BARECAT

■ Bob Baron

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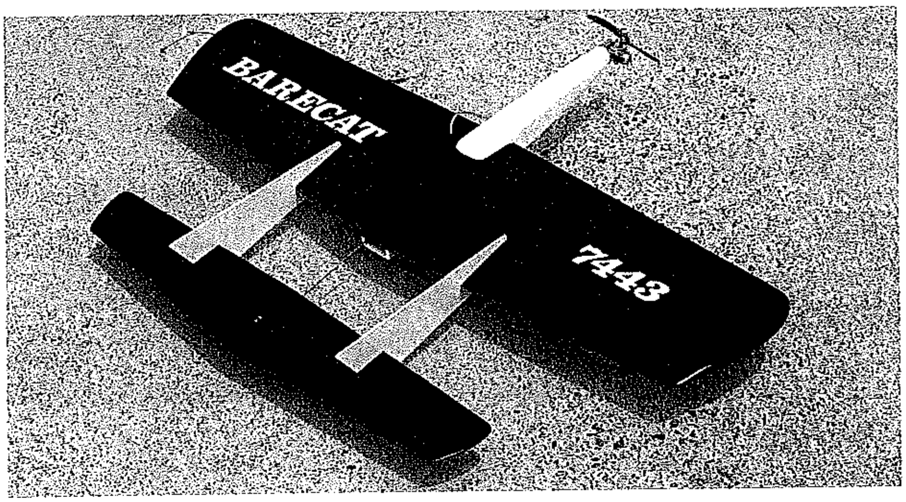
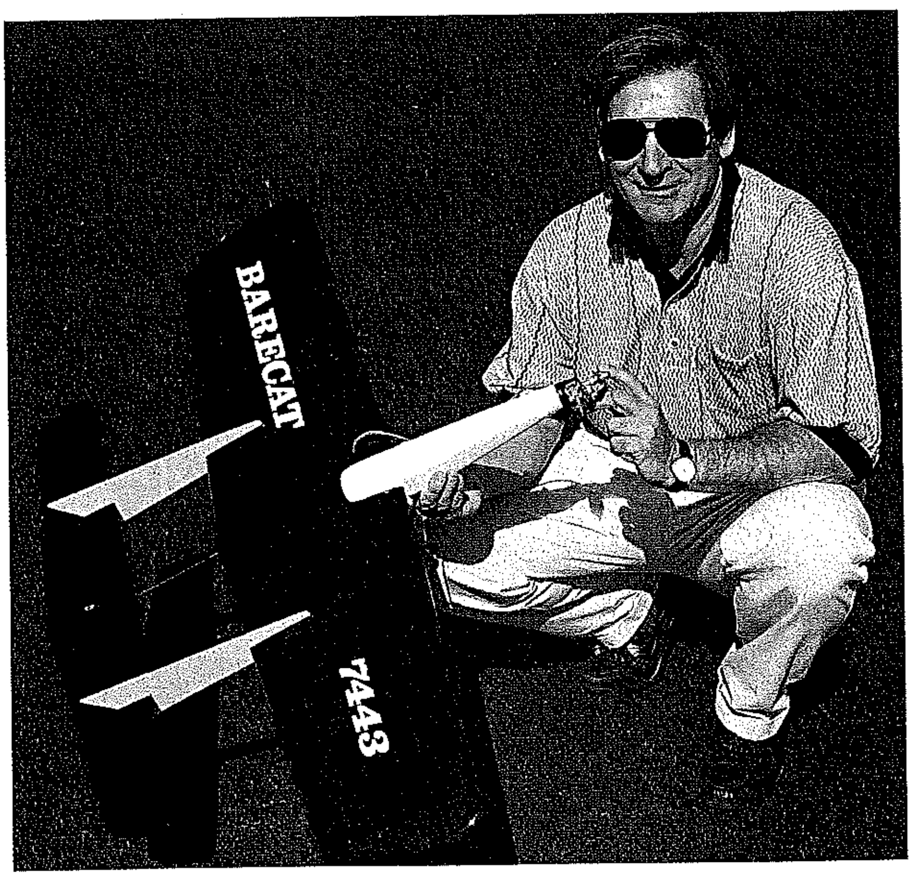


This design has the "bare" essentials—no cowl, flaps, etc. Despite the no-frills approach, "performance is truly spectacular." Norvel .049/.061 power.



