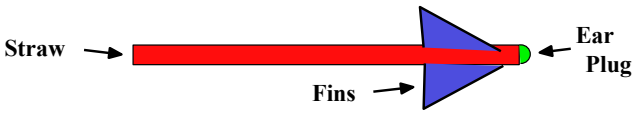
Straw Rockets

1. **Split** a large group into four smaller groups. Each group will test a different variable.
2. **Gather** large and small diameter straws, tape, paper (cut into triangles) and ear plugs.
3. **Give** every group member a large straw.
4. **Assign** the following group tasks:

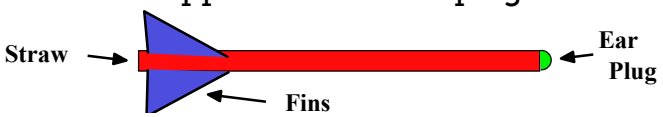
a) Have the first group seal an end of the straw with a small amount of tape.

b) Ask the second group to seal an end of the straw with just an ear plug.

c) Give the third group an ear plug to seal one straw end and paper triangles to tape three fins on the same end as the plug.



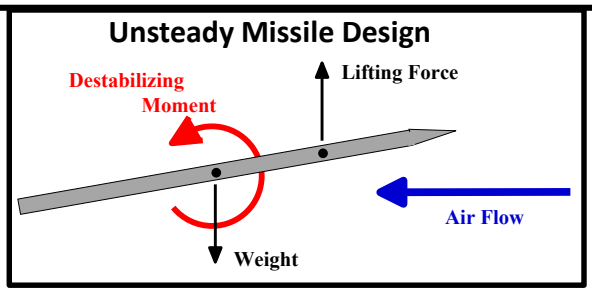
d) The last group will seal one end with an ear plug and put paper triangle fins on the opposite end of the plug.



5. **Insert** a smaller diameter straw into the unsealed end of the larger straw. Hold onto the smaller straw, aim at a target, and blow air into the smaller straw, propelling the rocket.

Stability in Flight

The stability of an object moving through a fluid is dependent not only on the magnitude of the forces (**thrust, drag, lift** and **weight**) acting on it but also the location through which they act. The distance between the locations of the lifting force (**center of pressure**) and the weight (**center of gravity**) will result in a rotational **moment** on the body of the missile. If the lifting force is forward of the weight, the moment is destabilizing and has a tendency to flip the missile. If the weight is forward of the lifting force, the moment is stabilizing and has a tendency to bring the body of the missile in line with the direction of flight. The placement of the fins and the addition of the ear plug shift the center of pressure and the center of gravity respectively, changing stability.



NAVY NOTES

The AIM-9 Sidewinder is an infrared tracking, short range air-to-air missile used on a range of modern aircraft including the Navy's F/A-18. The Sidewinder has two sets of fins. The rear fins provide stabilization for the missile in flight and the fins near the nose act in conjunction with the guidance control to steer the missile.

Which rocket designs had the most stable flight path? Why? Which designs did not work so well? Why?