

The Nocturne R/G

by Jeff Vincent

The Nocturne is a large slide-wing B Rocket/Glider which I developed in 1984. The slide-wing method uses a rearward wing position for a vertical boost and slides the wing forward at ejection, transitioning into a stable glide. Its large size provides a stable high-performance glide and high visibility, while achieving a respectable altitude. It should give a dead-air time of about two minutes on a B engine. It is a good choice for modelers looking for a proven model to begin flying rocket/gliders or for experienced flyers looking for a good reliable design. The Nocturne has performed well, capturing second place in B R/G at NARAM-26 in 1984.

The plans included here are 1/3 scale. The original full size plans (two 11x17" sheets) are available from your editor for just fifty cents. This article is written as a step-by-step tutorial for the beginner. It contains a lot of basic detailed information. While more experienced modelers may choose to skip over it, who knows, you just might learn something. So, read the instructions carefully before beginning construction.

Construction Materials

- 1) 3.0" Estes BT-20
- 2) one Estes BNC-20 nose cone
- 3) 1"Estes 3/16" launch lug
- 4) 3"0.032" (1/32") music wire
- 5) 1.25" x 12" 1/32" plywood
- 6) 2" x 15" 3/16" 8-10 lb balsa (fuselage)
- 7) 4" x 18" 3/16" 4-6 lb C-grain balsa (wing)
- 8) 3" x 12" 3/32" 6 lb A/B-grain balsa (tail)
- 9) 18" 3/32" square spruce or basswood
- 10) 12" 1/16" square v. hard balsa
- 11) several 3" rubber bands (or equivalent)

As with most balsa gliders, there are relatively few rocket supplies required for constructing the Nocturne. The music wire is required for various widgets and is available at better craft and hobby shops. The wood sizes are the minimum required for one model. It is possible to construct the wing from two pieces if 4" wide balsa is not available, more about that later. Carefully select the wood for your model, as improper materials may cause the model to shred under power or it may double the weight of your model! Information on balsa wood selection can be found in the 9.86 issue of STAR-DATE or in TR-103, "A Guide To Balsa Wood", available from NARTS for fifty cents. Use this information, take your time, and get the right wood. A majority of the construction is done with a slow cyanoacrylate (CA) adhesive, such as Hot Stuff Super-T, although some use may be made of aliphatic glue (yellow carpenter's glue) or 5-minute epoxy. Among the tools and materials you will need are a sanding block (essential!) with 100, 220, and 400 grit sandpaper (a small plane is also helpful), a good knife, needle-nose pliers, a straight-edge, masking tape, and some wax paper. You will also need a work board, a working surface you can cut and sand on (a foot square piece of 1/2" plywood is what I use). For finishing, spray dope is recommended, although the choice is left up to you.

Wing Construction

The first item is the construction of the wing. If you cannot find 4" wide balsa for the wing, use 3" wide 3/16" balsa and cut a 1" wide piece of 3/16" or 1/8" wood for the trailing edge. Put the two pieces on a piece of wax paper and glue them together with CA or aliphatic glue. Let this dry.

Take your wood and cut out the complete wing shape (don't cut the dihedral breaks yet). The plans show a 2" piece of 3/32" square spruce (or basswood) inset into the leading edge of the wing. This is to protect the soft balsa from the shock of the wing hitting the wing stop after ejection. You may install this small piece, or you may elect to use a length of spruce to cover the entire leading edge. This offers the added benefit of protecting the soft balsa leading edge from landing damage (running into trees, concrete walls, etc.). If you select the short piece, cut the inset and glue it into place with CA, with the bottoms of the spruce and wing flush. If you select the long piece, mark the center of the spruce and the wing. Place both pieces on a sheet of wax paper (to keep the bottoms flush). Starting at the center marks, glue the spruce

to the balsa with CA (and liberal shots of accelerator) a few inches at a time. The spruce will resist curving, so hold it in place until the glue cures (dampening the outside edge of the spruce may make it a bit more flexible). This piece should come within about 1/2" of the wingtips, cut off any excess (taper it to a gradual curve).

Mark the center of the wing on the bottom of the wing at the leading and trailing edges (make it visible and don't sand them off, you'll need these later).

