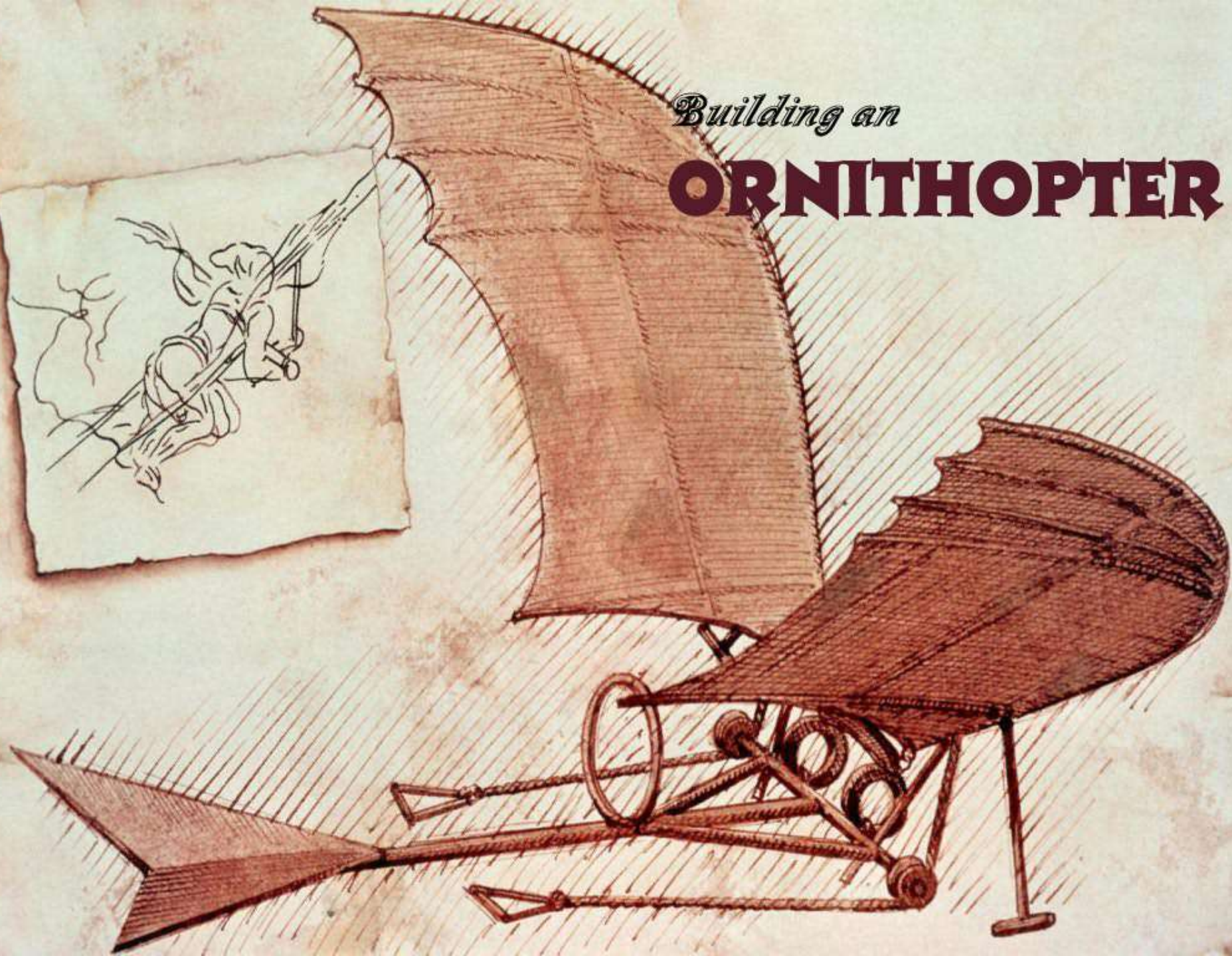
