

WRIGHT BROTHERS 1903 FLYER MODEL INSTRUCTIONS

DESIGNED BY Roger Storm, NASA Glenn Research Center

MATERIALS

- Clean foam meat trays, at least 9 inches by 11 inches and preferably white
- 40 to 50 toothpicks
- 30 inch piece of 1/8 x 1/8 piece of balsa wood
- 2 craft sticks or Popsicle sticks
- Low temperature glue gun
- Scissors
- Hobby knife, razor utility knife, or single-edge razor blade (adult help here)
- Cardboard or board to cut on
- Fine tip permanent black marker
- Ruler
- Emery board
- Manila folder
- Clear plastic sheet, such as used on an overhead transparency
- Plastic toy army soldiers (optional)

GENERAL INSTRUCTIONS

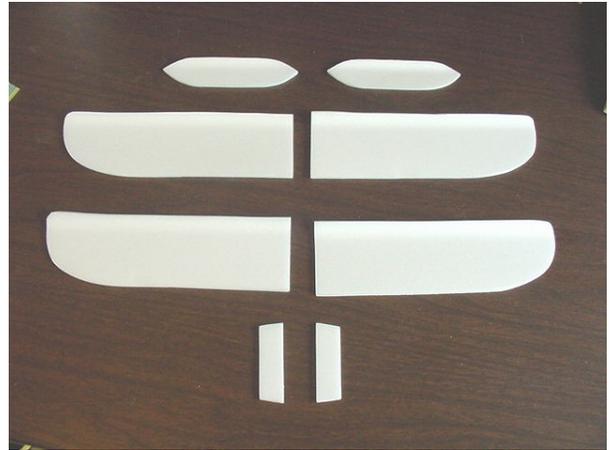
- Print a copy of the Wright Flyer templates (page 11).
- Use scissors to cut out all templates on the heavy lines.
- Do all hobby knife or razor blade cutting on the board or cardboard to protect your working surface.
- The finished model is for **display only**; it is **not** meant to fly.

PROCEDURE

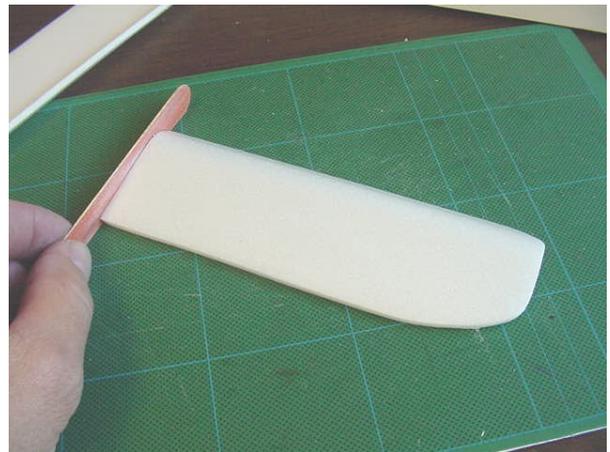
1. Carefully trace the wing and elevator shapes on the inside of two meat trays as shown. Be sure the front edges of the wings go about 2/3 of the way up the curved sides of the tray. Check the bottom of the tray and avoid any logo found there. Cut out the wings and elevator with the hobby knife or scissors. Use the emery board to smooth the cut edges and sand off the pen lines.



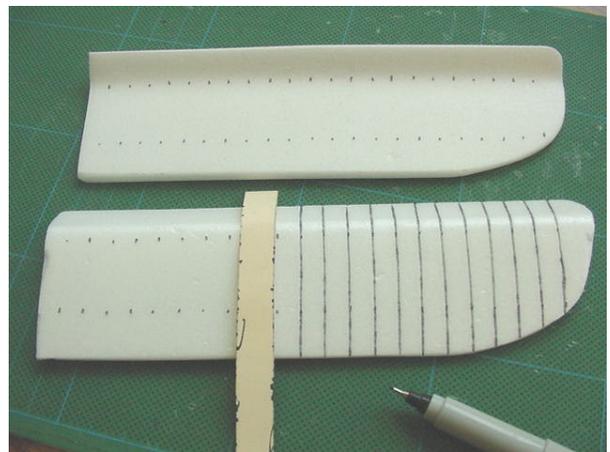
2. When finished you should have the parts as shown.