The next step is tapering the wing from the root to the tips. Using coarse sandpaper (100 grit), sand the top surface of the wing so it remains 3/16" at the root and smoothly tapers to 1/8" at the tips. (If you have a small plane, this is good for the preliminary work.) Then taper the last inch of the tips down to 1/16" thickness.

Now we start forming the airfoil. Ideally we want to end up with a shape like the "Finished Airfoil" in the Nocturne Detail Sketch. (Note that virtually no sanding is done on the bottom of the wing, it remains flat.) In the first stage of airfoiling the wing, the airfoil is done in two zones, as shown in the "Airfoil: Stage One" drawing. The first zone is from the leading edge to 1/4 chord (1/4 the distance from the leading to trailing edge). This zone will be sanded to half it's current thickness at the leading edge. The second zone is from 1/2 chord to the trailing edge. It will be sanded to 1/32" - 1/16" at the trailing edge. The best way is to put several layers of masking tape from wingtip to wingtip, one behind the 1/4 chord line and one ahead of the 1/2 chord line. These form the boundaries of the areas to be sanded. If you sand the wing with the leading edge 1/4 chord (1") away from the edge of your work board and sand with the trailing edge about 1/2" away from the edge of your work board, you should get just about the right final edge thicknesses. Sand the wing as described with coarse sandpaper (again, a plane may be helpful). Sanding against the grain is best here, as it will cut into the balsa better.

Now the second stage of airfoiling. Remove the tape. Use the sanding block (still using coarse sandpaper), to smooth the rough airfoil into the final airfoil shape. Sanding from the leading edge to the trailing edge with the sanding block will smooth any irregularities you may have created. Round the top and bottom of the leading edge. As you get the proper airfoil shape, change to medium sandpaper (220 grit or so) and sand with the grain (this won't damage the balsa as much). Make sure the airfoil is symmetrical from wingtip to wingtip, with no irregularities. (The shadow of a straight object such as a pencil held at just above the top of the wing and viewed from above the opposite wingtip gives a good view of the shape of the airfoil.) Continue your final sanding with fine sandpaper (about 400 grit). Lightly sand the bottom of the wing to give it a nice smooth surface. Now you should have a nicely airfoiled chunk o' balsa.

The final step is doing the dihedral breaks. Mark the leading and trailing edges 2.5" on each side of the center marks you made. Using a semi-flexible straight-edge (I use a 6" steel ruler) cut the dihedral breaks at these marks. (I know you don't want to hack up that nice new wing, but rest assured, it won't fly very well with no dihedral. Just think, it gives you a chance to look at a cross-section of the airfoil and see how accurate you were.) Take one wingtip and place it's root at the edge of your work board (top-side up!). Prop up the tip about 2 3/8". Carefully sand (coarse grit) against the edge of your work board, so the root of this piece will butt against the edge of the center of the wing at this angle. Make sure you don't sand too much at the leading or trailing edge of the root, you want the root to remain straight and parallel to the direction of flight. (Sanding straight down [and not up!] is the best method: you minimize the chance of changing the direction of the root or "twanging" the balsa.) Do the same with the opposite wingtip.

Get out the wax paper and place the center of the wing on it. Take one wingtip and place it where it belongs with the tip propped up about 2 3/8". The two pieces should butt together nicely for a good joint. If not, sand it a bit until it fits nicely. Glue the two pieces together in this position. Make sure that the bottom of both pieces are flush, so the airfoils will be parallel to each other (i.e.: so each piece of the wing will be flying at the same "angle of attack"). Once this is dry, do the other wingtip. Let this dry and fillet both joints. Congratulations, you are the proud owner of a new bouncing baby wing! (And about halfway to a completed rocket/glider.)

Tail Construction

The tail feathers are next on the agenda. Cut the stabilizer (or stab) and rudder from the 3/32" balsa. Mark the centerline on the top of the stab. Note that the rudder is made from two pieces with the grain running in different directions. Doing it this way gives you a strong rudder with a flexible trailing edge for trimming the model to turn. The stab may also be

made from two pieces as shown, although the benefit is negligible (I sometimes use stiff C-grain for the main stab and flexible A-grain for the trailing edge). As with the wing, you may wish to use the 1/16" square balsa as a leading edge protector. It's optional on the stab, but I would recommend it for the leading edge of the rudder. Assemble the rudder and attach the hard balsa pieces (if you desire). With medium grit sandpaper, gently taper the stab and rudder from the root to the tip (it's a lot more delicate working with these tiny pieces). Carefully airfoil the stab and rudder, so they have a nice rounded leading edge and a smoothly tapered trailing edge. The rudder will get a symmetrical airfoil, the same on both sides. Most people use symmetrical airfoils on their stabs as well, but I use an inverted airfoil, for extra stability. Sand it into an airfoil, just do it on the bottom of the stab. Sand the pieces with fine sandpaper to get a nice finish. Draw a second centerline on the bottom of the stab.

