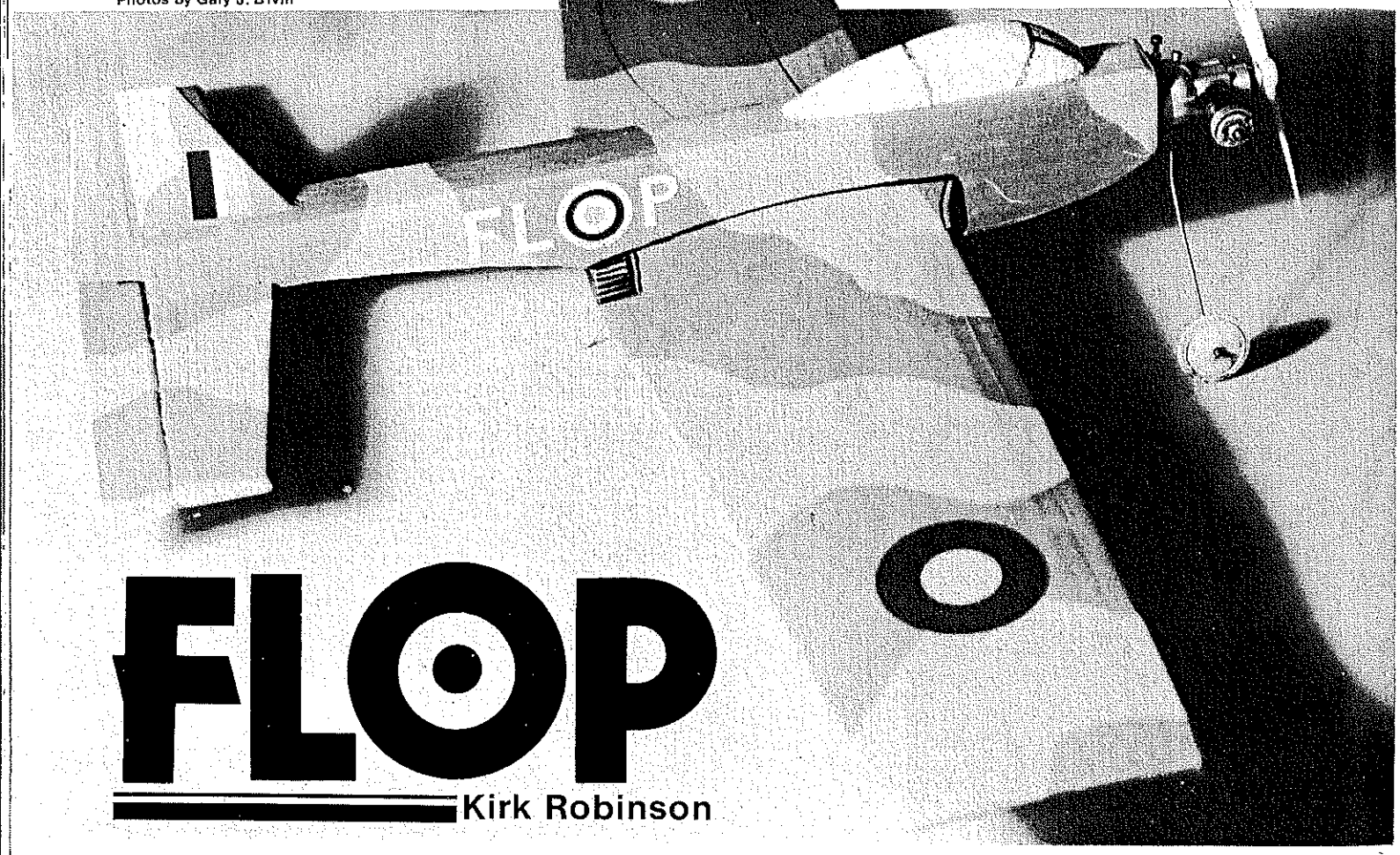
We first heard about this interesting and successful CL ½A trainer made of corrugated cardboard in *The Dope Bucket,* newsletter of the Utah State Aeromodelers. It has good looks, it is inexpensive to build, and it is amazingly strong.