The author shows the latest version. The design has been updated from the 1980 Bill Netzeband original with the advent of powerful modern ½A engines.

The Barecat is the Control Line Aerobatics equivalent of the bumblebee: it's difficult to grasp how it does what it does, and it can't be scaled up and still perform at the same high level. There are no large bumblebees flying around (for which we probably should be grateful) and the Barecat is most magical in the ½A size.

Conceived by Bill Netzeband in 1980, the design has recently been revived by the introduction of very powerful and reliable ½A engines. The engine and associated hardware comprise only 10% of the total airframe weight, compared to 20-25% for the typical Stunter. With a total weight of only 15 ounces with 360 square inches of wing area, the wing loading is ½ and the pitch inertia no more than ⅕ that of contemporary competition Stunters.

Like the bumblebee, the Barecat does not require flaps. Could there be a message here? The resulting performance level is truly spectacular, and more closely akin to Saturday morning cartoons than our present perception of Control Line Stunt.

The Barecat has only the essentials for maximum performance—hence the name. No cockpit detail, flaps, cowl, spinner, paint, wheel pants, wheel fairings, or ink lines. Even the gas tank is minimal; this design requires expanded surgical tubing to provide the required fuel pressurization.

With the power plant weighing only two ounces including engine mount, the fuel must be located on the center of gravity to keep the flight trim constant. The surgical tubing fuel system, with its high pressure, allows the air intake of the engine to be large, and the engine performance is much higher than a comparable engine running on "draw" (suction fuel feed). It's more difficult to operate than a conventional tank, but the surgical tubing is reliable and straightforward, once the basic procedure has been learned.

The reason for the short-coupled tail is that as the turn radius of an airplane becomes very small, the stabilizer is more prone to stall before the wing. The limit to turn radius in extreme designs such as the Barecat is the ability of the tail to maintain the required angle of attack of the wing.

As the moment arm becomes longer, it becomes increasingly difficult for the tail to maintain sufficient force to keep the airplane in a tight turn. The large area is then required to provide the degree of

Graphic Design by Jill Ann Cavanaugh

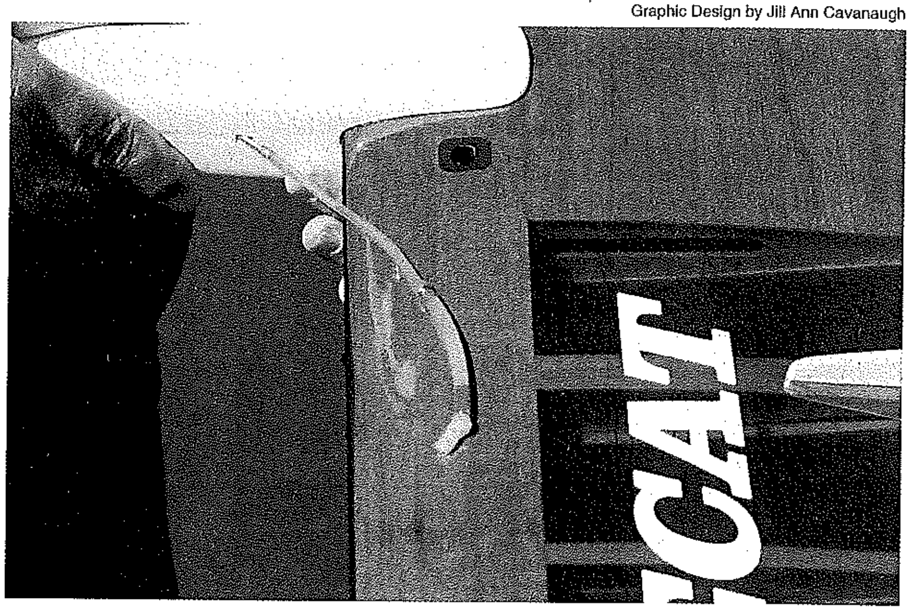
stability that is required in a Stunter, compared to a Combat model.

Once the geometry of the wing and tail is developed, the nose length is simply that required to position the center of gravity at the proper location. In this case, since the engine is so light, an ounce of ballast was used to keep an already long nose from becoming completely ridiculous.