Fuselage Construction

Cut the two main parts of the fuselage (the fuselage and pylon) from the heavy 3/16" balsa (actually, this is relatively light for fuselage wood, it's thickness makes up for it). The fuselage has a maximum depth of 0.5" at the leading edge of the wing, a minimum depth of 0.25" at the stab, and a total length of 15". Cut the T-rail from the plywood piece (it's 0.63" x 12"). Make sure the width of the plywood rail is relatively constant, it's important for the proper operation of the slide mechanism. Sand round the leading and trailing edge of the pylon. Sand the top of the fuselage square. Round the bottom of the fuselage (except for the last 2"+ where the stab goes). Round the edges of the plywood rail. Gently polish all the wood parts with 400 sandpaper.

Carefully glue (CA) the fuselage down the center of the plywood rail. Fillet the joint. Mark a line down the side of the tube and glue the pylon on along this line. Fillet this joint. Cut the exhaust vent in the balsa nose cone and the body tube as shown and glue them together. (Make sure the vent has no rough edges which will catch the burn-string or soft spots that the string could cut into, preventing the wing from sliding properly at ejection. Some people use a small hole punch before installing the nose to make two holes [in addition to the exhaust port] for the string to pass through and reinforce them with CA.) Cut or sand the small notch into the pylon so it will fit atop the plywood rail. Glue the pylon onto the fuselage, matching their leading edges. Place about five layers of 1/4" masking tape on the T-rail just behind the pylon to form the wing stop. Some people also use a masking tape wing stop behind the wing during boost, this prevents the wing from sliding back during boost. If you use this, apply it before flying and remove it shortly after flight to: a) allow removal of the wing, and b) avoid sticky tape build-up on the wing slide.

Align the stab on the rear of the fuselage; the top of the stab should be parallel to the plywood rail when viewed from the side (no angle of attack) and from the rear (no tilt). If necessary, sand the fuselage to achieve this. (Note that the model is designed so that when the wing is slid off the rear of the rail [for transport and storage], the launch lugs will just clear the top of the stab. Don't sand the fuselage too much here, or you won't be able to do this!) Glue the stab in place, making sure it is aligned along its centerline. (It's probably easiest to have the stab taped to your work board and glue the fuselage to it.) Test fit the rudder on the bottom of the stab, sanding as necessary to get a good flush fit. Glue the rudder to the bottom of the stab along the centerline, making sure that is perpendicular to the stab. Fillet both joints.

Putting It All Together

First, cut two 1/4" x 4" and two 3/8" x 4" pieces of plywood. These will form the guides on the wing which join it to the T-rail. Make a mark 5/16" on each side of the wing centerline at both the leading and trailing edges. This marks the inside edge of these guide pieces. Glue one of the 1/4" wide pieces on one of these lines (just outside it). Make sure that you don't get any glue in the area where the wing will be sliding. Take the fuselage, and test-fit the T-rail on the bottom of the wing. The second line should lie just beyond the outside edge of the T-rail. If not make a new line. (Ideally, the T-rail will have about 1/32" of total clearance between it and the wing guides. Either too little or too much clearance might cause wing binding.) Remove the fuselage and glue the second 1/4" piece in place. (If you really want to be sure you have the proper clearance, glue the second piece on with the T-rail in place; just don't glue the T-rail to the wing!) Glue the two 3/8" pieces in place atop the 1/4" pieces. As you can see in the "Wing Detail" in the Detail Sketch, the outside edge of these pieces should be just inside the outside edge of the 1/4" pieces. Externally fillet these joints. Test the fit of the T-rail in the slot. It will probably be a bit tight (I prefer loosening a tight fit to a loose fit in the first place). Use a piece of medium grit sandpaper to sand the bottom of the wing inside the slot (this is the most likely area of friction) until you

have a smooth-sliding assembly. Otherwise, you may have to sand the T-rail if it is too wide. (But it's not, since you did everything right. Right?)

