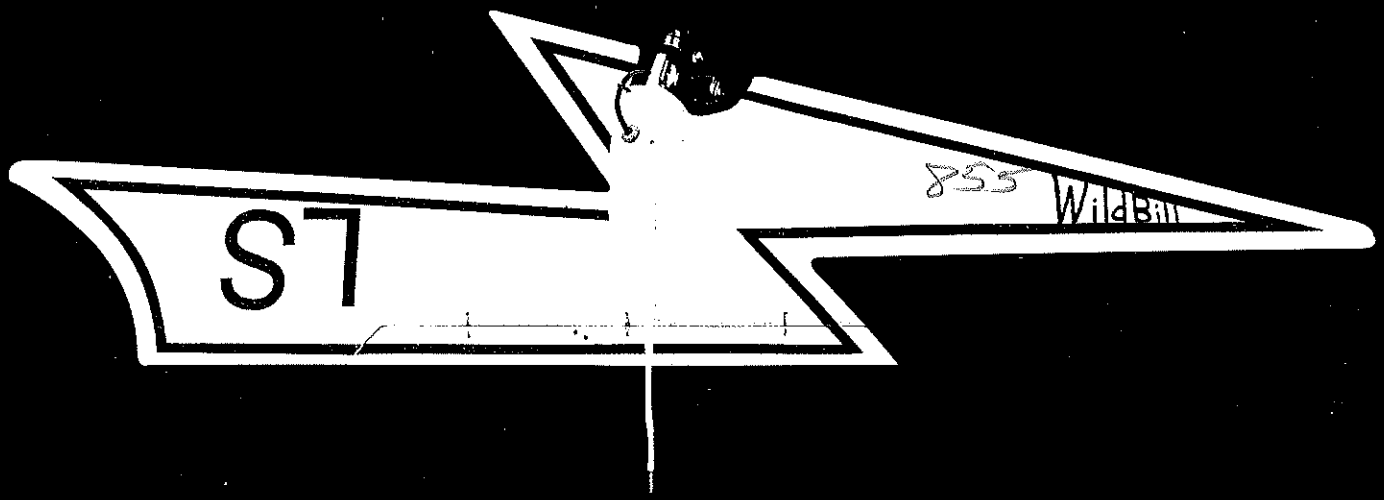
LARRY'S LIGHTNIN' BOLT

■ **Bill Netzeband**



I met Larry Scarinzi at the fifth Vintage Stunt Championships (1993). We got together and discovered that we viewed life and model airplanes a lot alike (if it hurts, don't do it). Larry's spirit deftly combines Peter Pan's and the legendary Puck from old English folklore. *Irrepressible* comes the closest to a description.

I observed that Larry's correspondence was illustrated with a lightning bolt logo. On August 7, 1995 I was clobbered by the inspiration to make that bolt fly. Once hooked, I elected to make it a flying wing, rather than an easier-to-tune conventional airplane.

Design Concepts: The only reason for this funny shape to be intimidating is its lack of symmetry, which makes it hard to find the centroid, and the Aerodynamic Center (AC) when it becomes a wing. (The centroid is a single point where the shape will rest in a level position in all axes. It establishes the wing's spanwise center, and the AC establishes the chordwise center. Both of these points are marked on the plans for reference.)

Happily, finding the centroid is a simple task, and can be tackled in several ways:

• I simply scaled the outline into my CAD program, and asked it for the area and the centroid. It delivered them faster than you can read this.

• A time-honored method involves cutting an exact-scale template from a piece of uniform material. Mount a large pin on a base block. The task is to find the single point (like the pin) where the template will balance in a level plane in all directions. Once you locate the centroid, punch a visible hole there.

• A real mathematician would divide the span in little slices, measure each chord, find the average chord, run a Simpson's approximation for the area, and then sum the mass moments to zero about the centroid.

The importance of the Aerodynamic Center to the system is its relationship of the Center of Gravity (CG) and controls to make a stable, controllable airplane. The popular methods to find the centroids of the two wing panels and the intersection of their Mean Aerodynamic Chord line with the panel's Quarter Chord lines have been documented many times.