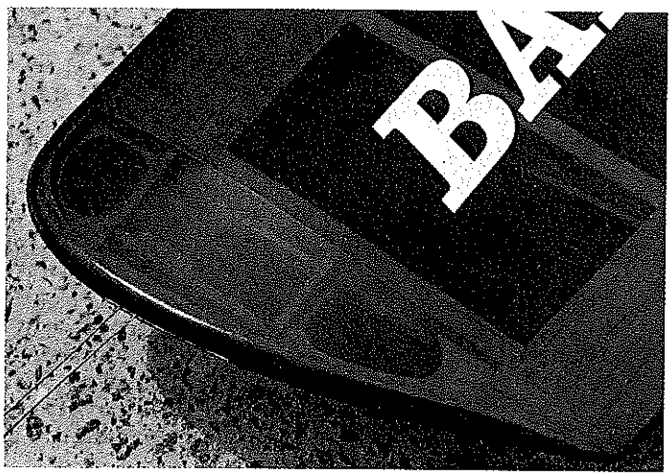
The landing gear may seem to be an extravagance, but since this is a Stunter, not a Combat model, a gear is used. The original had a single-wheel gear, in keeping with the bare-essential format, but it required additional skids, and was frankly a real nuisance when flying with a stooge. The airplane would rock from side-to-side with slight wind gusts, and each takeoff was a little nerve-wracking. The extra wheel is a small price to pay for eliminating this nuisance.

CONSTRUCTION

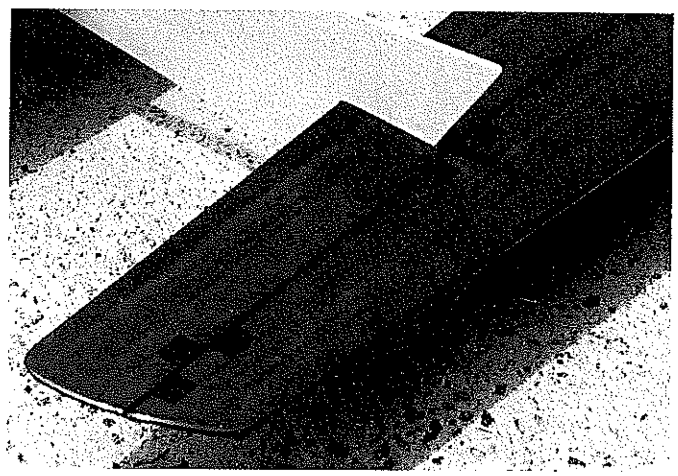
While this is "only" a ½A airplane, it is a very high-performance vehicle, and as



High-pressure surgical-tubing tank allows large engine air intake and increased performance compared to same engine on suction fuel feed.



Wing is built on rods in fashion similar to full-size Stunters. Remove rib material between rod holes for leadout clearance.



Text details MonoKote hinge method preferred by author for smooth hinges with minimal gap. Stab is light ⅛ sheet.