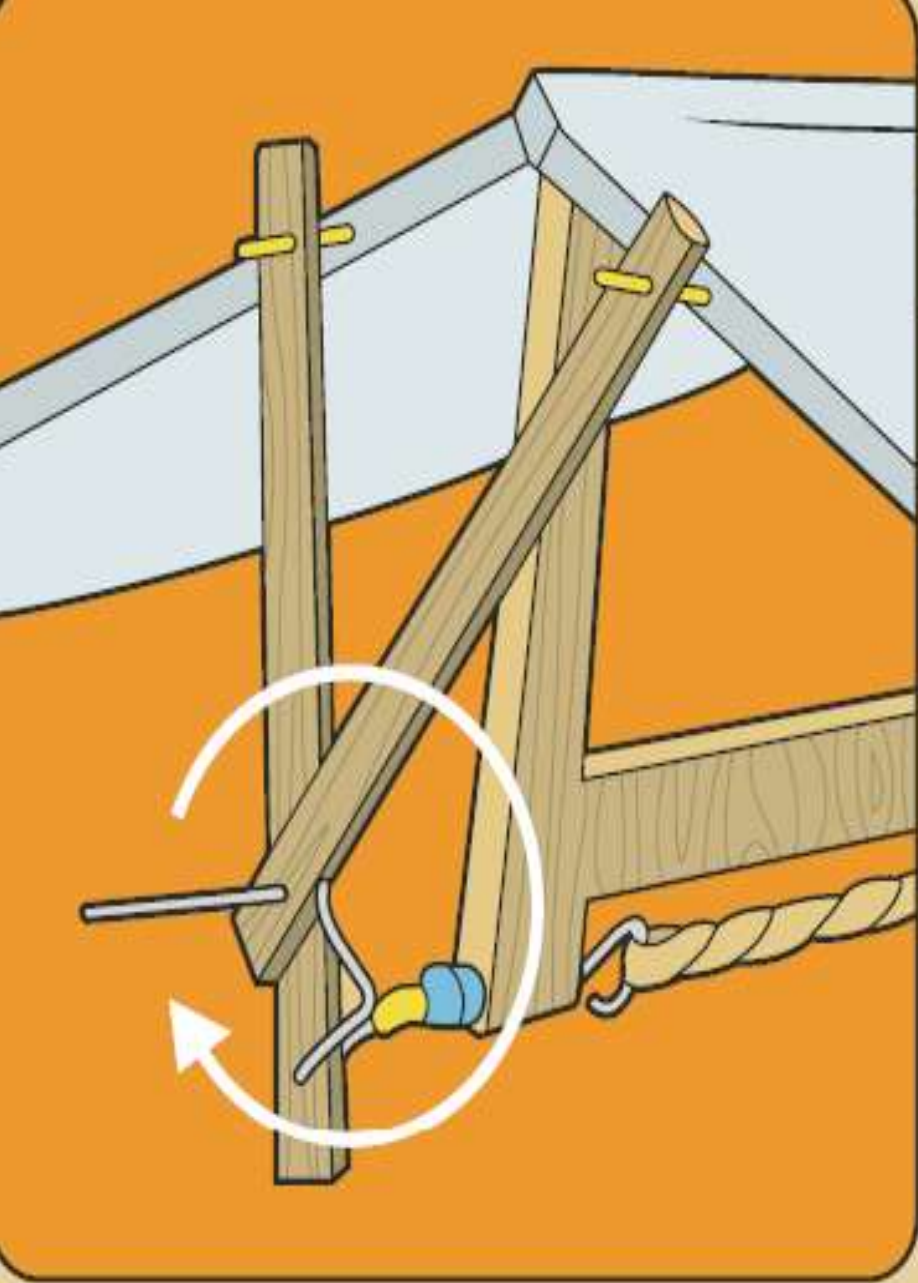