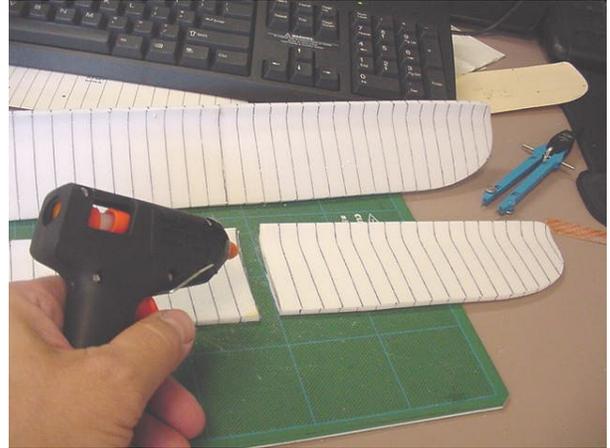
3. Use the emery board to smooth the edges. Make sure that the two halves of the upper and lower wings are flat where they will be joined, as shown at the lower right.



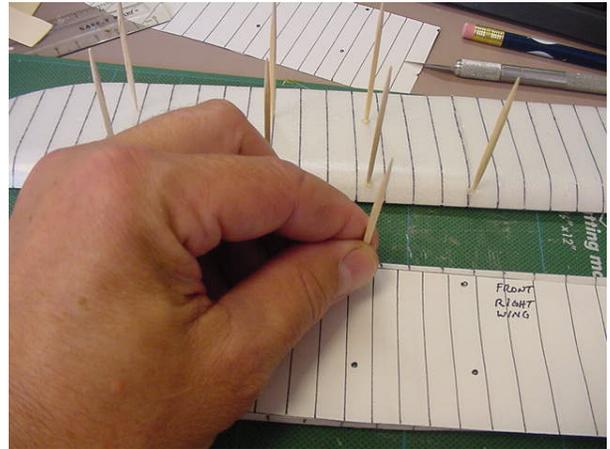
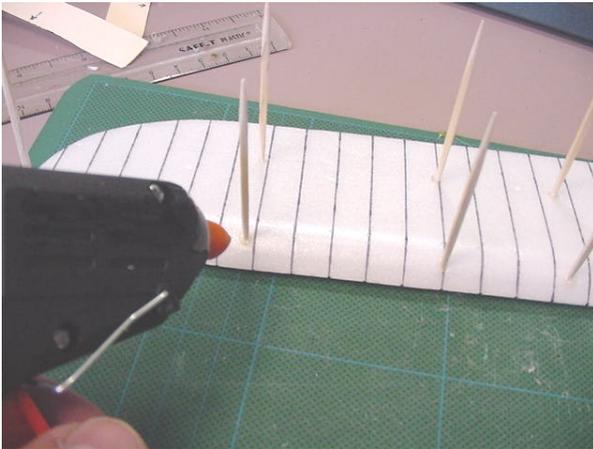
4. Using the template as a guide, take a black marker and mark the locations of the rib lines on the tops and bottoms of each wing and elevator section. Make two sets of marks, one on each edge. Connect the marks to make the rib lines. Use a permanent ultra fine black marker and a straight edge made from a manila folder (since it can be bent to conform to the rounded shape of the foam).



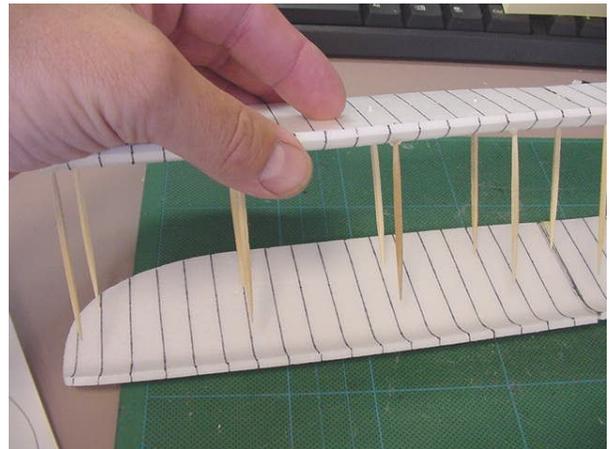
5. Place glue on the flat edge of the upper and lower wing halves and join each wing as shown.



6. Use the wing template and a sharp toothpick to mark the holes for the spars on the top surface of the lower wing. Note that the front edges of the wings curve down. Dip toothpicks into glue and set them upright in the lower wing. Try not to push them all the way through the wing. Be sure they are straight and let them dry.



7. Now turn the lower wing upside down and insert the spars into the underside of the upper wing, doing the back row (away from the curved edge) first. Be sure each is vertical and add a little glue to hold each in place. Now tip the wing forward and inset the front row of spars, working from one end to the other. Again, try not to push them all the way through the wing. It takes some effort to get each in the right place and vertical. Add a dab of glue at the top of each spar to help secure them to the upper wing.