Drill a small hole into the right side of the leading edge of the wing, as shown in the Top View (yes, that little square thing). Form the three widgets from the 0.032" music wire with your needle-nose pliers. Refer to the detail and overall drawings for proper shape and placement. Drill or punch a small hole the front of the fuselage and put Widget A in place, securing it with CA. Glue Widget B on the wing guide (left side). Drill/punch a hole in the fuselage and mount and secure Widget C (use the curved end to slide it into the hole). Fillet all these joints. To explain these widgets, a nylon thread is tied to the hole in the wing. This thread goes back and passes around Widget C, the thread comes forward, passes over the right side of Widget A, and finally passes over the exhaust port and is taped securely in place. A rubber band is hooked between Widget B and the left side of Widget A. The thread holds the wing in a rearward position until the ejection charge burns the thread, allowing the rubber band to pull the wing into it's forward position. Voila, a glider! If you are using a different length rubber band than I did (#18: a 1/32" x 1/16" x 3" loop, to be precise), glue Widget B in a position so the rubber will be stretched a bit with the wing in it's forward position (See! I told you to read all these instructions before you started building!!!)

Cut the 3/16" launch lug into two pieces and glue them on the right side of the bottom of the wing, next to the wing guide. You might want to do this with the wing in place on the model. Test to see if the wing will slide off the rear of the T-rail without the lugs hitting the stab. If they don't hit, great! If they do, you have two choices: put on 1/8" lugs or resign yourself to a one-piece model. I prefer the larger lugs with a model of this size for better guidance, although it's not critical. The removable wing is nice for transport and storage, but its not the end of the world if you can't do it. Just be more careful on your next Nocturne! Fillet the lugs once you are done.

Finishing Techniques

Ask ten modelers how to finish a glider, and you will get eleven different answers. It's largely a matter of personal choice and habit. My habit, of late, has been two or three light coats of Pactra spray dope (black is traditional), with intermittent sanding with 400 and 600 sandpaper. This provides a quick easy method of finishing which adds color, protects the wood, and doesn't add much weight (about 1.5 grams or 1/20 ounce on this size model). Other methods include no finish at all, magic markers, brushed-on dope, tissueing, or silkspan. All of these have their advantages and disadvantages, I leave it to the modeler to make his own choice. When you are all done, your model should come in around 25-30 grams without an engine.

Trimming The Glider

Attach the rubber band to the wing to insure it remains in it's forward position while trimming. Place a used standard engine casing in the engine mount. The model should balance at the middle of the wing root (mid-chord). Slide the engine in or out of the tube to achieve this, securing it with tape once completed. I prefer using this method to adjust the CG to adding unnecessary weight. If the engine must protrude more than about 1.75", add tail weight to achieve proper CG placement. Write the distance on the pod so you'll remember it.

Test the trim of the model with a gentle forward toss into the wind. It should smoothly glide to a point about 20-30 feet away, with a gradual turn. If it dives, gently warp the trailing edge of the stab up a bit and try again. If it stalls, warp it down slightly. If the model doesn't turn at all, gently warp the trailing edge of the rudder a bit in the direction you wish to turn (i.e.: warp it left for a left turn). If it turns too much, warp it in the opposite direction. Ideally, the model will have a turn radius of about 25-50 feet.

Once the model glides properly in light tosses, you can try to heave it in the standard hand launch style. WARNING!-- This is a good way to break a model if you toss it into the ground, so ease into it gently. For a proper hand launch, the model should be trimmed to turn in a direction opposite your "handedness" (i.e.: right-handers should fly models with left turns). Point the model upward at a 45 degree angle and bank it into a 30 degree turn opposite it's normal turn. Throw it hard into the wind in this manner. Like I said, if you're just starting this, take it easy. If all works well, your model will do several turns in the direction you banked it, climbing to about 20-30 feet, and roll-out into a gentle gliding turn in the