Building an

ORNITHOPTER





How do ornithopters fly? According to Nathan Chronister of the online Ornithopter Zone, "The ornithopter wing is attached to the body at a slight angle, which is called the angle of attack. The downward stroke of the wing deflects air downward and backward, generating lift and thrust.

"Also, the wing surface is flexible. This causes the wing to flex to the correct angle of attack we need in order to produce the forces that we want to achieve flight."

The mechanics of flapping flight are far more complicated than that of fixed-wing flight. For an aircraft with fixed wings, only forward motion is necessary to induce aerodynamic lift. But for flapping flight, the wing not only has to have a forward motion, but also must travel up and down. This additional dimension means the wing constantly changes shape during flight.

MATERIALS REQUIRED

1. 6mm Balsa wood to be used:

Motor stick : $5/16''$ * 7inches : cut into 5'' motor stick + 1.5'' front vertical connector.

Connecting rods: 2 in number, each $3/16''$ *3inches

Wing spars: 2 in number, each $2/16''$ *8 inches

Top wing attachment member: $2/16''$ * 5inch

Back vertical connector : 1.5 inch

0.5'' crank standoff.

2 tail members $2/16''$ * 7 inches

2. 10 inches steel wire , 1mm thick(and NOT music wire as mentioned below).

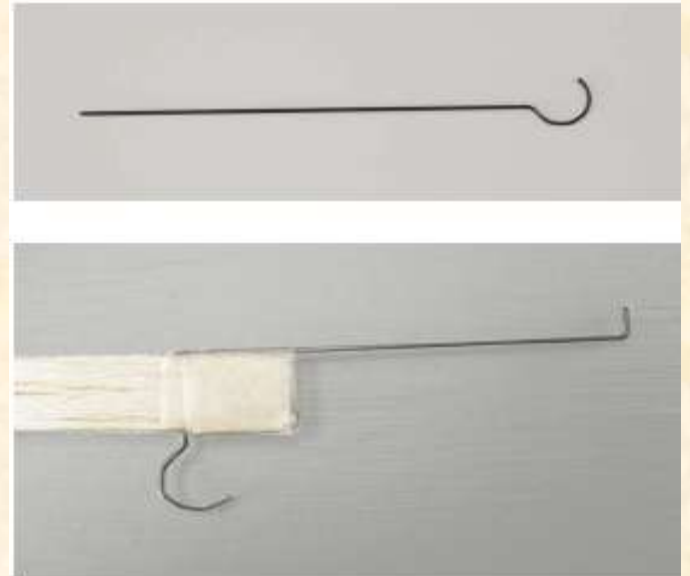
2. Normal paper 2'' * 2''