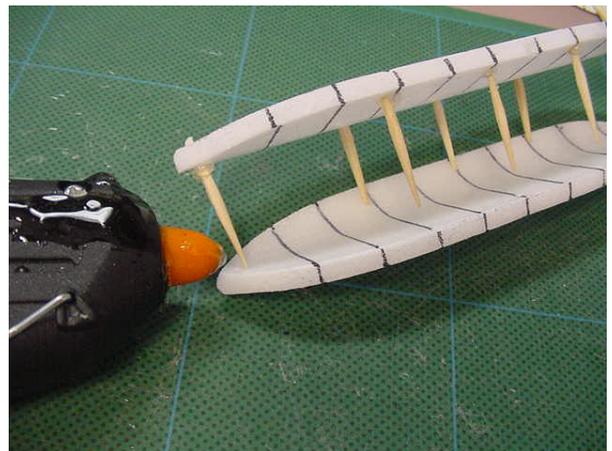
8. Cut eight toothpick sections, each 2.5 cm. in length, and sharpen the cut ends. Mark the locations for these spars in the upper surface of the lower elevator using the template just as you did previously with the wings.



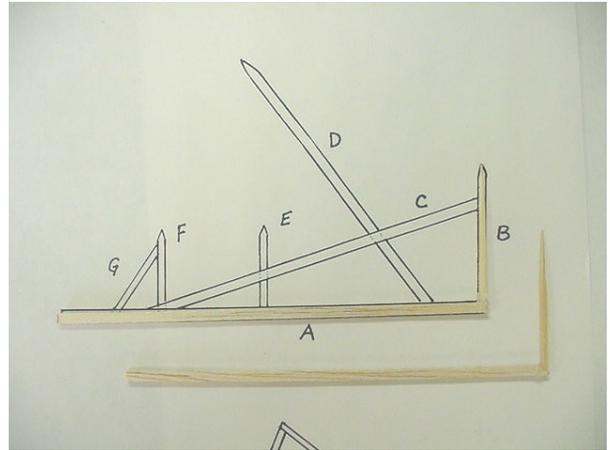
9. Set the eight short spars into the top surface of the lower elevator and add a bit of glue to each at the base as shown.



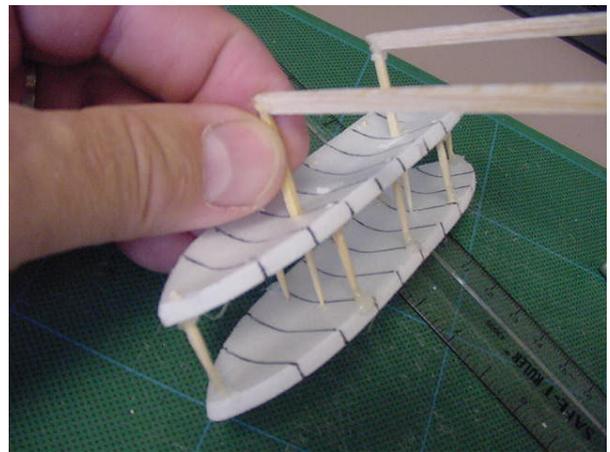
10. Turn this over and insert the spars into the underside of the upper elevator, doing the back row first and then the front, trying not to go all the way through the foam. Anchor with glue.



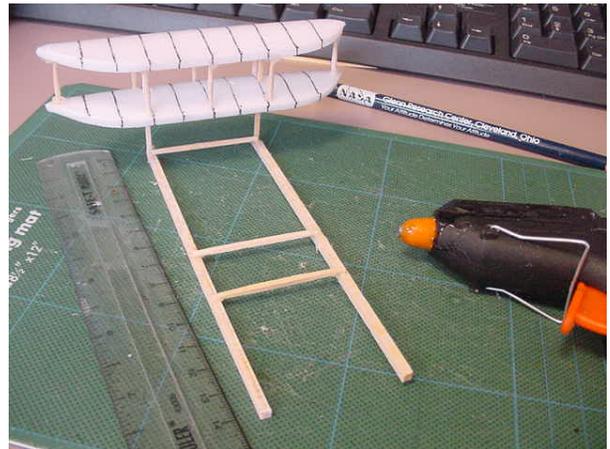
11. Print the Skids Template (page 12). Cut a 14 cm. piece of the balsa wood "A" and lay it on the template. Cut the right end at a 45 degree angle. Cut a toothpick "B" to a length of 4.5 cm., with the cut end also being at a 45 degree angle. Glue the toothpick to the balsa to form a 90 degree angle as shown. Repeat this step to make a second skid.