The problem with the Bolt is that there are too many kinks in the outline, making too many separate panels. I started to trudge through a complete study, then threw up my hands and used a dart to assign the AC. I then used conventional procedures to place the CG to create a safe first-flight condition. Other considerations regarding controls features and looping performance fell out of my routine dynamics programs in routine fashion.

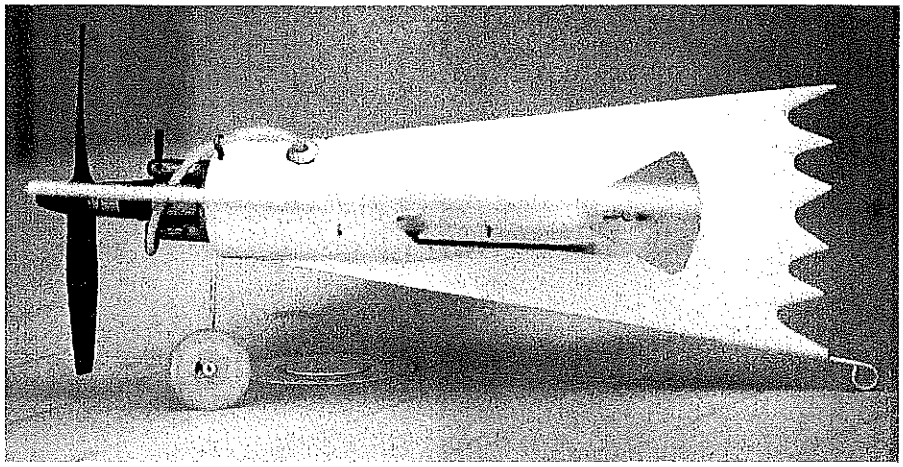
The thrustline angle really isn't bizarre; it simply makes the propeller parallel to the leading edge, and there isn't enough fuselage here to cause yaw upsets during maneuvers. I was careful to direct the thrust through the CG so there isn't any adverse torque in the yaw axis. When the engine is running, it does add some safe line tension.

The only down side of the prototype was my careless selection of eight-pound-density wood for the wing. The net dry weight was six ounces, and the tail weight boosted that to 6.6 ounces. With a wing area of only one square foot, the wing loading was too high to perform dazzling square turns on 42-foot lines. The #2 airplane (built with six-pound-density stock in the wing) is a substantial ounce lighter, and with no tail weight, does zip around and perform recognizable vertical eights, as well as "fake" squares.

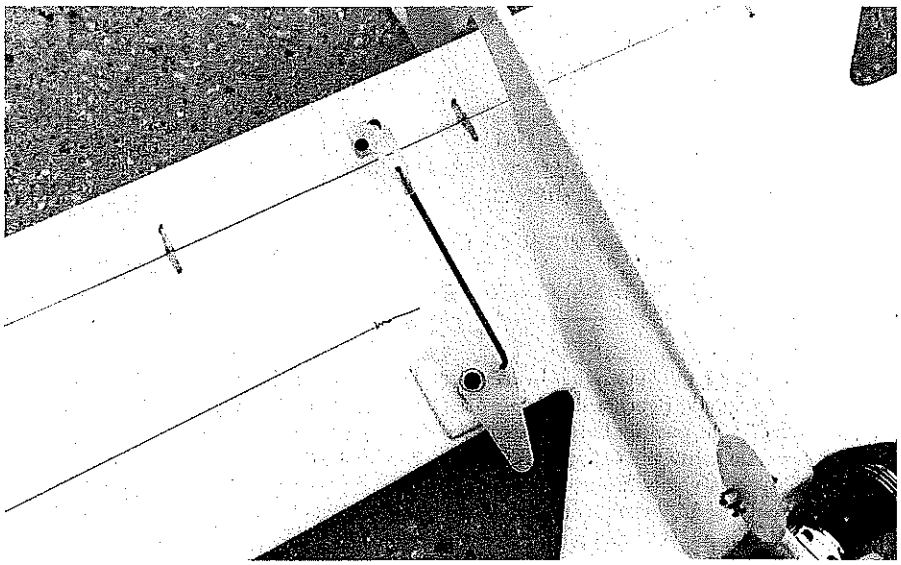
CONSTRUCTION

Please save yourself some frustration and trek to your balsa supplier for two sheets of 3/16 x 3 x 36 C-grain stock that weigh 1 to 1.25 ounces each. Anything lighter will require some exotic stiffening techniques; heavier will rob some of your fun in the wild blue.