Photos by Gary J. Bivin



FLOP

Kirk Robinson

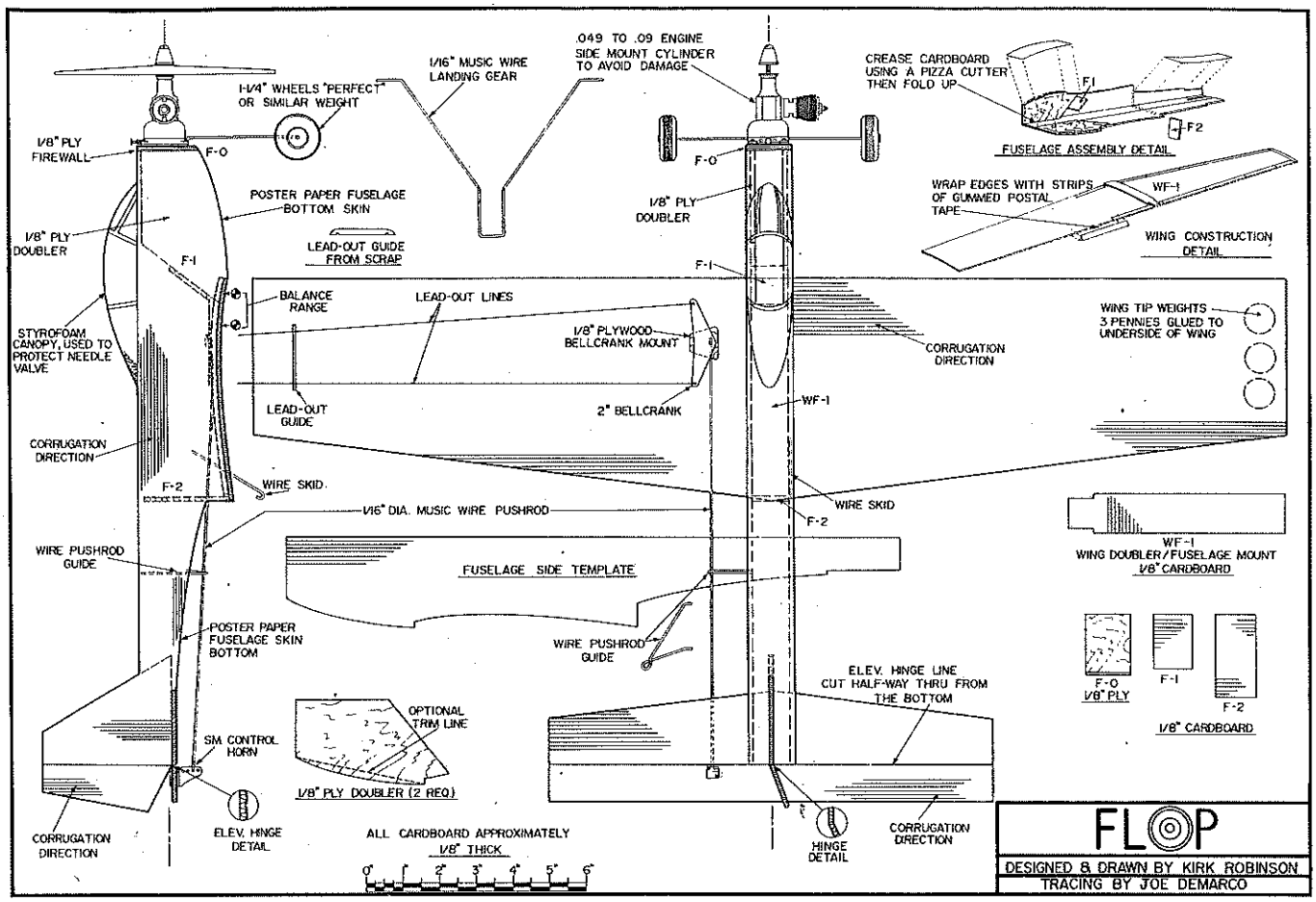
Cub Scout den (and den leader) with planes built as a Cub Scout project. Missing plane at right was chewed up by a large dog! Shown, from left, are Stephen Larson, Anthony Romero, Corey Gearhart, Kirk Robinson, Barr Hill, Kelly Mayhew, and Adam Olson. They put design to the test!