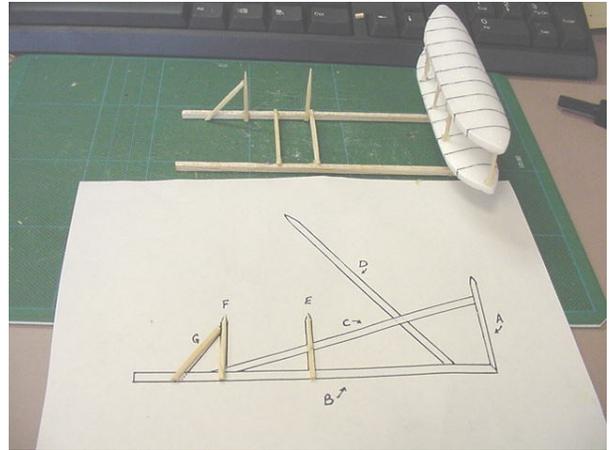
12. Turn the elevator assembly over and poke a hole through the lower elevator midway between the front and rear spars of the pairs next to the center pair of spars. Push the top of the skid assembly "A" through the hole just made, add a bit of glue, and then stick the skid into the upper elevator. Repeat with the second skid as shown.



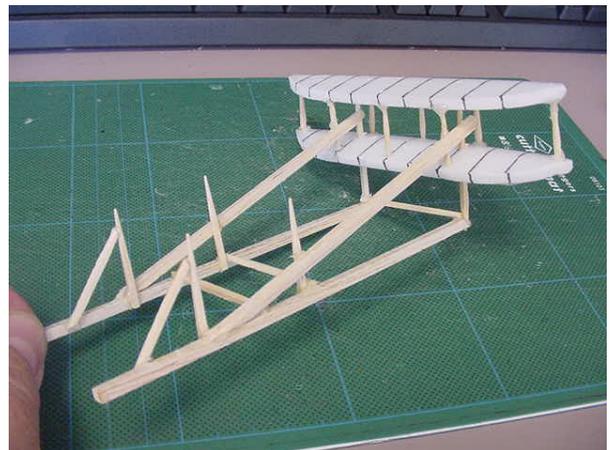
13. Cut the pointed ends off three toothpicks so that they are 4.5 cm. in length and place them as cross-braces across the skids as shown, one at the right angle, one at 7 cm. from the right angle, and one at 9 cm..



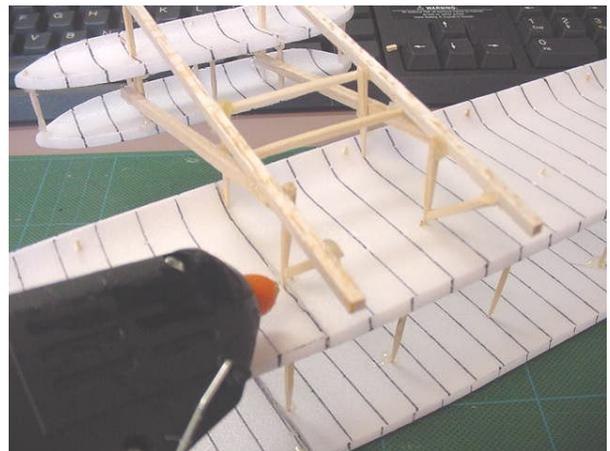
14. Cut 2 toothpicks to a 3 cm. length. Glue them to the skid as shown on the template at "E" and "F", pointed ends up. Now measure and cut another toothpick as the rear brace "G" and glue it in place. Repeat Step 14 for the second skid.



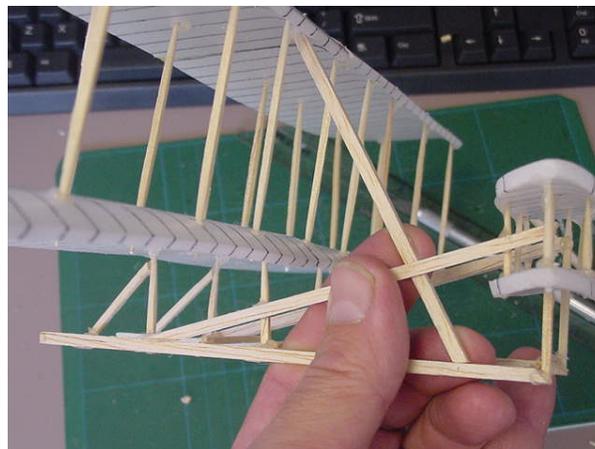
15. Now cut 2 balsa braces "C" to go from rear skid support up to elevator support. Glue them in place as shown.



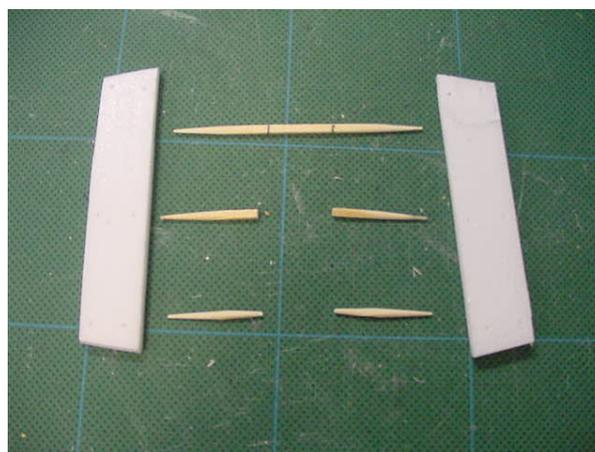
16. Turn the wing assembly over and press the skid assembly into the center of the lower wing as shown. Be sure the elevator projects out from the curved edge of the wing. Try to keep the toothpicks from going through the foam. Add some glue to each support.