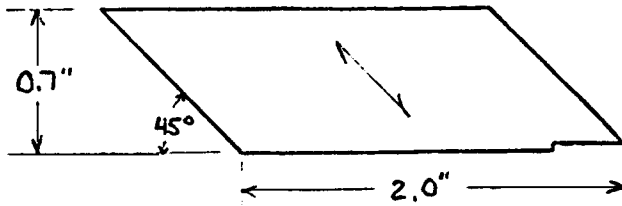
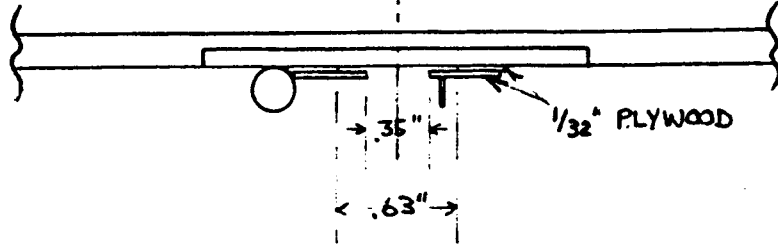
opposite direction. This will give you some time to analyze the trim of the model and any adjustments you want to make. If the model doesn't "boost" properly, adjust your throwing style to compensate.

Flying The Model

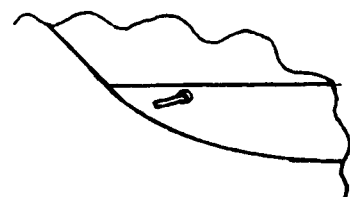
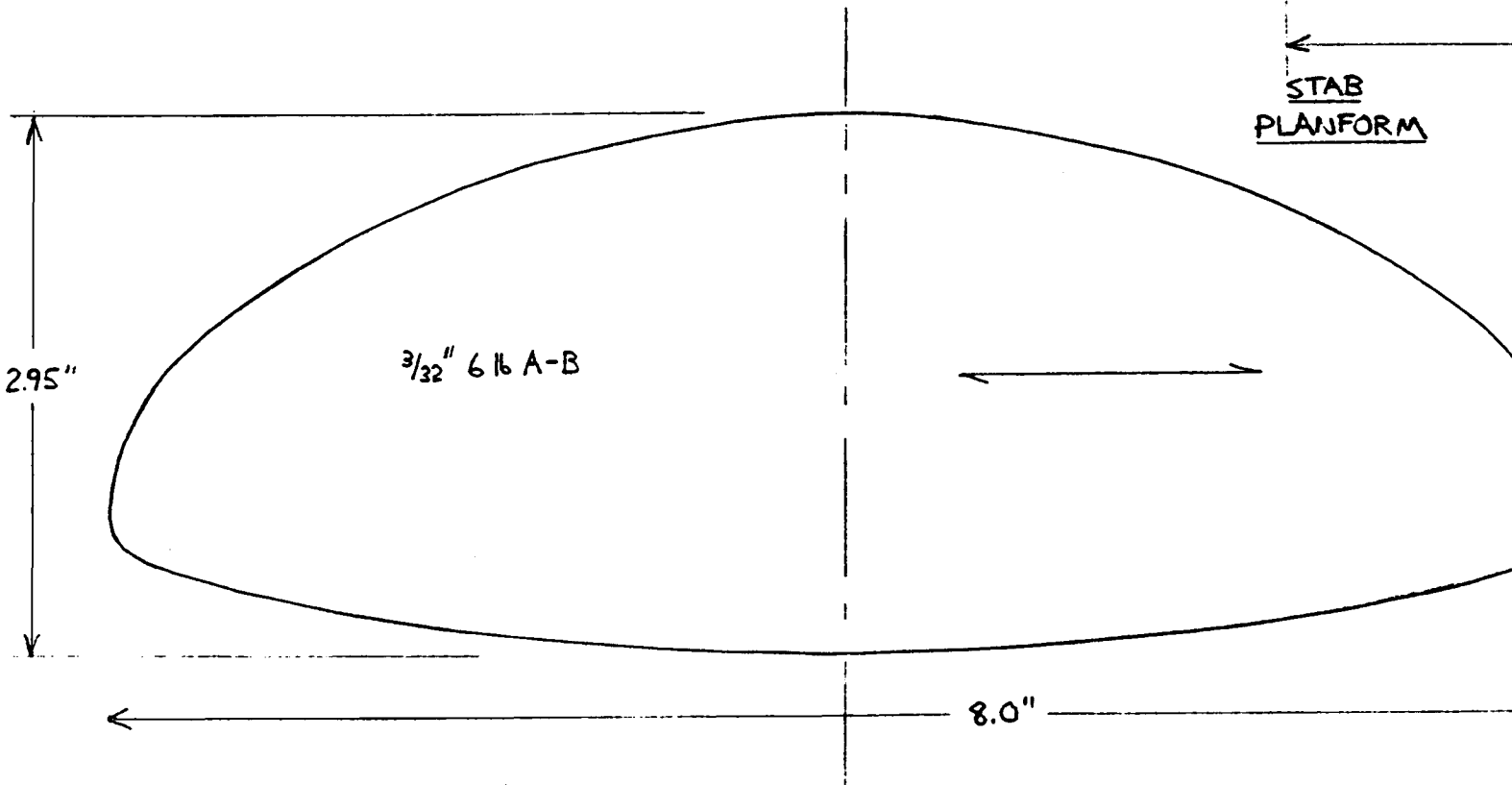
Prepping a rocket/glider is actually quite easy. Select an engine: an A8-3 is good for test-flying, for competition use a B4-2 or B6-2. (This model can be flown with a C6-3, although if you tried to build it super-light, you may find yourself in Shred City [as I did at NARAM-28]. Use heavier wood or thicker wood or tissue or silkspan to reinforce the model if you plan to use it with C engines.) Put the engine the proper distance into the tube and securely tape it in place. Install an ignitor, with the leads pointing away from the model. Tie a length of nylon thread (about 18") to the hole in the wing. Slide the wing back to it's boost position; I normally put it back about 4-5". Pass the thread around the widgets and exhaust port as described above and securely tape it in place. Put on your rubber band.