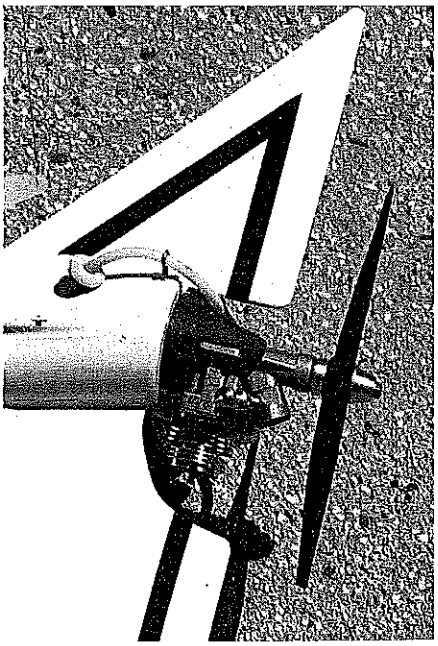
The remainder of the balsa is scrap-box material, as well as the plywood pieces. If



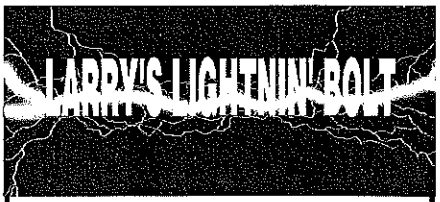
The side view of the Bolt is pure symmetry, except for the funny wheel.



Nice, simple controls path. Easy to install, and to tune (stays cool in flight).



The business end, filled by the Norvel Big Mig. 049; it was later replaced by the AME Mk IV. Note setup for pacifier tank.