17. Cut two 10 cm. pieces of balsa "D" (see template) and sharpen one end. Glue one end under the leading edge of the upper wing between the center and next-to-center spar and then glue the other end to the bottom skid. Repeat on the other side of the skid.

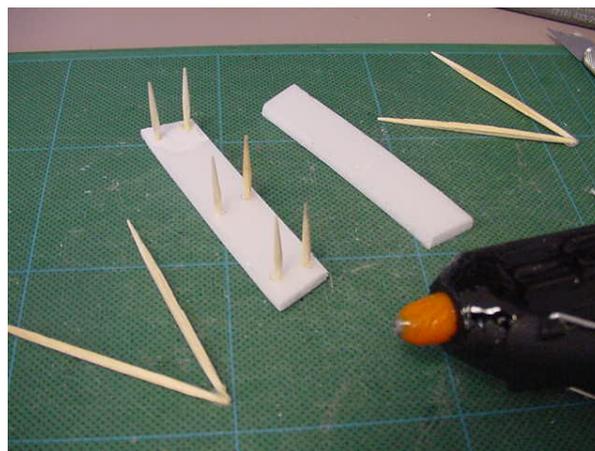


18. Six 2 cm. rudder braces are needed. Cut them from three toothpicks as shown and sharpen the cut ends.

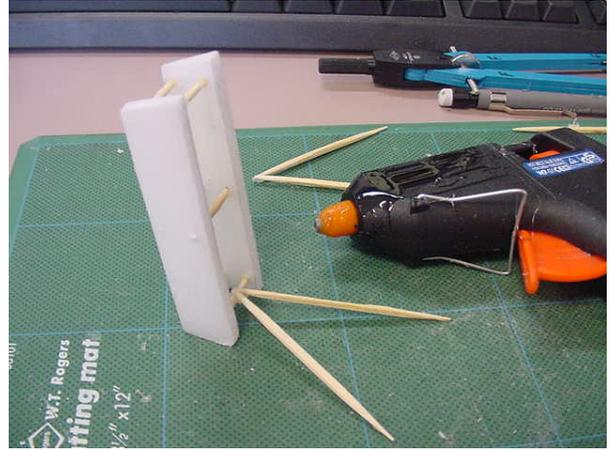


19. Dip the braces in glue, insert them into the rudder as shown here, and then turn the assembly over and insert it into the other rudder. Add more glue for support.

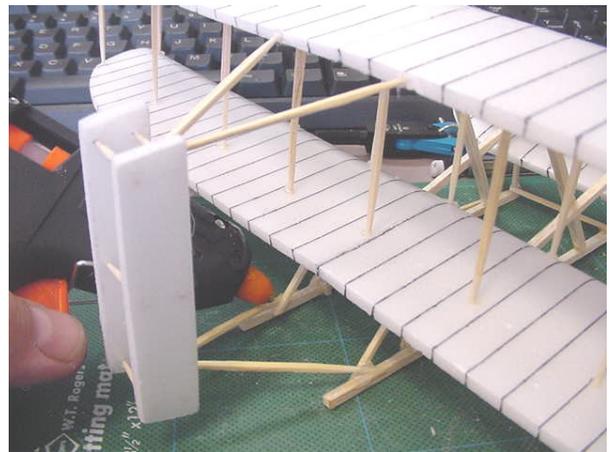
To attach the rudder to the flyer make two sets of V-shaped braces by gluing together two toothpicks as shown.