When you get to the pad, put a flag of masking tape on the rod, about 8" above the blast deflector. Slide the model down the rod with the flag on the wing-top side of the model. Use a dowel or old launch rod as a gantry for the launcher leads. Place the dowel in the ground so it passes within an inch or so of the ignitor and tape the launcher leads to the dowel. This prevents the weight of the leads from pulling out the ignitor before it lights the engine and keeps the leads away from the stab as the model moves up the rod. Look at the model to make sure the rubber band is hooked up (ALWAYS check the rubber band just before you fly!) and that there is nothing to obstruct the path of the model. You're on your own now!

WING DETAIL
(FROM LE)



PYLON
3/16" 816
(FUSELAGE SAME)



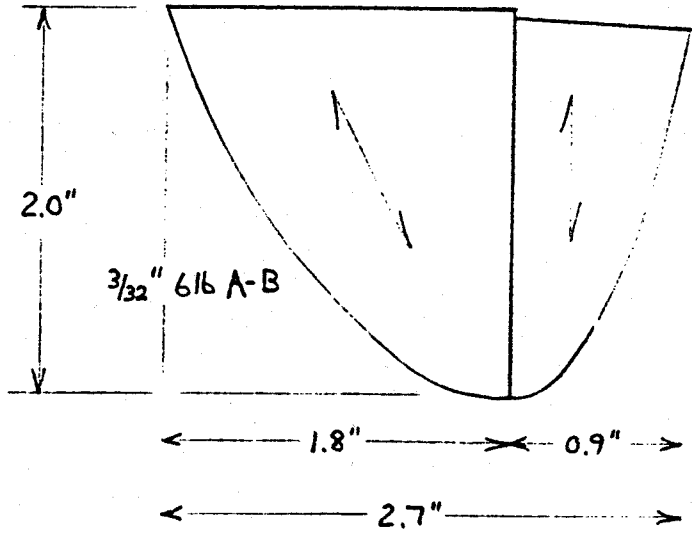
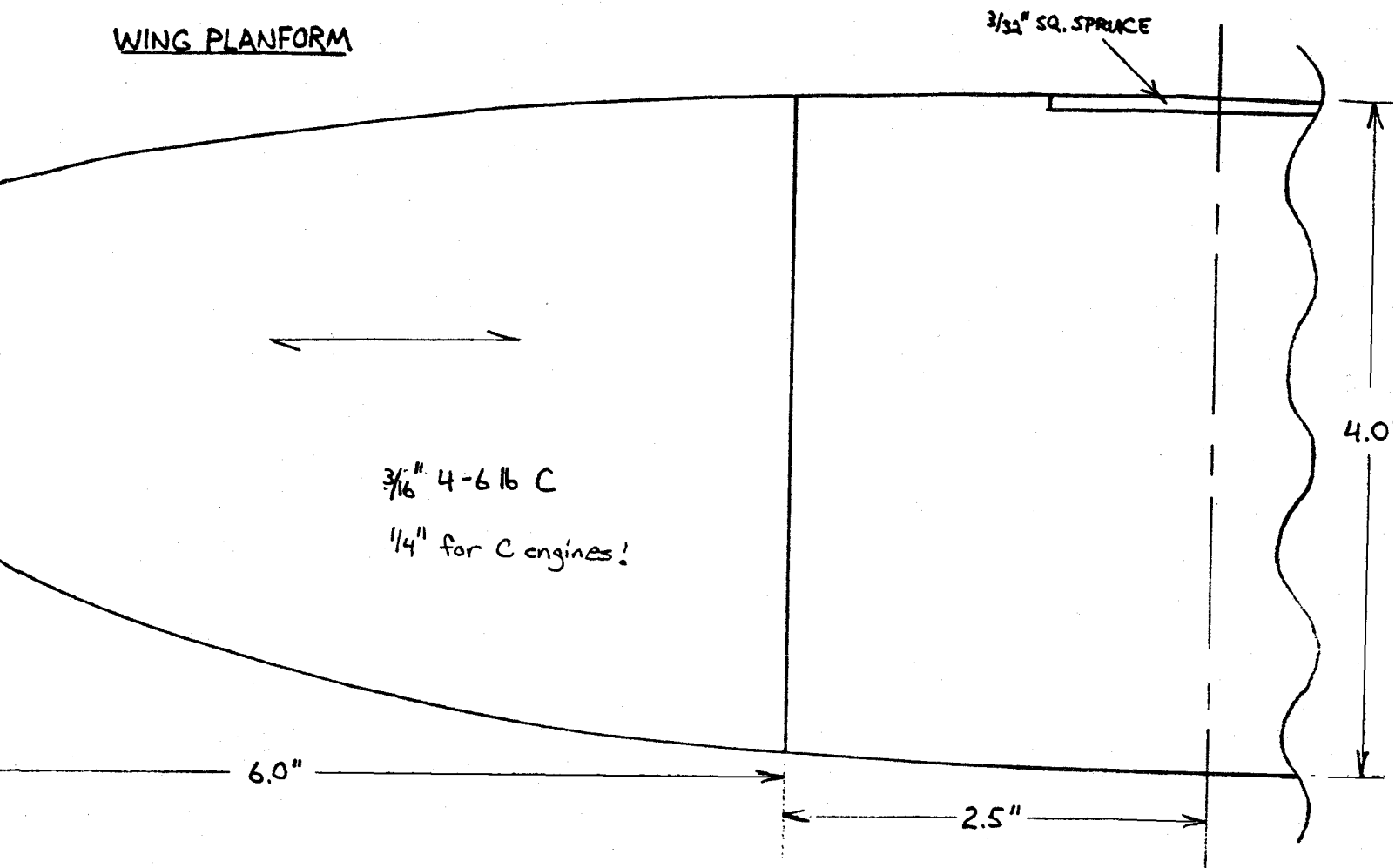
Ⓐ WIDGET
SIDE VIEW



BOTTOM VIEW

NOCTURNE BR/G
by: JEFF VINCENT 4/85
3rd PLACE NARAM-26
PLATE 2 FULL SCALE

WING PLANFORM

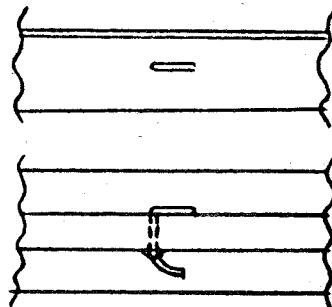


RUDDER PLANFORM
(FROM WINGTIP)

ALL WIDGETS ARE .032" MUSIC WIRE



Ⓑ WIDGET
SIDE VIEW



Ⓒ WIDGET
SIDE VIEW

BOTTOM VIEW

ALSO SEE WING
DETAIL