BARECAT

Type: CL ½A Stunt

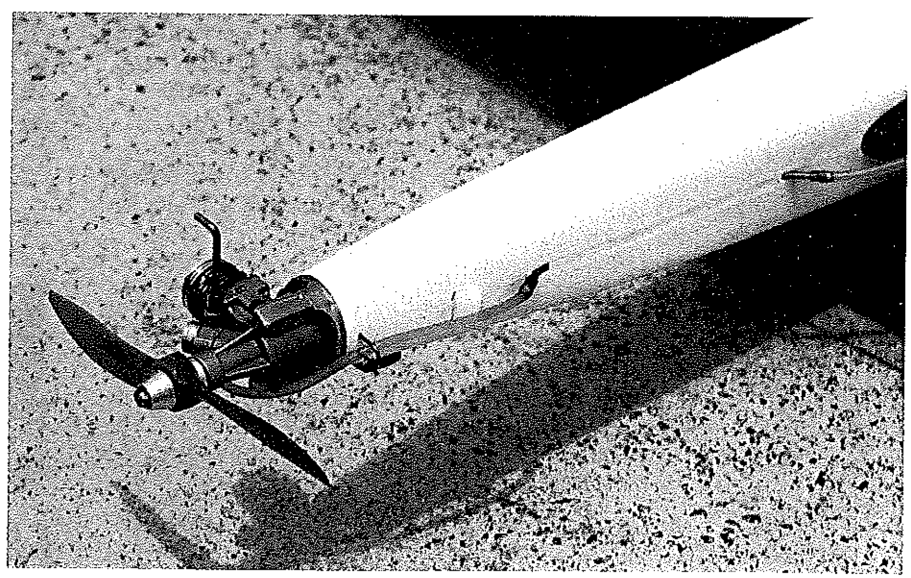
Wingspan: 40 inches

Engine: Norvel .049/.061

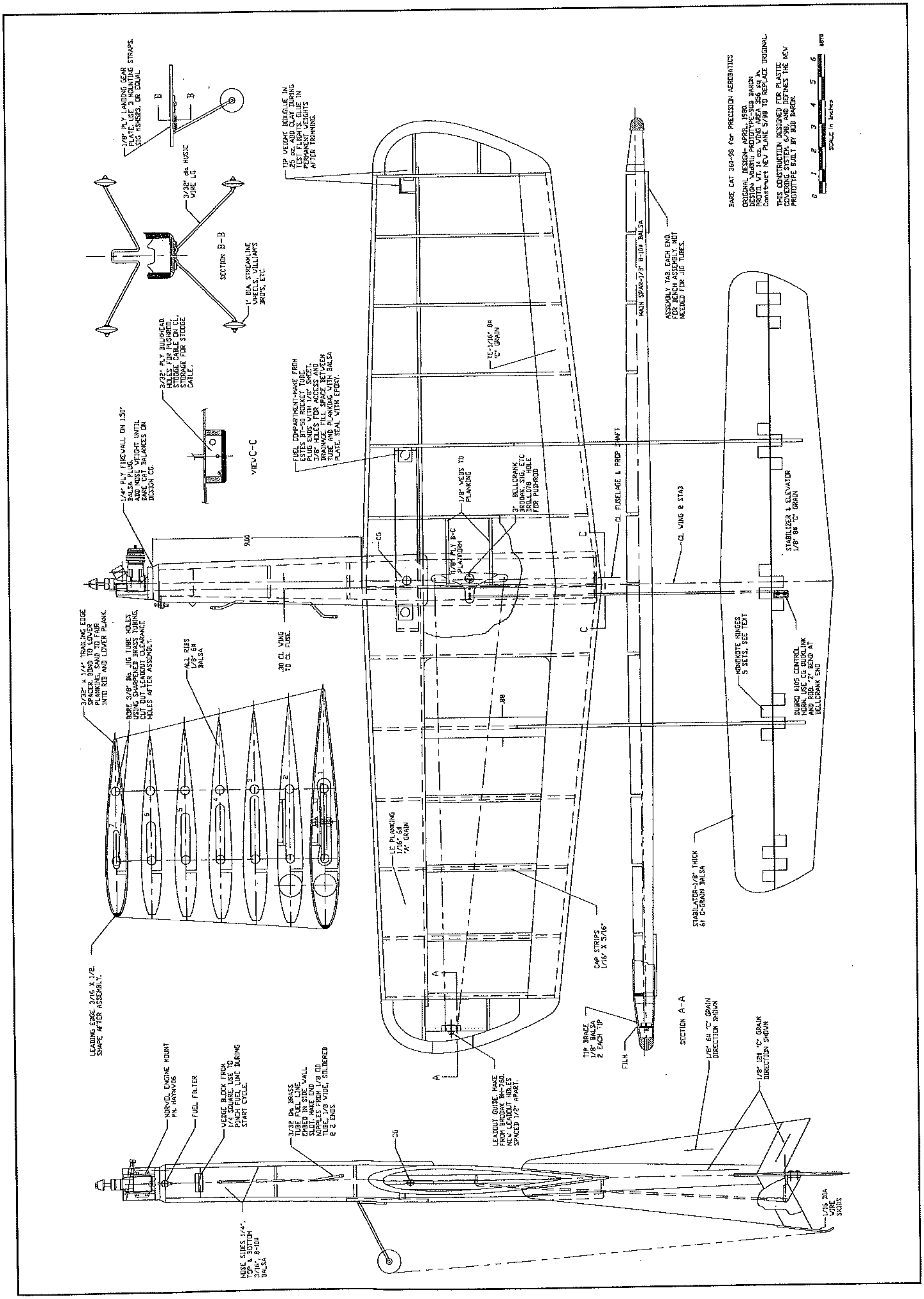
Flying weight: 14 ounces

Construction: Built-up

Covering/finish: MonoKote



Nose pod is sheet balsa covered with MonoKote prior to attachment to wing with epoxy. Kustom Kraftsmanship needle valve assembly replaces stock unit.