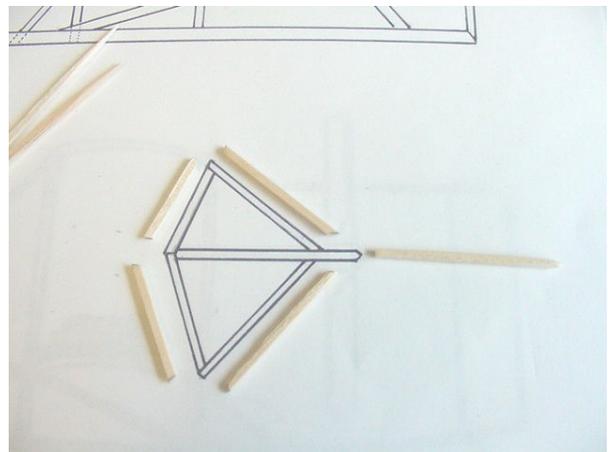
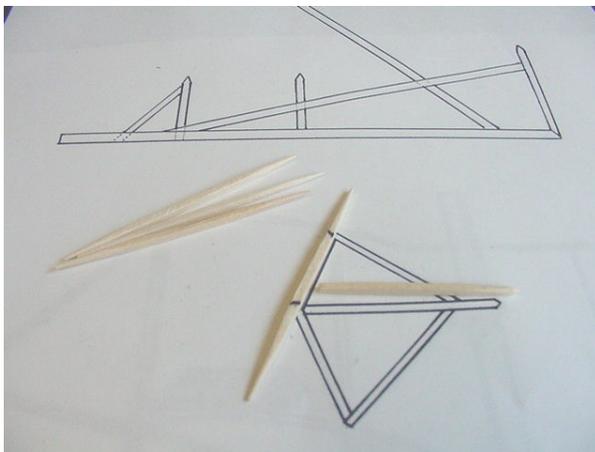
20. Glue the V-shaped braces to the rudders as shown. Once the glue is set, turn this over and glue on the other brace.



21. Stick the upper brace ends into the rear edge of the upper wing as shown and add a spot of glue. (If the wing is thin, glue the brace under the wing.) Now glue the ends of the lower brace to the rear of the skid so that the rudder is vertical.



22. To make the propeller supports, use the template and mark and cut 5 toothpicks for each. Try to keep the assembly flat as it is glued.



23. When dry, glue each propeller support to the lower wing 5.5 cm. from the center, in line with the back struts. Turn the Flyer over and glue to the top wing so that the support is vertical. Extra hot melt glue may be added to fill in any gap.

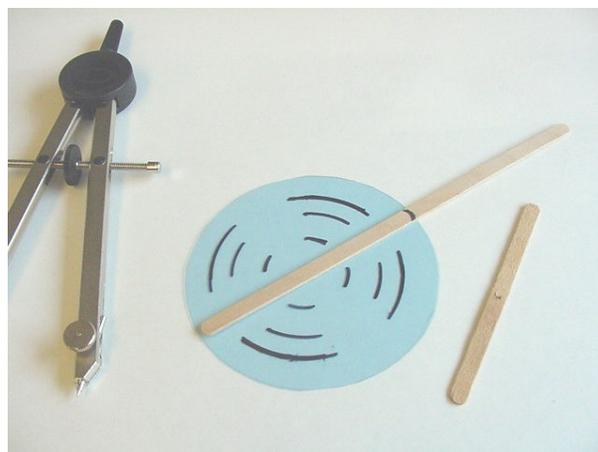
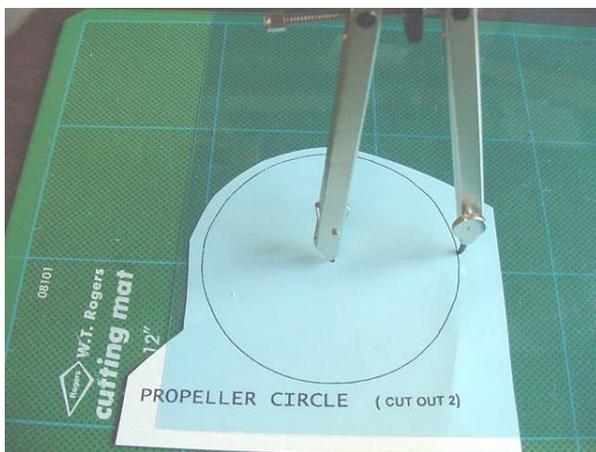


24. Simulate the small engine by gluing two 2 cm. x 3 cm. pieces of foam together and then adding a 1 cm. x 3 cm. piece on top. Trace and cut a circle with a penny or dime, cut out, and then glue on the end of the engine. Glue the engine onto the lower wing just to the right of center.



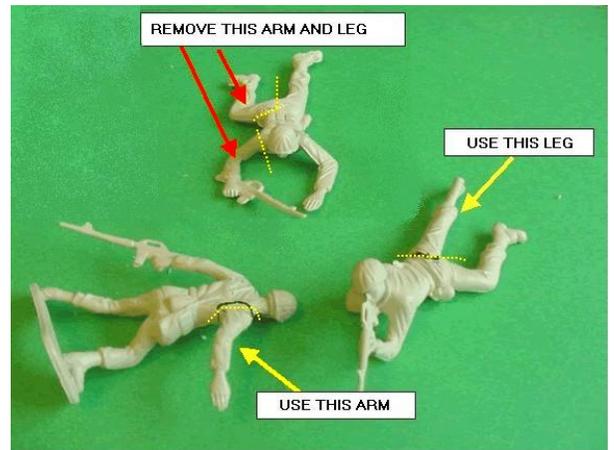
25. To simulate a turning propeller trace and cut two 7.2 cm. circles out of clear plastic, such as a piece of a blank overhead transparency. Use a black marker to draw pieces of smaller circles. Enlarge the small hole in the center of each circle with a toothpick.