Author decided he had to paint and decorate his model after he found out that it was so very strong and long lasting. Do take care to not put on too much paint, as the weight will penalize flight performance. Plane's name comes from an unusual combination of squadron and plane identification in conjunction with roundel.

I REMEMBER being in the mood to build a new plane, a few years ago, but didn't have the balsa necessary for any of the projects I had envisioned. However, I did have this nice big flat piece of cardboard I was using for a work board. A few hours later, I no longer had a work board, but I had an unpainted cardboard airplane (using box construction).

This was a high-wing monoplane designed for the wing to be glued on last (after the balance point had been determined). The performance of this plane surprised me. It was capable of consecutive loops, and it stayed out well on long lines in windy conditions. It also had a long landing glide.

Even more surprising was its durability. After a year of flying this plane for every 'expendable aircraft' situation (such as letting kids fly it), I found that cardboard airplanes don't break—they just get bent out of shape. Because of this 'bending out of shape' problem, it was finally necessary to junk the plane when it developed a severe deformity of the nose, which I choose to



call "the accordian syndrome."

I promptly decided to build a replacement. For this one, I wanted something that looked more like a full-scale aircraft, and was easier to build. It must also have cardboard doublers to strengthen the nose, I decided. After some sketching on paper, I came up with basically the present design. It was soon built, and it flew just as well as its predecessor.

About this time, I became a Cub Scout den leader, and the plane was put to the test. After a month or so of den meetings, all of the boys had soloed with this new plane. We also put on a flying demonstration for the pack, and let various people from the crowd try it (until I ran out of propellers).

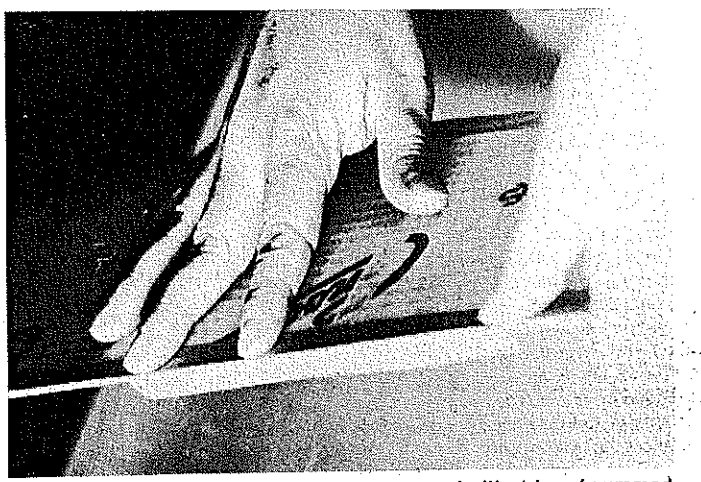
Successful as this plane was, however, as the season progressed, it became apparent that cardboard doublers were not sufficient to prevent "the accordian syndrome." Also, in my hurry to get the plane finished, I had only clear-doped it, and it kept on lasting and lasting—looking ugly the whole time.

Next spring, with some minor modifications, all of the boys in my Cub Scout den were busy building their own cardboard planes. We bought the bellcranks, wheels, and wire using den funds, and I donated the paint. After about two months of den meetings, the planes were all finished. Some of the boys saved up money to buy their own engines, and we took them out flying. The new planes looked great, flew well, and better yet, showed no signs of developing any annoying nose deformities even after numerous crashes.

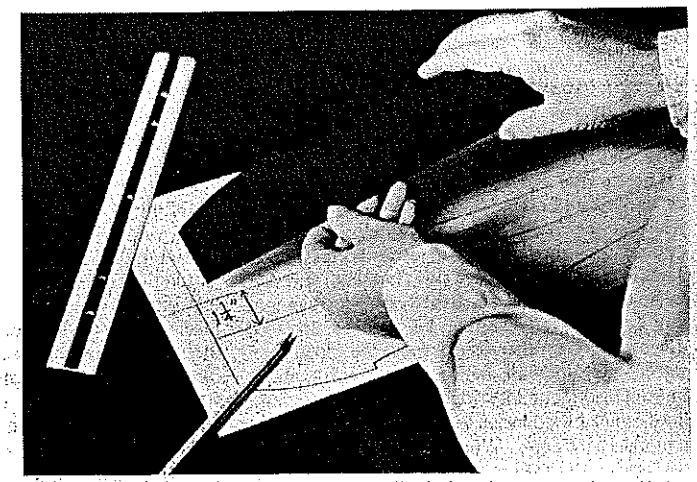
The most recent plane (shown in the photos) took longer to paint and make decals than it took to build, but I didn't want another plane to last and last while looking ugly the whole time. As you may have guessed from the pictures, the name comes from my choice of squadron and plane identification letters—in combination with the roundel.