BARE CAT 360-98 for PRECISION AEROBATICS
ORIGINAL DESIGN- APRIL, 1980.
DESIGN WEIGHT PROTOTYPE-BOB BARON
PROTO. WT. 14 oz. WING AREA 356 sq. in.
Construct NEW PLANE 5/98 TO REPLACE ORIGINAL
THIS CONSTRUCTION DESIGNED FOR PLASTIC COVERING SYSTEM, 6/98, AND DEFINES THE NEW PROTOTYPE BUILT BY BOB BARON.
SCALE in Inches
1/8" PLY LANDING GEAR PLATE. USE 3 MOUNTING STRAPS. SIG #SH625, OR EQUAL
3/32" dia MUSIC WIRE LG
SECTION B-B
1" DIA STREAMLINE WHEELS, WILLIAMS BRO'S, ETC
3/32" PLY BULKHEAD. HOLES FOR PUSHROD, STOOGE CABLE ON CL. STORAGE FOR STOOGE CABLE.
VIEW C-C
1/4" PLY FIREWALL ON 130° BALSA PLUG. ADD NOSE WEIGHT UNTIL BARE CAT BALANCES ON DESIGN CG.
TIP WEIGHT BOX-GLUE IN 25 oz. ADD CLAY DURING TEST FLIGHTS. GLUE IN PERMANENT WEIGHTS AFTER TRIMMING.
FUEL COMPARTMENT-MAKE FROM ESTES BT-50 ROCKET TUBE. PLUG ENDS WITH 1/8" SHEET. 3/8" HOLES FOR ACCESS AND DRAINAGE. FILL SPACE BETWEEN TUBE AND PLANKING WITH BALSA PLATE. SEAL WITH EPOXY.
TE-1/16" 8# "C" GRAIN
MAIN SPAR-1/8" 8-10# BALSA
ASSEMBLY TAB, EACH END. FOR BENCH ASSEMBLY. NOT NEEDED FOR JIG TUBES.
1/8" WEBS TO PLANKING
3" BELLCRANK BROOAK, SIG, ETC DRILL.078 HOLE FOR PUSHROD
1/8" PLY B-C PLATFORM
CG
9.00
CL FUSELAGE & PROP SHAFT
CL WING & STAB
STABILIZER & ELEVATOR 1/8" 8# "C" GRAIN
.30 CL WING TO CL FUSE.
3/32" x 1/4" TRAILING EDGE SPACER. BOND TO LOWER PLANKING, SAND TO FAIR INTO RIB AND LOWER PLANK.
BORE 3/8" dia JIG TUBE HOLES USING SHARPENED BRASS TUBING. CUT OUT LEADOUT CLEARANCE HOLES AFTER ASSEMBLY.
ALL RIBS 1/8" 6# BALSA
MONOKOTE HINGES 5 SETS, SEE TEXT
DUBRO #105 CONTROL HORN. USE CG QUIKLINK AND ROD. "Z" BEND AT BELLCRANK END
.88
LE PLANKING 1/16" 6# "A" GRAIN
CAP STRIPS 1/16" X 5/16"
STABILATOR-1/8" THICK 6# C-GRAIN BALSA
LEADING EDGE 3/16 X 1/2. SHAPE AFTER ASSEMBLY.
TIP BRACE 1/8" BALSA 2 EACH TIP
FILM
SECTION A-A
LEADOUT GUIDE. MAKE FROM BROOAK BH-760. NEW LEADOUT HOLES SPACED 1/2" APART.
1/8" 6# "C" GRAIN DIRECTION SHOWN
1/8" 12# "C" GRAIN DIRECTION SHOWN
NORVEL ENGINE MOUNT PW HAYNV86
FUEL FILTER
WEDGE BLOCK FROM 1/4 SQUARE. USE TO PINCH FUEL LINE DURING START CYCLE.
3/32 Dia BRASS TUBE FUEL LINE. EMBED IN SIDE WALL SLOT. MAKE END NIPPLES FROM 1/8 OD TUBE, 1/8 WIDE, SOLDERED @ 2 ENDS.
NOSE SIDES 1/4", TOP & BOTTOM 3/16", 8-10# BALSA
1/16 DIA WIRE SKIDS

such requires no less attention to detail than any conventional contest model. Straightness, lightness, and attention to detail are the order of the day if this airplane is to have a long and happy life.