From a thin craft stick or Popsicle stick cut a piece the diameter of the plastic circle, round the cut edge, and poke a hole in the center. Make two of these. Mount the plastic circle and then the propeller on the end of the propeller support and add glue. Repeat on the other side.





26. (Optional) You can make figures of Wilbur and Orville Wright from small, plastic army men. (These figures are about 2 inches tall). Enlarge the image at the right to see labels. Use a hobby knife to carefully trim off guns and army equipment. The helmet can be trimmed into a hat. To obtain the desired pose, arms and legs can be removed and some from other soldiers glued in their place. The picture to the right shows how to make a pilot to lay on the wing.



27. The original soldiers on the left were transformed into the figures of Wilbur and Orville Wright.



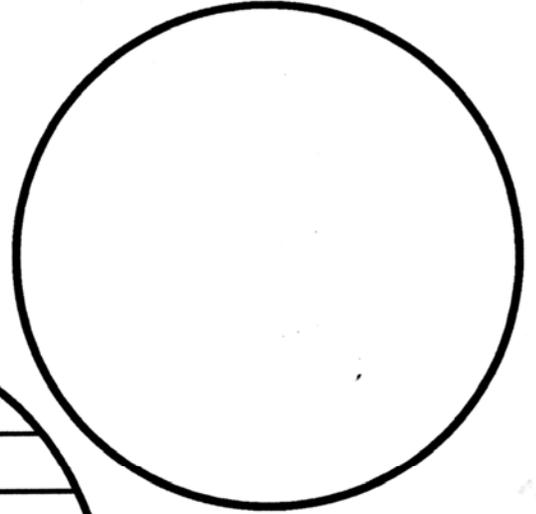
1903 Wright Flyer Templates



Propeller (cut out 2)



Rudder (cut out 2)

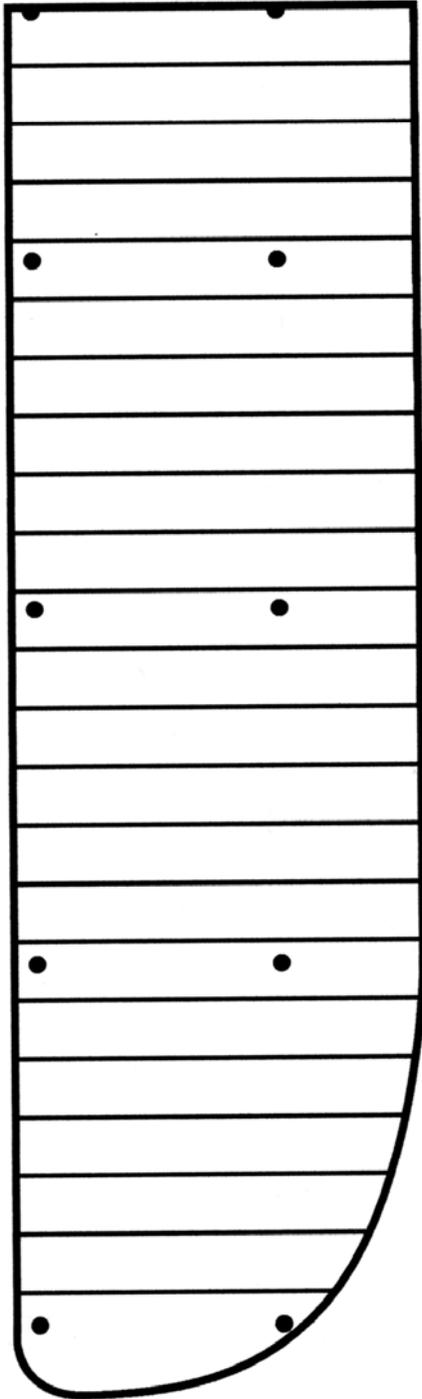


Propeller circle (cut out 2)