3. Transparent sheet of paper, just thicker than cellophane paper. 20 sq inch.

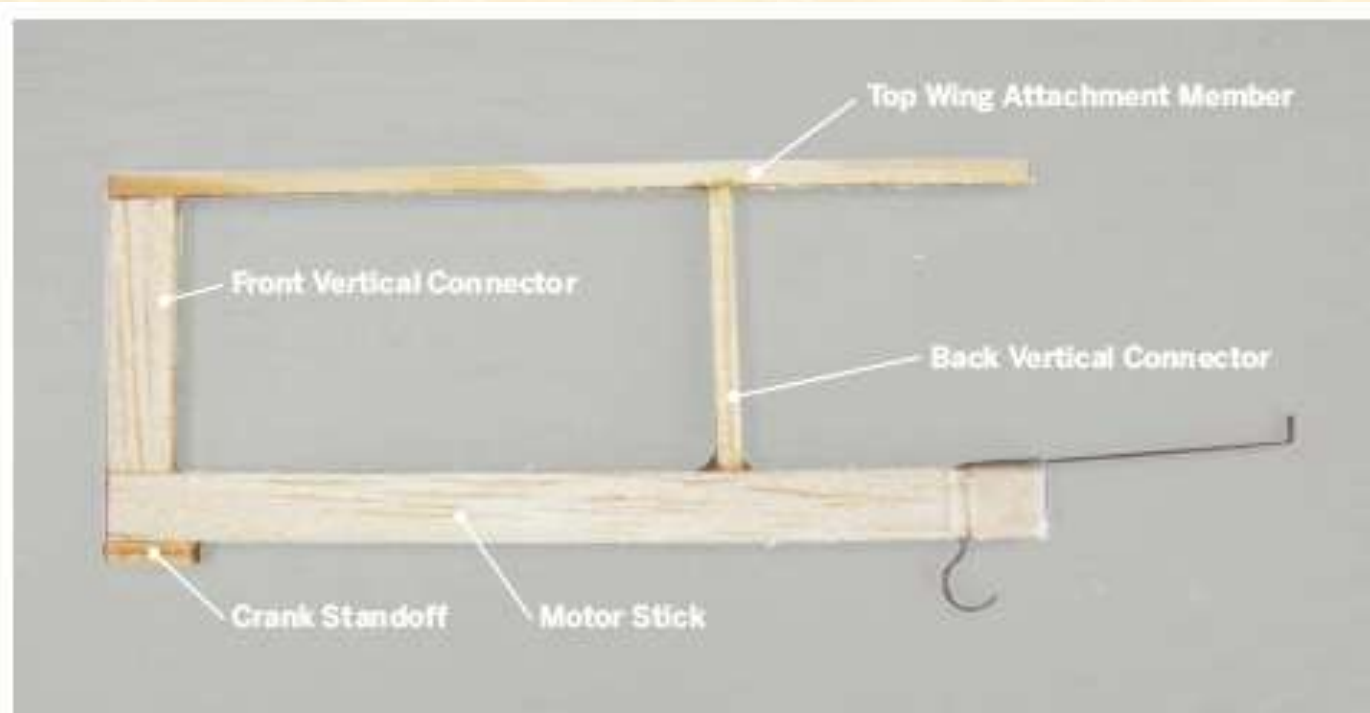
4. Bontite and Bond quick instead of CA as mentioned below.

1. MAKE THE FUSELAGE

1a. Form a hook in the tail end of the attachment wire. push the wire through the centre of the motorstick at 3/8" from tail end. Then make 2 90 deg. bends as shown. Glue into place using bondquick.



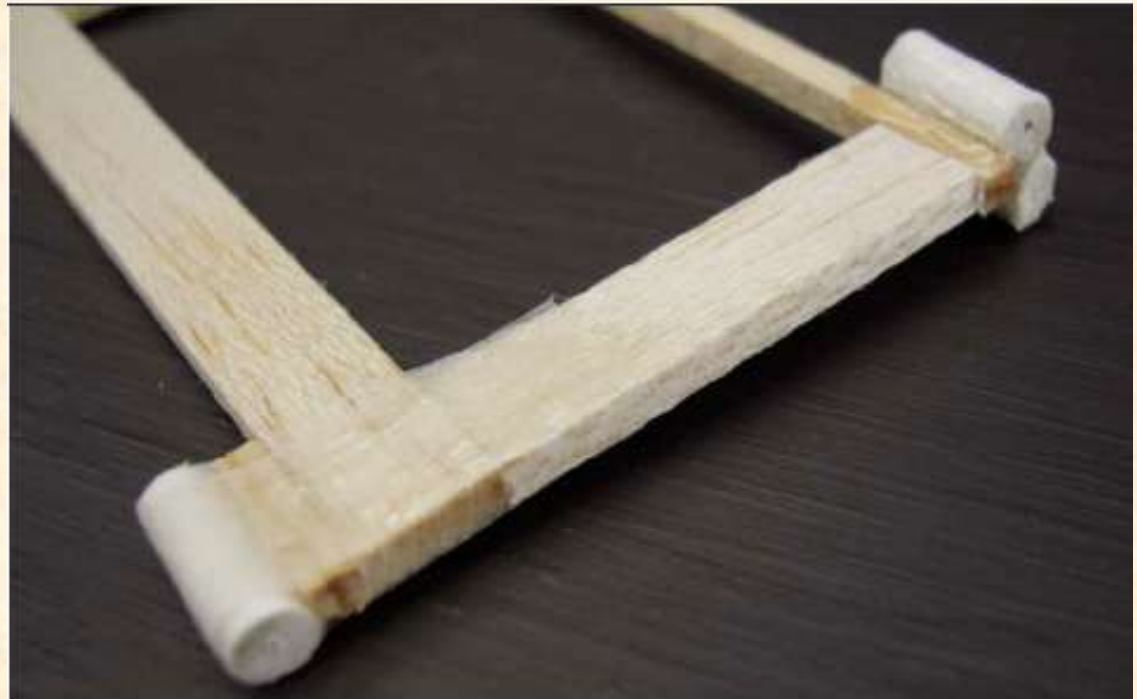
1b. Glue the fuselage together.