In summary, this is a simple plane which can be built very inexpensively from materials which, for the most part, can be found around the house. It is extremely durable and almost never breaks, even in crashes where it ends up cartwheeling wing over wing. It can be hand-launched, or it can take off in the same manner as balsa wood planes. It is capable of consecutive loops and even inverted flight (though it is somewhat difficult to return to upright flight from inverted). It also has a long, gentle landing glide.

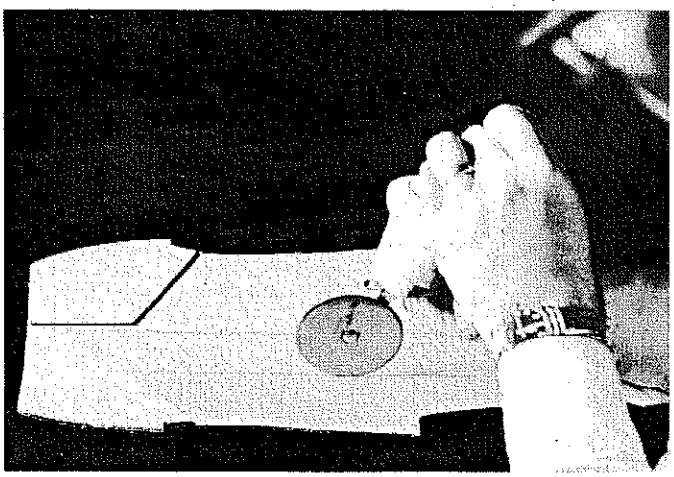
As a trainer, its strong point is durability. Also, after applying controls, the plane rotates before it starts either up or down, thus giving the novice a little time to think. Long (40-ft.) lines can be used



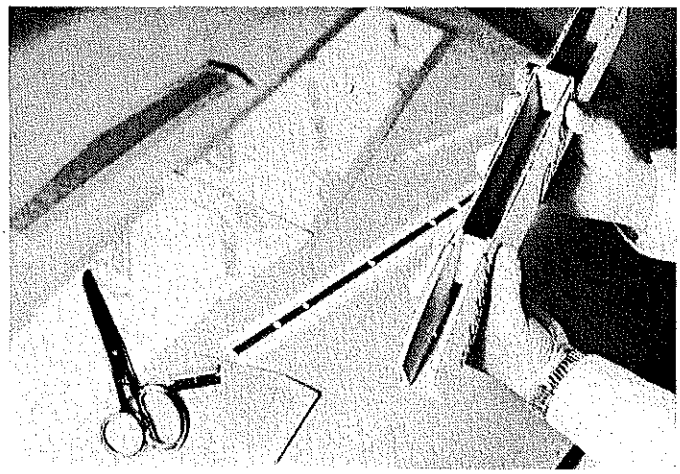
Edges of the wing and tail surfaces are wrapped with strips of gummed postal tape—moisture adhesive variety. Work in short lengths.



Laying out fuselage on corrugated cardboard, using a template. Note alignment of fuselage top with corrugation lines. Width may vary.



A pizza cutter is handy to crease the fuselage where it is to be folded. Note that plywood doublers for nose section are already in place.



Final assembly in progress. Formers glued to fuselage, wing/fuselage mounting key glued to wing, fin/rudder fold marked but not yet creased.

to prevent dizziness. Its main drawback—as a trainer—is that the lifting airfoil (necessary for wing strength) really makes it want to climb, and beginners tend to let it get uncomfortably high on the initial takeoff climb.

Construction. Start by cutting out the wing. For this, you'll need a good flat piece of cardboard 28-in. x 6-in. size, with the corrugations going lengthwise. Measure and mark the wing shape on the cardboard using a pencil, then cut it out.