Wing: The wing must be accurate, and there is no better way than building on rods, as pioneered by Al Rabe many years ago.

When making the wing ribs, sandwich the required number of rib blanks between two 1/16 plywood end templates. Pin the rib templates to the stack of rib blanks. Before carving and sanding the ribs to the templates, cut precision 3/8-inch holes in the rib blanks, using sharpened brass tubing in a drill press.

Once the ribs have been carved to shape, they are placed on 3/8 steel rods supported by precision blocks. Working directly over the plans, the ribs can be positioned exactly using additional precision blocks to keep each rib square to the table when bonding the trailing edge sheeting.

The 3/32 trailing edge insert is glued to the trailing edge prior to bonding the bottom trailing edge to the ribs. After bonding the bottom trailing edge, place fiberglass tape over the ribs to protect them when sanding the 3/32 insert to match the rib contour. Remove the tape and bond the top of the trailing edge in place.

The main spar, leading and trailing edge sheeting, trailing edge closeouts, and capstrips are installed while the assembly is aligned on the rods. Once the rods are removed, the clearance for the leadouts can be made by cutting out the area between the rib holes.

The controls and center section planking are completed, followed by the wingtips, leadout guide, and tip box. When sheeting the center section, it is best to splice the 1/16 sheet on a flat surface to obtain the required width, then cut to fit the center section.

Stab/Elevator: The original Barecat had a geodetic stabilator coupled with a unique nonlinear bellcrank. Although it was very successful, the design was modified to a conventional split stab/elevator with a standard bellcrank to make it more producible.

Since a light stab/elevator is particularly critical for this design, 1/8 sheet was used. The difficulty using thin sheet is to neatly hinge the assembly with minimal weight. I developed a technique for hinging with MonoKote, which works very well:

Cut and sand the stab/elevator and radius the hinge line of both surfaces. Then cover both surfaces with MonoKote.

Cut two 3 x 12 MonoKote sheets. Stretch one with adhesive side up on a piece of glass, using masking tape. Overlay the second piece, adhesive-side down, with 1/8 overlap and stretch this piece over the glass using masking tape.

Using a metal rule as a mask to protect the portion with exposed adhesive, iron the overlap joint with the iron set at 300°F to create the bond. Use a clear plastic two-inch-wide rule with grid lines to cut 1/2-inch-wide strips with a paperhanger's knife.

Cut each hinge loose by cutting the masking tape away, leaving 1/4 inch of masking tape on the hinge for handling ease. Lay the hinges on a clean sheet of paper. Clean the glass, since this will be used for the hinging operation.

Tack the hinges on one surface, attaching only the first 1/8 inch of the hinge. Space the hinges in groups of three with 3/32 spacing between each hinge of the group. Interlay the hinge tabs on the mating surface.

Lay the stab and elevator on the glass, and while gently pressing each surface to the glass, pull each tab and stretch in place. Tack the first 1/8 inch on the second surface. Now pull each tab taut and press down so that air pressure holds each hinge in place. Lay a 1/16-inch striping tape spanwise to mark where the hinge will be cut. Place a double-edged blade over each hinge and pull the tab to cut the excess.

When all tabs are cut, iron each hinge to finish the job. I use 200°F on the iron for covering solid surfaces and bonding the hinge to the stab. This sounds tedious, but the whole operation took about 1/2 hour; the result was very neat and

›rovided a very smooth hinge with a gap ›f only .010 inch.

'uselage: The nose pod is quite easy, ›eing made from sheet balsa. Cut the slot 'or the fuel tube prior to covering. *Be sure o use epoxy for the firewall mount—* ;yanoacrylate (CyA) glue is not tough ;nough for this joint.

Install the details such as the fuel tube ınd filter bracket prior to installing the ıssembly onto the wing. All components ıre MonoKoted separately and glued in ›lace. In each case, the covering must be ;arefully cut away to allow a wood-to-vood bond.

I use 30-minute epoxy for all major ıssembly joints. On the fuselage-to-wing, ›oom-to-wing, and stabilizer-to-boom ›onds, I tack-glue the parts in place, viping all excess epoxy away with ılcohol. The next day, I go back and place ı glue fillet in the joint and again wipe the :xcess away with alcohol.