Type: CL Sport

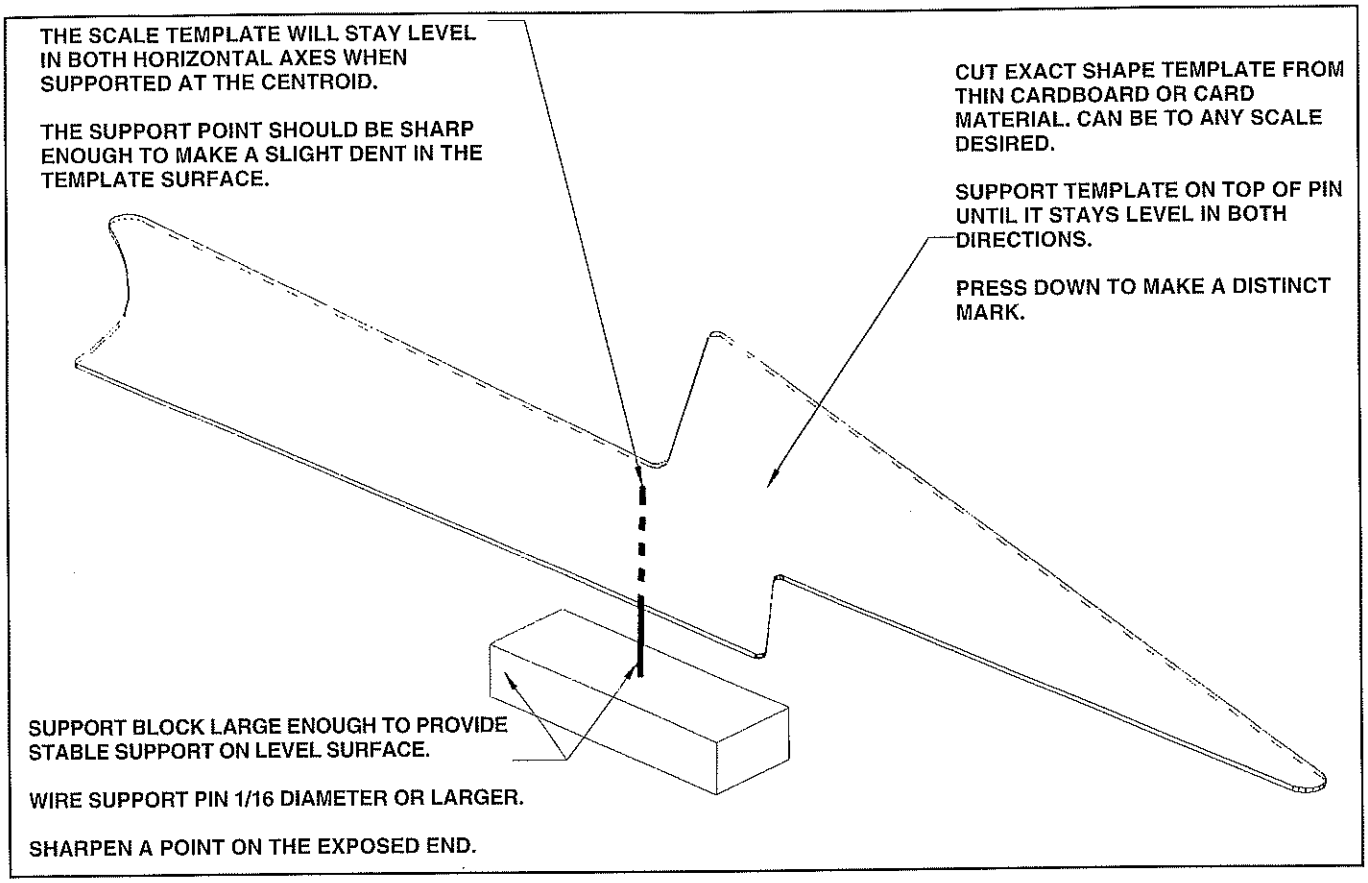
Wingspan: 33 inches

Engine: .049-.051 two-stroke

Flying weight: 5-6.6 ounces

Construction: Balsa and plywood

Finish: Dope



you have to buy control system hardware, check the plans. The Bear Necessities (Box 549, Beecher IL 60401) has everything you need, and also handles the pacifier fuel tank materials. He also has a neat catalog of exotic hardware. Otherwise, your favorite hobby dealer can probably satisfy your needs.

Time spent carefully straightening the mating edges of the sheets, so there is no gap when glued, will save you time later. The glue line doesn't have to be straight—just gap-free. Glue together on a really flat surface, and let cure thoroughly.

Wing parts are cut from the waste wing stock, per the templates. These should be carefully aligned during assembly to guarantee flatness. The flat wing has a sneaky fault lurking in its simplicity. If it warps, even slightly, into a cambered airfoil, it will drive you crazy (if not into the ground)! Keep checking this as you add parts.

I split the fuel pod skins into top and bottom groups to keep wing material through the center. The 3/16 bulkheads and 1/2 wedge blocks support the skins. Weight the wing flat while assembling the skins. Wetting the sheet (on the outside only) helps to form the curve without splitting, or excess built-in strain. The tapered rear skin should be trial-fitted until it nestles in place.

When the top half has cured, flip the assembly over and do the bottom half. Prepare the firewall and install it.

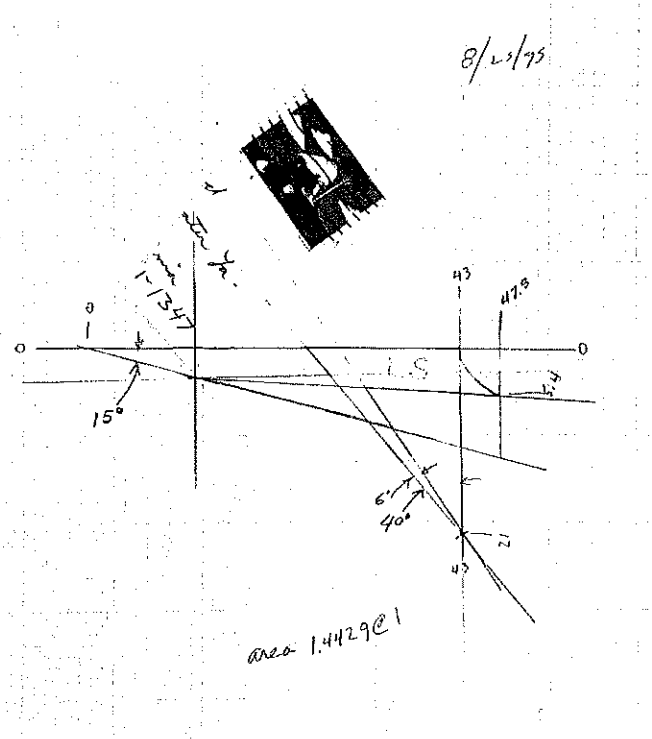
The landing gear rests in a groove and is trapped by the engine mount. Match-drill the pilot holes for self-threading mount screws. If you use 2-56 machine screws, install the blind nuts at this time.