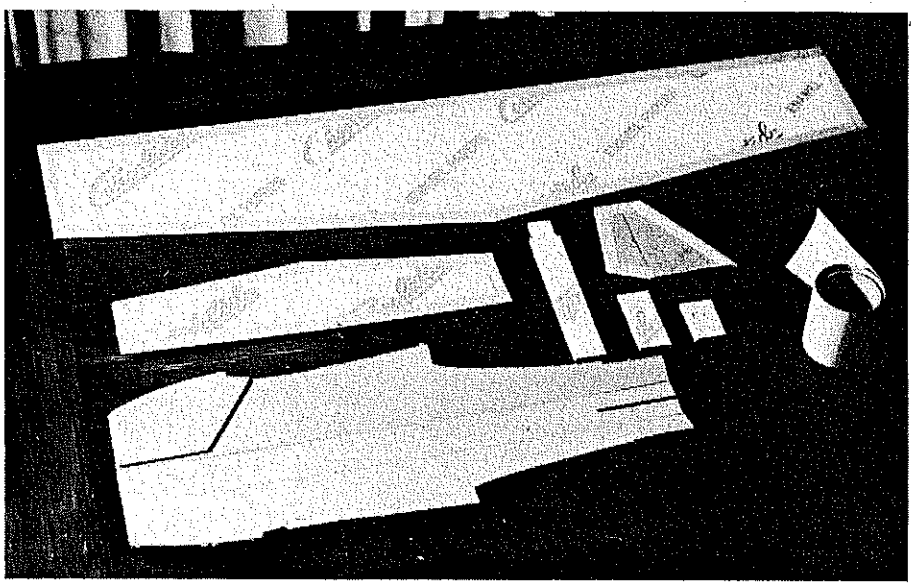
If you use a razor blade or razor knife to cut out the pieces, it is imperative that the blade be very sharp for the beginning; it will be dull by the time you get through cutting out all the pieces. If you use a razor blade, apply pressure to it mainly by pushing down with your fingernail. On the first stroke of the line with your razor blade or knife, merely score the surface. Follow the same path time after time, cutting deeper each time. It should take about five times before you start cutting clear through the cardboard. If you try to cut faster than that, the corrugations tend to turn the blade from the desired path. Cuts at an angle to the corrugation lines are harder that cuts parallel to or perpendicular to them.

If some of your cuts don't look so good when you pull the wing out of the cardboard piece, don't worry—none of these cuts are critical. Hopefully, you'll be pretty good at it by the time you get to the fuselage.

Measure and mark the horizontal stabilizer and elevator onto the cardboard. Again, the corrugations must be lengthwise. Also, the elevator hinge-line *on top* must be exactly on a corrugation line. On the bottom, it will then be midway between two corrugation lines. This is necessary for the elevator hinge to work properly.

Cut out the stabilizer and elevator piece, but don't cut the stabilizer and elevator apart from each other. Mark the hinge line *on the bottom.* This should be midway between two corrugation lines. Cut halfway through the cardboard along this (bottom) hinge line. Refer to the elevator hinge detail on the plans.

The fin and rudder piece is marked onto the cardboard and cut out next. For this, you might want to trace a template first, then trace the outline onto the cardboard, using the template. The hinge line on the left side (looking from the tail to the nose) should be exactly on a corrugation line (corrugations should be straight up and down). On the other (right) side, the hinge line should be midway between two corrugation lines. This alignment with respect to corrugation lines must be adhered to when positioning the template for tracing. When cutting out this piece, try especially hard to make the cut along the bottom of the fin exactly perpendicular to the surface.



All of the pieces cut out, edges taped as required, and folds already creased—ready for final assembly. Scrap ordinary corrugated cardboard of about ⅛-in. thickness is the principal material.

The fuselage is next. For this, the first step is to trace the fuselage side template from the plan onto a piece pf poster paper. Use scissors to cut out the template. Now, refer to the fuselage assembly diagram. Note that the top and sides of the fuselage are a single piece. The top corners of the fuselage (seen from the outside) must be exactly on corrugation lines. On the inside of the fuselage, these corners (fold lines) must be midway between two corrugation lines.

The width of the corrugations in the cardboard determines the fuselage width. Mine was five corrugations wide, the size shown on the plans. However, not all cardboard has the same corrugation width, so take note. The width of your fuselage may be different. Make sure it is big enough for the engine mount.