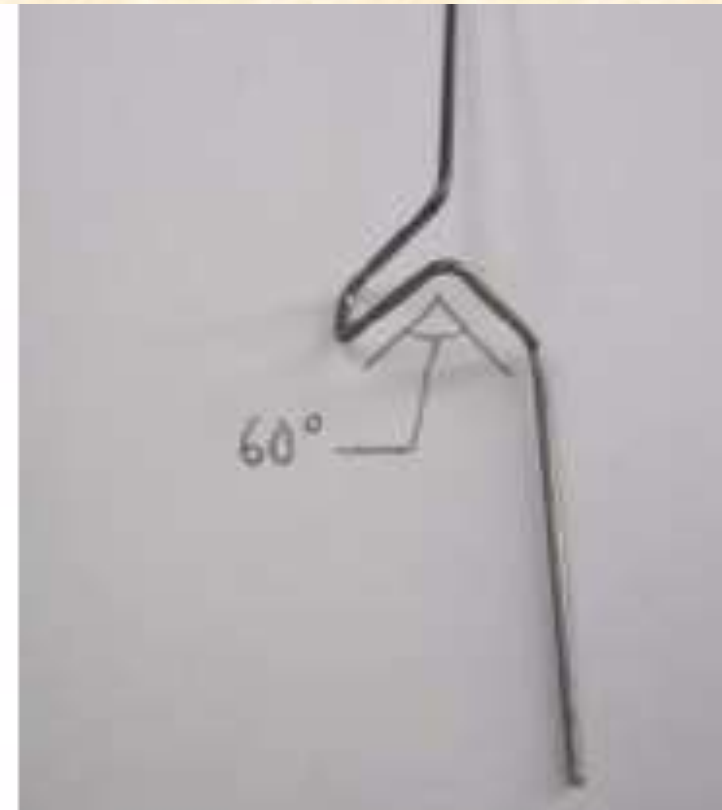
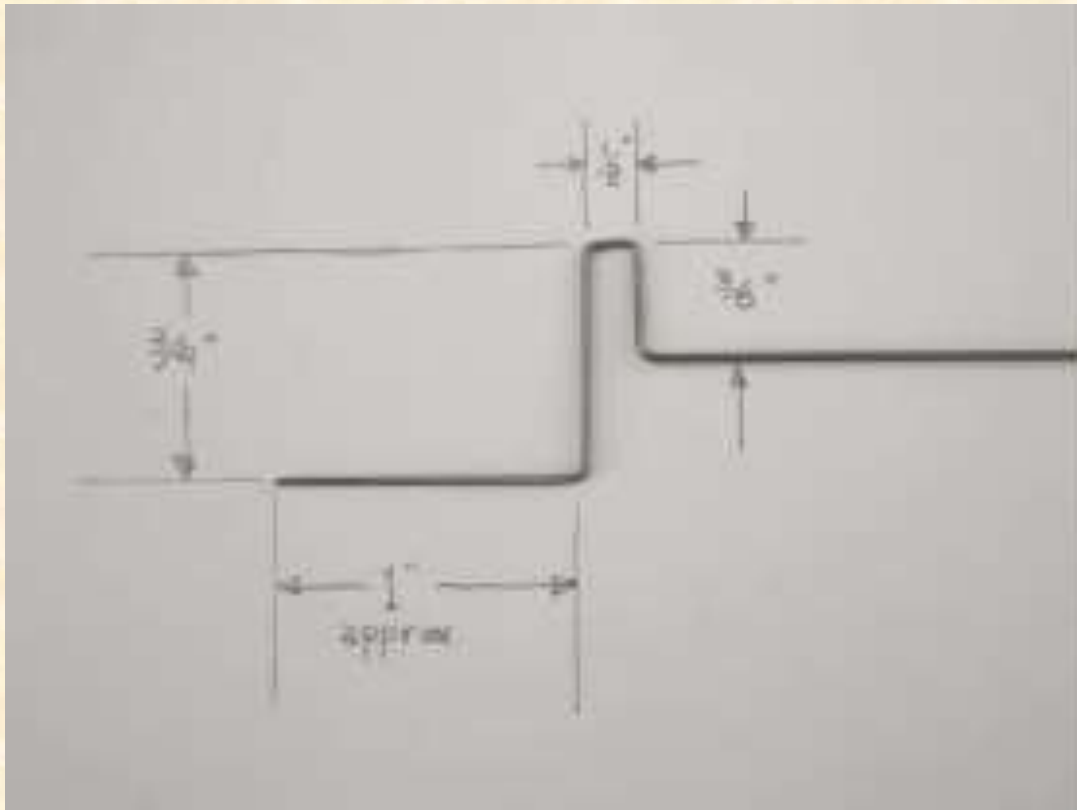
1c. Roll the 2" * 2" paper into a narrow tube using the wire for a mandrel. Remove the wire and daub the tube with BQ; maintain the tubes openings. Cut into three ½" tubes and discard the remainder. Or you could cut into 3 equal pieces.