Block up the wing parallel to the table top and use a square to check the vertical angle of the nose for exactly 90°. Adjust it with a sanding block until it is right on! (A tailless aerodyne is extremely sensitive to the thrustline angle in the pitch axis.) Glue the firewall to the pod.

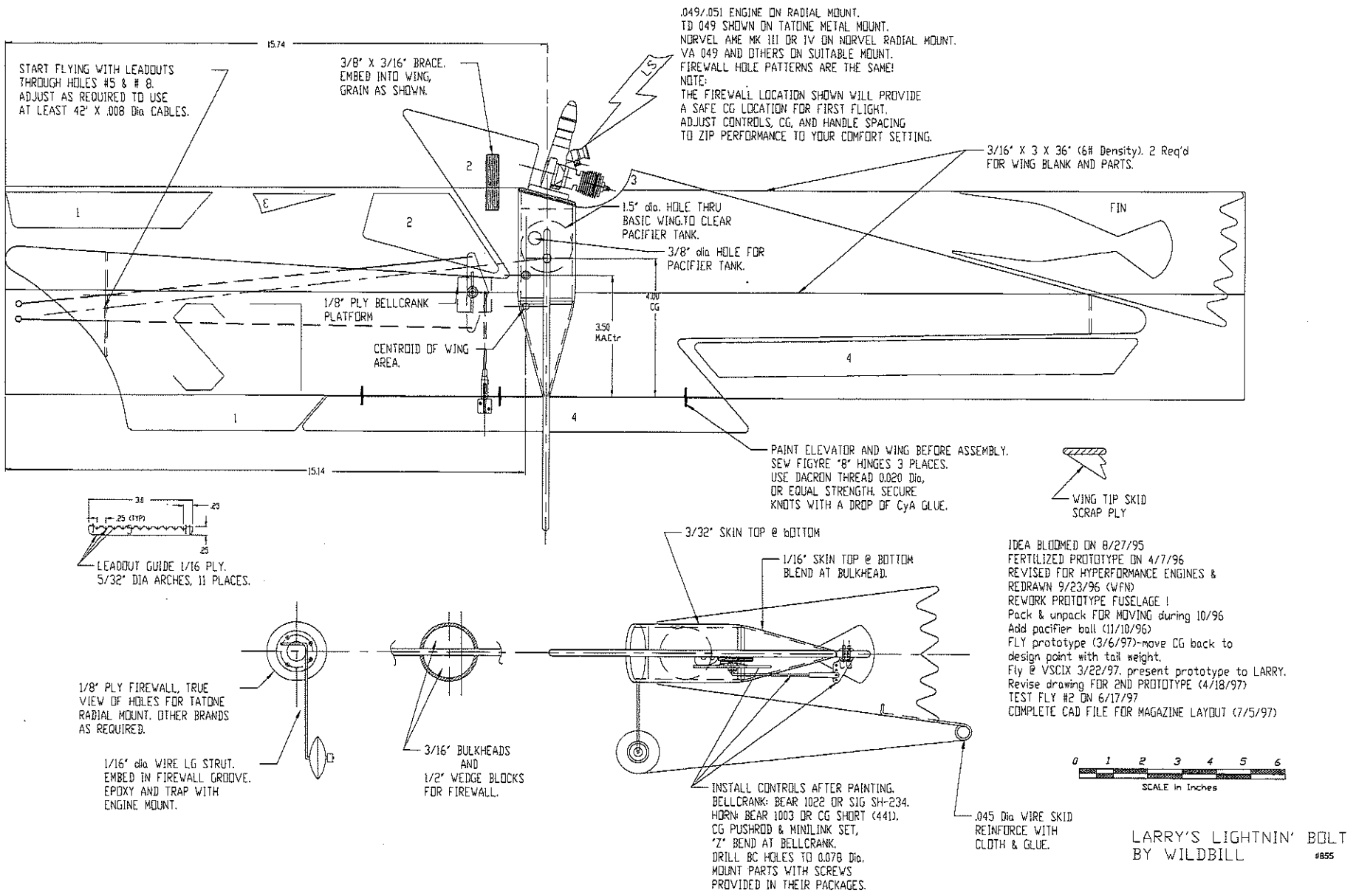
Shape the edges of the wing, smooth the surfaces, and get ready for final assembly. I highly recommend using sanding blocks for all of this effort. You can shape the edges with 220 grit, followed by 400, finished with 600. The flat surfaces need the same block-sanding sequence.