Trace the fuselage side shape onto the cardboard, lining up the top (flat) part of the template along a corrugation line. Using a pencil and ruler, extend the front line (perpendicular to the corrugation lines) three or so inches past the fuselage top line. Along this line, measure from the fuselage top line to the corrugation line nearest to the desired fuselage width. Now, with the top (flat) side of the template lined up along this corrugation line and the extended front line, trace out the shape of the other side of the fuselage. Use a ruler and pencil to connect the two tail end lines together.

Cut out the fuselage piece. Take extra care to ensure that all of these cuts are perpendicular to the surface. Turn over the fuselage piece, and mark the *inside* corner lines. These should each be midway between two corrugation lines. Using a pizza cutter, make an indentation along both of these (inside) corner lines. You have to push somewhat hard. The two sides will now fold upwards, giving the basic fuselage structure.

With the two sides folded up vertically, measure the inside width of the fuselage ¼-in. down from the inside of the fuselage top. This measurement will be the width of the WF-1, F-1, and F-2 pieces. If this width differs from what is shown on the plan, mark the correction on your plans.

Trace the plywood doubler shape onto ⅛ plywood. You will need two of these. Cut out these doublers, then glue them onto the inside of the fuselage with white glue. Refer to the fuselage assembly diagram for correct placement. They should line up with the front and bottom of the fuselage.

While this is drying, wrap the edges of the wing, stabilizer, elevator, fin and rudder. For this, I use gummed postal tape (the kind you moisten to stick on). This comes in rolls which are about two inches wide. If you cut this down the middle, you get two 1-in. strips, which are about right to work with.

Start with the stab and elevator piece. It works best to wrap the ends first, then the front and back. First, mark the length of the end of the stab

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from their machines. They are taping up the cheek cowl where it fits to the fuselage. They also are playing with the aspect ratio of the wing, and, of course, trying many different props.

By the way, a lady by the name of Judy Wagoner won the race. She was flying a plane called the Wagoner Solution.

In the report that I did on the NMPRA Championship Race held at Titusville, FL, I failed to mention that the sponsoring club was the Moonport Modelers and the CD was Mr. Roy Johanse. Sorry about that.

See you next month.

Bill Hager, 706 Glen Haven Dr., Conroe, TX 77302.

RC Helicopters/Chesney

Continued from page 49

expected, even when highly recommended by another expert flier.

The point is this: as a hobbyist, I am not in a position to test every modification or every design, and must rely on the designer's test or, in some cases, the impressions of fellow fliers (as was the case with the May column) before I make my choices.

To those of you beginning in RC Helicopters, I still recommend, as I did in my first column three years ago, that unless recommended by the manufacturer or a local flier willing to help with the new machine, modifications should be avoided until flying skills are developed. But for those of you who have flown RC for years, loved to experiment with differential flaps, reducing wingspans and stabilizer areas, and making a tail dragger of the year's best tricycle gear Pattern ship, I'll continue to pass on modifications as I hear from you.

I'm looking forward to some great flying weather. See you at the field!

Dave Chesney, Rt. 9, Box 621-A, Greensboro, NC 27409.

FLOP/Robinson

Continued from page 52

and elevator onto the end of the postal tape roll. Now, cut this length (straight across) with scissors. Cut down the middle of the strip, splitting the piece in half. You should now have a correct length of 1-in. tape for each end of the stabilizer and elevator piece. Where possible, try to cut out pairs of strips like this, since it saves measuring time.

Take each strip of gummed tape, and fold it in half lengthwise. This makes it easier to fold around the edge when you have to work fast before the gummed surface dries. Now, take one of the strips, get one of the ends of the stab and elevator ready in front of you, and moisten the strip (get it really wet). Quickly stick the strip on, lining the edge up with the fold, then quickly fold the bottom on around the edge, and stick it down. Rub both sides firmly to ensure the whole length is nicely adhered. Stick the other strip on the other end of the piece in the same manner.

We now go through the same procedure to do the leading edges of the stabilizer. After this is done, do the trailing edge of the elevator. Here, we use a pair of strips with slight overlap, because it's too hard to work with very long strips. Now, wrap all the edges of the fin and rudder, except the bottom edge of the fin (where it glues onto the stab inside the fuselage).