Engine/Fuel System: This is the most ıovel part of this airplane. It's :ommonplace for ½A Combat, but most 3tunt fliers will need some initial help.

The power plant of choice is the Vorvel series of ½A engines, either .049 ›r .061 displacement. I prefer the .061, ince it weighs the same as the .049 and ıas more torque and power. (The new ›ne-piece-case VA engine is another :andidate.)

After engine break-in, which can equire as much as an hour of running ime, hand-starts are possible—even on ›ressure. A small electric starter pecifically designed for ½As is very :onvenient, provided care is taken to make ure the engine is not hydraulically locked filled with fuel or flooded) prior to tarting. If this is the case, an electric tarter can damage the engine.

I reduced the intake diameter of the)61 with 5⁄32 OD brass tubing epoxied in ›lace with JB Weld. This reduced intake nakes the engine easier to needle when un on pressure, and there is still ample ›ower to fly the airplane on 50 feet of)08 cable.

I routinely add the Kustom Kraftsmanship (see ad this issue) needle valve assembly, as the stock needle is very sensitive on pressure fuel systems. The Kustom Kraftsmanship needle allows relatively easy adjustment, providing a running range of a full ¼ turn.

The injection-molded Norvel engine mount is accurate, but care must be taken to not strip the mount—the material is relatively soft. Sheet metal or self-tapping screws are recommended.

I used the Norvel Freedom plug with three to four head gaskets. This plug gives good performance, but lasts only three or four flights. Larry Driskill [(806) 796-3747] sells an adapter head for a Nelson plug that has proven to be more robust than the Norvel plugs.

The prop can be a Tornado 5.5 x 3, an APC 5.7 x 3 cut to 5.25, or an APC 6 x 2 cut to 5.25, depending on the style of flight you prefer.

Fuel is 25% nitro, with at least half of the lubricant castor oil. Sig ½A fuel and Norvel's fuel work well.

The surgical tubing tank requires a little finesse. I use tubing from Sig Manufacturing, since it is readily available and works well.

Some 1⁄16 ID surgical tubing is slipped over a small Sig eyelet. 3⁄32 ID x 1⁄16 wall thickness surgical tubing is slipped over the eyelet flange, then wrapped with 24-gauge wire. Be sure to use 1⁄16 wall thickness surgical tubing; 1⁄32 wall thickness does not provide sufficiently uniform pressure for good performance.

Then knot the end of the 3⁄32 tubing to seal the tank. The 3⁄32 tubing is then stretched near the eyelet to create a weak spot so that, when filled, the tank fills first at the front and then fills toward the knot.

When filling the tank, *always wear safety glasses*—an exploding tank can spray fuel in your face. A large syringe is used to pressurize the tank.

After the tank has been filled, close off the fuel line with an alligator clip and place the fuel line on the fuel transfer tube in the fuselage. Connect the ignition battery. Place your finger so as to cut off the fuel by pressing the fuel line against the pinch block, and remove the alligator clip. Slowly release pressure enough to prime the engine. Flip the engine until it fires, and then by modulating pressure on the pinch block, keep the engine running until it comes up to temperature and runs without any pressure on the pinch block. Then needle to a setting just slightly less than full power.

Use a Du-Bro Ni-Cd starting battery that positively clips to the head for the Norvel head/plug. Use alligator clips for the Nelson plug. You need a secure battery hookup, because your hands will be busy working the fuel system upon startup.

Once you get used to the procedure, starts are relatively easy and the power will surprise you. Don't forget to wear earplugs—this engine can turn a 5.25 x 3 at 27,000 rpm.

The lines are .008 cable—50 feet long. Lap times are approximately four seconds. In smooth air, this model can be flown on line as long as 55 feet.

One word of caution: Be sure to use seven-strand .008 cable—not three-strand. The three-strand is marginal from a safety standpoint and is difficult to handle. Brodak [(724) 966-2726] sells the seven-strand .008 cable. You can also use .012 cable, which is easier to handle than .008, but there is a noticeable loss in performance.

The Barecat is a challenge to build and fly, but the result can really boost your adrenaline. I once flew this design for six months to the exclusion of conventional .40-powered airplanes, and it was an excellent aid to sharpening my flying skills. It was not long after I returned to conventional Stunters that I won the US Team Trials for the first time.

After a few months with this airplane, regular Stunters will begin to look strange and seem tame by comparison. Don't worry—the fun you'll have will more than compensate. ✈

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