1d. Attach the 3 tubes to the fuselage. Ensure the tubes are aligned with the long axis of the fuselage.



1e. Use needle nose pliers to bend the wire so the crank appears as shown. Insert the crank wire through the paper tube glued to the crank standoff . Create a bend in back end of wire to serve as a motor hook. You could place beads in the wire as shown.



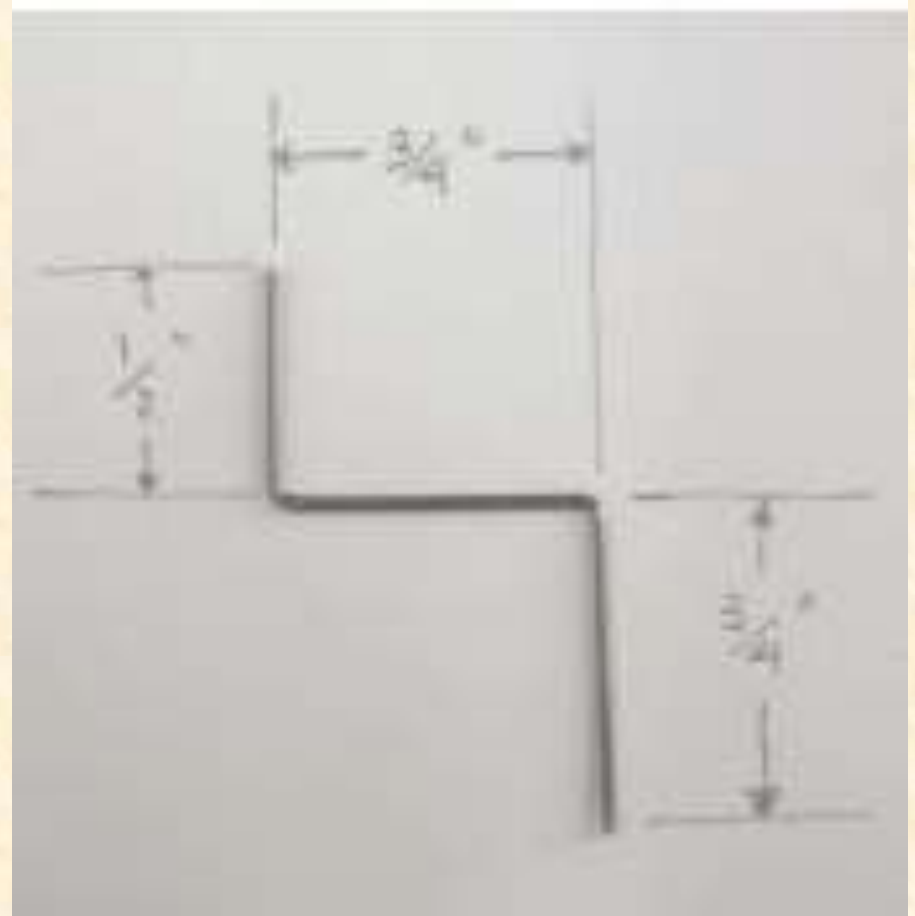
2. MAKE THE WING SPARS