Now, wrap all the edges of the wing. If you haven't been having much trouble with long

pieces, you can do the leading and trailing edges each in four pieces with slight overlap. Remember to do the wing tips before doing the leading or trailing edges. None of the edges of the fuselage are wrapped, so when you finish the wing, you're done with this procedure. Before starting the next step, however, check all the wrapped edges to see if any have become loose. If any have, cut the loose area open with a razor blade, and glue the tape back down with white glue.

Measure, mark, and cut out from cardboard the fuselage formers F-1 and F-2, and the wing/fuselage mounting key WF-1. Be sure the width of these pieces is the same as the inside width (that you measured earlier) of your fuselage. Also note that the corrugation direction on all these pieces is width-wise. Fold the fuselage to shape, and glue in place the two fuselage formers with white glue. Hold it together while it dries, using rubberbands or clamps. Before the glue gets completely dry, examine the front and back of the fuselage, and make any adjustments necessary to make the corners perfectly square. Also note that the front former is recessed ⅛-in. below the wing cutout. This is to make room for the wing/fuselage mounting key WF-1.

Now, carefully bend the wing to fit the wing cutout in the fuselage. You may inadvertently end up with some wrinkles on the bottom of the wing, but it isn't a problem. At this point, make sure that the wing/fuselage mounting key, WF-1, fits inside the wing cutout. It may be necessary to sand it down a bit with a sanding block. Mark the lengthwise center line on the top of the WF-1 piece, and the chord-wise center line on the top of the wing. Glue the WF-1 piece onto the top of the wing, using these center lines for alignment. Note that this piece lines up flush with the leading edge, but lacks ⅛-in. of reaching the tip of the trailing edge.

While this is drying, mark the fin/rudder hinge line on the right side (looking from the back of the plane to the front) of the fin and rudder piece. This line should be midway between two corrugation lines. Using a pizza cutter, make an indentation along this line. Now, carefully bend the rudder to the right to the angle shown on the plan top view.

There is also a detail we need to take care of on the stabilizer and elevator piece. Turn it upside down, and using a razor blade or knife, cut through the edge-wrapping (on the bottom surface only) to extend the hinge-line cut to the end of the elevator. Do the other end the same way. Now, take a medium-dull pencil, and run it up and down the elevator hinge cut to enlarge it a bit. You should now be able to bend the elevator up and down quite easily.

Measure and mark the rudder slot in the fuselage. Cut the front end of the slot by sticking the tip of a razor knife or blade through, then cut the sides of the slot with scissors. Now, examine the stabilizer cutout on the fuselage. If the fuselage sides don't fit flat and tight onto the stabilizer, true it up with a sanding block or file.

Glue the wing onto the fuselage with white glue. Lay the fuselage upside down, and put weights on the center of the wing to hold it firmly in place while it dries. Also, glue the stab onto the fuselage. Since the fuselage is upside down, the side of the stab and elevator which we can see is the bottom (the side with the hinge cut); make sure you have it right.

When the wing and stabilizer glue joints are dry, pick up the plane, and turn it over. Glue in the fin and rudder, again using white glue. It is glued into the slot and down against the stabilizer. Trace the shape of the front of the fuselage onto ⅛ plywood, and cut it out. Glue this piece (the firewall) onto the front of the fuselage using 5-min. epoxy. Hold it, or clamp it in place, until it hardens.

Hold poster paper up against the fuselage bottom, and trace the shape of the two fuselage bottom pieces. Be sure to mark the length, also. Notice that they overlap a little onto the wing (the front piece), and onto the stabilizer (the back piece). Cut these pieces out with scissors, and glue them onto the bottom of the fuselage. Also measure and cut small rectangular pieces of poster paper to fill in the hole on either side of the fin, and glue them in place. Cut some strips of postal tape to wrap around the corners of the fuselage sides and the F-2 former.

The plane needs a canopy to protect the needle valve (if it sticks up above the top of the fuselage). Don't try to kid yourself that the plane will never crash in that position! If you consider the styrofoam canopy to be too much work, just trace and cut out two to four side-view pieces of the canopy from cardboard, and glue (laminate) them together. A piece of poster paper should then be glued over the top, and the canopy can then be glued to the fuselage.