Once the wing is smoothed you can add the parts that stick out: the fin, the tail skid, the bellcrank platform, the tip skid, and the line guide. Add fillets using your favorite technique. The fillets can be shaped and finished with 400, wrapped around an appropriate-diameter dowel.

Finish: The wing assembly and elevator should be painted separately. My special finish technique is three coats of AeroGloss clear, sanded between coats. If I am going for spiffy appearance, I add two coats of AeroGloss color. The black trim on #2 was



The logo that started it all. "A study in excessive asymmetry—lean, mean, and weird," says Wild Bill.



Full-Size Plans Available—see page 189

MonoKote trim film, and the hand-painted lettering used AeroGloss Orange.

When you can handle the painted parts without leaving fingerprints, install the elevator. The sewn hinges are simple and tough, but you can also use commercial hinges; just be sure the elevator can be moved through 45° up and down with gnat force.

The controls hardware can be bolted in place and checked out for freedom and proper travel. Materials are listed on the plans, and except for drilling out the bellcrank holes (.078) to fit the Carl Goldberg pushrod wire, are used in stock form.

After assembly, route the leadout wires through holes five and eight for the first flight. Then make very certain that the elevator can be moved through full travel, using the leadouts, while the airplane rests freely on a table. If it slides before the controls move, you need to free things up better. Then assure that the up and down travels are matched when the bellcrank hits full travel by adjusting the pushrod length with the Minilink. This will get you ready for flight. Mount the engine and landing gear.

One method to make a pacifier tank: Cut a piece of 3/32 OD brass tubing 5/8 long and polish the ends. Push this tube fully into a 5 long piece of 1/16 ID x 1/32 wall latex tubing. Wetting both parts with saliva helps, as well as rotating the parts while pushing.

Cut a nine-inch length of #24 copper wire, and gather it, the fuel tube, and the pacifier together. The trick is to insert the fuel tube assembly into the neck of the pacifier and wrap the wire at least four turns around the neck to firmly trap the tubing without cutting through the parts. If this is your first-ever try at tank building, practice on a dowel until you can handle it smoothly. Practice does make this chore easier.

Twist the ends of the wire tightly, trim to about 1/8, and bend the twist away from the pacifier. Plug the assembled tank to a five-ounce fuel syringe, and blow it up to at least 2.5 inches in diameter. Massage the ball gently to expand the outside end. Blow it up at least five more times, holding it expanded at least 15 seconds each time. The tank will be a tight fit through the 3/8 diameter opening. Moistening it and twisting will ease the job.

Final Inspection/Admiration: Completion of the above has provided you with an exotic-looking machine, ready to dazzle your friends. Look it over and check things that need to be loose for looseness, and things that should be tight for tightness. Now put it somewhere in view of your most comfortable chair. Get a mug of your favorite beverage, turn on the stereo to your favorite music, and waft away into the wild blue on the wings of a Bolt.

Power Train: The plans show a TD engine, mostly because I have a template in my

'AD program, and a bunch of those ngines in my engine drawer.