2a. Bend the wire, push it thru the wing spar at a point $\frac{3}{4}$ " from an end. Glue into place using BQ.

3. MAKE THE TAIL

3a. Glue balsa rods into T shape. Reinforce the joint by covering it with thin paper soaked in glue.

3b. Poke the end of the fuselage tail attachment wire into the balsa tail member. Glue the assembly. Reinforce by wrapping with thin paper.



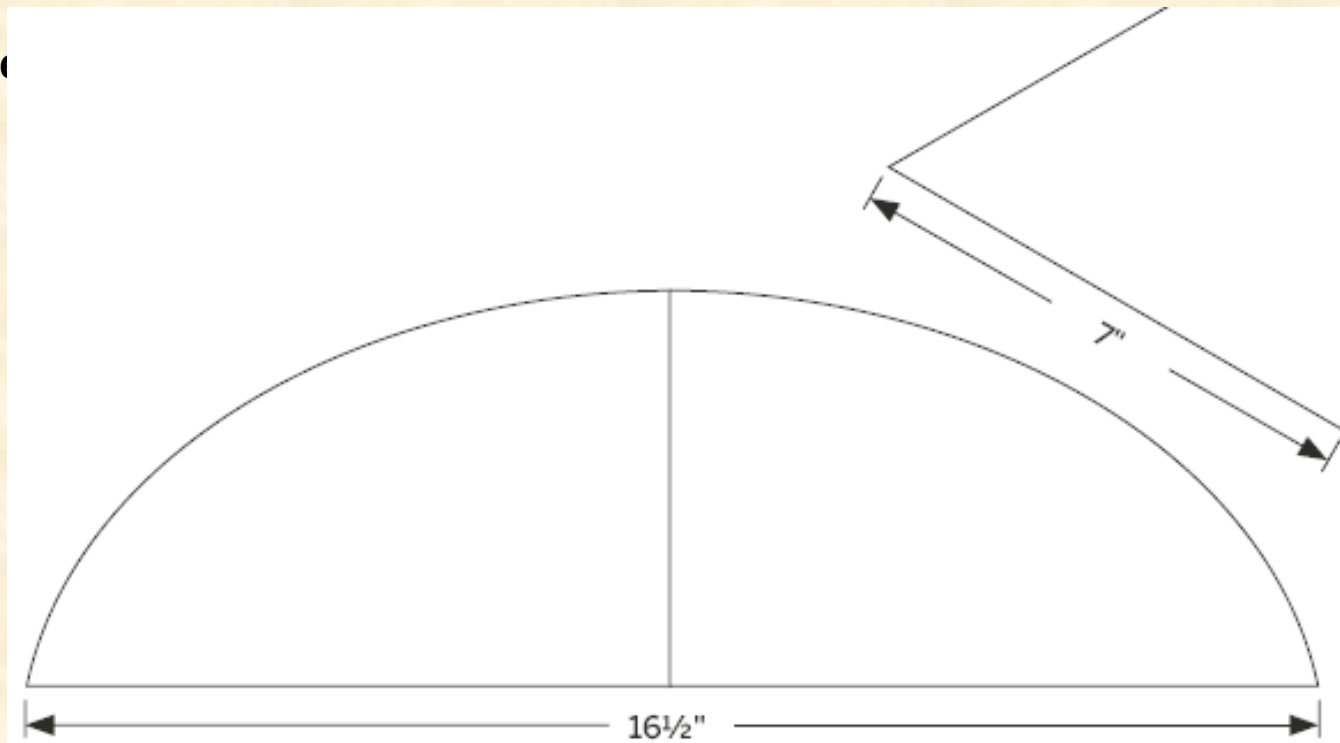
4. MAKE THE CONNECTING RODS(CONRODS)