To make the canopy out of styrofoam, trace the side view onto the styrofoam, and cut it with a hot-wire or a coping saw. Then measure and mark the center line along the top of the foam piece, and trace the top view shape of the canopy onto the bottom. Gently shape it with a file, or a coarse sandpaper block. The final shaping should be done gently with medium grit sandpaper.

If the plane is to be painted with paints which do not attack foam, the canopy should now be glued on with white glue. Otherwise, it is glued on after the painting is complete, using a silicone sealer type glue, or some other glue that will stick to both the foam and the paint without attacking the foam. Alternately, you could leave the spot where the canopy goes unpainted, and glue it on later with white glue.

Trace the bellcrank mount shape onto ⅛ plywood, and cut it out. Make the hole for the bellcrank's wood screw, and glue the mount onto the top of the left wing in the position shown on the plan. Measure to ensure correct positioning. Make the lead-out guide for the flying lines from a popsicle stick, or a similar piece of scrap. Glue it in place on top of the end of the left wing as shown on the plan. Again, be sure to measure for correct placement.

Painting tips. If you use dope (as I did), you will need two coats of clear dope (three coats for the postal tape edge-wrapping) before the color paint. Sand with fine sandpaper between coats. If you use polyurethane paint, you might just as well start with the color, and it will probably take three coats—sanding between coats. If you don't

live near a hobby shop, the Varathane plastic paints work well, and the fuel doesn't bother the finish. My plane is finished with a coat of Varathane clear satin finish paint.

Remaining details. If the canopy wasn't glued on earlier, glue it on now (after the paint has dried). Also, mark the canopy frame lines using a marking pen.

Cut and bend to shape 1/16-in. dia. wire for the pushrod, landing gear, and the wire skid. Poke the skid up through the wing into the right fuselage side at the angle shown. Glue it into its hole with epoxy. Install the bellcrank, pushrod, and elevator horn. I strongly recommend the use of the Carl Goldberg ½A nylon bellcrank and horn set. Flex the elevator up and down a number of times to loosen it up after painting. If the pushrod bows too much on applying up control, bend a pushrod guide out of 1/16-in. dia. wire, and glue in place. Mine didn't need one.

Attach the wheels to the wire landing gear. I do this using a glob of 5-min. epoxy and a paper washer. Mark the position of the engine mounting screws, make the screw holes (I use wood screws), and install the engine. Before you tighten it down, slide in the landing gear wire, then tighten it. Now, install the lead-outs, and you're finished.

Flying tips. For most types of flying and wind conditions, I recommend 35-ft. wire lines of .008-in. dia. On takeoff, avoid giving the plane up-control, since it will rise off the ground by itself when it reaches flying speed—because of the lifting airfoil. When the engine stops, you will have a long, gentle landing glide—provided you don't try to keep climbing. If you are overly nervous in trying to fly it, just let it bash into the ground a time or two. Pick it up, dust it off, start the engine, and try again.

CL Scale/Byron

Continued from page 53

The other aircraft Bill competed with is an F4U4 Corsair from Super Scale drawings, built in approximately 1963. It was powered with a Torpedo .35; it is built to ⅜-in. or one-in. scale. It had Bramco throttle, working lights, and working cowl flaps, also a scale arresting hook. The aircraft was painted with Aero Gloss paint, weighed approximately 3 lbs.

Bill is an old-time modeler whom we may be able to convince to compete again. His skills are quite obivous. He currently runs Bill Howard's Hobby Shop in Waterloo, IA, and is always more than happy to discuss things old and new alike. I find Bill to be a very enjoyable person to visit.

Anyone reading this column who also has any older pictures still available, please send them in! We would all enjoy reminiscing, in addition to looking at what is the latest thing on the block. We will try to use every piece of information we get.

Finishing hints. I have been experimenting with a new primer to decrease the finishing weight of an aircraft. It is made up using Sig microballoons and lightweight dope, thinned with Sig thinner. It has been sprayed very easily and does fill the larger-grained woods. The aircraft I primed with this filler would normally take eight hours to sand out; it took one hour and 10 minutes to completely sand this one, ready for clear dope.. While not working as well as talcum powder, it does appear that this type of primer will work in place of