The pacifier fuel system was a second hoice after I played with offset Black Vidows on other airplanes (I couldn't nd a fuel pickup position to feed reliably ı all attitudes). If you want to fly with ıe engine straight-on, turn the Bolt round, and the Black Widows, etc. will e adequate. I highly recommend that you se a Kustom Kraftsmanship Custom eedle Valve assembly (see ad this issue) or pressure fuel applications. Try the enerable Cox 5 x 3 gray nylon prop first. hen play.

When I offered the airplane to *Model viation*, Jim Haught suggested that I ork with more modern engines, based n their hot performance and the tenuous vailability of new TD products. So we btained two of the latest Norvel .049s, ıe Big Mig and the AME Mk. IV, and ew #2 with them. (The VA .049 was mporarily unavailable because of a elivery glitch, but there is no reason the olt won't really smoke trying to catch p with one of them.) Fact is, 52-foot nes look really good for the modern ookers.

Using the radial mounts, you can bolt ı anything you wish, but I should ution you that the flat wing might start ı flutter if you install .061s or run lots of itro in the modern engines.

The Norvel Big Mig .049 was not happy" being fed from the pacifier tank. ot a problem; we were simply asking it ı run under conditions outside of its esign envelope. The Big Mig venturi has een carefully tuned to run on a ompressurized fuel system, and it will ppily slurp fuel on its own. The ports ive of them) are timed to be docile, but is as powerful as a good TD, and should e quite happy in aerobatic machinery ith standard Uniflo hard tanks. When ed properly, it is quite nice to start and ndle.

And by all means, use their optional ring starter. It works. Their muffler is a al plus, to hide you from public wrath id to save your personal ears.

There is no need to modify the Big lig, because for a slight increase in ice, Norvel offers a high-performance ersion: the Norvel AME Mk. IV is a real ooker. We used an APC 4.5 x 2 prop, rst time. It has the advanced features cessary for high rpm and more nitro. In s stock form it runs very well, except for real hassle to set the needle valve under essure fuel. I solved this problem with a ustom Kraftsmanship Custom Needle alve Assembly, with finer threads and lvanced shape and seals. We had good sults with 15% nitro fuel and two head skets. Again, this project does not quire peak performance. The Mk. IV

has much more to offer in the "go" department.

Flight Tests: (The fun part!) Charlie Mackey and I went to one of our hit-and-run flying sites (a rocky knoll in the countryside) for the maiden voyage. The prototype came off the bench with safe nose-heavy trim, and the first flight was flat-out, in the groove, and chaotic in the rpm department. The nose-heavy trim was easily tuned-out with the sophisticated "borrowed-solder-in-the-tail" method.

The engine had an incompatible part, resulting from my disassembling a bunch of them and forgetting which parts had been together before. The next two flights showed acrobatic promise, so we quit while we were winning. Charlie, who is easily the King of the Offbeat CL domain, waxed enthusiastic about the flight performance and appearance in the air. I accept this as a fine compliment.

I performed the follow-up work in the shop, and prepared to attend the VSC IX in Tucson. We finished tuning the prototype at the Cholla Choppers Field in Silverbell Park, with help from all of the legends and experts who make the VSC pilgrimage each Spring.

Larry was much more comfortable flying it at fast lap times than I, and he looked so happy flying it, that I gave it to him for his very own. Of course, his first thought was to stick the pointy tip into the ground in the pit area for display. In our misspent youth, most of us "planted" the rear fuselage and undamaged tail of a tired Stunter in the pit area, for grins. Made you stop and look. Larry compromised by putting the model in the rear window of his Cadillac.

Flying: After attaching the lines, at least 42 feet x .008 cable, and a nice light handle with line space set to hit maximum elevator at your maximum command, flight procedures are routine. I fly the Bolt with 15% nitro fuel, and set the needle valve as rich as possible on the ground.

Take the first flight easy to get a feel for the airplane's comfort zone (and yours). Be sure that the engine will back up anything you want to do in the air, then check the glide to landing. The Bolt handles somewhere between a Combat model and a Stunt model. Fine-tune the controls until you are comfortable, and the airplane goes where you point it.

"Fun is too important not to be taken seriously." (Tom Dixon, 1996). I sincerely agree. ✈

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