Join

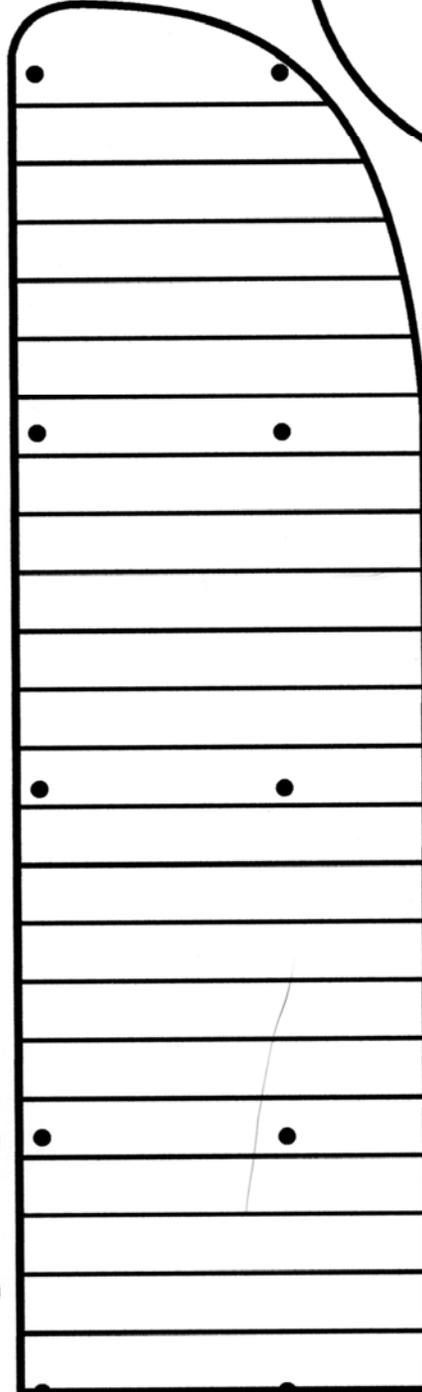
Front edge curved

Left wing (cut out 2)



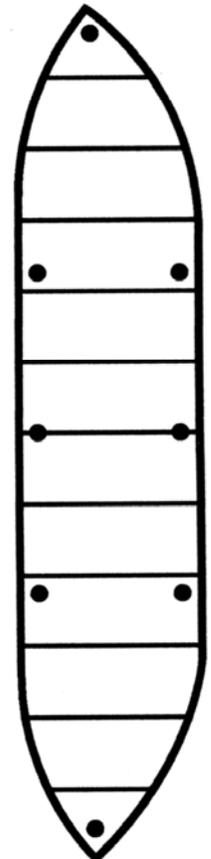
Front edge curved

Right wing (cut out 2)



Join

Elevator (cut out 2)



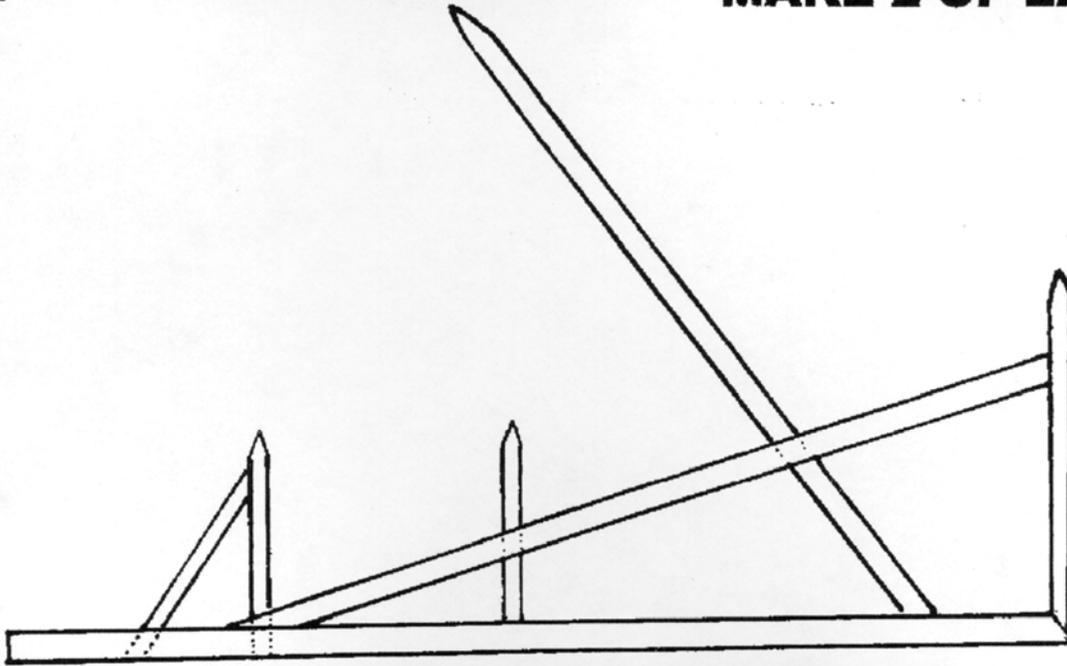
Front edge curved

Scale: 1 cm = 1 ft

1903 SKIDS TEMPLATE

(3 LONG PIECES ARE Balsa)

MAKE 2 OF EACH



1903 PROPELLER MOUNT TEMPLATE

MAKE 2 OF EACH

