight again is new, playing with an engine that doesn't start as an RC engine does when hit by the starter—well, that's new too.

But most of all the thrill is new. So, if you're a novice who wants to graduate from the all-balsa wind-up planes to one with reasonably priced glow engine power, try it. Even if you're a dyed-in-the-wool RC pilot, give the BDF-1 a try. We think you'll find it a welcome change.