

PLANE DESIGN AND FLYING TIPS

These design and flying tips apply to almost any kind of paper airplane. Start with simple planes, and then try more complicated planes.

MATERIALS: Paper airplanes; tape; scissors; paper clips; different weights of paper (e.g. tracing paper, construction paper, writing paper).

DOING IT:

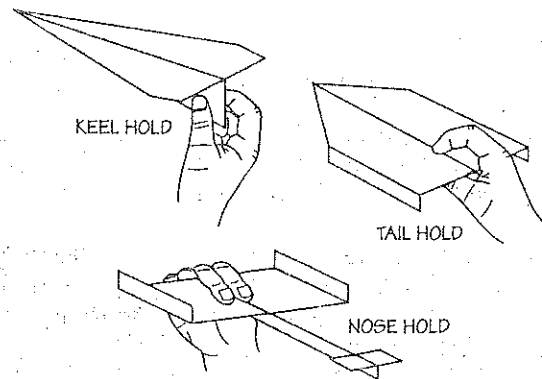
1. **Space:** Paper planes fly best in a large, empty area where there's little or no wind.

2. **Construction:** If a paper plane doesn't fly straight, it may be because it isn't made straight. Every little bend, cut, and dent in the paper changes how a plane flies. All folds should be sharp. Look down along the nose of a paper plane to see if both wings are the same size and bent to the same angle. Check that all the folds and cuts on one side are the same size and shape as those on the other side. If your plane is lopsided, it will never fly straight. If everything looks okay, and the plane still doesn't fly right, experiment with the factors listed below.

3. **Launching Speed:** There's no such thing as the "best" launching speed for paper planes. Different planes need different launching speeds. In general, try to launch a plane so that it glides in a straight path without diving, climbing, or turning. If a plane is launched too quickly, it tends to climb, then stall, and finally dive down. If a plane is launched too slowly, it dives to pick up more speed. Either way, distance and flying time are lost.

4. **Throws:** There are many ways to throw paper planes. Different planes work better with

certain throws. For the *keel hold*, hold the back of the plane at the bottom, and then launch the plane with a sharp throw. In the *tail hold*, put your index finger on top of the plane with your thumb and other fingers underneath. Move your hand forward at the speed you think the plane will fly and just let the plane go. Don't jerk or push the plane forward; just let it glide from your hand. The *nose hold* is best for loops and circles. If you want a plane to veer to the left or right, launch it at an angle.

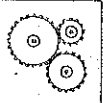


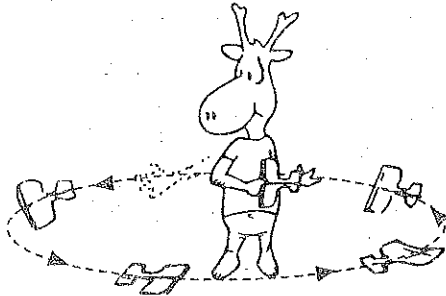
5. **Circles:** A Dart usually won't do circles, but the Barnaby (described later) and other planes with a long wingspan are good at circles. Hold a plane by its nose at your waist. Keep the bottom of the plane toward your body; the wings should be straight up and down. Pull your hand straight across from one side to the other and then let the plane go. The plane should circle and return to you. If a plane won't do circles, be sure it isn't lopsided and try throwing it harder.

6. **Loops:** When you're trying to make a plane loop, curl up the back edge of the tail or wings. For a *downward loop*, start by holding the plane's nose. Aim the nose down and quickly launch the plane with a hard throw. Be careful to launch the plane straight, without twisting your wrist or curving your arm. The plane should make a loop and then fly level. For an *upward loop*, hold the plane by its nose again. Aim the nose up. Pull the plane straight up, and let go when the plane is in front of your face. With practice, the plane should loop away from you and come back so that you can catch it.

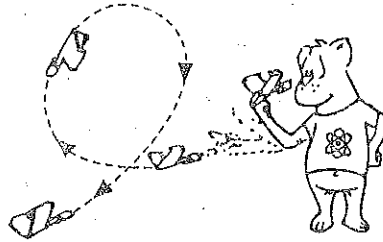
As you experiment with paper airplanes, you'll get insights into the problems that airplane pioneers had to overcome and the things that modern flight crews must know about. For example, weight is important in both paper airplanes and full-sized planes. When a real plane is loaded, it can carry only a certain amount of weight. The weight must also be loaded so the plane is balanced (i.e. not too much weight in the nose or tail).

Topics: Flight; Problem-Solving.

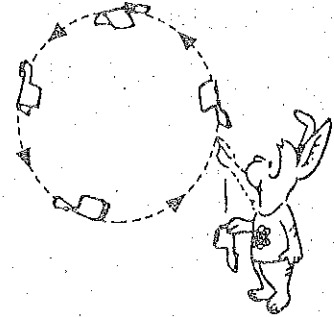




CIRCLES



DOWNWARD LOOP



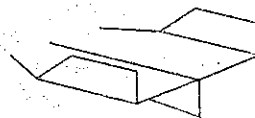
UPWARD LOOP

7. Weight: Try making several planes using the same design, but different kinds of paper (e.g. tracing paper, construction paper, writing paper). Do the planes fly differently? In what ways? Not only is overall weight important, but so is the way the weight is distributed. Shifting weight can be used to overcome problems like interference from air currents outdoors. Add a paper clip to a plane's nose. How does it fly? What happens if you put a paper clip on the tail instead of the nose? What happens if you add two or more paper clips? How can you tell too much weight has been added?

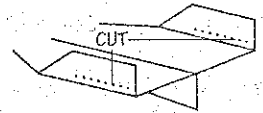
8. Ailerons: Make flaps, or ailerons, for a plane by cutting two 1 cm slits in the back of each wing. Bend the flaps. What happens when both flaps are tilted up? What happens when both flaps are tilted down? What happens if only one of the flaps is bent out? Try tilting one flap up and the other flap down. Try different flap widths.



9. Vertical Stabilizers: These are used to make a plane fly straight and smooth. Bend the tips of the wings upward. What happens if you have only one stabilizer on a plane instead of two? Try bending the stabilizers down instead of up. Try making small stabilizers, and then try larger stabilizers.

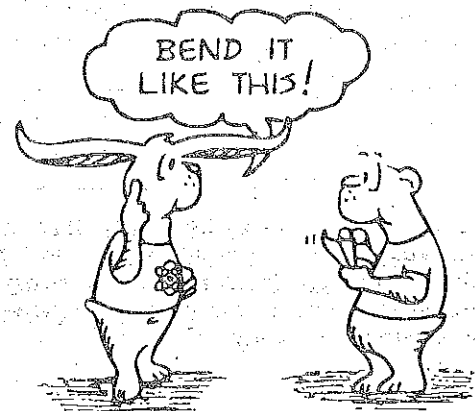


10. Rudders: Flaps in vertical stabilizers can be used as rudders which change the direction of a plane's flight. Turn both rudders slightly, the same way, to see one change in flight. Then, turn them the other way. Try bending in just one rudder. Try bending both rudders outward.



11. Cambering: Curve a paper plane's wings downward slightly by running them between your thumbnail and fingers. This will create a slight arch in the wings and the plane may fly better.

12. Extension: Come up with your own paper airplane design. Then write instructions, including diagrams, for making the plane. Can someone else follow your instructions and make the plane?



ONE LEADS TO ANOTHER