4a. Make 2 holes for the wire in each conrod, $\frac{1}{4}$ " from each end. Note that the conrods undergo considerable stress.



5. FINAL ASSEMBLY

5a. Cut out wings and tail using templates. The tail is a triangle of side= 7".



5b. Glue the wing to the wing spars and top wing attachment member. Glue the tail to the tail frame.



5c. Connect conrods to the wingspar attachment wires and crank. Adjust spacing so the crank turns smoothly.

5d. Bend the tail up so it's about 15 deg from the plane of the motor stick. This will ensure greater lift on the ornith.



6. FLIGHT

6a. Double the rubber band and place it over front and rear motor attachment hooks.

6b. Wind up the band motor by turning crank at least 8 turns.

6c. Incline the nose upwards and launch gently.



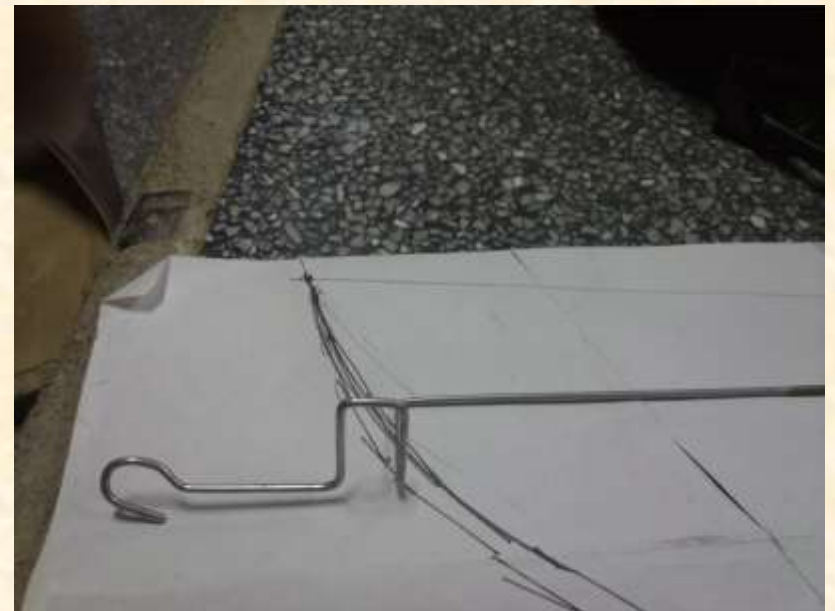
ORNITHOPTER : Different parts and assembly

1.The tail



ORNITHOPTER : Different parts and assembly

2.The angle that is used for the rotating mechanism



ORNITHOPTER : Different parts and assembly

3.Ornithopter with conrods connected to fuselage.











Reference : Building an Ornithopter by William Gurstelle
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<http://www.youtube.com/watch?v=e3wWfKEdvpY>